DRAFT ENVIRONMENTAL IMPACT STATEMENT

REDDING RANCHERIA
FEE-TO-TRUST AND CASINO PROJECT

VOLUME II - APPENDICES

APRIL 2019

LEAD AGENCY:

U.S. Department of the Interior
Bureau of Indian Affairs
Pacific Region Office
2800 Cottage Way # W2820
Sacramento, CA 95825

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REDDING RANCHERIA STRAWBERRY FIELDS
EIS ECONOMIC ANALYSIS

Report for:

Redding Rancheria Strawberry Fields EIS Economic Analysis

Redding, CA

Prepared for: Analytical Environment Services

Prepared by: Pro Forma Advisors LLC **e+r**

June 2017

Revised January 2018

PFAID: **10-913.05**

Pro Forma
Advisors LLC

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Certain information included in this report contains forward-looking estimates, projections and/or statements. Pro Forma Advisors LLC has based these projections, estimates and/or statements on expected future events. These forward-looking items include statements that reflect our existing beliefs and knowledge regarding the operating environment, existing trends, existing plans, objectives, goals, expectations, anticipations, results of operations, future performance and business plans.

Further, statements that include the words "may," "could," "should," "would," "believe," "expect," "anticipate," "estimate," "intend," "plan," "project," or other words or expressions of similar meaning have been utilized. These statements reflect our judgment on the date they are made and we undertake no duty to update such statements in the future.

No warranty or representation is made by Pro Forma Advisors that any of the projected values or results contained in this study will actually be achieved.

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In the production of this report, Pro Forma Advisors has served solely in the capacity of consultant and Pro Forma Advisors has not rendered any "expert" opinions and does not hold itself out as an "expert" (as the term "expert" is defined in Section 11 of the Securities Act of 1933).

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This study is qualified in its entirety by, and should be considered in light of, these limitations, conditions, and considerations.

Introduction

Pro Forma Advisors has been engaged by Analytical Environmental Services (AES) to perform a socioeconomic impact analysis for the Redding Rancheria's application requesting that the United States acquire land in trust in Shasta County, California, for the construction and operation of a new replacement casino resort. The Tribe's current casino facility operates near the City of Redding, California.

The proposed development would be a permanent casino replacement at a larger nearby parcel bordered by Interstate 5 and South Bonnyview Road (Strawberry Fields Site). The Redding Rancheria Tribe (Tribe) is considering a proposed project and five additional alternative project scenarios. Four project alternatives have been developed for the Strawberry Fields Site, one scenario for an alternative site location, and one for a remodel of the existing facility at its current location. This report examines and compares the various incremental impacts of the project alternatives against the current facility's operations from the socioeconomic perspective.

Background

Tribe

The Win-River Resort & Casino (Win-River) is a gaming and entertainment facility located on the Tribe's reservation near the City of Redding, California. The Bureau of Indian Affairs (BIA) purchased the land that is now considered the Redding Rancheria in 1922 to provide a place for Native American Indians of Pit-River, Wintu, and Yana descent. The Tribe was terminated by an act of congress on July 6, 1959 and it was no longer recognized by the government. During the late 1970's the Inter-Tribal Council of California was active in forming task forces challenging the termination of a number of state tribes. In 1983, a California district ruled that the failure of the BIA to comply with its obligations under the California Rancheria Act invalidated the Act. As a result, the Tribe and 17 other tribes were restored as federally-recognized Native American Indian tribes. In 1987 the restored Tribe formally adopted its Constitution.

WIn-River Casino

The original facility operated under the 1987 Indian Gaming Regulatory Act (IGRA) and 1999 Tribal Compact with the State of California. The facility was expanded in 2008 and further expanded in 2013 with additional gaming and a hotel property. The existing facility is open 24 hours a day, seven days a week, and currently features:

- Approximately 700 slots with 12 table games, 7 poker tables, and 300 bingo positions;
- Three food-service options - Elements (restaurant), Creekside Pub & Grill , and quick service and Overtime (lounge);
- An 84 room hotel;
- A gift shop;
- A 9,000 square foot event center for shows and bingo; and
- Approximately1,000 parking spaces.

Given the site constraints and age of the existing facility, the Tribe is considering developing a replacement casino facility at the Strawberry Fields Site that would:

- Provide a modern and permanent facility to house a market scaled gaming program;
- Compete at a quality and experience level required based on existing market competition;

- Provide additional overnight accommodation amenity to guests; and
- Expand the customer base of the Win-River casino.

While the Strawberry Fields Site is assumed to meet the needed development requirements, any necessary infrastructure support would be included in the development. During construction, the existing facility will maintain usual operations in most of the development alternatives.

Site Location

The Strawberry Fields Site consists of approximately 232-acres, located approximately two miles northeast of the the current Win-River facility, located adjacent to Interstate 5 and to the southwest of the South Bonnyview Road interchange.

Figure 1 - Strawberry Fields Site Map

Source: Pro Forma Advisors

Alternatives

As part of the EIS, the proposed project along with three development programs have been determined for the Strawberry Fields Site, one scenario for an alternative site location,[1] and one scenario where the existing facility is remodeled at its current location. As described in detail below, Alternative A is referred herein as the Project while Alternatives B through F are collectively referred to as the "Project Alternatives" if not specifically referenced by name. The following provides a brief description of the Project and each of the Project Alternatives in comparison the current Win-River facility.

Alternative A: Project

Alternative A illustrates the full buildout of the casino resort development. The program includes:

- Hotel - 250 key upscale hotel with amenities such as a spa, pool, amphitheater and winter garden;
- Casino - 70,000 square foot gaming floor with 1,200 slots, 30 table games, and a Poker room;
- Food & Beverage - 655 seats in various outlets including a buffet, cafe, fine dining, Sports Bar & Grill, quick service, and lounge;
- Meetings & Events - An 1,800 seat multiple-purpose venue and 10,000 square feet of meeting space;
- Parking - 1,650 structured parking and 600 space surface parking; and
- Retail - 130,000 square foot Outdoor Sports Retail.

Figure 2 - Alternative A: Project Development Elements

Element	Existing Facility	New Development	Net New Development
	Square Feet (rounded)		
Gaming	34,000	69,500	35,500
Hotel and Spa	60,700	171,300	110,600
Events and Conference Center	9,800	62,300	52,500
Restaurants	5,500	31,600	26,100
Non-Casino Related Retail	0	130,000	130,000
Parking Garage	0	583,500	583,500

Note: New development assumes closure of existing gaming facility. Existing surface parking not included.
Source: AES

Alternative B: Project with No Big Box Retail Alternative

Alternative B illustrates the full buildout of the casino resort development Alternative A without the proposed large-scale retail development. The program includes:

- Hotel - 250 key upscale hotel with amenities such as a spa, pool, amphitheater and winter garden;
- Casino - 70,000 square foot gaming floor with 1,200 slots, 30 table games, and a Poker room;

[1] Located in Anderson, California adjacent to Interstate 5 and bounded by North Street (South) and Oak Street (West)

- Food & Beverage - 655 seats in various outlets including a buffet, cafe, fine dining, Sports Bar & Grill, quick service, and lounge;
- Meetings & Events - An 1,800 seat multiple-purpose venue and 10,000 square feet of meeting space; and
- Parking - 1,650 structured parking and 600 space surface parking.

Figure 3 - Alternative B Development Elements

Element	Existing Facility	New Development	Net New Development
	Square Feet (rounded)		
Gaming	34,000	69,500	35,500
Hotel and Spa	60,700	171,300	110,600
Events and Conference Center	9,800	62,300	52,500
Restaurants	5,500	31,600	26,100
Non-Casino Related Retail	0	0	0
Parking Garage	0	583,500	583,500

Note: New development assumes closure of existing gaming facility. Existing surface parking not included.
Source: AES

Alternative C: Reduced Intensity Alternative

Alternative C illustrates a reduced intensity buildout of the casino resort development. The program includes:

- Hotel - 250 key upscale hotel with amenities such as a spa, pool, amphitheater and winter garden;
- Casino - 56,000 square foot gaming floor with 825 slots, 25 table games, and a Poker room;
- Food & Beverage - 630 seats in various outlets including a buffet, cafe, fine dining, Sports Bar & Grill, quick service, and lounge;
- Meetings & Events - An 1,800 seat multiple-purpose venue and 10,000 square feet of meeting space;
- Parking - 1,650 structured parking and 600 space surface parking; and
- Retail - 130,000 square foot Outdoor Sports Retail.

Figure 4 - Alternative C Development Elements

Element	Existing Facility	New Development	Net New Development
	Square Feet (rounded)		
Gaming	34,000	56,400	22,400
Hotel and Spa	60,700	171,300	110,600
Events and Conference Center	9,800	62,300	52,500
Restaurants	5,500	30,400	24,900
Non-Casino Related Retail	0	130,000	130,000
Parking Garage	0	583,500	583,500

Note: New development assumes closure of existing gaming facility. Existing surface parking not included.
Source: AES

Alternative D: Non-Gaming Alternative

Alternative D illustrates a non-gaming buildout. The program includes:

- Hotel - 128 key hotel with amenities such as a spa and pool;
- Food & Beverage - 265 seats in various outlets including a cafe, fine dining, Sports Bar & Grill, quick service, and lounge;
- Parking - 200 space surface parking; and
- Retail - 120,000 square foot Outdoor Sports Retail.

Figure 5 - Alternative D Development Elements

Element	Existing Facility	New Development	Net New Development
	Square Feet (rounded)		
Gaming	34,000	34,000	0
Hotel and Spa	60,700	89,700	29,000
Events and Conference Center	9,800	9,800	0
Restaurants	5,500	12,200	6,700
Non-Casino Related Retail	0	120,000	120,000
Parking Garage	0	0	0

Note: New development assumes no change to existing gaming facility. Existing surface parking not included.
Source: AES

Alternative E: Anderson Site

Alternative E illustrates an alternative site development of the casino resort development located near Interstate 5. The program includes:

- Hotel - 250 key upscale hotel with amenities such as a spa, pool, amphitheater and winter garden;
- Casino - 70,000 square foot gaming floor with 1,200 slots, 30 table games, and a Poker room;
- Food & Beverage - 655 seats in various outlets including a buffet, cafe, fine dining, Sports Bar & Grill, quick service, and lounge;
- Meetings & Events - 10,000 square feet of meeting space;
- Parking - 1,650 structured parking and 600 space surface parking; and
- Retail - 120,000 square foot Outdoor Sports Retail.

Figure 6 - Alternative E Development Elements

Element	Existing Facility	New Development	Net New Development
	Square Feet (rounded)		
Gaming	34,000	69,500	35,500
Hotel and Spa	60,700	165,800	105,100
Events and Conference Center	9,800	62,300	52,500
Restaurants	5,500	31,600	26,100
Non-Casino Related Retail	0	120,000	120,000
Parking Garage	0	583,500	583,500

Note: New development assumes closure of existing gaming facility. Existing surface parking not included.
Source: AES

Alternative F: Expansion Alternative

Alternative F illustrates an expansion of the existing casino resort development. The program includes:

- Hotel - Existing 84 room hotel;
- Casino - 9,826 square foot gaming floor remodel expanding to 881 slots, 15 table games, and a Poker room;
- Food & Beverage - Existing program;
- Meetings & Events - 10,000 square feet of new event center (replacement);
- Parking - 1,710 structured parking replacing existing surface lot; and
- Retail - No additional retail.

Figure 7 - Alternative F Expansion Elements (Existing Site Location)

Element	Existing Facility	Remodeled Development	Net New Development
	Square Feet (rounded)		
Gaming	34,000	43,800	9,800
Hotel and Spa	60,700	60,700	0
Events and Conference Center	9,800	10,000	200
Restaurants	5,500	5,500	0
Non-Casino Related Retail	0	0	0
Parking Garage	0	604,500	604,500

Note: New development assumes redevelopment of existing gaming facility. Existing surface parking not included.
Source: AES

General Assumptions

The findings presented herein make many general assumptions, which include:

- The Project and Project Alternatives are assumed to open in 2020 with the full envisioned development program as noted above in each identified alternative;
- The first year of stabilized operations is assumed to occur in 2022;
- For simplicity each financial model year reflects a full calendar year of operation;
- The Project and Project Alternatives are assumed to be operated under current class standards of the existing Win-River casino;
- No major changes to current tax structures in place as of year-end 2016;
- No major changes to the City of Redding or Shasta County's levels of service or budget process;
- No major changes to market competition; and
- No disruptive economic shocks (recession, oil price spikes, natural or manmade disasters, etc.) are assumed. Though such contingencies present significant risk, they are beyond the scope of an analysis of this type.

Socioeconomic Analysis

The Strawberry Fields Site is located in the City of Redding (City), which is located within Shasta County (County) in northern California (State). The following section presents an overview of select socioeconomic characteristics of the City in relation to the County and State. This socioeconomic analysis is followed by an overview of the social implications of gaming and a discussion of potential real estate impacts of a new casino resort facility. The purpose of this section is to establish the regions historic, current, and projected socioeconomic characteristics prior to evaluating the potential impact of the Project and Project Alternatives.

Population

According to the Census and the Department of Finance population projection, the City gained approximately 23,770 residents between 1990 and 2016. This represents an increase, on average, of 914 people per year or an annual growth rate of 1.2 percent a year. As of January 1st, 2016, the City represented approximately 50 percent of the County's population and 75 percent of the County's growth since 1990. The City's overall population growth has outpaced the County and State's growth during the time period under evaluation. However, like the County, the City's population growth has been relatively flat over the last six years. Due to its large land area and high percentage of rural areas, the County has a population density significantly lower than the State and most of the growth has occurred due to migration into the County.

Figure 8 - Population Trends

	4/1/90	4/1/00	4/1/10	1/1/16
Population				
City of Redding	66,462	80,865	89,861	90,230
Shasta County	147,036	163,256	177,223	178,592
State	29,758,213	33,873,086	37,253,956	39,255,883
Average Annual Population Growth	*4/1/90 - 4/1/00*	*4/1/00 - 4/1/10*	*4/1/10 - 1/1/16*	*1990 - 2016*
City of Redding	1,440	900	62	914
Shasta County	1,622	1,397	228	1,214
State	411,487	338,087	333,655	365,295
Population Growth Rate (CAGR)	*4/1/90 - 4/1/00*	*4/1/00 - 4/1/10*	*4/1/10 - 1/1/16*	*1990 - 2016*
City of Redding	2.0%	1.1%	0.1%	1.2%
Shasta County	1.1%	0.8%	0.1%	0.8%
State	1.3%	1.0%	0.9%	1.1%

Note: CAGR = Compound Annual Growth Rate

Source: US Census and California Department of Finance (Demographic Research Unit).

The most recent City projections, from the Shasta Regional Transportation Agency, of long-term population growth is estimated to increase between 2015 and 2030 at a slower rate than experienced since 1990. It is projected that the majority of new population growth between 2015 and 2030 will continue to reside in the City (74 percent) and they will continue to represent the majority of County residents in 2030.

Figure 9 - Population Projections

	2010	2020	2030
Population			
City of Redding	89,861	92,101	99,555
Shasta County	177,223	183,920	193,928
State	38,896,969	40,619,346	42,373,301
Average Annual Population Growth	*2010 - 2020*	*2020 - 2030*	*2010 - 2030*
City of Redding	224	745	485
Shasta County	670	1,001	835
State	172,238	175,396	173,817
Population Growth Rate (CAGR)	*2010 - 2020*	*2020 - 2030*	*2010 - 2030*
City of Redding	0.2%	0.8%	0.5%
Shasta County	0.4%	0.5%	0.5%
State	0.4%	0.4%	0.4%

Note: City of Redding and Shasta County estimates provided from the Shasta Regional Transportation Agency, which does not specify date of population estimate. Estimates were projected based on most recent population data provided by the Department of Finance and projected out based on published growth rates over the same period of time. CAGR = Compound Annual Growth Rate

Source: California Department of Finance (Demographic Research Unit) and Shasta Regional Transportation Agency

Education

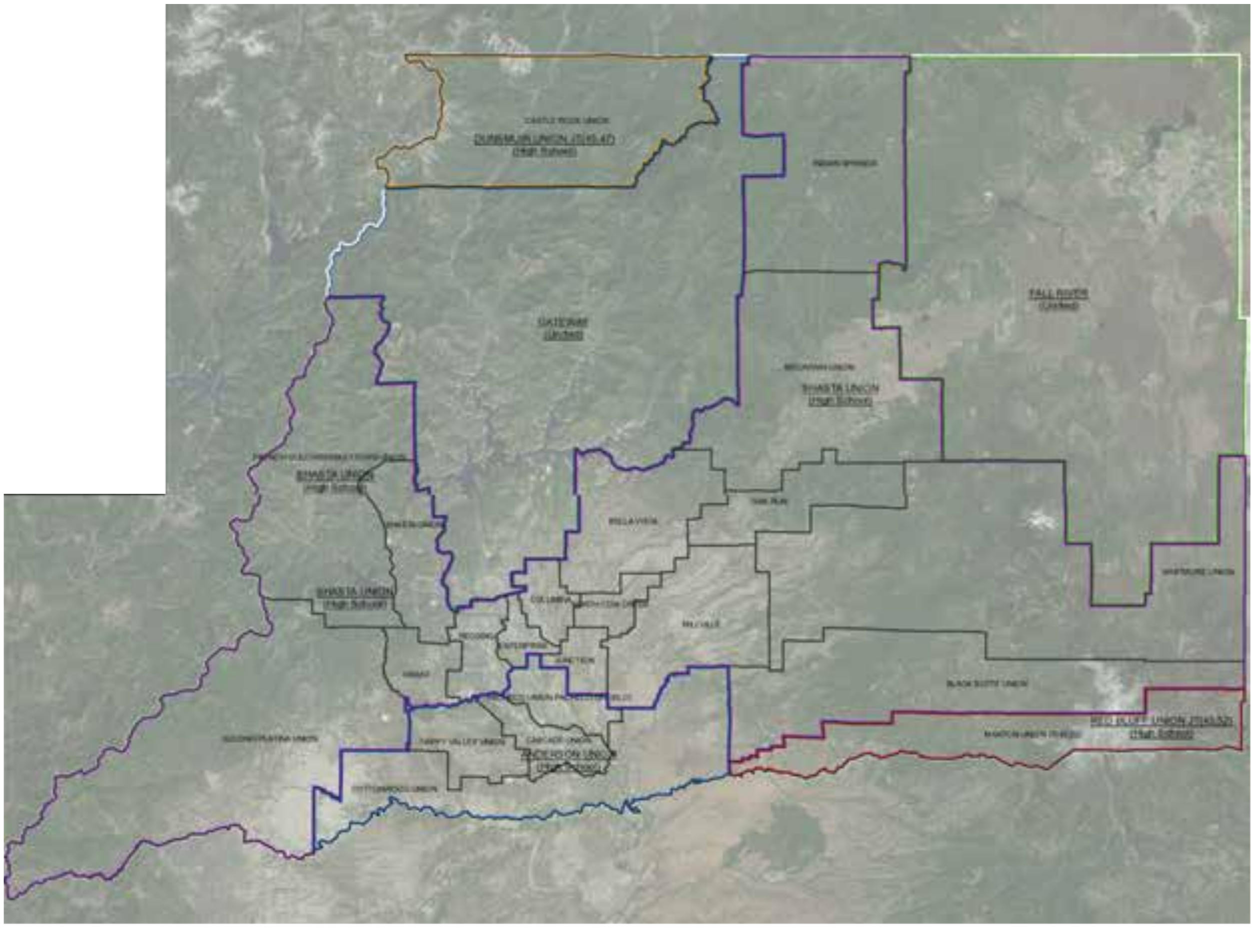
Shasta Union is the largest of three high school districts in the County and the various elementary districts feed into it. In total there are 25 school districts with over 100 public schools located throughout the County. As of the 2015 - 2016 school year the Department of Finance reports that the County's public schools have approximately 26,400 kindergarten through twelfth grade students. Since a peak attendance level of approximately 30,400 students in the 2000 - 2001 school year, enrollment has declined by approximately one percent per year. Looking forward, this trend is anticipated to continue with an average loss of approximately 160 students per year through 2026. Public education is evaluated because an increase or decrease in population may have an impact the County's public school system. Implicit in these projections are that fewer family households with children will be present in the region over the next 10-years.

Figure 10 - Shasta County Public Schools

Source: Shasta County Office of Education

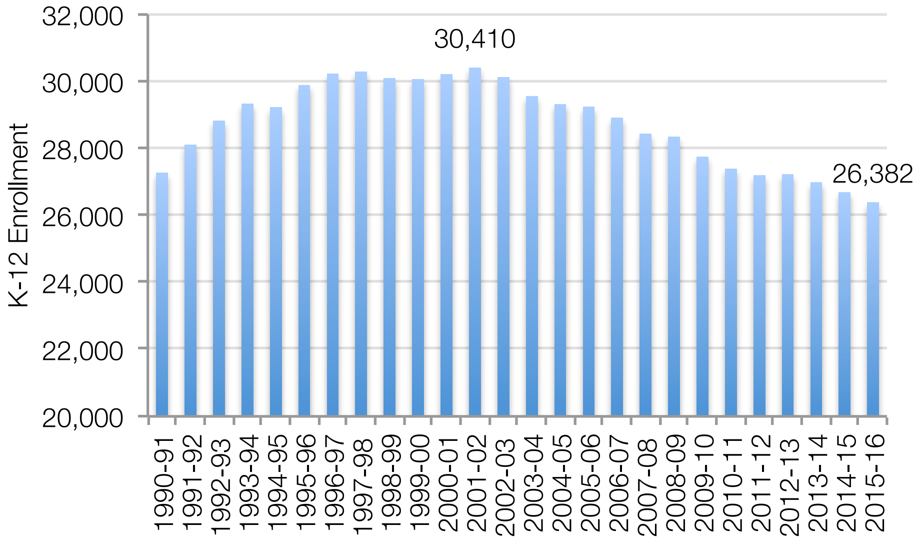
Academy of Personalized Learning	Foothill Plus High School	Pacheco Elementary School
Alta Mesa Elementary School	Freedom High Community Day	Parsons Jr. High
Anderson Adult School	French Gulch Whiskeytown Elementary School	Pioneer Continuation High School
Anderson Heights Elementary School	Gateway Community Day	Platina Elementary
Anderson High School	Gateway Educational Options	Prairie Elementary School
Anderson Middle School	Grand Oaks Elementary School	Redding Collegiate Academy
Anderson New Technology High School	Grant Elementary School	Redding Community Day
Bella Vista Elementary School	GREAT Partnership	Redding School of the Arts II
Black Butte Elementary	Happy Valley Community Day School	Redding STEM Academy
Black Butte Jr. High	Happy Valley Elementary School	Rocky Point Charter
Bonny View Elementary School	Happy Valley Primary	Rother Elementary School
Boulder Creek Elementary School	Igo-Ono-Elementary School	Sequoia Middle School
Buckeye School of the Arts	Indian Springs Elementary School	Shasta Adult School
Burney Community Day School	Junction Elementary School	Shasta County Independent Charter School
Burney Elementary School	Junction Middle School	Shasta County Juvenile Court School
Burney Jr/Sr High School	Juniper School	Shasta High School
Career Pathways to Success Community School	Lassen View Elementary School	Shasta Plus High School
Cascade Community Day School	Manzanita Elementary School	Shasta Lake School
Castle Rock Union Elementary School	Meadow Lane Elementary School	Shasta Meadows Elementary School
Central Valley High School	Millville Elementary School	Shasta Charter Academy
Chrysalis Charter School	Mistletoe Elementary School	Shasta-Trinity ROP
Columbia Elementary School	Monarch Learning Center	Shasta Union Elementary School
Cottonwood Community Day	Montgomery Creek Elementary School	Soldier Mountain Continuation High
Cottonwood Creek Charter School	Mountain Lakes High School	South County Community Day School
Cypress Elementary School	Mountain View Continuation High School	Special Ed/EXCEL Academy
Early Childhood Services	Mountain View Middle School	Stellar Charter Tech/Home Study
East Valley Community Day School	New Day Academy	Sycamore Elementary School
Enterprise High School	North Cottonwood Elementary School	Turtle Bay Elementary School
Enterprise Plus High School	North Cow Creek Elementary School	University Preparatory
EXCEL Academy (Special Education)	North State Independence High School	West Cottonwood Jr. High School
Fall River Community Day School	North Valley Continuation High School	West Valley High School
Fall River Elementary Community Day	Northern Summit Academy	Whitmore Elementary School
Fall River Elementary School	Oak Run Elementary School	
Fall River Jr/Sr High School	Oakview High School	
Foothill High School	PACE Academy	

Figure 11 - Shasta County Public School District Map



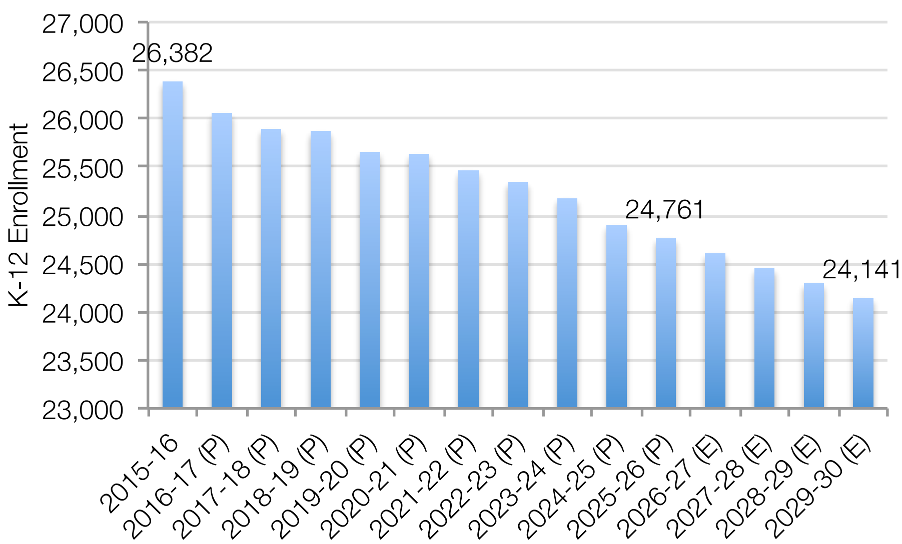
Source: Shasta County Office of Education

Figure 12 - Shasta County Public School Enrollment



Source: California Department of Finance (Demographic Research Unit)

Figure 13 - Projected Shasta County Public School Enrollment



Note: (P) Projected; (E) Estimate from Pro Forma Advisors based on extrapolation of Department of Finance projections

Source: California Department of Finance (Demographic Research Unit)

Employment

An evaluation of the primary "in-place" jobs in the City, County, and State was analyzed to more accurately reflect the employment activity that is occurring within these geographic areas. Many employment surveys are based on where workers live rather than where they work, which often skew the perception of jobs located in a regional economy.

Total in-place jobs[2] in the City and County declined from 2004 to 2009 due to the Great Recession. Unlike the City, where primary jobs remain slightly below their 2004 level, primary jobs in the County have increased since 2004 based on the last available year data. In all cases, in-place employment has risen between 2009 and 2014 as the economy recovered from the Great Recession. There were approximately 43,400 total jobs in the City, which represents approximately 72 percent of all jobs in the County.

Figure 14 - Employment Trends

	2004	2009	2014
Employment			
City of Redding	43,910	40,615	43,406
Shasta County	59,400	57,986	59,996
State	13,912,748	14,122,178	15,614,666
Average Annual Employment Growth	*2004 - 2009*	*2009 - 2014*	*2004 - 2014*
City of Redding	-659	558	-50
Shasta County	-283	402	60
State	41,886	298,498	170,192
Employment Growth Rate (CAGR)	*2004 - 2009*	*2009 - 2014*	*2004 - 2014*
City of Redding	-1.5%	1.3%	-0.1%
Shasta County	-0.5%	0.7%	0.1%
State	0.3%	2.0%	1.2%

Note: CAGR = Compound Annual Growth Rate

Source: Shasta Regional Transportation Agency and US Census, Center for Economic Studies

The most recent long-term employment City projections from the Shasta Regional Transportation Agency anticipates that jobs will increase between 2015 and 2020 and grow, on average, by 319 net new jobs per year between 2010 and 2030. This reflects a long-term growth rate of slightly under one percent for both the City and County and similar to in-place employment gains generally experienced over the last five-years of US Census data.

Unlike long-term population forecasting, which is typically more reliable because there is a deterministic element to the process (birth rate, death, etc.), long-term employment projections are often more unreliable because of the uncertainly involved in accurately predicting future economic trends. Most long-term economic forecasts simply assume that near-

[2] All public and private sector jobs.

term growth rates will continue at a set rate into the future and do not account for future recessions or other such downturns in economic activity.

Figure 15 - Employment Projections

	2010	2020	2030
Employment			
City of Redding	42,619	45,526	49,003
Shasta County	59,735	64,256	69,399
Average Employment Growth	*2010 - 2020*	*2020 - 2030*	*2010 - 2030*
City of Redding	291	348	319
Shasta County	904	514	483
Employment Growth Rate (CAGR)	*2010 - 2020*	*2020 - 2030*	*2010 - 2030*
City of Redding	0.7%	0.7%	0.7%
Shasta County	0.7%	0.8%	0.8%

Note: City of Redding and Shasta County estimates provided from the Shasta Regional Transportation Agency, which does not specify date of employment estimate. Estimates were projected based on most recent employment data provided by the US Census Center of Economic Studies and projected out based on published growth rates over the same period of time. CAGR = Compound Annual Growth Rate

Source: Shasta Regional Transportation Agency and US Census, Center for Economic Studies

Income

As of the 2000 Census, the City's median household income was approximately four percent lower than the County and 28 percent lower than the State. The household income projections (2016 - 2021), provided by ESRI Business Analyst, suggest that the City's households tend to be more concentrated in income cohorts below $100,000. Average household incomes and per capita incomes in the City, County, and State are projected to experience similar growth between 2016 and 2021 with median household incomes projected to decline slightly in the City and the County. This trend suggests that higher paying jobs will push the average household wage higher while the "middle" wage will not grow.

Figure 16 - Income Trends

		Census 2000	2016	2021	CAGR (2016-2021)
Median Household Income					
	City of Redding	$34,194	$44,931	$44,804	-0.1%
	Shasta County	$34,335	$45,817	$45,504	-0.1%
	State	$47,493	$62,554	$71,566	2.7%
Average Household Income					
	City of Redding	$44,712	$63,259	$68,187	1.5%
	Shasta County	$44,810	$63,837	$68,872	1.5%
	State	$64,725	$90,812	$98,876	1.7%
Per Capita Income					
	City of Redding	$18,207	$26,179	$28,108	1.4%
	Shasta County	$17,738	$25,916	$27,882	1.5%
	State	$22,711	$30,905	$33,433	1.6%

Note: Income expressed in current year dollars. CAGR = Compound Annual Growth Rate

Source: ESRI Business Analyst and US Census

Housing

As of January 1st, 2016 there were approximately 39,400 housing units in the City. This represents approximately half of the total housing units in the County. Since 1990, the City has increased its housing stock by 1.4 percent per year based on a compound annual growth rate basis. This is a higher rate than both the County and State over the same period of time. Due to the Great Recession, delivery of new housing units has slowed in recent years with average annual deliveries down 74 percent from the historic 25-year average.

Figure 17 - Housing Trends

		4/1/90	4/1/00	4/1/10	1/1/16
All Housing Units (HU)					
	City of Redding	27,238	33,837	38,679	39,423
	Shasta County	60,552	68,810	77,313	78,379
	State	11,182,513	12,214,550	13,670,304	13,981,826
Average Annual HU Growth		*4/1/90 - 4/1/00*	*4/1/00 - 4/1/10*	*4/1/10 - 1/1/16*	*1990 - 2016*
	City of Redding	660	484	124	469
	Shasta County	826	850	178	686
	State	103,204	145,575	51,920	107,666
HU Growth Rate (CAGR)		*4/1/90 - 4/1/00*	*4/1/00 - 4/1/10*	*4/1/10 - 1/1/16*	*1990 - 2016*
	City of Redding	2.2%	1.3%	0.3%	1.4%
	Shasta County	1.3%	1.2%	0.2%	1.0%
	State	0.9%	1.1%	0.4%	0.9%

Note: CAGR = Compound Annual Growth Rate; Housing Units inclusive of single-family, multi-family, and mobile homes.

Source: US Census and California Department of Finance (Demographic Research Unit).

As the economy continues to improve, housing unit production in the City and County are anticipated to increase in the near future. Looking forward over the 2010 to 2030 horizon the delivery of housing units is projected to be slightly higher than historic averages. However, it should be noted that these projections from the Shasta Regional Transportation Agency and are based on transportation models and associated land use planning and may not reflect changes in residential market conditions (i.e. similar to the employment projections).

Figure 18 - Housing Projections

		2010	2020	2030
Housing Units (HU)				
	City of Redding	33,837	41,048	44,431
	Shasta County	68,810	82,923	87,726
Average HU Growth		*2015 - 2020*	*2020 - 2025*	*2025 - 2030*
	City of Redding	721	338	530
	Shasta County	1,411	480	946
HU Growth Rate (CAGR)		*1990 - 2000*	*2000 - 2010*	*2010 - 2017*
	City of Redding	2.0%	0.8%	1.4%
	Shasta County	1.9%	0.6%	1.2%

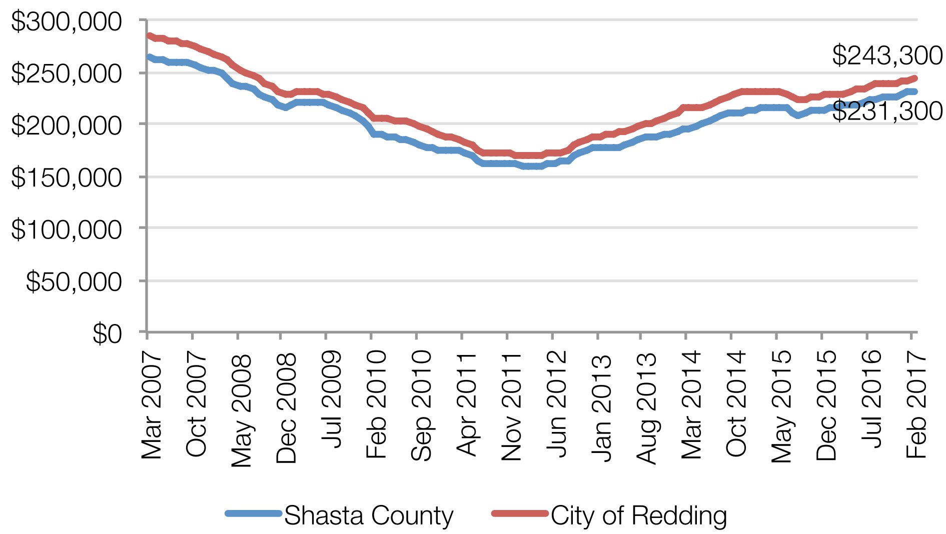
Note: Housing unit estimate was projected using Shasta Regional Transportation Agency projected household growth rates applied to the most recent year of housing data. CAGR = Compound Annual Growth Rate

Source: Department of Finance and Shasta Regional Transportation Agency

Housing Market Trends

In February 2017 the median home price in the City was approximately $243,300 for all for-sale residential housing units, which is approximately 5 percent higher than the County ($231,200). Following similar trends in the State, residential housing prices peaked around 2007. However, after the rapid drop in median housing prices from 2007 to 2011, prices have been generally increasing. Both the City and County's housing market lost approximately 40 percent of its value during the recession, but are now within 12 and 14 percent of their peak value, respectively. All pricing is presented in current year dollars and not adjusted for inflation.

Figure 19 - Historic Median Home Sales Prices (2007-2017)



Source: Zillow (all For-Sale Housing Included)

Social Cost of Gaming

The following provides an overview of select research regarding the social cost of gaming. This review focuses on research on the potential impact of gaming as it relates to crime and other social costs borne by the gambler, residents, and general society specific to the State.

Literature Review of Social Impacts of Gaming

A literature review was conducted to identify a select number of studies that provide insights regarding the social impacts of gaming. These studies were analyzed to assist in ascribing potential "costs" to the City, County, and State based on the incremental gaming increase in the Project and some of the Project Alternatives evaluated herein. A full understanding of the social impact of gaming on its surrounding communities is difficult to measure given that there is not a large volume of comprehensive research on the subject that is independent.[3] The research selected for this study include three commonly sited studies prepared for government agencies.[4]

As noted by Alan Mallach, in the report to the Federal Reserve Bank of Philadelphia (Economic and Social Impact of Introducing Casino Gambling), casinos are generally believed to impose social costs to local communities including, but not limited to an increase in crime, bankruptcies, and problem or pathological gambling. These community costs can potentially offset the benefits of casinos with respect to increased economic activity or potential direct or indirect tax revenues.

From an economic perspective, accounting for the fiscal impact of the social costs created by casino gambling is significantly more difficult than measuring the gross economic or revenue impact. This is true for a couple of reasons, which include the complexity of defining what is considered a "social cost" and what social costs can reasonably be attributed to a casino rather than to other factors in society.

Specifically, the Economic and Social Impact of Introducing Casino Gambling report identifies three distinct costs arising from problem gambling or other social costs potentially triggered by casinos:

1. Costs borne by the individual exhibiting that behavior;
2. Costs borne by the family and friends of that individual; and
3. Costs borne by society.

The first cost is thought to be a private expense of the individual engaging in the behavior (assuming the individual partaking in that behavior assumes the full cost of his or her behavior). For example, if one has significant gambling losses, even if they are disproportionately high relative to others participating in gaming, they are not social costs but rather private costs as long as the individual can afford to participate in that activity. With the exception of those

[3] National Gabling Impact Study Commission (1999)

[4] "Economic and Social Impact of Introducing Casino Gambling," Federal Reserve of Philadelphia (2010); "The Impact of Gambling: Economic Effects More Measurable than Social Effects," General Accounting Office (2000); and "Gambling's Impact on People and Place's," National Gabling Impact Study Commission (1999).

classified as having a gambling disorder the gambler is behaving rationally as it is his or her choice of how to spend discretionary income, even though it may not conform to societal norms.

The second and third identified categories are both external costs. It is difficult to quantify the costs to family and friends as they cannot always be documented. Societal costs (e.g. crime and the related police, judicial, and penal costs) are more easily determined. However, as noted in the Economic and Social Impact of Introducing Casino Gambling report, truly quantifying the social costs directly attributable to a casino is not straightforward due to the question of causality.

The observation that gaming is correlated with various problems does not necessarily imply that gaming causes them (i.e. If gaming was not present, would a person who engages in such behavior still harm the community in other ways?). If pathological gambling is a primary disorder, then there is a legitimate case that the costs associated with that disorder can be assigned to the casino. If it is a secondary disorder, the argument is more questionable. This issue is also referred to as the "co-morbidity" of pathological and problem gambling.

Problem Gaming

While most people gamble responsibly for recreation, as noted above, a certain number of people gamble excessively and become what is commonly referred to as either a pathological or problem gambler. Pathological gambling is a recognized impulse control disorder by the American Psychiatric Association. Pathological gamblers (often also referred to as "compulsive" gamblers) are identified by a number of characteristics, including repeated failures to resist the urge to gamble, loss of control over their gambling, personal lives, and employment, reliance on others to relieve a desperate financial situation caused by gambling, and the committing of illegal acts to finance gambling. Problem gambling, on the other hand, refers to gambling that significantly interferes with a person's basic occupational, interpersonal, and financial functions, albeit to a lesser degree than compulsive gambling.[5]

One way to address pathological and problem gaming is through publicly funded services. According to the 2014 study prepared for the National Council of Problem Gambling and Association of Problem Gaming, the total number of states that reported publicly funded problem gambling services increased from 37 in 2010 to 39 in 2013. The State dedicated $8.7 million in funds for such services, which was the most of any state offering public gambling services in the United States ($60.6 million in 2013). Although the State invested almost twice as many funds in problem gambling services as most other states, it is also has the largest population. The State's per capita allocation (23 cents) was below the 32 cent average among states with public funding for problem gambling services.

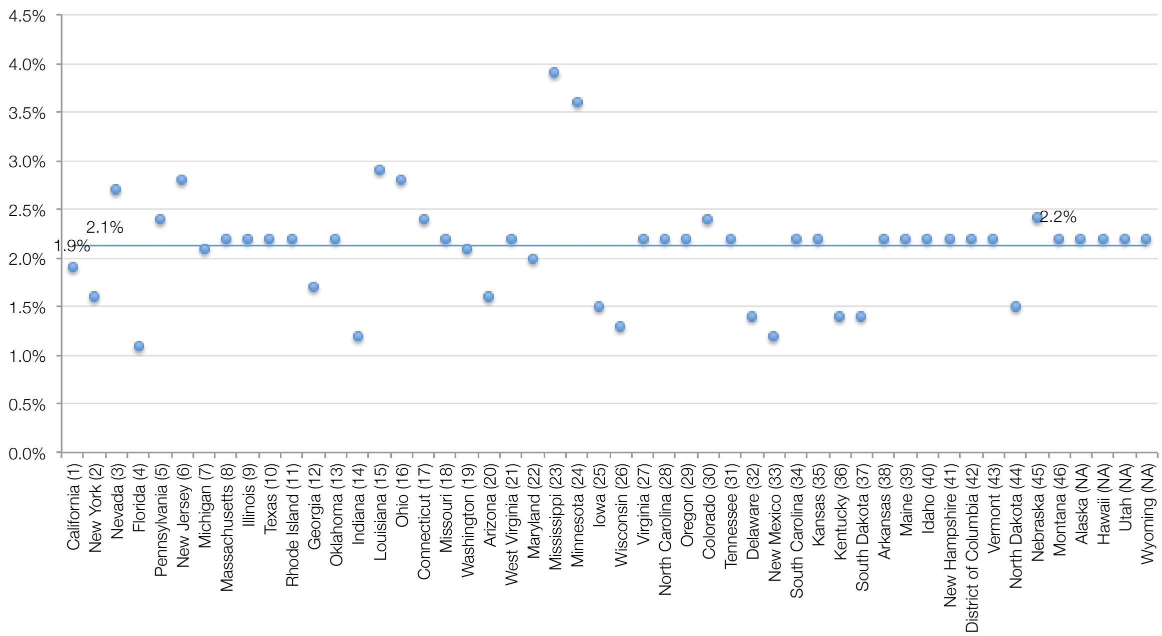
However, looking at national statistics from the study, there is not a clear correlation between the amount of gaming activity and the percent of the population identified as having a gambling disorder.[6] In 2012 it was estimated that the State ranked first in gaming revenues, generating over $2.4 billion in reported gaming revenues. At the same time it was

[5] General Accounting Office (2000)

[6] The National Council on Problem Gambling uses the following definition: "Problem gambling is gambling behavior which causes disruptions in any major area of life: psychological, physical, social or vocational. The term "Problem Gambling" includes, but is not limited to, the condition known as "Pathological", or "Compulsive" Gambling, a progressive addiction characterized by increasing preoccupation with gambling, a need to bet more money more frequently, restlessness or irritability when attempting to stop, "chasing" losses, and loss of control manifested by continuation of the gambling behavior in spite of mounting, serious, negative consequences."

estimated that 1.9 percent of the State's population (544,981 citizens)[7] are believed to have a gambling disorder. Conversely, Montana ranked last in reported gaming revenue[8], generating $71.5 million in gaming activity while 2.2 percent of the state's population (17,226) is believed to have a gambling disorder.[9] On average, it it is estimated that 2.1 percent of the population will have a pathological gambling disorder.

Figure 20 - State Rank by Gaming Revenue and Percent of Population with Gambling Disorder



Source: 2013 National Survey of Problem Gaming

[7] Based on a 2012 U.S. Census Bureau estimate of 28,683,238 persons age 18 and over and findings from two California problem gambling prevalence studies (1990, 2006) converted into a standardized past year problem gambling rate by Williams, Volberg, & Stevens (2012).

[8] Alaska, Hawaii, Utah, and Wyoming did not report any gaming revenue.

[9] Based on a 2012 U.S. Census Bureau estimate of persons age 18+ multiplied by the national average adult past year prevalence rates of problem gambling as reported and converted into standardized rates by Williams, Volberg, & Stevens (2012).

Public Safety

Proponents of gambling tend to stress the economic benefits of gaming while opponents site its social costs. Clearly there are both benefits and costs of gaming to a community. In the County, the Win-River casino was recognized as one of the top twenty-five employers in 2016. As previously noted, due to the complexity of estimating the total social impacts of gaming, it is not possible to determine its precise impact on a community. However, historical information regarding public safety is one important metric to analyze the existing and potential future impact of gaming to the region.

The County has identified a list of crimes that have been reported at the current Win-River facility that include, but not limited to:[10]

- Assault
- Burglary
- Grand Theft
- Petty Theft
- Robbery
- Narcotic Possession and Use
- Narcotic Sales
- Prostitution and Sex Trafficking
- Auto Theft
- Fighting/Disturbances
- Driving While Intoxicated
- Public Drunkenness
- Disorderly Conduct

The two jurisdictions that would be most impacted by current and potential future expanded casino operations are the City and the County. Currently the Win-River casino has a memorandum of understanding with the County's Sheriff's Department to provide law enforcement services. As such, the City does not provide police protection for the Win-River casino, nor is expected to provide police protection for the Project or Project Alternatives. However, given that potential crime can take place in the City, both the City and County were analyzed as it relates to potential increases in public safety issues coming from expanded casino operations.

City

Examining historic data from City, it was reported that the City had approximately 94,500 police related calls-for-service (CFS) for year end 2015. This is up from approximately 85,500 calls-for-service in 2008. Approximately five percent of these CFS were classified as Part 1 Crimes, which are cited as the most severe consequences of problem gaming (e.g. auto theft, robbery, etc.). For illustrative purposes, these Part 1 Crimes were analyzed from 2008 to 2015 to the Win-River gross gaming revenue (GGR) as a proxy of comparative growth. The data suggest that as GGR grew by nine percent, Part 1 Crimes have grown by approximately 27 percent with little comparison in the trend lines. Unlike the

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[10] Letter from Terri Howat, Chief Financial Officer, Shasta County Administrative Office, dated December 28, 2016, "Re: NOI Comments, Redding Rancheria Project."

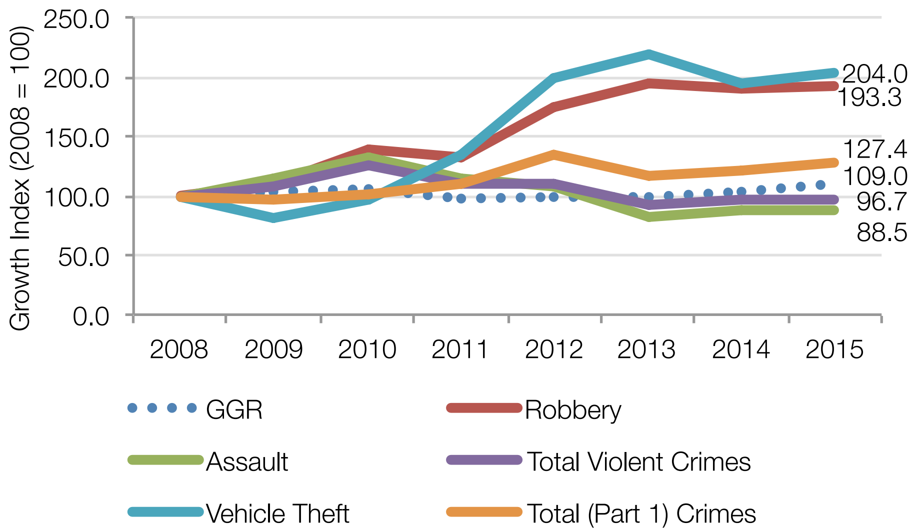
County, which is discussed in the next section, the City crimes would occur within its jurisdiction and does not necessarily have any relationship to casino operations and are provided for comparison purposes only.

County

Examining historic data from County, it was reported that the County had approximately 2,300 Part 1 Crime calls per year, on average, from 2000 - 2011.[11] For illustrative purposes, an estimate regarding calls initiated by the Win-River casino to the Sheriff's Department is provided. On average, 2 to 5 calls a month are initiated by the Win-River casino to the Sheriff's Department. As such, based on these historic trends there has not been a pressing need for law enforcement at the casino. It is important to note these data are not comparable because of the nature of the tracked calls (e.g. the CFS is not necessarily classified as a Part 1 Crime).

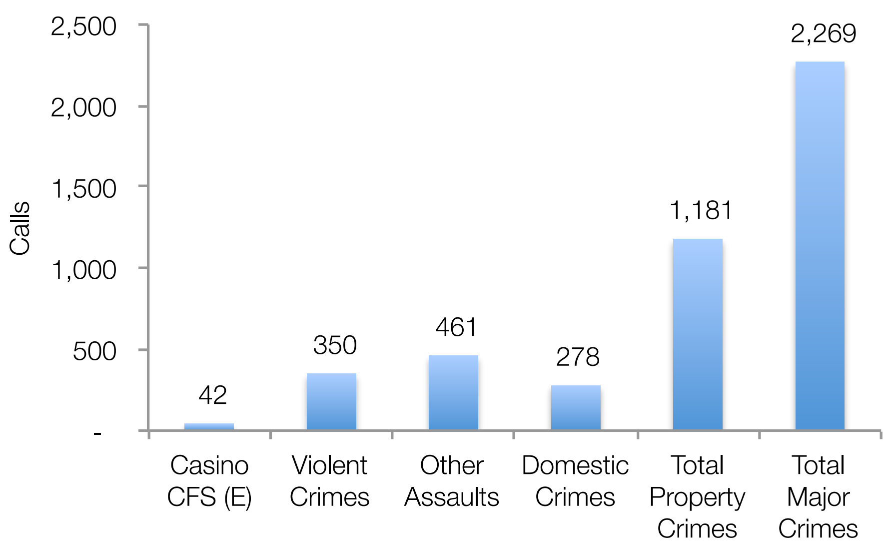
[11] The most current years of available information from the Shasta County Sheriff's Office Annual Report.

Figure 21 City of Redding Part I Crime Index (2008 - 2015)



Note: GGR = Gross Gaming Revenue
Source: City of Redding Police Department; Win-River Resort & Casino

Figure 22 Shasta County Part I Crime - Average Calls (2000 - 2011)



Note: CFS = Calls for Service; E = Estimate (as provided by Win River Casino
Source: Shasta County Sheriff's Office Annual Report; Win-River Resort & Casino

Implications of Casino Operations on Housing Values

As in most areas, the larger macro trends that influence the residential market will play a greater role in influencing home values than that of a specific development. However, a potential concern of residents of the City or County could be the impact of residential property values based on the Project and the Project Alternative. Similar to the social cost of gaming, there has been research conducted to determine the impacts of gaming operations on local residential real estate values.

As is the case with other types of commercial or industrial properties, the siting of a casino produces externalities that in turn can create positive and negative impacts on residential property values. Positive externalities will increase home values, while negative externalities will decrease home values. For example, studies observe positive price effects given a house's proximity to open space or an ocean and negative effects for proximity to rail a cell phone tower (visual) or a flight path (noise). The negative externalities are typically various types of residential "nuisances" that, while controlling for all other factors (e.g. house size, location, etc.), contribute to some quantifiable decrease in homing values. In contrast, positive externalities contribute to some quantifiable increase in residential home values.

Casinos would appear to have the potential of creating a negative impact on residential property values in their immediate area based on the externalities created from residential nuisances such as increased traffic, noise, perceived crime, light, etc. On a broader, area-wide basis; however, casinos may create new jobs and improve the economy that in turn can benefit housing prices. It is important to note that the location or siting of a casino operation and the relative impact of the negative externalities attributed to its operations on local residential real estate values are unique and differ widely from one area to another.

In the case of the Project and Project Alternatives, there is no anticipated impact on residential home values for several reasons. First, any negative externalities created by the casino are theoretically priced into the larger market area due to the existing operations at the Win-River casino. Second, the Project and Project Alternatives locations are near the Interstate 5 freeway and other commercial areas. These existing "negative" externalities make it difficult to isolate the potential incremental impact of future casino operations. On the other hand, there could be a positive impact to existing neighborhoods surrounding the existing Win-River casino site depending on the redevelopment of the current facility in Project Alternatives A, B, C, and E.

Competition

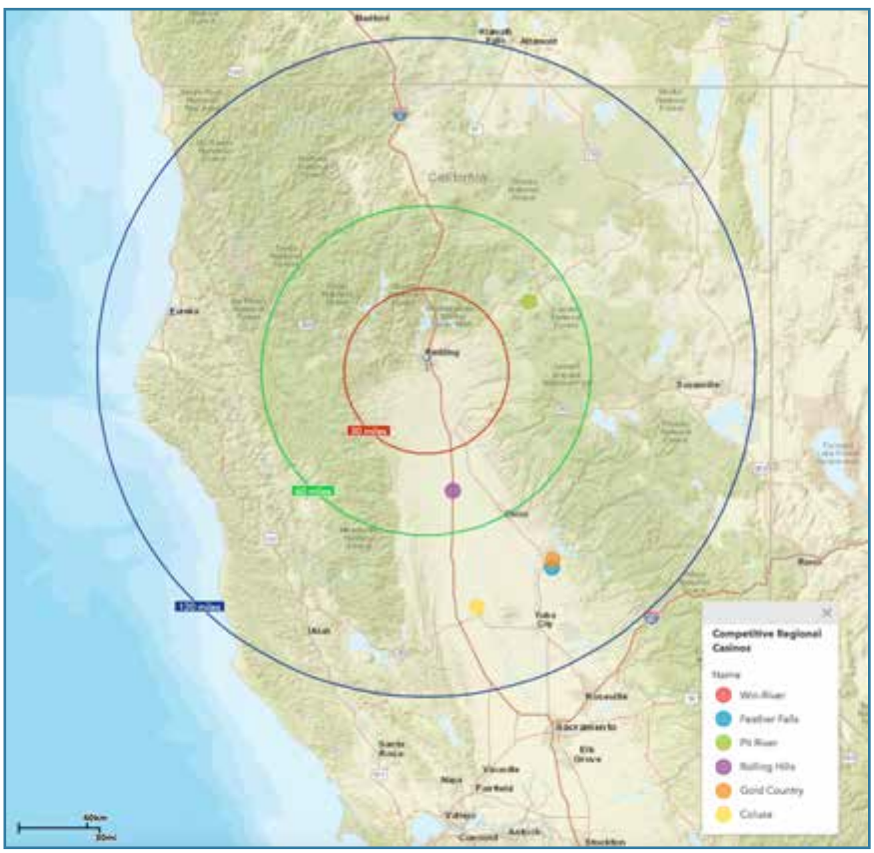
The following section provides analysis regarding the proposed development components (i.e. gaming, hotel, and retail) of the Project and Project Alternative's market (competition, performance, etc.) and a discussion of the estimated impact on the market's competition (also known as substitution or competitive effect).

Market Analysis

Gaming

As noted, the Project and Project Alternatives inclusive of gaming will operate within the framework of IGRA and a compact with the State. As there is no legal Las Vegas-style gaming in the State, other than that offered by Tribal Nations, the Project and Project Alternatives with gaming will primarily compete with regional Tribal casinos. The Northern California area is home to a number of tribal casinos, with five major competitive facilities within approximately a two hour drive time of the Win-River facility. The locations of the key competitive casinos are shown in the following map. To a lesser extent, the Project and certain Project Alternatives will compete with gaming destinations in Nevada and the rest of the State, as well as other forms of gaming (e.g. card clubs).

Figure 23 Gaming Competition Map



Source: ESRI; Pro Forma Advisors

The following is an overview of the current competitive casinos and the general characteristics of these properties in the market. Within the regional market, the key competitive facilities (primary competition) are Rolling Hills and Pit River and, to a lesser extent, Feather Falls, Gold Country, and Colusa casinos (generally defined as secondary competition in the analysis). There are a number of other casinos that are within the larger market area and are included in the gravity model analysis, but not listed below. Examples would include the new or under construction facilities such as Fire Mountain and Rain Rock casinos as well as others existing casinos that fall within the "other" competitive market category.

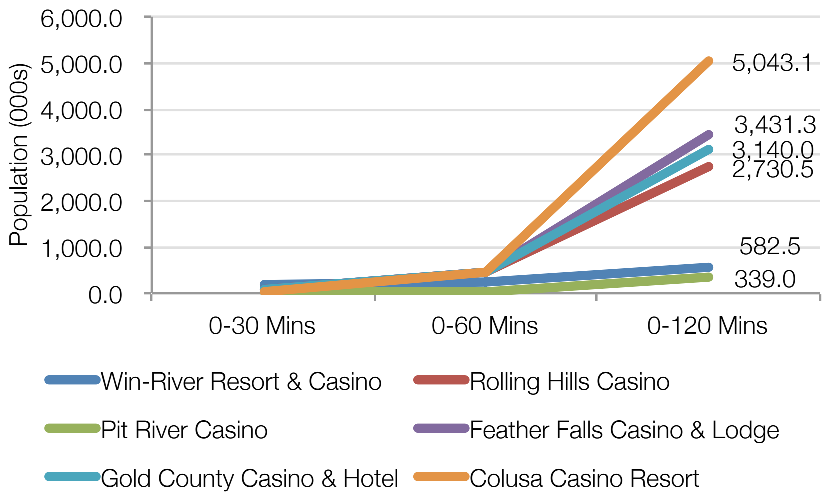
Figure 24 Competitive Casinos

	Primary		Secondary		
Element	Rolling Hills Casino	Pit River Casino	Feather Falls Casino & Lodge	Gold County Casino & Hotel	Colusa Casino Resort
Distance from Site (miles)	48	58	94	93	99
Casino Size (ft²)	70,000	9,000	118,112	60,000	66,000
Slots	840	145	1,000	930	1,000
Table Games	7	1	22	14	11
Poker	2	1	12	7	2
Restaurants & Bars	4	1	4	4	3
Hotel Rooms	111	0	84	87	52

Source: Casino City, Google Maps

As illustrated below, the available population for the existing Win-River casino is significantly lower than most other competitive casinos in the competitive market area. Pit River Casino, located approximately a hour northeast of the current Win-River facility has a similar market population within a two-hour drive time. The closest competitive casino is Rolling Hills Casino, which is approximately a 45-minute drive south of the current Win-River facility. Rolling Hills Casino along with the other secondary competitive locations benefit from a site location closer to population centers in the greater Sacramento area in the two-hour drive time market area.

Figure 25 Comparative Population (Thousands) by Travel Time (2017)

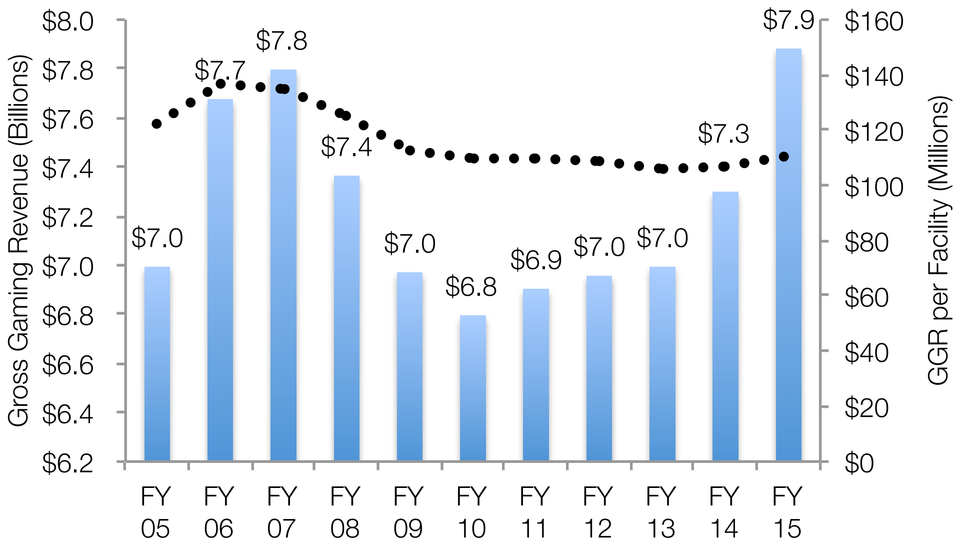


Casino	Drive Time (Population in 000s) 0-30 Minutes	0-60 Minutes	0-120 Minutes
Win-River Resort & Casino	177	252	583
Rolling Hills Casino	83	436	2,731
Pit River Casino	8	28	339
Feather Falls Casino & Lodge	84	450	3,431
Gold County Casino & Hotel	75	436	3,140
Colusa Casino Resort	33	476	5,043

Source: ESRi; Google Maps

State tribal casinos are not required to report independent public information on gaming revenue or performance. By compact, however, they report gaming revenues and revenue share payments to the State and National Indian Gaming Commission. As such, the total gaming revenues can be tracked. During the Fiscal Year (July - June) 2005, total State Tribal gaming revenues were $7.0 billion. They peaked in Fiscal Year (FY) 2007 at $7.8 billion, although only slightly up from FY2006. The first half of calendar year 2008 was a period of slower economic activity, mostly impacted by a severe increase in gas prices. FY2009, which included the November 2008 credit crisis period and subsequent “Great Recession” saw a decrease of 5.3% in GGR. In FY2010, statewide GGR fell another 2.5 percent to a low of $6.8 billion. Statewide GGR stabilized in FY2011 and has remained virtually flat at about $7.0 billion for FY2011 through FY2013. As of FY2015, statewide gaming revenue increased by 8.2 percent to 7.9 billion, which is the first time the total exceeded FY2007 peak levels. During the same time, more operations have opened and the average GGR per facility has remained relatively constant. Since fiscal year 2010, GGR per facility has increased only 1.3 percent (not adjusted for inflation).

Figure 26 State Tribal Gaming Revenues (in Billions of Dollars) Fiscal Year 2005 - 2015



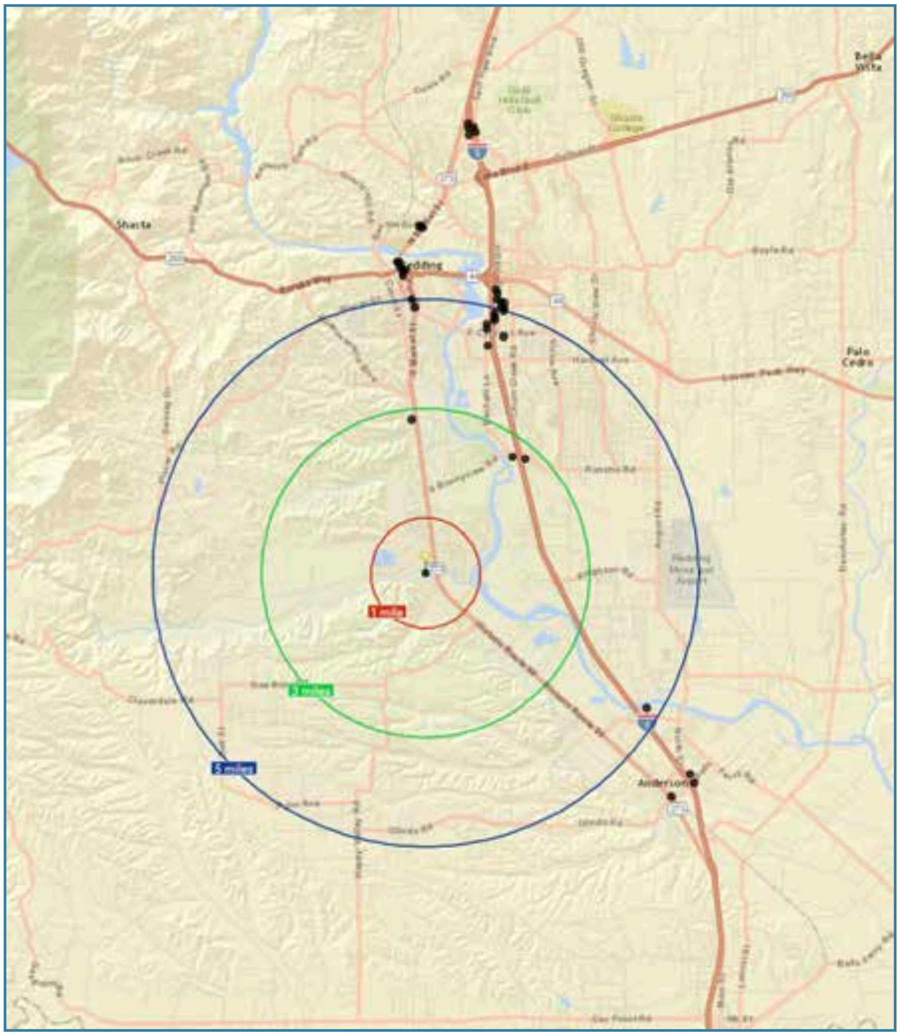
Source: National Indian Gaming Commission

Hotel

Tourism and hospitality is one of the State's largest, most visible, and valuable industry sectors, generating billions of dollars in economic activity. While a significant part of leisure and hospitality activity is associated with tourism, many of these jobs serve the local population and business travelers alike. The Project and Project Alternatives are located within the larger Shasta Cascade (also known as California North) hotel market area and more locally competitive Redding/ Chico submarket area as defined by Smith Travel Research (STR). These various hotel markets are used to evaluate historic trends and competitive forces that could impact future hotel development for the Project and Project Alternatives with a hotel component.

In general, the State's northeast corner tourism market is oriented towards outdoor activities. The region includes volcanoes, forests, and rivers where individuals fish, camp, hike, and mountain bike. The City is the Shasta Cascade market's largest metropolitan area, and includes many visitor destinations such as riverfront trails, Turtle Bay Exploration Park, and the Sundial Bridge. According STR data, hotels located within the City represent approximately half of hotel room supply in the submarket.

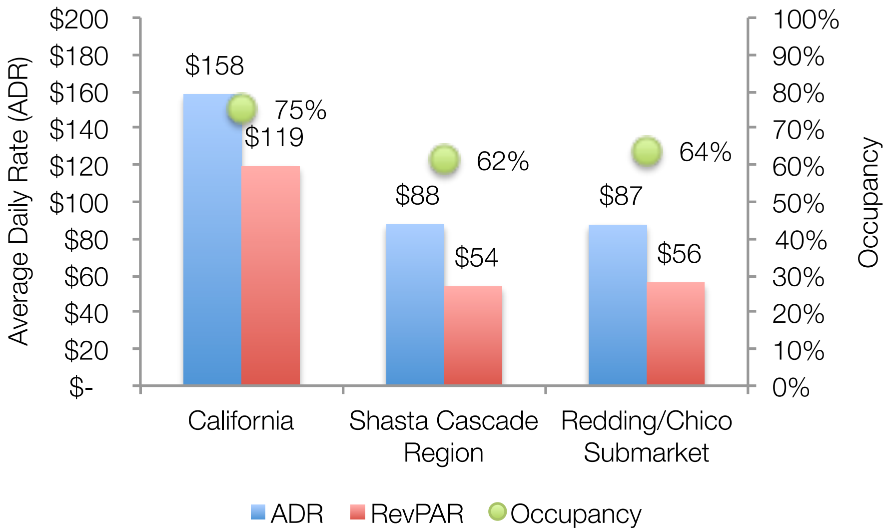
Figure 27 Competitive Hotel Map



Source: STR Global and Pro Forma Advisors

The following table provides information about key performance metrics for calendar year 2016. Hotels within the submarket perform comparably to the larger region with a slightly lower average daily rate (ADR) and slightly higher occupancy and revenue per available room (RevPAR). The submarket's ADR and RevPAR increased by 3.7 and 4.4 percent (year-over-year) from 2015, respectively. In terms of seasonality, occupancy and the ADR is typically highest in the summer months when recreational activities are at peak demand.

Figure 28 Comparative Hotel Performance by Market (2016)



Source: Smith Travel Research

By examining the types of hotel by segment and market area, some distinctions can be drawn. First, the region (inclusive of all market areas) is primarily composed of economy class hotels. In all instances this hotel segment represents approximately 40 percent of the hotel inventory. Second, given the significant number of economy class rooms and properties, which were often developed a decade or so ago and typically have a smaller number of rooms per property, the average size of hotel in the region is region is low (56 rooms per hotel). The City has the highest average hotel rooms with 77 rooms per property. This is followed by the Redding/Chico submarket with 68 rooms per hotel property. Third, given the significant number of value oriented hotel properties the 2016 ADR and RevPAR is significantly lower than the State. A typical range of average low and high rack rates by hotel segment and the relative room share by market is presented for comparison purposes.

Figure 29 Hotel Metrics by Market

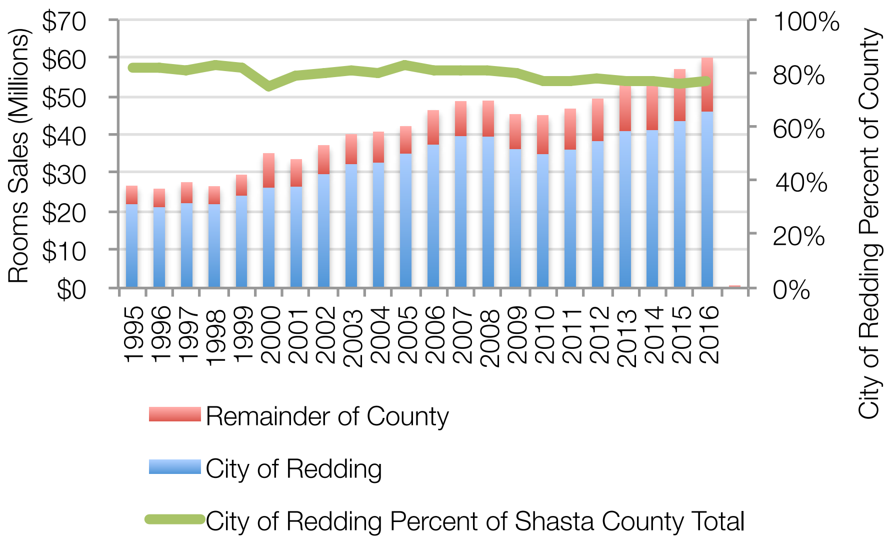
Location/Segment	Rack Rate Avg. Low	Rack Rate Avg. High	Properties	Rooms	Room Share	Avg. Size
Redding/Anderson						
Economy Class	$53	$61	21	1,278	40%	61
Midscale Class	$93	$111	8	769	24%	102
Upper Midscale Class	$77	$89	9	846	27%	94
Upscale Class	$139	$149	3	297	9%	89
Total			37	3,190	100%	77
Redding/Chico						
Economy Class	$56	$67	44	2,216	41%	50
Midscale Class	$94	$112	12	987	18%	82
Upper Midscale Class	$81	$92	17	1,642	31%	97
Upscale Class	$118	$129	6	508	9%	85
Total			79	5,353	100%	68
Shasta Cascade Region						
Economy Class	$59	$74	305	13,653	38%	45
Midscale Class	$94	$122	96	6,004	17%	63
Upper Midscale Class	$98	$131	111	7,048	20%	63
Upscale Class	$117	$167	70	4,537	13%	65
Upper Upscale Class	$164	$268	23	2,246	6%	98
Luxury Class	$282	$441	38	2,573	7%	68
Total			643	36,061	100%	56

Note: Hotel data current as of mid-year end 2015; Win-River's current hotel is considered an Upscale Class segment property

Source: Smith Travel Research and Pro Forma Advisors

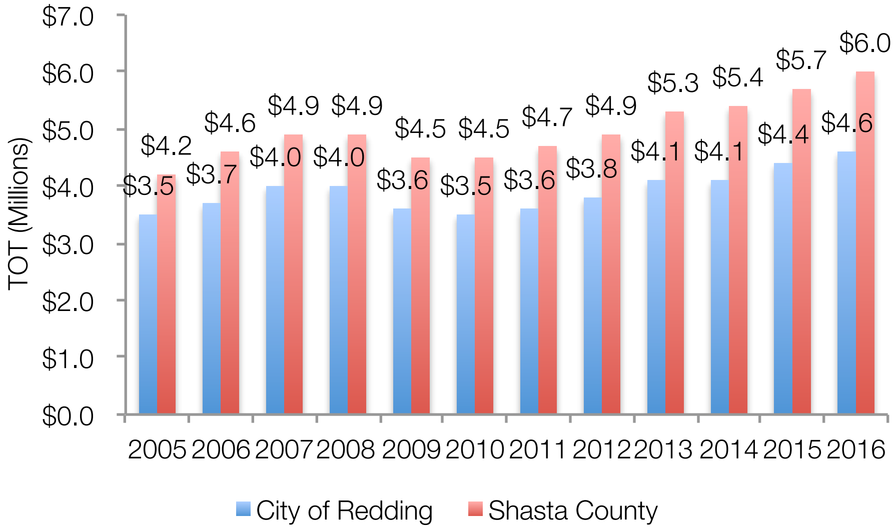
Examining historic room sales in the City and County demonstrates similar trends in historic performance. Between 1995 and 2008, the City's hotel sales and associated transient occupancy tax (TOT) grew by approximately 4.7 percent. This was followed by a two-year post-recession decline in room sales. Since 2010, the TOT in the City has increased by approximately a 4.5 percent compound annual growth rate. At the same time, room revenue outside of the City (remainder of County) grew by a 6.0 percent compound annual growth rate. The historic growth of room revenue and associated TOT demonstrate that the market continues to grow its visitation and associated demand for overnight hotel accommodations both in the City and within the larger County region.

Figure 30 Room Sales in City of Redding and Shasta County (1995 - 2016)



Source: Smith Travel Research

Figure 31 Transient Occupancy Tax in City of Redding and Shasta County (2005 - 2016)



Source: Smith Travel Research

Retail

Specific retail developments are oriented to capture sales from various markets based on their size and tenant mix. Specifically, market sheds (distance in which one will travel to buy goods) for shopping centers are defined by their type. For example, a super regional mall with an average gross lease area of over one million square feet typically has 40 to 80 smaller inline stores with a number of larger anchor retail stores designed to attract a large number of shoppers from up to 25 miles. In contrast, a strip/convenience shopping center with an average gross lease area of approximately 13,000 square feet include anchor-less small convenience oriented retail offerings (such as a mini-mart) and attract the majority of their sales from under a mile radius. The following summary of shopping centers and associated table provides a summary of United States shopping center classification and characteristics.

The following information from the International Council of Shopping Centers (ICSC) provides a general overview of the most common retail shopping center types located in the City, County, and State:

- **Super Regional Mal**l: Similar in concept to regional malls, but offering more variety and assortment.
- **Regional Mall**: General merchandise or fashion-oriented offerings. Typically, enclosed with inward-facing stores connected by a common walkway. Parking surrounds the outside perimeter.
- **Community Center**: General merchandise or convenience- oriented offerings. Wider range of apparel and other soft goods offerings than neighborhood centers. The center is usually configured in a straight line as a strip, or may be laid out in an L or U shape, depending on the site and design.
- **Neighborhood Center**: Convenience oriented.
- **Strip/Convenience**: Attached row of stores or service outlets managed as a coherent retail entity, with on-site parking usually located in front of the stores. Open canopies may connect the store fronts, but a strip center does not have enclosed walkways linking the stores. A strip center may be configured in a straight line, or have an "L" or "U" shape. A convenience center is among the smallest of the centers, whose tenants provide a narrow mix of goods and personal services to a very limited trade area.
- **Power Center**: Category-dominant anchors, including discount department stores, off-price stores, wholesale clubs, with only a few small tenants.
- **Lifestyle**: Upscale national-chain specialty stores with dining and entertainment in an outdoor setting.
- **Factory Outlet**: Manufacturers' and retailers' outlet stores selling brand- name goods at a discount.
- **Theme/Festival**: Leisure, tourist, retail and service-oriented offerings with entertainment as a unifying theme. Often located in urban areas, they may be adapted from older--sometimes historic--buildings and can be part of a mixed-use project.
- **Airport Retail**: Consolidation of retail stores located within a commercial airport.

Figure 32 United States Shopping-Center Classification and Characteristics (2017)

Type of Shopping Center	Centers	Gross Lease Area (GLA) in Millions Square Feet (SF)	Percent Share	Avg. Size	Typical GLA Range (SF)	Acres	Trade Area
General Purpose Center	**112,520**	**6,315**	**83%**	**56,122**			
Super Regional Mall	620	778	10%	1,255,382	800K +	3+	5-25 Miles
Regional Mall	600	354	5%	589,659	400K-800K	2+	5-15 Miles
Community Center	9,776	1,931	25%	197,509	125K-400K	2+	3-6 Miles
Neighborhood Center	32,588	2,341	31%	71,827	30K-125K	1+	3 Miles
Strip/Convenience	68,936	911	12%	13,218	<30K	<3	< 1 Mile
Specialized-Purpose Centers	**3,275**	**1,266**	**17%**	**386,622**			
Power Center	2,258	990	13%	438,626	250K-600K	25-80	5-10 Miles
Lifestyle	491	165	2%	335,852	150-500K	10-40	8-12 Miles
Factory Outlet	367	87	1%	238,060	50K-400	10-50	25-75 Miles
Theme/Festival	159	23	0%	147,791	80K-250K	5-20	25-75 Miles
Limited-Purpose Property	**62**	**15**	**0%**	**249,240**			
Airport Retail	62	15	0%	249,240	75K-300K	NA	NA
Total	**115,857**	**7,597**	**100%**	**65,568**			

Source: ICSC Research, CoStar, and Pro Forma Advisors

The proposed retail under consideration in the Project (Alternative A) and Project Alternatives C, D, and E would be an 120,000 to 130,000 square foot retailer of outdoor sporting, inclusive of hunting, fishing, camping and related merchandise. The business model is similar to large-scale retail shopping centers that rely on a large market area to drive business sales.[12] Such large-scale (also commonly referred to as “big box”) retail outdoor recreation developments are often located in areas that have a significant level of outdoor activities with an associated visitor market. These retail stores are also considered attractions in their own right, often customized to reflect the character of the region with other non-retail amenities such as aquariums, archery ranges, wildlife mounts and dioramas, restaurants, and other recreation activities. Examples include Bass Pro Shops and Cabella’s,[13] which have collectively pioneered the concept of outdoor

[12] Bass Pro Shops often sites a market draw of 100 - 200 miles.

[13] In October 2016 Bass Pro Shops announced that it had reached a deal to acquire Cabela’s Inc.

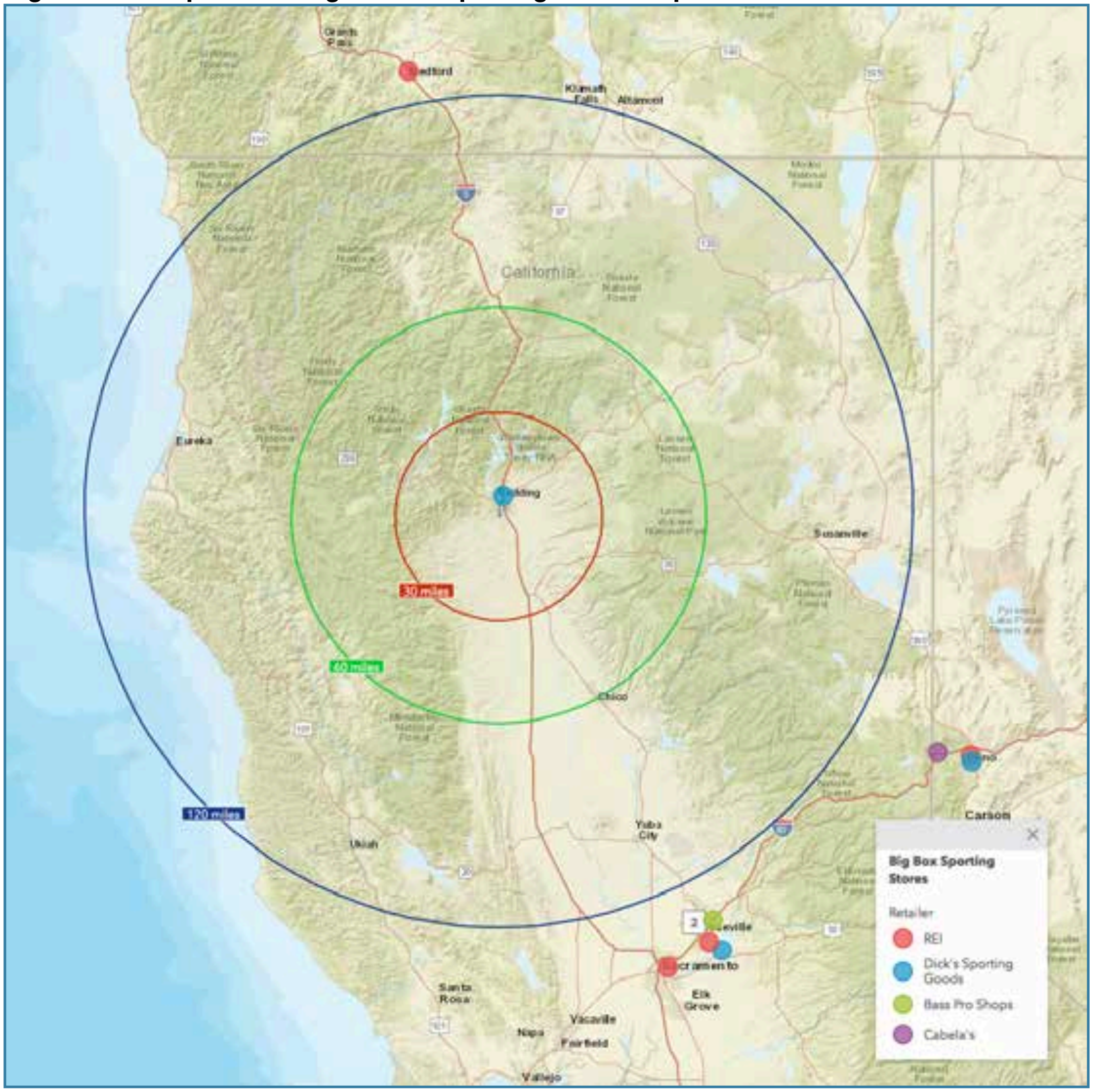
recreation stores that double as both shopping centers and entertainment destinations. In 2017, Bass Pro Shops boasted drawing more than 120 million visitors[14] in its 100 stores in North America.

Besides Bass Pro Shops and Cabela's, there are a number of other big box outdoor sport retailers. The most prominent larger scale sporting stores include Dick's Sporting Goods and REI. The following map illustrates that besides the Dick's Sporting Goods, which is located in the City, there are not any additional large-scale competitive outdoor retailers within the 120 mile market radius. It should be noted that there are a number of other smaller competitive sporting stores (i.e. Sports Ltd, Big 5, Sportsman's Warehouse, etc.) and other national chains such as Target, Walmart, etc. that also sell similar products. Examining the competitive large-scale outdoor sports stores, most are located over two-hours south of the alternative sites where there is a significantly larger number of available population within comparable market sheds.

Examining the key competitive retailers, Pro Forma Advisors has collected national data estimates regarding the most recently reported number of stores, associated square feet, and sales productivity. Additional information has also been collected regarding the number of jobs (inclusive of both full- and part-time employees) at each retail chain. The retail development contemplated herein would be most analogous to a Bass Pro Shops or Cabela's retail development. On average, these stores have 121,000 square feet with sales of $46.7 million or $386 per square foot of retail space. The observed employment density is approximately 500 per retail square feet per job. These chains also have the highest retail productivity on a square foot basis among competitive retailers.

[14] Visitors not analogous to tourists and may not be unique as people may visit the stores more than once a year.

Figure 33 Competitive Large-Scale Sporting Retail Map



Source: STR Global and Pro Forma Advisors

Figure 34 Comparative Population (Thousands) by Market Shed (2017)

			Market Population (in 000s)		
Name	**City**	**State**	**0-30 Miles**	**0-60 Miles**	**0-120 Miles**
Strawberry Fields Site	Redding	CA	210	340	1,214
REI	Medford	OR	280	386	1,010
REI	Roseville	CA	2,181	393	12,800
REI	Sacramento	CA	2,125	4,507	13,132
REI	Folsom	CA	2,101	3,756	12,916
REI	Reno	NV	572	720	3,460
Dick's Sporting Goods	Reno	NV	575	719	3,482
Dick's Sporting Goods	Folsom	CA	2,066	3,610	12,885
Dick's Sporting Goods	Redding	CA	201	289	1,256
Bass Pro Shops	Rocklin	CA	2,059	3,288	12,764
Cabela's	Verdi	NV	559	727	3,709

Source: ESRi; Google Maps

Figure 35 Competitive Retail Inventory by Performance Metrics and Location

Retailer	Stores	Millions of Square Feet (SF)	SF/ Store	Sales (Billions)	Sales/ SF	Jobs	Jobs/SF
Dick's Sporting Goods	644	34.4	53,000	$6.9	$201	37,200	925
Bass Pro Shops	94	12.8	136,000	$4.5	$352	22,000	582
Cabela's	77	7.9	103,000	$3.5	$441	19,700	401
REI	143	6.4	45,000	$2.2	$342	12,000	536
Total	958	61.5	64,000	$17.1	$278	90,900	677
Bass Pro/Cabela’s Total	**171**	**20.7**	**121,000**	**$8.0**	**$386**	**41,700**	**496**

Source: SGB Medial and Pro Forma Advisors

Substitution Analysis

Gaming

Gaming is a highly regulated industry which generally has limited the supply or capacity relative to the natural demand for gaming entertainment. Depending on the supply constraints, many markets have significant unmet demand and market growth potential. As such, many gaming market would be expected to grow with new supply before exhibiting significant substitution impact from existing facilities.

To measure the potential substitution impacts from the Project and Project Alternatives that include an increase in gaming, Pro Forma Advisors has used the Market Demand Gravity model and compared projections of Gaming Revenue for all market properties from the resident day trip market. The Market Demand Gravity Model (described in further detail in an Appendix) models the gaming market growth and substitution impacts by census tract between all market facilities. This provides a baseline GGR estimate assuming no market changes against estimated GGR Demand for the Project Alternative.

Using model year 2020 for comparison, the analysis indicates that the Project would generate an additional $24.6 million in GGR from the resident market compared to the existing Win-River casino. Approximately $21.7 million (88.2%) would come from growth in the market from increased trip frequency and market penetration, while approximately $2.9 million (11.8%) is estimated to come from gaming substitution from competitive facilities. These totals assume the closure of the existing facility and represent the net incremental revenue over the assumed baseline no development condition. The other Project Alternatives range from 7.7 to 22.5 percent substitution of future market growth.

Figure 36 Gaming Market Substitution - All Alternatives (2020)

Casino	Substitution (Million)					Percent of Total				
	A	B	C	E	F	A	B	C	E	F
Project Increase in GGR from Residents	$24.6	$24.6	$17.8	$18.4	$3.5	100.0	100.0	100.0	100.0	100.0
GRR Increase due to market growth	*$21.7*	*$21.7*	*$16.4*	*$14.2*	*$2.8*	*88.2*	*88.2*	*92.3*	*77.5*	*80.2*
GGR substitution from market facilities	*$2.9*	*$2.9*	*$1.4*	*$4.1*	*$.7*	*11.8*	*11.8*	*7.7*	*22.5*	*19.8*
GGR Substitution (2022 Dollars)	*$3.3*	*$3.3*	*$1.6*	*$4.6*	*$0.8*					

Note: The projected gross gaming revenue in Alternatives A, B, C, and E is net of closure of the existing facility. Alternatives D has no new gaming and Alternative F gaming revenue is net of the redevelopment of the existing facility.
Source: Pro Forma Advisors

The substituted gaming revenue comes primarily from regionally competitive facilities. The following table presents the impact estimates to key competitive facilities.

Figure 37 Competitive Properties Substitution (2020)

	Substitution as a Percent of Estimated 2020 GGR				
Casino	**A**	**B**	**C**	**E**	**F**
Rolling Hills Casino	5.8%	5.8%	3.0%	9.0%	1.4%
Pit River Casino	7.2%	7.2%	4.7%	3.5%	1.3%
Feather Falls Casino & Lodge	0.5%	0.5%	0.2%	0.9%	0.1%
Gold County Casino & Hotel	0.6%	0.6%	0.2%	1.1%	0.2%
Colusa Casino Resort	0.4%	0.4%	0.1%	0.6%	0.1%

Source: Pro Forma Advisors

Based on personal income and population growth assumptions in the Market Demand Gravity model, the gaming potential is estimated to increase by 0.92 percent annually in real growth terms in the residential market. As such, estimated declines based on substitution of GGR could be recaptured in the competitive facilities in subsequent years after the Project or Project Alternative is opened. For example, if the Project (Alternative A) was developed it would take or Pit River Casino an estimated eight years (assuming no additional changes in the market and equal allocation of GGR) to recapture the estimated loss of revenues from the new gaming facility.[15]

It is important to note that there are other gaming facilitates, such as card clubs, that are not directly competitive with the Project or Project Alternatives in the market. Since these establishments are currently operating within the market area, any competitive effects will be occurring today. Given that the number of table games are not significantly changing in the Project or Project Alternatives, there is an no anticipated gaming substitution with these facilities.

Convenience and leisure oriented retail is a typical component of casino developments. Typical casino resorts have retail stores to support guest convenience requirements, as well as to offer some unique impulse-oriented products. While not large enough to attract off-site customers outright, the casino retail offering leverages the proximity of hotel and casino guests. Some common impulse retail items include branded merchandise, gifts, artwork, and apparel.

It is assumed that no additional substitution will occur in casino retail and food and beverage spending, as this spending is not substitutable in the market given its direct association with gaming. Any substitution impacts have been accounted for in relation to the estimated net change (post existing facility closure) in gaming revenue as retail and food and beverage spendings is estimated as six (6.0) percent of GGR.

Hotel

Casino hotels have become integral elements in casino development strategies to increase gaming revenue and overall profitability. While typical competitive hotels in the submarket area accommodate demand for overnight out-of-town guests, casino hotels are developed primarily for marketing, player development programs, and to induce additional

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[15] 7.2 percent substituted GGR divided by 0.92 percent annual growth = 7.8 years to recapture substituted GGR.

visitation to the casino. Overnight visits to a casino hotel are generally additive to day trip visits, even though most originate from the same geographic day trip market. Overnight visitors, while lower in volume, are typically higher in value by selective marketing and management to gaming customers. As such, issues of substitution with hotels in the market area are largely irrelevant.

The core issue in casino hotel feasibility is not to quantify demand in an absolute market sense, but rather to ensure that the hotel component is optimized as an investment in the context of day trip market scale and other relevant economic factors. As such, Pro Forma Advisors estimates there will be minimal substitution in the local hotel market. The figure below presents the methodology utilized to determine the competitive effect of the development of net new hotel rooms in the market.

This estimate does not account for increased hotel demand that could offset any of the projected substitution herein. Project Alternatives A, B, C, D, and E all have an estimated substitution impact of approximately 6 to 24 percent of projected room sales. Alternative F does not include new hotel room supply in the market. As such, it will not have a substitution impact. This level of substitution reflects between approximately 0.5 to 4 percent of sales within the City and would most likely impact nearby comparable hotels as well as those located along I-5 oriented toward the freeway intercept market.

Figure 38 Hotel Substitution Impacts (2016)

	Alternative				
	A	B	C	D	E
Total Hotel Rooms	250	250	250	128	250
Occupancy	78%	78%	78%	78%	78%
Hotel Room Nights	71,175	71,175	71,175	36,442	71,175
Comp Hotel Room Nights	58,353	58,353	54,297	34,089	54,600
Cash Hotel Room Nights	12,822	12,822	16,878	2,353	16,575
Cash Hotel Room Nights (% of total hotel room nights)	18%	18%	24%	6%	23%
Average Daily Rate (ADR)	$105	$105	$105	$105	$105
Total Market Sales Substitution (Millions)	$1.3	$1.3	$1.8	$.2	$1.7
Total Market Sales of Existing Room Sales in the City (Millions)	$46.1	$46.1	$46.1	$46.1	$46.1
Percent Substitution of Existing Room Sales in the City	2.9%	2.9%	3.8%	0.5%	3.8%
Total Market Sales Substitution (Millions of 2022 Dollars)	$1.5	$1.5	$2.3	$.2	$1.9

Source: Dean Runyan Associates, Visit California, Pro Forma Advisors

Retail

Retail offered within the Project and Project Alternatives will be smaller stores oriented towards casino customers or the large-scale outdoor sporting goods store previously discussed. Unlike the casino retail previously discussed, the large-scale outdoor sporting goods store would stand alone and be primary marketed to the larger non-casino customers. As noted, the large-scale outdoor sporting store properties have a market shed of anywhere up to a four-hour drive time (100 - 200 miles) along with overnight tourist markets. The following table presents an estimate regarding the most recent per capita spending on general sporting good stores stores businesses in the State, County, and City.

Figure 39 Taxable Sales by Type of Business (Calendar Year 2015)

2012 NAICS	Type of Business	Per Capita Taxable Transactions		
		State	County	City
441	Motor Vehicle and Parts Dealers	$2,065	$4,662	$4,062
442-443	Home Furnishings and Appliance Stores	$733	$1,070	$899
444	Building Material and Garden Equipment and Supplies	$865	$2,286	$1,771
445	Food and Beverage Stores	$718	$1,514	$1,009
446	Health and Personal Care Stores (1)	$318		
447	Gasoline Stations	$1,218	$3,124	$1,843
448	Clothing and Clothing Accessories Stores	$988	$1,229	$973
452	General Merchandise Stores	$1,243	$3,403	$2,708
722	Food Services and Drinking Places	$1,899	$2,596	$2,063
446, 451, 453, 454	Other Retail Group	$1,047	$2,744	$1,888
45111	***Sporting Goods Stores (2)***	***$134***		
Total		**$11,094**	**$22,628**	**$17,216**

Note: (1) Health and Personal Care Stores are not provided at the County and City level (included in Other Retail Group); and (2) County and City Sporting Good Stores not reported. Pro Forma Estimate based on State spending, NAICS = North American Industry Classification System

Source: ESRI and Pro Forma Advisors

Given confidentiality issues associated with disclosure of retail sales by business type, specific information regarding the current level of sales in sporting good stores is not available at the County or City level. ESRI Business Analyst, however, provides estimates regarding estimated sales based on publicly reported information. The following table summarizes the 2016 estimates in the City and County.

Figure 40 Sporting Good Stores Sales Leakage/Surplus Analysis (2016)

	Estimated Retail Sales	
	County	City
Sporting Goods, Hobby, Book & Music Stores (NAICS 451) Sales	$86,542,713	$75,639,073
Sporting Good Stores percent of NAICS 451 (2015)	46%	46%
Sporting Good Stores Sales	$39,809,648	$34,793,974
Population	180,992	91,389
Sporting Good Stores Sales Per Capita	$220	$381
Sporting Good Stores Demand Per Capita	$160	$161
Leakage/Surplus Sales Per Capita	-$60	-$220
Leakage/Surplus Factor	-15.9	-40.6
Number of Businesses	104	71
Estimated Sales for Project Alternatives (Large-Format Retail)	*$50,180,000*	*$50,180,000*

Note: The Leakage/Surplus Factor presents a snapshot of retail opportunity. This is a measure of the relationship between supply and demand that ranges from +100 (total leakage) to -100 (total surplus). A positive value represents 'leakage' of retail opportunity outside the trade area. A negative value represents a surplus of retail sales, a market where customers are drawn in from outside the trade area. Example based on 130,000 square foot store.

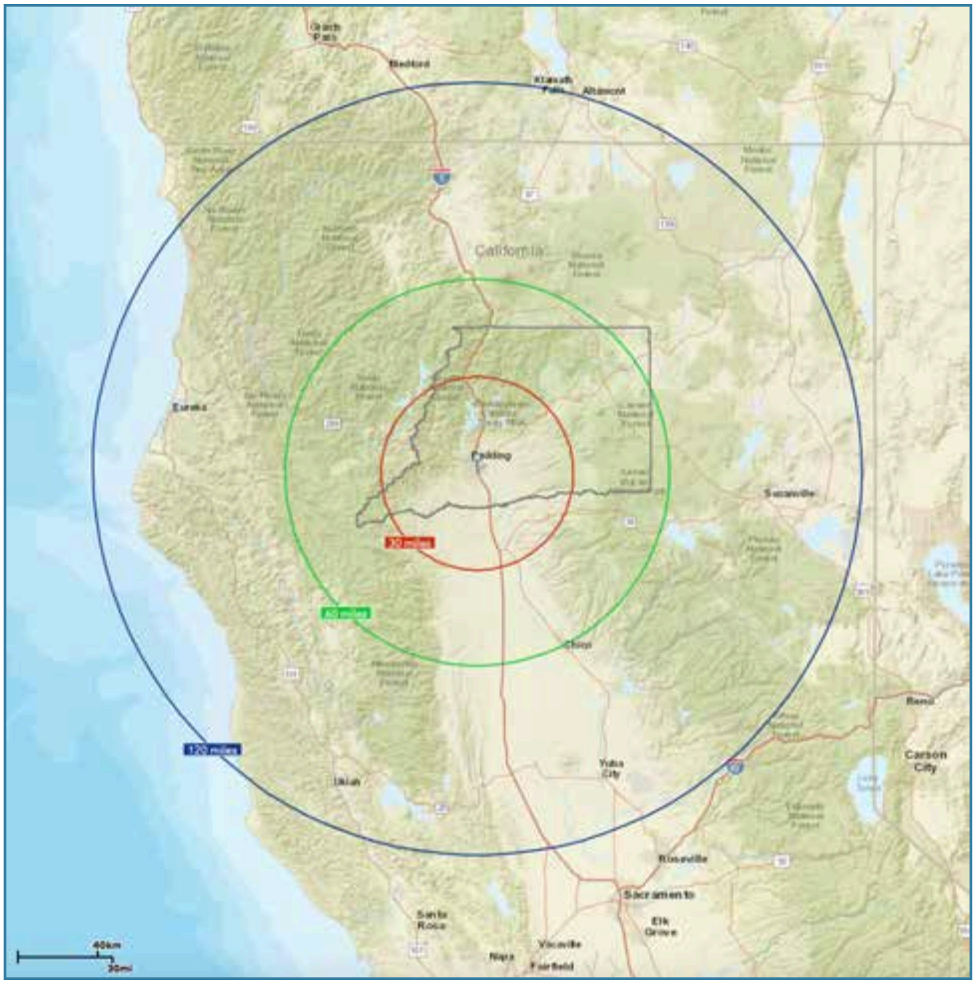
Source: ESRI and Pro Forma Advisors

Notable findings based on the ESRI estimates include:

- Both the City and County have estimated retail surpluses (suggesting that it exports sales to people living outside the region) for sporting good store sales.
- The proposed large-format retail store is 120,000 to130,000 square feet. Using current estimated sales productivity of $386 per square foot suggests annual sales of around $50.2 million could be achieved in the 130,000 square foot development, which is potentially larger than the estimated sales volume of all existing sporting stores in the City and greater County area combined.
- Given these dynamics, while the proposed large-scale format outdoor sporting goods retailer could take away some of the existing sales in the City and County, the vast majority of its projected sales would require the capture of sales from outside the region.

The following map helps contextualize the market sheds using market shed rings overlaid on the County's boundary.

Figure 41 Large-Scale Sporting Retail Market in Comparison to County Map



Source: ESRI and Pro Forma Advisors

Given these dynamics, Pro Forma Advisors estimates there will be substitution in the local retail market. Utilizing a Market Demand Gravity retail model, the following table calculates the projected level of sporting goods substitution in the market.[16] The competitive effect examines the impact to retailers located within the City based on the current level of estimated sales.

[16] On Cabela's fourth quarter 2014 earnings call, management cited four examples of new stores that were drawing from existing store sales, the combination of which reportedly hurt same store sales by 15 to 20 percent. In theory, this level of substitution would be the most relevant percentage for similar sales that could be applied to a competitive effect in the market. However, based on the gravity model analysis we have used a more conservative estimate herein.

Figure 42 Large-Scale Retail Substitution Impacts (2016)

Dollars in Millions	Alternatives D and E 120,000 SF	Alternatives A and C 130,000 SF
Projected Large-Scale Outdoor Retail Sales	$46.3	$50.2
Less 10.4% of Projected Non-Substitutable Retail Sales	$4.8	$5.2
Projected Project Sporting Goods Sales (Less 10.4% of Projected Non-Substitutable Retail Sales)	$41.5	$45.0
Existing Sporting Goods Sales in the City	$34.8	$34.8
Less Projected Change in Sporting Goods Sales with Large-Scale Outdoor Retail Sales	$26.5	$26.4
Total Market Sales Substitution	$8.3	$8.4
Total Market Sales Substitution as a Percent of Existing Sporting Goods Sales in the City	23.9%	24.1%
Total Market Sales Substitution (2022)	$9.4	$9.5

Source: Pro Forma Advisors

According to 2015 Cabela's Annual Report (Form 10-K) 30.4 percent of sales are within the General Outdoor category. This sales category includes the sales of boats and marine equipment and all-terrain vehicles that are not sold at comparable sports retail outlets. Using an estimate that one-third of these sales come from retail expenditures outside the traditional sporting goods sales category (NAICS 451) a 10.4 percent estimate has been utilized to quantify non-substitutable sales.

As noted, it is estimated that there is currently $34.8 million in sporting good store sales in the City with the proposed large-scale outdoor sporting goods store adding an adjusted $41.5 million to $45.0 million for the 120,000 square foot or 130,000 square foot development, respectively. Based on the gravity model, the introduction of the new large-scale outdoor sporting retailer to the market, sales are anticipated to decrease to approximately $26.5 million in the existing sporting goods retailers in the City. This suggests the competitive effect of a loss of approximately $8.4 million in retail sales or approximately 24 percent retail sales substitution in the City.

Based on this analysis, it is projected that approximately 24 percent of sporting good stores sales would be net transfers from existing retailers in the City. Once again, this does not any account for natural increase in future retail demand created by population and income growth that could offset any of the projected substitution estimated herein.

Events and Conference Center

A component of the proposed Events and Conference Center in Alternatives A, B, C, and E is a dedicated 1,800 seat theater that would increase Win-River's capacity by approximately 800 seats. Due to the nature of current entertainment programing at Win River (e.g. music acts, comedy, etc.), it is not anticipated that the new facility will have any quantifiable net new substitution effects with existing entertainment venues in the City of Redding. The Redding Civic Auditorium (2,000 seats) and Cascade Theater (1,350 seats) include a significant number of other events (e.g. symphony, performing arts, community events, etc.) that are not competitive with Win-River entertainment programing. Furthermore, the variability and unpredictability of annual performance acts among venues as well as the casino's comping practices make it difficult to compare Win-River with local venues as it relates to the substitution of cash ticket sales.

Financial Analysis

The following include Pro Forma estimates regarding the projected financial performance of the Project and Project Alternatives. The incremental revenue projections presented herein will be used as inputs to the impact analysis.

Methodology

Introduction

The key revenue projection for the Proposed Project and Project Alternatives that include gaming will be the GGR that can be expected based on the available markets, competition, and target penetration rates based on comparable market performance. Pro Forma Advisors uses a Market Demand Gravity Model that is a summation of demand from three distinct markets. These markets, in order of scale, are:

- Resident Market Gravity – Gaming demand from residents up to a four hour drive time from the casino site.
- Resort Overnight Market – Guests staying at the casino resort accommodations.
- Intercept Market – Long haul passengers passing adjacent to the facility along Interstate 5.

The resident market growth opportunity for Project gaming revenues will come from four main sources:

- Overall market population and future growth;
- Increased Attraction of the higher quality, larger scale casino to the resident market;
- Real and inflationary growth in income levels; and
- Impacts of competition.

Pro Forma Advisors has modeled the resident market gaming demand using the Market Demand Gravity Model, which is described in a detailed Appendix. The Market Demand Gravity Model steps consist of:

1. Gross GGR Demand by market census tract based on Attraction (e.g. quality and scale of facility), travel time, tract demographics and potential casino Yield (win per visitors based on quality of casino/amenities) for each casino in the market.

2. Substitution impacts for each census tract between competing casino facilities to estimate Net GGR Demand.

3. Market share calculations for Net GGR Demand for each census tract for each competing facility

A Project-specific Market Demand Gravity Model has been developed to illustrate the Project's market dynamics with all population sources, travel access, and gaming facilities. The Project-specific model inputs for Attraction are derived by calibrating the outputs to known or estimated GGR values for each of the competitive facilities. The Attraction and Yield variables are then compared to other market benchmarks to ensure that inputs are within consistent propensities.

Projections for the Project and Project Alternatives moving forward are generated by updating census tract population and demographic data, adjusting Attraction and Yield for the new facility, and incorporating changes in the competitive landscape. New Attraction and Yield inputs for the Project and competitors are based on comparisons with existing calibration levels and local and regional facility benchmarks with respect to number of gaming positions, quality level, amenities, etc.

The ratio of hotel rooms to gaming positions has been identified as a key ratio in defining the maturity of a casino destination as an overnight destination. In general, as a greater portion of gaming revenues come from overnight visitors, the ratio of rooms to gaming positions increases. Single property destinations have ratios of approximately 0.10 to 0.20. Pro Forma has modeled the hotel as a component of the larger casino development.

Pro Forma Advisors has modeled the big box outdoor retail development under an assumption set that assumes that the market conditions are viable for the delivery of a successful outdoor sports retail development similar to Bass Pro Shops or Cabella's. Pro Forma Advisors projects total retail sales productivity for the large-scale outdoor retailer of $434 dollars per square foot (in 2022 dollars).

Revenue Summary

The following tables highlights the operation and development cost projections for the Project and Project Alternatives by land use.

Casino

The Proposed Project (Alternative A) and Project with no Big Box Alternative (Alternative B) are projected to yield an estimated $39.6 million in net new revenue (after accounting for the effect of market substitution), which represent the highest revenue of all the proposed projects. Besides the Non-Gaming Alternative (Alternative D), the Expansion Alternative (Alternative F) has the lowest potential revenue based on the analysis. The following table provides a summary of net casino revenue in year 2022.

Figure 43 Summary of Incremental Gross Gaming Revenue (millions) - Stabilized Year (2022)

	Alternative				
	A (2022)	B (2022)	C (2022)	E (2022)	F (2022)
Operations Revenue					
GGR Potential	$38.0	$38.0	$26.2	$32.6	$3.7
Less Substitution	*$3.3*	*$3.3*	*$1.6*	*$4.6*	*$.8*
Casino GGR	$34.7	$34.7	$24.6	$27.9	$2.9
F&B	$4.6	$4.6	$3.7	$4.0	$1.5
Retail/Other	$.3	$.3	$.3	$.3	$.1
Total	$39.6	$39.6	$28.5	$32.2	$4.5

Note: Substitution included in gaming model. No substitution assumed for food and beverage, retail, or other revenue.

Source: Pro Forma Advisors

Hotel

The Proposed Project (Alternative A), Project with no Big Box Alternative (Alternative B), Reduced Intensity Alternative (Alternative C), and Anderson Site (Alternative E) are all projected to create an estimated $5.6 million in room revenue in 2022 after accounting for market substation, which represent the highest revenue of all the proposed projects. The Non-

Gaming Alternative (Alternative D) and the Expansion Alternative (Alternative F), which contemplate a smaller number of hotel rooms, have the lowest potential room revenue based on the Pro Forma Analysis. The following table provides a summary of net hotel revenue in year 2022.

Figure 44 Summary of Incremental Hotel Revenue (millions) - Stabilized Year (2022)

	Alternative				
	A (2022)	B (2022)	C (2022)	D (2022)	E (2022)
Operations Revenue					
Revenue (Millions)	$7.0	$7.0	$7.0	$2.0	$7.0
Less Substitution	$1.5	$1.5	$2.3	$.2	$1.9
Total	**$5.6**	**$5.6**	**$4.7**	**$1.8**	**$5.1**

Source: Pro Forma Advisors

Retail

The following table present a summary of the large-scale outdoor retail revenue potential in year 2022. With the exception of the Non-Gaming Alternative (Alternative D) and Expansion Alternative (Alternative F) the development alternatives that include the proposed large-scale outdoor retail are anticipated to generate between $47.0 and $42.6 million after accounting for market substitution in year 2022.

Figure 45 Summary of Incremental Retail Revenue (millions) - Stabilized Year (2022)

	Alternative			
	A (2022)	C (2022)	D (2022)	E (2022)
Large-Scale Outdoor Retail				
Square Feet (SF)	130,000	130,000	120,000	120,000
Sales Productivity per SF	$434	$434	$434	$434
Revenue (Millions)	$56.4	$56.4	$52.0	$52.0
Less Substitution	$9.5	$9.5	$9.4	$9.4
Total	**$46.9**	**$46.9**	**$42.7**	**$42.7**

Source: Pro Forma Advisors

Development Cost Summary

The following table highlights the projections for the Proposed Project and the Project Alternative. The estimated cost of development ranges significantly based on the alternative and associated level of proposed development.

Figure 46 Summary of Estimated Development Costs (2017 millions of dollars)

	Alternative					
	A (2016)	B (2016)	C (2016)	D (2016)	E (2016)	F (2016)
Casino/Hotel	$165.9	$165.9	$147.8	$35.9	$190.9	$43.3
Large Scale Outdoor Retail	$32.5	$0.0	$32.5	$30.0	$30.0	$0.0
Total	**$198.4**	**$165.9**	**$180.3**	**$65.9**	**$220.9**	**$43.3**

Source: Pro Forma Advisors

Impact Analysis

This section provides a general explanation of the methodology utilized to estimate the potential economic impacts, fiscal impacts, and community and social impacts of the proposed Project and proposed Project Alternatives. Following the methodology, where the model inputs are described, the impacts for the Project and Project Alternatives are discussed.

Methodology and Base Assumptions

Economic Impacts

Economic impact can be described as the sum of the economic activity within a defined geographic region resulting from an initial change in the economy. This initial change spurs a series of subsequent indirect and induced activities (the re-spending of dollars) as a result of interconnected economic relationships.

Economic impact is composed of the following components:

- Direct Impact: Direct Impact is the initial change in the economy attributed to the development of the proposed project, i.e. output, jobs, and labor income generated directly by the Project or Project Alternative.
- Indirect and Induced Impact, commonly referred to as the multiplier effect:
  - Indirect Impact: Additional output, earnings, and employment generated as a result of the purchases of the industries that supply goods and services to the development under consideration.
  - Induced Impact: Additional output, earnings, and employment generated by re-spending of employee income for household purchases.
- Total Impact: The cumulative impact of the above components.

Economic Impact is reported in terms of:

- Output: Output represents the value of industry production. In IMPLAN, the economic impact modeling software used in this analysis, these are annual production estimates for the year of the data set and are in producer prices.
- Jobs: In IMPLAN a job is equivalent to the the average monthly jobs in the corresponding industry. Thus, 1 job lasting 12 months, 2 jobs lasting 6 months each and 3 jobs lasting 4 months are all equivalent. A job could be either full-time or part-time. The one-time construction impact is inclusive of an estimate for all jobs over the development period.
- Labor Income: All forms of employment income including employee compensation (e.g. wages and benefits). Total income for the Project's related jobs (gaming, food & beverage, etc.) includes labor income.

Economic multipliers measure the re-spending of dollars in an economy and are used to calculate indirect and induced impact. Economic multipliers are developed using an accounting framework called Input-Output (I-O) tables, which are tables that provide information on all production activities and transactions between producers and consumers in an economy.

As noted, this analysis uses the IMPLAN Software to derive multipliers, key economic data, and total economic impact. IMPLAN is an economic impact assessment software system that assembles economic accounts using I-O tables and social accounting formats to derive multipliers.

The IMPLAN system is widely used throughout the public and private sectors to estimate the economic impact of changes in a regional economy.

The analysis quantifies: (1) the ongoing annual economic impact generated as a result of the stabilized operations of the Project and Project Alternatives; and (2) the one-time construction impact generated by the construction of the Project and Project Alternatives. Annual ongoing economic impact has been evaluated using a revenue approach through IMPLAN. In this approach, indirect and induced impact is determined based on estimated Project and Project Alternatives *revenue* as opposed to *expenditures*. This approach was utilized given the preliminary nature of the planning.

The Project and Project Alternatives are further analyzed to estimate locally-purchased goods, services, and employment.[17] The indirect and induced impact is then determined by applying multipliers to these local purchases, to estimate the re-spending generated within the City and County. The direct impact is then added back to the indirect and induced impact generated by locally purchased goods, services, and employees, in order to determine the total impact. Based on IMPLAN's estimates approximately 91 to 96 percent of construction and 51 to 76 percent of operations spending will be captured in the County, depending on the development scenario.

All model inputs are in the "event" year (e.g. operation data in inflated 2022 dollars), which is then adjusted by IMPLAN to run the impact analysis through the base year and then presented in constant 2017 dollars. The default model assumptions have not been adjusted in this analysis with the exception that retail revenue has been presented as gross retail sales or purchasers prices. As a result, the appropriate retail margin[18] has been applied and the impacts only reflect that marginalized retail value. Finally, as previously noted, all impacts are presented net of existing casino operations.

Figure 47 Summary of Model Assumptions (Model Base Year 2015)

Region	Jobs	Labor Income (Billions)	Output (Billions)
Shasta County	90,516	$3.51	$11.00

Source: IMPLAN and Pro Forma Advisors

The economic impact analysis does not considers that substitution can be an offsetting factor to the total economic impact beyond the adjustments previously discussed and noted in this analysis. Some may argue that a portion of spending may be substituted for other local economic consumption (e.g. other related activities), which is beyond the scope of this study.

[17] IMPLAN Regional Purchase Coefficients (RPC) are used to determine the share of each expenditure category assumed to be purchased locally. For each industry, the regional purchase amount represents the average locally-purchased amount of goods and services within the defined area. IMPLAN is also used to estimate detailed re-purchasing by expenditure category. Similarly, the "Locally-purchased employee earnings" are the earnings of employees who are residents of the City or County.

[18] The paid by industries and final users for the goods and services they use. Purchaser Prices is equal to producers value plus trade (wholesale and retail) margins and transportation costs.

Fiscal Impacts

There will be fiscal revenue generated from the construction and operation of the proposed Project and Project Alternatives at the City, County, State, and federal levels from a variety of taxes. In some cases there may be tax exemptions due to purchases by the Tribe and its tax exempt status. The IMPLAN model creates a projection of the total taxes, such that these discounts are not reflected in the model's tax tables. All fiscal impacts are based on construction cost estimates and stabilized operation presented in constant 2017 dollars.

It should be noted that any increase in population or employment in the City and County may also result in fiscal costs and revenues as well. The primary anticipated fiscal costs (as applicable) are typically public safety related, which are discussed below in the social effect section. The City and County do not provide utilities (water, sewer, etc.) to the current Win-River casino facility. City power comes to the Tribal boundary, at which point it becomes Tribal power. As such, the Tribe is a customer of the City but incurs no direct fiscal costs. This said, the City does maintain and provide services associated with roadways and employees of the casino living within and outside the City.

The most immediate fiscal impact will occur once the Strawberry Fields Site is placed into trust by the United States and the land is then exempt from local and State taxation. The impact of the loss of property taxes will effect the proposed Project and Project Alternatives A, B, C, and D. Based on the secured tax roll for Fiscal Year July 1, 2016 to June 30, 2017 in the County, the loss of annual taxes would be $33,962. Proposition 13 limits the properties' future value to increase at the inflation rate, which is measured by the lesser of the California consumer price index or two percent. The 2017 property tax estimate for the Strawberry Fields and Anderson sites, to be compared with fiscal impact of the Project and Project Alternatives, is $34,641 and $24,181, respectively.

Figure 48 Strawberry Fields and Anderson Site Property Tax (Fiscal Year 7/1/16 - 6/30/17)

Parcel	2016 Fee
Strawberry Fields Total Revenue	$33,962
Strawberry Fields Total Revenue (2017)	*$34,641*
Anderson Total Revenue	$23,707
Anderson Total Revenue (2017)	*$24,181*

Source: Shasta County and Pro Forma Advisors

Community and Social Effects

A summary of the reported projected change in population, housing, employment, and public school enrollment are provided below, which will be compared against potential incremental growth created by the Project or Project Alternatives.

Figure 49 Growth Estimate Summary (2016 - 2030)

	2016	2030	Projected Change
City			
Population	90,230	99,555	9,325
Employment (1)	44,575	49,003	4,428
Housing	39,423	44,431	5,008
K-12 (2)	26,382	24,141	-2,241
County			
Population	178,592	193,928	15,336
Employment (1)	60,819	69,399	8,580
Housing	78,379	87,726	9,347
K-12 (2)	26,382	24,141	-2,241

Notes: (1) Employment (in-place) estimate based on extrapolation of 5-year employment trends based on US Census estimates; and (2) Public School projections available through 2015/2016 at County level only.

Source: Department of Finance; Shasta Regional Transportation Agency; and Pro Forma Advisors

Employment

The unemployment rate in the County was 6.0 percent in April 2017, down from a revised 6.9 percent in March 2017, and below last years estimate of 7.0 percent. This compares with an unadjusted unemployment rate of 4.5 percent for the State and 4.1 percent for the nation during the same period.

Californians who have failed to find work and have stopped looking either because they believe no jobs are available for them ("discouraged" workers) or for any other reason ("marginally attached" workers) are not considered part of the labor force. It is estimated that the labor underutilization for the State is 11.1 percent. The estimate pertains to the averages from the second quarter of 2016 through the first quarter of 2017 in the State based on the U-6 classification.[19]

As such, It is assumed that most of the jobs created will be filled by local residents looking for work or a new job and some other jobs will be filled by people who live outside the City or County and commute in for work. Internal Revenue Service (IRS) 2011 - 2015 Statistic of Income (SOI) Tax Stats - Migration Data for the County were used to estimate new jobs induced from outside the County based on the Project and Project Alternatives. The five-year ratio of net new in-migration income tax returns in relation to net new job growth suggests that, on average, 12.06 percent of new

[19] Total unemployed, plus all marginally attached workers, plus total employed part time for economic reasons, as a percent of the civilian labor force plus all marginally attached workers.

employment is from new residents migrating to the County from areas outside the County. This benchmark has been used as an assumption in the analysis to estimate the impact of future non-County induced employment.

Calls for Service

The social effects have been estimated utilizing a fair share analysis based on the current level of calls for service initiated by the casino. Using the high-range estimate (5 per month) for casino initiated calls for service to the County Sheriff, the current facility would represent under 0.1 percent of all calls in the County. The analysis has also assumed that the existing casino operations creates additional calls for service that are not initiated by the Win-River Casino. There is no historic basis for the estimate, but a similar non-casino related estimate (5 per month) has been utilized. In total there are an estimated 120 call for service per year based on current casino related operations. Additional calls for services is based on the assumed increase in annual visitors on a pro-rata basis. This ranges from a high of approximately 29 percent (Project Alternatives A and B) to 0 percent (Project Alternative D).

Figure 50 Annual Casino Calls for Service Estimate (2016)

	CFS per Month	CFS per Year	Casino Visitation Increase
Existing CFS			
Casino	5	60	0%
Additional (Non-Casino)	5	60	0%
Total	10	120	0%
Incremental CFS			
Project (A)	3	35	29%
Project with No Big Box (B)	3	35	29%
Reduced Intensity (C)	2	24	20%
Non-Gaming (D)	0	0	0%
Anderson Site (E)	2	25	21%
Expansion (F)	1	6	5%

Note: CFS = Call for Service
Source: Win-River Resort & Casino and Pro Forma Advisors

Additional calls for service will originate with the development of the large-scale outdoor sporting store and hotel. The following calls for service data have been extrapolated from the Police Service Impact Report for a Proposed Wal-Mart in the City of Galt (Police Service Impact Study) and reported City data. Based on the Police Service Impact Study, it was estimated that 24-hour operating Wal-Mart stores, on average, generate 118 calls for service per 100,000 square feet of retail space per year. The benchmark has been adjusted by 46 percent to align with the estimated hours of operations of the large-sale outdoor sporting goods store. This would project to 65 and 71 average calls for service for the 120,000 square feet and 130,00 square feet development, respectively.

Figure 51 Annual Large-Scale Retail Calls for Service Benchmarks

	120,000 SF	130,000 SF
CFS per 100,000 SF	118	118
Annual CFS Estimate	142	154
Hours of Operation		
Survey Hours of Operation	24	24
Large-Scale Outdoor Sporting Goods Store Hours of Operation	11	11
Percent of Total Hours of Operation	46%	46%
Estimated CFS for Large-Scale Outdoor Sporting Goods Store	65	71

Note: CFS = Call for Service

Source: Robert Olson Associates, "Police Service Impact Report - Proposed Wal-Mart Store City of Galt, California" (2008) and Pro Forma Advisors

Additional research was conducted to establish calls for service benchmarks for the hotel development on a per room basis. Below provides the findings for local, state and national municipalities, which include high calls for service ratios for distressed properties in less desirable locations (City of Redding and Costa Mesa) as well as a range of averages based various annual calls for service data. The annual estimate for the Project and Project Alternatives of 0.25 calls for service per hotel room was utilized because the proposed hotel development will be high quality and thus less likely to generate a large number of calls for service requests, which is aligned with the observed ratio in Chula Vista as well as the Tier 1 benchmark in Branson, Missouri.

Figure 52 Annual Hotel and Retail Calls for Service Benchmarks

	Annual CFS per Room
City	
City of Redding, CA (1)	2.20
City of Costa Mesa, CA (2)	4.80
City of Chula Vista, CA (3)	0.22
City of Branson, MO (4)	
Tier 1	Less than 0.25
Tier 2	0.25 - 0.99
Tier 3	Greater than 1.0
Estimate	0.25
Hotel Rooms	
250 Rooms (166 net new)	42
128 Rooms (44 net new)	11

Note: CFS = Call for Service (1) Represents most often cited hotels for CFS, seven month period extrapolated to 12-month period; (2) High benchmark for CFS; (3) Average CFS; (4) Low, mid, and high benchmarks for CFS.

Source: City of Redding Police Department, Los Angeles Times, City of Chula Vista, Branson Tri-Lakes News

Model Inputs

Construction (One-Time) Impacts

The following table summarizes previous presented information to present the estimated construction costs of the Project and Project Alternatives and the corresponding IMPLAN model input/output categories by code and description.

Figure 53 Summary of Economic Impact Construction Inputs (Millions $2017)

Alternative	Facility	Parking (Structure)	Parking (Surface)	FF&E (Slots)	FF&E (Other)	Soft Costs	Cont.	Site Work / Other	Non-Casino Retail	Total	Total Less FF&E (Slots)
Project (A)	$88.2	$14.4	$2.1	$10.0	$15.4	$20.5	$10.3	$5.0	$32.5	$198.4	**$188.4**
Project with No Big Box (B)	$88.2	$14.4	$2.1	$10.0	$15.4	$20.5	$10.3	$5.0	$0.0	$165.9	**$155.9**
Reduced Intensity (C)	$82.3	$14.4	$0.0	$2.5	$14.5	$19.4	$9.7	$5.0	$32.5	$180.3	**$177.8**
Non-Gaming (D)	$21.6	$0.0	$0.7	$0.0	$3.2	$4.3	$1.1	$5.0	$30.0	$65.9	**$65.9**
Anderson Site (E)	$88.2	$14.4	$2.1	$10.0	$15.4	$20.5	$10.3	$30.0	$30.0	$220.9	**$210.9**
Expansion (F)	$4.0	$15.1	$0.0	$3.6	$2.9	$3.8	$1.9	$12.0	$0.0	$43.3	**$39.7**

Development Category	IMPLAN Code	IMPLAN Description
Facility	57	Construction of new commercial structures, including farm structures
Parking	58	Construction of other new nonresidential structures
Parking (Structure)	58	Construction of other new nonresidential structures
FF&E (Other)	450	Specialized design services
Soft Costs	449	Architectural, engineering, and related services
Cont.	58	Construction of other new nonresidential structures
Site Work/Other	58	Construction of other new nonresidential structures
Non-Casino Retail	57	Construction of new commercial structures, including farm structures

Note: Cont. = Contingency

Source: IMPLAN and Pro Forma Advisors

Operations (On-Going) Impacts

The following table summarizes previous presented information to present the estimated operation revenues of the Project and Project Alternatives and the corresponding IMPLAN model input/output categories by code and description.

Figure 54 Summary of Economic Impact Operation Inputs (Millions $2022)

Alternative	Casino	Hotel	Casino F&B	Casino Retail	Non-Casino Retail	Total
Project (A)	$34.7	$5.6	$4.6	$0.3	$46.9	**$92.1**
Project with No Big Box (B)	$34.7	$5.6	$4.6	$0.3	$0.0	**$45.2**
Reduced Intensity (C)	$24.6	$4.7	$3.7	$0.3	$46.9	**$80.2**
Non-Gaming (D)	$0.0	$1.8	$2.7	$0.2	$42.7	**$47.4**
Anderson Site (E)	$27.9	$5.1	$4.0	$0.3	$42.7	**$80.0**
Expansion (F)	$2.9	$0.0	$1.5	$0.1	$0.0	**$4.5**

Development Category	IMPLAN Code	IMPLAN Description
Casino	495	Gambling industries (except casino hotels)
Hotel	499	Hotels and motels, including casino hotels
Casino (F&B)	501	Full-service restaurants
Casino (Retail)	406	Retail - Miscellaneous store retailers
Non-Casino Retail	404	Retail - Sporting goods, hobby, musical instrument and book stores

Note: Operation impacts are net of closure/renovation of existing facility and substitution.

Source: IMPLAN and Pro Forma Advisors

Alternative A - Project

Economic Impacts

The following summarizes the economic impacts anticipated to result from the Project (Alternative A).

Construction

The one-time construction of the Project is anticipate to create the need for 2,127 temporary jobs. A summary of direct, indirect/induced, and total impact generated by Project construction is included below. The Project's one-time construction related impact on the County is estimated to create $99.1 million in income earnings and $270.6 million in output.

Figure 55 Summary of Economic Impact of Alternative A Construction (Millions of 2017 dollars)

Impact Type	Jobs	Labor Income	Output
Direct	1,372	$67.6	$175.4
Indirect/Induced	756	$31.4	$95.2
Total	2,127	$99.1	$270.6

Source: IMPLAN

Operations

As of stabilization in 2022, total Project direct employment of 921 jobs is expected. A summary of direct, indirect/induced, and total impact generated by Project operations is included below. As of 2022, the Project's ongoing operational impact on the County (presented in 2017 dollars) is estimated to include $23.9 million in income earnings and $82.2 million in output.

Figure 56 Summary of Economic Impact of Alternative A Operations (Millions of 2017 dollars)

Impact Type	Jobs	Labor Income	Output
Direct	650	$14.2	$50.4
Indirect/Induced	271	$9.7	$31.8
Total	921	$23.9	$82.2

Source: IMPLAN

Fiscal Impacts

There will be fiscal impacts resulting from the construction and operation of Alternative A at the County, State, and federal level from a variety of taxes.

Construction

The one time State and Local Tax (inclusive of City and County) are estimated at $12.2 million, which reflect the significant taxes associated with construction materials. An additional $22.3 million would be paid in federal taxes largely driven by taxes related to labor.

Figure 57 Summary of Fiscal Impact of Alternative A Construction (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$24,611	$24,611
Social Insurance Tax	$312,320	$0	$0	$0	$0	$312,320
Tax on Production and Imports	$0	$0	$7,913,916	$0	$0	$7,913,916
Corporate Profits Tax	$0	$0	$0	$0	$296,948	$296,948
Personal Tax	$0	$0	$0	$3,615,782	$0	$3,615,782
Total State and Local Tax	**$312,320**	**$0**	**$7,913,916**	**$3,615,782**	**$321,559**	**$12,163,577**
Federal Tax						
Social Insurance Tax	$9,991,038	$882,935	$0	$0	$0	$10,873,973
Tax on Production and Imports	$0	$0	$1,054,166	$0	$0	$1,054,166
Corporate Profits Tax	$0	$0	$0	$0	$1,984,528	$1,984,528
Personal Tax	$0	$0	$0	$8,407,436	$0	$8,407,436
Total Federal Tax	**$9,991,038**	**$882,935**	**$1,054,166**	**$8,407,436**	**$1,984,528**	**$22,320,103**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Operations

As noted, in some instances direct taxes may not be applicable due to sales and property tax exemptions applicable to the Tribe. The IMPLAN model projects total taxes without consideration of these exemptions. As such, the IMPLAN model was adjusted to remove the direct tax impacts and only include the secondary tax impacts (indirect and induced) to more accurately reflect the alternatives fiscal impact of the Project's operations.

The ongoing State and Local Tax are estimated at $1.9 million, which reflect the taxes associated with operation related costs. An additional $2.4 million would be paid in federal taxes largely driven by taxes related to labor. Not withstanding

Tribal tax exemptions, given the level of projected tax revenue, it is reasonable to assume that that the operations will exceed the loss in property related taxes due to moving the Strawberry Fields Site into trust.

Figure 58 Summary of Fiscal Impact of Alternative A Operations (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$4,774	$4,774
Social Insurance Tax	$29,736	$0	$0	$0	$0	$29,736
Tax on Production and Imports	$0	$0	$1,475,014	$0	$0	$1,475,014
Corporate Profits Tax	$0	$0	$0	$0	$57,603	$57,603
Personal Tax	$0	$0	$0	$352,945	$0	$352,945
Total State and Local Tax	**$29,736**	**$0**	**$1,475,014**	**$352,945**	**$62,377**	**$1,920,072**
Federal Tax						
Social Insurance Tax	$951,265	$93,588	$0	$0	$0	$1,044,853
Tax on Production and Imports	$0	$0	$196,478	$0	$0	$196,478
Corporate Profits Tax	$0	$0	$0	$0	$384,967	$384,967
Personal Tax	$0	$0	$0	$820,667	$0	$820,667
Total Federal Tax	**$951,265**	**$93,588**	**$196,478**	**$820,667**	**$384,967**	**$2,446,965**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Social and Community Effects

There could be a number of growth related impacts on the City or County based on the need for additional jobs, housing, and education that might increase demand (municipal service costs) for public services. Growth in both the construction and operational phase will be based on the creation of new full-time equivalent jobs and the secondary impacts on household foundation and educational requirements. It is important to note that all construction related job growth is considered to be temporary jobs that do not impact municipal costs given the nature of the construction industry. All jobs created by the Project and related impacts are discussed below.

Analyzing the potential impact of growth due to operations, the amount of projected population, housing, and public school capacity seem to be sufficient to accommodate projected growth. Based on these projections, the available housing supply or municipal costs will not be unduly burdened by the Project in the City or County. Due to diverse housing preferences it is assumed that enrollments will occur throughout the County and minimize the potential impacts at any particular school.

Figure 59 Alternative A Growth Impact Analysis (Operations)

	New Jobs	New FTE Jobs (Impact Jobs x .94)	New FTE Located in the County (FTE Jobs x 71.6%)	New FTE Located in the City (FTE Jobs x 44.0%)	Induced Growth from Outside of County (FTE Jobs x 12.1%)	
					City	County
Project	921	869	622	382	46	75

Notes: Assumes that 71.6 percent of new employees will live and work in Shasta County based on US Census 2014 and excludes those new employees estimated to work in the City of Redding. Assumes that 44.0 percent of new employees will live and work in the City of Redding based on US Census 2014 estimates; Employment (in-place) estimate based on extrapolation of IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County, which suggests that 12.06 percent of new employment is from in-migration based on the ratio of net new income tax returns in relation to net new job growth. FTE = Full-time equivalent job.

	2016	2030	Projected Change	Induced Growth from Outside of County	Growth as Percent of Projected Change
City of Redding					
Population (1)	90,230	99,555	9,325	87	0.9%
Employment (2)	44,575	49,003	4,428	46	1.0%
Housing (3)	39,423	44,431	5,008	48	1.0%
Shasta County					
Population (1)	178,592	193,928	15,336	180	1.2%
Employment (2)	60,819	69,399	8,580	75	0.9%
Housing (3)	78,379	87,726	9,347	79	0.8%
K-12 (4)	26,382	24,141	-2,241	40	-1.8%

Notes: (1) Analysis assumes ratio of 1.9 persons per household based on IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County; (2) Please see table above. (3) Assumes current ratio of 0.95 jobs per household; and (4) Public School projections available through 2015/2016 at County level only and analysis assumes current ratio of 22 percent of households having children that may require public school education.

Source: Department of Finance; IRS; Shasta Regional Transportation Agency; and Pro Forma Advisors

Based on the literature review, there is no conclusive evidence that legalized gambling increases the pathological or problem gaming. Furthermore, there is little correlation with legalized gambling and crime. Based on the existing reported CFS at the casino, the development would have little overall impact on public safety adding only 30 additional CFS based on the Project.

Figure 60 Alternative A Calls for Service Estimate (Stabilized Year)

	Casino			Hotel			Retail			Total
	Existing CFS	Attendance Increase	Net New CFS	New Rooms	CFS per Room	Net New CFS	New Retail (SF)	CFS per SF	Net New CFS	Net New CFS
Project	120	29%	35	166	0.25	42	130,000	54.3	71	147

Source: Win-River Resort & Casino and Pro Forma Advisors

Alternative B - Project with No Big Box Retail Alternative

Economic Impacts

The following summarizes the economic impacts anticipated to result from the Project Alternative B (Project with no Big Box Retail).

Construction

The one-time construction of the Project is anticipate to create the need for 1,745 temporary jobs. A summary of direct, indirect/induced, and total impact generated by Project Alternative B construction is included below. The Project Alternative B's one-time construction related impact on the County is estimated to create $81.4 million in income earnings and $221.4 million in output.

Figure 61 Summary of Economic Impact of Alternative B Construction (Millions of 2017 dollars)

Impact Type	Jobs	Labor Income	Output
Direct	1,114	$55.2	$142.6
Indirect/Induced	631	$26.1	$78.8
Total	1,745	$81.4	$221.4

Source: IMPLAN

Operations

As of stabilization in 2022, total Project Alternative B's direct employment of 494 jobs is expected. A summary of direct, indirect/induced, and total impact generated by Project Alternative B operations is included below. As of 2022, the Project Alternative B's ongoing operational impact on the County (presented in 2017 dollars) is estimated to include $11.9 million in earnings and $50.7 million in output.

Figure 62 Summary of Economic Impact of Alternative B Operations (Millions of 2017 dollars)

Impact Type	Jobs	Labor Income	Output
Direct	319	$5.9	$30.7
Indirect/Induced	175	$6.0	$20.0
Total	494	$11.9	$50.7

Source: IMPLAN

Fiscal Impacts

Construction

The one time State and Local Tax are estimated at $9.9 million, which reflect the significant taxes associated with construction materials. An additional $18.3 million would be paid in federal taxes largely driven by taxes related to labor.

Figure 63 Summary of Fiscal Impact of Alternative B Construction (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$19,844	$19,844
Social Insurance Tax	$255,441	$0	$0	$0	$0	$255,441
Tax on Production and Imports	$0	$0	$6,423,665	$0	$0	$6,423,665
Corporate Profits Tax	$0	$0	$0	$0	$239,439	$239,439
Personal Tax	$0	$0	$0	$2,970,650	$0	$2,970,650
Total State and Local Tax	**$255,441**	**$0**	**$6,423,665**	**$2,970,650**	**$259,283**	**$9,909,039**
Federal Tax						
Social Insurance Tax	$8,171,491	$736,803	$0	$0	$0	$8,908,294
Tax on Production and Imports	$0	$0	$855,658	$0	$0	$855,658
Corporate Profits Tax	$0	$0	$0	$0	$1,600,187	$1,600,187
Personal Tax	$0	$0	$0	$6,907,374	$0	$6,907,374
Total Federal Tax	**$8,171,491**	**$736,803**	**$855,658**	**$6,907,374**	**$1,600,187**	**$18,271,513**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Operations

The ongoing State and Local Tax are estimated at $1.2 million, which reflect the taxes associated with indirect and induced operation related costs. An additional $1.5 million would be paid in federal taxes largely driven by taxes related to labor. Given the level of projected tax revenue, it is reasonable to assume that that the operations will exceed the loss in property related taxes due to moving the Strawberry Fields Site into trust. Direct taxes have been removed to account for tax exemptions applicable to the Tribe.

Figure 64 Summary of Fiscal Impact of Alternative B Operations (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$3,099	$3,099
Social Insurance Tax	$18,090	$0	$0	$0	$0	$18,090
Tax on Production and Imports	$0	$0	$889,415	$0	$0	$889,415
Corporate Profits Tax	$0	$0	$0	$0	$37,400	$37,400
Personal Tax	$0	$0	$0	$220,257	$0	$220,257
Total State and Local Tax	**$18,090**	**$0**	**$889,415**	**$220,257**	**$40,499**	**$1,168,261**
Federal Tax						
Social Insurance Tax	$578,723	$63,009	$0	$0	$0	$641,732
Tax on Production and Imports	$0	$0	$118,473	$0	$0	$118,473
Corporate Profits Tax	$0	$0	$0	$0	$249,952	$249,952
Personal Tax	$0	$0	$0	$512,141	$0	$512,141
Total Federal Tax	**$578,723**	**$63,009**	**$118,473**	**$512,141**	**$249,952**	**$1,522,298**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Community and Social Effects

Similar to the Project, given growth projections there does not appear to be any community and social impacts of the development for Project Alternative B.

Figure 65 Alternative B Growth Impact Analysis

	New Jobs	New FTE Jobs (Impact Jobs x .94)	New FTE Located in the County (FTE Jobs x 71.6%)	New FTE Located in the City (FTE Jobs x 44.0%)	Induced Growth from Outside of County (FTE Jobs x 12.1%)	
					City	County
Project	494	466	333	205	25	40

Notes: Assumes that 71.6 percent of new employees will live and work in Shasta County based on US Census 2014 and excludes those new employees estimated to work in the City of Redding. Assumes that 44.0 percent of new employees will live and work in the City of Redding based on US Census 2014 estimates; Employment (in-place) estimate based on extrapolation of IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County, which suggests that 12.06 percent of new employment is from in-migration based on the ratio of net new income tax returns in relation to net new job growth. FTE = Full-time equivalent job.

	2016	2030	Projected Change	Induced Growth from Outside of County	Growth as Percent of Projected Change
City of Redding					
Population (1)	90,230	99,555	9,325	48	0.5%
Employment (2)	44,575	49,003	4,428	25	0.6%
Housing (3)	39,423	44,431	5,008	26	0.5%
Shasta County					
Population (1)	178,592	193,928	15,336	96	0.6%
Employment (2)	60,819	69,399	8,580	40	0.5%
Housing (3)	78,379	87,726	9,347	42	0.5%
K-12 (4)	26,382	24,141	-2,241	21	-0.9%

Notes: (1) Analysis assumes ratio of 1.9 persons per household based on IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County; (2) Please see table above. (3) Assumes current ratio of 0.95 jobs per household; and (4) Public School projections available through 2015/2016 at County level only and analysis assumes current ratio of 22 percent of households having children that may require public school education.

Source: Department of Finance; IRS; Shasta Regional Transportation Agency; and Pro Forma Advisors

Figure 66 Alternative B Calls for Service Estimate (Stabilized Year)

	Casino			Hotel			Retail			Total
	Existing CFS	Attendance Increase	Net New CFS	New Rooms	CFS per Room	Net New CFS	New Retail (SF)	CFS per SF	Net New CFS	Net New CFS
Project with No Big Box	120	29%	35	166	0.25	42	0	54.3	0	76

Source: Win-River Resort & Casino and Pro Forma Advisors

Alternative C - Reduced Intensity Alternative

Economic Impacts

The following summarizes the economic impacts anticipated to result from the Project Alternative C (Reduced Intensity Alternative).

Construction

The one-time construction of the Project is anticipate to create the need for 2,008 temporary jobs. A summary of direct, indirect/induced, and total impact generated by Project Alternative C construction is included below. The Project Alternative C's one-time construction related impact on the County is estimated to create $93.5 million in income earnings and $255.4 million in output.

Figure 67 Summary of Economic Impact of Alternative C Construction (Millions of 2017 dollars)

Impact Type	Jobs	Income	Output
Direct	1,295	$63.8	$165.5
Indirect/Induced	713	$29.7	$89.8
Total	2,008	$93.5	$255.4

Source: IMPLAN

Operations

As of stabilization in 2022, total Project Alternative C's direct employment of 780 jobs is expected. A summary of direct, indirect/induced, and total impact generated by Project operations is included below. As of 2022, the Project Alternative C's ongoing operational impact on the County (presented in 2017 dollars) is estimated to include $20.6 million in earnings and $68.0 million in output.

Figure 68 Summary of Economic Impact of Alternative C Operations (Millions of 2017 dollars)

Impact Type	Jobs	Income	Output
Direct	558	$12.7	$41.9
Indirect/Induced	222	$8.0	$26.2
Total	780	$20.6	$68.0

Source: IMPLAN

Fiscal Impacts

Construction

The one time State and Local Tax are estimated at $11.5 million, which reflect the significant taxes associated with construction materials. An additional $21.1 million would be paid in federal taxes largely driven by taxes related to labor.

Figure 69 Summary of Fiscal Impact of Alternative C Construction (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$23,220	$23,220
Social Insurance Tax	$295,025	$0	$0	$0	$0	$295,025
Tax on Production and Imports	$0	$0	$7,471,916	$0	$0	$7,471,916
Corporate Profits Tax	$0	$0	$0	$0	$280,173	$280,173
Personal Tax	$0	$0	$0	$3,413,037	$0	$3,413,037
Total State and Local Tax	**$295,025**	**$0**	**$7,471,916**	**$3,413,037**	**$303,393**	**$11,483,371**
Federal Tax						
Social Insurance Tax	$9,437,777	$831,279	$0	$0	$0	$10,269,056
Tax on Production and Imports	$0	$0	$995,291	$0	$0	$995,291
Corporate Profits Tax	$0	$0	$0	$0	$1,872,419	$1,872,419
Personal Tax	$0	$0	$0	$7,936,013	$0	$7,936,013
Total Federal Tax	**$9,437,777**	**$831,279**	**$995,291**	**$7,936,013**	**$1,872,419**	**$21,072,779**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Operations

The ongoing State and Local Tax are estimated at $1.6 million, which reflect the taxes associated with indirect and induced operation related costs. An additional $2.0 million would be paid in federal taxes largely driven by taxes related to labor. Given the level of projected tax revenue, it is reasonable to assume that that the operations will exceed the loss in property related taxes due to moving the Strawberry Fields Site into trust. Direct taxes have been removed to account for tax exemptions applicable to the Tribe.

Figure 70 Summary of Fiscal Impact of Alternative C Operations (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$3,902	$3,902
Social Insurance Tax	$24,707	$0	$0	$0	$0	$24,707
Tax on Production and Imports	$0	$0	$1,228,224	$0	$0	$1,228,224
Corporate Profits Tax	$0	$0	$0	$0	$47,084	$47,084
Personal Tax	$0	$0	$0	$291,463	$0	$291,463
Total State and Local Tax	**$24,707**	**$0**	**$1,228,224**	**$291,463**	**$50,986**	**$1,595,380**
Federal Tax						
Social Insurance Tax	$790,359	$75,803	$0	$0	$0	$866,162
Tax on Production and Imports	$0	$0	$163,603	$0	$0	$163,603
Corporate Profits Tax	$0	$0	$0	$0	$314,671	$314,671
Personal Tax	$0	$0	$0	$677,710	$0	$677,710
Total Federal Tax	**$790,359**	**$75,803**	**$163,603**	**$677,710**	**$314,671**	**$2,022,146**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Community and Social Effects

Similar to the Project, given growth projections there does not appear to be any community and social impacts of the development for Project Alternative C.

Figure 71 Alternative C Growth Impact Analysis

	New Jobs	New FTE Jobs (Impact Jobs x .94)	New FTE Located in the County (FTE Jobs x 71.6%)	New FTE Located in the City (FTE Jobs x 44.0%)	Induced Growth from Outside of County (FTE Jobs x 12.1%)	
					City	County
Project	780	736	527	323	39	63

Notes: Assumes that 71.6 percent of new employees will live and work in Shasta County based on US Census 2014 and excludes those new employees estimated to work in the City of Redding. Assumes that 44.0 percent of new employees will live and work in the City of Redding based on US Census 2014 estimates; Employment (in-place) estimate based on extrapolation of IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County, which suggests that 12.06 percent of new employment is from in-migration based on the ratio of net new income tax returns in relation to net new job growth. FTE = Full-time equivalent job.

	2016	2030	Projected Change	Induced Growth from Outside of County	Growth as Percent of Projected Change
City of Redding					
Population (1)	90,230	99,555	9,325	74	0.8%
Employment (2)	44,575	49,003	4,428	39	0.9%
Housing (3)	39,423	44,431	5,008	41	0.8%
Shasta County					
Population (1)	178,592	193,928	15,336	151	1.0%
Employment (2)	60,819	69,399	8,580	63	0.7%
Housing (3)	78,379	87,726	9,347	66	0.7%
K-12 (4)	26,382	24,141	-2,241	33	-1.5%

Notes: (1) Analysis assumes ratio of 1.9 persons per household based on IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County; (2) Please see table above. (3) Assumes current ratio of 0.95 jobs per household; and (4) Public School projections available through 2015/2016 at County level only and analysis assumes current ratio of 22 percent of households having children that may require public school education.

Source: Department of Finance; IRS; Shasta Regional Transportation Agency; and Pro Forma Advisors

Figure 72 Alternative C Calls for Service Estimate (Stabilized Year)

	Casino			Hotel			Retail			Total
	Existing CFS	Attendance Increase	Net New CFS	New Rooms	CFS per Room	Net New CFS	New Retail (SF)	CFS per SF	Net New CFS	Net New CFS
Reduced Intensity	120	20%	24	166	0.25	42	130,000	54.3	71	136

Source: Win-River Resort & Casino and Pro Forma Advisors

Alternative D - Non-Gaming Alternative

Economic Impacts

The following summarizes the economic impacts anticipated to result from the Project Alternative D (Non-Gaming Alternative).

Construction

The one-time construction of the Project is anticipated to create the need for 757 temporary jobs. A summary of direct, indirect/induced, and total impact generated by Project Alternative D construction is included below. The Project Alternative D's one-time construction related impact on the County is estimated to create $35.2 million in income earnings and $96.7 million in output.

Figure 73 Summary of Economic Impact of Alternative D Construction (Millions of 2017 dollars)

Impact Type	Jobs	Income	Output
Direct	497	$24.2	$63.4
Indirect/Induced	260	$10.9	$33.3
Total	757	$35.2	$96.7

Source: IMPLAN

Operations

As of stabilization in 2022, total Project Alternative D's direct employment of 445 jobs is expected. A summary of direct, indirect/induced, and total impact generated by Project Alternative D operations is included below. As of 2022, the Project Alternative D's ongoing operational impact on the County (presented in 2017 dollars) is estimated to include $12.3 million in earnings and $32.0 million in output.

Figure 74 Summary of Economic Impact of Alternative D Operations (Millions of 2017 dollars)

Impact Type	Jobs	Income	Output
Direct	346	$8.6	$20.1
Indirect/Induced	98	$3.7	$12.0
Total	445	$12.3	$32.0

Source: IMPLAN

Fiscal Impacts

Construction

The one time State and Local Tax are estimated at $4.4 million, which reflect the significant taxes associated with construction materials. An additional $8.0 million would be paid in federal taxes largely driven by taxes related to labor.

Figure 75 Summary of Fiscal Impact of Alternative D Construction (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$9,036	$9,036
Social Insurance Tax	$111,697	$0	$0	$0	$0	$111,697
Tax on Production and Imports	$0	$0	$2,870,157	$0	$0	$2,870,157
Corporate Profits Tax	$0	$0	$0	$0	$109,022	$109,022
Personal Tax	$0	$0	$0	$1,282,522	$0	$1,282,522
Total State and Local Tax	**$111,697**	**$0**	**$2,870,157**	**$1,282,522**	**$118,058**	**$4,382,434**
Federal Tax						
Social Insurance Tax	$3,573,142	$304,130	$0	$0	$0	$3,877,272
Tax on Production and Imports	$0	$0	$382,317	$0	$0	$382,317
Corporate Profits Tax	$0	$0	$0	$0	$728,603	$728,603
Personal Tax	$0	$0	$0	$2,982,126	$0	$2,982,126
Total Federal Tax	**$3,573,142**	**$304,130**	**$382,317**	**$2,982,126**	**$728,603**	**$7,970,318**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Operations

The ongoing State and Local Tax are estimated at $772,000, which reflect the taxes associated with indirect and induced operation related costs. An additional $945,000 would be paid in federal taxes largely driven by taxes related to labor. Given the level of projected tax revenue, it is reasonable to assume that that the operations will exceed the loss in property related taxes due to moving the Strawberry Fields Site into trust. Direct taxes have been removed to account for tax exemptions applicable to the Tribe.

Figure 76 Summary of Fiscal Impact of Alternative D Operations (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$1,695	$1,695
Social Insurance Tax	$11,940	$0	$0	$0	$0	$11,940
Tax on Production and Imports	$0	$0	$602,035	$0	$0	$602,035
Corporate Profits Tax	$0	$0	$0	$0	$20,454	$20,454
Personal Tax	$0	$0	$0	$135,667	$0	$135,667
Total State and Local Tax	**$11,940**	**$0**	**$602,035**	**$135,667**	**$22,149**	**$771,791**
Federal Tax						
Social Insurance Tax	$381,977	$30,935	$0	$0	$0	$412,912
Tax on Production and Imports	$0	$0	$80,193	$0	$0	$80,193
Corporate Profits Tax	$0	$0	$0	$0	$136,696	$136,696
Personal Tax	$0	$0	$0	$315,454	$0	$315,454
Total Federal Tax	**$381,977**	**$30,935**	**$80,193**	**$315,454**	**$136,696**	**$945,255**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Community and Social Effects

Similar to the Project, given growth projections there does not appear to be any community impacts of the development for Project Alternative D. Given that no new gaming will occur there will be no additional social impact on the City or County.

Figure 77 Alternative D Growth Impact Analysis

	New Jobs	New FTE Jobs (Impact Jobs x .94)	New FTE Located in the County (FTE Jobs x 71.6%)	New FTE Located in the City (FTE Jobs x 44.0%)	Induced Growth from Outside of County (FTE Jobs x 12.1%)	
					City	County
Project	445	419	300	184	22	36

Notes: Assumes that 71.6 percent of new employees will live and work in Shasta County based on US Census 2014 and excludes those new employees estimated to work in the City of Redding. Assumes that 44.0 percent of new employees will live and work in the City of Redding based on US Census 2014 estimates; Employment (in-place) estimate based on extrapolation of IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County, which suggests that 12.06 percent of new employment is from in-migration based on the ratio of net new income tax returns in relation to net new job growth. FTE = Full-time equivalent job.

	2016	2030	Projected Change	Induced Growth from Outside of County	Growth as Percent of Projected Change
City of Redding					
Population (1)	90,230	99,555	9,325	42	0.4%
Employment (2)	44,575	49,003	4,428	22	0.5%
Housing (3)	39,423	44,431	5,008	23	0.5%
Shasta County					
Population (1)	178,592	193,928	15,336	86	0.6%
Employment (2)	60,819	69,399	8,580	36	0.4%
Housing (3)	78,379	87,726	9,347	38	0.4%
K-12 (4)	26,382	24,141	-2,241	19	-0.8%

Notes: (1) Analysis assumes ratio of 1.9 persons per household based on IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County; (2) Please see table above. (3) Assumes current ratio of 0.95 jobs per household; and (4) Public School projections available through 2015/2016 at County level only and analysis assumes current ratio of 22 percent of households having children that may require public school education.

Source: Department of Finance; IRS; Shasta Regional Transportation Agency; and Pro Forma Advisors

Figure 78 Alternative D Calls for Service Estimate (2022)

	Casino			Hotel			Retail			Total
	Existing CFS	Attendance Increase	Net New CFS	New Rooms	CFS per Room	Net New CFS	New Retail (SF)	CFS per SF	Net New CFS	Net New CFS
Non-Gaming	120	0%	0	44	0.25	11	120,000	54.3	65	76

Source: Win-River Resort & Casino and Pro Forma Advisors

Alternative E - Anderson Site

Economic Impacts

The following summarizes the economic impacts anticipated to result from the Project Alternative E (Anderson Site).

Construction

The one-time construction of the Project is anticipate to create the need for 2,392 temporary jobs. A summary of direct, indirect/induced, and total impact generated by Project Alternative E construction is included below. The Project Alternative E's one-time construction related impact on the County is estimated to create $111.2 million in income earnings and $305.5 million in output.

Figure 79 Summary of Economic Impact of Alternative E Construction (Millions of 2017 dollars)

Impact Type	Jobs	Income	Output
Direct	1,537	$75.6	$197.9
Indirect/Induced	855	$35.5	$107.6
Total	2,392	$111.2	$305.5

Source: IMPLAN

Operations

As of stabilization in 2022, total Project Alternative E's direct employment of 783 jobs is expected. A summary of direct, indirect/induced, and total impact generated by Project Alternative E operations is included below. As of 2022, the Project Alternative E's ongoing operational impact on the County (presented in 2017 dollars) is estimated to include $20.6 million in earnings and $69.7 million in output.

Figure 80 Summary of Economic Impact of Alternative E Operations (Millions of 2017 dollars)

Impact Type	Jobs	Income	Output
Direct	554	$12.4	$42.8
Indirect/Induced	229	$8.2	$26.9
Total	783	$20.6	$69.7

Source: IMPLAN

Fiscal Impacts

Construction

The one time State and Local Tax are estimated at $13.6 million, which reflect the significant taxes associated with construction materials. An additional $25.0 million would be paid in federal taxes largely driven by taxes related to labor.

Figure 81 Summary of Fiscal Impact of Alternative E Construction (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$28,067	$28,067
Social Insurance Tax	$346,180	$0	$0	$0	$0	$346,180
Tax on Production and Imports	$0	$0	$8,868,283	$0	$0	$8,868,283
Corporate Profits Tax	$0	$0	$0	$0	$338,650	$338,650
Personal Tax	$0	$0	$0	$4,061,767	$0	$4,061,767
Total State and Local Tax	**$346,180**	**$0**	**$8,868,283**	**$4,061,767**	**$366,717**	**$13,642,947**
Federal Tax						
Social Insurance Tax	$11,074,235	$1,037,877	$0	$0	$0	$12,112,112
Tax on Production and Imports	$0	$0	$1,181,292	$0	$0	$1,181,292
Corporate Profits Tax	$0	$0	$0	$0	$2,263,225	$2,263,225
Personal Tax	$0	$0	$0	$9,444,444	$0	$9,444,444
Total Federal Tax	**$11,074,235**	**$1,037,877**	**$1,181,292**	**$9,444,444**	**$2,263,225**	**$25,001,073**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Operations

The ongoing State and Local Tax are estimated at $1.6 million, which reflect the indirect and induced taxes associated with operation related costs. An additional $2.1 million would be paid in federal taxes largely driven by taxes related to labor. Given the level of projected tax revenue, it is reasonable to assume that that the operations will exceed the loss in property related taxes due to moving the Anderson Site into trust. Direct taxes have been removed to account for tax exemptions applicable to the Tribe.

Figure 82 Summary of Fiscal Impact of Alternative E Operations (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$4,031	$4,031
Social Insurance Tax	$25,259	$0	$0	$0	$0	$25,259
Tax on Production and Imports	$0	$0	$1,253,955	$0	$0	$1,253,955
Corporate Profits Tax	$0	$0	$0	$0	$48,627	$48,627
Personal Tax	$0	$0	$0	$299,114	$0	$299,114
Total State and Local Tax	**$25,259**	**$0**	**$1,253,955**	**$299,114**	**$52,658**	**$1,630,986**
Federal Tax						
Social Insurance Tax	$808,012	$78,749	$0	$0	$0	$886,761
Tax on Production and Imports	$0	$0	$167,033	$0	$0	$167,033
Corporate Profits Tax	$0	$0	$0	$0	$324,983	$324,983
Personal Tax	$0	$0	$0	$695,501	$0	$695,501
Total Federal Tax	**$808,012**	**$78,749**	**$167,033**	**$695,501**	**$324,983**	**$2,074,278**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Community and Social Effects

Similar to the Project, given growth projections there does not appear to be any community and social impacts of the development for Project Alternative E.

Figure 83 Alternative E Growth Impact Analysis

	New Jobs	New FTE Jobs (Impact Jobs x .94)	New FTE Located in the County (FTE Jobs x 71.6%)	New FTE Located in the City (FTE Jobs x 13.2%)	Induced Growth from Outside of County (FTE Jobs x 12.1%)	
					City	County
Project	783	738	528	97	12	64

Notes: Assumes that 71.6 percent of new employees will live and work in Shasta County based on US Census 2014 and excludes those new employees estimated to work in the City of Anderson. Assumes that 13.2 percent of new employees will live and work in the City of Anderson based on US Census 2014 estimates; Employment (in-place) estimate based on extrapolation of IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County, which suggests that 12.06 percent of new employment is from in-migration based on the ratio of net new income tax returns in relation to net new job growth. FTE = Full-time equivalent job.

	2016	2030	Projected Change	Induced Growth from Outside of County	Growth as Percent of Projected Change
City of Anderson					
Population (1)	10,485	13,183	2,698	23	0.8%
Employment (2)	3,032	3,780	748	12	1.6%
Housing (3)	4,141	5,260	1,119	13	1.1%
Shasta County					
Population (1)	178,592	193,928	15,336	154	1.0%
Employment (2)	60,819	69,399	8,580	64	0.7%
Housing (3)	78,379	87,726	9,347	67	0.7%
K-12 (4)	26,382	24,141	-2,241	34	-1.5%

Notes: (1) Analysis assumes ratio of 1.9 persons per household based on IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County; (2) Please see table above. (3) Assumes current ratio of 0.95 jobs per household; and (4) Public School projections available through 2015/2016 at County level only and analysis assumes current ratio of 22 percent of households having children that may require public school education.

Source: Department of Finance; IRS; Shasta Regional Transportation Agency; and Pro Forma Advisors

Figure 84 Alternative E Calls for Service Estimate (Stabilized Year)

	Casino			Hotel			Retail			Total
	Existing CFS	Attendance Increase	Net New CFS	New Rooms	CFS per Room	Net New CFS	New Retail (SF)	CFS per SF	Net New CFS	Net New CFS
Anderson Site	120	21%	25	166	0.25	42	120,000	54.3	65	132

Source: Win-River Resort & Casino and Pro Forma Advisors

Alternative F - Expansion Alternative

Economic Impacts

The following summarizes the economic impacts anticipated to result from the Project Alternative F (Expansion Alternative).

Construction

The one-time construction of the Project is anticipate to create the need for 450 temporary jobs. A summary of direct, indirect/induced, and total impact generated by Project Alternative F construction is included below. The Project Alternative F's one-time construction related impact on the County is estimated to create $20.8 million in income earnings and $58.2 million in output.

Figure 85 Summary of Economic Impact of Alternative F Construction (Millions of 2017 dollars)

Impact Type	Jobs	Income	Output
Direct	280	$13.8	$37.1
Indirect/Induced	170	$7.0	$21.0
Total	450	$20.8	$58.2

Source: IMPLAN

Operations

As of stabilization in 2022, total Project Alternative F's direct employment of 64 jobs is expected. A summary of direct, indirect/induced, and total impact generated by Project Alternative F operations is included below. As of 2022, the Project Alternative F's ongoing operational impact on the County (presented in 2017 dollars) is estimated to include $1.6 million in earnings and $5.7 million in output.

Figure 86 Summary of Economic Impact of Alternative F Operations (Millions of 2017 dollars)

Impact Type	Jobs	Income	Output
Direct	45	$0.9	$3.4
Indirect/Induced	19	$0.7	$2.2
Total	64	$1.6	$5.7

Source: IMPLAN

Fiscal Impacts

Construction

The one time State and Local Tax are estimated at $2.5 million, which reflect the significant taxes associated with construction materials. An additional $4.6 million would be paid in federal taxes largely driven by taxes related to labor.

Figure 87 Summary of Fiscal Impact of Alternative F Construction (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$5,402	$5,402
Social Insurance Tax	$61,092	$0	$0	$0	$0	$61,092
Tax on Production and Imports	$0	$0	$1,613,253	$0	$0	$1,613,253
Corporate Profits Tax	$0	$0	$0	$0	$65,179	$65,179
Personal Tax	$0	$0	$0	$763,865	$0	$763,865
Total State and Local Tax	**$61,092**	**$0**	**$1,613,253**	**$763,865**	**$70,581**	**$2,508,791**
Federal Tax						
Social Insurance Tax	$1,954,299	$234,805	$0	$0	$0	$2,189,104
Tax on Production and Imports	$0	$0	$214,893	$0	$0	$214,893
Corporate Profits Tax	$0	$0	$0	$0	$435,595	$435,595
Personal Tax	$0	$0	$0	$1,776,143	$0	$1,776,143
Total Federal Tax	**$1,954,299**	**$234,805**	**$214,893**	**$1,776,143**	**$435,595**	**$4,615,735**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Operations

The ongoing State and Local Tax are estimated at $135,000, which reflect the indirect and induced taxes associated with operation related costs. An additional $176,000 would be paid in federal taxes largely driven by taxes related to labor. Project Alternative F does not contemplate require moving the Strawberry Fields Site into trust, hence it will not result in the loss of the site's property tax. Direct taxes have been removed to account for tax exemptions applicable to the Tribe.

Figure 88 Summary of Fiscal Impact of Alternative F Operations (2017 dollars)

Description	Job Comp.	Proprietor Income	Tax on Production and Imports	HH	Corp.	Total
State and Local Tax						
Dividends	$0	$0	$0	$0	$332	$332
Social Insurance Tax	$2,080	$0	$0	$0	$0	$2,080
Tax on Production and Imports	$0	$0	$103,585	$0	$0	$103,585
Corporate Profits Tax	$0	$0	$0	$0	$4,004	$4,004
Personal Tax	$0	$0	$0	$24,728	$0	$24,728
Total State and Local Tax	**$2,080**	**$0**	**$103,585**	**$24,728**	**$4,336**	**$134,729**
Federal Tax						
Social Insurance Tax	$66,555	$6,587	$0	$0	$0	$73,142
Tax on Production and Imports	$0	$0	$13,798	$0	$0	$13,798
Corporate Profits Tax	$0	$0	$4,201	$0	$26,765	$30,966
Personal Tax	$0	$0	$587	$57,501	$0	$58,088
Total Federal Tax	**$66,555**	**$6,587**	**$18,586**	**$57,501**	**$26,765**	**$175,994**

Note: Job Comp. = Job Compensation; HH = Household; Corp. = Corporation

Source: IMPLAN

Community and Social Effects

Similar to the Project, given growth projections there does not appear to be any community and social impacts of the development for Project Alternative F.

Figure 89 Alternative F Growth Impact Analysis

	New Jobs	New FTE Jobs (Impact Jobs x .94)	New FTE Located in the County (FTE Jobs x 71.6%)	New FTE Located in the City (FTE Jobs x 44.0%)	Induced Growth from Outside of County (FTE Jobs x 12.1%)	
					City	County
Project	64	60	43	27	3	5

Notes: Assumes that 71.6 percent of new employees will live and work in Shasta County based on US Census 2014 and excludes those new employees estimated to work in the City of Redding. Assumes that 44.0 percent of new employees will live and work in the City of Redding based on US Census 2014 estimates; Employment (in-place) estimate based on extrapolation of IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County, which suggests that 12.06 percent of new employment is from in-migration based on the ratio of net new income tax returns in relation to net new job growth. FTE = Full-time equivalent job.

	2016	2030	Projected Change	Induced Growth from Outside of County	Growth as Percent of Projected Change
City of Redding					
Population (1)	90,230	99,555	9,325	6	0.1%
Employment (2)	44,575	49,003	4,428	3	0.1%
Housing (3)	39,423	44,431	5,008	3	0.1%
Shasta County					
Population (1)	178,592	193,928	15,336	12	0.1%
Employment (2)	60,819	69,399	8,580	5	0.1%
Housing (3)	78,379	87,726	9,347	5	0.1%
K-12 (4)	26,382	24,141	-2,241	3	-0.1%

Notes: (1) Analysis assumes ratio of 1.9 persons per household based on IRS 2011 - 2015 SOI Tax Stats - Migration Data for Shasta County; (2) Please see table above. (3) Assumes current ratio of 0.95 jobs per household; and (4) Public School projections available through 2015/2016 at County level only and analysis assumes current ratio of 22 percent of households having children that may require public school education.

Source: Department of Finance; IRS; Shasta Regional Transportation Agency; and Pro Forma Advisors

Figure 90 Alternative F Calls for Service Estimate (Stabilized Year)

	Casino			Hotel			Retail			Total
	Existing CFS	Attendance Increase	Net New CFS	New Rooms	CFS per Room	Net New CFS	New Retail (SF)	CFS per SF	Net New CFS	Net New CFS
Expansion	120	5%	6	0	0.25	0	0	54.3	0	6

Source: Win-River Resort & Casino and Pro Forma Advisors

Appendix

Firm Overview

Pro Forma Advisors is a partnership committed to providing objective, unbiased economic analysis of real estate development projects. We specialize in land use economics consulting for developers, owners, operators, investors, cultural institutions, non-profits, government, and sovereign Indian Tribes. We offer exceptional global market experience, yet avoid ancillary services which might compromise our objectivity and allows us to support partnering firms in the areas of design, engineering, or project management. We provide our clients and partners with superior service in delivering accurate, actionable, and objective assessments of a project's market and financial potential. We apply extensive experience, creative thinking, new business approaches, and data-driven analysis to your projects.

Our entertainment + resort (e+r) practice offers services in our areas of specialty, which include integrated resorts, theme parks, casino gaming, dining, retail and entertainment (RD&E) centers, branded attractions, museums, and visitor destinations of all types. Our economic master planning (emp) practice focuses on advisory services for traditional land use development including urban mixed-use, large scale master plans, retail and other site specific development. Services common to our practice areas include market analysis, financial feasibility, program right-sizing, economic impacts, fiscal impacts, valuations, and negotiation support.

Pro Forma Advisors was founded in 2008 by former Principals from Economics Research Associates (ERA) after its acquisition by AECOM. The founding principles are to maintain a strategic focus on recreation feasibility while offering independent, high quality service in the most cost-effective manner. We have built a team comprised of five core partners who were former department heads and lead managers at ERA. We focus on the highest value portion of the analytical process, while maintaining strong working relationships with specialists and outside consultants who are affiliated with our firm, as well as with dedicated research teams and staff. This allows us to concentrate on our core competency, while offering the highest value possible for our clients.

Below is information for the company's partners that worked on this analysis.

Mark Dvorchak, Managing Partner

With over 20 years of experience in the entertainment and real estate industry, Mr. Dvorchak is an experienced land-use economist. His practice specialty is the analysis of integrated and unique projects combining traditional real estate development with entertainment land uses such as theme parks, casinos, and destination resorts.

Mr. Dvorchak is a founding partner of Pro Forma Advisors, having brought together experienced land use professionals to create a firm dedicated to market and financial analysis of land use. Prior to founding Pro Forma Advisors, Mr. Dvorchak was a Vice President at Economics Research Associates (ERA) where he was a principal in the Recreation Practice. He also was a Product Manager at Iwerks Entertainment working on product development and Location Based Entertainment. Prior to his graduate degree, he worked in technology for Andersen Consulting and Unify Software.

Mark received an M.B.A from the UCLA's Anderson School of Management in 1994 specializing in entertainment and strategy. He also has a B.S degree in Computer Science from the University of Illinois. Mr. Dvorchak represents Pro

Forma Advisors in the Themed Entertainment Association (TEA) and International Association of Amusement Parks and Attractions (IAAPA). Mr. Dvorchak has presented and moderated panels are many industry events such as the Global Gaming Expo (G2E), the TEA Summit, and G2E Asia.

Lance Harris, Partner

With over 10 years of experience in land use economics, Mr. Harris provides clients with market demand and feasibility studies, mixed-use programming recommendations, financial analysis, economic and fiscal impact assessments, and economic development strategies.

Integral to Mr. Harris's work is the premium placed on developing analysis techniques to gather data at the micro level for market analysis. Using a combination of public data sources, private secondary data sources, first person interviews, GIS data, and on-the-ground site inspection, he is able to construct various models of analysis to effectively determine a development's market area, capture rate, and absorption, which determine overall demand and feasibly. Mr. Harris also has vast experience with both fiscal/economic impact analysis. Mr. Harris has created a variety of fiscal models and provided economic impact analysis at the city, county, state, and national level.

Prior to joining Pro Forma Advisors, Mr. Harris was an Associate Director of Economics at AECOM. He was also a Senior Associate at Economics Research Associates (ERA) prior to the company's acquisition. Mr. Harris received an M.A. in Urban Planning from the USC Price School of Public Policy specializing in real estate and economic development. He also has a B.A. degree in Political Science from the Trinity College in Hartford, Connecticut. Mr. Harris represents Pro Forma Advisors in the American Planning Association and is the chair of APA's national Economic Development Division.

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Pro Forma Gravity Model Overview

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Pro Forma
Advisors LLC

Appendix

Market Demand Gravity Model

Version: 3.0

Pro Forma Advisors LLC Los Angeles **T** 310.616.5079 Hartford **T** 203.604.9007 **F** 888.696.9716 www.ProFormaAdvisors.com

1. Gravity-based Market Model Details

Theoretical Gaming Demand - How much day trip gaming revenue is possible for a given facility in a given location?

- The model estimates theoretical gaming demand for all individuals in reasonable daytrip travel distance from a facility. By summing this demand, a theoretical total can be generated for each facility.

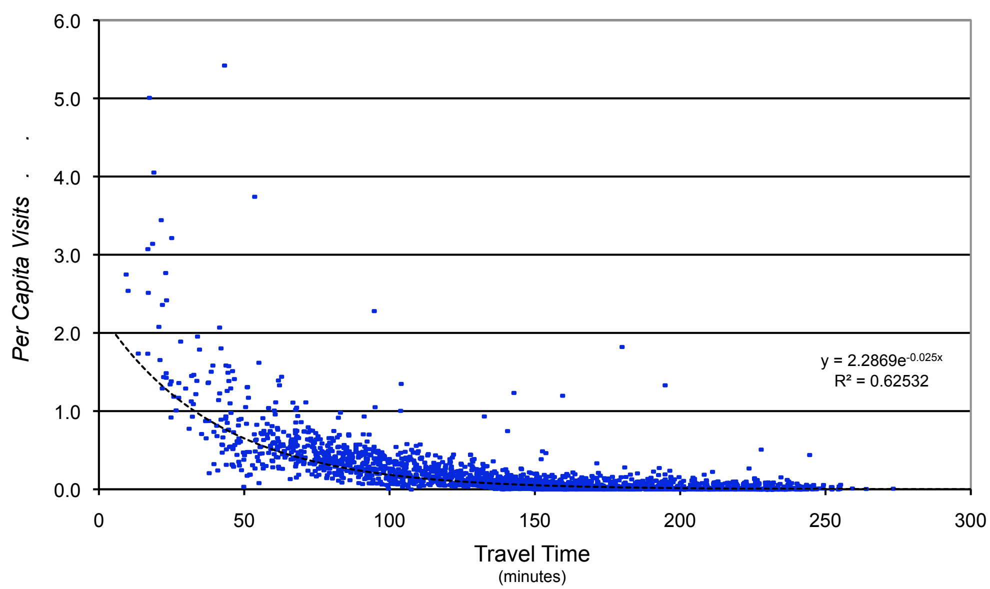
Impact Factors	Comments	Modeling Approach
Distance	Accounts for up to two-thirds of variability in penetration rates.	Model includes drive-time distance from each census tract in the market to each casino property in the market.
Facility Attractiveness	Combination of scale, quality, amenities, competitive environment, and operational skill that collectively form a facility's market drawing power. With respect to distance, close-in market tends to visit at similar rates whether facility is destination or locals-oriented. Attraction represents the ability to maintain drawing power at greater distances.	Model uses comparable facility values from real-life Attractiveness Factor calibrations of GGR. Attractiveness Factor has both quantitative and qualitative input, but in general is calibrated to reflect a facility's *actual* ability to penetrate markets over distance.
Demographics	Certain demographic factors other than distance tend to increase/decrease market penetration potential.	Model adjusts distance-penetration of a census tract based on a relative index of age and income.
Yield	Different facilities will tend to have varying win-per-visitor averages, a dynamic influenced by factors such as visitor length of stay, bet limit or other similar regulations, and overall focus on cultivating high-value visitors.	Model allows a yield factor for each facility to account for observed or expected differences in win-per-visitor.

Source: Pro Forma Advisors

Distance Impact

- Casinos exhibit typical geometric declines in penetration at increased travel times. Statistical patterns and trend lines provide expected penetration values for various casino facilities.

Confidential Casino Data

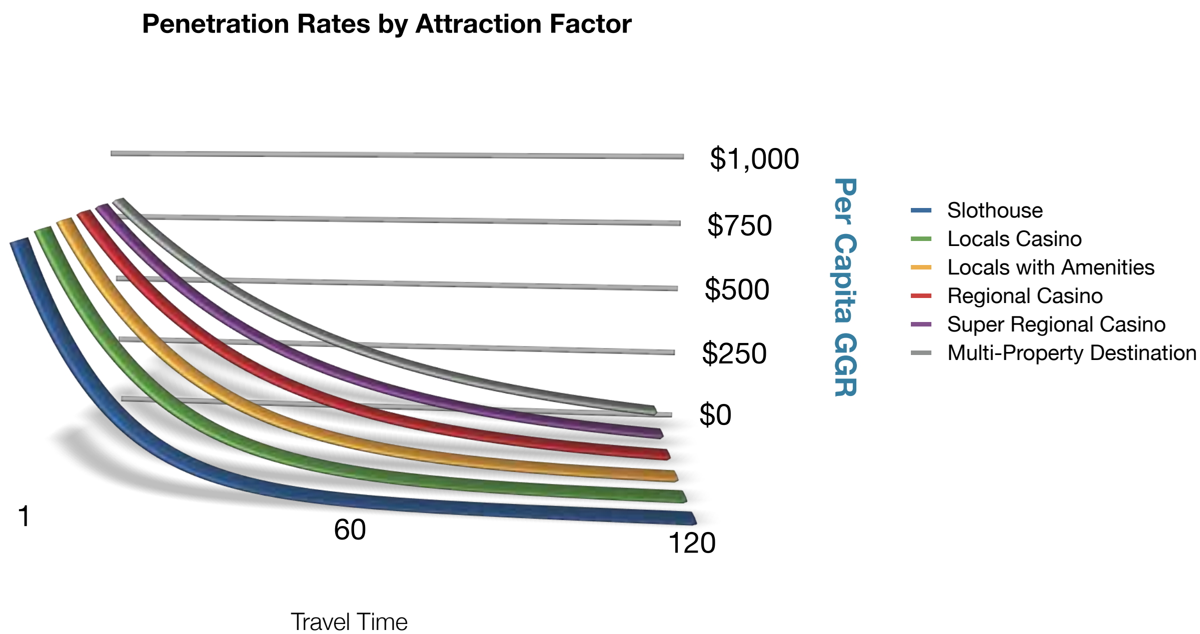


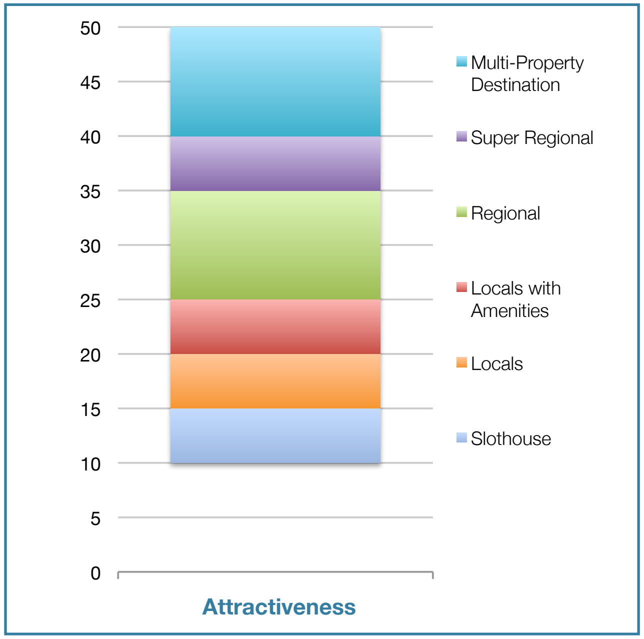
Source: Pro Forma Advisors

Appendix

Attraction Factor

- A facility's Attractiveness is based on many factors including:
  - Size (Slots, Tables, Casino floor, etc.)
  - Quality (Finishes, spacing, layout, landscaping, parking, etc)
  - Amenities (Restaurants, Entertainment, Lounges, etc)
  - Operations (Staff, Marketing, Comping Policy, CMS skill, Promotions, etc)
- Additional factors also impact Attractiveness
  - Highway adjacency increases calibrated Attractiveness
  - High win-per-unit (implying high utilization/low availability) reduces expected Attractiveness Factor





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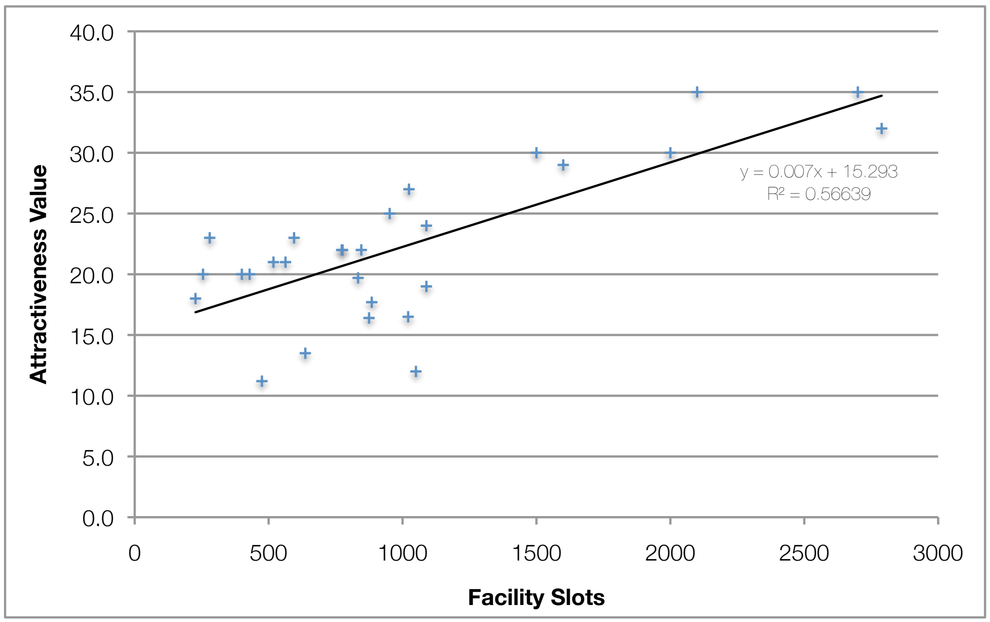
Appendix

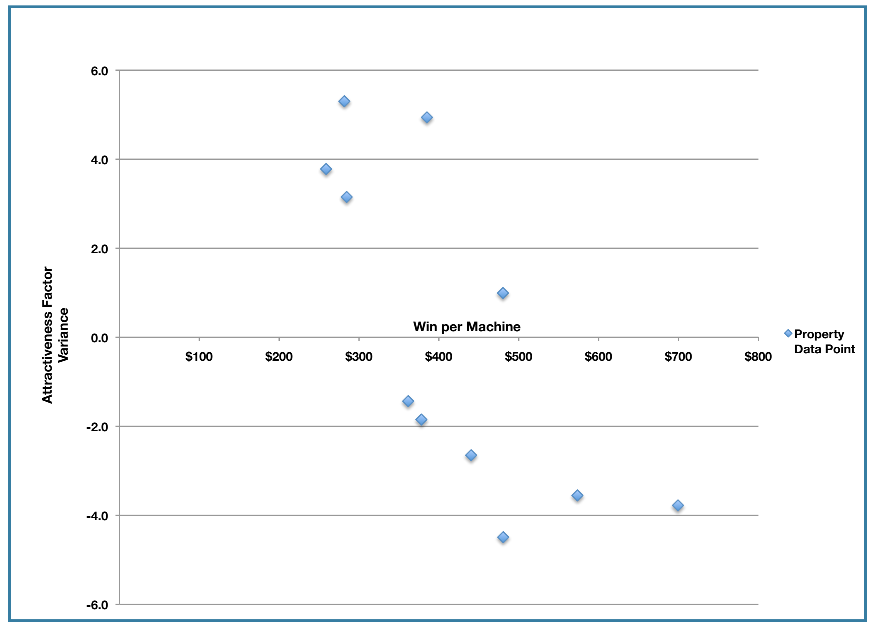
- Calibrated **Attractiveness** is highly correlated with scale (e.g. number of slots)
- However, a statistically significant discount in calibrated **Attractiveness** is seen when slot utilization (win per unit) is high.

Attractiveness Factor vs. Casino Machine Count



Source: Pro Forma Advisors

Attractiveness Factor Variance vs. Daily Win per Machine



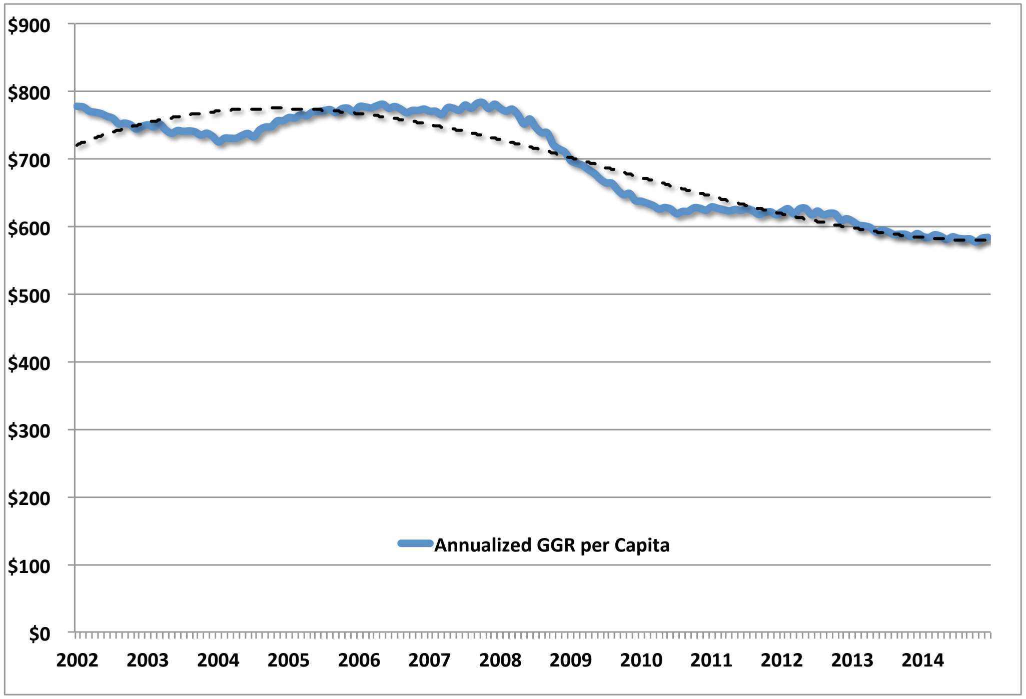
Source: Pro Forma Advisors

Per Capita GGR

- GGR per capita is a function of visits multiplied by win-per-visit, which in turn is impacted by distance, attractiveness, etc. The Pro Forma model directly calculates GGR per capita.
- Theoretical per capita GGR is the average amount of gaming at zero distance. This amount is imputed from various data sources depending on the market being analyzed.
- Las Vegas (non-Strip) provides a near-saturation gaming market with spending levels approaching theoretical GGR per capita.

Las Vegas Resident Market GGR per Capita Trend

(Rolling Twelve-Month Average, Nominal Dollars)

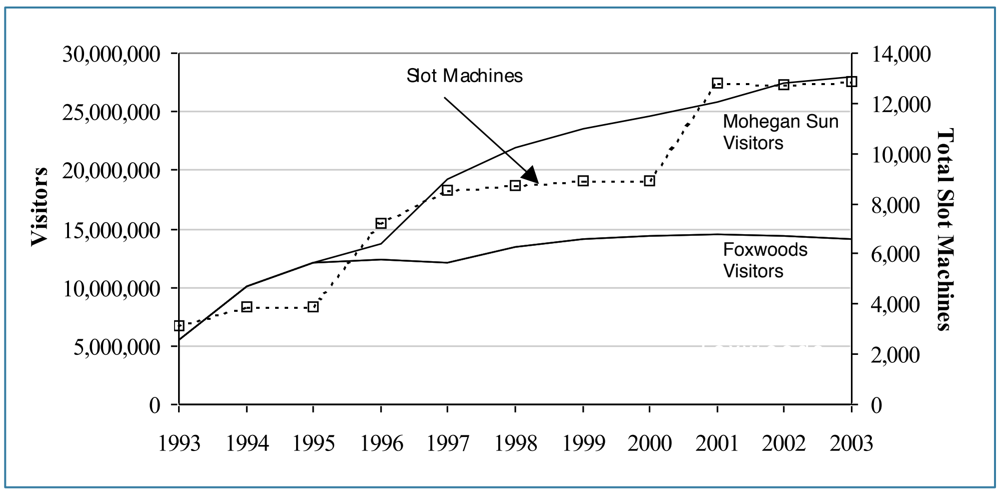


Source: Nevada Gaming Commission

Net Demand - When there is more than one casino in a market, how is total market gaming revenue impacted?

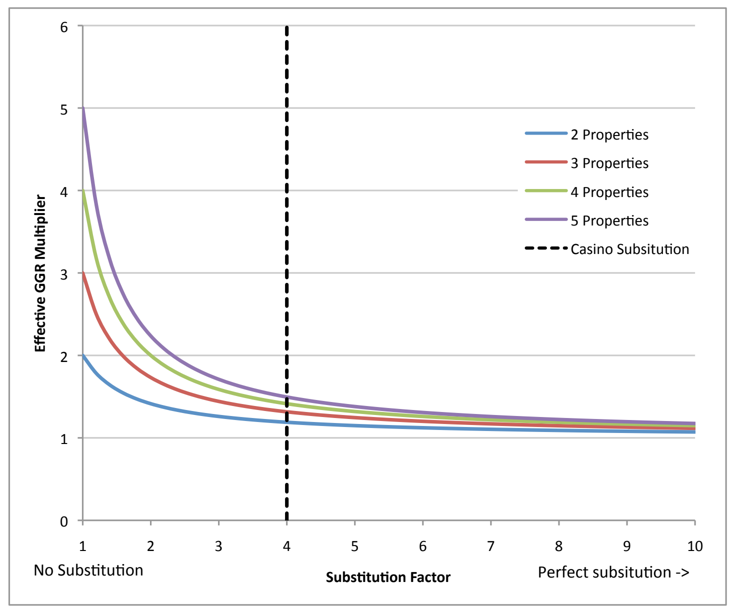
- The question can be rephrased as one of Economic Substitution:
  - With **perfect substitution**, all facilities are "generic" and customers will substitute demand at one facility for another - total gaming revenue remains the same and is just split across all facilities.
  - With **no substitution**, each facility's demand is not impacted by any other facility - theoretical gaming revenue is achieved for each facility.
  - In the real world, substitution is partial - somewhere between the two extremes. The model calculates a substitution multiplier for each census tract based on the competitive situation.
- With partial substitution, total market gaming revenue will increase with additional facilities, but at a lower level than if there was no substitution. However, individual facilities are impacted and may see decreases in GGR.

Connecticut Slot Market Analysis



Source: State of Connecticut and Pro Forma Advisors

Substitution Multiplier



Source: Pro Forma Advisors

Appendix

Market Share and Competition

- Market share is calculated as a power share based on theoretical distribution. (Typically a square function in a gravity model, power share compares individual “T-contribution” vs. all others.

Calibration

- The most current year is “calibrated” to understand and confirm the market model projections.
- Attractiveness and yields are set to match current market conditions. Assuming no major anomalies, the calibrated model illustrates how well properties are performing in the current market and competitive situation.

Net Demand Example

Selma (Tract ID: 6019007002)	TMC	Chukchansi	Tachi	Others
Population	5,618			
Travel Minutes To:	41.2	51.9	38.9	--
Theoretical GGR Demand Calculated using calibration Attractiveness, etc)	$1,054	$753	$1004	$456
Total Theoretical (No Subsitution)	$3267			
Net GGR (with Substitution Multiplier)	$1267			
Power Share by Contribution	34.9%	21.9%	32.5%	10.7%
Projected GGR Demand	**$442**	**$278**	**$412**	**$135**

APPENDIX B

REDDING RANCHERIA CASINO WASTEWATER MANAGEMENT & DRINKING WATER FEASIBILITY STUDY

REDDING RANCHERIA CASINO

Wastewater Management and Drinking Water

FEASIBILITY STUDY

Prepared by:

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ENGINEERING

Coleman Project #: ANES16-002

January 26, 2018

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References:

- *Capital Improvement Plan, 2015-16 to 2020-21*, City of Redding
- *City of Redding Water Utility Master Plan Update 2016*, prepared by the City of Redding Public Works Department, Engineering Division
- *Custom Soil Resource Report for Shasta County Area, California, Shasta County, CA – Redding Rancheria*, by USDA/NRCS, dated April 17, 2017
- *Custom Soil Resource Report for Shasta County Area, California, Anderson Site – Redding Rancheria*, by USDA/NRCS, dated April 17, 2017
- *Preliminary Evaluation of Water and Wastewater Service Requirements*, Cowlitz Casino, by Olson Engineering, dated 12/22/05
- *Draft EIS*, Graton Rancheria Casino, by AES, dated February 2007
- *Water and Wastewater Technical Study*, Karuk Tribe Casino and Hotel Development, by Bray & Associates, dated July 3, 2013
- *North Fork Water and Wastewater Feasibility Study*, by HydroScience Engineers, dated June 2008
- *Thunder Valley Casino Expansion Project Water & Wastewater Feasibility Study*, by HydroScience Engineers, dated February 2008
- *Water & Wastewater Feasibility Study*, Wilton Rancheria, by Summit, dated June 10, 2015

1 Introduction

1.1 Background

Coleman Engineering was retained by Analytical Environmental Services (AES) to prepare a wastewater management and drinking water feasibility study for the Redding Rancheria Casino (Casino) Environmental Impact Statement (EIS). This study includes estimated projections of wastewater flow, drinking water demand, and discussions regarding key wastewater and water facilities and services for the alternatives evaluated in the EIS.

This study is a report on consideration of two sites along Interstate 5: A primary site adjacent to the City of Redding and an alternate site in the City of Anderson. For both sites, wastewater and water options include service from new and independent onsite facilities or from the local municipality (City of Redding for Alternatives A, B, C, and D or the City of Anderson for Alternative E). Alternative F entails the expansion of the existing Redding Rancheria Casino. Exhibit 1 shows the proposed Alternative site locations.

1. <u>Primary Site, Alternatives A, B, C, and D</u>: City of Redding area, Shasta County, California. This site is commonly referred to as the Strawberry Fields Site. The property lies just outside the present City limits between I-5 and the Sacramento River, south of South Bonnyview Road. Each Alternative varies in size and the services and amenities offered, which subsequently effects the wastewater flow and water demand.
2. <u>Alternate Site, Alternative E</u>: City of Anderson, Shasta County, California. The property lies inside the current City limits west of and adjacent to I-5 and north of North Street.
3. <u>Expansion of Existing Casino, Alternative F</u>: City of Redding area, Shasta County, California. The property lies adjacent to the current City limits south of Redding. The property is bordered by Highway 273 on the east and Clear Creek to the north. This Casino is already receiving utility services from the City of Redding.

1.2 Project Description

Six Alternatives are being considered, including five new development concepts and expansion of the existing Casino. Site plans for each of the Alternatives are provided in the EIS. Total proposed building and amenity areas (square footage) for each Alternative are summarized in Appendix A, Table 1.

1.3 Project Objectives

The purpose of this study is to evaluate the feasibility of wastewater and water utility systems to serve each of the proposed Alternatives. This study is not intended for purposes of design and construction. The objectives of this feasibility study include:

Sewer

- Estimate wastewater flows based on the proposed amenities and comparable facilities, including the existing Casino.
- Present an onsite wastewater treatment and disposal strategy and discuss key onsite wastewater collection and treatment facilities.
- Present an offsite wastewater service option from the City of Redding and the City of Anderson and discuss necessary infrastructure upgrades, including the need for improvements to off-site pumping facilities and collection pipelines.

Water

- Estimate drinking water demands based on the proposed amenities and comparable gaming facilities, including the existing Casino.
- Present an onsite drinking water supply strategy and discuss key onsite water distribution, storage, and treatment facilities.
- Present an offsite drinking water supply strategy from the City of Redding and the City of Anderson and discuss necessary infrastructure upgrades, including the need for improvements to onsite and off-site distribution pipelines.

2 Projected Water Demands and Sewer Flows

Design of casino water and wastewater systems are dependent on accurate flow projections. Water and wastewater unit flows from several similar casino development projects were researched and compared as a means of verifying assumptions and calculations for these specific development project alternatives. Other development projects that were used as references are listed on Page iv of this report. Using this research, specific wastewater unit flows were derived for use with the Alternatives in this report. Once the wastewater flows were determined, the estimated domestic water demands were then back-calculated using acceptable assumptions.

Unique to this report undertaking is that the existing Casino has water usage recorded by the City of Redding. Therefore, once the above calculations are made, Alternatives A-E domestic water projections will be compared to actual water usage from the existing Casino to validate assumptions used in the initial water projection calculations. Validation of the water projections will also validate wastewater projection assumptions.

Alternative F will simply use existing water usage information and project increased demand due to the proposed expansion project.

2.1 Wastewater Flow Calculation Approach and Projections

Average wastewater production for Alternatives A-E were estimated using the following approach:

1. Each Alternative was broken up into smaller specified “amenities” and each amenity was further broken up into smaller facility designated uses (units). The uses under each amenity describes things like what type of restaurants are proposed and the respective number of seats, the number of hotel rooms, square footage of facility areas including retail, number of gaming seats, etc. From these descriptions and using unit flows derived from similar gaming facilities, wastewater flows were estimated.

2. Casinos differ from other business establishments in the hours they are open, the type of services they provide, and occupancy. There is a typical pattern to the rate of occupancy for casinos. The occupancy or use of the casino typically varies depending on whether it is a weekday or weekend. On a normal seven-day week, occupancy and flows are usually the lowest during the weekdays of Monday through Friday and usually the highest on Saturday and Sunday.

   A casino is open 24 hours per day and the number of guests varies throughout the day. Based on researched flows at other similar casinos, there are times of the day when the casino has a lower or higher occupancy rate and these times are different, depending on whether it is during a weekday or a weekend. For example, during a typical weekday in the morning and early afternoon the casino has an occupancy rate of roughly 30 to 50 percent but starting in the late afternoon, and extending into the night, the casino may have a 50 to 70 percent occupancy rate.

   Estimated flows were based on a summation of flows for two 12-hour cycles, a 12-hour morning (a.m.) cycle and a 12-hour evening (p.m.) cycle. The rates of occupancy for daily 12-hour cycles changes dramatically depending on whether it is during a weekday or a weekend day. For all Alternatives, an average estimated wastewater flow is calculated using the weekday and weekend flows. The average is weighted based on five days of weekday plus two days of weekend flows.

3. Considerations have been made to account for casino heating and air conditioning systems which consume water for their normal operations. Water is required to make up for water lost in the exhaust air as well as blow down water required to flush the system periodically. Based on other comparable facilities, noted in the references section of the report, the floor area of the central plant/cooling tower operations is estimated to be 4.5% of the total building floor area, and unit water demand is estimated to be 3 gpd/sf.

Appendix C contains worksheets that illustrate the above approach for each Alternative using the derived unit flows and following the same rationale of estimating occupancy rate based on time of day and day of the week. Appendix A, Table 2 summarizes the estimated weekend peak flows and average day flows, by building use, for each Alternative from the wastewater flow projections worksheets.

Table 3 below is a summary of the projected wastewater flows.

Table 3: Estimated Wastewater Flow Projections – Alternative Summaries

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F [a]
Average Day Demand (ADD)	200,300	166,200	190,700	69,300	194,100	49,000
Typical Weekend Demands Maximum Day	289,600	247,100	277,450	91,000	281,800	76,500 [b]
Calculated Maximum Day Factor	1.4	1.5	1.5	1.3	1.5	1.6
Calculated Peak Hour Flow (2.5 x Avg.)	500,750	415,500	476,750	173,250	485,250	122,500

Units: gallons per day (gpd)
[a] *5% less than metered drinking water usage from City of Redding (Year 2016)*
[b] *Summer months (June-September)*

2.2 Drinking Water Demand Projections

When determining the average day water demand from wastewater flows, similar gaming facilities suggest about a 5% difference between wastewater and water, meaning not all potable water ends up as wastewater for various reasons such as consumption, evaporation, and leakage. Water demand, therefore, is calculated by adding 5% to the estimated wastewater flow projections found in Appendix A, Table 2, to create the estimated average day, maximum day (weekend), and peak hour water demands for each Alternative as summarized in Table 4 below.

In addition, an estimate of irrigation water demand is also included and added to the total site demand. Based on review of the site plans, it was estimated that approximately 20% of the total developed site area would be irrigated to account for landscaping, parking lot trees, entry road features, etc. This irrigation demand was added to the Average Day Demand which was then peaked to determine Maximum Day Demand and Peak Hour Demand.

Alternative F water demands are derived directly from three years of metered water usage data obtained from the City of Redding for the existing Redding Rancheria Casino and Hotel. Refer to Appendix A, Table 5 for information regarding the existing Casino metered water usage. The year 2016 information is used because the summer demand essentially represents the average of the three years.

Table 4: Calculated Water Demand Projections – Alternative Summaries

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F [a]
Average Day Demand (gpd)	210,400	174,600	200,300	72,800	203,800	51,600
Landscape Irrigation [b]	10,919	7,935	10,546	5,094	10,311	
Calculated Weekend Demands Maximum Day (gpd)	315,000	267,400	301,900	77,894	306,300	80,500 [c]
Calculated Maximum Day Factor	1.4	1.5	1.4	1.3	1.4	1.6
Calculated Peak Hour Flow (2.5 x Avg.) (gpm)	385	317	367	135	372	90

[a] *Metered drinking water usage from City of Redding (Year 2016)*
[b] *Estimated at average daily demand of 5,000 gpd/acre of landscaping.*
[c] *Summer months (June-September)*

The peaking factors calculated for the water usage compare very well with actual peaking factors observed in the City. Note that per the data provided by the City of

Redding, presented in Table 5 of Appendix A, the City observes Max Day and Peak Hour factors of 1.5 and 2.3 respectively. These actual factors compare well with the calculated average Max Day Factor of 1.4 and assumed Peak Hour Factor of 2.5.

The maximum day demand expressed in gallons per minute (gpm) was provided to be useful in sizing a water supply to the site such as a well or City connection.

2.3 Alternative F Wastewater and Water Projections

Alternative F projections are based entirely on the metered water usage obtained from the City of Redding. The year 2016 information is used because the summer demand (June through September) essentially represents the average of the three years. Future water demand was calculated by multiplying the future Casino size (151,571 sf) by the rates in Table 6. The increased anticipated demand was simply the unit rate times the new 10,000-sq. ft. addition. A 5% reduction was applied to the water demand to estimate the wastewater flows. Table 6 below summarizes the projections associated with Alternative F.

Table 6: Alternative F Water and Wastewater Projections

	Water Demand (gpd)		Sewer Flow (gpd)
Average Day	55,300	4,000 +/- increase	52,600
Weekend Peak	86,200	6,000 +/- increase	81,900
Peak Hour (x 2.5)	138,300		131,500

Units: gpd

Because the relative increase in land use for Alternative F is so small, the projected increases in water and wastewater demand is less than 8%.

2.4 Recycled Water Reuse

Based on past experience, comparison to similar casinos used as references (see Page iv), and industry standards, the recycling of disinfected tertiary reclaimed wastewater typically ranges between 20-40% of total wastewater flow depending on multiple factors including type and extent of landscaping. Because actual planting schedules and areas are not yet available, a universal reuse rate of 30% was used for all calculations in this study. This assumption is commensurate with the level of detail available and required at this stage of the feasibility study. During preliminary and final design stages, the recycled water reuse rate will be refined.

Reclamation has the dual advantage of reducing the net potable water demand and reducing wastewater disposal requirements. Treated wastewater that would normally require disposal can instead be used to reduce potable water demand and be applied for beneficial reuse such as landscape irrigation and toilet flushing. If utility services from the local cities are not available, and onsite systems are necessary, reuse should be considered. Recycled water use on tribal land would be regulated by USEPA.

3 Wastewater – Basis of Design

This section presents general development assumptions and wastewater design criteria for each of the casino development Alternatives. Wastewater from the proposed Alternatives will be collected via a gravity collection system and then either treated and disposed of onsite or conveyed to the local municipality's sewer collection system and wastewater treatment plant. There is currently no service agreement between the Casino and the Cities for sewer collection, treatment, and disposal for Alternatives A-E. However, the City of Redding is currently providing sewer service to the existing Casino. It is assumed herein that the City will be agreeable to continue sewer service for the Alternative F expansion project.

3.1 Regulatory Requirements

This section identifies some regulatory requirements applicable to the casino development alternatives with respect to proposed wastewater treatment and disposal methods identified in this report. Regulatory requirements differ depending on the method of treatment and disposal. As discussed above, under each alternative, there are several options for wastewater treatment and disposal that would involve either the development of an on-site treatment and disposal system, or connection to municipal service providers.

Because the options for onsite systems will be on Tribal Lands ("Trust Land"), the primary regulatory agency will be the United States Environmental Protection Agency (USEPA). Options involving connection to the municipal service providers will be subject to state and local requirements.

The Regional Water Quality Control Board (RWQCB) does not have discretionary authority over actions on trust land, however, USEPA is expected to include the Redding office of the RWQCB in the development of any wastewater permitting in a consulting capacity. The local water quality goals and criteria which RWQCB is expected to recommend for implementation by USEPA are included in the Water Quality Control Plan for the Sacramento River Basin Plan.

Although USEPA is the regulatory agency on trust land, the Shasta County Sewage Disposal Standards, as amended through November 20, 2001, will be used as a basis of conceptual design of the onsite treatment and disposal options for this study. These standards are at least as restrictive as USEPA standards and they are tailored for local conditions. It is most likely that USEPA will utilize local design criteria as much as possible.

3.1.1 Surface Disposal

Wastewater land disposal options which would be subject to regulation include: spray application to a disposal field; irrigation of a crop grown on land; discharge to a percolation pond; or discharge to an evaporation pond. Land disposal on trust land is regulated by USEPA.

Typical disposal system design features required by regulation include:

- Tailwater and runoff control.
- Installation of ground water monitoring wells.

Typical discharge prohibitions include:

- No discharge of pollutants or wastes to surface waters are allowed.
- Bypass around, or overflow from, the treatment plant and spray disposal area of untreated or partially treated waste is not allowed.
- Resurfacing of wastewater percolating from the spray disposal field is not allowed.

Typical discharge specifications include:

- Wastewater spray drift from the WWTP or spray disposal field must not migrate out of the plant's property boundaries.
- All tail water and/or stormwater reaching the downgradient limit of the recycled water use areas must be collected and returned to the WWTP at all times when wastewater is being applied to the spray disposal field.
- The discharger must not irrigate with recycled water during periods of rainfall and/or runoff or for 24-hours before rainfall is predicted.
- The discharger must not irrigate with recycled water during periods of high winds.
- Public contact with wastewater must be precluded through such means as fences, signs, and/ or irrigation management practices (or other acceptable methods).
- Objectionable odors originating at this facility must not be perceivable beyond the boundary of the WWTP and disposal areas.
- A limited-access buffer must be maintained around the spray disposal field's wetted area.

3.1.2 Subsurface Disposal

Wastewater subsurface disposal options which would be subject to regulations include: conventional leach fields, engineered (specially-designed) leach fields, mound systems, and injection wells. Subsurface disposal on trust land is regulated under USEPA's Federal Underground Injection Control (UIC) Program. Subsurface disposal is classified as a Class V injection well under the UIC Program.

For reference only, a few key disposal criteria have been summarized below from the Shasta County Sewage Disposal Standards.

"Disposal area shall not include:

- Land subject to flooding.
- Land within 100-feet of any existing or proposed well site for the parcel or any adjoining parcels.
- Land closer than 100-feet to an intermittent, seasonal, or perennial waterway.
- Land closer than 50-feet downhill from an irrigation ditch or canal.
- Land closer than 50-feet uphill from an existing or proposed cut.

"Disposal material characteristics. Usable disposal material has both the following characteristics:

- Percolation rates greater than 5 and less than 60 minutes per inch.
- Depth to seasonal high water table shall be at least 8-feet for…community disposal field.

"The leach line dimensions depend on the required capacity of the system. Disposal field construction criteria:

- Maximum length of each line: 100-feet
- Minimum bottom width of trench: 18-inches
- Minimum spacing of lines (edge to edge): 8-feet
- Maximum depth of earth cover over lines: 36-inches
- Maximum grade of lines: 4-in/100-feet
- Minimum grade of trench: Level
- Maximum grade of trench: 4-in/100-feet
- Minimum usable material below trench bottom: 12-inches
- Minimum filter material below trench bottom: 12-inches

- Minimum filter material over drain lines: 2-inches
- Maximum distance drain pipe to edge of trench: 18-inches
- All onsite sewage disposal systems shall be designed so that additional subsurface disposal fields, equivalent to at least 100% of the required area of the original system, may be installed in the future.
- The site of the initial and replacement disposal fields shall not be covered by asphalt or concrete or subject to vehicular traffic or other activity which would adversely affect the soil.
- Other 'specially-designed' systems may be acceptable and approved by the County that may be applicable and may reduce the leach field area."

3.2 Wastewater Characteristics

Most of the wastewater generated from the alternative development scenarios will be from the patrons who visit the proposed entertainment, hotel and retail facilities. Other wastewater flows will be generated from kitchens and other service areas integrated into the development. In short, the composition of wastewater will be typical of untreated domestic wastewater but with a higher grease content. Passive or active grease interceptors are likely to be required from the cities and onsite treatment processes. Table 7 below lists typical textbook ranges for the composition of untreated domestic wastewater.

Table 7: Typical Composition of Untreated Domestic Wastewater [a]

Contaminants	Unit	Range	Typical
Total Solids (TS)	mg/L	350 - 1200	700
Total Dissolved Solids (TDS)	mg/L	250 - 850	500
Total Suspended Solids (TSS)	mg/L	100 - 350	220
Biological Oxygen Demand (BOD5)	mg/L	110 - 400	220
Total Organic Carbon (TOC)	mg/L	80 - 290	160
Total Nitrogen	mg/L	20 - 85	40
Total Phosphorus	mg/L	4 - 15	8
Oils and Grease	mg/L	50 - 150	100
Volatile Organic Compounds (VOCs)	µg/L	<100 – >400	100-400

[a] (Ref: *Wastewater Engineering*, Metcalf & Eddy, Third Edition, Table 3-16 Typical composition of untreated domestic wastewater)

3.3 Onsite Option: Wastewater Management

If conveyance to and treatment at a municipal treatment plant is not possible, wastewater could be treated and disposed of onsite. This section discusses the onsite wastewater treatment and disposal option design considerations.

3.3.1 Wastewater Collection

It is recommended to use City of Redding Public Works Department, Sanitary Sewer Construction Criteria. Acceptable pipe materials for wastewater mains (8-to 12-inches) and trunk lines (15- to 30-inches) are PVC solid wall SDR 26 per ASTM D-3034 and PVC solid wall pipe (C900).

A sewer lift station will be required to lift the wastewater from the development site to an onsite treatment plant.

3.3.2 Wastewater Treatment and Disposal

Methods of onsite disposal systems considered in this report include land disposal (spray fields or overland flow irrigation), and subsurface disposal (seepage pits or leaching trenches).

The means of effluent disposal and/or water reuse will determine the level of treatment required. For example, spray fields and subsurface disposal require only primary non-disinfected effluent, quality which can be achieved from a typical facultative treatment pond.

Due to aesthetic and potential odor issues, a sewer treatment pond will not be considered further. This method of wastewater treatment is incompatible with the anticipated site development and uses. In order to provide the Casino with the greatest flexibility, produce high quality effluent, and reduce the wastewater treatment plant (WWTP) footprint, a membrane bioreactor (MBR) treatment is recommended. The MBR treatment facility will be located by the architect to be minimally impactful to the aesthetics of the site. Typically, the water and wastewater facilities and equipment can be combined into a single yard and located behind the structures so that they are not noticeable to casino visitors.

The following are a few additional design criteria of an onsite wastewater system:

Surface Disposal (Land Application) – Agronomic Rates

No onsite soil explorations and crop type research were done at either site to determine site specific design parameters for nutrient uptake and assimilation and water absorption. Design of any onsite land disposal system will require actual onsite explorations and soil and crop classifications. The primary factors for calculating the land area required for disposal can be:

- Nutrient loading, specifically nitrogen. The total nitrogen mass loading to Land Application Areas (LAAs) shall not exceed the agronomic rate for the crop grown
- Hydraulic loading, depending on the volume of water needed to be discharged
- Other constituent loading, like sodium and chloride

“Agronomic rate” is defined as the land application of irrigation water and nutrients (which may include process wastewater) at rates of application necessary to satisfy the plants’ evapotranspiration requirements and in accordance with a plan for nutrient management that will enhance soil productivity and provide the crop with needed nutrients for optimum health and growth.

Application rates higher than the agronomic rate may lead to runoff or the accumulation of nutrients (nitrates and phosphates) and organic chemicals in the soil, which could then be flushed by winter rains into the groundwater.

For the proposed land application, a hydraulic loading of 0.2 gpd/ft^2 was assumed for use in primary sizing. This hydraulic loading rate was selected based on professional experience and based on the descriptions of the site soils in the Custom Soil Resource Reports prepared for both the Redding Site and the Anderson Site. The actual absorption rate will need to be determined by field-testing.

Seasonal Storage for Surface Disposal (Land Application)

A typical growing season is about 183 days (mid-May to mid-October). Therefore, winter storage, typically in the form of an earth pond, would need to be constructed in order to store 182 days of average day wastewater effluent during the non-growing months. A storage pond may be unlined if the water entering it has been treated. A pond should be sized to also accommodate rainfall accumulation during the winter months. The regulatory requirements for the operation of seasonal storage ponds are typically minor relative to other wastewater disposal facilities.

Subsurface Disposal – Soil / Subsurface Application Rates

No onsite soil and subsurface explorations were done to obtain percolation rates and other parameters necessary to fully evaluate and consider this disposal option in detail. Design of any onsite subsurface disposal system will require actual site specific explorations and soil classifications. Percolation tests will be required and possibly groundwater monitoring for design.

For purposes of this feasibility study, SCS Soils Maps and Surveys, NRCS Custom Soil Resource Report, and City GIS maps were reviewed. Said sources classified the majority of the Redding site as “Reiff fine sandy loam,” “Riverwash,” and “Tujunga loamy sand” and the majority of the Anderson site as “Wet alluvial land” and “Reiff loam.”

For the proposed leach fields, a hydraulic loading of 0.45 gpd/ft^2 was selected for primary sizing. This hydraulic loading rate was selected based on professional experience and based on the descriptions of the site soils in the Custom Soil Resource Reports prepared by the Natural Resources Conservation Service for both the Redding Site and the Anderson Site. This percolation rate will need to be verified by site specific field-testing prior to detailed design of the sub-surface disposal systems.

Floodplain

FEMA maps indicate that a large portion of both the Redding and Anderson sites are in a floodplain. This is significant, keeping in mind that the Shasta County Sewage Disposal Standards that are used as design criteria for this feasibility level study state in part that subsurface disposal systems “shall not include land subject to flooding.” However, spray irrigation disposal may include land in the floodplain. If the storage pond is located in the floodplain, levees could also be constructed around the pond to protect it from flood conditions, if required and necessary. However, there is adequate acreage on the site for a storage pond to be constructed outside the 100-year floodplain. During flooding conditions, land application would not be allowed. Floodplain considerations for the two sites include the following:

Redding (Primary Site)

- The study area contains 114.8 acres that are within the 100-year floodplain per a Draft Technical Memorandum from Mr. Paul Kirk, dated October 20, 2008 for the Strawberry Fields Floodplain Evaluation.
- Of the 232-acre site, approximately 111 acres is outside the 100-year floodplain (Zone X). The remaining 6.2 acres lie in Flood Zone AE.
- Appendix B, Exhibit 2A shows an approximate Alternative A development footprint and the floodplain for the site.
- There is a Churn Creek Floodway that may need to be addressed by piping or otherwise diverting potential flooding around the development so that water may continue to flow uninhibited to the river.

Anderson (Alternate Site)

- Of the 55-acre site, the floodplain encompasses over 80% of the proposed development site.
- Appendix B, Exhibit 2B shows an approximate Alternative E development footprint and the floodplain for the site.

3.4 Off-Site Option: City Provided Sewer Services

Both the City of Redding and City of Anderson provide collection/transmission, treatment, and disposal of wastewater for their residents and commercial, industrial, and institutional customers. City services are readily available to both sites. From initial dialogue, both Cities have expressed interest in serving the Casino.

3.4.1 City of Redding Wastewater Design Criteria

New Site – Alternatives A-D

According to City personnel and GIS maps, a 30-inch vitrified clay pipe (VCP) and the Sunnyhill Lift Station exists less than 300-feet from the northern property boundary (refer to Appendix B, Exhibit 3). According to the City of Redding 2012 Wastewater Utility Master Plan, the capacity of the Sunnyhill Sewer Lift Station exceeds the projected buildout flows by 4.12 MGD. Therefore, there is ample capacity for the lift station to provide services for any of the development alternatives, none of which are projected to exceed a sewer flow of 0.2 MGD from the Casino site.

With the exception of West Side Interceptor Phase III (which is programmed in the City's Capital Improvement Plan for construction completion in 2018) the existing collection system downstream of the Sunnyhill Lift Station has adequate capacity as well. After completion of the interceptor, the City reports that the system will have capacity to serve the casino site.

A new Casino onsite sewer lift station will be required to convey the Casino's wastewater from Alternatives A-D under the existing Anderson Cottonwood Irrigation District canal to the Sunnyhill Lift Station.

City of Redding Public Works Department, Sanitary Sewer Construction Criteria will be required.

The City currently operates two wastewater treatment plants, both of which are considered tertiary treatment facilities. Wastewater from this development would be treated at the Clear Creek Wastewater Treatment Plant (CCWWTP). The City has indicated that there is adequate capacity in the CCWWTP to accept the Casino wastewater.

Existing Site Expansion – Alternative F

There are no unique design criteria that are applicable to the expansion project. If the existing site were expanded as programmed in Alternative F, it is assumed that some minor upsizing of existing facilities may be required. This will be determined during design once details of existing on-site systems and equipment are available. The City has indicated that it has the capacity to convey, treat, and dispose of increased volumes of wastewater as anticipated by Alternative F.

3.4.2 City of Anderson Wastewater Design Criteria

According to City of Anderson staff and from maps provided by the City, an existing 21-inch sewer trunk line parallels Tormey Drain which bisects the proposed development property (refer to Appendix B, Exhibit 4). Dave Durette, City Engineer at the City of Anderson, there is capacity in the 21-inch trunk line to accept the Casino's wastewater flow. Mr. Durette also reports that the existing 2.0 MGD WWTP also has sufficient capacity.

Mr. Durette specifically reported that the 2007 Sewer Master Plan was his source for making this determination. No specific capacity study or modeling effort was completed as part of this study or by Mr. Durette.

The existing sewer pipe is 9.5-feet deep. Because there are no sub-surface structures such as basements, this depth will be sufficient to allow for gravity sewer flow from the site and to avoid a lift station to serve the new Alternative E development.

The City of Anderson uses the City of Redding Public Works Department, Sanitary Sewer Construction Criteria.

4 Drinking Water – Basis of Design

This section presents general development assumptions and water utility design criteria for the Alternatives. There is currently no service agreement between the Casino and the Cities for water supply for Alternatives A-E. However, the City of Redding is currently providing water service to the existing Casino. It is assumed herein that the City will be agreeable to continue water service for the Alternative F expansion project.

As documented in Table 4, the new water supply source needs to provide a flow between 50 and 176 gpm depending on the development alternative that is selected. A well would need to provide the maximum day flow which would be combined with an on-site water storage tank to provide local fire flow. If a connection is made to the City water system, City storage could provide the required fire protection and piped connections would need to be sized to accommodate fire flows during a max day demand condition.

4.1 Regulatory Requirements

This section identifies key regulatory requirements applicable for the Alternatives with respect to the proposed water supply. Because the proposed system is on Tribal lands ("trust land"), the primary regulatory agency would be the USEPA.

4.1.1 On-Site Public Water System

The development of a drinking water system using onsite wells would be classified as a public water system under the Safe Drinking Water Act (SDWA). A public water system is defined as any entity serving water for the purposes of human consumption to 15 or more active service connections or 25 or more people at least 60 days out of the year. More specifically, the drinking water system for the Casino would be classified as a Non-Transient/Non-Community (NTNC) public water system under the SDWA because it is not a community water system and it will regularly serve at least the same 25 persons over 6 months per year.

Baseline monitoring will be submitted to the USEPA before a new well goes online and the public begins to use the water. Similar facilities have requirements for monthly coliform testing, quarterly lead and copper testing, and other laboratory testing that must be conducted annually. Monitoring requirements for a new public water systems serving the proposed Casino will likely be similar, but will be determined by the USEPA based on the size of the facility, the anticipated population using the facility, and other factors specific to the project.

4.1.2 Source Water Protection Plan

The USEPA's Ground Water Office supports Tribes in their efforts to develop and implement a Source Water Protection (SWP) Program. Source water is untreated water from streams, rivers, lakes, or underground aquifers which supplies groundwater wells used for public drinking water.

The SWP Program outlines a comprehensive plan to achieve maximum public health protection. According to the plan, it is essential that every water user take the following six steps:

1. Delineate the source water protection area (SWPA)
2. Inventory known and potential sources of contamination
3. Determine the susceptibility of the Public Water System (PWS) to contaminant sources or activities within the SWPA
4. Notify the public about threats identified in the contaminant source inventory and what they mean to the public water system
5. Implement management measures to prevent, reduce, or eliminate risks to the drinking water supply
6. Develop contingency planning strategies that address water supply contamination or service interruption emergencies

4.2 Onsite Option: Drinking Water System

4.2.1 Water Supply and Quality

There are two possible options for on-site water supply: groundwater (well) or river intake and treatment.

<u>Groundwater Well</u>

There was no test well drilled or groundwater sampling on the project sites as part of this study. Research and exploration by drilling a test well will be required to finalize the production well details and to document groundwater quality. From research and discussions with the Cities, there should be ample groundwater supply for the Casino at either new location but there could be arsenic and/or manganese at levels requiring some form of treatment.

The Redding Groundwater Basin (RGWB) is the local groundwater source covering a large area, including the Cities of Redding and Anderson. From City of Redding documents, it appears groundwater from the RGWB will be a reliable water source. The City of Redding has wells of varying water quality in two areas within the RGWB: Enterprise in the southeast of the City and Cascade in the south-central area of the City (refer to Appendix B, Exhibit 5).

The following excerpt from the City of Redding Urban Water Management Plan is helpful to gaining an understanding of the groundwater in the vicinity of the Redding site.

> "The Redding Groundwater Basin (RGWB)…provided the City with approximately 7,500-10,000-acre-feet of water per year…through sixteen wells…. The wells range in depth from 170-feet to 600-feet…"
>
> "The RGWB is not an adjudicated basin. As the basin is not in overdraft, no legal pumping limit has been set—therefore, no overdraft mitigation efforts are currently underway. Though no safe yield has been established for the RGWB, groundwater modeling…indicates that the RGWB is resilient to severe drought conditions and is able to recover with one year of normal rainfall.
>
> "The well water is generally of very high quality with the exception of arsenic concentrations above the Primary Maximum Contaminant Level (MCL) at wells #11 and #13 and manganese levels above the Secondary MCL in all Enterprise wells except #3 and #4. As defined by the United States Environmental Protection Agency (USEPA), a Primary MCL provides a standard to protect public health while a Secondary MCL exists to prevent aesthetic issues such as taste, color and odor. In Enterprise area wells, leaching from natural deposits can result in dissolved manganese concentrations near or above the Secondary MCL and requires treatment in order to avoid the black color that develops as manganese precipitates out of solution. …iron levels above the Secondary MCL have not been encountered at any of the City's wells.
>
> "…[two City Enterprise] wells…have been placed on standby due to arsenic levels testing close to and above the Maximum Contaminant Level (MCL) of

10 mg/L…" (Draft City of Redding 2015 Urban Water Management Plan, pgs. 27-28).

The depth to groundwater is unknown. It is assumed that a well drilled 300- to 600-feet should produce sufficient water quantity and quality. A well drawing from the deeper aquifer should not impact the shallower local residential wells.

River Intake

The Tribe currently has a riparian water right from the Sacramento River; however, it is understood that the existing water right would not be sufficient to meet the demand of the Proposed Project. Because of the regulatory complexity associated with an increased river water right and the associated infrastructure, and because of the increased cost associated with treatment of river water, no further consideration is given to the use of river water as a supply for any of the Casino alternatives.

4.2.2 Distribution Pipeline System

It is recommended to use City of Redding Public Works Department, Water System Construction Criteria: Pipe sizes 6-inches and 8-inches use DIP AWWA C151-09 (Pressure Class 350) or PVC (C900) AWWA DR18 (Class 150). For pipe sizes 12-to-24-inches use DIP AWWA C151-09 (Pressure Class 350). All pipe and system facilities shall be designed to deliver water at the Maximum Day Demand (MDD) plus fire flow.

4.2.3 Storage and Fire Protection

The water supply source is planned to have the capacity to satisfy the maximum day demand. Therefore, the water storage will be required to provide fire protection, peaking storage, and operational storage.

The fire protection storage volume is dictated by the requirements of the California Building Code and the California Fire Code. In the case of the various casino alternatives, the code dictates that a maximum fire protection flow of 3,000 gpm be provided for a minimum of 3 hours. This flow and duration results in a fire protection storage requirement of 540,000 gallons for all alternatives.

Peaking storage is the difference between the maximum day demand and the peak hour demand, multiplied over the hour that the peak occurs. For planning purposes, we have extended the peaking time for four hours to be conservative.

Operational storage is typically a subjective calculation made by the design engineer to account for design criteria such as unusable tank volume, system requirements, unaccounted for system losses, and to generally provide a safety factor. A typical operational storage volume is 50% of the maximum day demand.

Table 8 below is a summary of the contributing data and the calculated storage component for each category. The total calculated water storage tank size for each alternative is shown in the table.

Table 8: Calculated Water Storage Tank Sizes

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Max Day Demand (gpm)	219	186	210	70	213	56
Calculated Peak Hour Flow (2.5 x Avg.) (gpm)	385	317	367	135	372	90
Fire Storage (gal)	540,000	540,000	540,000	540,000	540,000	540,000
Peaking Storage (gal)	39,840	31,440	37,680	15,600	38,160	8,160
Operational Storage (gal)	157,500	133,700	150,950	50,350	153,150	40,250
Total Water Storage Required (gal) [a]	737,000	705,000	729,000	606,000	731,000	589,000

Units: gallons
[a] *Rounded up to the nearest 1,000*

4.2.4 Booster Pump Station

Pumping will be required to pressurize water provided by an on-site source. Assuming a well is constructed, it is most likely that a well pump will be used to pressurize water through any treatment processes that are required and into a ground level storage tank.

A booster pump station will be required to pressurize water from the ground level storage tank into the public water distribution system for use by customers.

In addition, a separate fire booster pump facility is also likely to be required to provide fire flows to the system.

4.3 Off-Site Option: City Provided Drinking Water Service

Both the City of Redding and City of Anderson provide potable water to their residents and commercial, industrial, and institutional customers. City services are readily available to both sites. From initial dialogue, both Cities have expressed interest in serving the Casino.

4.3.1 City of Redding Water System Design Criteria

New Site – Alternatives A-D

According to City personnel and GIS maps, a 24-inch ductile iron pipe exists less than 300-feet from the northern property boundary (refer to Exhibit 3 in Appendix B). According to David Braithwaite, Project Coordinator in the City of Redding Public Works Department, there is sufficient capacity in this transmission line to serve casino Alternatives A-D.

Mr. Braithwaite used the 2016 Water Utility Master Plan to make this determination. No other modeling or studies specific to this project were prepared by the City or by Coleman Engineering.

City of Redding Public Works Department, Water System Construction Criteria will be required.

The City of Redding uses both surface-water and groundwater supplies. The surface-water supply is governed under two separate contracts with the Bureau of Reclamation and one with Anderson Cottonwood Irrigation District (ACID). The City also has two groups of ground water wells: the Enterprise wells and the Cascade wells. On average, the City gets approximately 69 percent of its total annual supply from surface water and 31 percent from groundwater. Surface water is used seasonally throughout the year and groundwater is used minimally in the winter but peaks along with surface-water use in the summer.

Because the City receives source water from these two third parties, any agreement by the City to serve water outside of its existing City limits, or to adjust its City limits, is likely to require Local Agency Formation Commission (LAFCO) action and concurrence.

Existing Site Expansion – Alternative F

There appears to be no unique design criteria that are applicable to the expansion project. If the existing site were expanded as programmed in Alternative F, it is assumed that some minor upsizing of existing facilities may be required. The total calculated increase in water and sewer demand is less than 8% so it is also possible that existing systems will be sufficient. Infrastructure sizing will be detailed during design as necessary. The City has indicated that it has the capacity to provide increased volumes of water as anticipated by Alternative F.

4.3.2 City of Anderson Water System Design Criteria

According to City of Anderson personnel and from maps provided by the City, an existing high-producing well (Automall Well) is located near the northeast corner of the proposed project site. There is an existing 12-inch water line that parallels the northern property line and serves residences to the west of the well. The City Water System Master Plan includes plans to construct a 12-inch water pipe south, through the proposed project site, to serve residences to the south and provide better City-wide pressures and flows (refer to Appendix B, Exhibit 4). Working with the City, the alignment of the new 12-inch waterline could be planned to accommodate the proposed Casino development project.

City of Anderson uses the City of Redding Public Works Department, Water System Construction Criteria.

4.4 Water Conservation

Water conservation measures are likely to be required by both Cities and should be anticipated in any water planning and design effort for the Casino Alternatives. The following statement by the USEPA was provided in response to the solicitation for public comment on the potential Casino development. For the purposes of this feasibility study, the measures mentioned in the USEPA comment are assumed to be included in water system planning and design.

“While California’s drought has eased in several counties, including Shasta, it is prudent to plan for maximum water use efficiency in light of changing precipitation patterns. The project description should include the purchase, installation, and implementation of water-efficient products and practices. This includes purchase of WaterSense labeled toilets and faucets, which use 20% and 30% less water respectively than conventional products. We recommend the project implement the 14 federal water efficiency best management practices, including those for boiler/steam systems, single-pass cooling equipment, cooling tower management, commercial kitchen equipment, and alternate water sources including rain water harvesting for irrigation, toilet flushing, and fire suppression. The federal water efficiency BMPs are available at http://energy.gov/eere/femp/best-management-practices-water-efficiency" (USEPA public comment letter dated December 28, 2016).

5 Wastewater Assessment

This Section will identify and discuss components necessary for onsite wastewater management, including effluent disposal options, and off-site sewer service.

Required wastewater facilities will need to be accounted for, located, and incorporated into the overall selected Casino Alternative site layout. All facilities and concepts described in this section are preliminary and should be considered for planning purposes only.

5.1 Onsite Wastewater Management

If connection to a municipal wastewater treatment plant is not feasible, it is recommended that a tertiary wastewater treatment plant capable of producing high quality effluent suitable for reuse be constructed. It is recommended that a membrane bio-reactor (MBR) wastewater treatment plant (WWTP) be used for the Casino development. The following is a discussion about the components of a sewer system centered around a MBR (refer to Appendix B, Exhibit 6). Onsite wastewater facilities must comply with all applicable permitting requirements.

5.1.1 Collection System and Headworks

Wastewater will be collected from the Casino via gravity to the influent pump station where it will be pumped to the influent screen (headworks) of the MBR WWTP. Proper removal of fats, oils, and greases (FOG) from the wastewater stream is crucial to the operation of a small WWTP, especially an MBR plant to prolong the life of the membrane units. Automatically cleaning grease interceptors located at the back of the Casino, prior to the WWTP, are recommended.

The influent pump station wet well can be constructed of concrete or fiberglass and may be approximately 6-feet diameter and 12- to 16-feet deep. It is likely that a triplex sewage lift station will be required to convey sanitary sewage to the treatment plant. The pumps could be grinder pumps or submersible non-clog pumps. Actual pump selection and pump station sizing will be completed during design.

The headworks for the onsite WWTP will utilize fine screens. Fine screens are necessary to keep any inert solids from coming into contact with the membranes; as they could damage the membranes. Fine screens should have 1 to 2 mm openings. There are several ways to manage the solids off the screens.

The most common methods include facilities and equipment for filtering inorganic solids from the influent waste stream, washing and dewatering the solids, then conveying the dewatered solids for proper landfill disposal.

5.1.2 Flow Equalization

An equalization tank should be utilized to reduce peak instantaneous hydraulic and organic loading rates on the MBR. A tank can distribute peak flows over multiple days, which would reduce the sizing requirements for the MBR and associated treatment system components.

5.1.3 Treatment Membrane Bioreactor System (MBR)

Tertiary treatment utilizing an MBR was assessed in this study because it provides the Casino the greatest flexibility for reuse and disposal. Primary and secondary treatment consist of gravity settling and biological processes necessary to break down wastewater. Tertiary treatment follows and generally includes both filtration and disinfection. A MBR WWTP is a proven technology excellent for close proximity to populated areas. Advantages include:

- Ease of permitting due to the high quality effluent
- Keeps the treatment plant footprint to a minimum
- The cost of the MBR system is competitive with more conventional treatment processes
- Reliably and consistently produce high-quality effluent ideal for a variety of disposal and reuse alternatives
- The effluent can be utilized for recycled water, when coupled with proper disinfection (refer to Appendix A, Table 9).

The treatment plant should be designed to treat the maximum day flow and biological loadings on a continuous basis. An anoxic/denitrification basin and aeration/nitrification basin can be provided, if required, for nitrate removal.

There are packaged MBR wastewater treatment plants that can be provided factory assembled and tested on a truck trailer roughly 8.5-ft wide x 45-ft long x 12-ft tall. The package unit comes equipped with an influent screen, process tanks, membrane units, air blowers, pumps, instrumentation, controls and instrumentation. Ancillary equipment not installed on the skid that may be necessary include oxygen generation units and additional flow equalization tanks. Whether to install a “package” unit or not can be determined during the design.

5.1.4 Disinfection

Disinfection from a MBR is required if water reuse takes place on landscaped areas and other features with the possibility of human contact. Direct surface discharge also requires disinfection. However, disinfection from a MBR is not required when spray field (under certain circumstances) or subsurface disposal is used.

5.1.5 Solids Handling and Disposal

Biosolids handling is typically one of the most land intensive and odorous process in a wastewater treatment plant. Therefore, this feasibility assessment has assumed that biosolids produced at the Casino site will simply be dewatered, hauled off-site, and disposed of at a designated landfill approved to accept biosolids.

The process of dewatering reduces hauling weight and volume. All liquid extracted from the sludge dewatering process is sent back to the fine screens for treatment. This approach will result in a facility that is much more conducive to the aesthetic site constraints at the Casino site.

5.1.6 Seasonal Storage Pond

For spray irrigation disposal, as discussed in Section 5.2, treated effluent would need to be stored during the winter months until spray irrigation could take place. For leach field disposal, storage would not be required since year-round sub-surface disposal is possible.

5.1.7 Irrigation Pump Station and Spray Field System

Spray irrigation will require a pump station, associated transmission pipes, and a sprinkler system. The pumps will take the water from the storage pond and deliver it to the sprinkler system via a transmission pipeline. The spray fields could be irrigated using traditional rows of impact head sprinklers mounted on wheels. The sprinklers would need to be moved as required within the spray field site to ensure even application of water and to minimize the piping infrastructure required. Land requirements for disposal are discussed in Section 5.2.

5.1.8 Site Conditions and Constraints

<u>Redding (Strawberry Fields Site / Primary Site, Alternatives A-D)</u>. The site doesn't appear to have technical constraints prohibiting or restricting a treatment plant facility and associated pumps and tanks. There is also sufficient

land available for treatment, storage, and disposal of the wastewater effluent (surface or subsurface) as shown on Exhibit 7 in Appendix B.

Anderson (Alternative E). As shown in the tables that follow, there is not sufficient land available for disposal on the Alternative E site. Surface disposal is not possible due to the small area constraint, nor would a large winter storage pond in close proximity to the Casino and the neighbors be aesthetically pleasing or acceptable. Subsurface disposal is also not possible due to the lack of suitable land. As Table 12 indicates, 65 acres would be required to accommodate the required sub-surface disposal design but there are only 8 acres available for sub-surface or surface disposal on the Alternative E site.

5.1.9 Wastewater System Operation

A certified wastewater operator will be required to operate the onsite wastewater treatment system. This operator can either be an employee or a contract operator.

5.1.10 Recycled Water Reuse

Because an MBR WWTP produces treated and filtered effluent that meets tertiary treatment standards, there are many uses allowed by CCR Title 22 regulations which are summarized in Table 9 in Appendix A.

If the effluent is disinfected, a combination of ultraviolet (UV) and chlorine disinfection is recommended to ensure the inactivation of pathogens. UV disinfection will be used to treat wastewater to meet Title 22 disinfection standards. Additional chlorine disinfection will be applied to leave a disinfectant residual for continued protection from pathogens downstream. This added disinfection step provides a safety factor for meeting Title 22 requirements and reduces customer concerns about the safety of recycled water.

A recycled water storage tank should also be constructed to provide equalization storage for onsite recycled water use for toilet flushing, landscape watering, etc. This separate tank should be sized to hold one to two days of peak treated water reuse demand.

5.2 Onsite Wastewater Disposal Options

The onsite disposal options are spray field, leach field, surface water discharge, or a combination. The following table summarizes the land available for wastewater disposal by taking the total parcel area and subtracting the actual site development area and the floodplain influence.

Table 10: Available Land for Disposal – Alternative A as Worst Case

Alternative	Land Parcel Size	Casino Development Area	Flood Plain Area Not Including Development Area	Land Available for Subsurface Disposal	Land Available for Surface Disposal
A	232	(47)	(115)	46	190

Units: acres

Appendix B, Exhibit 7 illustrates the Alternative A land area available for disposal and the land required for both spray field irrigation and leach field disposal based on the following discussion and tables. Since Alternative A is the most land intensive, it was illustrated in Table 10 above and in Exhibit 7. Because it is demonstrated that there are multiple wastewater disposal options that work on the site for Alternative A, the other Alternatives can also work since they are less land intensive.

5.2.1 Spray Field Disposal (Surface Land Application)

For purposes of this study, the hydraulic agronomic rate was used to calculate land application acreage. Actual design should confirm whether or not nutrients and/or other constituents from the effluent may be the driving force behind the agronomic loading rate. The type of crop grown and subsequent water and nutrient uptake will also impact the Land Application Area (LAA) requirement.

A seasonal winter storage earth pond will be necessary for land application. The storage pond should be a depth of 10-feet to minimize algae, plant growth, and the potential for odors. The following criteria was used for the LAA calculations:

- Typical Irrigation Season = 183 days (mid-April – mid-October)
- Hydraulic Loading Rate = 0.2 gpd/ft^2
- Winter Storage = 182 Days (6 months)
- Winter Storage Pond Depth = 10-feet
- Annual Average Rainfall (Western Regional Climate Center, 1971-2000) = 40.42-inches. Assume 100-Year rainfall to be 2x the annual average rainfall.

Water Balance worksheets for each Alternative are found in Appendix C that was used to populate the following table. The table summarizes the estimated land requirements for winter storage and spray field irrigation. The table also shows the effect wastewater reuse would have on the land requirement. Alternative F is not applicable because it is assumed that any expanded uses at the existing site will be served by City utilities.

Table 11: Land Application Area (Surface Disposal) – Alternative Summaries

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Winter Storage [a]	15	13	14	5	14
LAA (Spray Field Irrigation) [a]	71	62	69	22	71
Reclaim Treated Wastewater: Area Reduction [b]	50	44	49	16	50

Units: acres

[a] *20% contingency added for construction, setbacks, soil and crop type, etc.*

[b] *30% reduction used due to reuse*

5.2.2 Leach Field Disposal (Subsurface)

In order to design a disposal system appropriate for the project site, soil testing and identification is required at each location. Exploratory excavations should be constructed to conduct percolation tests to determine infiltration rates; note any confining soil layers; identify shallow groundwater table; and classify soil types and soil structures. Depending on site-specific soil and subsurface information, conventional or specially-designed leach fields may be used.

<u>Conventional Leach Fields</u>

For purposes of this study, since there were no onsite investigations and percolation tests performed, general assumptions were made and calculations performed to estimate an approximate land requirement for a conventional leach field system. The following criteria was used for the land area calculations for each Alternative:

- Peak Flows used
- Percolation rate (hydraulic loading) = 0.45 gallons per day (gpd) per square foot (Note: this rate is consistent with the Custom Soil Resource Report prepared by the Natural Resources Conservation Service and will need to be verified by field testing prior to detailed design)
- 100% replacement area accounted for
- No storage required, assume year-round disposal
- Subsurface disposal allowed during rain events

<u>Redding (Strawberry Fields Site / Primary Site, Alternatives A-D).</u> The required absorption area for Alternative A is calculated by dividing the average 24-hour

volume of wastewater by the absorption capacity of the soil. Required Absorption Area = (200,300 gallons) / (0.45 gallons/day/ft^2) = 445,111 ft^2. The approximate total land area required for Alternative A based on Shasta County design criteria found in Section 3.1.2 is 54 acres, including 100% replacement and 20% contingency addition. The Redding site has land available for a conventional leach field system.

Conventional leach field land requirements were calculated and are summarized below in Table 12 and Alternative A is illustrated in Appendix B, Exhibit 7. The table also shows the effect wastewater reuse could have on the land requirement assuming at least 20% of the wastewater is recycled. A final design by a licensed engineer will be necessary to determine actual size and placement. Alternative F is not applicable because it is assumed that any expanded uses at the existing site will be served by City utilities.

Table 12: Leach Field Land Area (Subsurface Disposal) – Alternative Summaries

	Alt A	Alt B	Alt C	Alt D	Alt E
Sub-Surface Disposal Land Area incl. 100% Replacement [a]	54	46	52	20	53
Reclaim Treated Wastewater: Sub-Surface Disposal Area [b]	45	36	42	16	42

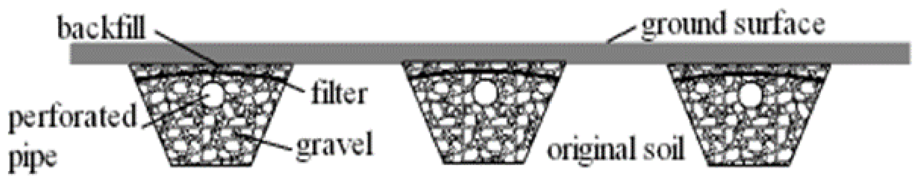
Units: acres
[a] 20% contingency added to avoid over saturation of the soil and to handle high peak flows
[b] 20% reduction used due to reuse

<u>Anderson (Alternative E).</u> Based on the assumptions above, a conventional leach field does not appear possible at the Anderson site. The property site is not large enough to account for a casino development and a complete sub-surface disposal system with a 100% replacement area. There may be one option for Alternative E – the design and use of a specially-designed system as discussed below. The application of appropriate technology may reduce the land requirement enough to fit in the open spaces that are outside the flood zone.

Field-testing on both sites may reveal that only certain portions of the respective sites have soils conducive to leach field disposal. Design of a leach field is dependent on the percolation characteristics of the soil. Different percolation rates yield varying hydraulic loading rates. In addition, hydraulic loading rates also vary depending on the effluent quality – untreated wastewater discharged to leach fields would require a lower hydraulic loading rate to allow additional treatment by microorganisms in the soil.

The advantage of an MBR is that it produces a higher quality effluent thereby reducing the organic loading on the leach field soils and allowing an increase in the hydraulic loading rate. The higher loading rate allows for a smaller disposal field. MBR-quality effluent also reduces the risk of soil clogging and system failure and increases the lifespan of the leach field.

Typical leach lines consist of trenches filled with washed rock/gravel to flow level with a perforated pipe on the top. Rock is added to cover the pipe and an approved filter material is used to keep soil from filtering down into the rock as shown in the graphic below.



Specially-Designed Leach Fields

Engineered or Specially-Designed leach fields are high capacity designs that can accept higher hydraulic loading rates than conventional leach fields, thus reducing the required land. This is possible since the water quality of the MBR effluent being discharged to the engineered leach field is treated to such a high level that reliance on the soil media to provide additional treatment, typical of a conventional leach field design, is not necessary. Engineered leach fields can provide a much smaller footprint than a conventional leach field and should be researched and considered during design. The above land area requirement associated with a conventional leach system could be a “worse-case” scenario.

5.2.3 Surface Water Discharge

Although a National Pollutant Discharge Elimination System (NPDES) permit may be possible for the Sacramento River, there are significant requirements and possible constraints to surface discharge of treated wastewater. Surface water discharge as a disposal option can have high operational costs, increased responsibilities, and liability associated with a NPDES surface water discharge permit. Since other disposal methods appear viable and possible, surface water discharge is not recommended. As such, detailed research and consideration of surface water discharge was not conducted.

5.2.4 Disposal Combination and Selection Criteria

There is the reasonable possibility that final design could utilize a combination spray field / leach field disposal strategy on the Primary Site. The advantage to this approach would be the elimination of the winter storage pond. Most wastewater would be disposed using spray fields in the flood plain. Spray field disposal in the floodplain would work for most summer months and many winter days that are not subject to rainfall and river flooding.

During times of rainfall or river flooding, wastewater would simply be disposed in the leach fields to be located out of the floodplain. As Exhibit 7 demonstrates, there is sufficient land on site to accommodate this approach if desired at a future date.

Site designers will need to select surface disposal, sub-surface disposal, or a combination for use on the site. Each disposal method has its advantages and both can be appropriate in different circumstances. Surface disposal is advantageous because plants and surface evaporation result in more water disposal per unit area of land used. Also, beneficial reuse of treated wastewater can offset the need for drinking water to be used for irrigating landscaping.

But, surface disposal requires a storage pond to allow for times when precipitation precludes the ability to irrigate. Storage ponds can be large and unsightly and can be a source of odors.

Subsurface disposal is advantageous because it can be utilized in any weather conditions and does not require a storage pond to be paired with it. Also, it is possible for subsurface disposal to be applied under parking lot areas though that approach is not recommended unless absolutely necessary.

The site designers will select the best combination of surface and subsurface disposal that will result in the most efficient use of land, best site aesthetics, and most reliable wastewater disposal method.

5.3 Off-Site City Provided Sewer Services

The off-site disposal option is to connect to the respective City wastewater system. As stated previously, David Braithwaite at the City of Redding and David Durette at the City of Anderson have both expressed interest in providing sewer service to the Casino.

Further, both Cities have confirmed that they have sufficient capacity, or plans to add sufficient capacity, in their existing systems to provide service to the new Casino.

Services are readily available and in very close proximity to each proposed site (see Appendix B, Exhibits 3 and 4). Physical connection to either system appears to be technically feasible and relatively accessible. A lift station will be required at the Redding site to pump Casino sewer into the City's system. The sewer pipe at the Anderson site is 9.5-feet deep, which is sufficient for gravity discharge thereby precluding the need for a lift station.

For the Primary Site, the area under consideration is outside Redding City Limits and therefore will need to obtain approval from the Redding City Council to obtain wastewater service. Additionally, the City's service area boundary change could require Local Agency Formation Commission (LAFCO) approval.

The wastewater generated from the primary site (Alternatives A-D) will flow to the Sunnyhill Lift Station, through the wastewater Westside Interceptor pipe, and into the Clear Creek WWTP for treatment and disposal to the Sacramento River.

The Sunnyhill Lift Station has sufficient existing capacity to accommodate flows from the primary site according to the City of Redding 2012 Wastewater Utility Wastewater Master Plan. The available capacity in the Sunnyhill Lift Station exceeds the projected buildout flows by 4.12 MGD. There is capacity for the lift station to provide services for 0.501 MGD wastewater flow from the Casino site.

The Westside Interceptor currently exceeds its capacity during storm events and does not have additional existing capacity to accept flow from the primary casino site during peak flow events. However, according to the City of Redding Capital Improvement Plan for 2015-16 to 2020-21, the Westside Interceptor Phase III project is a planned sewer expansion project that includes building an additional 42-inch sewer pipe in parallel with the current pipe, which will double the wastewater conveyance capacity. The parallel pipe will be installed along Girvan Road and then continue south for a short run until it reaches the Clear Creek WWTP. This will provide sufficient conveyance capacity during all flow events for the wastewater generated from the casino.

The Westside Interceptor Phase III project is programmed to be designed in 2015-16 and constructed in 2016-2018. The City has reported that they are currently behind that schedule but that they plan to pursue the project in a timely manner with current plans to construct the project and have the additional capacity on line by the end of 2021.

In the interim, the Casino site will need to include flow equalization storage as part of the wastewater design. According to the City of Redding, the Westside Interceptor has sufficient capacity to accept and convey wastewater flows during dry conditions. System modeling indicates that from the onset of a 10-year, 24-hour storm event, it takes 30 hours for the wastewater conveyance system to return to flows below the system capacity. Therefore, the project will be required to construct flow equalization storage sufficient to store Maximum Day Flows for 30 hours so that no discharge occurs that would further tax the undersized conveyance system.

The Maximum Day Flow for Alternative A is shown in Table 3 above to be 289,600 gpd. Therefore, 362,000 gallons (289,600 gpd / 24hrs/day * 30 hrs) of equalization storage is required to be constructed on the Casino site. This storage will retain peak flows during and after a storm event so that wastewater from the site does not discharge into the downstream system until the peak event has resided and flow is below the capacity of the pipeline conveyance system.

Using the planned flow equalization storage on site until the downstream conveyance system is complete in 2021 will mitigate the possibility of the project contributing to overflows or spills as a result of flows exceeding the capacity of the pipe system. After the conveyance capacity increase project is complete in 2021, the on-site storage should not be needed.

The Clear Creek WWTP currently treats about 9 MGD per day of wastewater and has a capacity of about 20 MGD. The peak flow that can be handled is approximately 50 MGD. The existing WWTP is confirmed to have sufficient current capacity to treat the peak flow of 0.501 MGD generated by the primary site.

For the Alternate Site (Alternative E), the City of Anderson Sewer System Management Plan provides detailed information on the pipe diameter, length, current flow, and flow capacity. The City's topography slopes from west to east so the majority of wastewater flows by gravity to the City's Wastewater Treatment Plant located at the east end of the city.

The wastewater from the alternative site will enter the City sewer system at manhole D310M, which has a current peak wet weather flow of 1.39 MGD versus a pipe capacity of 3.54 MGD. The wastewater peak flow from the Alternate Site would 0.486 MGD, only slightly adding to the carrying load of the pipe. The flow was routed from the entry point into the sewer system all the way to the end of the sewer line where it enters the WWTP. The wet peak weather flow in the sewer system before entering the WWTP at manhole B603M is 5.08 MGD. The carrying capacity of this section is 14.91 MGD, meaning that there is plenty of room for the wastewater generated from the Alternate Site.

The WWTP currently treats about 1.1 MGD, but it has capacity to treat 2.4 MGD, leaving plenty of space for the additional flow from the proposed Alternate Site.

For the Existing Site (Alternative F), the city currently treats the wastewater at the Clear Creek Water Treatment Plant. There is a private sewer pipe that runs from the existing Casino to the WWTP where the wastewater is treated and then discharged into the Sacramento River. As documented above, the calculated increase in wastewater flow is anticipated to be less than 8% which should easily be accommodated in the existing sewer conveyance system.

6 Drinking Water Assessment

This Section presents a summary of the water system components needed to supply onsite water to each of the six Alternatives, including supply and water quality, treatment, distribution and pumping, and storage. Off-site city supply will also be discussed.

Required water facilities will need to be accounted for, located, and incorporated into the overall selected Casino Alternative site layout. All facilities and concepts described in this section are preliminary, and should be considered for planning purposes only.

6.1 Onsite Drinking Water System

It is feasible for the Casino to have their own onsite water supply system. The onsite drinking water system would be classified as a non-transient, non-community public water system. Appendix B, Exhibit 8 shows a process flow diagram of a typical groundwater supplied drinking water system.

6.1.1 Water Supply

There are two feasible water sources for the proposed Alternatives: (1) onsite groundwater for Alternatives A-E; and (2) river intake for Alternatives A-D.

<u>Groundwater</u>

The 1992 Assembly Bill 3030 (AB3030) provided a systematic procedure for an existing local agency to develop a groundwater management plan. In November 1998 Shasta County developed the “Coordinated AB 3030 Groundwater Management Plan for the Redding Groundwater Basin.” This Plan was updated in May 2007. Overall water balance and current water demands in the basin suggest that a sufficient quantity of water is available on a regional basis to meet current demands and support future development.

An excerpt from the Plan states the following:

> "Section 2.29. Over the long term, groundwater levels in the Redding Basin have remained steady. There are seasonal fluctuations (summer to winter), and there are some fluctuations caused by climatic patterns (wet or dry years), but overall, groundwater levels have not changed significantly throughout the period of record." (Coordinated AB 3030 Groundwater Management Plan for the Redding Groundwater Basin, November 1998, Updated May 2007).

Depending on the water-bearing formation tapped into, yields from 100 to 1,000 gallons per minute are possible, which is more than enough to support the Casino. As part of the well development and to confirm that the actual yield potential is sufficient to meet the Casino's demand, a 72-hour pumping test with a consistent and constant pumping rate should be performed.

River Intake

River intake is not the preferred or best option due to the apparent availability of groundwater. The use of surface water would require water rights in addition to what is already held by the Tribe; permit for an intake structure and all its regulatory conditions; and more expensive water treatment. This option was not researched and is not discussed further.

6.1.2 Groundwater Quality

The Coordinated AB 3030 Groundwater Management Plan for the Redding Groundwater Basin also includes the following relevant information about regional groundwater quality.

> "Section 2.32. The general quality of groundwater in the Redding Basin is considered good to excellent (TDS between 95 and 424 mg/L) for most uses, except for that water from shallow depths along the margin of the basin where pre-Tertiary formations may be tapped. Some wells in those areas yield water with constituents that are above limits for drinking (primarily metals, TDS, chloride and sulfate)…" (Coordinated AB 3030 Groundwater Management Plan for the Redding Groundwater Basin, November 1998, Updated May 2007).

Based on the groundwater quality of some City of Redding wells, an onsite groundwater well may produce water requiring treatment. Specifically, arsenic and/or manganese could be encountered. Arsenic is considered a primary contaminant and limits must be below 10 parts per billion. Manganese is considered a secondary contaminant in water and does not create a health hazard but in high concentrations will cause brownish-black staining of laundry, porcelain, dishes, utensils, and even glassware.

If contamination is found, another possible approach to take before conceding to treatment is to perform aquifer zone testing. A zone testing well isolates and tests water quality within each distinct zone, or aquifer. If “clean” water is found in certain zones, then a production well can be designed and constructed to only pump water from these “clean” zones with the contaminated zones being sealed off.

6.1.3 Distribution Pipeline System

A distribution system should be designed to accommodate all drinking water demands, irrigation demands, and firefighting demands. Unless an elevated tank is constructed, a pressure pump station will be required to provide and maintain pressure to the Casino from the storage tank.

6.1.4 Storage

Section 4.2.3 provided the basis of design for storage and fire protection. A water storage tank(s) will be required for each Alternative to store water produced by onsite wells.

The tank could be of welded steel construction or a bolted steel tank. Tank dimensions can vary and can be optimized for aesthetic and functional purposes in order to be integrated into the Alternative site layout. The tank at the Redding site could even be partially or completely buried, which would require a concrete tank.

If recycled water is used to satisfy fire suppression, fire suppression and potable water storage would need to be contained in two separate tanks (refer to Appendix B, Exhibit 8). To prevent stagnation of the fire protection water, the fire supply would need to be drained periodically or used regularly for irrigation.

6.1.5 Booster Pump Station

Unless an elevated storage tank is constructed at either site, a pump station will be required to convey water from the storage tank to the facilities and to keep the distribution system pressurized. The pump station configuration may consist of multiple pumps of increasing horsepower, coupled with a variable frequency drive (VFD), to provide the range of demand that will take place throughout a day. A designated fire pump large enough for the volumes needed should be incorporated into the pump station.

6.1.6 Treatment

Arsenic limits above 10 parts per billion (10 µg/L) will require treatment. For manganese, treatment is not required but is usually desirable. Groundwater sampling and quality testing must be performed to verify the water quality at the site before actual treatment requirements can be determined.

Iron and manganese is typically treated with pressure filters loaded with greensand media. Arsenic removal may be achieved using media adsorption, coagulation and filtration, or oxidation filtration methods.

6.1.7 Site Conditions and Constraints

The Redding site appears not to have any technical constraints for the location of a well, storage tank, treatment facility (if necessary), and booster pump station. However, the Anderson site, being a smaller land parcel with a proposed large casino complex, and wastewater components that also need to be sited, will require thoughtful design in order to accommodate a well, tank, and pump station. At least 100-feet separation from any new well and any sewer leach field must be maintained. This includes leach fields that may be located on neighboring properties.

6.1.8 Water System Operation

A certified water treatment plant operator will be required to operate any onsite water treatment system. If no treatment is found to be required, a certified distribution system operator will be required. This operator can either be an employee or a contract operator.

6.2 Off-Site City Provided Drinking Water Supply

As mentioned previously, both David Braithwaite at the City of Redding and David Durette at the City of Anderson have stated that their respective systems have the capacity and ability to supply the Casino with potable water, though neither has made any offer to do so at this time. Both cities have pipelines within a few hundred feet of both Casino properties. These representatives from the Cities have stated that there is sufficient capacity and pressure with their water systems to serve the Casino. Physical connection to either system appears to be technically possible, and relatively easy due to close proximities of the systems. Both Cities will require a master meter be installed in order to track water usage and bill accordingly.

The site for Alternatives A-D is outside Redding City Limits. Therefore, approval from the Redding City Council and the Local Agency Formation Commission (LAFCO) is likely to be required in order for the site to receive water service.

According to the City of Redding 2016 Water Utility Master Plan, drinking water for the Primary Site (Alternatives A-D) comes from the Enterprise Zone of the City's water supply system. The Enterprise Zone receives water from the Foothill Water Treatment Plant, located on Foothill Blvd on the west side of the City. The source of the water of the Foothill WTP is the Sacramento River.

When drinking water demand is high, the Enterprise Zone is also supplied by the Enterprise Wells, which include of a total of 12 wells. The water quality at the wells is generally considered good, but chlorination is provided at each well, and 10 wells have a treatment process to reduce iron and manganese. The Enterprise Zone has current maximum and average daily demands of 6.22 MGD and 12.09 MGD respectively. There are also other areas of the City that either fully or party rely on the Foothill WTP for their water, including the Hill 900/Mary Lake Booster, Cascade, and Hilltop-Dana Zones. All of these zones combined have an average daily demand of 9.5 MGD and a maximum daily demand of 21.74 MGD.

The Foothill WTP can treat 24 MGD and the Enterprise Wells can produce 19 MGD, for a total existing capacity of 43 MGD. For the given area that is supplied water, the total average daily demand is 15.72 MGD and the maximum daily is 33.83 MGD. The Primary Site will need a supply of 0.555 MGD. Therefore, there is a sufficient supply of water for the site.

At the Alternate Site (Alternative E), the City of Anderson gets all of their water from 10 wells. The water is treated with a small amount of chlorine before it is sent to the public. There is groundwater for the wells to pump from the range of 20-feet down to about 1,000-feet. Usually, only one well is needed for the City's domestic water, however occasionally a second well will be used during peak hours. The City consumes approximately 2 MGD. The site would need a supply of 0.535 MGD. Near the proposed site there is a 12-inch water pipe which would feed the site, plus there is a 10-inch water pipe on the back side of the property which can serve as a looped connection.

For the Existing Site (Alternative F), according to the City of Redding 2016 Water Utility Master Plan the drinking water for this site is provided by the Cascade Zone of the City's water supply system. The Cascade Zone was discussed above and receives its water from the Foothill Water Treatment Plant. If there is a high demand, water will be used from the Bonnyview Pump Station, however under average demand the pump station is not required. The water for the Bonnyview Pump Station comes from the Enterprise Zone, which is supplied water from the Foothill WTP and the Enterprise Wells when needed. The Cascade Zone has an average daily demand of 2.37 MGD and a maximum daily demand of 5.76 MGD. As stated previously the water provided to this area of the city can total 43 MGD and with taking into account the other areas that will use this water supply, there is an adequate amount of water for the site which is only calculated to need less than 8% more water than currently demanded.

7 Conclusion and Recommendation

Each of the six project Alternatives were evaluated. Alternatives A-D and F were found to be feasible in terms of onsite water and wastewater service. Alternative E was found to be feasible in terms of onsite water only; onsite wastewater disposal appears to be unfeasible.

As demonstrated by this Study, connections to the existing City utility systems will be less costly to the expanded Casino operation than providing their own on-site utilities. However, on-site water and wastewater utilities are well within the capability of the Casino to plan, construct, and maintain as has been demonstrated on many similar sites.

This Section summarizes wastewater and water, onsite and off-site service for each site. Advantages and disadvantages are presented.

7.1 Wastewater Management

7.1.1 Primary Site – City of Redding (Alternatives A, B, C, and D)

Onsite:

A. Requires collection system; lift station; treatment facilities; and disposal system be built and operated onsite.
B. A lift station will be required to convey raw wastewater from the development to the new WWTP.
C. MBR technology is recommended for treatment. MBR facilities are compact systems ideal for close proximity to populated areas. Tertiary treatment can be achieved using an MBR which provides greater flexibility for disposal and reuse options.
D. Wastewater disposal can be either (1) spray field; (2) leach field; or (3) a combination of both.
E. Seasonal storage will be required with spray field disposal.

F. Recommend effluent be recycled to reduce wastewater disposal requirements.
G. Advantages: (1) autonomy from the City; (2) recycled water may be used for toilets, landscape irrigation, and fire suppression (refer to Appendix A, Table 9); (3) No connection fee or on-going monthly billings; and (4) can accommodate future expansion.
H. Disadvantages: (1) higher capital cost due to the requirement to construct several components; (2) requires regular and ongoing operation and maintenance of the systems; (3) requires certified operator; (4) may require seasonal storage which would be very land intensive; (5) requires crop/soil management; (6) future casino expansion may be limited due to land required to be committed to disposal; and (7) responsible for permitting and compliance of treated wastewater and biosolids disposal

Off-site – City-Provided Wastewater Service:

A. Will require approval from the City Council and the Local Agency Formation Commission (LAFCO) to receive wastewater service.
B. Requires a utility service agreement with the City and physical connection to the sewer system.
C. Onsite lift station required to convey raw wastewater from the development to the City's lift station.
D. Pretreatment, such as FOG removal, may be required.
E. Advantages: (1) lower capital costs; (2) the City is responsible and liable for disposal of treated wastewater and biosolids, operation and maintenance, and regulatory compliance; (3) No employed or retained certified sewer operator is necessary; (4) no wastewater treatment components and structures to incorporate into the site layout and design; and (5) land would be available for other purposes and possible future casino or retail expansions.
F. Disadvantages: (1) monthly fees; (2) no ability to recycle; and (3) at the will and discretion of the City – any improvements, expansions, etc. will require discussions with the City and possibly LAFCO as well.

7.1.2 Alternate Site – City of Anderson (Alternative E)

Onsite:

A. Surface land disposal not possible

B. Subsurface disposal not possible, even using specially designed leach fields, there is simply not enough land area
C. Onsite wastewater management appears not possible for this Alternate Site

Off-site – City-Provided Wastewater Service:

A. Requires a utility service agreement with the City and physical connection to the sewer system.
B. Pretreatment, such as FOG removal, may be required.
C. Gravity connection into the City's existing gravity pipeline appears possible.
D. Advantages: (1) City-service is readily available; (2) the City is responsible and liable for disposal of treated wastewater and biosolids, operation and maintenance, and regulatory compliance; (3) lower capital costs; and (4) no lift station required.
E. Disadvantages: (1) monthly fees; (2) no ability to recycle; and (3) at the will and discretion of the City.

7.1.3 Existing Site – City of Redding (Alternative F)

Onsite:

A. There are no wastewater management options available for this existing site.

Off-site – City-Provided Wastewater Service:

A. May require an updated utility service agreement with the City.
B. May require expansion of an existing sewer lift station or downstream pipelines.
C. Advantages: (1) service is already established and guaranteed, a good relationship already exists; and (2) disposal of treated wastewater and biosolids is the City's responsibility.
D. Disadvantages: There are no unique disadvantages as a result of the expansion project.

7.2 Water Supply

7.2.1 Primary Site – City of Redding (Alternatives A, B, C, and D)

Onsite:

A. Requires water supply (well); distribution system; pump station; possible treatment facilities; and storage.
B. Well development will be required: 72-hour drawdown testing and water quality analysis.
C. Advantages: (1) autonomy from the City; (2) no connection fee or on-going monthly billings; and (3) can design a water system to accommodate future expansion.
D. Disadvantages: (1) requires onsite construction of several components that must be included in the site layout; (2) requires regular and ongoing onsite operation and maintenance; (3) requires certified operator; (4) may require treatment facilities be built and operated onsite; and (5) requires storage for fire and emergency use.

Off-site – City-provided Water Service:

A. Will require approval from the City Council, the Local Agency Formation Commission (LAFCO), and Bureau of Reclamation to receive water service.
B. Requires a utility service agreement with the City and physical connection to the water system.
C. Advantages: (1) lower capital costs; (2) the City is responsible for operation and maintenance, quality of water, and regulatory compliance; and (3) no water components and structures to incorporate into the site layout and design.
D. Disadvantages: (1) monthly fees; and (2) at the will and discretion of the City.

7.2.2 Alternate Site – City of Anderson (Alternative E)

Onsite:

A. Requires water supply (well); distribution system; pump station; possible treatment facilities; and storage.
B. Well development will be required: 72-hour drawdown testing and water quality analysis.
C. Advantages: (1) autonomy from the City; (2) no connection fee or on-going monthly billings; and (3) can design a water system to accommodate future expansion.
D. Disadvantages: (1) requires onsite construction of several components that must be included in the site layout; (2) requires regular and ongoing onsite operation and maintenance; (3) requires certified

operator; (4) may require treatment facilities be built and operated onsite; and (5) requires storage for fire and emergency.

Off-site – City-provided Water Service:

A. Requires a utility service agreement with the City and physical connection to the water system.
B. Work with the City to accommodate their master plan of extending a large trunk line through the development.
C. Advantages: (1) lower capital costs; (2) operation and maintenance, quality of water, and regulatory compliance is the City's responsibility; and (3) no water components and structures to incorporate into the site layout and design.
E. Disadvantages: (1) monthly fees; and (2) at the will and discretion of the City.

7.2.3 Existing Site – City of Redding (Alternative F)

Onsite:

A. Although there may be other water supply options available for this existing site, it is recommended to continue service with the City.

Off-site – City-provided Water Service:

A. May require an updated utility service agreement with the City.
B. May require expansion of existing infrastructure.
C. Advantages: (1) lower capital costs; and (2) service is already established and guaranteed.
D. Disadvantages: There are no unique disadvantages as a result of the expansion project.

Appendix A

Tables 1, 2, 5 and 9

Table 1: Total Building and Amenity Areas

Amenities	Alt A Primary Site	Alt B Primary Site	Alt C Primary Site	Alt D Primary Site	Alt E Alternate Site	Alt F Existing Expansion
	Proposed Project Full Build-Out	Proposed Project w/ No Retail	Reduced Intensity	Non-Gaming	Alternative Site	Expansion – Increase Gaming
Hotel Area	182,288	182,288	182,288	89,717	165,788	71,208
Casino Area	69,515	69,515	56,412	--	69,515	64,861[a]
Food and Beverage	31,565	31,565	30,390	12,178	31,565	5,502
Events Center	52,200	52,200	52,200	--	52,200	+10,000[b]
Conference Center	10,080	10,080	10,080	--	10,080	--
Total Building Area (Casino Resort)	**345,648**	**345,648**	**329,370**	**101,895**	**329,148**	**141,571 (Existing)** **151,571 (New)**
Outdoor Sports Retail	130,000	--	130,000	120,000	120,000	--

Units: square foot (sf)

[a]*Casino area includes 9,826-sf of the existing event center which will be remodeled to expand gaming*

[b]*Event Center Addition*

Table 2: Estimated Wastewater Flows by Building Use

Amenities	Alt A		Alt B		Alt C		Alt D		Alt E	
	Typical WEEKEND Peak Flows	AVERAGE Day Flows[a]	Typical WEEKEND Peak Flows	AVERAGE Day Flows[a]	Typical WEEKEND Peak Flows	AVERAGE Day Flows[a]	Typical WEEKEND Peak Flows	AVERAGE Day Flows[a]	Typical WEEKEND Peak Flows	AVERAGE Day Flows[a]
Hotel area	53,500	34,000	53,500	34,000	53,500	34,000	26,600	17,300	50,700	32,100
Casino area	41,300	30,300	41,300	30,300	32,900	23,800	-	-	41,300	30,300
Food and Beverage	51,200	35,100	51,200	35,100	49,200	33,700	14,900	10,200	51,200	35,100
Events Center	48,200	22,400	48,200	22,400	48,200	22,400	-	-	48,200	22,400
Conference Center	17,800	9,300	17,800	9,300	17,800	9,300	-	-	17,800	9,300
Outdoor Sports Retail	29,300	20,900	-	-	29,300	20,900	27,000	19,300	27,000	19,300
Central Plant/Cooling Towers	48,300	48,300	35,100	35,100	46,600	46,600	22,500	22,500	45,600	45,600
Total	**289,600**	**200,300**	**247,100**	**166,200**	**277,500**	**190,700**	**91,000**	**69,300**	**281,800**	**194,100**

Units: gallons per day (gpd)

[a]Average Day Flow = 5/7 Weekday + 2/7 Weekend

Table 5: Metered Water Usage (Demands) of the Existing Redding Rancheria Casino from the City of Redding

	2016		2015		2014	
Month	Days	Usage, ccf	Days	Usage, ccf	Days	Usage, ccf
December	30	1282	34	1387	34	1300
November	33	1535	29	1400	29	1201
October	29	1902	29	2116	31	1829
September[a]	*32*	*3510*	*32*	*3116*	*30*	*3008*
August[a]	*29*	*3278*	*29*	*2773*	*29*	*3334*
July[a]	*30*	*3267*	*30*	*3250*	*32*	*3959*
June[a]	*32*	*3183*	*31*	*3146*	*29*	*3109*
May	29	2054	30	2826	30	2042
April	29	1590	29	1911	29	1728
March	29	1178	29	1564	31	1414
February	32	1246	32	1342	30	1170
January	31	1163	31	1178	33	1492
Total Usage (Cubic Foot) (gallons)		2,518,800 (ccf) 18,840,624 (gal)		2,600,900 (ccf) 19,454,732 (gal)		2,558,600 (ccf) 19,138,328(gal)
Average Annual Day (gpd)		**51,618**		**53,301**		**52,148**
Average Summer Day (gpd)		**80,504**		**75,321**		**83,589**
Peaking Factor[b]		**1.56**		**1.41**		**1.60**

Source: David Braithwaite, City of Redding

Units: cubic foot (ccf); gallons per day (gpd)

[a]*Summer Flows*

[b]*Per City of Redding: Seasonal peaking factor is approximately 2.3 and diurnal peaking factor is 1.5*

Table 9: Recycled Water Uses Allowed in California (2013)

Recycled Water Uses Allowed[1] in California

Use of Recycled Water	Treatment Level: Disinfected Tertiary Recycled Water	Disinfected Secondary – 2.2 Recycled Water	Disinfected Secondary – 23 Recycled Water	Undisinfected Secondary Recycled Water
Irrigation of:				
Food crops where recycled water contacts the edible portion of the crop, including all root crops	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Parks and playgrounds	**Allowed**	Not Allowed	Not Allowed	Not Allowed
School yards	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Residential landscaping	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Unrestricted-access golf courses	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Any other irrigation uses not prohibited by other provisions of the California Code of Regulations	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Food crops, surface-irrigated, above-ground edible portion, and not contacted by recycled water	**Allowed**	**Allowed**	Not Allowed	Not Allowed
Cemeteries	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Freeway landscaping	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Restricted-access golf courses	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Ornamental nursery stock and sod farms with unrestricted public access	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Pasture for milk animals for human consumption	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Non-edible vegetation with access control to prevent use as a park, playground or school yard	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Orchards with no contact between edible portion and recycled water	**Allowed**	**Allowed**	Not Allowed[2]	Not Allowed[2]
Vineyards with no contact between edible portion and recycled water	**Allowed**	**Allowed**	Not Allowed[2]	Not Allowed[2]
Non food-bearing trees, including Christmas trees not irrigated less than 14 days before harvest	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Fodder and fiber crops and pasture for animals not producing milk for human consumption	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Seed crops not eaten by humans	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Food crops undergoing commercial pathogen-destroying processing before consumption by humans	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Ornamental nursery stock, sod farms not irrigated less than 14 day before harvest	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Supply for impoundment:				
Non-restricted recreational impoundments, with supplemental monitoring for pathogenic organisms	**Allowed[3]**	Not Allowed	Not Allowed	Not Allowed
Restricted recreational impoundments and publicly-accessible fish hatcheries	**Allowed**	**Allowed**	Not Allowed	Not Allowed
Landscape impoundments without decorative fountains	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Supply for cooling or air conditioning:				
Industrial or commercial cooling or air conditioning involving cooling tower, evaporative condenser, or spraying that creates a mist	**Allowed[4]**	Not Allowed	Not Allowed	Not Allowed
Industrial or commercial cooling or air conditioning not involving cooling tower, evaporative condenser, or spraying that creates a mist	**Allowed**	**Allowed**	**Allowed**	Not Allowed

Recycled Water Uses Allowed[1] in California
(continued)

Use of Recycled Water	Treatment Level: Disinfected Tertiary Recycled Water	Disinfected Secondary – 2.2 Recycled Water	Disinfected Secondary – 23 Recycled Water	Undisinfected Secondary Recycled Water
Other uses:				
Groundwater recharge	**Allowed** under special case-by-case permits by RWQCBs[5]			
Flushing toilets and urinals	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Priming drain traps	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Industrial process water that may contact workers	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Structural fire fighting	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Decorative fountains	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Commercial laundries	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Consolidation of backfill material around potable water pipelines	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Artificial snow making for commercial outdoor uses	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Commercial car washes, not heating the water, excluding the general public from washing process	**Allowed**	Not Allowed	Not Allowed	Not Allowed
Industrial process water that will not come into contact with workers	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Industrial boiler feedwater	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Non-structural fire fighting	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Backfill consolidation around non-potable piping	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Soil compaction	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Mixing concrete	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Dust control on roads and streets	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Cleaning roads, sidewalks, and outdoor work areas	**Allowed**	**Allowed**	**Allowed**	Not Allowed
Flushing sanitary sewers	**Allowed**	**Allowed**	**Allowed**	**Allowed**

This summary is prepared from the December 2, 2000-adopted Title 22 Water Recycling Criteria and supersedes all earlier versions. Prepared by Bahman Sheikh and edited by EBMUD Office of Water Recycling, who acknowledge this is a summary and not the formal version of the regulations referenced above.

[1] Refer to the full text of the December 2, 2000 version of Title 22: California Code of Regulations, Chapter 3 Water Recycling Criteria. This chart is only an informal summary of the uses allowed in this version, with the exception of orchards and vineyards noted as "Not Allowed[2]" on page 1 and explained below.

[2] Per California Department of Public Health letter of January 8, 2003 to California Regional Water Quality Control Boards.

[3] Allowed with "conventional tertiary treatment." Additional monitoring for two years or more is necessary with direct filtration.

[4] Drift eliminators and/or biocides are required if public or employees can be exposed to mist.

[5] Refer to Groundwater Recharge Guidelines, available from the California Department of Public Health.

2013

Appendix B

Exhibits

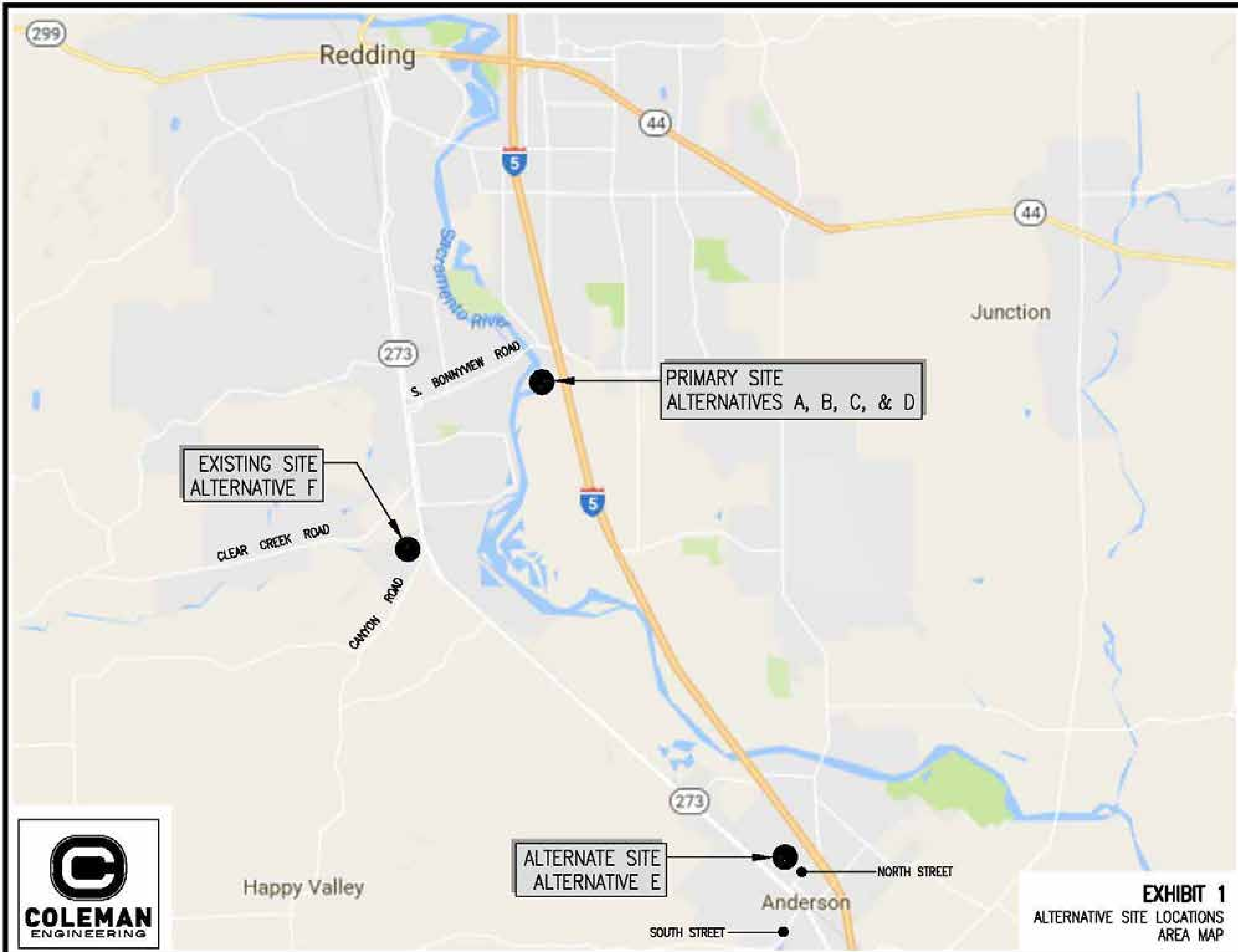
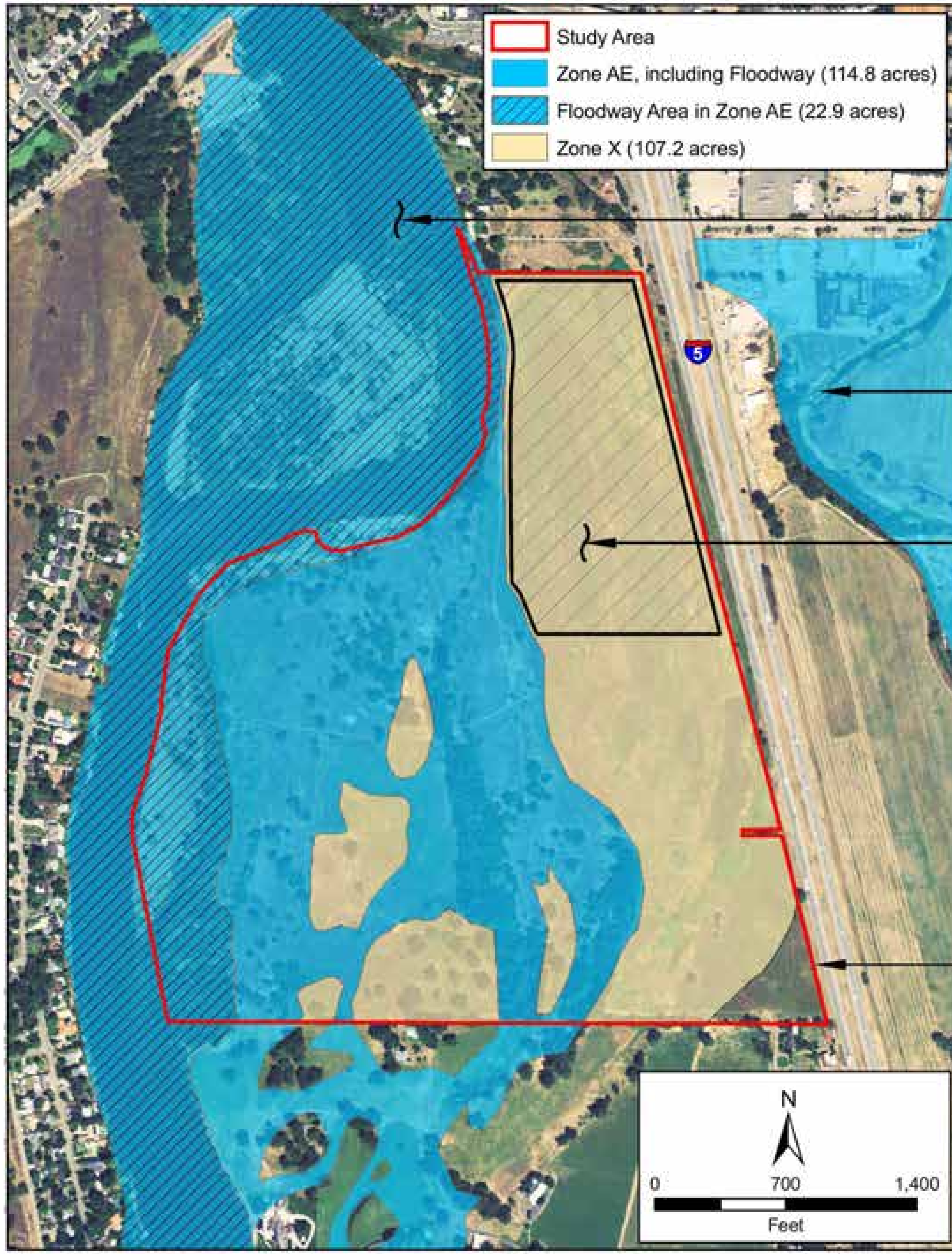


EXHIBIT 1
ALTERNATIVE SITE LOCATIONS
AREA MAP



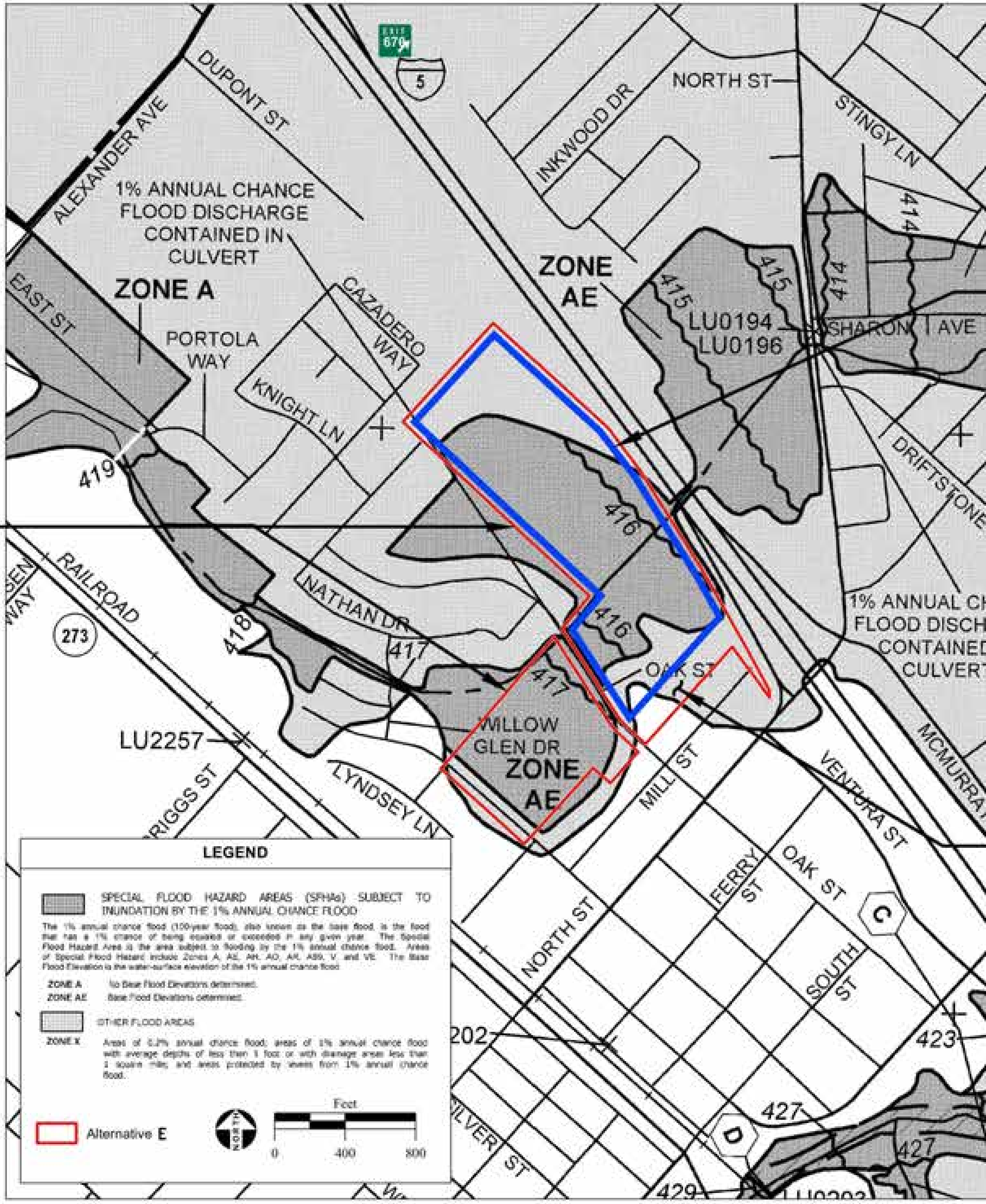
ORIGINAL FIGURE FROM THE DRAFT TECHNICAL MEMORANDUM, FIGURE 2 – OCTOBER 20, 2008 MR. PAUL KIRK

COLEMAN ENGINEERING

EXHIBIT 2A

REDDING PRIMARY SITE FLOODPLAIN MAP

TOTAL PROPERTY BOUNDARY AREA APPROXIMATELY 55 ACRES



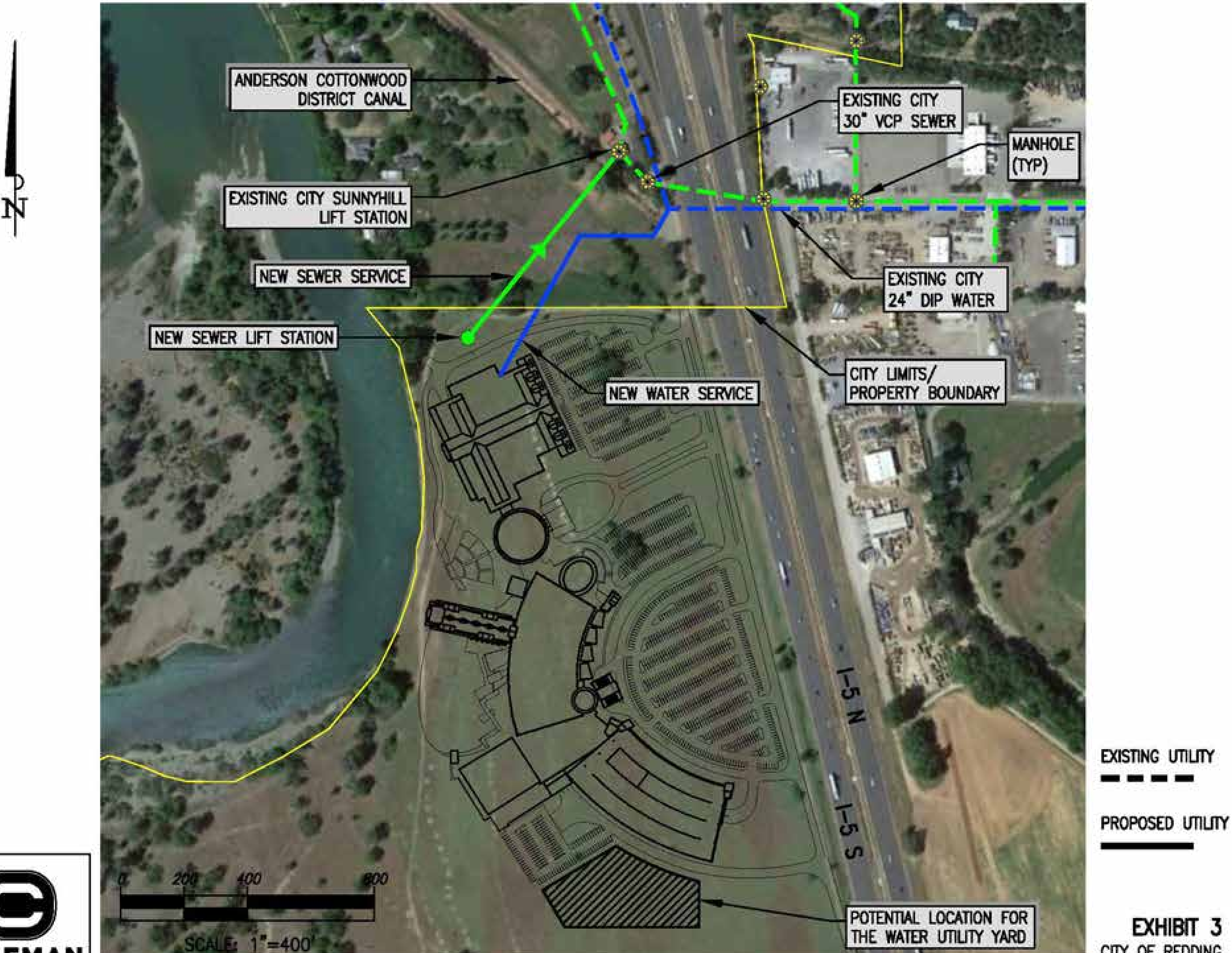
ALTERNATIVE E DEVELOPMENT FOOTPRINT APPROXIMATELY 26 ACRES

APPROXIMATELY 8 ACRES OUTSIDE THE FLOODPLAIN AND NOT CLAIMED BY DEVELOPMENT

COLEMAN ENGINEERING

EXHIBIT 2B

ANDERSON ALTERNATE SITE FLOODPLAIN MAP



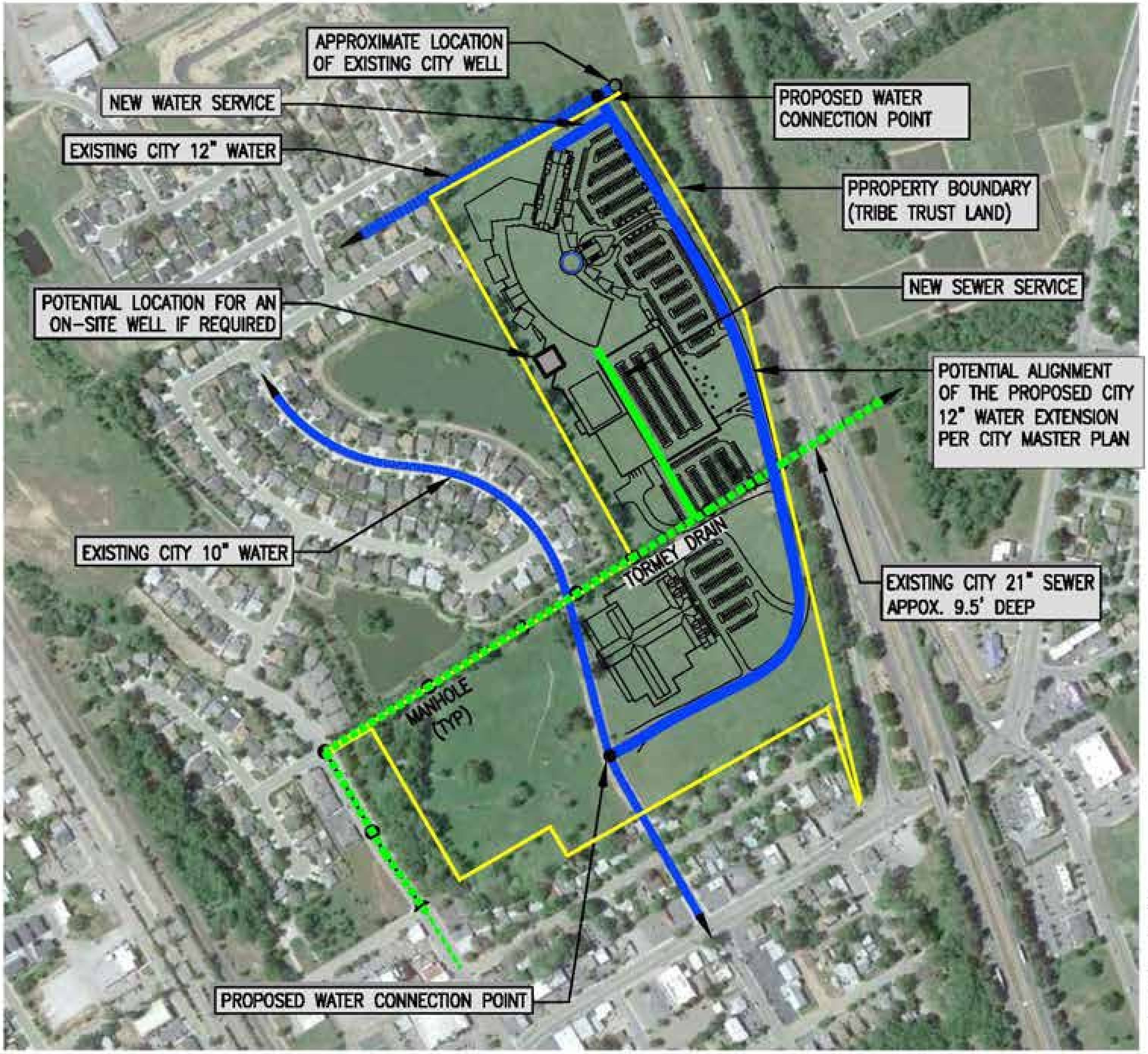
COLEMAN ENGINEERING

IMAGE FROM CITY OF REDDING GIS (WEBSITE)

EXHIBIT 3
CITY OF REDDING
EXISTING WATER AND SEWER UTILITIES NEAR CASINO SITE

N

NOT TO SCALE



EXISTING UTILITY

PROPOSED UTILITY

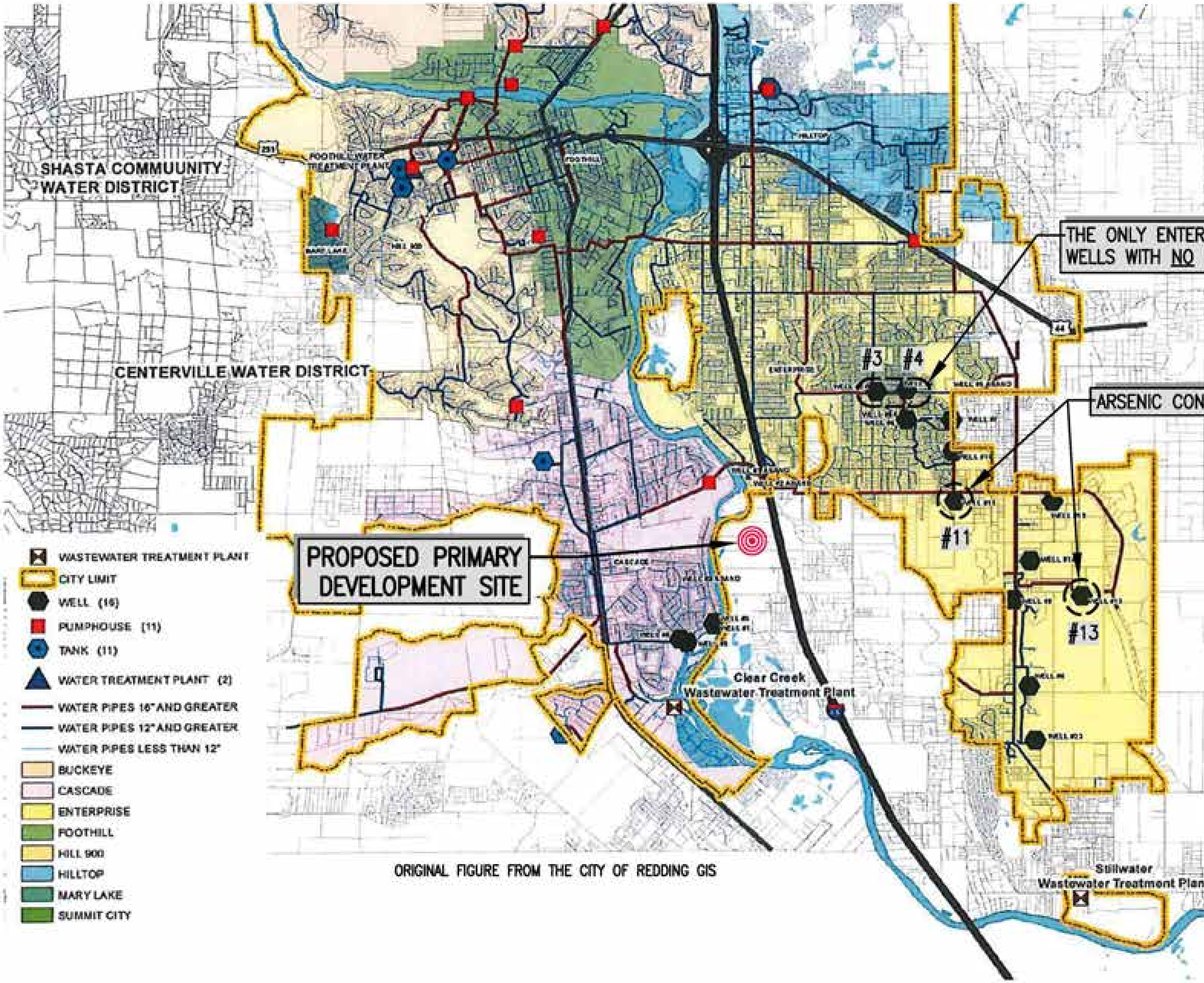
COLEMAN ENGINEERING

NOTE: NO ON-SITE WASTEWATER TREATMENT OR DISPOSAL IS RECOMMENDED AT THIS SITE.

EXHIBIT 4

CITY OF ANDERSON

EXISTING WATER AND SEWER UTILITIES NEAR CASINO SITE



ORIGINAL FIGURE FROM THE CITY OF REDDING GIS

COLEMAN ENGINEERING

EXHIBIT 5

CITY OF REDDING

MUNICIPAL WELL LOCATIONS

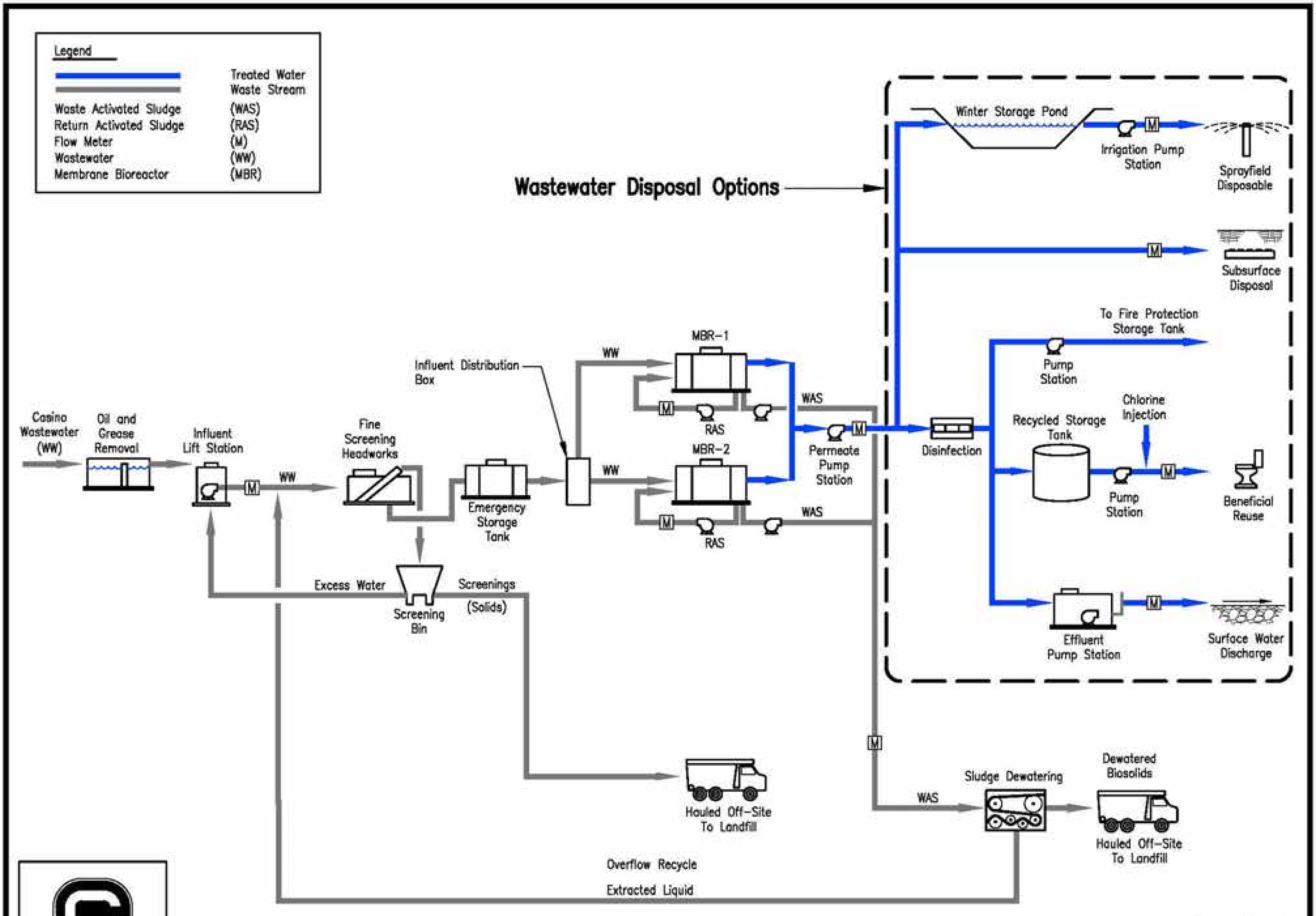


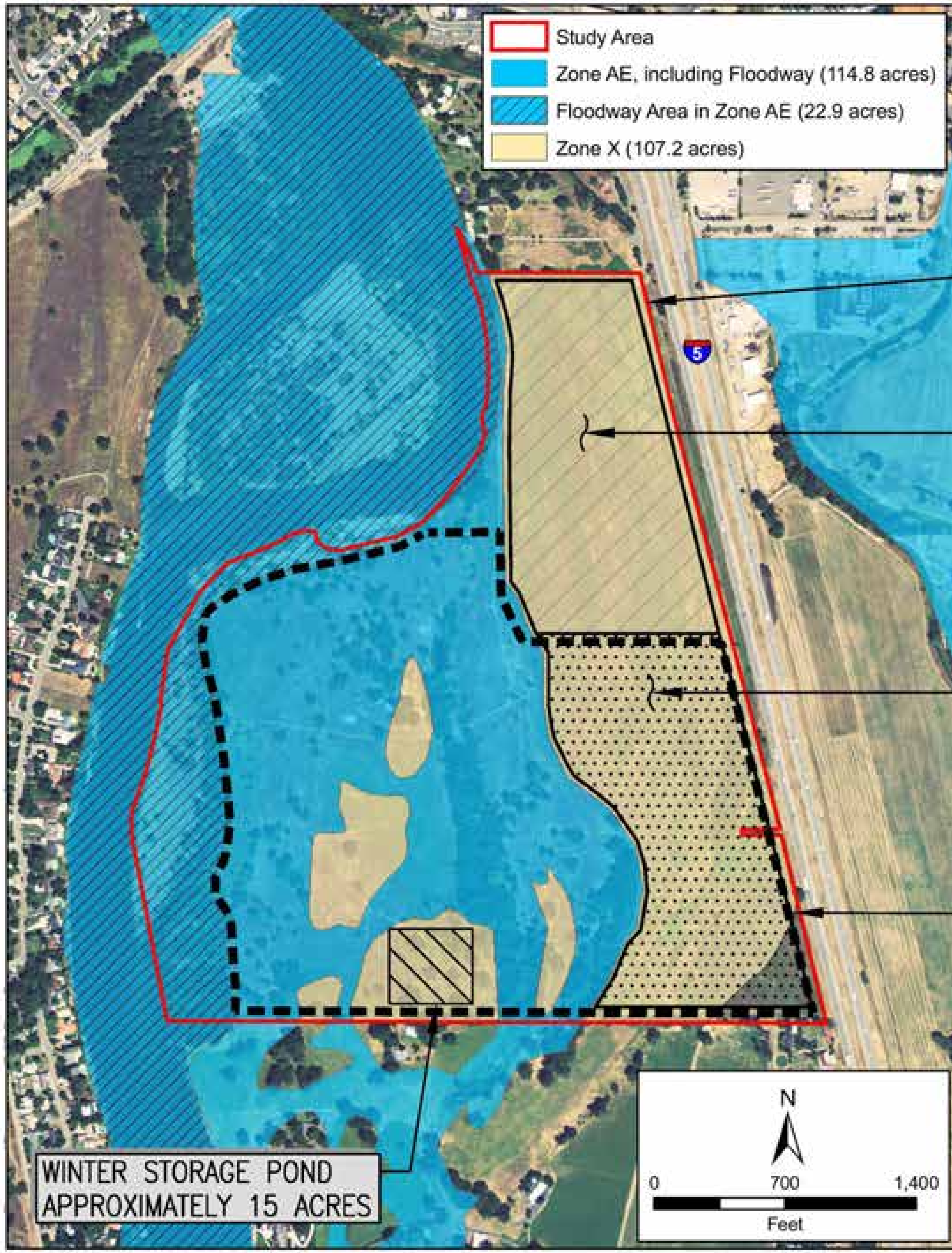
EXHIBIT 6

WASTEWATER MANAGEMENT
MBR PROCESS FLOW DIAGRAM

NOTES:

1. IF SUBSURFACE DISPOSAL IS USED, BOTH THE SUBSURFACE DISPOSAL AREA AND THE WINTER STORAGE AREA CAN BE USED FOR A TOTAL OF 61 ACRES AVAILABLE.

2. ALTERNATIVE A IS THE MOST LAND INTENSIVE DEVELOPMENT OPTION. ALTERNATIVES B-D CAN ALSO BE ACCOMMODATED ON THE REDDING SITE.



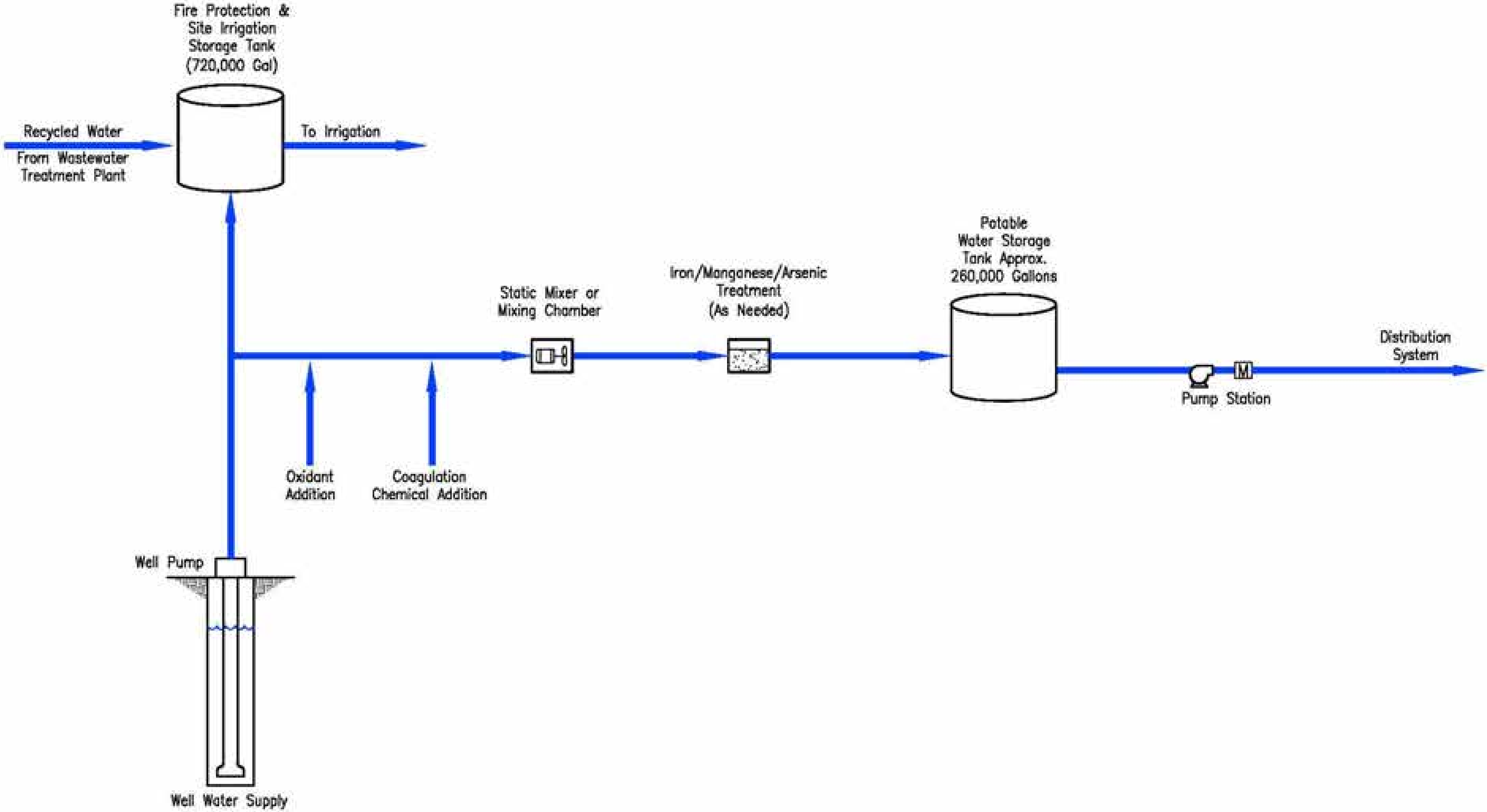
COLEMAN ENGINEERING

ORIGINAL FIGURE FROM THE DRAFT TECHNICAL MEMORANDUM, FIGURE 2 – OCTOBER 20, 2008 MR. PAUL KIRK

EXHIBIT 7

PRIMARY SITE – ALTERNATIVE A

WASTEWATER DISPOSAL OPTIONS LAND REQUIREMENT



COLEMAN ENGINEERING

EXHIBIT 8

DRINKING WATER
PROCESS FLOW DIAGRAM

Appendix C

Tables 2 and 3 Alternatives A-E Worksheets
Table 11 Alternatives A-E Worksheets
Table 12 Alternatives A-E Worksheet

Redding Rancheria Casino - Alternative A
Proposed Project Full Build-Out
Estimated Wastewater Flow Projections

Estimated Wastewater Flows for Alternative A	Unit	Quantity	Unit flow	Base Flow	A.M		P.M		Typical WEEKDAY Flows	A.M		P.M		Typical WEEKEND Peak Flows	A.M		P.M		AVERAGE Day Flows
			(gpd/unit)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)
CASINO / ENTERTAINMENT																			
Hotel - building area = 182,288 sf	SF	182,288	0.33	60,200															
Standard rooms	Room	225	140	31,500	50%	15,750	50%	15,750	15,750	100%	31,500	100%	31,500	31,500	64%	20,250	64%	20,250	20,250
Suites (rooms)	Room	25	220	5,500	50%	2,750	50%	2,750	2,750	100%	5,500	100%	5,500	5,500	64%	3,536	64%	3,536	3,536
Hotel Lobby, Admin, Back of House	LS	1	2500	2,500	30%	750	50%	1,250	1,000	50%	1,250	100%	2,500	1,875	36%	893	64%	1,607	1,250
Spa	SF	5,000	0.75	3,750	30%	1,125	50%	1,875	1,500	50%	1,875	100%	3,750	2,813	36%	1,339	64%	2,411	1,875
Fitness Center	SF	900	0.5	450	30%	135	50%	225	180	50%	225	100%	450	338	36%	161	64%	289	225
Winter Garden	SF	15,000	0.25	3,750	30%	1,125	50%	1,875	1,500	50%	1,875	100%	3,750	2,813	36%	1,339	64%	2,411	1,875
Outdoor Pool and Facilities	LS	1	4000	4,000	30%	1,200	50%	2,000	1,600	50%	2,000	100%	4,000	3,000	36%	1,429	64%	2,571	2,000
Outdoor Amphitheatre and Facilities	Seats	1,500	5	7,500	0%	-	50%	3,750	1,875	50%	3,750	100%	7,500	5,625	14%	1,071	64%	4,821	2,946
Sub-Total				**59,000**		**22,835**		**29,475**	**26,155**		**48,000**		**59,000**	**53,500**		**30,100**		**37,900**	**34,000**
Casino - building area = 69,515 sf	SF	69,515	0.73	50,800															
Slots	Seat	1,200	20	24,000	45%	10,800	70%	16,800	13,800	70%	16,800	100%	24,000	20,400	52%	12,514	79%	18,857	15,686
Tables (30)	Seat	210	25	5,250	45%	2,363	70%	3,675	3,019	70%	3,675	100%	5,250	4,463	52%	2,738	79%	4,125	3,431
Poker Room	Seat	100	25	2,500	45%	1,125	70%	1,750	1,438	70%	1,750	100%	2,500	2,125	52%	1,304	79%	1,964	1,634
Player's Club	LS	1	2500	2,500	30%	750	50%	1,250	1,000	50%	1,250	100%	2,500	1,875	36%	893	64%	1,607	1,250
Center Bar, "Neighborhood Bars"	LS	1	4500	4,500	30%	1,350	50%	2,250	1,800	50%	2,250	100%	4,500	3,375	36%	1,607	64%	2,893	2,250
Service Bars, Self-Serving Beverage Stations	LS	1	4000	4,000	30%	1,200	50%	2,000	1,600	50%	2,000	100%	4,000	3,000	36%	1,429	64%	2,571	2,000
Back of House spaces	LS	1	8000	8,000	30%	2,400	50%	4,000	3,200	50%	4,000	100%	8,000	6,000	36%	2,857	64%	5,143	4,000
Sub-Total				**50,800**		**19,988**		**31,725**	**25,856**		**31,800**		**50,800**	**41,300**		**23,400**		**37,200**	**30,300**
Food and Beverage - building area = 31,565 sf	SF	31,565	1.9	60,000															
Specialty Restaurants	Seat	66	75	4,950	30%	1,485	65%	3,218	2,351	70%	3,465	100%	4,950	4,208	41%	2,051	75%	3,713	2,882
Café	Seat	100	60	6,000	30%	1,800	65%	3,900	2,850	70%	4,200	100%	6,000	5,100	41%	2,486	75%	4,500	3,493
24-hour Bakery/Deli Counter	Seat	15	50	750	30%	225	65%	488	356	70%	525	100%	750	638	41%	311	75%	563	437
Food Court	Seat	125	150	18,750	30%	5,625	65%	12,188	8,906	70%	13,125	100%	18,750	15,938	41%	7,768	75%	14,063	10,915
Buffet	Seat	225	95	21,375	30%	6,413	65%	13,894	10,153	70%	14,963	100%	21,375	18,169	41%	8,855	75%	16,031	12,443
Sports Bar and Grill Concept	Seat	124	65	8,060	30%	2,418	65%	5,239	3,829	70%	5,642	100%	8,060	6,851	41%	3,339	75%	6,045	4,692
Retail	SF	1,000	0.3	300	40%	120	50%	150	135	70%	210	80%	240	225	49%	146	59%	176	161
Sub-Total				**60,200**		**18,086**		**39,075**	**28,580**		**42,200**		**60,200**	**51,200**		**25,000**		**45,100**	**35,100**
Events Center - building area = 52,200 sf	SF	52,200	0.9	47,000															
Entertainment Venue	Seat	1,800	19	34,200	0%	-	50%	17,100	8,550	100%	34,200	100%	34,200	34,200	29%	9,771	64%	21,986	15,879
Pre-function area, bar, box office	LS	1	7000	7,000	0%	-	50%	3,500	1,750	100%	7,000	100%	7,000	7,000	29%	2,000	64%	4,500	3,250
Stage, Green Room, Back of House, Banquet Kitchen, Storage	LS	1	7000	7,000	0%	-	50%	3,500	1,750	100%	7,000	100%	7,000	7,000	29%	2,000	64%	4,500	3,250
Sub-Total				**48,200**		**-**		**24,100**	**12,050**		**48,200**		**48,200**	**48,200**		**13,800**		**31,000**	**22,400**
Conference Center - building area = 10,080 sf	SF	10,080	1.8	18,200															
Divisible Ballroom	SF	4,800	1	4,800	0%	-	65%	3,120	1,560	100%	4,800	100%	4,800	4,800	29%	1,371	75%	3,600	2,486
Pre-function space, Service Bar, Restrooms	LS	1	6500	6,500	0%	-	65%	4,225	2,113	100%	6,500	100%	6,500	6,500	29%	1,857	75%	4,875	3,366
Banquet Kitchen, Storage, Back of House	LS	1	6500	6,500	0%	-	65%	4,225	2,113	100%	6,500	100%	6,500	6,500	29%	1,857	75%	4,875	3,366
Sub-Total				**17,800**		**-**		**11,570**	**5,785**		**17,800**		**17,800**	**17,800**	**100**	**5,100**	**100**	**13,400**	**9,300**

Redding Rancheria Casino - Alternative A
Proposed Project Full Build-Out
Estimated Wastewater Flow Projections

	Unit	Quantity	Unit flow	Base Flow	A.M		P.M		Typical WEEKDAY Flows	A.M		P.M		Typical WEEKEND Peak Flows	A.M		P.M		AVERAGE Day Flows
			(gpd/unit)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)
Outdoor Sports Retail - building area = 130,000 sf	SF	130,000	0.3	39,000	40%	15,600	50%	19,500	17,550	70%	27,300	80%	31,200	29,250	49%	18,943	59%	22,843	20,893
Sub-Total				**39,000**		**15,600**		**19,500**	**17,550**		**27,300**		**31,200**	**29,300**		**18,943**		**22,843**	**20,900**
Central Plant/Cooling Towers @ 4.5% of gross building area	SF	21,404	3	64,300	50%	32,150	100%	64,300	48,225	50%	32,150	100%	64,300	48,225	50%	32,150	100%	64,300	48,225
Sub-Total				**64,300**		**32,150**		**64,300**	**48,225**		**32,150**		**64,300**	**48,300**		**32,150**		**64,300**	**48,300**
Parking - area = 583,500 sf		583,500																	
Garage (Cars)		1,650																	
Surface (Cars)		600																	
	TOTAL	2,250																	
GRAND TOTAL				275,000		**108,658**		**219,745**	**164,202**		**247,450**		**331,500**	**289,600**		**148,493**		**251,743**	**200,300**
				275,200															
Daily Flows						**Weekday Average Flow**			**164,300**		**Weekend Average Flow**			**289,600**		**Week Average Flow**			**200,300**
Calculating Peaking Factor									1.0					1.4					1.22

Average Water Demand (5% increase over this WW calculation above)		210,400
Landscape Irrigation - 5,000 gpd/acre of landscaping (see calc below)		10,919
Average Day Demand (gpd)		221,319
Max Day Demand (gpd)	315,000	
Max Day Demand (gpm)	219	
Calculated Max/Ave Peaking Factor =		1.4
Peak Hour Demand (gpm) = avg. day x 2.5		385

Total Area (SF) =	475,648			
SEWER Flows		WATER Demand		
Average WeekDay Flow (gpd/SF)	0.35	0.00	peaking factor	Peak Hour
Average WeekEnd Flow (gpd/sf)	**0.61**	**0.67**	1.5	
Average Day Flow (gpd/sf)	**0.42**	**0.45**		1.125

Landscaping Demand Calc	
Estimated area that is landscaped, % =	20%
Assumed unit landscaping water demand, gpd/acre =	5,000
Calculated landscape water demand, gpd =	10,919

NO OUTDOOR RETAIL SPACE			
Total Area (SF) =	345,648		
SEWER Flows		WATER Demand	
Average WeekDay Flow (gpd/SF)	0.42	0.45	peaking factor
Average WeekEnd Flow (gpd/sf)	**0.75**	**0.79**	1.5
Average Day Flow (gpd/sf)	**0.52**	**0.54**	
Peak Hour (use 2.5) (gpd/sf)		1.36	

Redding Rancheria Casino - Alternative B
Proposed Project with No Retail
Estimated Wastewater Flow Projections

Estimated Wastewater Flows for Alternative B	Unit	Quantity	Unit flow	Base Flow	A.M		P.M		Typical WEEKDAY Flows	A.M		P.M		Typical WEEKEND Peak Flows	A.M		P.M		AVERAGE Day Flows
			(gpd/unit)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)
CASINO / ENTERTAINMENT																			
Hotel - building area = 182,288 sf	SF	182,288	0.33	60,200															
Standard rooms	Room	225	140	31,500	50%	15,750	50%	15,750	15,750	100%	31,500	100%	31,500	31,500	64%	20,250	64%	20,250	20,250.00
Suites (rooms)	Room	25	220	5,500	50%	2,750	50%	2,750	2,750	100%	5,500	100%	5,500	5,500	64%	3,536	64%	3,536	3,535.71
Hotel Lobby, Admin, Back of House	LS	1	2500	2,500	30%	750	50%	1,250	1,000	50%	1,250	100%	2,500	1,875	36%	893	64%	1,607	1,250.00
Spa	SF	5,000	0.75	3,750	30%	1,125	50%	1,875	1,500	50%	1,875	100%	3,750	2,813	36%	1,339	64%	2,411	1,875.00
Fitness Center	SF	900	0.5	450	30%	135	50%	225	180	50%	225	100%	450	338	36%	161	64%	289	225.00
Winter Garden	SF	15,000	0.25	3,750	30%	1,125	50%	1,875	1,500	50%	1,875	100%	3,750	2,813	36%	1,339	64%	2,411	1,875.00
Outdoor Pool and Facilities	LS	1	4000	4,000	30%	1,200	50%	2,000	1,600	50%	2,000	100%	4,000	3,000	36%	1,429	64%	2,571	2,000.00
Outdoor Amphitheatre and Facilities	Seats	1,500	5	7,500	0%	-	50%	3,750	1,875	50%	3,750	100%	7,500	5,625	14%	1,071	64%	4,821	2,946.43
Sub-Total				**59,000**		**22,835**		**29,475**	**26,155**		**48,000**		**59,000**	**53,500**		**30,100**		**37,900**	**34,000**
Casino - building area = 69,515 sf	SF	69,515	0.73	50,800															
Slots	Seat	1,200	20	24,000	45%	10,800	70%	16,800	13,800	70%	16,800	100%	24,000	20,400	52%	12,514	79%	18,857	15,685.71
Tables (30)	Seat	210	25	5,250	45%	2,363	70%	3,675	3,019	70%	3,675	100%	5,250	4,463	52%	2,738	79%	4,125	3,431.25
Poker Room	Seat	100	25	2,500	45%	1,125	70%	1,750	1,438	70%	1,750	100%	2,500	2,125	52%	1,304	79%	1,964	1,633.93
Player's Club	LS	1	2500	2,500	30%	750	50%	1,250	1,000	50%	1,250	100%	2,500	1,875	36%	893	64%	1,607	1,250.00
Center Bar, "Neighborhood Bars"	LS	1	4500	4,500	30%	1,350	50%	2,250	1,800	50%	2,250	100%	4,500	3,375	36%	1,607	64%	2,893	2,250.00
Service Bars, Self-Serving Beverage Stations	LS	1	4000	4,000	30%	1,200	50%	2,000	1,600	50%	2,000	100%	4,000	3,000	36%	1,429	64%	2,571	2,000.00
Back of House spaces	LS	1	8000	8,000	30%	2,400	50%	4,000	3,200	50%	4,000	100%	8,000	6,000	36%	2,857	64%	5,143	4,000.00
Sub-Total				**50,800**		**19,988**		**31,725**	**25,856**		**31,800**		**50,800**	**41,300**		**23,400**		**37,200**	**30,300**
Food and Beverage - building area = 31,565 sf	SF	31,565	1.9	60,000															
Specialty Restaurants	Seat	66	75	4,950	30%	1,485	65%	3,218	2,351	70%	3,465	100%	4,950	4,208	41%	2,051	75%	3,713	2,881.61
Café	Seat	100	60	6,000	30%	1,800	65%	3,900	2,850	70%	4,200	100%	6,000	5,100	41%	2,486	75%	4,500	3,492.86
24-hour Bakery/Deli Counter	Seat	15	50	750	30%	225	65%	488	356	70%	525	100%	750	638	41%	311	75%	563	436.61
Food Court	Seat	125	150	18,750	30%	5,625	65%	12,188	8,906	70%	13,125	100%	18,750	15,938	41%	7,768	75%	14,063	10,915.18
Buffet	Seat	225	95	21,375	30%	6,413	65%	13,894	10,153	70%	14,963	100%	21,375	18,169	41%	8,855	75%	16,031	12,443.30
Sports Bar and Grill Concept	Seat	124	65	8,060	30%	2,418	65%	5,239	3,829	70%	5,642	100%	8,060	6,851	41%	3,339	75%	6,045	4,692.07
Retail	SF	1,000	0.3	300	40%	120	50%	150	135	70%	210	80%	240	225	49%	146	59%	176	160.71
Sub-Total				**60,200**		**18,086**		**39,075**	**28,580**		**42,200**		**60,200**	**51,200**		**25,000**		**45,100**	**35,100**
Events Center - building area = 52,200 sf	SF	52,200	0.9	47,000															
Entertainment Venue	Seat	1,800	19	34,200	0%	-	50%	17,100	8,550	100%	34,200	100%	34,200	34,200	29%	9,771	64%	21,986	15,878.57
Pre-function area, bar, box office	LS	1	7000	7,000	0%	-	50%	3,500	1,750	100%	7,000	100%	7,000	7,000	29%	2,000	64%	4,500	3,250.00
Stage, Green Room, Back of House, Banquet Kitchen, Storage	LS	1	7000	7,000	0%	-	50%	3,500	1,750	100%	7,000	100%	7,000	7,000	29%	2,000	64%	4,500	3,250.00
Sub-Total				**48,200**		**-**		**24,100**	**12,050**		**48,200**		**48,200**	**48,200**		**13,800**		**31,000**	**22,400**
Conference Center - building area = 10,080 sf	SF	10,080	1.8	18,200															
Divisible Ballroom	SF	4,800	1	4,800	0%	-	65%	3,120	1,560	100%	4,800	100%	4,800	4,800	29%	1,371	75%	3,600	2,485.71
Pre-function space, Service Bar, Restrooms	LS	1	6500	6,500	0%	-	65%	4,225	2,113	100%	6,500	100%	6,500	6,500	29%	1,857	75%	4,875	3,366.07
Banquet Kitchen, Storage, Back of House	LS	1	6500	6,500	0%	-	65%	4,225	2,113	100%	6,500	100%	6,500	6,500	29%	1,857	75%	4,875	3,366.07
Sub-Total				**17,800**		**-**		**11,570**	**5,785**		**17,800**		**17,800**	**17,800**	**100**	**5,100**	**100**	**13,400**	**9,300**

Redding Rancheria Casino - Alternative B
Proposed Project with No Retail
Estimated Wastewater Flow Projections

	Unit	Quantity	Unit flow	Base Flow	A.M		P.M		Typical WEEKDAY Flows	A.M		P.M		Typical WEEKEND Peak Flows	A.M		P.M		AVERAGE Day Flows
			(gpd/unit)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)
Outdoor Sports Retail - building area = 130,000 sf	SF	-	0.3	-	40%	-	50%	-	-	70%	-	80%	-	-	49%	-	59%	-	-
Sub-Total				-		-		-	-		-		-	-		-		-	-
Central Plant/Cooling Towers @ 4.5% of gross building area	SF	15,554	3	46,700	50%	23,350	100%	46,700	35,025	50%	23,350	100%	46,700	35,025	50%	23,350	100%	46,700	35,025
Sub-Total				46,700		23,350		46,700	35,025		23,350		46,700	35,100		23,350		46,700	35,100
Parking - area = 583,500 sf		583,500																	
Garage (Cars)		1,650																	
Surface (Cars)		600																	
	TOTAL	2,250																	
GRAND TOTAL				236,000		**84,258**		**182,645**	**133,452**		**211,350**		**282,700**	**247,100**		**120,750**		**211,300**	**166,200**
				236,200															
Daily Flows						**Weekday Average Flow**			**133,500**		**Weekend Average Flow**			**247,100**		**Week Average Flow**			**166,200**
Calculating Peaking Factor									1					1.5					1.24

Average Water Demand (5% increase over this WW calculation above)		174,600
Landscape Irrigation - 5,000 gpd/acre of landscaping (see calc below)		7,935
Average Day Demand (gpd)		182,535
Max Day Demand (gpd)	267,400	
Max Day Demand (gpm)	186	
Calculated Max/Ave Peaking Factor =		1.5
Peak Hour Demand (gpm) = avg. day x 2.5		317

Total Area (SF) =	345,648			
SEWER Flows		WATER Demand		
Average WeekDay Flow (gpd/SF)	0.39	0.00	peaking factor	Peak Hour
Average WeekEnd Flow (gpd/sf)	**0.71**	**0.78**	1.5	
Average Day Flow (gpd/sf)	**0.48**	**0.51**		1.28

Landscaping Demand Calc	
Estimated area that is landscaped, % =	20%
Assumed unit landscaping water demand, gpd/acre =	5,000
Calculated landscape water demand, gpd =	7,935

NO OUTDOOR RETAIL SPACE			
Total Area (SF) =	345,648		
SEWER Flows		WATER Demand	
Average WeekDay Flow (gpd/SF)	0.39	0.41	peaking factor
Average WeekEnd Flow (gpd/sf)	**0.71**	**0.75**	1.5
Average Day Flow (gpd/sf)	**0.48**	**0.50**	
Peak Hour (use 2.5) (gpd/sf)		1.26	

Redding Rancheria Casino - Alternative C
Reduced Intensity
Estimated Wastewater Flow Projections

Estimated Wastewater Flows for Alternative C																			
	Unit	**Quantity**	**Unit flow**	**Base Flow**	**A.M**		**P.M**		**Typical WEEKDAY Flows**	**A.M**		**P.M**		**Typical WEEKEND Peak Flows**	**A.M**		**P.M**		**AVERAGE Day Flows**
			(gpd/unit)	**(gpd)**	**(%)**	**(gpd)**	**(%)**	**(gpd)**	**(gpd)**	**(%)**	**(gpd)**	**(%)**	**(gpd)**	**(gpd)**	**(%)**	**(gpd)**	**(%)**	**(gpd)**	**(gpd)**
CASINO / ENTERTAINMENT																			
Hotel - building area = 182,288 sf	SF	182,288	0.33	60,200.00															
Standard rooms	Room	225	140	31,500.00	50%	15,750.00	50%	15,750.00	15,750.00	100%	31,500.00	100%	31,500.00	31,500.00	64%	20,250.00	64%	20,250.00	20,250.00
Suites (rooms)	Room	25	220	5,500.00	50%	2,750.00	50%	2,750.00	2,750.00	100%	5,500.00	100%	5,500.00	5,500.00	64%	3,535.71	64%	3,535.71	3,535.71
Hotel Lobby, Admin, Back of House	LS	1	2500	2,500.00	30%	750.00	50%	1,250.00	1,000.00	50%	1,250.00	100%	2,500.00	1,875.00	36%	892.86	64%	1,607.14	1,250.00
Spa	SF	5,000	0.75	3,750.00	30%	1,125.00	50%	1,875.00	1,500.00	50%	1,875.00	100%	3,750.00	2,812.50	36%	1,339.29	64%	2,410.71	1,875.00
Fitness Center	SF	900	0.5	450.00	30%	135.00	50%	225.00	180.00	50%	225.00	100%	450.00	337.50	36%	160.71	64%	289.29	225.00
Winter Garden	SF	15,000	0.25	3,750.00	30%	1,125.00	50%	1,875.00	1,500.00	50%	1,875.00	100%	3,750.00	2,812.50	36%	1,339.29	64%	2,410.71	1,875.00
Outdoor Pool and Facilities	LS	1	4000	4,000.00	30%	1,200.00	50%	2,000.00	1,600.00	50%	2,000.00	100%	4,000.00	3,000.00	36%	1,428.57	64%	2,571.43	2,000.00
Outdoor Amphitheatre and Facilities	Seats	1,500	5	7,500.00	0%	-	50%	3,750.00	1,875.00	50%	3,750.00	100%	7,500.00	5,625.00	14%	1,071.43	64%	4,821.43	2,946.43
Sub-Total				**59,000**		**22,835**		**29,475**	**26,155**		**48,000**		**59,000**	**53,500**		**30,100**		**37,900**	**34,000**
Casino - building area = 54,412 sf	SF	54,412	0.73	39,800.00															
Slots	Seat	825	20	16,500.00	45%	7,425.00	70%	11,550.00	9,487.50	70%	11,550.00	100%	16,500.00	14,025.00	52%	8,603.57	79%	12,964.29	10,783.93
Tables (25)	Seat	175	25	4,375.00	45%	1,968.75	70%	3,062.50	2,515.63	70%	3,062.50	100%	4,375.00	3,718.75	52%	2,281.25	79%	3,437.50	2,859.38
Poker Room	Seat	40	25	1,000.00	45%	450.00	70%	700.00	575.00	70%	700.00	100%	1,000.00	850.00	52%	521.43	79%	785.71	653.57
Player's Club	LS	1	2500	2,500.00	30%	750.00	50%	1,250.00	1,000.00	50%	1,250.00	100%	2,500.00	1,875.00	36%	892.86	64%	1,607.14	1,250.00
Center Bar, "Neighborhood Bars"	LS	1	4500	4,500.00	30%	1,350.00	50%	2,250.00	1,800.00	50%	2,250.00	100%	4,500.00	3,375.00	36%	1,607.14	64%	2,892.86	2,250.00
Service Bars, Self-Serving Beverage Stations	LS	1	4000	4,000.00	30%	1,200.00	50%	2,000.00	1,600.00	50%	2,000.00	100%	4,000.00	3,000.00	36%	1,428.57	64%	2,571.43	2,000.00
Back of House spaces	LS	1	8000	8,000.00	30%	2,400.00	50%	4,000.00	3,200.00	50%	4,000.00	100%	8,000.00	6,000.00	36%	2,857.14	64%	5,142.86	4,000.00
Sub-Total				**40,900**		**15,544**		**24,813**	**20,178**		**24,900**		**40,900**	**32,900**		**18,200**		**29,500**	**23,800**
Food and Beverage - building area = 30,390 sf	SF	30,390	1.9	57,800.00															
Specialty Restaurants	Seat	66	75	4,950.00	30%	1,485.00	65%	3,217.50	2,351.25	70%	3,465.00	100%	4,950.00	4,207.50	41%	2,050.71	75%	3,712.50	2,881.61
Café	Seat	100	60	6,000.00	30%	1,800.00	65%	3,900.00	2,850.00	70%	4,200.00	100%	6,000.00	5,100.00	41%	2,485.71	75%	4,500.00	3,492.86
24-hour Bakery/Deli Counter	Seat	15	50	750.00	30%	225.00	65%	487.50	356.25	70%	525.00	100%	750.00	637.50	41%	310.71	75%	562.50	436.61
Food Court	Seat	125	150	18,750.00	30%	5,625.00	65%	12,187.50	8,906.25	70%	13,125.00	100%	18,750.00	15,937.50	41%	7,767.86	75%	14,062.50	10,915.18
Buffet	Seat	200	95	19,000.00	30%	5,700.00	65%	12,350.00	9,025.00	70%	13,300.00	100%	19,000.00	16,150.00	41%	7,871.43	75%	14,250.00	11,060.71
Sports Bar and Grill Concept	Seat	124	65	8,060.00	30%	2,418.00	65%	5,239.00	3,828.50	70%	5,642.00	100%	8,060.00	6,851.00	41%	3,339.14	75%	6,045.00	4,692.07
Retail	SF	1,000	0.3	300.00	40%	120.00	50%	150.00	135.00	70%	210.00	80%	240.00	225.00	49%	145.71	59%	175.71	160.71
Sub-Total				**57,900**		**17,373**		**37,532**	**27,452**		**40,500**		**57,800**	**49,200**		**24,000**		**43,400**	**33,700**
Events Center - building area = 52,200 sf	SF	52,200	0.9	47,000.00															
Entertainment Venue	Seat	1,800	19	34,200.00	0%	-	50%	17,100.00	8,550.00	100%	34,200.00	100%	34,200.00	34,200.00	29%	9,771.43	64%	21,985.71	15,878.57
Pre-function area, bar, box office	LS	1	7000	7,000.00	0%	-	50%	3,500.00	1,750.00	100%	7,000.00	100%	7,000.00	7,000.00	29%	2,000.00	64%	4,500.00	3,250.00
Stage, Green Room, Back of House, Banquet Kitchen, Storage	LS	1	7000	7,000.00	0%	-	50%	3,500.00	1,750.00	100%	7,000.00	100%	7,000.00	7,000.00	29%	2,000.00	64%	4,500.00	3,250.00
Sub-Total				**48,200**		**-**		**24,100**	**12,050**		**48,200**		**48,200**	**48,200**		**13,800**		**31,000**	**22,400**
Conference Center - building area = 10,080 sf	SF	10,080	1.8	18,200.00															
Divisible Ballroom	SF	4,800	1	4,800.00	0%	-	65%	3,120.00	1,560.00	100%	4,800.00	100%	4,800.00	4,800.00	29%	1,371.43	75%	3,600.00	2,485.71
Pre-function space, Service Bar, Restrooms	LS	1	6500	6,500.00	0%	-	65%	4,225.00	2,112.50	100%	6,500.00	100%	6,500.00	6,500.00	29%	1,857.14	75%	4,875.00	3,366.07
Banquet Kitchen, Storage, Back of House	LS	1	6500	6,500.00	0%	-	65%	4,225.00	2,112.50	100%	6,500.00	100%	6,500.00	6,500.00	29%	1,857.14	75%	4,875.00	3,366.07
Sub-Total				**17,800**		**-**		**11,570**	**5,785**		**17,800**		**17,800**	**17,800**	**100**	**5,100**	**100**	**13,400**	**9,300**

Redding Rancheria Casino - Alternative C
Reduced Intensity
Estimated Wastewater Flow Projections

	Unit	Quantity	Unit flow	Base Flow	A.M		P.M		Typical WEEKDAY Flows	A.M		P.M		Typical WEEKEND Peak Flows	A.M		P.M		AVERAGE Day Flows
			(gpd/unit)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)
Outdoor Sports Retail - building area = 130,000 sf	SF	130,000	0.3	39,000	40%	15,600.00	50%	19,500	17,550	70%	27,300	80%	31,200	29,250	49%	18,943	59%	22,843	20,893
Sub-Total				39,000		15,600		19,500	17,550		27,300		31,200	29,250		18,943		22,843	20,893
Central Plant/Cooling Towers @ 4.5% of gross building area	SF	20,672	3	62,100	50%	31,050	100%	62,100	46,575	50%	31,050	100%	62,100	46,575	50%	31,050	100%	62,100	46,575
Sub-Total				62,100		31,050		62,100	46,575		31,050		62,100	46,600		31,050		62,100	46,600
Parking - area = 583,500 sf		583,500																	
Garage (Cars)		1,650																	
Surface (Cars)		600																	
GRAND TOTAL				262,800		102,402		209,089	155,745		237,750		317,000	277,450		141,193		240,143	190,693
				262,000															
Daily Flows								**Weekday Average Flow**	155,800				**Weekend Average Flow**	277,500				**Week Average Flow**	190,700
Calculating Peaking Factor									1.0					1.5					1.22

Average Water Demand (5% increase over this WW calculation above)		200,300
Landscape Irrigation - 5,000 gpd/acre of landscaping (see calc below)		10,546
Average Day Demand (gpd)		210,846
Max Day Demand (gpd)	301,900	
Max Day Demand (gpm)	210	
Calculated Max/Ave Peaking Factor =		1.4
Peak Hour Demand (gpm) = avg. day x 2.5		367

Total Area (SF) =	459,370			
SEWER Flows		WATER Demand		
Average WeekDay Flow (gpd/SF)	0.34	0.00	peaking factor	Peak Hour
Average WeekEnd Flow (gpd/sf)	**0.60**	**0.66**	1.5	
Average Day Flow (gpd/sf)	**0.42**	**0.44**		1.10

Landscaping Demand Calc	
Estimated area that is landscaped, % =	20%
Assumed unit landscaping water demand, gpd/acre =	5,000
Calculated landscape water demand, gpd =	10,546

NO OUTDOOR RETAIL SPACE			
Total Area (SF) =	329,370		
SEWER Flows		WATER Demand	
Average WeekDay Flow (gpd/SF)	0.42	0.44	peaking factor
Average WeekEnd Flow (gpd/sf)	**0.75**	**0.79**	1.5
Average Day Flow (gpd/sf)	**0.52**	**0.54**	
Peak Hour (use 2.5) (gpd/sf)		1.35	

Redding Rancheria Casino - Alternaive D
Non-Gaming
Estimated Wastewater Flow Projections

Estimated Wastewater Flows for Alternative D	Unit	Quantity	Unit flow	Base Flow	A.M		P.M		Typical WEEKDAY Flows	A.M		P.M		Typical WEEKEND Peak Flows	A.M		P.M		AVERAGE Day Flows
			(gpd/unit)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)
CASINO / ENTERTAINMENT																			
Hotel - building area = 89,717 sf	SF	89,717	0.33	29,700.00															
Standard rooms	Room	121	140	16,940.00	50%	8,470.00	50%	8,470.00	8,470.00	100%	16,940.00	100%	16,940.00	16,940.00	64%	10,890.00	64%	10,890.00	10,890.00
Suites (rooms)	Room	7	220	1,540.00	50%	770.00	50%	770.00	770.00	100%	1,540.00	100%	1,540.00	1,540.00	64%	990.00	64%	990.00	990.00
Hotel Lobby, Admin, Back of House	LS	1	2500	2,500.00	30%	750.00	50%	1,250.00	1,000.00	50%	1,250.00	100%	2,500.00	1,875.00	36%	892.86	64%	1,607.14	1,250.00
Spa	SF	5,000	0.75	3,750.00	30%	1,125.00	50%	1,875.00	1,500.00	50%	1,875.00	100%	3,750.00	2,812.50	36%	1,339.29	64%	2,410.71	1,875.00
Fitness Center	SF	900	0.5	450.00	30%	135.00	50%	225.00	180.00	50%	225.00	100%	450.00	337.50	36%	160.71	64%	289.29	225.00
Winter Garden	SF		0.25	-	30%	-	50%	-	-	50%	-	100%	-	-	36%	-	64%	-	-
Outdoor Pool and Facilities	LS	1	4000	4,000.00	30%	1,200.00	50%	2,000.00	1,600.00	50%	2,000.00	100%	4,000.00	3,000.00	36%	1,428.57	64%	2,571.43	2,000.00
Outdoor Amphitheatre and Facilities	Seats		5	-	0%	-	50%	-	-	50%	-	100%	-	-	14%	-	64%	-	-
Sub-Total				29,200		12,450		14,590	13,520		23,900		29,200	26,600		15,800		18,800	17,300
Casino - building area = 0 sf	SF	-	0.73	-															
Slots	Seat		20	-	45%	-	70%	-	-	70%	-	100%	-	-	52%	-	79%	-	-
Tables	Seat		25	-	45%	-	70%	-	-	70%	-	100%	-	-	52%	-	79%	-	-
Poker Room	Seat		25	-	45%	-	70%	-	-	70%	-	100%	-	-	52%	-	79%	-	-
Player's Club	LS		2500	-	30%	-	50%	-	-	50%	-	100%	-	-	36%	-	64%	-	-
Center Bar, "Neighborhood Bars"	LS		4500	-	30%	-	50%	-	-	50%	-	100%	-	-	36%	-	64%	-	-
Service Bars, Self-Serving Beverage Stations	LS		4000	-	30%	-	50%	-	-	50%	-	100%	-	-	36%	-	64%	-	-
Back of House spaces	LS		8000	-	30%	-	50%	-	-	50%	-	100%	-	-	36%	-	64%	-	-
Sub-Total				-		-		-	-		-		-	-		-		-	-
Food and Beverage - building area = 12,178 sf	SF	12,178	1.9	23,200.00															
Specialty Restaurants	Seat	66	75	4,950.00	30%	1,485.00	65%	3,217.50	2,351.25	70%	3,465.00	100%	4,950.00	4,207.50	41%	2,050.71	75%	3,712.50	2,881.61
Café	Seat	85	60	5,100.00	30%	1,530.00	65%	3,315.00	2,422.50	70%	3,570.00	100%	5,100.00	4,335.00	41%	2,112.86	75%	3,825.00	2,968.93
24-hour Bakery/Deli Counter	Seat	15	50	750.00	30%	225.00	65%	487.50	356.25	70%	525.00	100%	750.00	637.50	41%	310.71	75%	562.50	436.61
Food Court	Seat		150	-	30%	-	65%	-	-	70%	-	100%	-	-	41%	-	75%	-	-
Buffet	Seat		95	-	30%	-	65%	-	-	70%	-	100%	-	-	41%	-	75%	-	-
Sports Bar and Grill Concept	Seat	99	65	6,435.00	30%	1,930.50	65%	4,182.75	3,056.63	70%	4,504.50	100%	6,435.00	5,469.75	41%	2,665.93	75%	4,826.25	3,746.09
Retail	SF	1,000	0.3	300.00	40%	120.00	50%	150.00	135.00	70%	210.00	80%	240.00	225.00	49%	145.71	59%	175.71	160.71
Sub-Total				17,600		5,291		11,353	8,322		12,300		17,500	14,900		7,300		13,200	10,200
Events Center - building area = 0 sf	SF	-	0.9	-															
Entertainment Venue	Seat		19	-	0%	-	50%	-	-	100%	-	100%	-	-	29%	-	64%	-	-
Pre-function area, bar, box office	LS		7000	-	0%	-	50%	-	-	100%	-	100%	-	-	29%	-	64%	-	-
Stage, Green Room, Back of House, Banquet Kitchen, Storage	LS		7000	-	0%	-	50%	-	-	100%	-	100%	-	-	29%	-	64%	-	-
Sub-Total				-		-		-	-		-		-	-		-		-	-
Conference Center - building area = 0 sf	SF	-	1.8	-															
Divisible Ballroom	SF		1	-	0%	-	65%	-	-	100%	-	100%	-	-	29%	-	75%	-	-
Pre-function space, Service Bar, Restrooms	LS		6500	-	0%	-	65%	-	-	100%	-	100%	-	-	29%	-	75%	-	-
Banquet Kitchen, Storage, Back of House	LS		6500	-	0%	-	65%	-	-	100%	-	100%	-	-	29%	-	75%	-	-
Sub-Total				-		-		-	-		-		-	-		-		-	-

Redding Rancheria Casino - Alternaive D
Non-Gaming
Estimated Wastewater Flow Projections

	Unit	Quantity	Unit flow	Base Flow	A.M		P.M		Typical WEEKDAY Flows	A.M		P.M		Typical WEEKEND Peak Flows	A.M		P.M		AVERAGE Day Flows
			(gpd/unit)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)
Outdoor Sports Retail - building area = 120,000 sf	SF	120,000	0.3	36,000	40%	14,400.00	50%	18,000	16,200	70%	25,200	80%	28,800	27,000	49%	17,486	59%	21,086	19,286
Sub-Total				**36,000**		**14,400**		**18,000**	**16,200**		**25,200**		**28,800**	**27,000**		**17,486**		**21,086**	**19,286**
Central Plant/Cooling Towers @ 4.5% of gross building area	SF	9,985	3	30,000	50%	15,000	100%	30,000	22,500	50%	15,000	100%	30,000	22,500	50%	15,000	100%	30,000	22,500
Sub-Total				**30,000**		**15,000**		**30,000**	**22,500**		**15,000**		**30,000**	**22,500**		**15,000**		**30,000**	**22,500**
Parking - area = ?? sf		-																	
Garage (Cars)																			
Surface (Cars)		200																	
GRAND TOTAL				82,800		**47,141**		**73,943**	**60,542**		**76,400**		**105,500**	**91,000**		**55,586**		**83,086**	**69,286**
				88,900															
Daily Flows								**Weekday Average Flow**	**60,600**				**Weekend Average Flow**	**91,000**				**Week Average Flow**	**69,300**
Calculating Peaking Factor									1.0					1.3					1.14

Average Water Demand (5% increase over this WW calculation above)		72,800
Landscape Irrigation - 5,000 gpd/acre of landscaping (see calc below)		5,094
Average Day Demand (gpd)		77,894
Max Day Demand (gpd)	100,700	
Max Day Demand (gpm)	70	
Calculated Max/Ave Peaking Factor =		1.3
Peak Hour Demand (gpm) = avg. day x 2.5		135

Total Area (SF) =	221,895			
SEWER Flows		WATER Demand		
Average WeekDay Flow (gpd/SF)	0.27	0.00	peaking factor	Peak Hour
Average WeekEnd Flow (gpd/sf)	**0.41**	**0.46**	1.4	
Average Day Flow (gpd/sf)	**0.31**	**0.33**		0.83

Landscaping Demand Calc	
Estimated area that is landscaped, % =	20%
Assumed unit landscaping water demand, gpd/acre =	5,000
Calculated landscape water demand, gpd =	5,094

NO OUTDOOR RETAIL SPACE			
Total Area (SF) =	101,895		
SEWER Flows		WATER Demand	
Average WeekDay Flow (gpd/SF)	0.44	0.46	peaking factor
Average WeekEnd Flow (gpd/sf)	**0.63**	**0.66**	1.3
Average Day Flow (gpd/sf)	**0.49**	**0.52**	
Peak Hour (use 2.5) (gpd/sf)		1.29	

Redding Rancheria Casino - Alternaive E
Alternative Site
Estimated Wastewater Flow Projections

Estimated Wastewater Flows for Alternative E - City of Anderson Alternate Site																			
	Unit	**Quantity**	**Unit flow**	**Base Flow**		**A.M**		**P.M**	**Typical WEEKDAY Flows**		**A.M**		**P.M**	**Typical WEEKEND Peak Flows**		**A.M**		**P.M**	**AVERAGE Day Flows**
			(gpd/unit)	**(gpd)**	**(%)**	**(gpd)**	**(%)**	**(gpd)**	**(gpd)**	**(%)**	**(gpd)**	**(%)**	**(gpd)**	**(gpd)**	**(%)**	**(gpd)**	**(%)**	**(gpd)**	**(gpd)**
CASINO / ENTERTAINMENT																			
Hotel - building area = 165,788 sf	SF	165,788	0.33	54,800															
Standard rooms	Room	225	140	31,500	50%	15,750.00	50%	15,750	15,750	100%	31,500	100%	31,500	31,500	64%	20,250	64%	20,250	20,250
Suites (rooms)	Room	25	220	5,500	50%	2,750.00	50%	2,750	2,750	100%	5,500	100%	5,500	5,500	64%	3,536	64%	3,536	3,536
Hotel Lobby, Admin, Back of House	LS	1	2500	2,500	30%	750.00	50%	1,250	1,000	50%	1,250	100%	2,500	1,875	36%	893	64%	1,607	1,250
Spa	SF	5,000	0.75	3,750	30%	1,125.00	50%	1,875	1,500	50%	1,875	100%	3,750	2,813	36%	1,339	64%	2,411	1,875
Fitness Center	SF	900	0.5	450	30%	135.00	50%	225	180	50%	225	100%	450	338	36%	161	64%	289	225
Winter Garden	SF			-	30%	-	50%	-	-	50%	-	100%	-	-	36%	-	64%	-	-
Outdoor Pool and Facilities	LS	1	4000	4,000	30%	1,200.00	50%	2,000	1,600	50%	2,000	100%	4,000	3,000	36%	1,429	64%	2,571	2,000
Outdoor Amphitheatre and Facilities	Seats	1,500	5	7,500	0%	-	50%	3,750	1,875	50%	3,750	100%	7,500	5,625	14%	1,071	64%	4,821	2,946
Sub-Total				**55,200**		**21,710**		**27,600**	**24,655**		**46,100**		**55,200**	**50,700**		**28,700**		**35,500**	**32,100**
Casino - building area = 69,515 sf	SF	69,515	0.73	50,800															
Slots	Seat	1,200	20	24,000	45%	10,800.00	70%	16,800	13,800	70%	16,800	100%	24,000	20,400	52%	12,514	79%	18,857	15,686
Tables (30)	Seat	210	25	5,250	45%	2,362.50	70%	3,675	3,019	70%	3,675	100%	5,250	4,463	52%	2,738	79%	4,125	3,431
Poker Room	Seat	100	25	2,500	45%	1,125.00	70%	1,750	1,438	70%	1,750	100%	2,500	2,125	52%	1,304	79%	1,964	1,634
Player's Club	LS	1	2500	2,500	30%	750.00	50%	1,250	1,000	50%	1,250	100%	2,500	1,875	36%	893	64%	1,607	1,250
Center Bar, "Neighborhood Bars"	LS	1	4500	4,500	30%	1,350.00	50%	2,250	1,800	50%	2,250	100%	4,500	3,375	36%	1,607	64%	2,893	2,250
Service Bars, Self-Serving Beverage Stations	LS	1	4000	4,000	30%	1,200.00	50%	2,000	1,600	50%	2,000	100%	4,000	3,000	36%	1,429	64%	2,571	2,000
Back of House spaces	LS	1	8000	8,000	30%	2,400.00	50%	4,000	3,200	50%	4,000	100%	8,000	6,000	36%	2,857	64%	5,143	4,000
Sub-Total				**50,800**		**19,988**		**31,725**	**25,856**		**31,800**		**50,800**	**41,300**		**23,400**		**37,200**	**30,300**
Food and Beverage - building area = 31,565 sf	SF	31,565	1.9	60,000															
Specialty Restaurants	Seat	66	75	4,950	30%	1,485.00	65%	3,218	2,351	70%	3,465	100%	4,950	4,208	41%	2,051	75%	3,713	2,882
Café	Seat	100	60	6,000	30%	1,800.00	65%	3,900	2,850	70%	4,200	100%	6,000	5,100	41%	2,486	75%	4,500	3,493
24-hour Bakery/Deli Counter	Seat	15	50	750	30%	225.00	65%	488	356	70%	525	100%	750	638	41%	311	75%	563	437
Food Court	Seat	125	150	18,750	30%	5,625.00	65%	12,188	8,906	70%	13,125	100%	18,750	15,938	41%	7,768	75%	14,063	10,915
Buffet	Seat	225	95	21,375	30%	6,412.50	65%	13,894	10,153	70%	14,963	100%	21,375	18,169	41%	8,855	75%	16,031	12,443
Sports Bar and Grill Concept	Seat	124	65	8,060	30%	2,418.00	65%	5,239	3,829	70%	5,642	100%	8,060	6,851	41%	3,339	75%	6,045	4,692
Retail	SF	1,000	0.3	300	40%	120.00	50%	150	135	70%	210	80%	240	225	49%	146	59%	176	161
Sub-Total				**60,200**		**18,086**		**39,075**	**28,580**		**42,200**		**60,200**	**51,200**		**25,000**		**45,100**	**35,100**
Events Center - building area = 52,200 sf	SF	52,200	0.9	47,000															
Entertainment Venue	Seat	1,800	19	34,200	0%	-	50%	17,100	8,550	100%	34,200	100%	34,200	34,200	29%	9,771	64%	21,986	15,879
Pre-function area, bar, box office	LS	1	7000	7,000	0%	-	50%	3,500	1,750	100%	7,000	100%	7,000	7,000	29%	2,000	64%	4,500	3,250
Stage, Green Room, Back of House, Banquet Kitchen, Storage	LS	1	7000	7,000	0%	-	50%	3,500	1,750	100%	7,000	100%	7,000	7,000	29%	2,000	64%	4,500	3,250
Sub-Total				**48,200**		**-**		**24,100**	**12,050**		**48,200**		**48,200**	**48,200**		**13,800**		**31,000**	**22,400**
Conference Center - building area = 10,080 sf	SF	10,080	1.8	18,200															
Divisible Ballroom	SF	4,800	1	4,800	0%	-	65%	3,120	1,560	100%	4,800	100%	4,800	4,800	29%	1,371	75%	3,600	2,486
Pre-function space, Service Bar, Restrooms	LS	1	6500	6,500	0%	-	65%	4,225	2,113	100%	6,500	100%	6,500	6,500	29%	1,857	75%	4,875	3,366
Banquet Kitchen, Storage, Back of House	LS	1	6500	6,500	0%	-	65%	4,225	2,113	100%	6,500	100%	6,500	6,500	29%	1,857	75%	4,875	3,366
Sub-Total				**17,800**		**-**		**11,570**	**5,785**		**17,800**		**17,800**	**17,800**	**100**	**5,100**	**100**	**13,400**	**9,300**

Redding Rancheria Casino - Alternaive E
Alternative Site
Estimated Wastewater Flow Projections

	Unit	Quantity	Unit flow	Base Flow	A.M		P.M		Typical WEEKDAY Flows	A.M		P.M		Typical WEEKEND Peak Flows	A.M		P.M		AVERAGE Day Flows
			(gpd/unit)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)	(%)	(gpd)	(%)	(gpd)	(gpd)
Outdoor Sports Retail - building area = 120,000 sf	SF	120,000	0.3	36,000	40%	14,400.00	50%	18,000	16,200	70%	25,200	80%	28,800	27,000	49%	17,486	59%	21,086	19,286
Sub-Total				**36,000**		**14,400**		**18,000**	**16,200**		**25,200**		**28,800**	**27,000**		**17,486**		**21,086**	**19,286**
Central Plant/Cooling Towers @ 4.5% of gross building area	SF	20,212	3	60,700	50%	30,350	100%	60,700	45,525	50%	30,350	100%	60,700	45,525	50%	30,350	100%	60,700	45,525
Sub-Total				**60,700**		**30,350**		**60,700**	**45,525**		**30,350**		**60,700**	**45,600**		**30,350**		**60,700**	**45,600**
Parking - area = 583,500 sf		583,500																	
Garage (Cars)		1,650																	
Surface (Cars)		600																	
GRAND TOTAL				**268,200**		**104,533**		**212,770**	**158,652**		**241,650**		**321,700**	**281,800**		**143,836**		**243,986**	**194,086**
				266,800															
Daily Flows							**Weekday Average Flow**		**158,700**			**Weekend Average Flow**		**281,800**			**Week Average Flow**		**194,100**
Calculating Peaking Factor									1.0					1.5					1.2

Average Water Demand (5% increase over this WW calculation above)		######
Landscape Irrigation - 5,000 gpd/acre of landscaping (see calc below)		10,311
Average Day Demand (gpd)		######
Max Day Demand (gpd)	306,300	
Max Day Demand (gpm)	213	
Calculated Max/Ave Peaking Factor =		1.4
Peak Hour Demand (gpm) = avg. day x 2.5		372

Total Area (SF) =	449,148			
SEWER Flows		WATER Demand		
Average WeekDay Flow (gpd/SF)	0.35	0.00	peaking factor	Peak Hour
Average WeekEnd Flow (gpd/sf)	**0.63**	**0.69**	1.5	
Average Day Flow (gpd/sf)	**0.43**	**0.46**		1.15

Landscaping Demand Calc	
Estimated area that is landscaped, % =	20%
Assumed unit landscaping water demand, gpd/acre =	5,000
Calculated landscape water demand, gpd =	10,311

NO OUTDOOR RETAIL SPACE			
Total Area (SF) =	329,148		
SEWER Flows		WATER Demand	
Average WeekDay Flow (gpd/SF)	0.43	0.45	peaking factor
Average WeekEnd Flow (gpd/sf)	**0.77**	**0.81**	1.5
Average Day Flow (gpd/sf)	**0.53**	**0.56**	
Peak Hour (use 2.5) (gpd/sf)		1.39	

Redding Rancheria Casino
Alternative A - Water Balance

100-YEAR RAINFALL

										Conversion from (in) to (MG)			Agronomic Rate			
MONTH	DAY	RAINFALL* (in)	PAN EVAP. (in)	POND EVAP. (in)	POND INFILTRATION (in)	CROP EVAPOTRANSPIRATION** (in/month)	CROP COEFFICIENT*** (alfalfa)	CROP ET (in)	NET RAIN / EVAPO / CROP (in)	NET RAIN / EVAPO / CROP (MG)	POND INFILTRATION (MG)	INFLOW (MG)	DISPOSAL TO SPRAY FIELD (GPD)	DISPOSAL TO SPRAY FIELD (MG)	NET FLOW TO/FROM POND (MG)	ACCUM. IN POND (MG)
NOV	30	9.48	2.72	-1.74	-0.10	2.1	0.9	0	7.74	2.52	-0.03	6.01			8.50	8.50
DEC	31	9.68	1.77	-1.13	-0.10	1.55	0.9	0	8.55	2.78	-0.03	6.21			8.96	17.46
JAN	31	15.08	2.05	-1.31	-0.10	1.55	0.9	0	13.77	4.49	-0.03	6.21			10.66	28.12
FEB	28	12.08	2.80	-1.79	-0.10	2.24	0.9	0	10.29	3.35	-0.03	5.61			8.93	37.05
MARCH	31	13.20	4.96	-3.17	-0.10	3.72	0.9	0	10.03	3.27	-0.03	6.21			9.44	46.50
APRIL	30	5.80	7.01	-4.49	-0.10	5.1	0.9	-4.59	-3.28	-1.07	-0.03	6.01	179,903	-5.40	-0.49	46.01
MAY	31	2.58	9.25	-7.03	-0.10	6.82	0.9	-6.138	-10.59	-3.45	-0.03	6.21	359,806	-11.15	-8.43	37.58
JUNE	30	1.54	11.46	-8.71	-0.10	7.8	0.9	-7.02	-14.19	-4.62	-0.03	6.01	359,806	-10.79	-9.44	28.14
JULY	31	1.26	14.21	-10.80	-0.10	8.68	0.9	-7.812	-17.35	-5.65	-0.03	6.21	359,806	-11.15	-10.63	17.51
AUG	31	1.74	13.50	-10.26	-0.10	7.75	0.9	-6.975	-15.50	-5.05	-0.03	6.21	359,806	-11.15	-10.03	7.48
SEPT	30	4.00	11.54	-8.77	-0.10	5.7	0.9	-5.13	-9.90	-3.22	-0.03	6.01	359,806	-10.79	-8.04	-0.56
OCT	31	4.40	6.34	-4.82	-0.10	4.03	0.9	-3.627	-4.04	-1.32	-0.03	6.21	179,903	-5.58	-0.72	-1.28
TOTAL	**365**	**80.84**	**87.60**	**-64.02**	**-1.20**	**57.04**		**-41.29**	**-24.47**	**-7.97**	**-0.39**	**73.11**	**2,158,834**	**-66.02**	**-1.28**	

INFLOW (WASTEAWATER) (gpd) =	200,300
AREA OF WINTER STORAGE POND (acres) (interation) =	12
LAND APPLICATION AREA (acres) (iteration) =	**59**
SOIL APPLICATION (HYDRAULIC LOADING) RATE for PERCOLATION (gpd/sf) =	0.14
DAYS OF IRRIGATION (days) - Half months of October and April =	183

Pond Size (acres) =	**12**	@ 12' deep
20% Pond Size Increase =	**15**	
20% LAA Increase =	**71**	
Reuse (LAA reduction by 30%) =	**50**	

*Rainfall data from Western Regional Climate Center (1971-2000); assume 100-year rainfall is 2x the average year rainfall
**California Irrigation Management Information System (CIMIS) Reference EvapoTranspiration (Eto) Zones, Department of Water Resources
***Alfalfa crop coefficient range of 0.57 to 1.15 during growing season. Use 0.90 for Zone 14.

Redding Rancheria Casino
Alternative B - Water Balance

100-YEAR RAINFALL

										Conversion from (in) to (MG)			Agronomic Rate			
MONTH	DAY	RAINFALL*	PAN EVAP.	POND EVAP.	POND INFILTRATION	CROP EVAPOTRANSPIRATION**	CROP COEFFICIENT***	CROP ET	NET RAIN / EVAPO / CROP	NET RAIN / EVAPO / CROP	POND INFILTRATION	INFLOW	DISPOSAL TO SPRAY FIELD	DISPOSAL TO SPRAY FIELD	NET FLOW TO/FROM POND	ACCUM. IN POND
		(in)	(in)	(in)	(in)	(in/month)	(alfalfa)	(in)	(in)	(MG)	(MG)	(MG)	(GPD)	(MG)	(MG)	(MG)
NOV	30	9.48	2.72	-1.74	-0.10	2.1	0.9	0	7.74	2.31	-0.03	4.99			7.27	7.27
DEC	31	9.68	1.77	-1.13	-0.10	1.55	0.9	0	8.55	2.55	-0.03	5.15			7.67	14.94
JAN	31	15.08	2.05	-1.31	-0.10	1.55	0.9	0	13.77	4.11	-0.03	5.15			9.24	24.18
FEB	28	12.08	2.80	-1.79	-0.10	2.24	0.9	0	10.29	3.07	-0.03	4.65			7.70	31.88
MARCH	31	13.20	4.96	-3.17	-0.10	3.72	0.9	0	10.03	2.99	-0.03	5.15			8.12	39.99
APRIL	30	5.80	7.01	-4.49	-0.10	5.1	0.9	-4.59	-3.28	-0.98	-0.03	4.99	155,509	-4.67	-0.69	39.30
MAY	31	2.58	9.25	-7.03	-0.10	6.82	0.9	-6.138	-10.59	-3.16	-0.03	5.15	311,018	-9.64	-7.68	31.62
JUNE	30	1.54	11.46	-8.71	-0.10	7.8	0.9	-7.02	-14.19	-4.24	-0.03	4.99	311,018	-9.33	-8.61	23.01
JULY	31	1.26	14.21	-10.80	-0.10	8.68	0.9	-7.812	-17.35	-5.18	-0.03	5.15	311,018	-9.64	-9.70	13.31
AUG	31	1.74	13.50	-10.26	-0.10	7.75	0.9	-6.975	-15.50	-4.63	-0.03	5.15	311,018	-9.64	-9.15	4.16
SEPT	30	4.00	11.54	-8.77	-0.10	5.7	0.9	-5.13	-9.90	-2.96	-0.03	4.99	311,018	-9.33	-7.33	-3.17
OCT	31	4.40	6.34	-4.82	-0.10	4.03	0.9	-3.627	-4.04	-1.21	-0.03	5.15	155,509	-4.82	-0.91	-4.08
TOTAL	**365**	**80.84**	**87.60**	**-64.02**	**-1.20**	**57.04**		**-41.29**	**-24.47**	**-7.31**	**-0.36**	**60.66**	**1,866,110**	**-57.07**	**-4.08**	

INFLOW (WASTEAWATER) (gpd) =	166,200
AREA OF WINTER STORAGE POND (acres) (interation) =	11
LAND APPLICATION AREA (acres) (iteration) =	**51**
SOIL APPLICATION (HYDRAULIC LOADING) RATE for PERCOLATION (gpd/sf) =	0.14
DAYS OF IRRIGATION (days) - Half months of October and April =	183

Pond Size (acres) =	**10**	@ 12' deep
20% Pond Size Increase =	**13**	
20% LAA Increase =	**62**	
Reuse (LAA reduction by 30%) =	**44**	

*Rainfall data from Western Regional Climate Center (1971-2000); assume 100-year rainfall is 2x the average year rainfall
**California Irrigation Management Information System (CIMIS) Reference EvapoTranspiration (Eto) Zones, Department of Water Resources
***Alfalfa crop coefficient range of 0.57 to 1.15 during growing season. Use 0.90 for Zone 14.

Redding Rancheria Casino
Alternative C - Water Balance

100-YEAR RAINFALL

MONTH	DAY	RAINFALL* (in)	PAN EVAP. (in)	POND EVAP. (in)	POND INFILTRATION (in)	CROP EVAPOTRANSPIRATION** (in/month)	CROP COEFFICIENT*** (alfalfa)	CROP ET (in)	NET RAIN / EVAPO / CROP (in)	Conversion from (in) to (MG): NET RAIN / EVAPO / CROP (MG)	Conversion from (in) to (MG): POND INFILTRATION (MG)	Conversion from (in) to (MG): INFLOW (MG)	Agronomic Rate: DISPOSAL TO SPRAY FIELD (GPD)	Agronomic Rate: DISPOSAL TO SPRAY FIELD (MG)	NET FLOW TO/FROM POND (MG)	ACCUM. IN POND (MG)
NOV	30	9.48	2.72	-1.74	-0.10	2.1	0.9	0	7.74	2.31	-0.03	5.72			8.00	8.00
DEC	31	9.68	1.77	-1.13	-0.10	1.55	0.9	0	8.55	2.55	-0.03	5.91			8.43	16.44
JAN	31	15.08	2.05	-1.31	-0.10	1.55	0.9	0	13.77	4.11	-0.03	5.91			9.99	26.43
FEB	28	12.08	2.80	-1.79	-0.10	2.24	0.9	0	10.29	3.07	-0.03	5.34			8.38	34.82
MARCH	31	13.20	4.96	-3.17	-0.10	3.72	0.9	0	10.03	2.99	-0.03	5.91			8.88	43.69
APRIL	30	5.80	7.01	-4.49	-0.10	5.1	0.9	-4.59	-3.28	-0.98	-0.03	5.72	124,146	-3.72	0.99	44.68
MAY	31	2.58	9.25	-7.03	-0.10	6.82	0.9	-6.138	-10.59	-3.16	-0.03	5.91	248,292	-7.70	-4.98	39.70
JUNE	30	1.54	11.46	-8.71	-0.10	7.8	0.9	-7.02	-14.19	-4.24	-0.03	5.72	248,292	-7.45	-5.99	33.71
JULY	31	1.26	14.21	-10.80	-0.10	8.68	0.9	-7.812	-17.35	-5.18	-0.03	5.91	248,292	-7.70	-7.00	26.71
AUG	31	1.74	13.50	-10.26	-0.10	7.75	0.9	-6.975	-15.50	-4.63	-0.03	5.91	248,292	-7.70	-6.44	20.26
SEPT	30	4.00	11.54	-8.77	-0.10	5.7	0.9	-5.13	-9.90	-2.96	-0.03	5.72	248,292	-7.45	-4.71	15.55
OCT	31	4.40	6.34	-4.82	-0.10	4.03	0.9	-3.627	-4.04	-1.21	-0.03	5.91	124,146	-3.85	0.83	16.38
TOTAL	**365**	**80.84**	**87.60**	**-64.02**	**-1.20**	**57.04**		**-41.29**	**-24.47**	**-7.31**	**-0.36**	**69.61**	**1,489,752**	**-45.56**	**16.38**	

INFLOW (WASTEAWATER) (gpd) =	190,700
AREA OF WINTER STORAGE POND (acres) (interation) =	11
LAND APPLICATION AREA (acres) (iteration) =	**57**
SOIL APPLICATION (HYDRAULIC LOADING) RATE for PERCOLATION (gpd/sf) =	0.1
DAYS OF IRRIGATION (days) - Half months of October and April =	183

Pond Size (acres) =	**11**	@ 12' deep
20% Pond Size Increase =	**14**	
20% LAA Increase =	**69**	
Reuse (LAA reduction by 30%) =	**49**	

*Rainfall data from Western Regional Climate Center (1971-2000); assume 100-year rainfall is 2x the average year rainfall

**California Irrigation Management Information System (CIMIS) Reference EvapoTranspiration (Eto) Zones, Department of Water Resources

***Alfalfa crop coefficient range of 0.57 to 1.15 during growing season. Use 0.90 for Zone 14.

Redding Rancheria Casino
Alternative D - Water Balance

100-YEAR RAINFALL

										Conversion from (in) to (MG)			Agronomic Rate			
				POND	POND	CROP	CROP	CROP	NET RAIN /	NET RAIN /	POND		DISPOSAL TO	DISPOSAL TO	NET FLOW TO/FROM	ACCUM. IN
MONTH	DAY	RAINFALL*	PAN EVAP.	EVAP.	INFILTRATION	EVAPOTRANSPIRATION**	COEFFICIENT***	ET	EVAPO / CROP	EVAPO / CROP	INFILTRATION	INFLOW	SPRAY FIELD	SPRAY FIELD	POND	POND
		(in)	(in)	(in)	(in)	(in/month)	(alfalfa)	(in)	(in)	(MG)	(MG)	(MG)	(GPD)	(MG)	(MG)	(MG)
NOV	30	9.48	2.72	-1.74	-0.10	2.1	0.9	0	7.74	0.84	-0.01	2.08			2.91	2.91
DEC	31	9.68	1.77	-1.13	-0.10	1.55	0.9	0	8.55	0.93	-0.01	2.15			3.07	5.97
JAN	31	15.08	2.05	-1.31	-0.10	1.55	0.9	0	13.77	1.50	-0.01	2.15			3.63	9.61
FEB	28	12.08	2.80	-1.79	-0.10	2.24	0.9	0	10.29	1.12	-0.01	1.94			3.05	12.65
MARCH	31	13.20	4.96	-3.17	-0.10	3.72	0.9	0	10.03	1.09	-0.01	2.15			3.23	15.88
APRIL	30	5.80	7.01	-4.49	-0.10	5.1	0.9	-4.59	-3.28	-0.36	-0.01	2.08	39,204	-1.18	0.54	16.42
MAY	31	2.58	9.25	-7.03	-0.10	6.82	0.9	-6.138	-10.59	-1.15	-0.01	2.15	78,408	-2.43	-1.44	14.97
JUNE	30	1.54	11.46	-8.71	-0.10	7.8	0.9	-7.02	-14.19	-1.54	-0.01	2.08	78,408	-2.35	-1.82	13.15
JULY	31	1.26	14.21	-10.80	-0.10	8.68	0.9	-7.812	-17.35	-1.88	-0.01	2.15	78,408	-2.43	-2.18	10.97
AUG	31	1.74	13.50	-10.26	-0.10	7.75	0.9	-6.975	-15.50	-1.68	-0.01	2.15	78,408	-2.43	-1.98	8.99
SEPT	30	4.00	11.54	-8.77	-0.10	5.7	0.9	-5.13	-9.90	-1.07	-0.01	2.08	78,408	-2.35	-1.36	7.64
OCT	31	4.40	6.34	-4.82	-0.10	4.03	0.9	-3.627	-4.04	-0.44	-0.01	2.15	39,204	-1.22	0.48	8.12
TOTAL	**365**	**80.84**	**87.60**	**-64.02**	**-1.20**	**57.04**		**-41.29**	**-24.47**	**-2.66**	**-0.13**	**25.29**	**470,448**	**-14.39**	**8.12**	

INFLOW (WASTEAWATER) (gpd) =	69,300
AREA OF WINTER STORAGE POND (acres) (interation) =	4
LAND APPLICATION AREA (acres) (iteration) =	**18**
SOIL APPLICATION (HYDRAULIC LOADING) RATE for PERCOLATION (gpd/sf) =	0.1
DAYS OF IRRIGATION (days) - Half months of October and April =	183

Pond Size (acres) =	**4**	@ 12' deep
20% Pond Size Increase =	**5**	
20% LAA Increase =	**22**	
Reuse (LAA reduction by 30%) =	**16**	

*Rainfall data from Western Regional Climate Center (1971-2000); assume 100-year rainfall is 2x the average year rainfall
**California Irrigation Management Information System (CIMIS) Reference EvapoTranspiration (Eto) Zones, Department of Water Resources
***Alfalfa crop coefficient range of 0.57 to 1.15 during growing season. Use 0.90 for Zone 14.

Redding Rancheria Casino
Alternative E - Water Balance

100-YEAR RAINFALL

										Conversion from (in) to (MG)			Agronomic Rate			
MONTH	DAY	RAINFALL* (in)	PAN EVAP. (in)	POND EVAP. (in)	POND INFILTRATION (in)	CROP EVAPOTRANSPIRATION** (in/month)	CROP COEFFICIENT*** (alfalfa)	CROP ET (in)	NET RAIN / EVAPO / CROP (in)	NET RAIN / EVAPO / CROP (MG)	POND INFILTRATION (MG)	INFLOW (MG)	DISPOSAL TO SPRAY FIELD (GPD)	DISPOSAL TO SPRAY FIELD (MG)	NET FLOW TO/FROM POND (MG)	ACCUM. IN POND (MG)
NOV	30	9.48	2.72	-1.74	-0.10	2.1	0.9	0	7.74	2.31	-0.03	5.82			8.11	8.11
DEC	31	9.68	1.77	-1.13	-0.10	1.55	0.9	0	8.55	2.55	-0.03	6.02			8.54	16.65
JAN	31	15.08	2.05	-1.31	-0.10	1.55	0.9	0	13.77	4.11	-0.03	6.02			10.10	26.75
FEB	28	12.08	2.80	-1.79	-0.10	2.24	0.9	0	10.29	3.07	-0.03	5.43			8.48	35.22
MARCH	31	13.20	4.96	-3.17	-0.10	3.72	0.9	0	10.03	2.99	-0.03	6.02			8.98	44.21
APRIL	30	5.80	7.01	-4.49	-0.10	5.1	0.9	-4.59	-3.28	-0.98	-0.03	5.82	128,502	-3.86	0.96	45.17
MAY	31	2.58	9.25	-7.03	-0.10	6.82	0.9	-6.138	-10.59	-3.16	-0.03	6.02	257,004	-7.97	-5.14	40.02
JUNE	30	1.54	11.46	-8.71	-0.10	7.8	0.9	-7.02	-14.19	-4.24	-0.03	5.82	257,004	-7.71	-6.15	33.87
JULY	31	1.26	14.21	-10.80	-0.10	8.68	0.9	-7.812	-17.35	-5.18	-0.03	6.02	257,004	-7.97	-7.16	26.70
AUG	31	1.74	13.50	-10.26	-0.10	7.75	0.9	-6.975	-15.50	-4.63	-0.03	6.02	257,004	-7.97	-6.61	20.10
SEPT	30	4.00	11.54	-8.77	-0.10	5.7	0.9	-5.13	-9.90	-2.96	-0.03	5.82	257,004	-7.71	-4.87	15.22
OCT	31	4.40	6.34	-4.82	-0.10	4.03	0.9	-3.627	-4.04	-1.21	-0.03	6.02	128,502	-3.98	0.80	16.02
TOTAL	**365**	**80.84**	**87.60**	**-64.02**	**-1.20**	**57.04**		**-41.29**	**-24.47**	**-7.31**	**-0.36**	**70.85**	**1,542,024**	**-47.16**	**16.02**	

INFLOW (WASTEAWATER) (gpd) =	194,100
AREA OF WINTER STORAGE POND (acres) (interation) =	11
LAND APPLICATION AREA (acres) (iteration) =	**59**
SOIL APPLICATION (HYDRAULIC LOADING) RATE for PERCOLATION (gpd/sf) =	0.1
DAYS OF IRRIGATION (days) - Half months of October and April =	183

Pond Size (acres) =	**11**	@ 12' deep
20% Pond Size Increase =	**14**	
20% LAA Increase =	**71**	
Reuse (LAA reduction by 30%) =	**50**	

*Rainfall data from Western Regional Climate Center (1971-2000); assume 100-year rainfall is 2x the average year rainfall
**California Irrigation Management Information System (CIMIS) Reference EvapoTranspiration (Eto) Zones, Department of Water Resources
***Alfalfa crop coefficient range of 0.57 to 1.15 during growing season. Use 0.90 for Zone 14.

Redding Rancheria Casino
Leach Field Disposal Land Requirement

YEAR-ROUND LEACH FIELD DISPOSAL - Subsurface Land Area Calculations

	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Week Average Sewer flows (gpd)	200,300	166,200	190,700	69,300	194,100
Percolation rate =		0.45	gallons/day/ft2		
Absorption Area Needed (ft2)	445,111	369,333	423,778	154,000	431,333
Trench is 3' wide x 100' long =		300	ft2		
Side wall estimation 1' x 2 sides x 100' =		200	ft2		
TOTAL absorption area =		500	ft2 per 100' trench		
# of 100' trenches	890	739	848	308	863
11-foot separation between pipes (8-foot separation from trench edge to edge)					
Land area (ft^2) =	979,244	812,533	932,311	338,800	948,933
100% Replacement	979,244	812,533	932,311	338,800	948,933
Total Area required (ft^2)	**1,958,489**	**1,625,067**	**1,864,622**	**677,600**	**1,897,867**
Total Area (acres) w/ 100% Replacement	45	38	43	16	44
20% Efficiency Add. (acres)	**54**	**46**	**52**	**20**	**53**

WASTEWATER RECYCLE - Subsurface Land Area Calculations

Leach Field to be designed for maximum possible use. Winter months represent the maximum flows possible.

20% — Winter Months: Percentage of wastewater reused during winter months. Total number of bathrooms and other such facilities will need to be quantified and will affect this percentage.

	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Reduced Sewer Flow	160,240	132,960	152,560	55,440	155,280
Absorption Area Needed (ft^2)	356,089	295,467	339,022	123,200	345,067
# of 100' trenches	713	591	679	247	691
Land area (ft^2) =	784,300	650,100	746,900	271,700	760,100
100% Replacement	784,300	650,100	746,900	271,700	760,100
Total Area required (ft^2)	**1,568,600**	**1,300,200**	**1,493,800**	**543,400**	**1,520,200**
Total Area (acres) w/ 100% Replacement	37	30	35	13	35
20% Efficiency Add. (acres)	**45**	**36**	**42**	**16**	**42**

APPENDIX C

REDDING RANCHERIA CASINO MASTER PLAN DRAFT GRADING AND DRAINAGE STUDY

REDDING RANCHERIA CASINO MASTER PLAN

DRAFT GRADING AND DRAINAGE STUDY

PREPARATION DATE:
FEBRUARY 9, 2018

PREPARED FOR:

REDDING RANCHERIA
2000 REDDING RANCHERIA ROAD
REDDING, CA 96001

PREPARED BY:

SHARRAH DUNLAP SAWYER, INC.
6590 LOCKHEED DRIVE
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Section 1 – Project Description

1.1 Purpose

The purpose of this analysis is to assess the development potential of the undeveloped property described in Section 1.2 as the Proposed Project. This analysis will address project grading, drainage, and stormwater management for the Proposed Project and the project alternatives.

1.2 Project Description

The Redding Rancheria has submitted an application to the Department of the Interior requesting the placement of approximately 232 acres of fee land in trust by the United States upon which the Tribe would construct a casino resort (Proposed Project). The facility would include an approximately 70,000 square foot casino, an approximately 250-room hotel, an event/convention center, a retail center, and associated parking and infrastructure and would be located at the south end of Bechelli Lane in Redding, CA (see Figure 1). The new facility would replace the Tribe's existing casino located at 2100 Redding Rancheria Road in Redding, CA (near the intersection of State Highway 273 and Canyon Road).

This analysis will address the Proposed Project as well as five alternatives, including one off-site alternative, on an equal level basis in both the build out year and cumulative year (likely 2035). Alternatives to be addressed within this report will include the following:

- Alternative A - Proposed Project
- Alternative B – No Big Box Retail
- Alternative C - Reduced Intensity Alternative – smaller casino and hotel
- Alternative D - Non-Gaming Alternative –Convention Center and Hotel
- Alternative E - Alternative Site (in the City of Anderson)

1.3 Project Alternatives

1.3.1. Alternative A - Proposed Project

Alternative A includes the construction of an approximately 70,000 square foot casino, an approximately 250-room hotel, an event/convention center, a retail center, associated parking and infrastructure, and 130,000 square feet of big box retail. Alternative A will be constructed at the Proposed Project Site located at the south end of Bechelli Lane in Redding, CA (see Figure 1). Access to the Project Site from the north will include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south will include a road connection to Smith Road south of the Project Site (see Figure 6).

1.3.2. Alternative B – No Big Box Retail

Alternative B is identical to Alternative A with the exception that Alternative B does not include the 130,000 square feet of big box retail. Alternative B includes the construction of an approximately 70,000 square foot casino, an approximately 250-room hotel, an event/convention center, and associated parking and infrastructure. Alternative B will be constructed at the Proposed Project Site located at the south end of Bechelli Lane in Redding, CA (see Figure 1). Access to the Project Site from the north will include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south will include a road connection to Smith Road south of the Project Site (see Figure 6).

1.3.3. Alternative C – Reduced Intensity Alternative

Alternative C includes the construction of an approximately 57,000 square foot casino, an approximately 250-room hotel, an event/convention center, a retail center, and associated parking and infrastructure, as well as 130,000 square feet of big box retail. The limits of disturbance and project footprint for Alternative C are approximately the same as that of Alternative A. Alternative C will be constructed at the Proposed Project Site located at the south end of Bechelli Lane in Redding, CA (see Figure 1). Access to the Project Site from the north will include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south will include a road connection to Smith Road south of the Project Site (see Figure 6).

1.3.4. Alternative D – Non-Gaming Alternative

Alternative D includes the construction of an approximately 128-room hotel, a retail center, and associated parking and infrastructure, as well as 120,000 square feet of big box retail. Alternative D will be constructed at the Proposed Project Site located at the south end of Bechelli Lane in Redding, CA (see Figure 1). Access to the Project Site from the north will include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south will include a road connection to Smith Road south of the Project Site (see Figure 6).

1.3.5. Alternative E – Alternative Site

Alternative E includes the construction of an approximately 70,000 square foot casino, an approximately 250-room hotel, an event/convention center, a retail center, and associated parking and infrastructure, as well as 120,000 square feet of big box retail. Alternative E will be constructed at an Alternate Project Site located north of North Street and west of Interstate 5 in Anderson California (see Figure 7). Access to the Alternate Project Site will include a road connection to Oak Street as shown on Figure E1.

Section 2 – Existing Site Conditions

2.1 Proposed Project Site – Alternatives A thru D

The Proposed Project site topography is relatively flat with the site sloping from north to south in the uplands portion adjacent to Interstate 5, and the remaining portions of the site sloping from northeast to southwest toward the river. The elevation (NAVD 88) varies on site from a high of roughly 455 feet above mean sea level on the north east corner of the project to a low point of roughly 430 feet above mean sea level near the Sacramento River on the south west corner of the project. In the uplands portion of the site adjacent to Interstate 5, the site slopes from north to south at less than 0.5%. Surface drainage from Interstate 5 is collected in the median and east side of the roadway, then conveyed through a series of pipes across the traveled way to a roadside earth ditch that runs from north to south along the project's eastern boundary. Toward the southern portion of the project site, a natural swale conveys the storm water runoff from the project site as well as the Interstate 5 storm water runoff in a south westerly direction toward the Sacramento River. See Figure 3 for existing topography and existing drainage.

A majority of the uplands portion (eastern portion of the site near Interstate 5) of the Site are either a sandy loam, or loamy sand. The soils found in these uplands portions of the project are excessively drained to well drained soils with rapid to moderately rapid permeability. The majority of the soil located in the lower areas near the river in the southwest portion of the project is riverwash or cobbly alluvium that is subjected to frequent flooding. These soils have highly variable characteristics, and typically are excessively drained with very rapid permeability. The potential for subsurface or surface stormwater infiltration for both the uplands and the lower areas of the Proposed Project site is excellent.

According to the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map #06089C1561G and #06089C1563G, a majority of the Proposed Project site is located within one of two different flood zones from the Sacramento River to the west. A majority of the lowlands portion of the site is located in a special flood hazard area within the 100 year flood plain which means that these areas are subject to inundation during the 100-year event. The uplands portion of the site adjacent to Interstate 5 is located within Zone X. Zone X is defined as an area that lies within the 500 year (0.2% annual chance of flood) flood zone, and may have less than 1' of flooding during a 100-year event. The FEMA 100 year flood plain from the Sacramento River is shown on Figure 3.

FEMA Flood Insurance Rate Map #06089C1561G and #06089C1563G, shows that there is potential overflow from Churn Creek to the Sacramento River. This flow may come from Churn Creek, may spill over Interstate 5 and then would be conveyed overland to the Sacramento River. This potential is discussed in detail in Section 4.1. The FEMA 100 year flood plain from Churn Creek is shown on Figure 3.

Several regulatory agencies have jurisdiction of portions of the Sacramento River, but their jurisdiction falls west of the FEMA 100 year flood plain line. The Agencies and their jurisdictional lines are as follows:

- The Central Valley Flood Protection Board – The Designated Floodway Line refers to the channel of the stream and that portion of the adjoining floodplain reasonably required providing for the passage of a design flood; it is also the floodway between existing levees as adopted by the Central Valley Flood Protection Board (formerly the Reclamation Board) or the Legislature. The Designated Floodway Line follows the FEMA 100 year flood plain line, or is located west of the FEMA 100 year flood plain line adjacent to the Proposed Project site.
- The California State Lands Commission (CSLC) – The CSLC has jurisdiction and management authority over all un-granted tidelands, submerged lands and the beds of navigable lakes and waterways. The CSLC jurisdictional line lies west of the FEMA 100 year flood plain line adjacent to the Proposed Project site.

The eastern bank of the Sacramento River is actively eroding in areas adjacent to the proposed development during exceptionally high river flows. See Section 6.2 streambank erosion details and streambank stabilization recommendations.

2.2 Alternative Project Site – Alternative E

The Alternative Project site topography is relatively flat with the site generally sloping easterly towards the Tormey Drain and Interstate 5. The Tormey Drain bisects the site and runs from southwest to northeast to a box culvert under Interstate 5. The portion of the site located north of the Tormey Drain generally flows from north to south with a high elevation (NAVD 88) at the northwest corner of roughly 420 feet above mean sea level to a low point the easterly project boundary of 413 feet above mean sea level. The portion of the site located south of the Tormey Drain generally flows from south to north with a high elevation along the southerly site boundary of roughly 420 feet above mean sea level to a low point the easterly project boundary of 413 feet above mean sea level. The site generally has slopes less than 0.5%. Surface drainage from surrounding areas west of the project are collected and conveyed via the Tormey Drain through the site eastward under Interstate 5. The site is also bisected by Oak Street running north and south. The portion of the site located west of Oak Street will remain undeveloped and be used for a material borrow area and stormwater infiltration and storage.

Soils types were determined using the *Web Soil Survey* provided by the United States Department of Agriculture Soil Conservation Service and Forest Service. It was determined from the Web Soil Survey that the site consists of Hydrologic Soil Group A and D.

According to the FEMA Flood Insurance Rate Map #06089C1935G, a majority of the Alternative Project site is located within the special flood hazard area within the 100 year flood plain which means that these areas are subject to inundation during the 100-year event. The FEMA 100 year flood plain from the Tormey Drain is shown on Figure E4.

Section 3 – Grading and Drainage

3.1 Proposed Project Access

The proposed project will be accessed from the north by extending Bechelli Lane and from the south by a new road connection to Smith Road as described in the Access Alternative Concepts Memorandum prepared by Kimley-Horn dated July 7, 2017.

3.1.1 Proposed Project Access from the North

As described in the Access Alternative Concepts Memorandum the Proposed Project Site will require significant improvements to the intersection of South Bonneyview Road and Bechelli Lane including road widening and construction of a three lane roundabout at the intersection. The intersection will require numerous retaining walls to accommodate the roundabout footprint and sidewalk extension.

Widening Bechilli Lane to access the Proposed Project Site as described in the Access Alternative Concepts Memorandum would require significant grading, retaining walls, and relocation/extension of existing facilities to avoid impacting the City of Redding's Sunnyhill Wastewater Pump Station infrastructure and the Anderson Cottonwood Irrigation District's (ACID) canal. Significant grading will be required to maintain access to the adjacent residential properties, Sunnyhill Wastewater Pump Station and the ACID canal. Additional grading may be required to mitigate the 28 lost parking spaces eliminated by the Bechelli Lane widening as described in the Access Alternatives Concepts Memorandum.

3.1.2 Proposed Project Access from the South

As described in the Access Alternative Concepts Memorandum, a Shasta County Standard "Major Local Rural" road will be constructed south to Smith Road. At the intersection of Smith Road, a Shasta County Standard Road Connection will be constructed. These improvements will require minimal grading beyond the typical roadway infrastructure (street improvements, pedestrian facilities, drainage and other utility infrastructure, etc.). The road will be designed to follow the existing terrain where possible, and minimize the roadway grading footprint and impact. It is anticipated that the access road will extend approximately 3,500 feet south to Smith Road and the grading footprint will be approximately 5 acres.

3.2 Alternative A – Proposed Project Grading

The grading for Alternative A has been designed to be a balanced earthwork operation, meaning the cut and fill quantities will be the same and there is no import or export of material required. The finished floor elevations (including basements) for each of the buildings were established based upon the adjacent top of bank elevation of the Sacramento River west of the development. The finished floor elevations (including basements) are approximately 3 feet above the adjacent top of bank elevation and the FEMA 100-year water surface elevation.

The parking lots are graded generally to flow from west to east at approximately 2% cross slope towards the access road with runoff being collected and conveyed in the underground storm drain system. The grades in the parking lots have been designed to have a minimum of approximately 1% slope and a maximum of approximately 4%, see Figure A3. For safety all access routes from the building sites to the access road will be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot will be approximately 1-foot above the FEMA 100-year floodplain elevation. Since the development site is entirely out of the FEMA 100-year floodplain the soil removal will not change the FEMA 100-year flood delineation.

The access road runs north and south along the project's easterly boundary (adjacent to Interstate 5), see Figure A1. The profile of the access road has been designed to match the existing grade to minimize earthwork from Bechelli Lane at the north to Smith Road at the south.

A 40-feet wide, 5-foot deep vegetated swale has been designed to run north to south between the access road and Interstate 5 approximately 1,000 feet south of the project's northerly line. This vegetated swale will convey project runoff, provide stormwater filtration and infiltration, as well as provide a bypass channel for the 600-700 cubic feet per second flow that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale then passes through a large box culvert under the access road and to a 650,000 cubic foot wet pond as shown on Figure A4.

The wet pond is sized per the California Stormwater Quality Association (CASQA) California Stormwater BMP Handbook for New Development and Redevelopment, see calculations in Appendix C. The wet pond will store water and allow for infiltration into the native soil.

Table 3.1 - Grading Quantities – Alternative A

DISTURBANCE AREA	57 ACRES	SEE FIGURE A1 & A2
VOLUME OF CUT	94,000 CUBIC YARDS	SEE FIGURE A5
VOLUME OF FILL (ADJUSTED FOR MATERIAL SHRINK)	94,000 CUBIC YARDS	SEE FIGURE A5
INFILTRATION / WET POND SIZE	650,000 CUBIC FEET	SEE FIGURE A4 & A6

See Figures A1-A6 for Alternative A grading and drainage Exhibits.

3.3 Alternative B – No Big Box Retail Grading

The grading for Alternative B has been designed to be a balanced earthwork operation. The finished floor elevations for each of the buildings were established based upon the adjacent top of bank elevation of the Sacramento River west of the development. The finished floor elevations (including basements) are approximately 2 to 3 feet above the adjacent top of bank elevation and the FEMA 100-year water surface elevation.

The parking lots are graded generally to flow from west to east at approximately 2% cross slope towards the access road with runoff being collected and conveyed in the underground storm drain system. The grades in the parking lots have been designed to have a minimum of approximately 1% slope and a maximum of approximately 4%, see Figure B3. For safety all access routes from the building sites to the access road will be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot will be approximately 1-foot above the FEMA 100-year floodplain elevation. Since the development site is entirely out of the FEMA 100-year floodplain the soil removal will not change the FEMA 100-year flood delineation.

The access road runs north and south along the project's easterly boundary (adjacent to Interstate 5), see Figure B1. The profile of the access road has been designed to match the existing grade to minimize earthwork from Bechelli Lane at the north to Smith Road at the south.

A 40-feet wide, 5-foot deep vegetated swale has been designed to run north to south between the access road and Interstate 5 approximately 1,000 feet south of the project's northerly line. This vegetated swale will convey project runoff, provide stormwater filtration and infiltration, as well as provide a bypass channel for the 600-700 cubic feet per second flow that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale then passes through a large box culvert under the access road and to a 510,000 cubic foot wet pond as shown on Figure B4.

The wet pond is sized per the CASQA California Stormwater BMP Handbook for New Development and Redevelopment, see calculations in Appendix C. The wet pond will store water and allow for infiltration into the native soil.

Table 3.2 - Grading Quantities – Alternative B

DISTURBANCE AREA	48 ACRES	SEE FIGURE B1 & B2
VOLUME OF CUT	80,000 CUBIC YARDS	SEE FIGURE B5
VOLUME OF FILL (ADJUSTED FOR MATERIAL SHRINK)	80,000 CUBIC YARDS	SEE FIGURE B5
INFILTRATION / WET POND SIZE	510,000 CUBIC FEET	SEE FIGURE B4 & B6

See Figures B1-B6 for Alternative B grading and drainage Exhibits.

3.4 Alternative C – Reduced Intensity Alternative

The grading for Alternative C has been designed to be a balanced earthwork operation. The finished floor elevations for each of the buildings were established based upon the adjacent top of bank elevation of the Sacramento River west of the development. The finished floor elevations (including basements) are approximately 3 feet above the adjacent top of bank elevation and the FEMA 100-year water surface elevation.

The parking lots are graded generally to flow from west to east at approximately 2% cross slope towards the access road with runoff being collected and conveyed in the underground storm drain system. The grades in the parking lots have been designed to have a minimum of approximately 1% slope and a maximum of approximately 4%, see Figure C3. For safety all access routes from the building sites to the access road will be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot will be approximately 1-foot above the FEMA 100-year floodplain elevation. Since the development site is entirely out of the FEMA 100-year floodplain the soil removal will not change the FEMA 100-year flood delineation.

The access road runs north and south along the project's easterly boundary (adjacent to Interstate 5), see Figure C1. The profile of the access road has been designed to match the existing grade to minimize earthwork from Bechelli Lane at the north to Smith Road at the south.

A 40-feet wide, 5-foot deep vegetated swale has been designed to run north to south between the access road and Interstate 5 approximately 1,000 feet south of the project's northerly line. This vegetated swale will convey project runoff, provide stormwater filtration and infiltration, as well as provide a bypass channel for the 600-700 cubic feet per second flow that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale then passes through a large box culvert under the access road and to a 650,000 cubic foot wet pond as shown on Figure C4.

The wet pond is sized per the CASQA California Stormwater BMP Handbook for New Development and Redevelopment, see calculations in Appendix C. The wet pond will store water and allow for infiltration into the native soil.

Table 3.3 - Grading Quantities – Alternative C

Disturbance Area	57 acres	See Figure C1 & C2
Volume of Cut	94,000 cubic yards	See Figure C5
Volume of Fill (Adjusted for Material shrink)	94,000 cubic yards	See Figure C5
Infiltration / Wet Pond size	650,000 cubic feet	See Figure C4 & C6

See Figures C1-C6 for Alternative C grading and drainage Exhibits.

3.5 Alternative D – Non-Gaming Alternative

The grading for Alternative D has been designed to be a balanced earthwork operation. The finished floor elevations for each of the buildings were established based upon the adjacent top of bank elevation of the Sacramento River west of the development. The finished floor elevations are approximately 3 feet above the adjacent top of bank elevation and the FEMA 100-year water surface elevation.

The parking lots are graded generally to flow from west to east at approximately 2% cross slope towards the access road with runoff being collected and conveyed in the underground storm drain system. The grades in the parking lots have been designed to have a minimum of approximately 1% slope and a maximum of approximately 4%, see Figure D3. For safety all access routes from the building sites to the access road will be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot will be approximately 1-foot above the FEMA 100-year floodplain elevation. Since the development site is entirely out of the FEMA 100-year floodplain the soil removal will not change the FEMA 100-year flood delineation.

The access road runs north and south along the project's easterly boundary (adjacent to Interstate 5), see Figure D1. The profile of the access road has been designed to match the existing grade to minimize earthwork from Bechelli Lane at the north to Smith Road at the south.

A 40-feet wide, 5-foot deep vegetated swale has been designed to run north to south between the access road and Interstate 5 approximately 1,000 feet south of the project's northerly line. This vegetated swale will convey project runoff, provide stormwater filtration and infiltration, as well as provide a bypass channel for the 600-700 cubic feet per second flow that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale then passes through a large box culvert under the access road and to a 450,000 cubic foot wet pond as shown on Figure D4.

The wet pond is sized per the CASQA California Stormwater BMP Handbook for New Development and Redevelopment, see calculations in Appendix C. The wet pond will store water and allow for infiltration into the native soil.

Table 3.4 - Grading Quantities – Alternative D

DISTURBANCE AREA	39 ACRES	SEE FIGURE D1 & D2
VOLUME OF CUT	75,000 CUBIC YARDS	SEE FIGURE D5
VOLUME OF FILL (ADJUSTED FOR MATERIAL SHRINK)	75,000 CUBIC YARDS	SEE FIGURE D5
INFILTRATION / WET POND SIZE	450,000 CUBIC FEET	SEE FIGURE D4 & D6

See Figures D1-D6 for Alternative D grading and drainage Exhibits.

3.6 Alternative E – Alternative Site

The grading for Alternative E has been designed to be a balanced earthwork operation. The finished floor elevations for each of the buildings were established based upon the FEMA 100-year water surface elevation of the Tormey Drain that runs southwest to north east through the middle of the project. The finished floor elevations (including basements) are approximately 2 to 3 feet above the FEMA 100-year water surface elevation of the Tormey Drain.

The parking lots are graded generally to flow from west to east at approximately 2% cross slope towards the access road with runoff being collected and conveyed in the underground storm drain system. The grades in the parking lots have been designed to have a minimum of approximately 1% slope and a maximum of approximately 4%, see Figure E2.

The access road runs north and south along the project's easterly boundary (adjacent to Interstate 5), see Figure E1. Since the project proposes a large amount of fill within the 100-year flood plain, an excavation equal to that fill volume must be constructed in order to prevent additional flooding and mitigate for the proposed fill within the flood plain. Two large retention ponds will be constructed along the southern portion of the project, a large pond on the west side of Oak Street, and a smaller one on the east side of Oak Street.

Table 3.5 - Grading Quantities – Alternative E

DISTURBANCE AREA	52 ACRES	SEE FIGURE E1
VOLUME OF CUT	138,000 CUBIC YARDS	SEE FIGURE E2
VOLUME OF FILL (ADJUSTED FOR MATERIAL SHRINK)	138,000 CUBIC YARDS	SEE FIGURE E2
RETENTION POND SIZE	99,000 CUBIC FEET	SEE FIGURE E4

See Figures E1-E4 for Alternative E grading and drainage Exhibits.

3.7 Cumulative Project Grading Impacts

The proposed project and all the alternatives will be designed in such a way that the grading will be a balanced earthwork operation, meaning the cut and fill quantities will be the same and there is no import or export of material required. There will be no fill placed in the FEMA 100-year floodplain. There will be no adverse impacts on the existing FEMA 100-year floodplain as a result of the project grading.

Additionally, hazardous materials that FEMA has identified as being "extremely hazardous or vulnerable to flood conditions" will not be stored within the 500-year floodplain of the proposed development.

For safety all access routes from the building sites to the access road will be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot will be approximately 1-foot above the FEMA 100-year floodplain elevation. Since the development site is entirely out of the FEMA 100-year floodplain the soil removal will not change the FEMA 100-year flood delineation.

Section 4 – Hydrology and Hydraulics – Proposed Site

4.1 Description of Existing Watershed Characteristics

The site for Alternatives A, B, C, and D is relatively flat and generally drains southwesterly from Interstate 5 towards the Sacramento River. The 232 -acre site is a part of the Sacramento River Basin and consists of pastureland and scattered oak trees. Soils types were determined using the *Web Soil Survey* provided by the United States Department of Agriculture Soil Conservation Service and Forest Service. It was determined from the Web Soil Survey that the site consists of Hydrologic Soil Group A.

The current FEMA Flood Insurance Rate Map (FIRM) identifies that the developed area of the proposed project is outside of the 100-year floodplain but within the 500-year floodplain. The State Central Valley Flood Protection Board Floodway Map shows that the proposed project is outside of the designated floodway. Figures A7, B7, C7, and D7 show both the FEMA 100-year floodplain and the designated floodway as compared to the project.

In this area an estimated flow of 600 to 700 cubic feet per second at a depth of approximately 9 inches, as identified by a State of California Department of Water Resources work map, could cross Interstate 5 from the east (Churn Creek). This hydrologic and hydraulic model of Churn Creek shows that Churn Creek could overtop Interstate 5, and that could cause shallow overflow across the project site. In discussions with Brett Ditzler with Caltrans, there are no historical records of this section of Interstate 5 ever overtopping. Caltrans found a note in their files stating that not even in the large rainfall event of 1964, did Churn Creek overtop I-5. However, in the event that this might happen all the alternatives have been designed to convey possible floodwaters from Churn Creek that may overtop Interstate 5 via a large newly constructed vegetated swale that parallels Interstate 5 and discharges into the proposed infiltration wet pond south of the proposed development. The vegetated swale has been sized to convey the possible overflow from Churn Creek. The proposed channel has been oversized by 35% to accommodate increases in peak runoff that might occur in the future.

4.2 Methodology

Hydrology Calculations were prepared using engineering industry standard methodology and the on-site storm drain conveyance system will be designed using local jurisdiction requirements regarding storm event. Peak flows for the 2-, 10-, and 100-year storm events for a 24-hour period were estimated using the United States Army Corp of Engineers flood hydrograph package HEC-1 to model rainfall runoff. Rainfall estimates are discussed in detail within the *City of Redding Department of Public Works Hydrology Manual*. An excerpt from the manual discussing the calculation of Redding Area design storms can be found in Appendix A. Existing peak flows can be in found in Table 4.1. The Rational Method was used to estimate the proposed size of the on-site storm drain conveyance system. The Darcy Equation was used to estimate the amount of infiltration that will be achieved in the proposed storm drain conveyance and infiltration system.

4.2.1 Alternative Studies

There are two hydrologic studies that encompass the project area; The Army Corps of Engineers Comprehensive Study (Sacramento and San Joaquin River Basins Comprehensive Study – 2002) and the current FEMA 100-year floodplain (2011). The intent of the Army Corps of Engineers Comprehensive Study was to inventory resource conditions within the Sacramento and San Joaquin River Basins and to analyze problems and opportunities for flood management and ecosystem restoration. The flood delineation for the Army Corps of Engineers Comprehensive Study (Sacramento and San Joaquin River Basins Comprehensive Study – 2002) used a "composite floodplain" concept, which considers a combination of several flood events, each shaping the floodplain at different locations at different times. The flood events considered ranged from the from the 2-year to the 500-year storm event. However, the 10- and 500-year events were not computed or mapped between Redding and Deer Creek (which is located just upstream of Woodson Bridge in Corning, California approximately 70 river miles downstream of the proposed development). Each flood event was combined for the maximum extent of the composite floodplain for a conservative approach. The composite floodplain, ACOE Comprehensive Study Line, shown (the pink area shown in the California Department of Water Resources Best Available Maps) does not include the operational effects of headwaters reservoirs. The ACOE study recognizes that Shasta Reservoir has 1.3 million acre-feet of flood control space and operates for the Sacramento River at Keswick (upstream of the proposed development) and Bend Bridge (30 miles downstream of the project in Red Bluff, California). Between Keswick and Bend there are several unregulated tributaries that generate significant inflows to the Sacramento River. There are no significant unregulated tributaries between the project and Shasta Dam, so Shasta Reservoir completely regulates the river flow at the project location.

The ACOE floodplain composite line in the area of the proposed development has no elevation associated with it as the river profiles end at Woodson Bridge. Extensive topographic data was collected south of the Woodson Bridge, producing 2-foot contour mapping whereas the study north of Woodson Bridge is much less detailed. The study north of Woodson Bridge used topography in the overbank areas that was derived from USGS 30-meter (roughly 98-feet) digital elevation models with 10-foot contour intervals. The detail of the floodplain model is dependent on the detail of the overbank topography. In the development area the existing topography varies a few feet; therefore, using USGS 30-meter topography with 10-foot contour intervals would not pick up the existing detailed terrain. The ACOE Comprehensive Study Line is not consistent with the known existing topography of the proposed development and was not studied in detail in the region of the proposed project.

The current FEMA 100-year floodplain, effective March 17, 2011, is based on a detailed study with detailed cross sections for the Sacramento River throughout the Redding Area. These cross sections show flood elevations for the 100-year storm event. The current FEMA 100-year floodplain follows the existing topography in the project development area. In discussions with Raul Barba of the California Department of Water resources regarding the ACOE Comprehensive Study Line, it was stated that the FEMA 100-year Floodplain shown on the Flood Insurance Maps is the regulatory line regarding flood elevations and special building requirements. Additionally, as stated on the FEMA website, FEMA does not have setback guidelines from river channels. If no part of the structure falls within the FEMA 100-year floodplain, there are no special building requirements. If there is an encroachment, then FEMA has very specific requirements that must be followed. Since the proposed development does not encroach into the FEMA 100-year floodplain, there are no special requirements.

For all these reasons and consistent with our telephone conversations with Raul Barba of the California Department of Water resources we are using the well-studied and documented FEMA 100-year floodplain as the best available and regulatory 100-year floodplain for this project. All hydrology exhibits clearly show that no part of the proposed development falls within the FEMA 100-year floodplain.

4.3 Results of Analysis

The existing condition peak flows for Alternatives A through D were calculated and are summarized in Table 4.1. These flows were calculated for the overall developable project area (66.2-acres) which is shown in Figure A6. The HEC-1 input parameters and hydrologic calculations can be found in Appendix A.

Table 4.1: Estimated Existing Condition Peak Flows

Storm Event	Existing Condition Peak Flow, cfs
2-YEAR	3
10-YEAR	7
100-YEAR	19

With development the post-developed runoff will be captured by onsite inlets and conveyed by a series of perforated storm drain pipe and drain rock infiltration trenches to the sandy loam or gravel layer below or to the proposed vegetated swale along the frontage road.

In order to convey the potential overflow from Churn Creek, a vegetated swale will be constructed between the proposed frontage road and Interstate 5. This proposed vegetated swale will be approximately 40-feet wide and 5-feet deep and is shown in Appendix D. It will have a longitudinal slope of 0.4 percent to encourage infiltration to the sandy gravelly layer below. The vegetated swale will convey the onsite runoff, and when necessary the potential overflow from Churn Creek, from the project to a proposed water quality retention facility and ultimately to the Sacramento River. The proposed swale along with the water quality retention facility will act as an infiltration trench and infiltration basin and wet pond. Preliminary calculations can be found in Appendix D.

6.2.1 Alternative A – Proposed Project

With development of the proposed project, the site will develop into 18% rooftop, sidewalks, and parking lot. Table 4.2 summarizes the peak flows from the post-development condition. The HEC-1 input parameters and hydrologic calculations can be found in Appendix A.

Table 4.2: Estimated Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs
2-YEAR	87
10-YEAR	118
100-YEAR	174

In the post-development condition the on-site drainage basin will be broken into four separate drainage areas, Drainage Area #1, Drainage Area #2, Drainage Area #3, and Drainage Area #4. These drainage areas are shown in Figure A7. Each drainage area is less than 25 acres so a design storm of 10 years was used to estimate the size of the storm drain pipe.

<u>Drainage Area #1</u> is approximately 16 acres in size and will drain the runoff from the proposed north parking lot, entry, and Big Box Retail. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will range from 15 to 36 inches in size.

<u>Drainage Area #2</u> is approximately 4 acres in size and will drain the runoff from approximately half of the east side of the proposed casino. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will be a maximum of 24 inches in size.

<u>Drainage Area #3</u> is approximately 6 acres in size and will drain the runoff from the remainder of the east side of the casino. A series of inlets and storm drain pipe will collect

and convey the runoff to the proposed infiltration channel. The storm drain pipe will range from 15 to 30 inches in size.

Drainage Area #4 is approximately 4 acres in size and will drain the runoff from the proposed south parking lot. A series of inlets and perforated storm drain pipe will collect and convey the runoff to the Sacramento River. The perforated storm drain pipe will be a maximum of 24 inches in size and will be placed within a drain rock infiltration trench three feet wide. This infiltration trench will infiltrate 1.3 cubic feet per second of the peak flow.

Table 4.3 summarizes the post-development peak flows for each drainage area for the 2- and 10- year events.

Table 4.3: Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs			
	Drainage Area #1	Drainage Area #2	Drainage Area #3	Drainage Area #4
2-YEAR	36	10	14	11
10-YEAR	47	14	19	14

The proposed infiltration channel will be sized to convey the overflow from Churn Creek to the Sacramento River. The channel has a 20-foot bottom, 2:1 side slopes, with a longitudinal slope of 0.4 percent. This large flat channel will also convey the on-site stormwater that does not infiltrate to the proposed water quality detention pond. Using Darcy's Law the maximum flow that the proposed channel can infiltrate was calculated to be approximately 182 cubic feet per second as shown in Appendix A, which is larger than the calculated 100-year peak flow of 174 cubic feet per second. Comparing this calculated flow to the peak flows shown in Table 4.2 the proposed channel has the ability to infiltrate the 2-, 10-, and 100-year events.

Peak flow and infiltration calculations can be found in Appendix D. Pipe and infiltration trench sizing calculations can be found in Appendix D.

6.2.2 Alternative B – No Big Box Retail

With development of the proposed project, the site will develop into 13% rooftop, sidewalks, and parking lot. Table 4.4 summarizes the peak flows from the post-development condition. The HEC-1 input parameters and hydrologic calculations can be found in Appendix A.

Table 4.4: Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs
2-YEAR	64
10-YEAR	90
100-YEAR	139

In the post-development condition the on-site drainage basin will be broken into four separate drainage areas, Drainage Area #1, Drainage Area #2, Drainage Area #3, and Drainage Area #4. These drainage areas are shown in Figure B7. Each drainage area is less than 25 acres so a design storm of 10 years was used to estimate the storm drain pipe diameter.

Drainage Area #1 is approximately 6.5 acres in size and will drain the runoff from the proposed north parking lot and entry. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will range from 15 to 30 inches in size.

Drainage Areas #2, #3, and #4 are the same as Alternative A.

Table 4.5 summarizes the post-development peak flows for each drainage area for the 2- and 10- year events.

Table 4.5: Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs			
	Drainage Area #1	Drainage Area #2	Drainage Area #3	Drainage Area #4
2-YEAR	15	10	14	11
10-YEAR	20	14	19	14

The maximum flow that the proposed channel can infiltrate was calculated to be approximately 182 cubic feet per second as shown in Appendix A, which is much larger than the calculated peak flows shown in Tables 4.4 and 4.5. Therefore the proposed channel has the ability to infiltrate the 2-, 10-, and 100-year events.

Peak flow and infiltration calculations can be found in Appendix D. Pipe and infiltration trench sizing calculations can be found in Appendix D.

6.2.3 Alternative C – Reduced Intensity Alternative

Hydrologically and hydraulically speaking, Alternative C is the same as Alternative A.

6.2.4 Alternative D – Non-Gaming Alternative

With development of the proposed project, the site will develop into 10% rooftop, sidewalks, and parking lot. Table 4.6 summarizes the peak flows from the post-development condition. The HEC-1 input parameters and hydrologic calculations can be found in Appendix A.

Table 4.6: Estimated Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs
2-YEAR	52
10-YEAR	73
100-YEAR	117

In the post-development condition, the on-site drainage basin will be broken into two separate drainage areas, Drainage Area #1 and Drainage Area #2. These drainage areas are shown on Figure D7. Each drainage area is less than 25 acres, so a design storm of 10 years was used to estimate the storm drain pipe diameter.

Drainage Area #1 is approximately 10 acres in size and will drain the runoff from the proposed north parking lot and Big Box Retail. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will range from 15 to 30 inches in size.

Drainage Area #2 is approximately 6 acres in size and will drain the runoff from the proposed hotel and south parking lot. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will be a maximum of 30 inches in size.

Table 4.7 summarizes the post-development peak flows for each drainage area for the 2- and 10- year events.

Table 4.7: Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs	
	Drainage Area #1	Drainage Area #2
2-YEAR	23	15
10-YEAR	32	20

The maximum flow that the proposed channel can infiltrate was calculated to be approximately 182 cubic feet per second as shown in Appendix A, which is much larger than the calculated peak flows shown in Tables 4.6 and 4.7. Therefore, the proposed channel has the ability to infiltrate the 2-, 10-, and 100-year events.

Peak flow and infiltration calculations can be found in Appendix D. Pipe and infiltration trench sizing calculations can be found in Appendix D.

6.3 Cumulative Project Drainage Impacts

As seasonal precipitation patterns may be changing, and rainfall may become more concentrated and intense the following has been considered in the hydraulic design of the storm drain conveyance system to accommodate future peak flows:

- The on-site storm drain system will be oversized by at least 25%, leaving additional capacity for future conditions.
- The design of the storm drain pipe system provides infiltration into the loam soil, however the calculations neglect the infiltration into the ground by the proposed LID features; vegetated swales, retention pond, and infiltration trenches which is a conservative approach and adds additional capacity to the system.

The flow in the Sacramento River adjacent to the project is almost entirely regulated by the upstream releases from Shasta Dam and Keswick Dam. The project drainage system has been designed in such a way that there will be no increase in flows downstream. This will be accomplished using infiltrations trenches, an infiltration wet pond, and numerous other stormwater quality BMPs that encourage groundwater infiltration as described in Section 6.1.

Surrounding development will be subject to the City of Redding's City Council Policy 1806, the City of Redding Storm Water Quality Improvement Plan, and the City of Redding Phase II NPDES Permit in regard to both stormwater quality and quantity. The City of Redding's City Council Policy 1806 requires that proposed development address peak flows to maintain pre-development levels at all locations downstream of the project. Both the City of Redding Storm Water Quality Improvement Plan and the City of Redding Phase II NPDES Permit require proposed development to incorporate Low Impact Development (LID) Best Management Practices (BMPs) to improve stormwater quality in the runoff to mitigate for the increased impervious area. Development surrounding the proposed project will not negatively impact Stormwater quality or quantity.

All of the proposed project alternatives have been designed to convey the estimated 600-700 cubic feet per second that might overtop Interstate 5 from Churn Creek (east of Interstate 5), as described in Section 4.1. This flow will be conveyed by constructing a large vegetated swale along the project's easterly boundary that will allow the estimated 600-700 cfs to bypass the proposed development and be conveyed to the Sacramento River. The development will have no negative impact on the flooding that occurs in the neighborhoods of the Churn Creek area as it is not tributary to the Churn Creek Watershed and will not impede the potential Interstate 5 overflow. Any future watershed development upstream of the proposed development will be required to mitigate for any future increases in impervious area to maintain pre-development conditions per local jurisdiction and state standards and regulations.

No levees will be constructed as part of this project and ground elevations will not be increased within the FEMA 100-year floodplain. Therefore there will be no loss of existing floodplain storage volume.

There will be no adverse impacts to stormwater quality or stormwater quantity to locations downstream as a result of the proposed project development and drainage system.

Section 5 – Hydrology and Hydraulics – Alternative Site

5.1 Description of Existing Watershed Characteristics

The Alternative E site is relatively flat and generally drains easterly towards the Tormey Drain and Interstate 5. The 40.5-acre site is a part of the Tormey Drain Basin and consists of pastureland and scattered oak trees. Soils types were determined using the *Web Soil Survey* provided by the United States Department of Agriculture Soil Conservation Service and Forest Service. It was determined from the Web Soil Survey that the site consists of Hydrologic Soil Group A and D.

The current FEMA FIRM identifies that the proposed project is within the Tormey Drain 100-year floodplain. The Flood Insurance Study provided by FEMA shows that the 100-year peak flow at Oak Street is 744 cubic feet per second and at Interstate 5 is 788 cubic feet per second. Figure E4 shows FEMA 100-year floodplain.

5.2 Methodology

Peak flows for the 2-, 10-, and 100-year storm events for a 24-hour period were estimated using the United States Army Corp of Engineers flood hydrograph package HEC-1 to model rainfall runoff. Existing peak flows can be in Table 5.1. The Rational Method was used to estimate the proposed size of the on-site storm drain conveyance system. The Darcy Equation was used to estimate the amount of infiltration that will be utilized in the proposed storm drain conveyance system.

5.3 Results of Analysis

The existing condition peak flows for Alternative E were calculated and are summarized in Table 5.1.

Table 5.1: Estimated Existing Condition Peak Flows

Storm Event	Existing Condition Peak Flow, cfs
2-YEAR	4
10-YEAR	8
100-YEAR	21

With development of the proposed project, the site will develop into 84% rooftop, sidewalks, and parking lot. Table 5.2 summarizes the peak flows from the post-development condition.

Table 5.2: Estimated Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs
2-YEAR	55
10-YEAR	76
100-YEAR	115

Post-developed runoff will be captured by onsite inlets and conveyed by a series of perforated storm drain pipe and drain rock infiltration trenches to the proposed retention pond located in the southeast of the project site. Approximately 24 acres of the site (Drainage Area #1) will be conveyed by the proposed on-site system. A series of inlets and perforated storm drain pipe will collect and convey the runoff to the proposed retention pond. The perforated storm drain pipe will be a maximum of 36 inches in size and will be placed within a drain rock infiltration trench five feet wide. This infiltration trench will infiltrate 38 cubic feet per second of the peak flow. Table 5.3 summarizes the post-development peak flows for Drainage Area #1 for the 2- and 10- year events.

Table 5.3: Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs
	Drainage Area #1
2-YEAR	35
10-YEAR	49

This site has approximately 58 acre-feet of storage within the 100-year floodplain. With development of the project it is estimated that 36 acre-feet of the floodplain will be filled. This will require filing a Letter of Map Revision - Fill with FEMA. This storage will be relocated to the southeast portion of the site on both sides of Oak Street. The bottom of the proposed retention pond will be set at the flowline of the Tormey Drain (elevation 410) and the top of the pond will be at the ground elevation of 416 feet. The proposed pond depicted will have a volume of 62 acre-feet. Figure E4 shows the location of the proposed retention pond.

5.4 Cumulative Impact of Alternative Site Grading & Drainage

The proposed alternative site will be designed in such a way that the grading will be a balanced earthwork operation, meaning the cut and fill quantities will be the same and there is no import or export of material required. The grading design of the alternative site will require fill to be placed in the FEMA 100-year floodplain in order to get the building finished floors a minimum of one foot above the 100-year flood elevation of the Tormey Drain. The project has been designed in such a way that the volume of fill placed within the FEMA 100-year floodplain will be mitigated by an equal volume of cut (detention/ infiltration basins) within the FEMA 100-year floodplain. This will maintain pre-development flood levels at all locations upstream and downstream of the project.

The project drainage system has been designed in such a way that there will be no increase in flows downstream. This will be accomplished using infiltrations trenches, infiltration/detention basins, and numerous other stormwater quality BMPs that encourage groundwater infiltration as described in Section 6.1.

Surrounding development will be subject to the City of Anderson’s policy to demonstrate “No Net” offsite downstream drainage effects as a result of any proposed development. The City of Anderson is a Phase II NPDES community and any proposed development will be required to incorporate Low Impact Development (LID) Best Management Practices (BMPs) to improve stormwater quality in the runoff to mitigate for the increased impervious area. Development surrounding the proposed project will not negatively impact Stormwater quality or quantity.

There will be no adverse impacts to stormwater quality or stormwater quantity to locations downstream as a result of the alternative site development and drainage system.

Section 6 – Stormwater Quality

6.1 Stormwater Quality Best Management Practices

During urban development two important changes occur, first a portion of the vegetated, pervious ground cover is converted to impervious surfaces. Vegetated soil both absorbs rain water, and helps to remove pollutants, providing a natural purification system. This natural absorption purification system is blocked by the newly developed impervious surface. The second important change of urban development is the addition of new pollutants, such as vehicle emissions, pesticides, trash, and other contaminants that come along with development. Because of these changes, storm water runoff leaving a site in a newly developed or redeveloped area may be considerably greater in volume, velocity and level of pollutants. The proposed project will incorporate numerous stormwater quality and quantity BMPs into the project design and landscaping to reduce pollutants and leaving the site, including but not limited to the following:

- Catch Basin Filters
- Infiltration Trenches (Perforated storm drain pipe with drain rock)
- Vegetated Swales
- Bio-filtration Swales
- Natural Water Quality Retention Basins
- Wet Ponds
- Pervious Pavements

6.1.1 Catch Basin Filters

Catch Basin insert filters will be installed at select area drains and catch basins on-site. These inlet filters are designed to capture sediment, debris, trash, oil and grease from storm water. These filters clean the storm water during low flows, and have no standing water which minimizes any bacteria and odor problems. The system consists of a fabric filter that is placed inside the area drain or catch basin. This fabric is permeable so that the water may pass through leaving the pollutants & debris behind. The filters require regular maintenance, and must be checked regularly. The debris and contaminants can be removed and disposed of properly, the filter can be then be reused.

All of the alternatives will utilize catch basin inlet filters where feasible in the parking and landscape areas to improve the water quality of the runoff prior to entering the underground storm drain system.

6.1.2 Infiltration Trenches

Where feasible, Infiltration Trenches will be built as opposed to solid wall underground storm drain systems. Perforated pipe will be installed in a drain rock backfilled trench which will allow the low storm water flows to flow through the drain rock. The drain rock acts as a filter removing sediment and other contaminants. Most of the storm water will absorb into the ground which simulates the pre-development natural absorption and purification condition that existed prior to development. These infiltration trenches will be constructed in areas that have favorable soil conditions to promote stormwater infiltration. The entire site consists of Hydrologic Soil Group A soils, which provides excellent infiltration and absorption.

6.1.3 Vegetated Swales

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems. The 40 foot wide vegetated swale provides filtration through proposed vegetation and infiltration for stormwater runoff.

6.1.4 Wet Ponds

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling.

The wet pond will be located at the southern portion of the Proposed Project site and runoff will be conveyed to the wet pond via the vegetated swale (40' vegetated swale) described in Section 6.1.3. The wet pond will retain water and allow infiltration into the native alluvial soil during a typical rain event. During rare extreme runoff events, the wet pond will spill and runoff will make its way south to the Sacramento River. The wet pond will be submerged when the Sacramento River is flooding.

6.1.5 Pervious Pavements

Pervious paving is used for light vehicle loading in parking areas and in outdoor pedestrian areas. The term describes a system comprising a load-bearing, durable surface together with an underlying layered structure that temporarily stores water prior to infiltration or drainage to a controlled outlet. The surface can itself be porous such that water infiltrates across the entire surface of the material (e.g., grass and gravel surfaces, porous concrete and porous asphalt), or can be built up of impermeable blocks separated by spaces and joints, through which the water can drain. This latter system is termed 'permeable' paving.

Advantages of pervious pavements are that they reduce runoff volume while providing treatment and are unobtrusive resulting in a high level of acceptability.

Pervious pavement was not used in the stormwater quality or stormwater quantity mitigation calculations. However pervious pavement could be implemented on the proposed project to further improve the stormwater quality. Pervious pavements could be used in parking areas, courtyard areas, pedestrian areas or any other areas where feasible. Pervious pavements may be any of the following:

- Porous Concrete
- Porous Asphalt
- Pavers
- Gravel Surfaces

6.1.6 Green Roofs

When used in appropriate climates, green roofs can significantly reduce the amount of rain water that would otherwise run off an impervious roof surface. However, green roofs are not a viable option due to Redding's climate. Redding experiences cold, wet winters with dry, hot summers. Green roofs have been attempted in some projects around the Redding area but have fallen into disrepair as the amount of water to keep plants thriving in the harsh summer is counterproductive to the intent of the LID.

6.2 Sacramento River Streambank Stabilization

The eastern streambank of the Sacramento River (westerly project boundary) has a layer of loam that easily erodes with high river flows, see the photos below. As shown in the photos, there is an approximate 2:1 slope that contains cobble and established vegetation. This slope extends to the bottom of the riverbed and appears stable. As shown in the photos, the top 4 feet to 8 feet of the streambank contains a layer of loam that shows evidence of erosion and instability when it is exposed to high river flows as it was in early 2017.

Sacramento River eastern bank (Facing north)

Sacramento River eastern bank (Facing north)

Sacramento River eastern bank (Facing north)

6.2.1 Streambank Stabilization Recommendations

The upper loam portion of the riverbank should be stabilized using the ‘Windrow Rock Slope Protection’ method as described on page 16 of “California Bank and Shore Rock Slope Protection Design” Third Edition – Internet October 2000. This involves removal of existing stream bank material above the ordinary high-water mark and placement of a wide row of appropriately sized rock (boulders) over the existing cobbly alluvium up to at least the flood water surface elevation of the river. The river-side and top surface of the boulders is then covered with native cobbly alluvium, and the top surface is further covered with a minimum of 18 inches of native loam up to the desired finished surface elevation. This “hardened” bank will reduce erosion but will not increase the flow energy because the channel roughness coefficient and geometry will remain relatively the same. The ACOE Comprehensive Study stated that the HEC-RAS model in the upper Sacramento River “was not highly sensitive to changes in channel roughness”. The roughness coefficient used by both the ACOE study and FEMA in the channel was 0.035. The roughness coefficient values for boulders range from 0.035-0.05. See Figure 6.1 below.

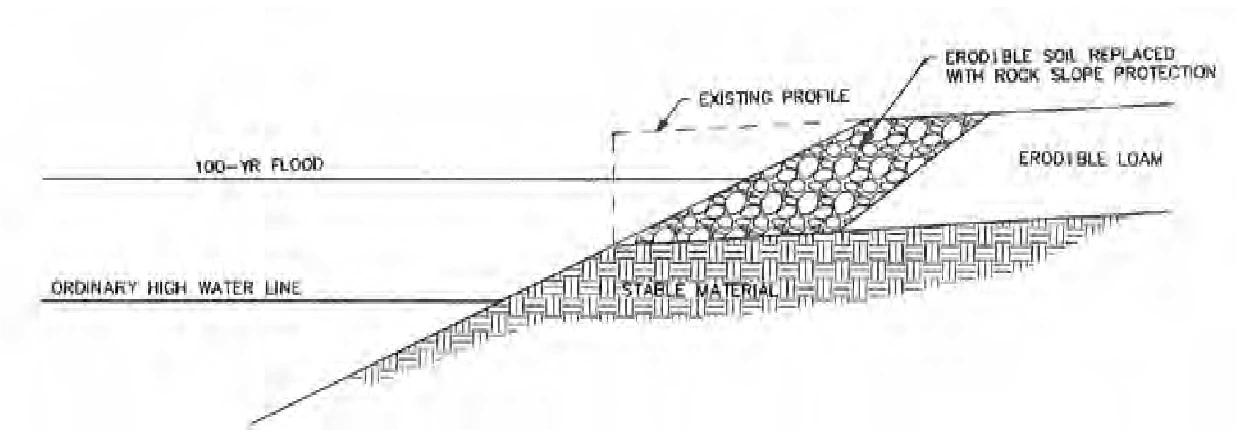
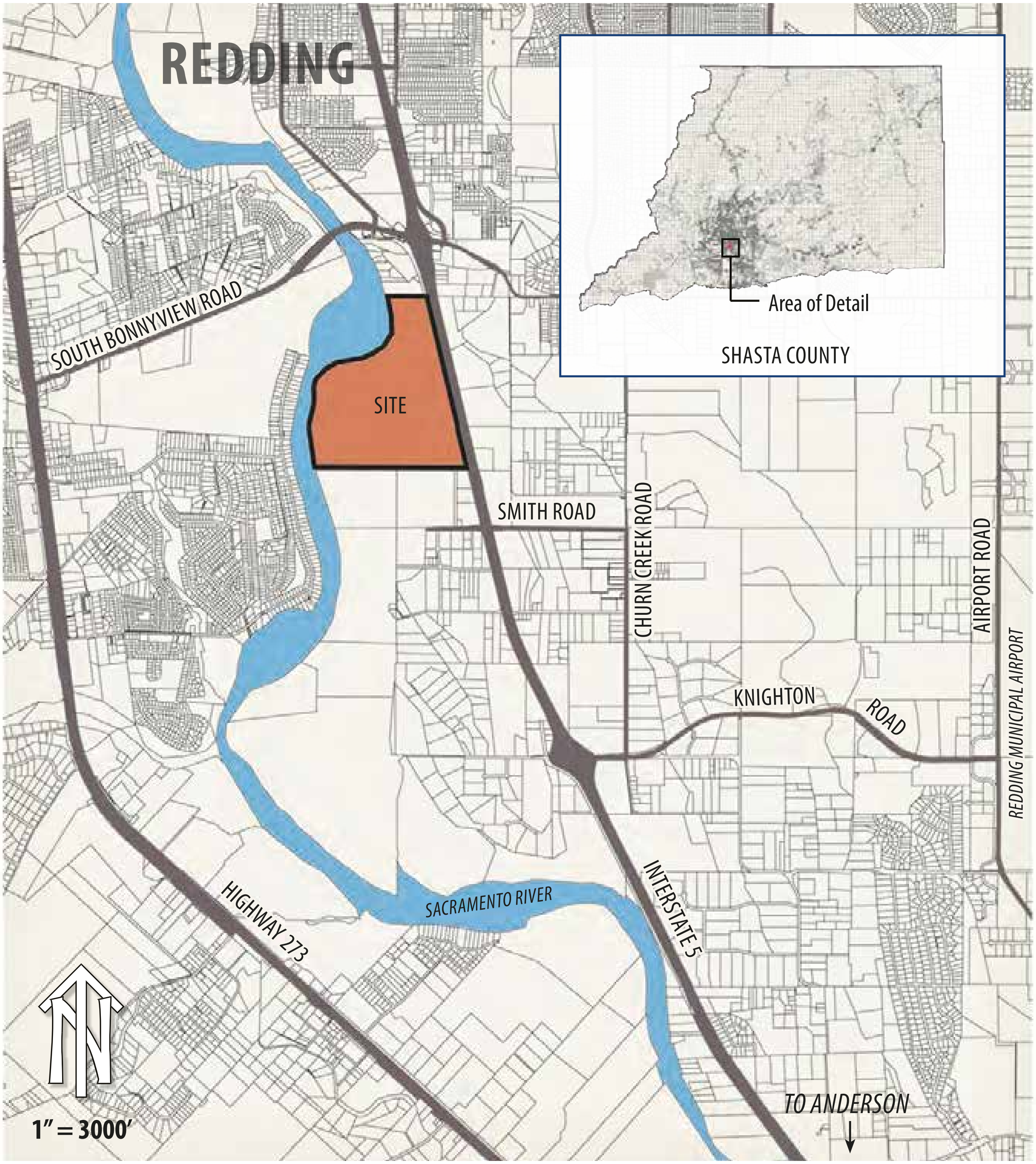


Figure 6.1: Streambank Stabilization

Figures

REDDING RANCHERIA
CASINO MASTER PLAN



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE 1
PROPOSED PROJECT - ALT 'A', 'B', 'C', & 'D'
LOCATION MAP

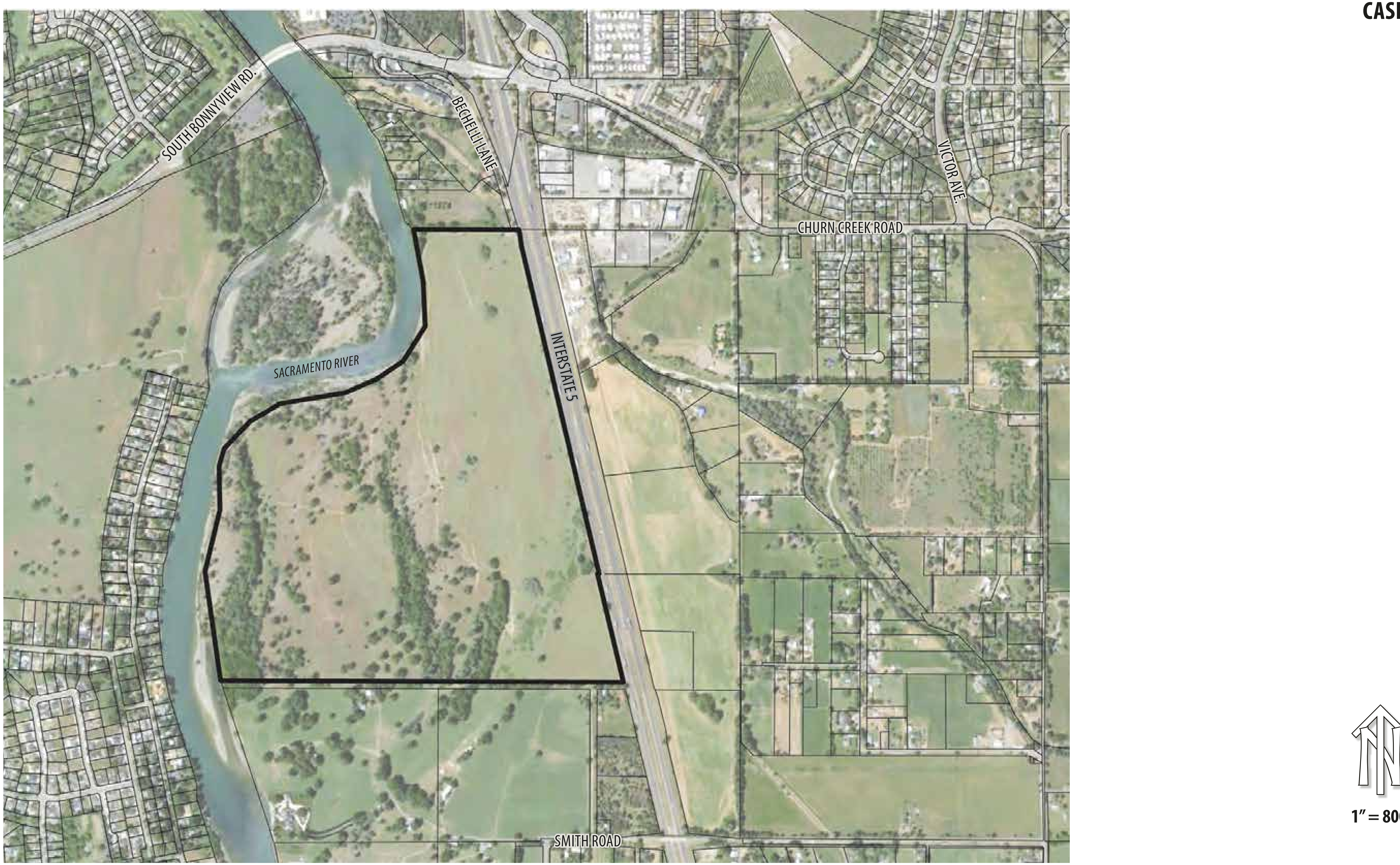


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FIGURE 2
PROPOSED PROJECT
ENLARGED LOCATION MAP WITH AERIAL

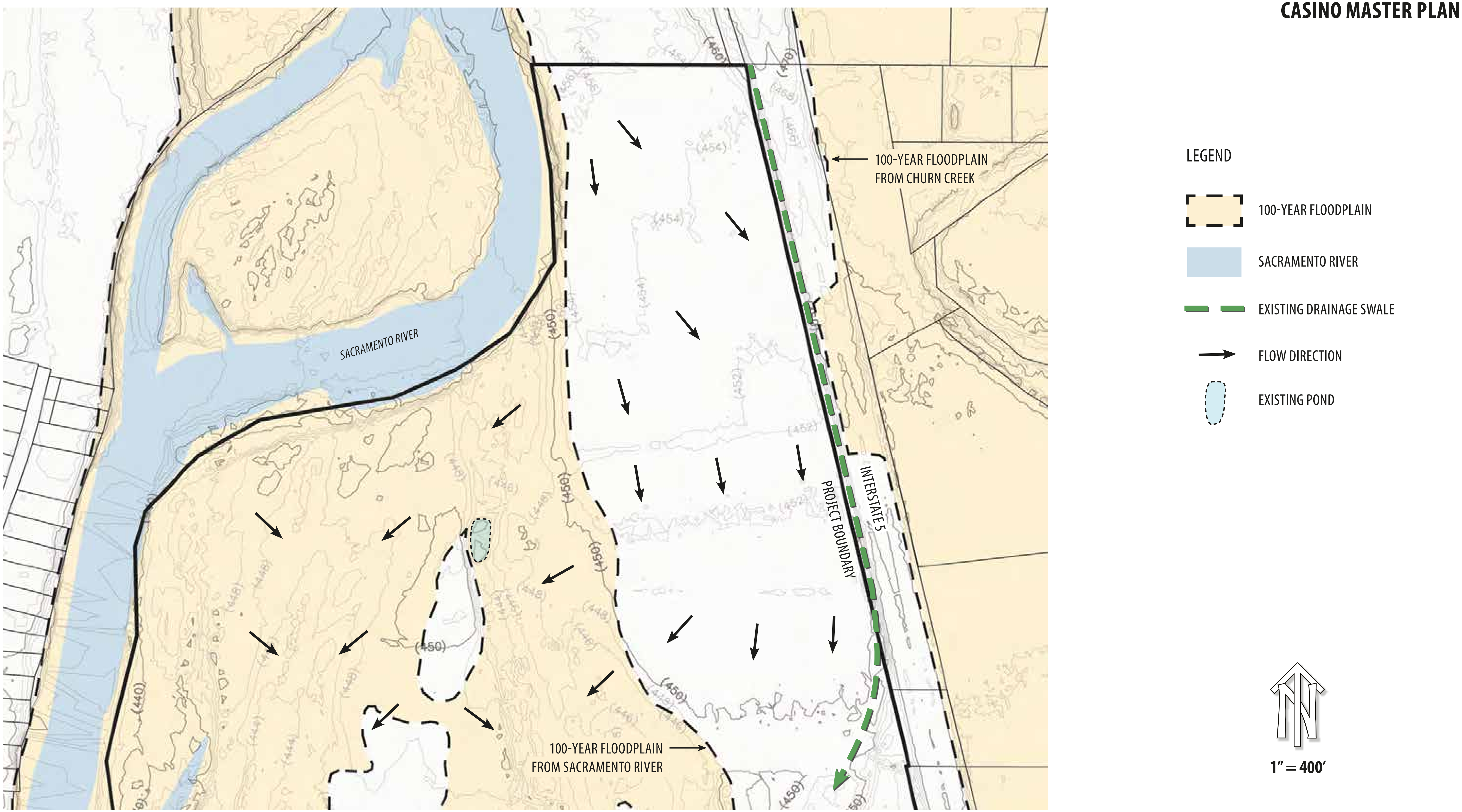

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FIGURE 3
PROPOSED PROJECT EXISTING TOPOGRAPHY

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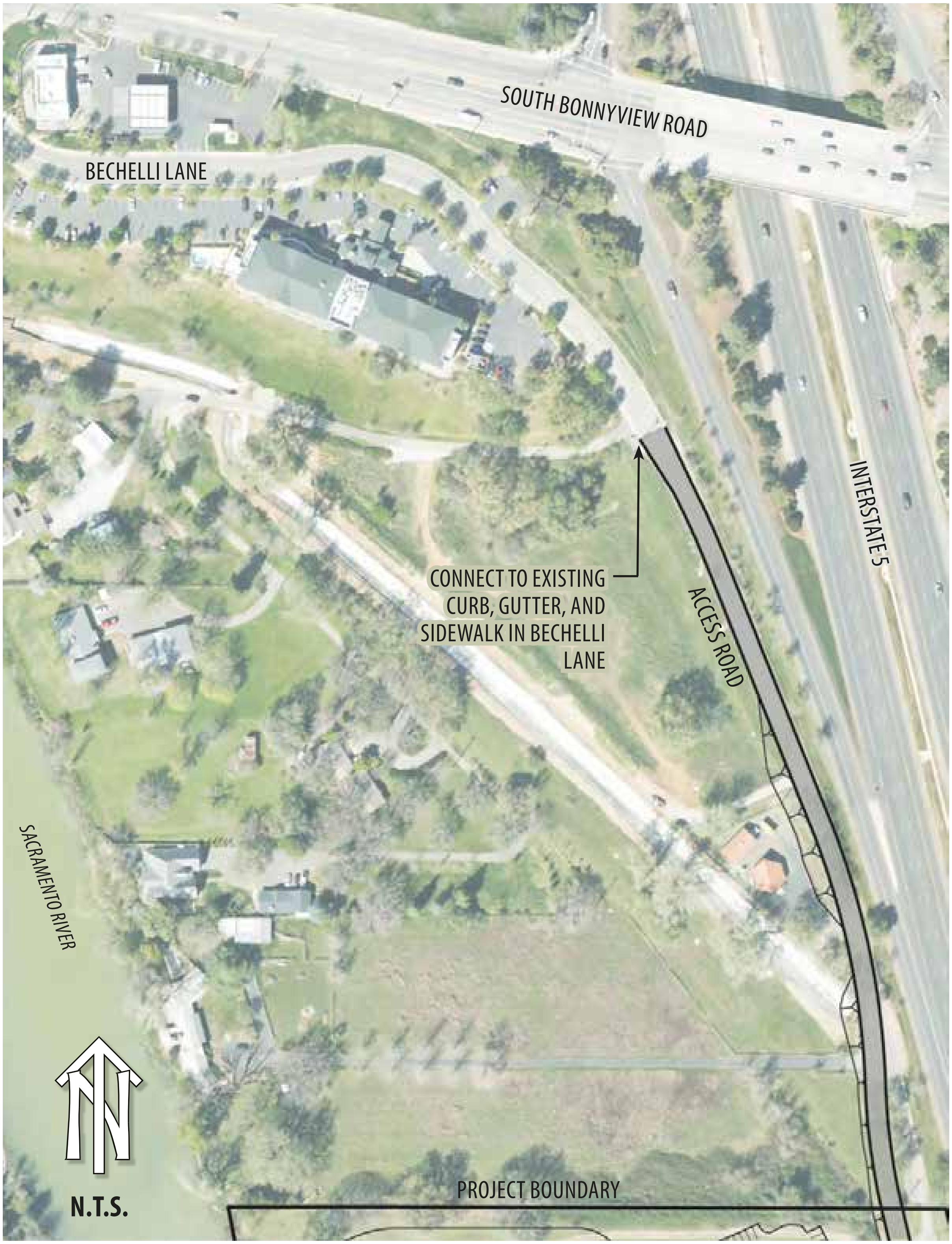
FIGURE 4
PROPOSED PROJECT
AERIAL AND TOPOGRAPHY



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE 5
PROPOSED PROJECT NORTH ROAD CONNECTION

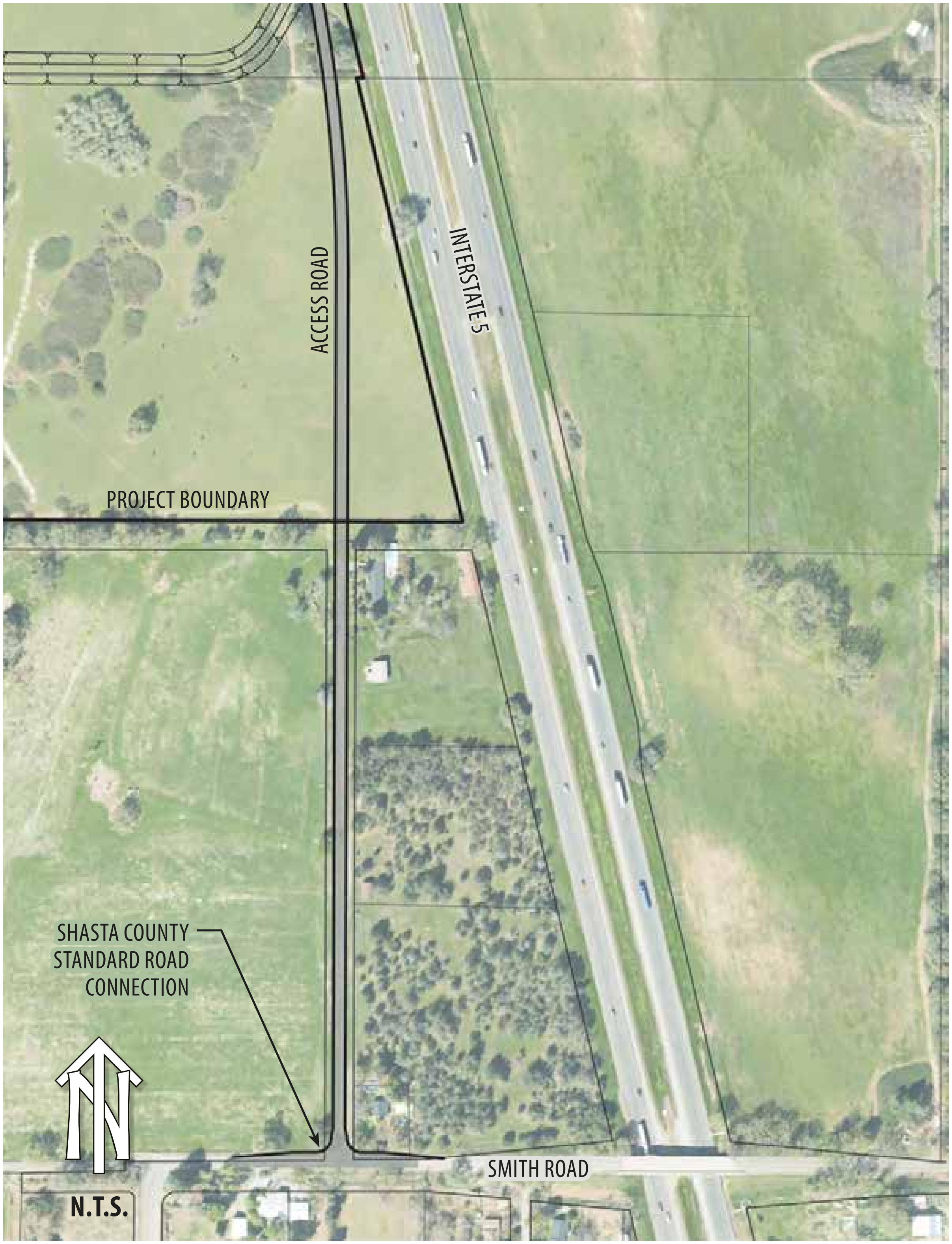


FIGURE 6
PROPOSED PROJECT
SOUTH ROAD CONNECTION

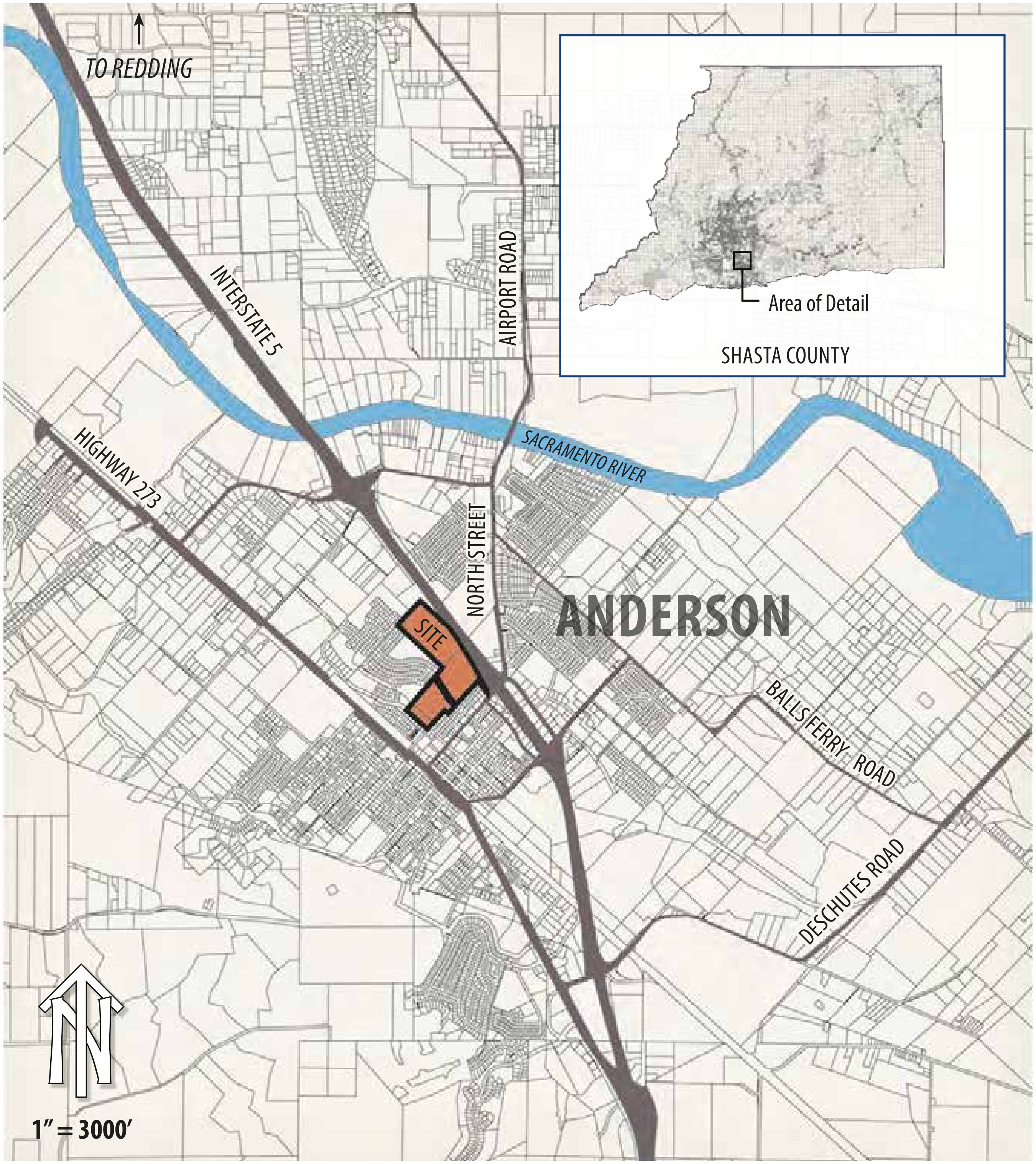


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FIGURE 7
PROPOSED PROJECT - ALT 'E'
LOCATION MAP

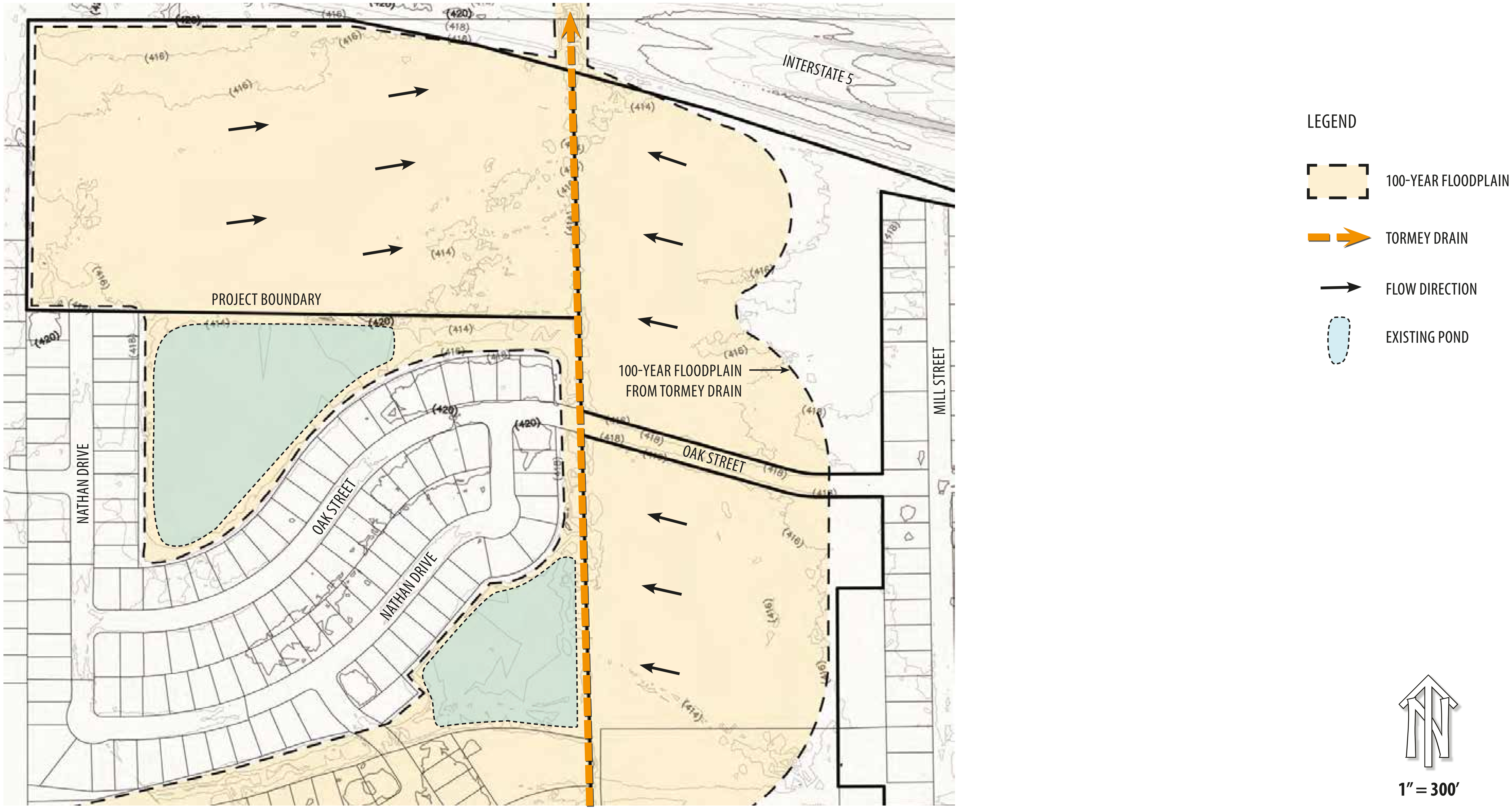

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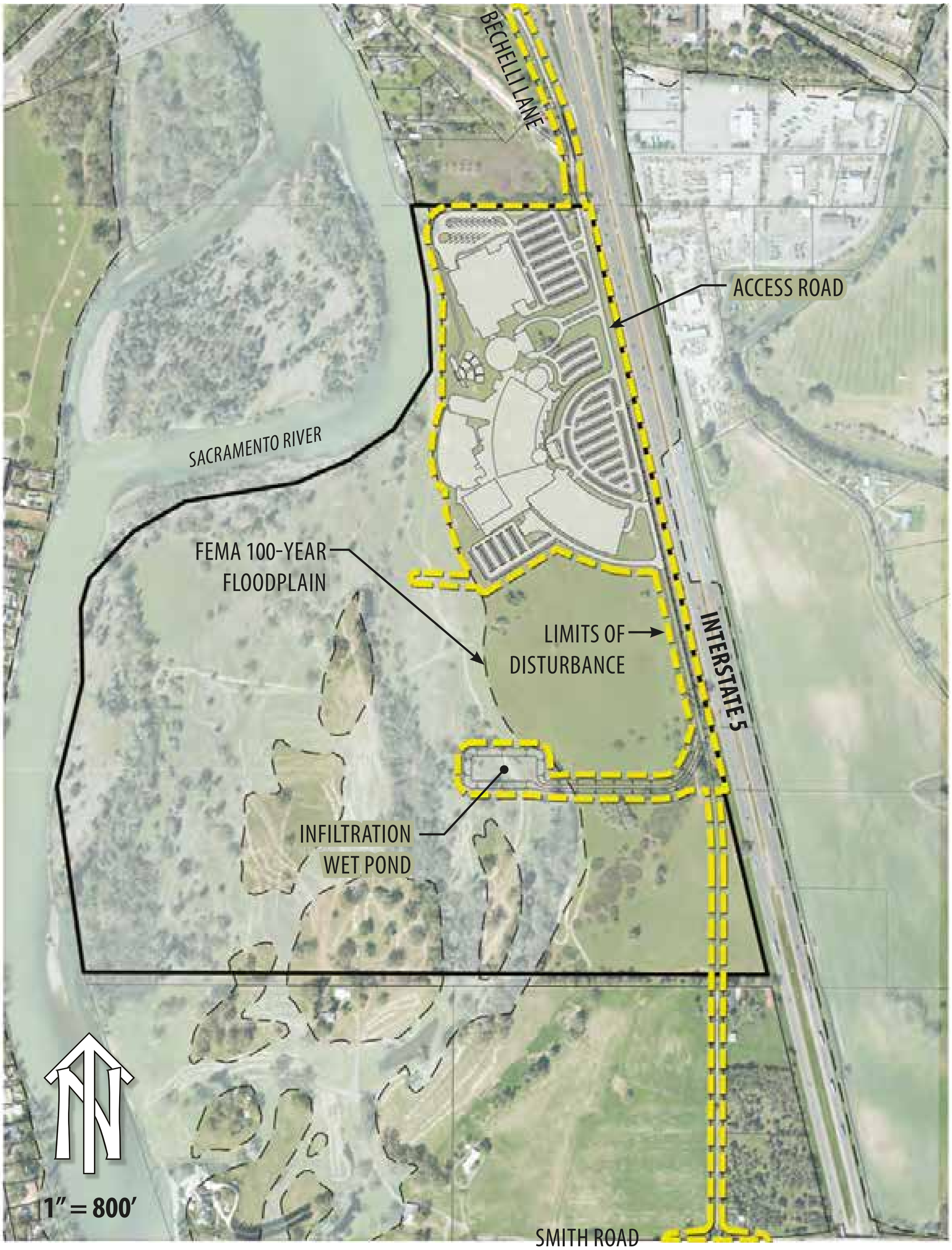
FIGURE 8
ALT SITE
EXISTING TOPOGRAPHY

SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE 9
ALT SITE
AERIAL AND TOPOGRAPHY

Figures – Alternative A

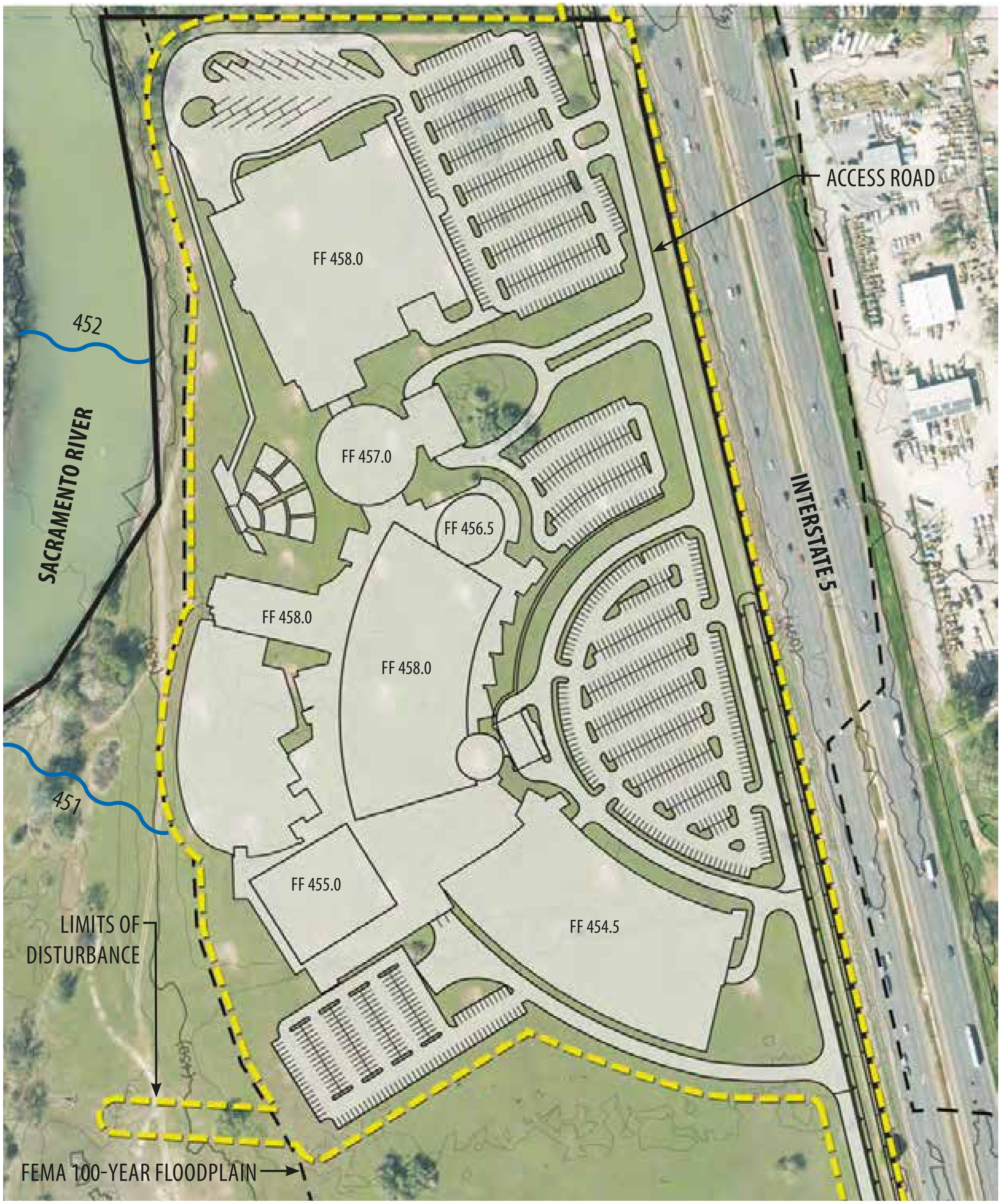
REDDING RANCHERIA
CASINO MASTER PLAN



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE A1
PROPOSED PROJECT - ALT 'A'
OVERALL DISTURBANCE LIMITS

REDDING RANCHERIA
CASINO MASTER PLAN



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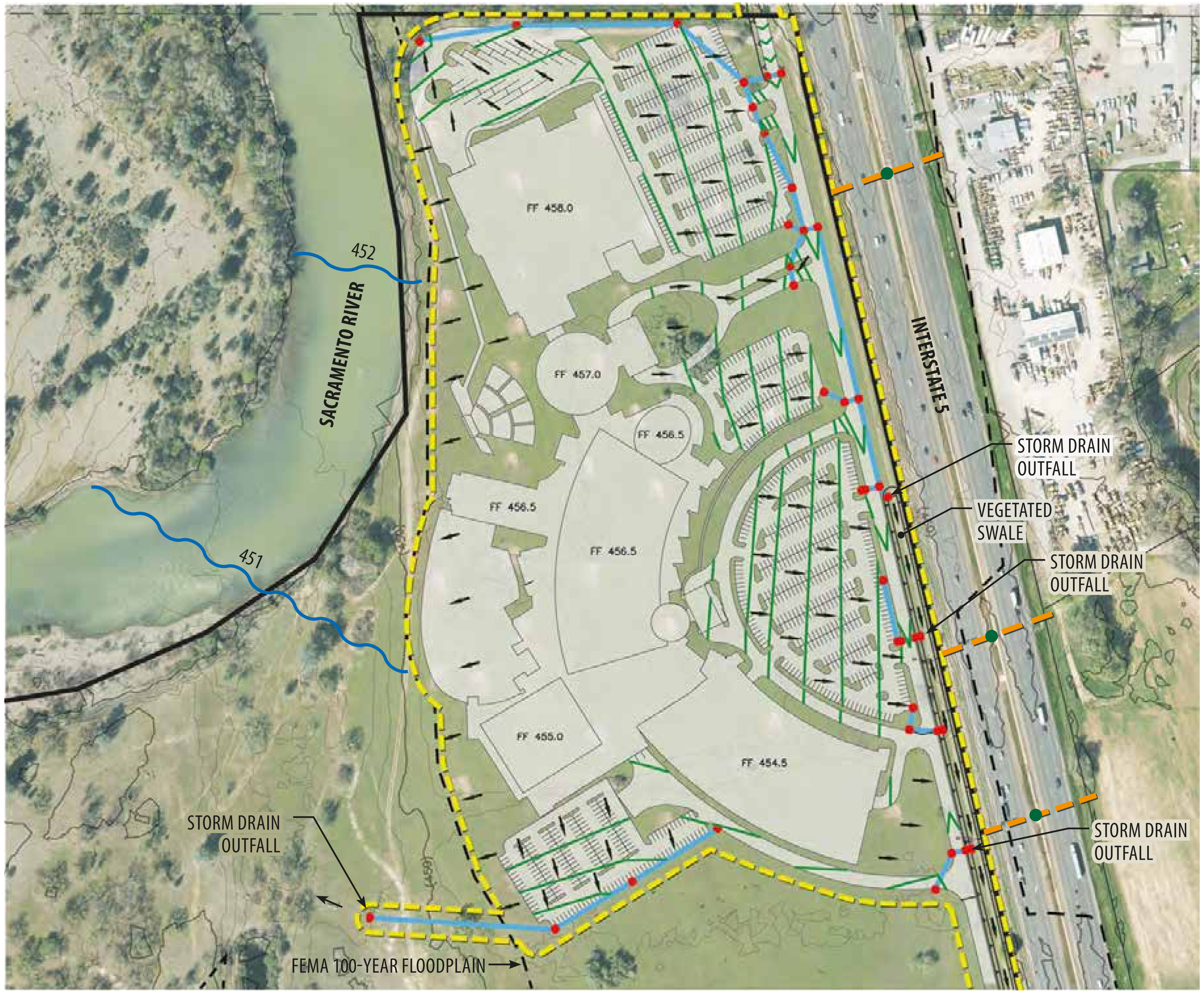
SAWYER
INCORPORATED

FIGURE A2
PROPOSED PROJECT - ALT 'A'
ONSITE DISTURBANCE LIMITS



LEGEND

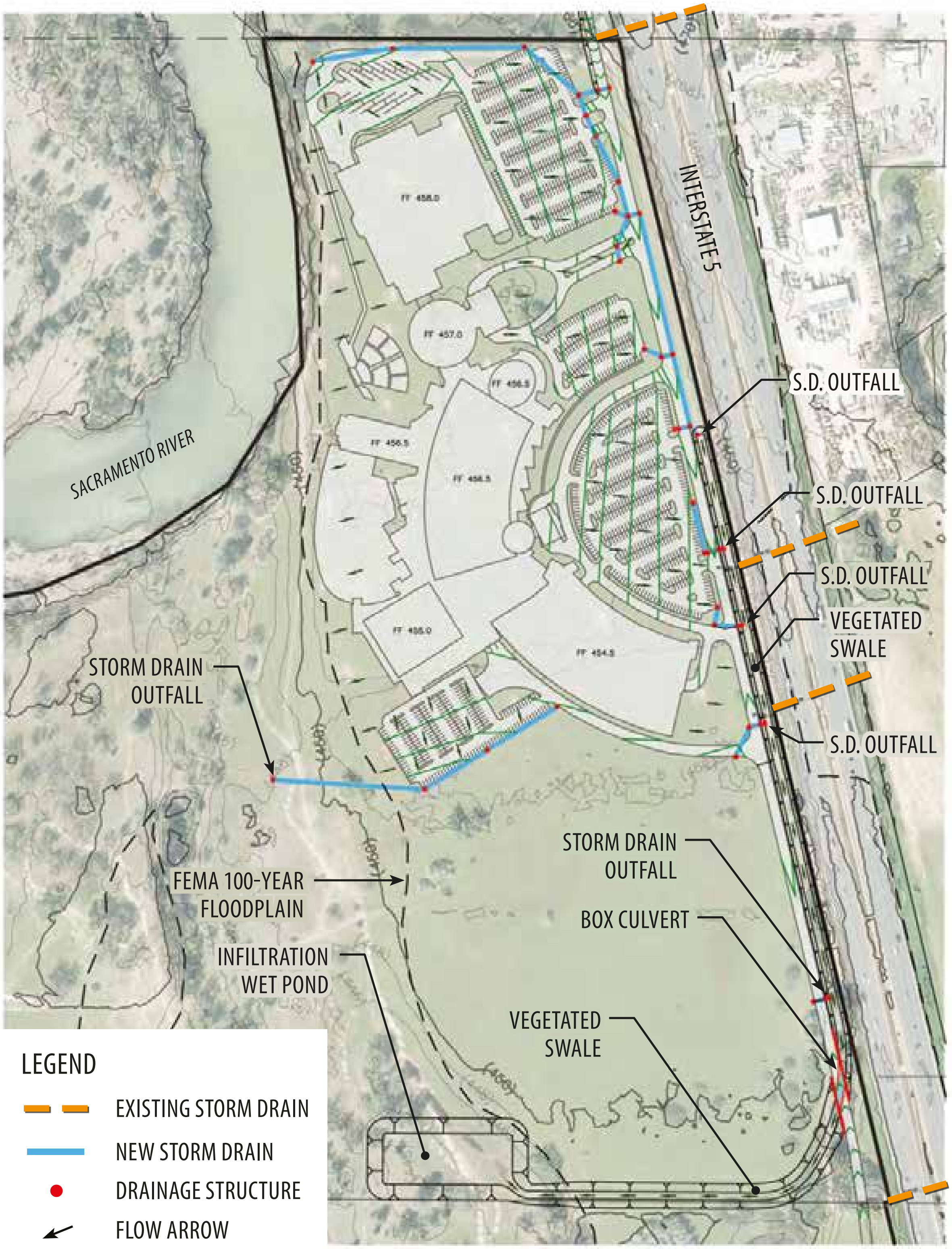
- FINISH GRADE CONTOUR
- NEW STORM DRAIN
- EXISTING STORM DRAIN
- DRAINAGE STRUCTURE
- EXISTING DRAINAGE STRUCTURE
- 452 FEMA 100 YEAR FLOOD ELEVATION
- FLOW DIRECTION

N

NOT TO SCALE

SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE A3
PROPOSED PROJECT - ALT 'A'
ONSITE GRADING



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE A4
PROPOSED PROJECT - ALT 'A'
OVERALL GRADING

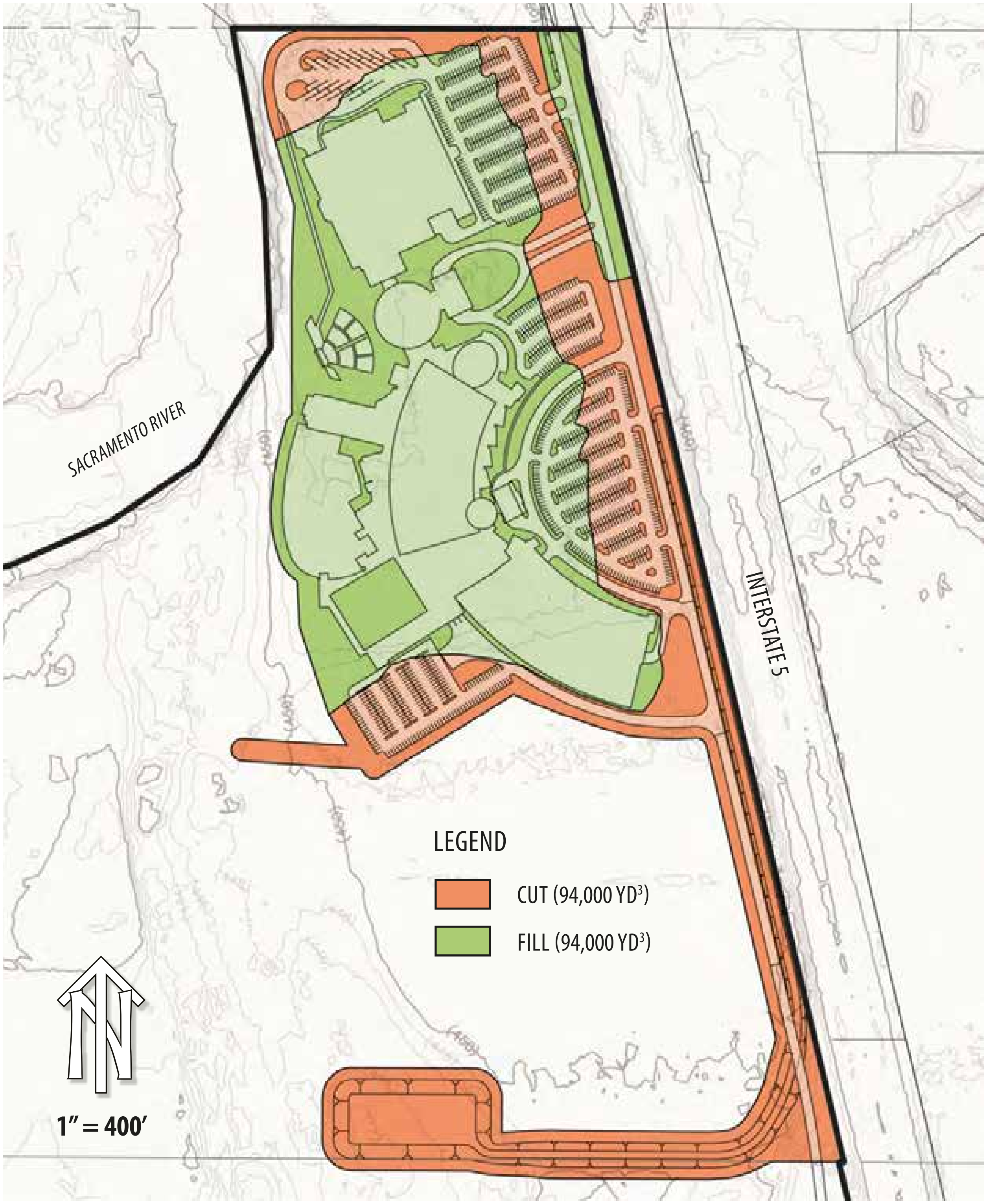
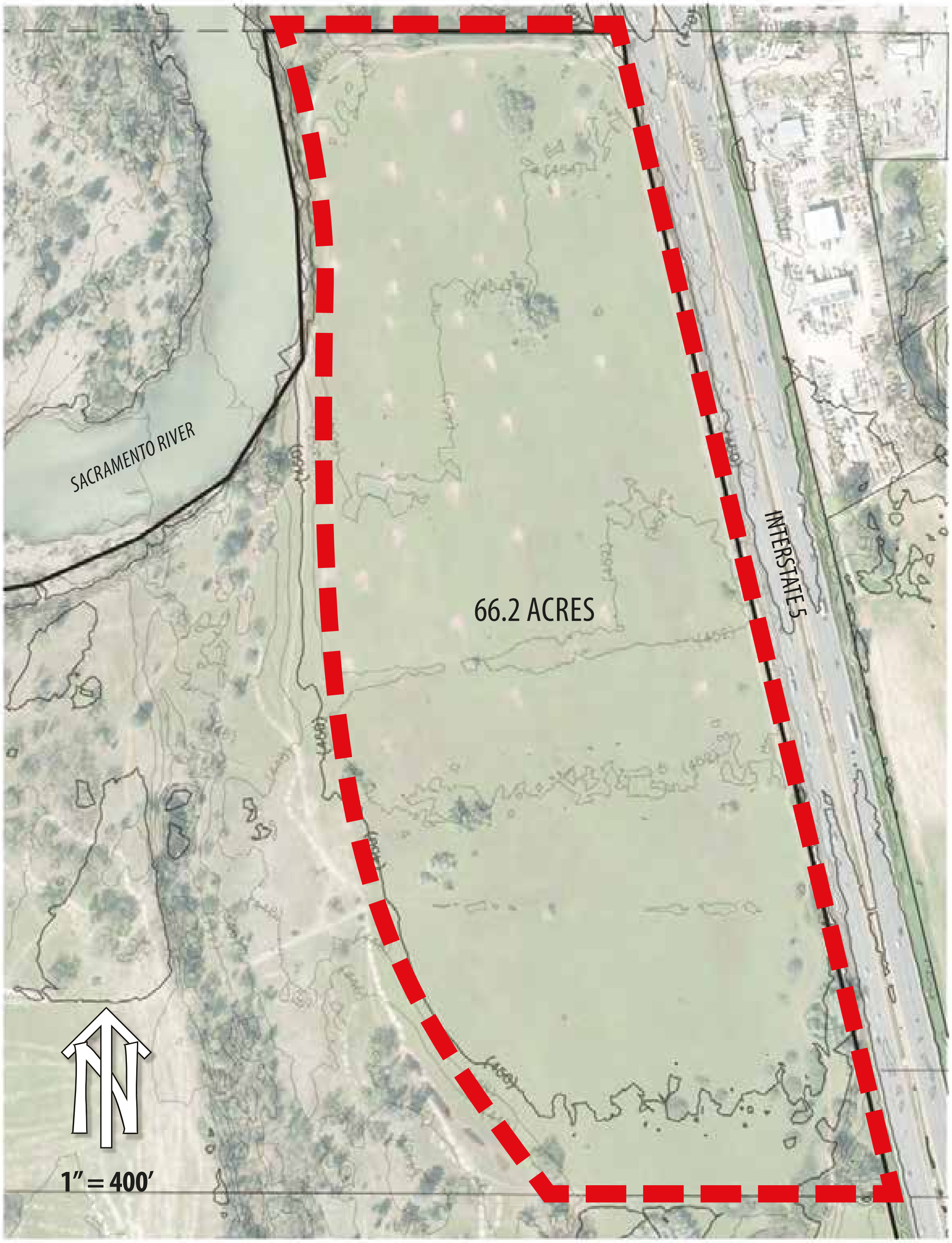
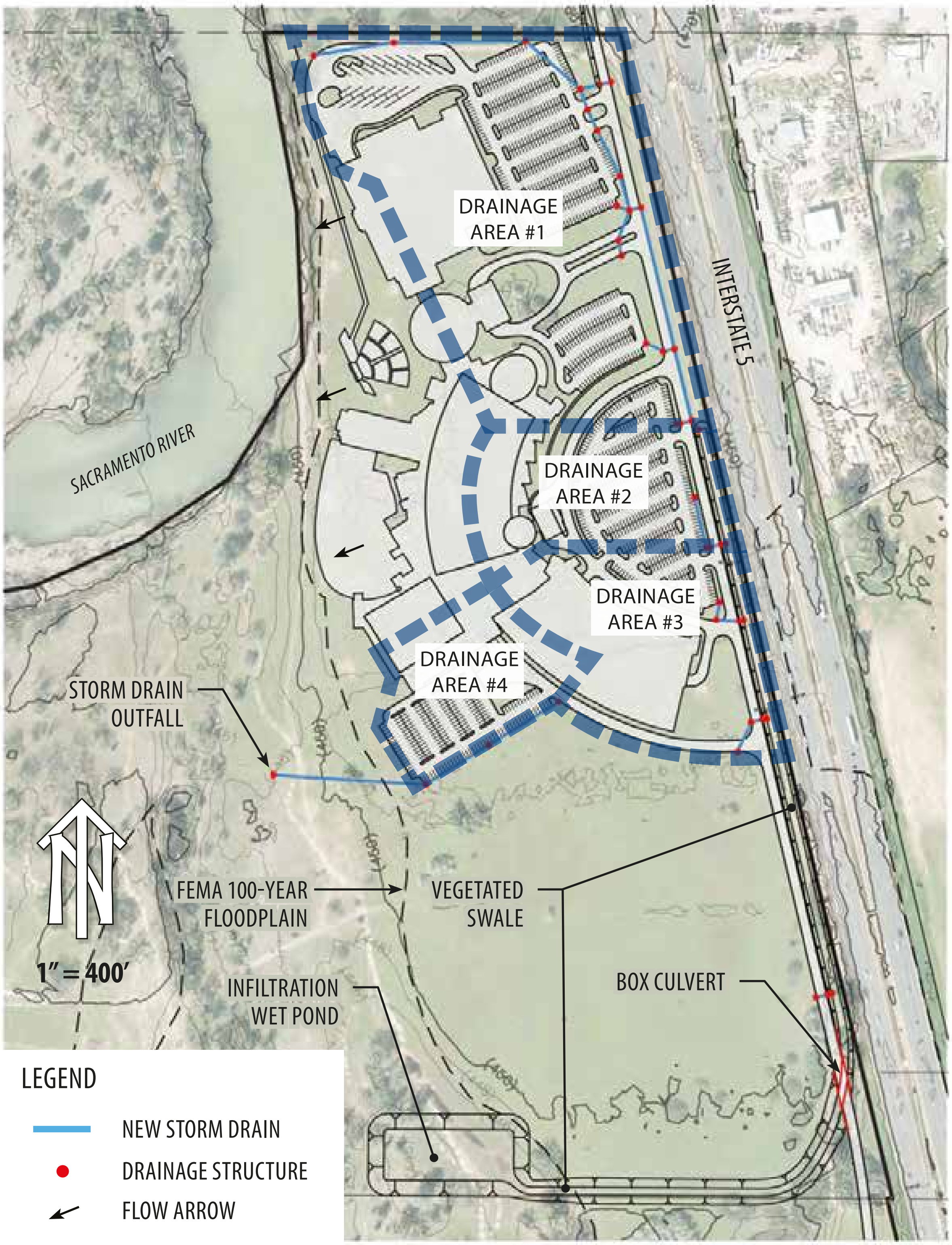


FIGURE A5
PROPOSED PROJECT - ALT 'A'
CUT FILL DIAGRAM



SHARRAH DUNLAP SAWYER INCORPORATED

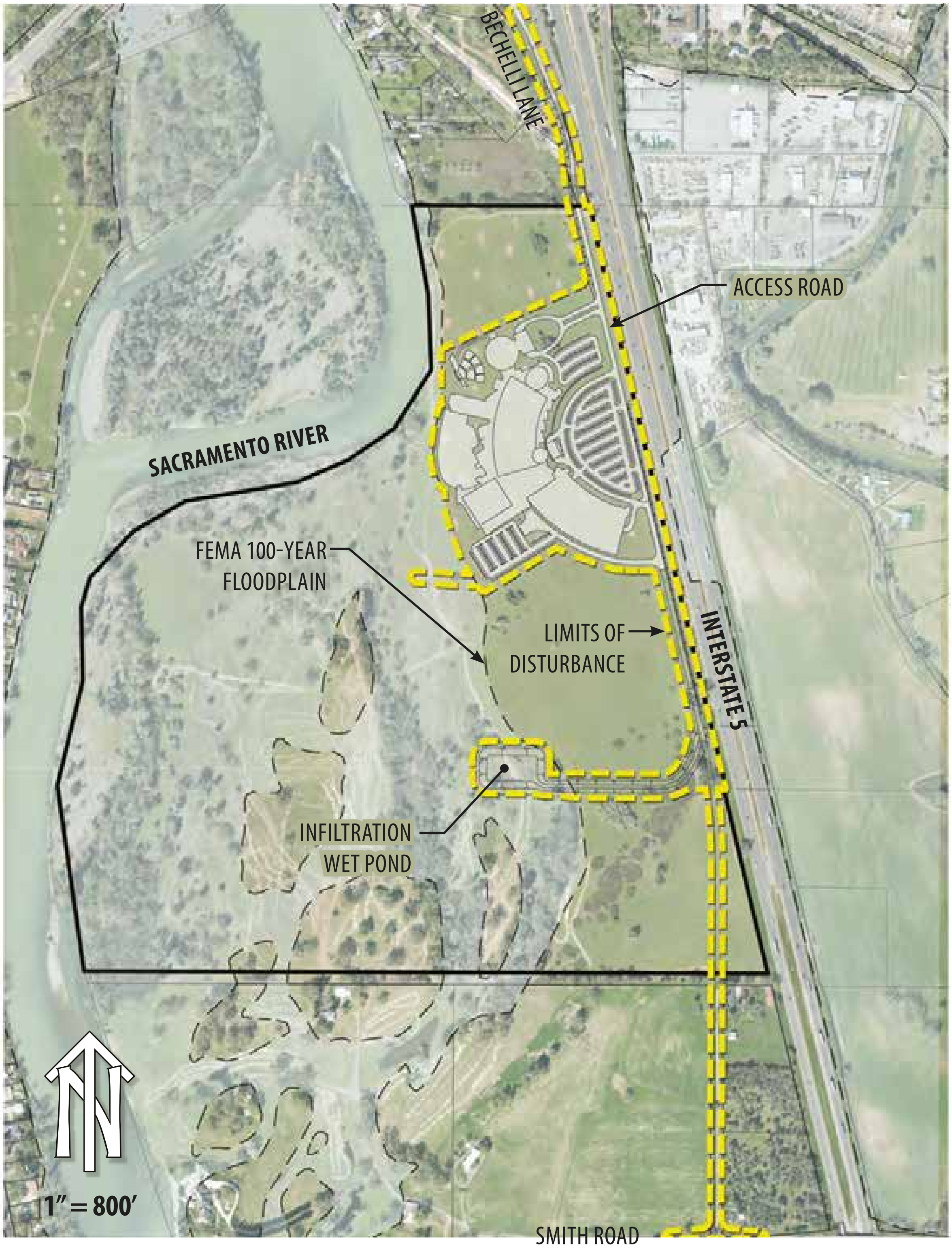
FIGURE A6
OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'A'
EXISTING CONDITION



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE A7
PROPOSED PROJECT - ALT 'A'
STORMWATER MANAGEMENT

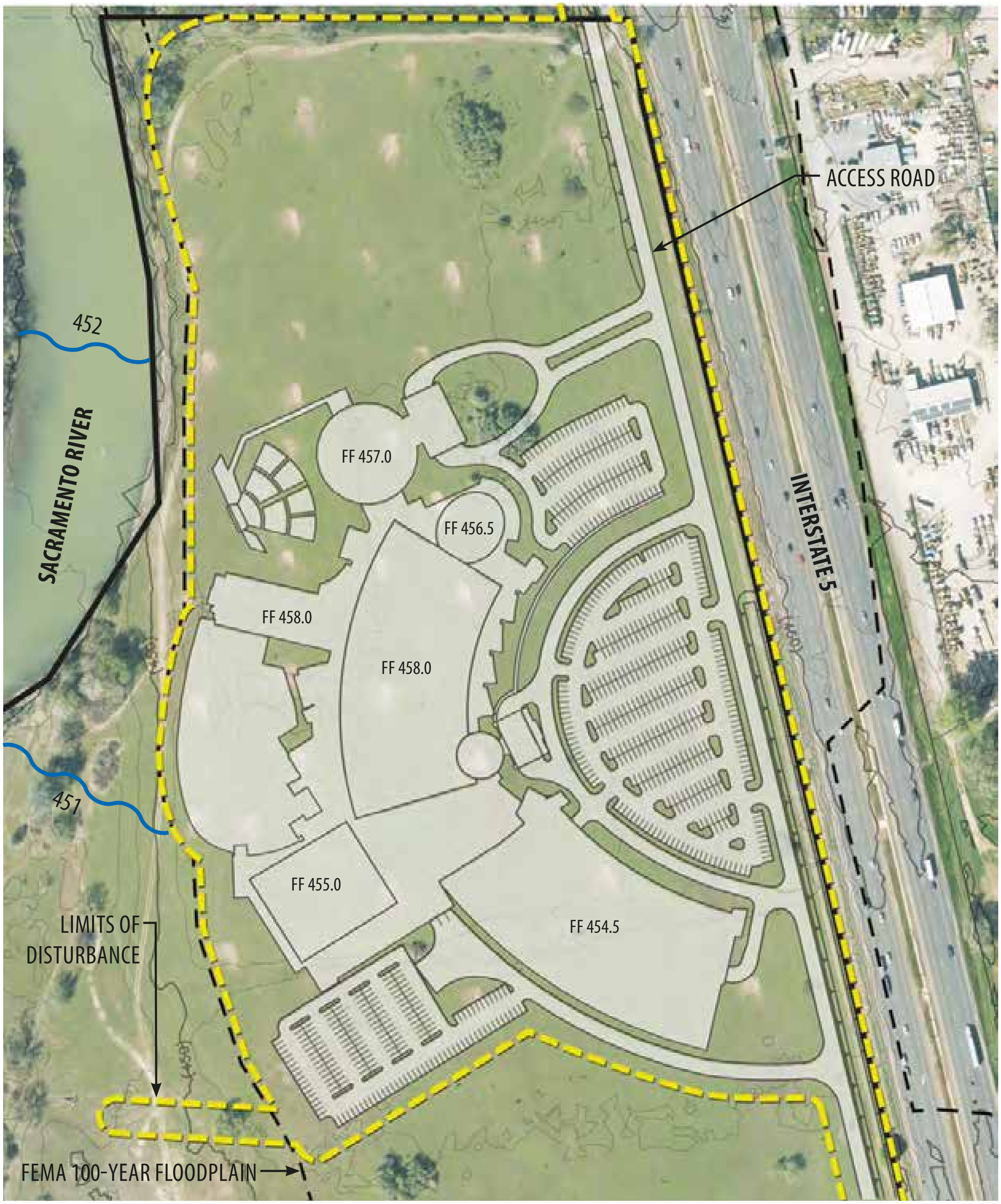
Figures – Alternative B



SHARRAH DUNLAP SAWYER INCORPORATED

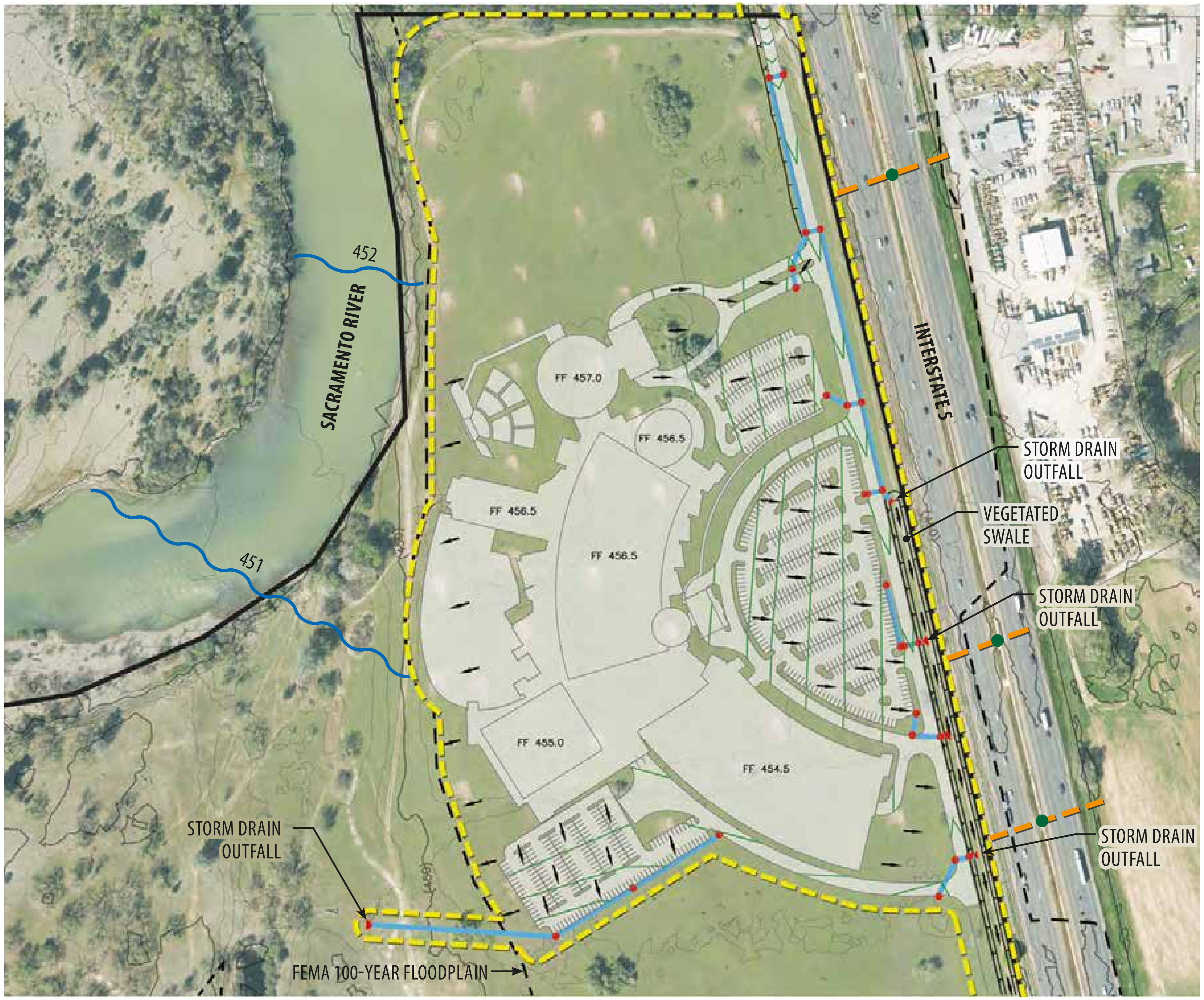
FIGURE B1
PROPOSED PROJECT - ALT 'B'
OVERALL DISTURBANCE LIMITS

REDDING RANCHERIA
CASINO MASTER PLAN



SHARRAH
DUNLAP
SAWYER
INCORPORATED

FIGURE B2
PROPOSED PROJECT - ALT 'B'
ONSITE DISTURBANCE LIMITS



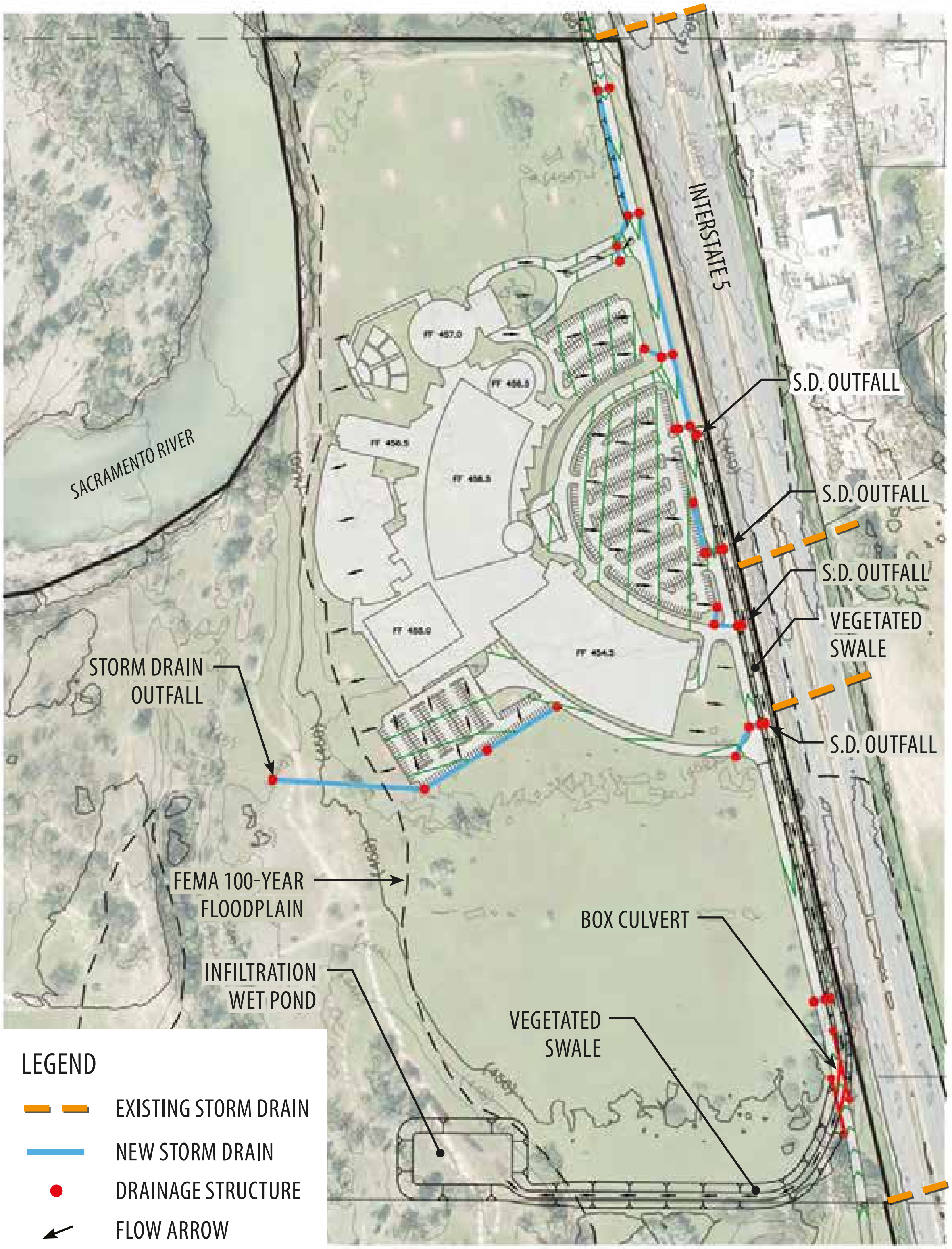
LEGEND

- FINISH GRADE CONTOUR
- NEW STORM DRAIN
- EXISTING STORM DRAIN
- DRAINAGE STRUCTURE
- EXISTING DRAINAGE STRUCTURE
- 452 FEMA 100 YEAR FLOOD ELEVATION
- FLOW DIRECTION

N

NOT TO SCALE

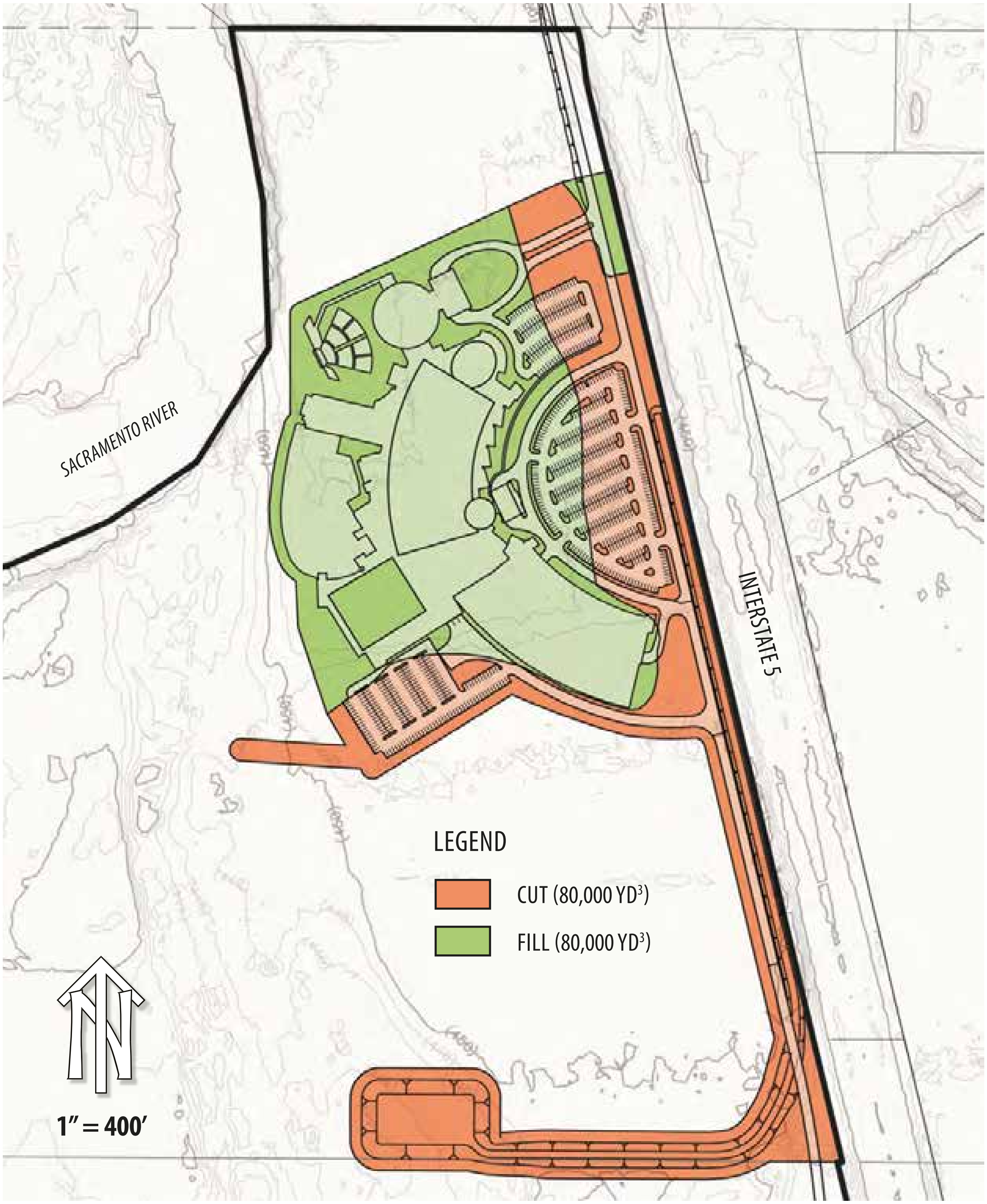
FIGURE B3
PROPOSED PROJECT - ALT 'B'
ONSITE GRADING



SHARRAH DUNLAP SAWYER INCORPORATED

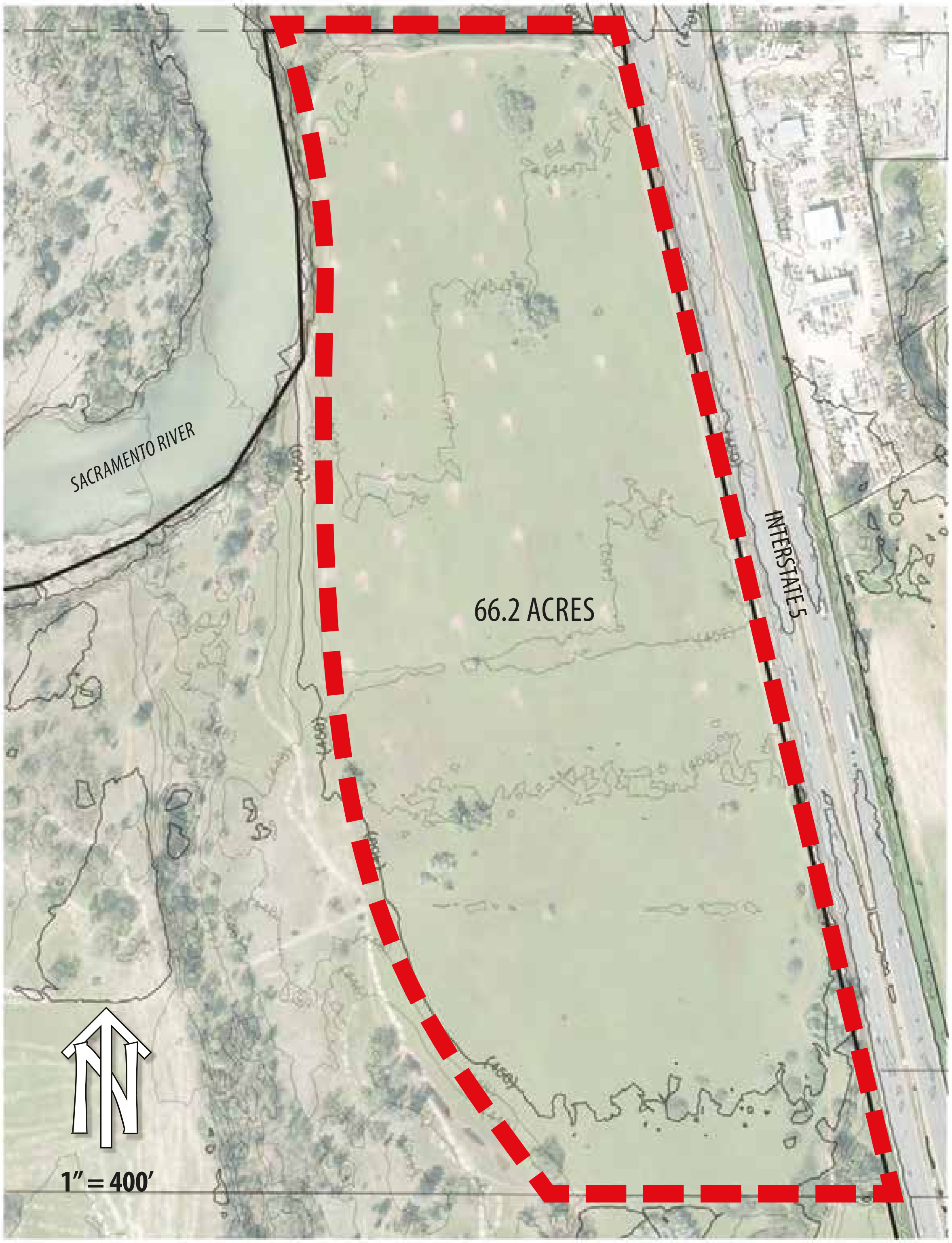
FIGURE B4
PROPOSED PROJECT - ALT 'B'
OVERALL GRADING

REDDING RANCHERIA CASINO MASTER PLAN



SHARRAH DUNLAP SAWYER INCORPORATED

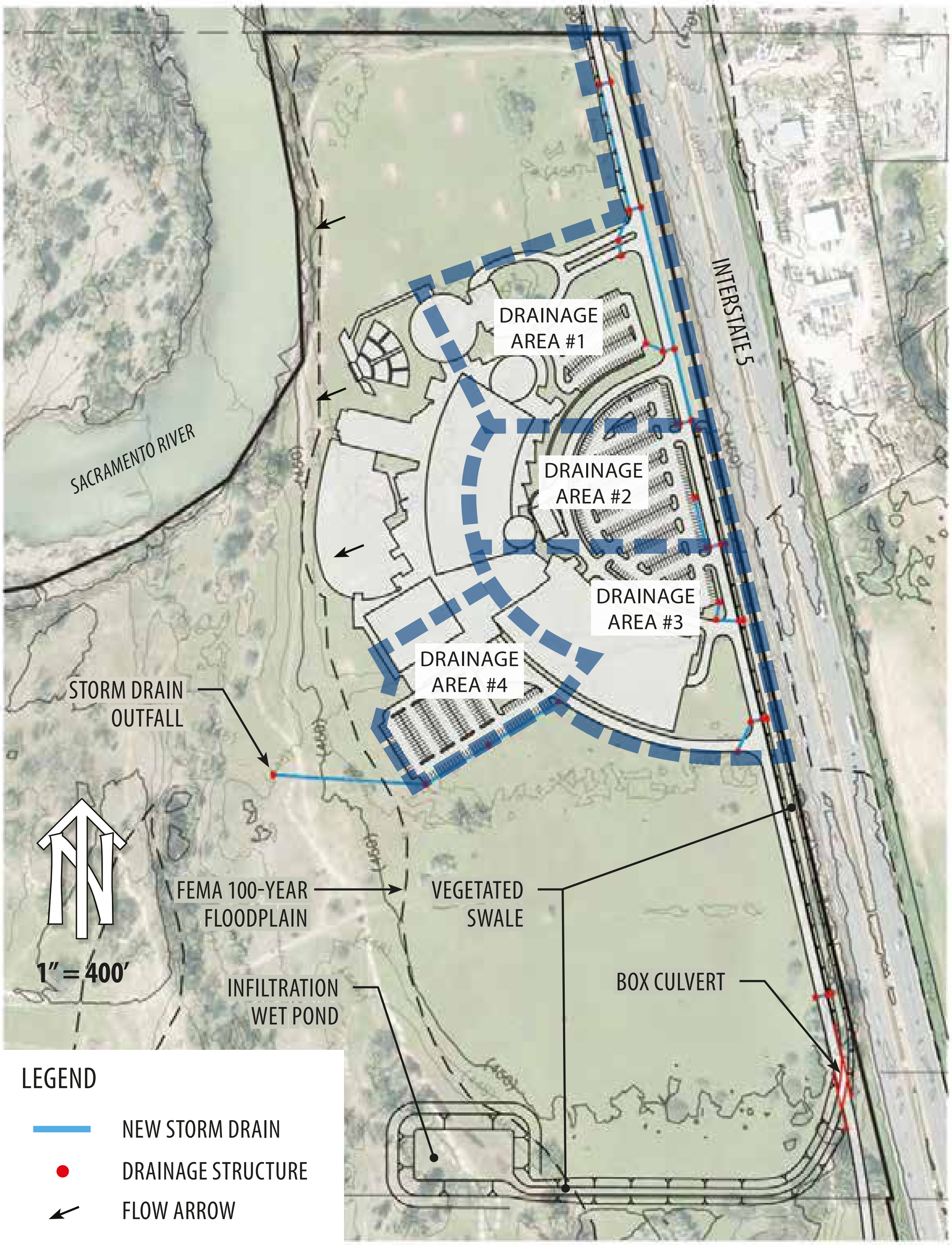
FIGURE B5
PROPOSED PROJECT - ALT 'B'
CUT FILL DIAGRAM



SHARRAH
DUNLAP
SAWYER
INCORPORATED

FIGURE B6
OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'B'
EXISTING CONDITION

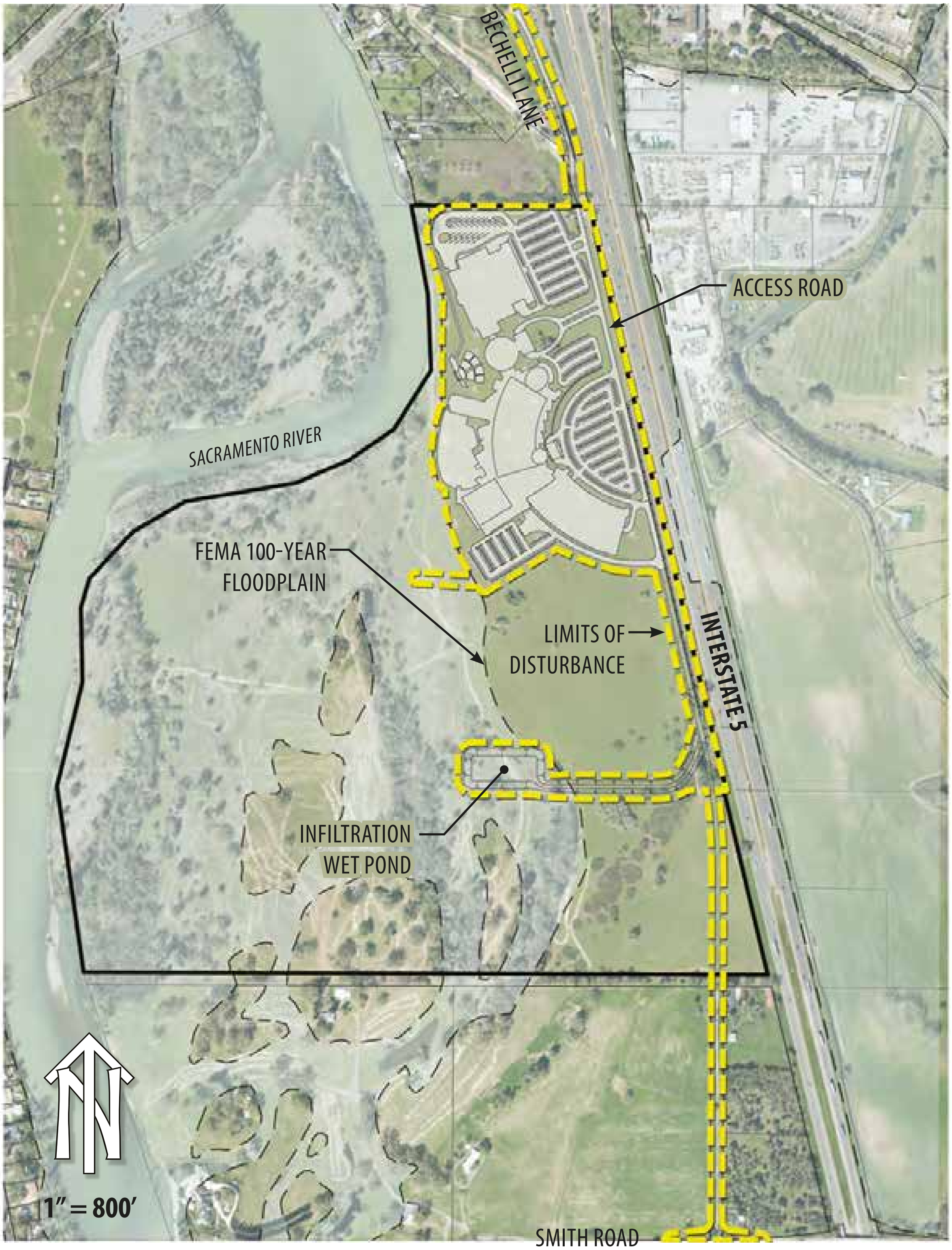
REDDING RANCHERIA
CASINO MASTER PLAN



SHARRAH DUNLAP SAWYER INCORPORATED

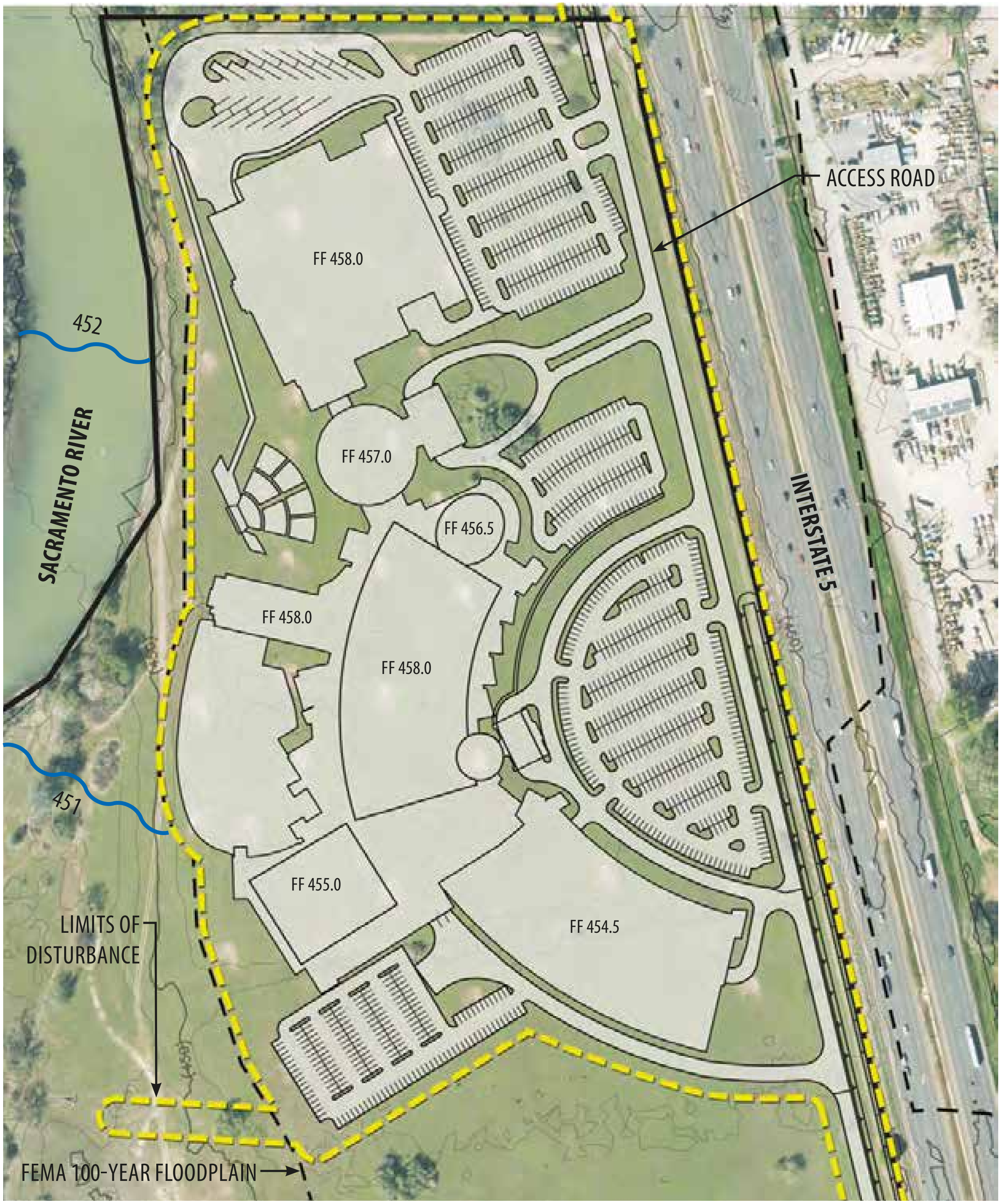
FIGURE B7
PROPOSED PROJECT - ALT 'B'
STORMWATER MANAGEMENT

Figures – Alternative C



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE C1
PROPOSED PROJECT - ALT 'C'
OVERALL DISTURBANCE LIMITS

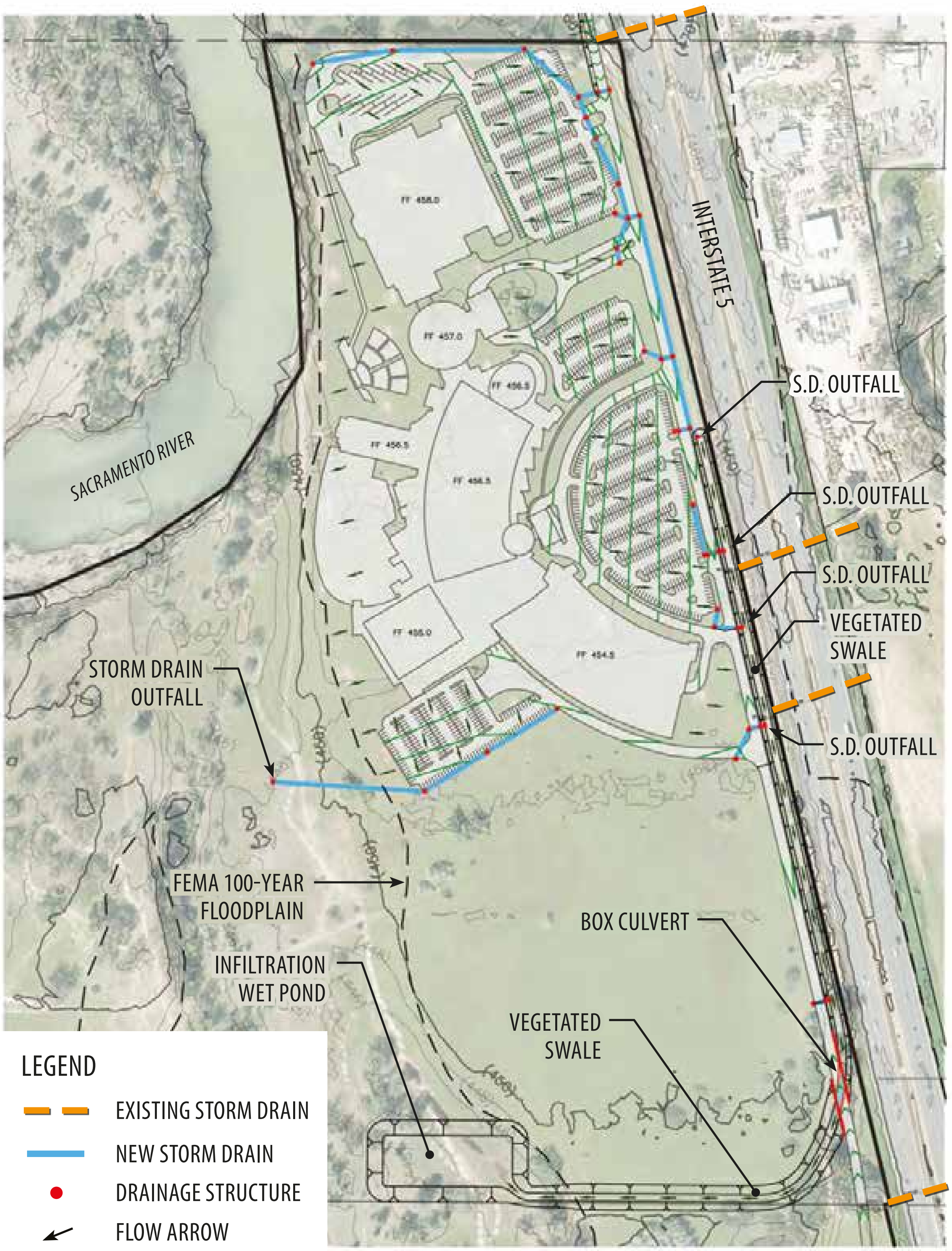


SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE C2
PROPOSED PROJECT - ALT 'C'
ONSITE DISTURBANCE LIMITS

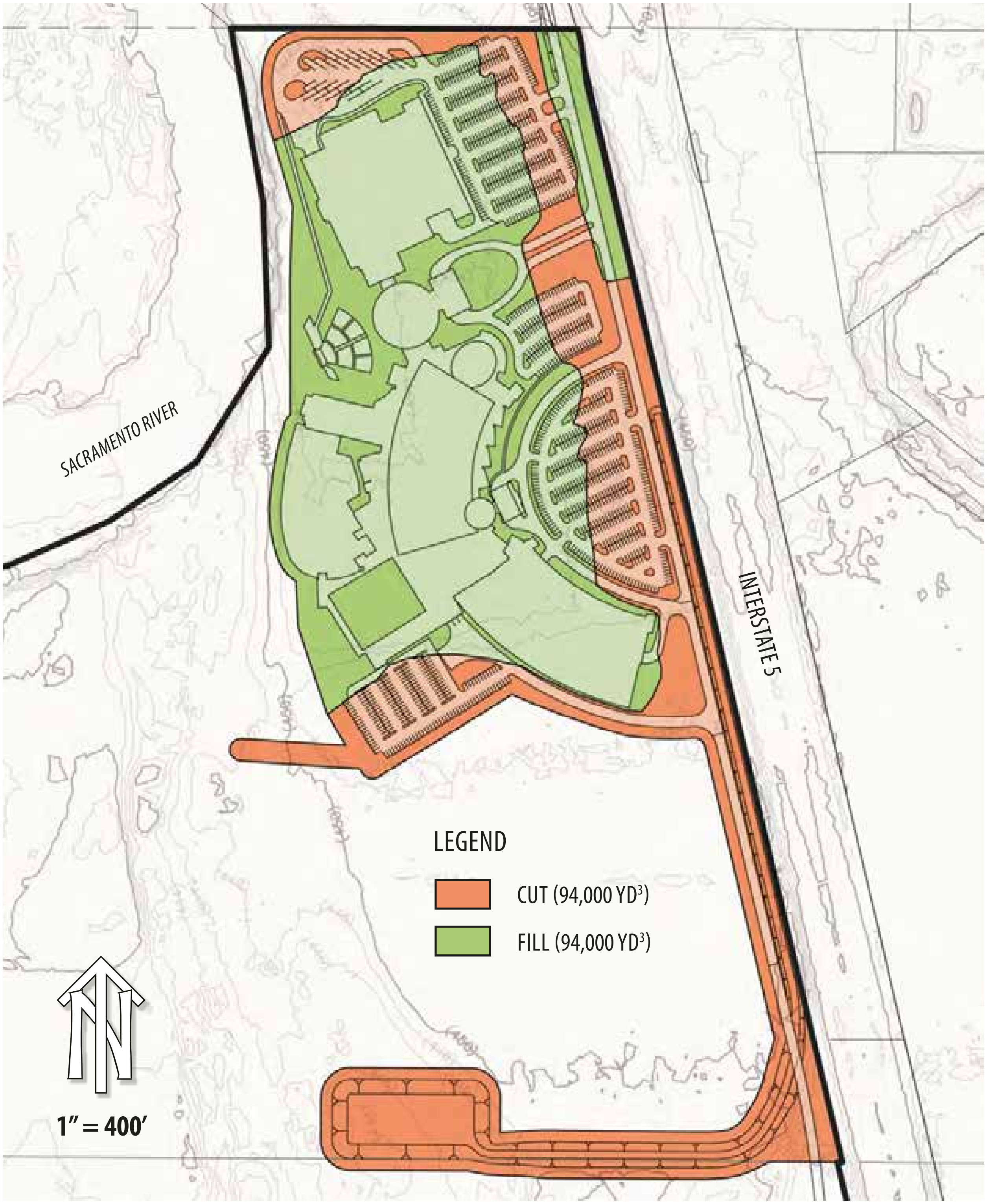
SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE C3
PROPOSED PROJECT - ALT 'C'
ONSITE GRADING



SHARRAH DUNLAP SAWYER INCORPORATED

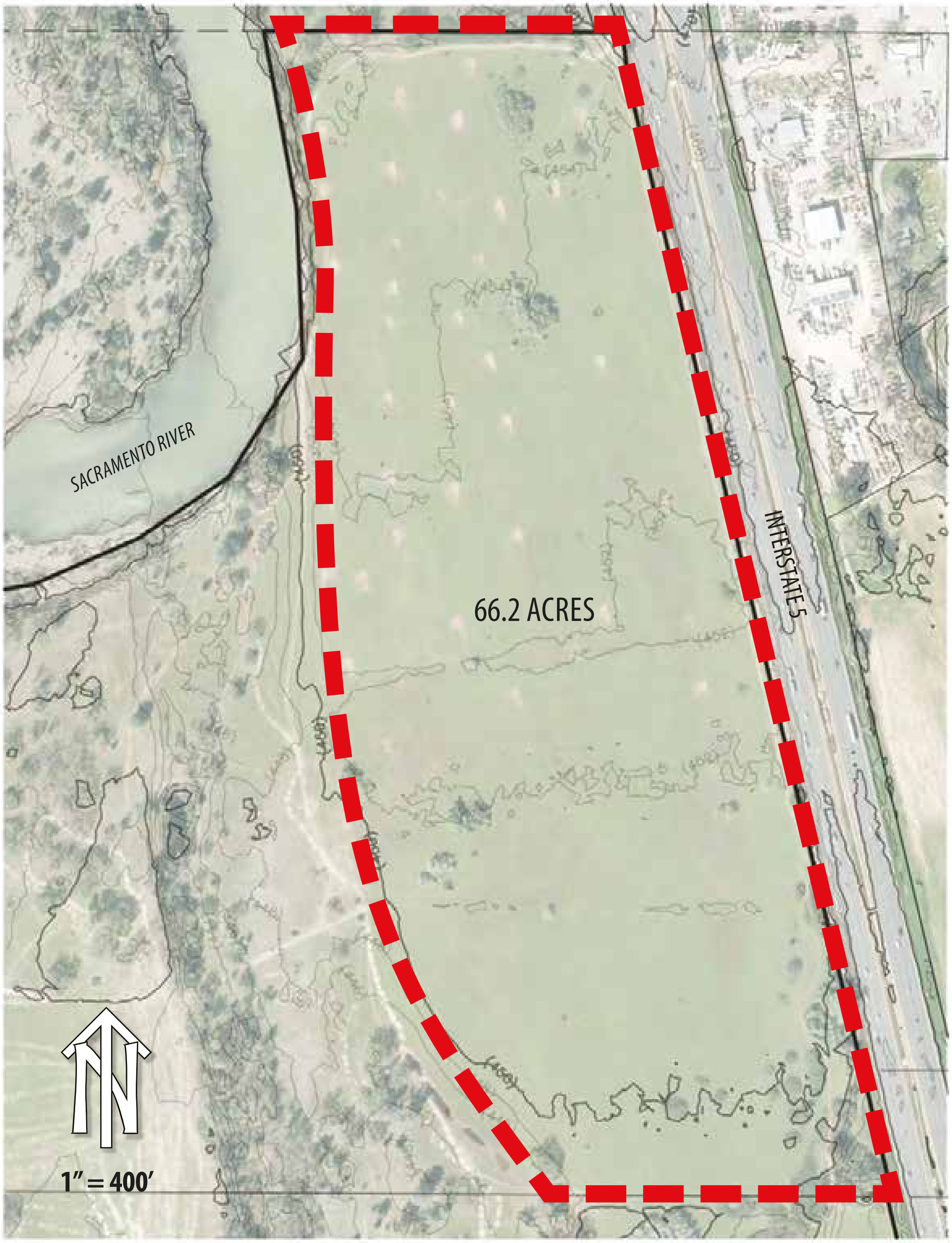
FIGURE C4
PROPOSED PROJECT - ALT 'C'
OVERALL GRADING



SHARRAH DUNLAP SAWYER INCORPORATED

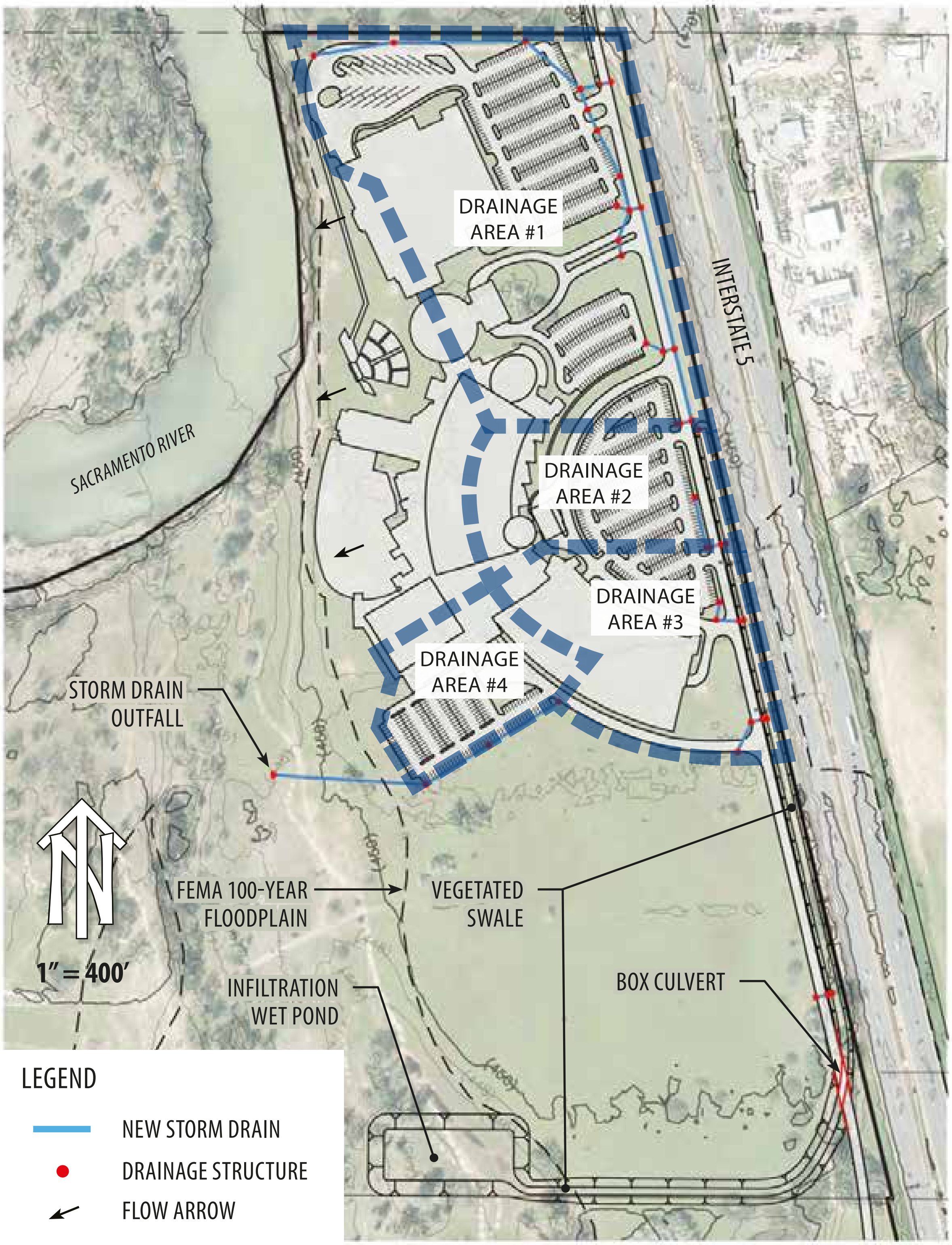
FIGURE C5
PROPOSED PROJECT - ALT 'C'
CUT FILL DIAGRAM

REDDING RANCHERIA
CASINO MASTER PLAN



SHARRAH DUNLAP SAWYER INCORPORATED

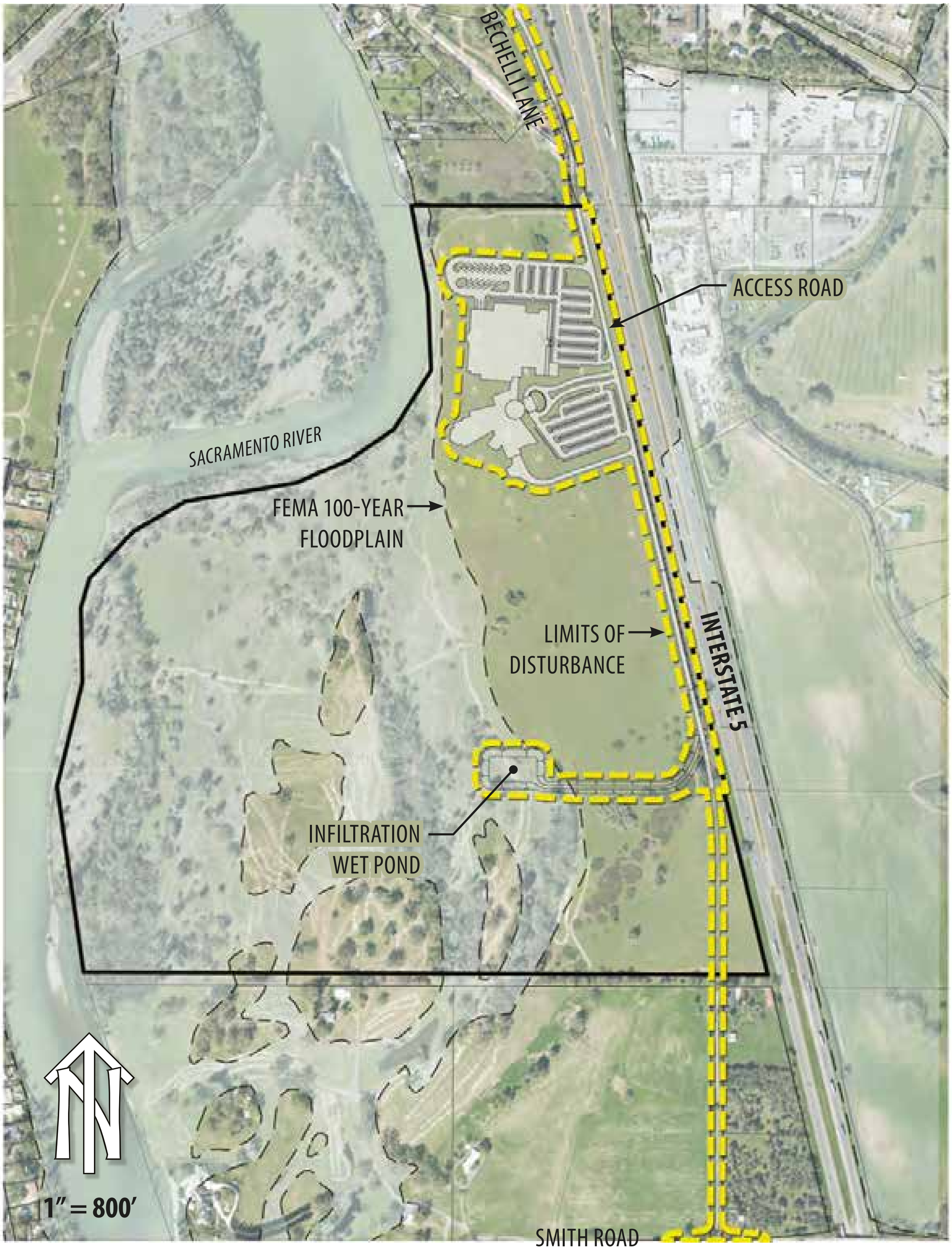
FIGURE C6
OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'C'
EXISTING CONDITION



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE C7
PROPOSED PROJECT - ALT 'C'
STORMWATER MANAGEMENT

Figures – Alternative D



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE D1
PROPOSED PROJECT - ALT 'D'
OVERALL DISTURBANCE LIMITS

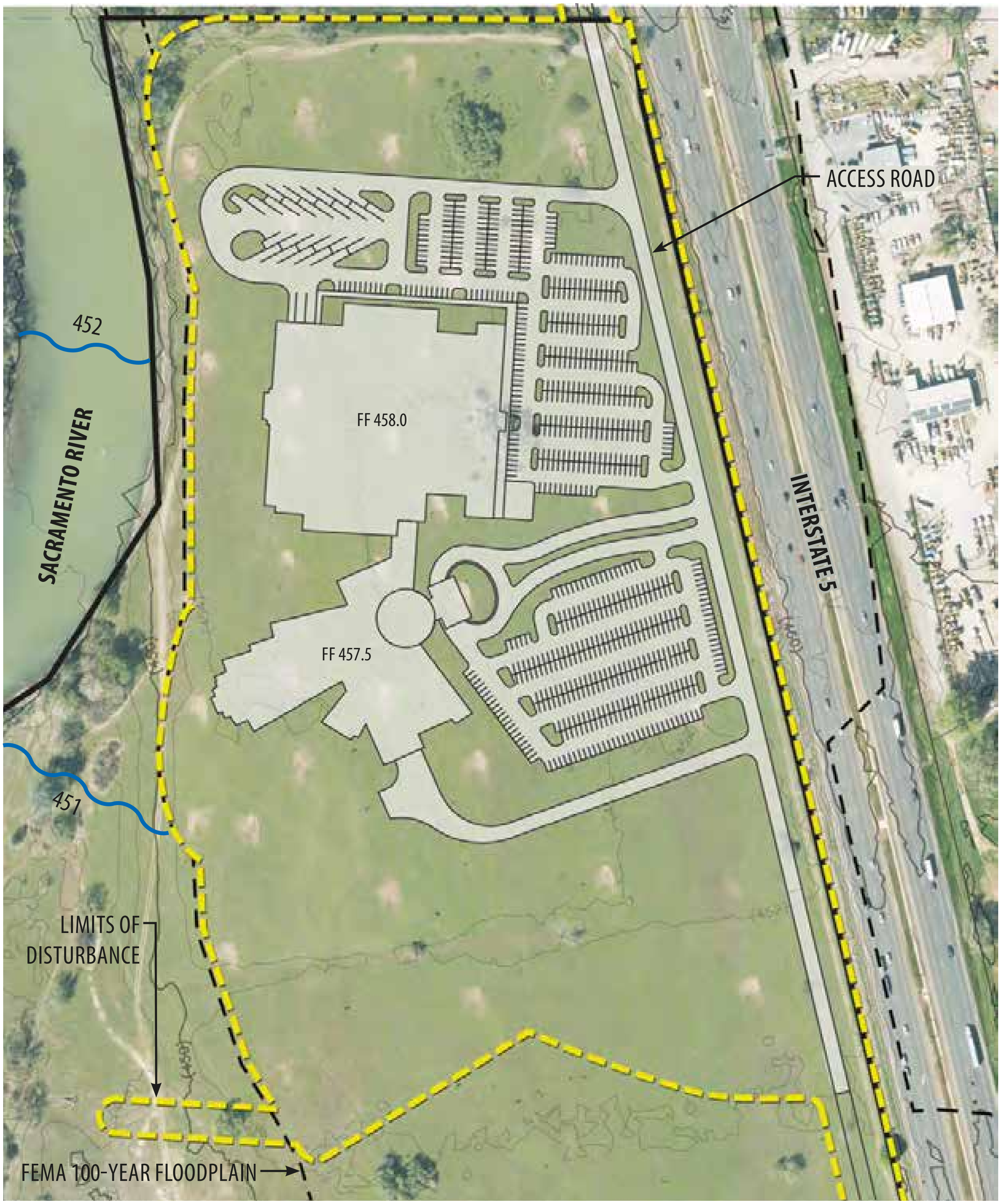


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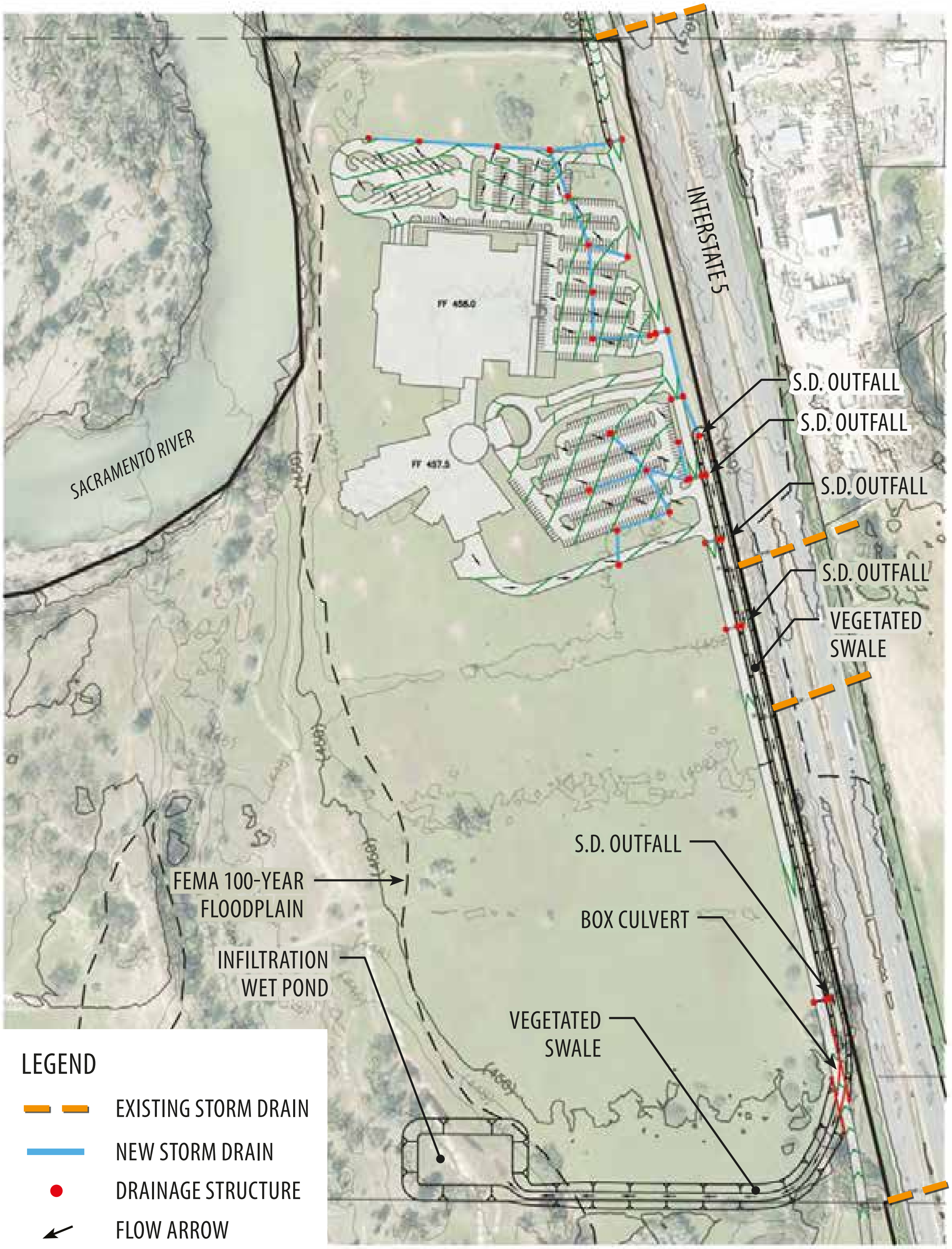
FIGURE D2
PROPOSED PROJECT - ALT 'D'
ONSITE DISTURBANCE LIMITS

LEGEND

- FINISH GRADE CONTOUR
- NEW STORM DRAIN
- EXISTING STORM DRAIN
- DRAINAGE STRUCTURE
- EXISTING DRAINAGE STRUCTURE
- 452 FEMA 100 YEAR FLOOD ELEVATION
- FLOW DIRECTION

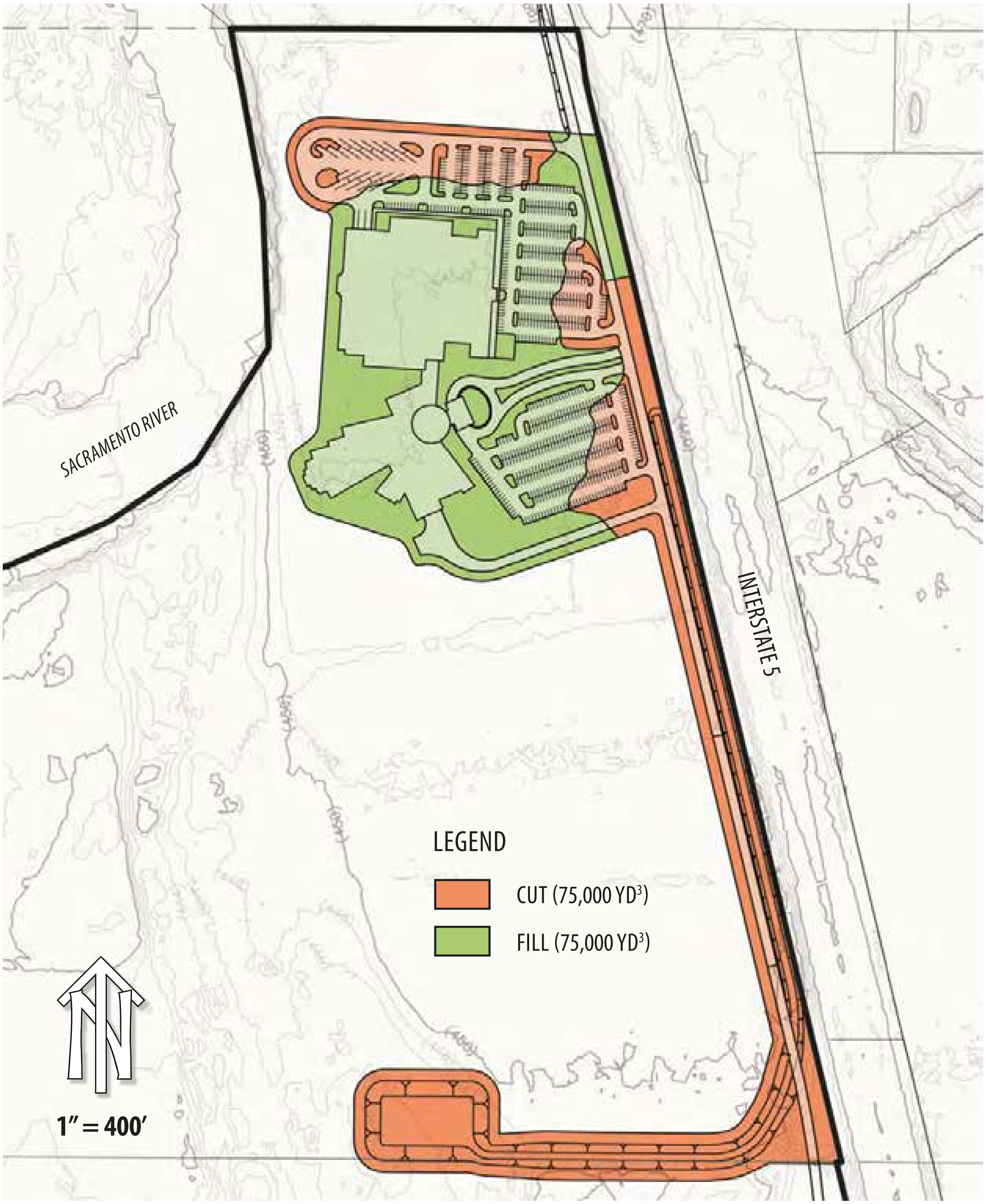
NOT TO SCALE

FIGURE D3
PROPOSED PROJECT - ALT 'D'
ONSITE GRADING



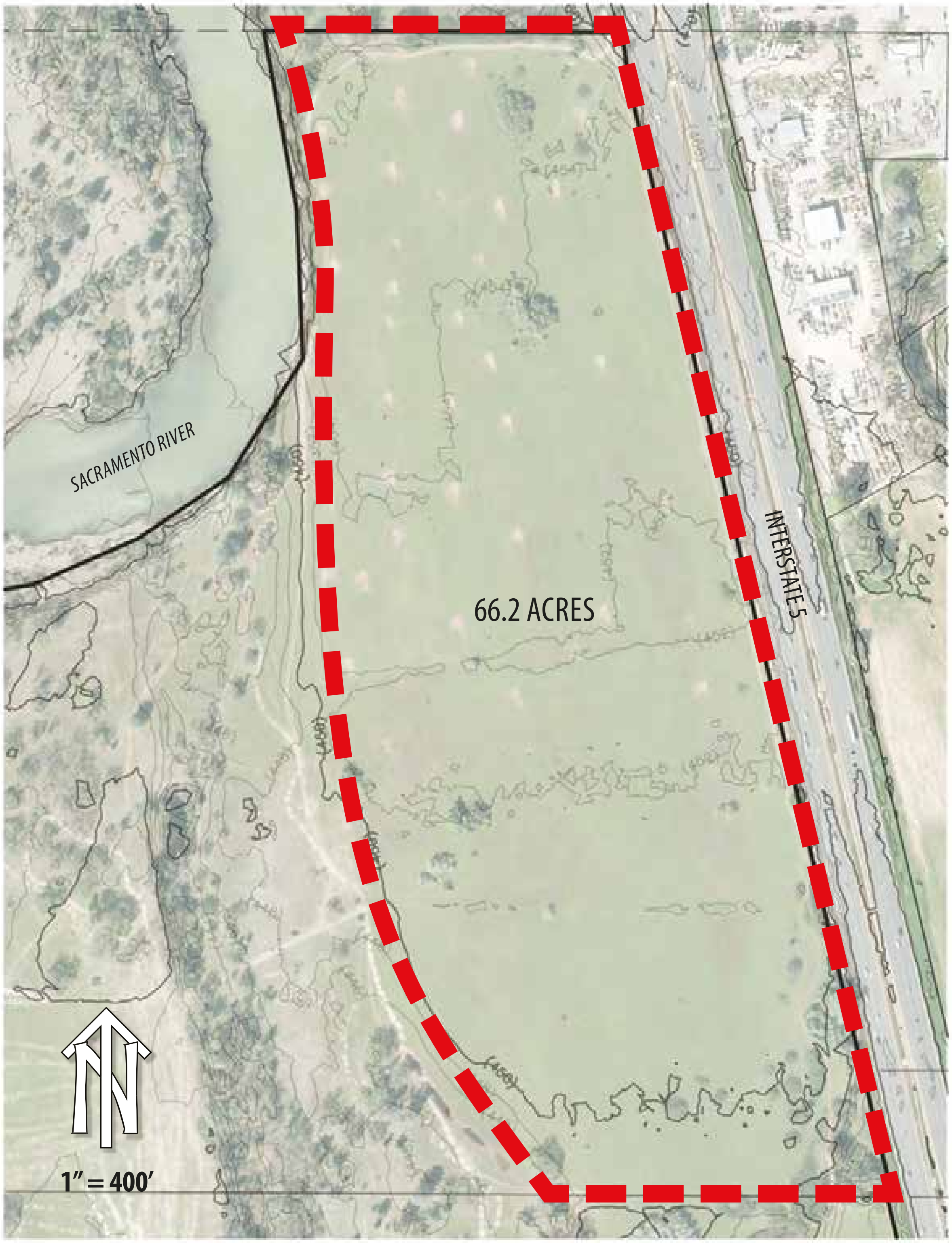
SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE D4
PROPOSED PROJECT - ALT 'D'
OVERALL GRADING



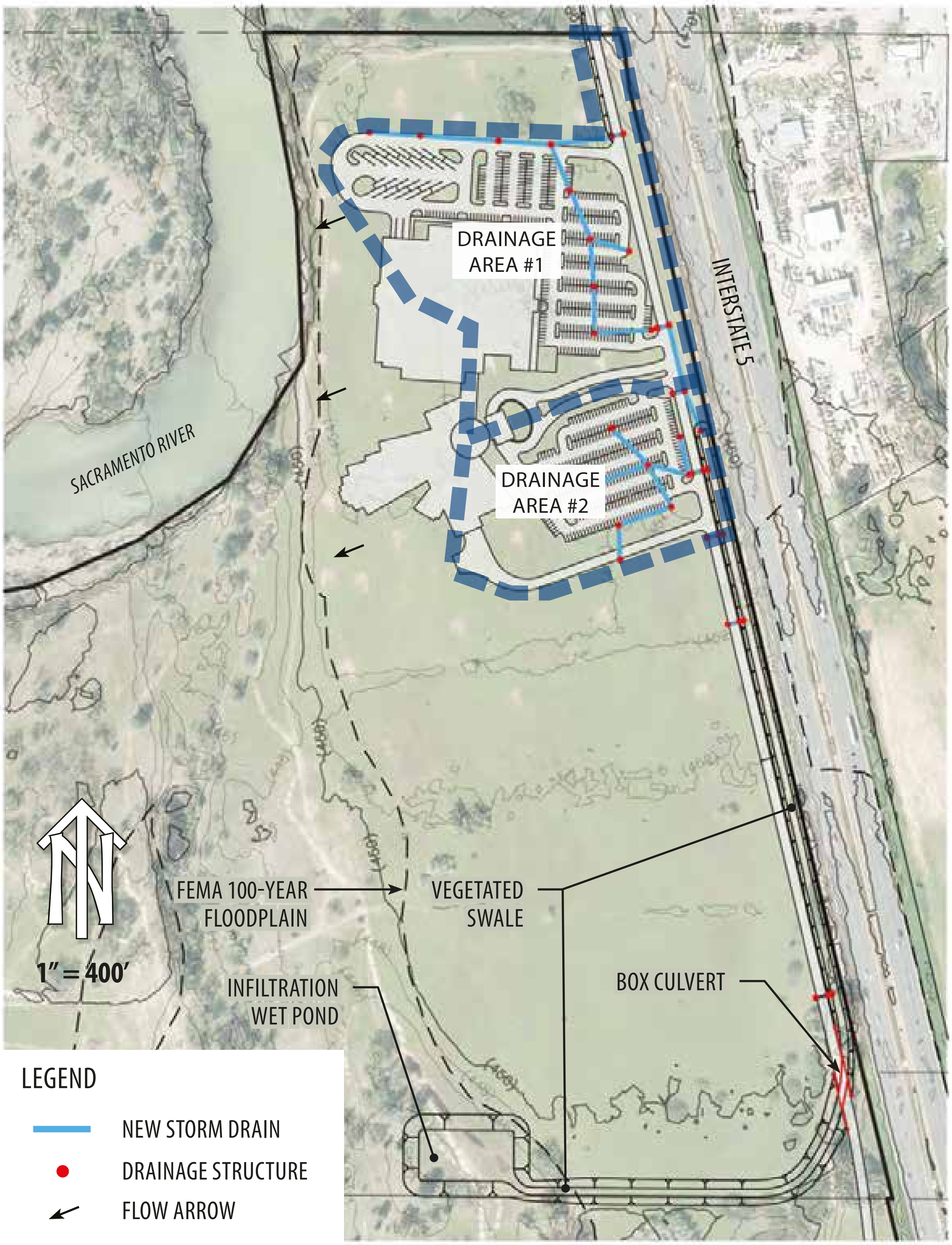
SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE D5
PROPOSED PROJECT - ALT 'D'
CUT FILL DIAGRAM



SHARRAH DUNLAP SAWYER INCORPORATED

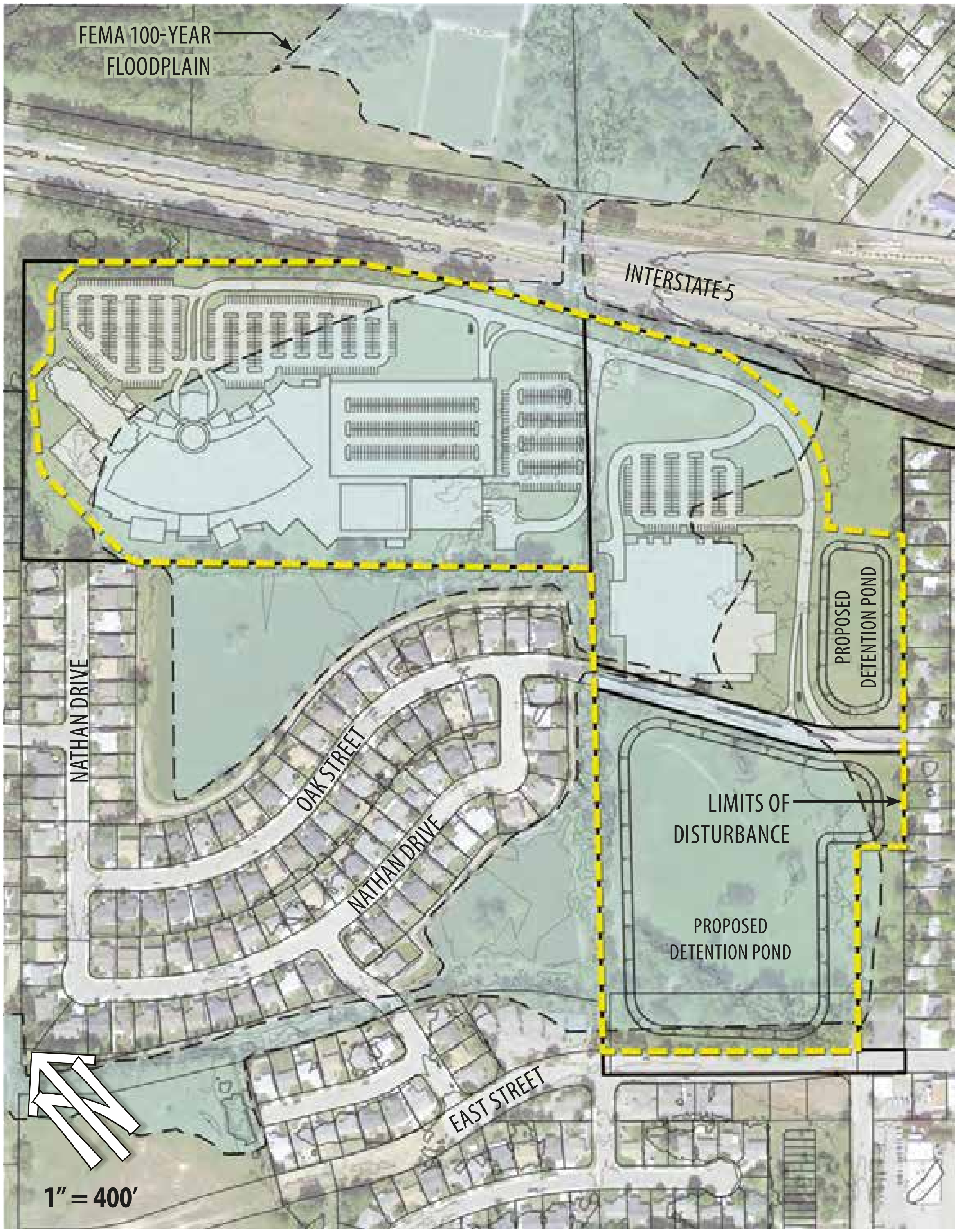
FIGURE D6
OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'D'
EXISTING CONDITION



SHARRAH DUNLAP SAWYER INCORPORATED

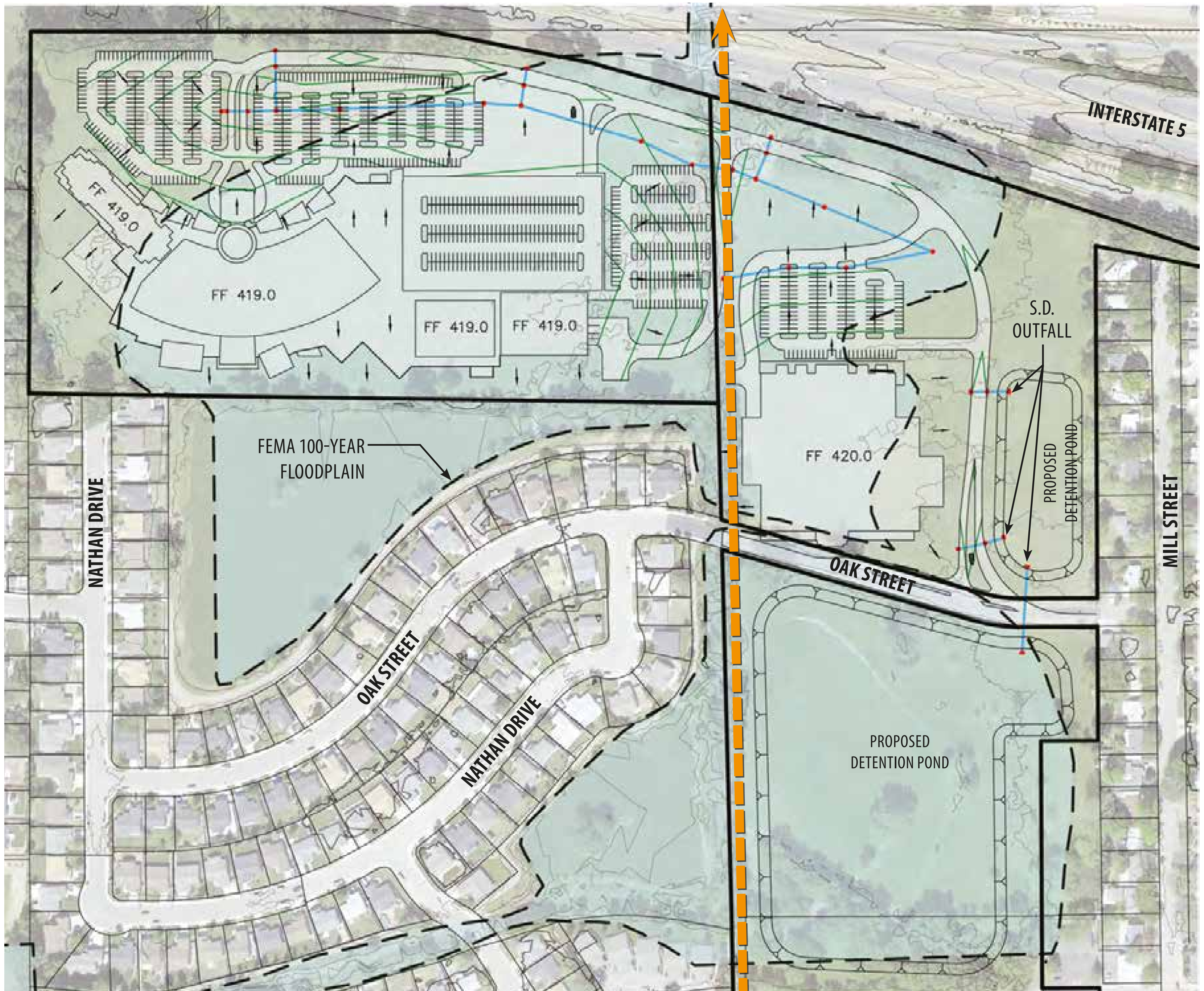
FIGURE D7
PROPOSED PROJECT - ALT 'D'
STORMWATER MANAGEMENT

Figures – Alternative E



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE E1
PROPOSED PROJECT - ALT 'E'
OVERALL DISTURBANCE LIMITS



LEGEND

- FINISH GRADE CONTOUR
- NEW STORM DRAIN
- TORMEY DRAIN
- DRAINAGE STRUCTURE
- FLOW DIRECTION

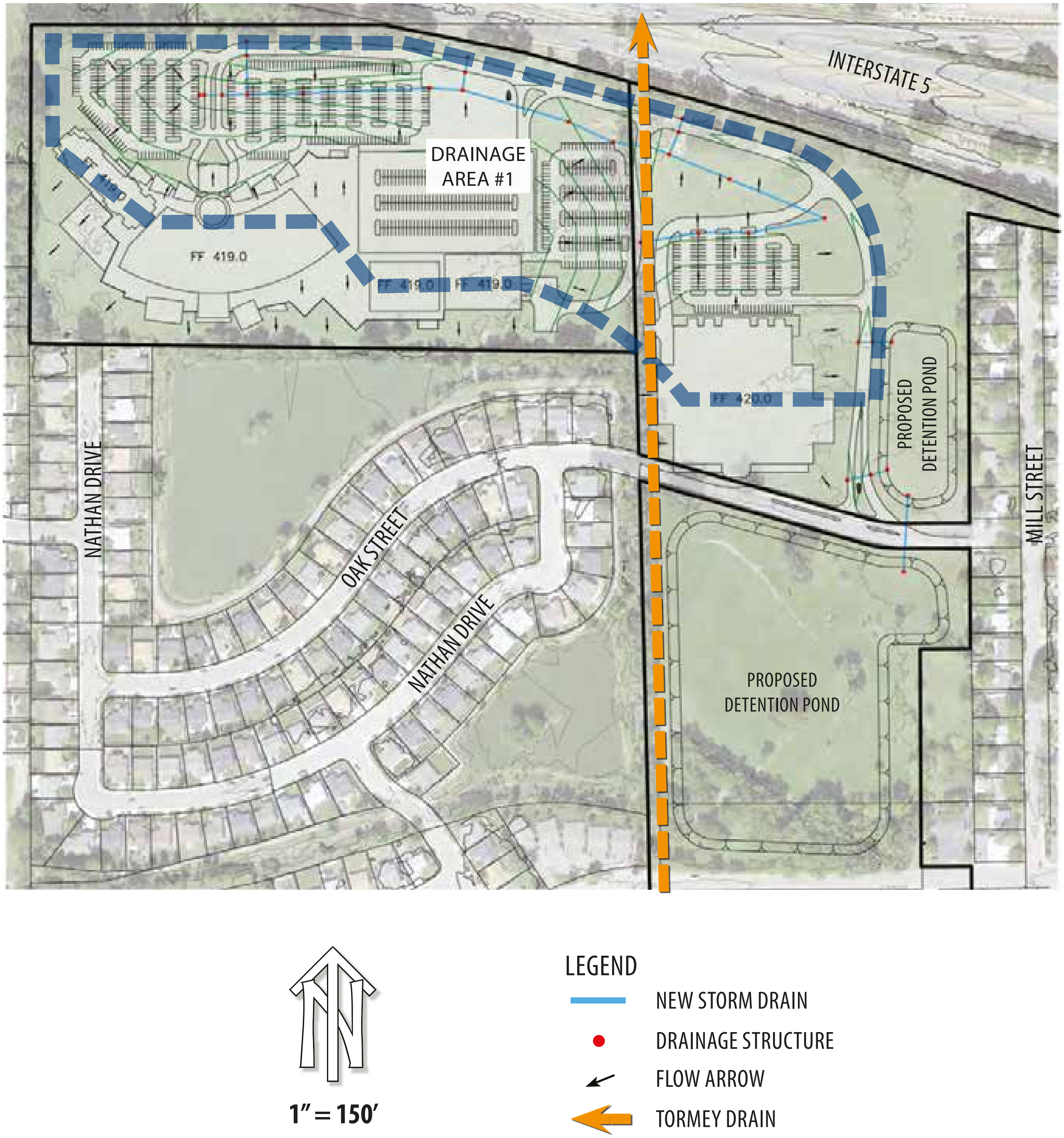
NOT TO SCALE

SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE E2
PROPOSED PROJECT - ALT 'E'
ONSITE GRADING

SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE E3
PROPOSED PROJECT - ALT 'E'
CUT FILL DIAGRAM



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE E4
PROPOSED PROJECT - ALT 'E'
STORMWATER MANAGEMENT

Appendix A

Hydrology and Hydraulic Calculations

Existing Condition Subbasin Parameters

Subbasin:	BA
Mean Subbasin Elevation (ft):	450
Subbasin Area (Sq. Mi.):	0.1034375
Subbasin Area (acres):	66.2
Land Use:	Soil A:61% 14-Pasture/Parkland/Mowed Grass Soil A:39% 17- Open Oak/Pine Woodland/Grassland
Pervious Curve Number:	66
Pervious Overland Length (ft):	300
Pervious Overland Slope (ft/ft):	0.003
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	98
Impervious Overland Length (ft):	300
Impervious Overland Slope (ft/ft):	0.003
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	700
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.040
Representative Area (acres):	10.30
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	20.0
Collector #2 (pipe or channel):	street
Length (ft):	995
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.040
Representative Area (acres):	33.10
Width (ft)/Diameter (in) :	3.0
Sideslopes (ft/ft-H/V):	20.0
Collector #3 (pipe or channel):	street
Length (ft):	995
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.040
Representative Area (acres):	66.20
Width (ft)/Diameter (in) :	4.0
Sideslopes (ft/ft-H/V):	20.0

```
1*****************************************           ****************************************
 *                                       *           *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *           *   U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998                *           *   HYDROLOGIC ENGINEERING CENTER      *
 *          VERSION 4.1                  *           *         609 SECOND STREET            *
 *                                       *           *      DAVIS, CALIFORNIA 95616         *
 * RUN DATE   23MAR17  TIME  10:47:16    *           *          (916) 756-1104              *
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                    XXXXXXX  XXXX     X      XXXXX   X
                    X     X  X        X              X
                    X     X  X        X     X        X
                    X     X  XXXXXXX   XXXXX        XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                   HEC-1 INPUT                                             PAGE  1

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   3       ID   Recurrence Interval:  2 year
   4       ID   Storm Duration:       24 hours
   5       ID   Date Compiled:        03/23/2017
   6       ID   Total Area at Point of Interest: 66.2
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           *
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  9        IN       5
           *
           * BA
           * Casino Master Plan Alternates A-D

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 24        PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
 25        PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
 26        PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
 27        PI   0.035   0.042   0.055   0.094   0.286   0.068   0.047   0.038   0.032   0.028
 28        PI   0.025   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
 29        PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
 30        PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
 31        PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 32        PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
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 44        LS       0      66       0     .05      99       0
 45        UK     300   0.003   0.600      98
 46        UK     300   0.003   0.050       2
 47        RD     700  0.0030   0.040   0.016    TRAP     2.0    20.0
```

1

```
                                     HEC-1 INPUT                                                PAGE  2

LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48        RD     995  0.0030   0.040   0.052    TRAP     3.0    20.0
 49        RD     995  0.0030   0.040   0.103    TRAP     4.0    20.0
 50        ZZ
```

```
1*****************************************                                              *****************************************
*                                         *                                              *                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *                                              *   U.S. ARMY CORPS OF ENGINEERS        *
*              JUN   1998                 *                                              *   HYDROLOGIC ENGINEERING CENTER       *
*            VERSION 4.1                  *                                              *        609 SECOND STREET              *
*                                         *                                              *     DAVIS, CALIFORNIA 95616           *
* RUN DATE   23MAR17  TIME  10:47:16      *                                              *         (916) 756-1104                *
*                                         *                                              *                                       *
*****************************************                                              *****************************************
```

```
                   HEC-1 Input Filename: 16196pre2
                   Description:          Casino Master Plan Pre-development Flow
                   Recurrence Interval:  2 year
                   Storm Duration:       24 hours
                   Date Compiled:        03/23/2017
                   Total Area at Point of Interest: 66.2

 8 IO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN           1  MINUTES IN COMPUTATION INTERVAL
                     IDATE     23Mar17  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE     24   17  ENDING DATE
                    NDTIME        0559  ENDING TIME
                     ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL      .02 HOURS
                     TOTAL TIME BASE    29.98 HOURS

       ENGLISH UNITS
           DRAINAGE AREA           SQUARE MILES
           PRECIPITATION DEPTH     INCHES
           LENGTH, ELEVATION       FEET
           FLOW                    CUBIC FEET PER SECOND
           STORAGE VOLUME          ACRE-FEET
           SURFACE AREA            ACRES
           TEMPERATURE             DEGREES FAHRENHEIT

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
               **************
               *            *
  10 KK        *      BA    *
               *            *
               **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

         *** ROFGRD - MAXIMUM NUMBER OF DX INTERVALS REACHED. MDX=201
          THIS MAY AFFECT ACCURACY OF KW SOLUTION TO REDUCE ERRORS SHORTEN OVERLANDFLOW LENGTH PLANE 1
1
                                                    RUNOFF SUMMARY
                                                FLOW IN CUBIC FEET PER SECOND
                                              TIME IN HOURS,  AREA IN SQUARE MILES

                                         PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN   MAXIMUM     TIME OF
          OPERATION       STATION        FLOW     PEAK                                            AREA    STAGE     MAX STAGE
+                                                            6-HOUR      24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             BA            3.   18.27           2.          1.          1.        .10
1
                                       SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                          (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                         INTERPOLATED TO
                                                                       COMPUTATION INTERVAL
           ISTAQ     ELEMENT      DT        PEAK     TIME TO      VOLUME       DT       PEAK    TIME TO      VOLUME
                                                       PEAK                                       PEAK

                                 (MIN)      (CFS)     (MIN)        (IN)       (MIN)     (CFS)    (MIN)        (IN)

               BA    MANE         1.00       2.66    1096.00        .42        1.00      2.66   1096.00         .42

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2643E+01 OUTFLOW= .2305E+01 BASIN STORAGE= .8765E-01 PERCENT ERROR=   9.5


 *** NORMAL END OF HEC-1 ***
```

```
1****************************************                    ****************************************
*                                       *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN  1998                *                    *   HYDROLOGIC ENGINEERING CENTER      *
*             VERSION 4.1               *                    *        609 SECOND STREET             *
*                                       *                    *     DAVIS, CALIFORNIA 95616          *
*  RUN DATE   23MAR17  TIME  10:55:33   *                    *         (916) 756-1104               *
*                                       *                    *                                      *
****************************************                    ****************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X        XXXXX  X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                         HEC-1 INPUT                                          PAGE  1

 LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1         ID   HEC-1 Input Filename: 16196pre10
   2         ID   Description:          Casino Master Plan Pre-development Flow
   3         ID   Recurrence Interval:  10 year
   4         ID   Storm Duration:       24 hours
   5         ID   Date Compiled:        03/23/2017
   6         ID   Total Area at Point of Interest: 66.2
             *
             *
             *
             *
   7         IT       1 23Mar17    0000     1800
```

```
    8           IO        5         0         0
    9           IN        5
                *
                * BA
                * Casino Master Plan Alternates A-D

   10           KK       BA
   11           KO        0
   12           PB    3.599
   13           PI    0.005     0.005     0.005     0.005     0.005     0.005     0.005     0.005     0.005     0.005
   14           PI    0.005     0.005     0.005     0.005     0.005     0.005     0.005     0.005     0.005     0.005
   15           PI    0.005     0.005     0.005     0.005     0.006     0.006     0.006     0.006     0.006     0.006
   16           PI    0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006
   17           PI    0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006
   18           PI    0.006     0.006     0.006     0.007     0.007     0.007     0.007     0.007     0.007     0.007
   19           PI    0.007     0.007     0.007     0.007     0.007     0.007     0.007     0.007     0.007     0.007
   20           PI    0.007     0.007     0.008     0.008     0.008     0.008     0.008     0.008     0.008     0.008
   21           PI    0.008     0.008     0.008     0.008     0.008     0.009     0.009     0.009     0.009     0.009
   22           PI    0.009     0.009     0.009     0.009     0.009     0.010     0.010     0.010     0.010     0.010
   23           PI    0.010     0.010     0.010     0.011     0.011     0.011     0.011     0.011     0.012     0.012
   24           PI    0.012     0.012     0.012     0.013     0.013     0.013     0.013     0.014     0.014     0.014
   25           PI    0.015     0.015     0.016     0.016     0.017     0.017     0.018     0.018     0.019     0.020
   26           PI    0.021     0.022     0.023     0.024     0.025     0.027     0.029     0.032     0.035     0.039
   27           PI    0.045     0.055     0.072     0.122     0.372     0.088     0.062     0.049     0.042     0.037
   28           PI    0.033     0.030     0.028     0.026     0.025     0.023     0.022     0.021     0.020     0.019
   29           PI    0.019     0.018     0.017     0.017     0.016     0.016     0.015     0.015     0.015     0.014
   30           PI    0.014     0.014     0.013     0.013     0.013     0.012     0.012     0.012     0.012     0.012
   31           PI    0.011     0.011     0.011     0.011     0.011     0.011     0.010     0.010     0.010     0.010
   32           PI    0.010     0.010     0.010     0.009     0.009     0.009     0.009     0.009     0.009     0.009
   33           PI    0.009     0.009     0.009     0.008     0.008     0.008     0.008     0.008     0.008     0.008
   34           PI    0.008     0.008     0.008     0.008     0.008     0.008     0.007     0.007     0.007     0.007
   35           PI    0.007     0.007     0.007     0.007     0.007     0.007     0.007     0.007     0.007     0.007
   36           PI    0.007     0.007     0.007     0.007     0.007     0.007     0.006     0.006     0.006     0.006
   37           PI    0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006
   38           PI    0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006     0.006
   39           PI    0.006     0.006     0.006     0.006     0.005     0.005     0.005     0.005     0.005     0.005
   40           PI    0.005     0.005     0.005     0.005     0.005     0.005     0.005     0.005     0.005     0.005
   41           PI    0.005     0.005     0.005     0.005     0.005     0.005     0.005     0.005
   42           BA   0.1034
   43           BF       -1     -0.01       1.1
   44           LS        0        66         0       .05        99         0
   45           UK      300     0.003     0.600        98
   46           UK      300     0.003     0.050         2
   47           RD      700    0.0030     0.040     0.016      TRAP       2.0      20.0
1                                                 HEC-1 INPUT                                                PAGE  2

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   48           RD      995    0.0030     0.040     0.052      TRAP       3.0      20.0
```

```
        49            RD      995  0.0030   0.040   0.103    TRAP     4.0     20.0
        50            ZZ
1***************************************                                                       ***************************************
 *                                     *                                                       *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                       *   U.S. ARMY CORPS OF ENGINEERS        *
 *            JUN   1998                 *                                                       *   HYDROLOGIC ENGINEERING CENTER       *
 *         VERSION 4.1                   *                                                       *         609 SECOND STREET             *
 *                                     *                                                       *      DAVIS, CALIFORNIA 95616          *
 *  RUN DATE   23MAR17  TIME  10:55:33   *                                                       *        (916) 756-1104                 *
 *                                     *                                                       *                                     *
***************************************                                                       ***************************************



                         HEC-1 Input Filename: 16196pre10
                         Description:          Casino Master Plan Pre-development Flow
                         Recurrence Interval:  10 year
                         Storm Duration:       24 hours
                         Date Compiled:        03/23/2017
                         Total Area at Point of Interest: 66.2

   8 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          1  MINUTES IN COMPUTATION INTERVAL
                      IDATE    23Mar17  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE    24   17  ENDING DATE
                     NDTIME       0559  ENDING TIME
                      ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
  10 KK   *       BA   *
          *            *
          **************

  11 KO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                          RUNOFF SUMMARY
                                   FLOW IN CUBIC FEET PER SECOND
                                 TIME IN HOURS,  AREA IN SQUARE MILES

                                      PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD       BASIN    MAXIMUM     TIME OF
         OPERATION        STATION     FLOW     PEAK                                              AREA     STAGE    MAX STAGE
+                                                          6-HOUR      24-HOUR     72-HOUR

         HYDROGRAPH AT
+                             BA        7.   16.03           5.          2.          2.           .10
1
                                     SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                         (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                              INTERPOLATED TO
                                                                           COMPUTATION INTERVAL
           ISTAQ    ELEMENT       DT       PEAK     TIME TO    VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                    PEAK

                                (MIN)     (CFS)      (MIN)      (IN)      (MIN)     (CFS)    (MIN)       (IN)

              BA  MANE           1.00      6.55     962.00       .82       1.00      6.55    962.00        .82

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .4999E+01 OUTFLOW= .4546E+01 BASIN STORAGE= .9902E-01 PERCENT ERROR=   7.1


*** NORMAL END OF HEC-1 ***
```

```
1*****************************************                         *****************************************
 *                                       *                         *                                       *
 *   FLOOD HYDROGRAPH PACKAGE   (HEC-1)  *                         *   U.S. ARMY CORPS OF ENGINEERS        *
 *             JUN   1998                *                         *   HYDROLOGIC ENGINEERING CENTER       *
 *            VERSION 4.1                *                         *        609 SECOND STREET              *
 *                                       *                         *      DAVIS, CALIFORNIA 95616          *
 * RUN DATE   23MAR17  TIME  10:56:13    *                         *         (916) 756-1104                *
 *                                       *                         *                                       *
*****************************************                         *****************************************


                    X     X  XXXXXXX   XXXXX         X
                    X     X  X        X     X       XX
                    X     X  X        X              X
                    XXXXXXX  XXXX     X       XXXXX  X
                    X     X  X        X              X
                    X     X  X        X     X        X
                    X     X  XXXXXXX   XXXXX        XXX


     THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

     THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
     THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
     NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
     DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
     KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                          HEC-1 INPUT                                                    PAGE  1

     LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

       1           ID   HEC-1 Input Filename: 16196pre100
       2           ID   Description:          Casino Master Plan Pre-development Flow
       3           ID   Recurrence Interval:  100 year
       4           ID   Storm Duration:       24 hours
       5           ID   Date Compiled:        03/23/2017
       6           ID   Total Area at Point of Interest: 66.2
                   *
                   *
                   *
                   *
       7           IT       1 23Mar17    0000     1800
```

```
  8         IO      5       0       0
  9         IN      5
            *
            * BA
            * Casino Master Plan Alternates A-D

 10         KK     BA
 11         KO      0
 12         PB  5.069
 13         PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 14         PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008
 15         PI  0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 16         PI  0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 17         PI  0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 18         PI  0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.010   0.010
 19         PI  0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
 20         PI  0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
 21         PI  0.011   0.011   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.012
 22         PI  0.013   0.013   0.013   0.013   0.013   0.013   0.014   0.014   0.014   0.014
 23         PI  0.014   0.015   0.015   0.015   0.015   0.015   0.016   0.016   0.016   0.016
 24         PI  0.017   0.017   0.017   0.018   0.018   0.019   0.019   0.019   0.020   0.020
 25         PI  0.021   0.021   0.022   0.023   0.023   0.024   0.025   0.026   0.027   0.028
 26         PI  0.029   0.030   0.032   0.034   0.036   0.038   0.041   0.045   0.049   0.055
 27         PI  0.064   0.077   0.101   0.172   0.526   0.125   0.087   0.070   0.059   0.052
 28         PI  0.047   0.043   0.040   0.037   0.035   0.033   0.031   0.030   0.028   0.027
 29         PI  0.026   0.025   0.024   0.024   0.023   0.022   0.022   0.021   0.021   0.020
 30         PI  0.020   0.019   0.019   0.018   0.018   0.018   0.017   0.017   0.017   0.016
 31         PI  0.016   0.016   0.016   0.015   0.015   0.015   0.015   0.014   0.014   0.014
 32         PI  0.014   0.014   0.013   0.013   0.013   0.013   0.013   0.013   0.013   0.012
 33         PI  0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011   0.011   0.011
 34         PI  0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
 35         PI  0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
 36         PI  0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 37         PI  0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008
 38         PI  0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 39         PI  0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 40         PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 41         PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 42         BA 0.1034
 43         BF     -1   -0.01     1.1
 44         LS      0      66       0     .05      99       0
 45         UK    300   0.003   0.600      98
 46         UK    300   0.003   0.050       2
 47         RD    700  0.0030   0.040   0.016    TRAP     2.0    20.0
1                                       HEC-1 INPUT                                            PAGE  2

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48         RD    995  0.0030   0.040   0.052    TRAP     3.0    20.0
```

```
          49             RD      995  0.0030   0.040   0.103    TRAP     4.0     20.0
          50             ZZ
1*****************************************                                                    ****************************************
*                                        *                                                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE   (HEC-1)   *                                                    *   U.S. ARMY CORPS OF ENGINEERS       *
*             JUN   1998                 *                                                    *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.1                  *                                                    *        609 SECOND STREET             *
*                                        *                                                    *     DAVIS, CALIFORNIA 95616          *
*  RUN DATE   23MAR17  TIME  10:56:13    *                                                    *        (916) 756-1104                *
*                                        *                                                    *                                      *
*****************************************                                                    ****************************************



                    HEC-1 Input Filename: 16196pre100
                    Description:          Casino Master Plan Pre-development Flow
                    Recurrence Interval:  100 year
                    Storm Duration:       24 hours
                    Date Compiled:        03/23/2017
                    Total Area at Point of Interest: 66.2

  8 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          1  MINUTES IN COMPUTATION INTERVAL
                      IDATE    23Mar17  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE    24   17  ENDING DATE
                     NDTIME       0559  ENDING TIME
                      ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL      .02 HOURS
                     TOTAL TIME BASE    29.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

             **************
             *            *
  10 KK      *        BA  *
             *            *
             **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                     RUNOFF SUMMARY
                              FLOW IN CUBIC FEET PER SECOND
                           TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF      AVERAGE FLOW FOR MAXIMUM PERIOD       BASIN     MAXIMUM     TIME OF
         OPERATION       STATION   FLOW    PEAK                                               AREA      STAGE     MAX STAGE
+                                                       6-HOUR      24-HOUR     72-HOUR

         HYDROGRAPH AT
+                           BA       19.   14.35          12.          5.          4.         .10
1
                             SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                  INTERPOLATED TO
                                                               COMPUTATION INTERVAL
           ISTAQ    ELEMENT     DT        PEAK    TIME TO     VOLUME      DT        PEAK    TIME TO      VOLUME
                                                    PEAK                                       PEAK

                               (MIN)      (CFS)    (MIN)       (IN)      (MIN)      (CFS)    (MIN)        (IN)

               BA   MANE        1.00      18.61   861.00       1.69       1.00      18.61   861.00        1.69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1013E+02 OUTFLOW= .9309E+01 BASIN STORAGE= .1035E+00 PERCENT ERROR=   7.1


*** NORMAL END OF HEC-1 ***
```

Existing Condition Subbasin Parameters

Subbasin:	Basin E
Mean Subbasin Elevation (ft):	414
Subbasin Area (Sq. Mi.):	0.06328125
Subbasin Area (acres):	40.5
Land Use:	Soil A:75% Soil D:25% 14-Pasture/Parkland/Mowed Grass
Pervious Curve Number:	73
Pervious Overland Length (ft):	200
Pervious Overland Slope (ft/ft):	0.005
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	98
Impervious Overland Length (ft):	200
Impervious Overland Slope (ft/ft):	0.005
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	672
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.040
Representative Area (acres):	3.00
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	20.0
Collector #2 (pipe or channel):	street
Length (ft):	672
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.040
Representative Area (acres):	20.25
Width (ft)/Diameter (in) :	3.0
Sideslopes (ft/ft-H/V):	20.0
Collector #3 (pipe or channel):	street
Length (ft):	672
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.040
Representative Area (acres):	40.50
Width (ft)/Diameter (in) :	4.0
Sideslopes (ft/ft-H/V):	20.0

```
1****************************************                    ****************************************
*                                        *                    *                                        *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                    *   U.S. ARMY CORPS OF ENGINEERS         *
*              JUN   1998                *                    *   HYDROLOGIC ENGINEERING CENTER        *
*            VERSION 4.1                 *                    *        609 SECOND STREET               *
*                                        *                    *     DAVIS, CALIFORNIA 95616            *
*  RUN DATE   27MAR17  TIME  10:57:25    *                    *         (916) 756-1104                 *
*                                        *                    *                                        *
****************************************                    ****************************************


                    X     X  XXXXXXX   XXXXX         X
                    X     X  X        X     X       XX
                    X     X  X        X              X
                    XXXXXXX  XXXX     X       XXXXX  X
                    X     X  X        X              X
                    X     X  X        X     X        X
                    X     X  XXXXXXX   XXXXX        XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                     HEC-1 INPUT                                              PAGE  1

LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1        ID   HEC-1 Input Filename: 16196preE
  2        ID   Description:          Casino Master Plan Alternative E Pre-development Flow
  3        ID   Recurrence Interval:  2 year
  4        ID   Storm Duration:       24 hours
  5        ID   Date Compiled:        03/27/2017
  6        ID   Total Area at Point of Interest: 40.5
           *
           *
           *
           *
  7        IT       1 27Mar17    0000    1800
```

```
  8       IO      5       0       0
  9       IN      5
          *
          * Basin E
          * Alternative E - Anderson, Ca

 10       KK  Basin
 11       KO      0
 12       FB  2.580
 13       PI  0.003   0.003   0.003   0.003   0.004   0.004   0.004   0.004   0.004   0.004
 14       PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 15       PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 16       PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 17       PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 18       PI  0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 19       PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 20       PI  0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
 21       PI  0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 22       PI  0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 23       PI  0.007   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 24       PI  0.008   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010
 25       PI  0.011   0.011   0.011   0.011   0.012   0.012   0.013   0.013   0.014   0.014
 26       PI  0.015   0.015   0.016   0.017   0.018   0.020   0.021   0.023   0.025   0.028
 27       PI  0.033   0.040   0.052   0.089   0.278   0.065   0.045   0.036   0.030   0.027
 28       PI  0.024   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.014   0.014
 29       PI  0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011   0.010   0.010
 30       PI  0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008
 31       PI  0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007   0.007
 32       PI  0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 33       PI  0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 34       PI  0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 35       PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 36       PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.004   0.004
 37       PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 38       PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 39       PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 40       PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 41       PI  0.004   0.004   0.004   0.004   0.003   0.003   0.003   0.003
 42       BA 0.0632
 43       BF     -1   -0.01     1.1
 44       LS      0      73       0     .05      99       0
 45       UK    200   0.005   0.600      98
 46       UK    200   0.005   0.050       2
 47       RD    672  0.0050   0.040   0.005    TRAP     2.0    20.0
1                                    HEC-1 INPUT                                        PAGE  2

LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48       RD    672  0.0050   0.040   0.032    TRAP     3.0    20.0
```

```
          49           RD     672  0.0050   0.040   0.063    TRAP     4.0    20.0
          50           ZZ
1****************************************                                                            ****************************************
*                                       *                                                            *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                            *   U.S. ARMY CORPS OF ENGINEERS        *
*             JUN   1998                *                                                            *   HYDROLOGIC ENGINEERING CENTER       *
*           VERSION 4.1                 *                                                            *        609 SECOND STREET              *
*                                       *                                                            *     DAVIS, CALIFORNIA 95616           *
*  RUN DATE   27MAR17  TIME  10:57:25   *                                                            *        (916) 756-1104                 *
*                                       *                                                            *                                      *
****************************************                                                            ****************************************


                           HEC-1 Input Filename: 16196postE
                           Description:          Casino Master Plan Alternative E Pre-development Flow
                           Recurrence Interval:  2 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/27/2017
                           Total Area at Point of Interest: 40.5

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                       ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
  10 KK       *   Basin    *
              *            *
              **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                      RUNOFF SUMMARY
                                               FLOW IN CUBIC FEET PER SECOND
                                            TIME IN HOURS,  AREA IN SQUARE MILES

                                          PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD       BASIN     MAXIMUM     TIME OF
         OPERATION        STATION         FLOW     PEAK                                              AREA      STAGE     MAX STAGE
+                                                               6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                          Basin             4.    14.82           2.          1.          1.         .06
1
                                               SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                  (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                 INTERPOLATED TO
                                                                              COMPUTATION INTERVAL
           ISTAQ     ELEMENT        DT        PEAK     TIME TO      VOLUME        DT        PEAK     TIME TO      VOLUME
                                                         PEAK                                          PEAK

                                  (MIN)      (CFS)      (MIN)       (IN)       (MIN)      (CFS)      (MIN)        (IN)

           Basin    MANE           1.00       3.54     889.00        .62        1.00       3.54     889.00         .62

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2184E+01 OUTFLOW= .2074E+01 BASIN STORAGE= .2573E-01 PERCENT ERROR=   3.8


*** NORMAL END OF HEC-1 ***
```

```
1****************************************                    ****************************************
*                                       *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN   1998               *                    *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.1                 *                    *         609 SECOND STREET            *
*                                       *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   27MAR17  TIME  10:58:10   *                    *          (916) 756-1104              *
*                                       *                    *                                      *
****************************************                    ****************************************


                     X     X  XXXXXXX   XXXXX          X
                     X     X  X        X     X        XX
                     X     X  X        X               X
                     XXXXXXX  XXXX     X       XXXXX   X
                     X     X  X        X               X
                     X     X  X        X     X         X
                     X     X  XXXXXXX   XXXXX         XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                          HEC-1 INPUT                                          PAGE  1

      LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

        1         ID   HEC-1 Input Filename: 16196preE
        2         ID   Description:          Casino Master Plan Alternative E Pre-development Flow
        3         ID   Recurrence Interval:  10 year
        4         ID   Storm Duration:       24 hours
        5         ID   Date Compiled:        03/27/2017
        6         ID   Total Area at Point of Interest: 40.5
                  *
                  *
                  *
                  *
        7         IT       1 27Mar17    0000    1800
```

```
  8          IO      5       0       0
  9          IN      5
             *
             * Basin E
             * Alternative E - Anderson, Ca

 10          KK  Basin
 11          KO      0
 12          PB  3.362
 13          PI  0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 14          PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 15          PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 16          PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 17          PI  0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 18          PI  0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 19          PI  0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
 20          PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 21          PI  0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 22          PI  0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 23          PI  0.009   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.011   0.011
 24          PI  0.011   0.011   0.011   0.012   0.012   0.012   0.012   0.013   0.013   0.013
 25          PI  0.014   0.014   0.015   0.015   0.015   0.016   0.016   0.017   0.018   0.018
 26          PI  0.019   0.020   0.021   0.022   0.024   0.025   0.027   0.030   0.033   0.037
 27          PI  0.043   0.052   0.068   0.116   0.362   0.084   0.059   0.047   0.040   0.035
 28          PI  0.031   0.029   0.026   0.025   0.023   0.022   0.021   0.020   0.019   0.018
 29          PI  0.017   0.017   0.016   0.016   0.015   0.015   0.014   0.014   0.014   0.013
 30          PI  0.013   0.013   0.012   0.012   0.012   0.012   0.011   0.011   0.011   0.011
 31          PI  0.011   0.010   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009
 32          PI  0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008   0.008
 33          PI  0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007
 34          PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 35          PI  0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006
 36          PI  0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 37          PI  0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.005   0.005
 38          PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 39          PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 40          PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 41          PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 42          BA 0.0632
 43          BF     -1   -0.01     1.1
 44          LS      0      73       0     .05      99       0
 45          UK    200   0.005   0.600      98
 46          UK    200   0.005   0.050       2
 47          RD    672  0.0050   0.040   0.005    TRAP     2.0    20.0
1                                     HEC-1 INPUT                                                  PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48          RD    672  0.0050   0.040   0.032    TRAP     3.0    20.0
```

```
        49          RD    672  0.0050   0.040   0.063    TRAP     4.0    20.0
        50          ZZ
1***************************************                                                   ***************************************
 *                                     *                                                   *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                   *   U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                   *   HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                                   *        609 SECOND STREET            *
 *                                     *                                                   *     DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   27MAR17  TIME  10:58:10  *                                                   *         (916) 756-1104              *
 *                                     *                                                   *                                     *
***************************************                                                   ***************************************


                          HEC-1 Input Filename: 16196postE
                          Description:          Casino Master Plan Alternative E Pre-development Flow
                          Recurrence Interval:  10 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/27/2017
                          Total Area at Point of Interest: 40.5

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          1  MINUTES IN COMPUTATION INTERVAL
                       IDATE    27Mar17  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME       0559  ENDING TIME
                       ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL      .02 HOURS
                      TOTAL TIME BASE    29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


              **************
              *            *
   10 KK      *   Basin    *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                         RUNOFF SUMMARY
                                                 FLOW IN CUBIC FEET PER SECOND
                                              TIME IN HOURS,  AREA IN SQUARE MILES

                                             PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD       BASIN     MAXIMUM     TIME OF
           OPERATION        STATION          FLOW     PEAK                                              AREA      STAGE     MAX STAGE
+                                                                  6-HOUR      24-HOUR      72-HOUR

           HYDROGRAPH AT
+                            Basin              8    13.80           5.           2.           1.         .06
1
                                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                     INTERPOLATED TO
                                                                                  COMPUTATION INTERVAL
             ISTAQ     ELEMENT       DT        PEAK     TIME TO     VOLUME       DT       PEAK     TIME TO      VOLUME
                                                          PEAK                                       PEAK

                                   (MIN)      (CFS)      (MIN)       (IN)      (MIN)     (CFS)      (MIN)        (IN)

              Basin    MANE         1.00       8.28     828.00       1.08       1.00      8.28     828.00        1.08

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .3810E+01 OUTFLOW= .3642E+01 BASIN STORAGE= .2725E-01 PERCENT ERROR=   3.7



*** NORMAL END OF HEC-1 ***
```

```
1***************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*            VERSION 4.1               *
*                                      *
* RUN DATE  27MAR17  TIME  10:58:57    *
*                                      *
****************************************

****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************

X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X         XXXXX  X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                    HEC-1 INPUT                                        PAGE  1

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID   HEC-1 Input Filename: 16196preE
   2          ID   Description:          Casino Master Plan Alternative E Pre-development Flow
   3          ID   Recurrence Interval:  100 year
   4          ID   Storm Duration:       24 hours
   5          ID   Date Compiled:        03/27/2017
   6          ID   Total Area at Point of Interest: 40.5
              *
              *
              *
              *
   7          IT       1 27Mar17    0000    1800
```

```
   8          IO       5       0       0
   9          IN       5
              *
              * Basin E
              * Alternative E - Anderson, Ca

  10          KK   Basin
  11          KO       0
  12          PB   4.702
  13          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.007
  14          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  15          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  16          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008   0.008
  17          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  18          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  19          PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  20          PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  21          PI   0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
  22          PI   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.013   0.013   0.013
  23          PI   0.013   0.013   0.014   0.014   0.014   0.014   0.014   0.015   0.015   0.015
  24          PI   0.015   0.016   0.016   0.016   0.017   0.017   0.017   0.018   0.018   0.019
  25          PI   0.019   0.020   0.020   0.021   0.022   0.022   0.023   0.024   0.025   0.026
  26          PI   0.027   0.028   0.030   0.031   0.033   0.036   0.038   0.042   0.046   0.052
  27          PI   0.060   0.073   0.096   0.163   0.509   0.118   0.082   0.065   0.055   0.049
  28          PI   0.044   0.040   0.037   0.034   0.032   0.030   0.029   0.028   0.026   0.025
  29          PI   0.024   0.023   0.023   0.022   0.021   0.021   0.020   0.019   0.019   0.018
  30          PI   0.018   0.018   0.017   0.017   0.017   0.016   0.016   0.016   0.015   0.015
  31          PI   0.015   0.015   0.014   0.014   0.014   0.014   0.013   0.013   0.013   0.013
  32          PI   0.013   0.013   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011
  33          PI   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
  34          PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.009   0.009
  35          PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  36          PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  37          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  38          PI   0.008   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  39          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  40          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  41          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  42          BA  0.0632
  43          BF      -1   -0.01     1.1
  44          LS       0      73       0     .05      99       0
  45          UK     200   0.005   0.600      98
  46          UK     200   0.005   0.050       2
  47          RD     672  0.0050   0.040   0.005    TRAP     2.0    20.0
1                                         HEC-1 INPUT                                          PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48          RD     672  0.0050   0.040   0.032    TRAP     3.0    20.0
```

```
         49          RD     672  0.0050   0.040   0.063    TRAP     4.0     20.0
         50          ZZ
1*****************************************                                                  *****************************************
 *                                       *                                                  *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                                                  *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                                                  *          609 SECOND STREET            *
 *                                       *                                                  *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   27MAR17  TIME  10:58:57   *                                                  *           (916) 756-1104              *
 *                                       *                                                  *                                       *
 *****************************************                                                  *****************************************


                            HEC-1 Input Filename: 16196postE
                            Description:          Casino Master Plan Alternative E Pre-development Flow
                            Recurrence Interval:  100 year
                            Storm Duration:        24 hours
                            Date Compiled:         03/27/2017
                            Total Area at Point of Interest: 40.5

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN          1  MINUTES IN COMPUTATION INTERVAL
                        IDATE    27Mar17  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE    28   17  ENDING DATE
                       NDTIME       0559  ENDING TIME
                        ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
   10 KK      *   Basin    *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                    RUNOFF SUMMARY
                                            FLOW IN CUBIC FEET PER SECOND
                                         TIME IN HOURS,  AREA IN SQUARE MILES

                                       PEAK    TIME OF      AVERAGE FLOW FOR MAXIMUM PERIOD        BASIN     MAXIMUM      TIME OF
         OPERATION        STATION      FLOW     PEAK                                                AREA      STAGE      MAX STAGE
+                                                            6-HOUR      24-HOUR      72-HOUR

         HYDROGRAPH AT
+                          Basin          21.    13.03           9.          3.           3.         .06
1
                                    SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                        (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                 INTERPOLATED TO
                                                                              COMPUTATION INTERVAL
           ISTAQ    ELEMENT       DT        PEAK    TIME TO      VOLUME       DT       PEAK    TIME TO      VOLUME
                                                      PEAK                                        PEAK

                                 (MIN)      (CFS)      (MIN)      (IN)       (MIN)     (CFS)     (MIN)       (IN)

            Basin   MANE          1.00      20.79    782.00       1.98        1.00     20.79    782.00        1.98

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .7076E+01 OUTFLOW= .6662E+01 BASIN STORAGE= .2647E-01 PERCENT ERROR=   5.5


*** NORMAL END OF HEC-1 ***
```

Existing Condition 100-year Storm Event
Alternative E

Existing Condition 100-year Storm Event
Alternative E

Post-development Subbasin Parameters

Subbasin:	BA
Mean Subbasin Elevation (ft):	450
Subbasin Area (Sq. Mi.):	0.1034375
Subbasin Area (acres):	66.2
Land Use:	Soil A:62% 1-Commercial/Highways/Parking Soil A:36% 14-Pasture/Parkland/Mowed Grass Soil A:2% 17- Open Oak/Pine Woodland/Grassland
Pervious Curve Number:	76
Pervious Overland Length (ft):	100
Pervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	40
Impervious Overland Length (ft):	100
Impervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	200
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.030
Representative Area (acres):	10.30
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	15.0
Collector #2 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	33.10
Width (ft)/Diameter (in) :	24.0
Sideslopes (ft/ft-H/V):	0
Collector #3 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	66.20
Width (ft)/Diameter (in) :	36.0
Sideslopes (ft/ft-H/V):	0

```
1****************************************                                                      ****************************************
 *                                      *                                                      *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                      *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                      *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                                      *          609 SECOND STREET           *
 *                                      *                                                      *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   07APR17  TIME  11:24:36  *                                                      *           (916) 756-1104             *
 *                                      *                                                      *                                      *
 ****************************************                                                      ****************************************


                                                  X     X  XXXXXXX   XXXXX           X
                                                  X     X  X        X     X         XX
                                                  X     X  X        X                X
                                                  XXXXXXX  XXXX     X        XXXXX   X
                                                  X     X  X        X                X
                                                  X     X  X        X     X          X
                                                  X     X  XXXXXXX   XXXXX          XXX


           THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

           THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
           THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
           NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
           DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
           KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                                      HEC-1 INPUT                                                  PAGE  1

          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post2
             2           ID   Description:          Casino Master Plan Post-development Flow
             3           ID   Recurrence Interval:  2 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        04/07/2017
             6           ID   Total Area at Point of Interest: 66.2
                         *
                         *
                         *
                         *
             7           IT       1 07Apr17    0000    1800
             8           IO       5       0       0
```

```
   9           IN       5
               *
               * BA
               * Casino Master Plan

  10           KK      BA
  11           KO       0
  12           PB   2.762
  13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
  17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
  20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
  23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
  25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
  26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
  27           PI   0.035   0.042   0.055   0.094   0.286   0.068   0.047   0.038   0.032   0.028
  28           PI   0.025   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
  29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
  30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
  31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  42           BA  0.1034
  43           BF      -3    -0.1    1.05
  44           LS       0      76       0     .05      99       0
  45           UK     100   0.010   0.600      40
  46           UK     100   0.010   0.050      60
  47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                          PAGE  2

LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     900  0.0030   0.020   0.052    CIRC       2       0
  49           RD     900  0.0030   0.020   0.103    CIRC       3       0
  50           ZZ
```

```
1*****************************************                    ***************************************
 *                                       *                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                    *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                    *          609 SECOND STREET          *
 *                                       *                    *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   07APR17  TIME  11:24:36   *                    *           (916) 756-1104            *
 *                                       *                    *                                     *
 *****************************************                    ***************************************
```

```
                           HEC-1 Input Filename: 16196post2
                           Description:          Casino Master Plan Post-development Flow
                           Recurrence Interval:  2 year
                           Storm Duration:       24 hours
                           Date Compiled:        04/07/2017
                           Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE      7Apr17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      8   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *       BA   *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	BA	87.	12.15	13.	7.	6.	.10		

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
BA	MANE	1.00	86.72	729.00	1.42	1.00	86.72	729.00	1.42

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1054E+02 OUTFLOW= .7838E+01 BASIN STORAGE= .4305E-02 PERCENT ERROR= 25.6

*** NORMAL END OF HEC-1 ***

(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
INTERPOLATED TO
COMPUTATION INTERVAL

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
BA	MANE	1.00	86.23	729.00	1.43	1.00	86.23	729.00	1.43

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1037E+02 OUTFLOW= .7681E+01 BASIN STORAGE= .4190E-02 PERCENT ERROR= 25.9

*** NORMAL END OF HEC-1 ***

```
1*****************************************                        ***************************************
 *                                       *                        *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                        *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                        *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                        *          609 SECOND STREET          *
 *                                       *                        *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   23MAR17  TIME  11:00:15   *                        *           (916) 756-1104            *
 *                                       *                        *                                     *
 *****************************************                        ***************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X       XXXXX   X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                      HEC-1 INPUT                                                PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post10
             2           ID   Description:          Casino Master Plan Post-development Flow
             3           ID   Recurrence Interval:  10 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/23/2017
             6           ID   Total Area at Point of Interest: 66.2
                         *
                         *
                         *
                         *
             7           IT       1 23Mar17    0000    1800
             8           IO       5       0       0
```

```
  9           IN       5
              *
              * BA
              * Casino Master Plan

 10           KK      BA
 11           KO       0
 12           PB   3.599
 13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
 16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
 22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
 23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
 24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
 25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
 26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
 27           PI   0.045   0.055   0.072   0.122   0.372   0.088   0.062   0.049   0.042   0.037
 28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
 29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
 30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
 31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
 32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
 35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
 40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 42           BA  0.1034
 43           BF      -5    -0.1    1.05
 44           LS       0      76       0     .05      99       0
 45           UK     100   0.010   0.600      40
 46           UK     100   0.010   0.050      60
 47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                                  HEC-1 INPUT                                   PAGE  2

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     900  0.0030   0.020   0.052    CIRC       2       0
 49           RD     900  0.0030   0.020   0.103    CIRC       3       0
 50           ZZ
```

```
1****************************************                      ***************************************
 *                                       *                      *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                      *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                      *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                      *          609 SECOND STREET          *
 *                                       *                      *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   23MAR17  TIME  11:00:15   *                      *           (916) 756-1104            *
 *                                       *                      *                                     *
 ****************************************                       ***************************************



                        HEC-1 Input Filename: 16196post10
                        Description:          Casino Master Plan Post-development Flow
                        Recurrence Interval:  10 year
                        Storm Duration:       24 hours
                        Date Compiled:        03/23/2017
                        Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     23Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     24   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *        BA  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                    RUNOFF SUMMARY
                                            FLOW IN CUBIC FEET PER SECOND
                                         TIME IN HOURS,  AREA IN SQUARE MILES

                                             PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION            FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA       118.   12.15          18.          9.          8.        .10
1
                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                        INTERPOLATED TO
                                                                     COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                      PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE         1.00    117.46    729.00      1.92      1.00    117.46    729.00        1.92

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1459E+02 OUTFLOW= .1059E+02 BASIN STORAGE= .4445E-02 PERCENT ERROR=  27.4



 *** NORMAL END OF HEC-1 ***


                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                        INTERPOLATED TO
                                                                     COMPUTATION INTERVAL
```

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
BA	MANE	1.00	86.23	729.00	1.43	1.00	86.23	729.00	1.43

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1037E+02 OUTFLOW= .7681E+01 BASIN STORAGE= .4190E-02 PERCENT ERROR= 25.9

*** NORMAL END OF HEC-1 ***

```
1***************************************                                                    ***************************************
 *                                      *                                                   *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                   *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                                                   *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                                   *          609 SECOND STREET          *
 *                                      *                                                   *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   23MAR17  TIME  11:01:41   *                                                   *          (916) 756-1104             *
 *                                      *                                                   *                                     *
 ***************************************                                                    ***************************************


                                                   X     X  XXXXXXX   XXXXX           X
                                                   X     X  X        X     X         XX
                                                   X     X  X        X                X
                                                   XXXXXXX  XXXX     X        XXXXX   X
                                                   X     X  X        X                X
                                                   X     X  X        X     X          X
                                                   X     X  XXXXXXX   XXXXX          XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                      HEC-1 INPUT                                                      PAGE  1

           LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1             ID   HEC-1 Input Filename: 16196post100
             2             ID   Description:          Casino Master Plan Post-development Flow
             3             ID   Recurrence Interval:  100 year
             4             ID   Storm Duration:       24 hours
             5             ID   Date Compiled:        03/23/2017
             6             ID   Total Area at Point of Interest: 66.2
                           *
                           *
                           *
                           *
             7             IT       1 23Mar17    0000    1800
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```
  8           IO       5       0       0
  9           IN       5
              *
              * BA
              * Casino Master Plan

 10           KK      BA
 11           KO       0
 12           PB   5.069
 13           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 14           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008
 15           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 16           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 17           PI   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 18           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.010   0.010
 19           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
 20           PI   0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
 21           PI   0.011   0.011   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.012
 22           PI   0.013   0.013   0.013   0.013   0.013   0.013   0.014   0.014   0.014   0.014
 23           PI   0.014   0.015   0.015   0.015   0.015   0.015   0.016   0.016   0.016   0.016
 24           PI   0.017   0.017   0.017   0.018   0.018   0.019   0.019   0.019   0.020   0.020
 25           PI   0.021   0.021   0.022   0.023   0.023   0.024   0.025   0.026   0.027   0.028
 26           PI   0.029   0.030   0.032   0.034   0.036   0.038   0.041   0.045   0.049   0.055
 27           PI   0.064   0.077   0.101   0.172   0.526   0.125   0.087   0.070   0.059   0.052
 28           PI   0.047   0.043   0.040   0.037   0.035   0.033   0.031   0.030   0.028   0.027
 29           PI   0.026   0.025   0.024   0.024   0.023   0.022   0.022   0.021   0.021   0.020
 30           PI   0.020   0.019   0.019   0.018   0.018   0.018   0.017   0.017   0.017   0.016
 31           PI   0.016   0.016   0.016   0.015   0.015   0.015   0.015   0.014   0.014   0.014
 32           PI   0.014   0.014   0.013   0.013   0.013   0.013   0.013   0.013   0.013   0.012
 33           PI   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011   0.011   0.011
 34           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
 35           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
 36           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 37           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008
 38           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 39           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 40           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 41           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 42           BA  0.1034
 43           BF     -10    -0.1    1.05
 44           LS       0      76       0     .05      99       0
 45           UK     100   0.010   0.600      40
 46           UK     100   0.010   0.050      60
 47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                         PAGE  2

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     900  0.0030   0.020   0.052    CIRC       2       0
```

```
          49           RD     900  0.0030   0.020   0.103    CIRC       3       0
          50           ZZ
1*****************************************                                                    ****************************************
 *                                       *                                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                  *                                                    *          609 SECOND STREET           *
 *                                       *                                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   23MAR17  TIME  11:01:41   *                                                    *           (916) 756-1104             *
 *                                       *                                                    *                                      *
 *****************************************                                                    ****************************************


                         HEC-1 Input Filename: 16196post100
                         Description:          Casino Master Plan Post-development Flow
                         Recurrence Interval:  100 year
                         Storm Duration:       24 hours
                         Date Compiled:        03/23/2017
                         Total Area at Point of Interest: 66.2

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN          1  MINUTES IN COMPUTATION INTERVAL
                        IDATE    23Mar17  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE    24   17  ENDING DATE
                       NDTIME       0559  ENDING TIME
                       ICENT          19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT
```

```
 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *        BA  *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                           RUNOFF SUMMARY
                                                                   FLOW IN CUBIC FEET PER SECOND
                                                                TIME IN HOURS,  AREA IN SQUARE MILES

                                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION      FLOW     PEAK                                          AREA      STAGE     MAX STAGE
+                                                                  6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                             BA       174.   12.15          28.         14.         12.        .10
1
                                                         SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                             (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                 INTERPOLATED TO
                                                                                              COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                      PEAK

                               (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                BA  MANE         1.00    173.82    729.00      3.20      1.00    173.82    729.00       3.20

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2200E+02 OUTFLOW= .1764E+02 BASIN STORAGE= .4494E-02 PERCENT ERROR=  19.8



 *** NORMAL END OF HEC-1 ***
```

Post-development 100-year Storm Event
Alternative A

```
1****************************************                        ***************************************
 *                                      *                        *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                        *   U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                        *   HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                        *         609 SECOND STREET           *
 *                                      *                        *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   23MAR17  TIME  11:47:01  *                        *          (916) 756-1104             *
 *                                      *                        *                                     *
 ****************************************                        ***************************************


                  X     X  XXXXXXX   XXXXX           X
                  X     X  X        X     X         XX
                  X     X  X        X                X
                  XXXXXXX  XXXX     X        XXXXX   X
                  X     X  X        X                X
                  X     X  X        X     X          X
                  X     X  XXXXXXX   XXXXX          XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                        HEC-1 INPUT                                                  PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post2
              2          ID   Description:          Drainage Area #1 Post-development Flow
              3          ID   Recurrence Interval:  2 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/23/2017
              6          ID   Total Area at Point of Interest: 15.7
                         *
                         *
                         *
                         *
              7          IT       1 23Mar17    0000    1800
              8          IO       5       0       0
```

```
  9           IN       5
              *
              * BA
              * Casino Master Plan

 10           KK      BA
 11           KO       0
 12           PB   2.767
 13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
 17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
 20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
 22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
 23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
 24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
 25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
 26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
 27           PI   0.035   0.042   0.055   0.094   0.290   0.068   0.047   0.038   0.032   0.028
 28           PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
 29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
 30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
 31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 42           BA  0.0245
 43           BF      -3    -0.1    1.05
 44           LS       0      80       0     .05      99       0
 45           UK     100   0.010   0.600       5
 46           UK     100   0.010   0.050      95
 47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                              PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     582  0.0030   0.020   0.012    CIRC       2       0
 49           RD     582  0.0030   0.020   0.025    CIRC     2.5       0
 50           ZZ
```

```
1****************************************                                                      ****************************************
 *                                      *                                                      *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                      *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                                                      *    HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                 *                                                      *          609 SECOND STREET           *
 *                                      *                                                      *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   23MAR17  TIME  11:47:01  *                                                      *          (916) 756-1104              *
 *                                      *                                                      *                                      *
 ****************************************                                                      ****************************************



                           HEC-1 Input Filename: 16196post2
                           Description:          Drainage Area #1 Post-development Flow
                           Recurrence Interval:  2 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/23/2017
                           Total Area at Point of Interest: 15.7

   8 IO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN           1  MINUTES IN COMPUTATION INTERVAL
                      IDATE     23Mar17  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     24   17  ENDING DATE
                     NDTIME        0559  ENDING TIME
                     ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *        BA  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                             RUNOFF SUMMARY
                                                     FLOW IN CUBIC FEET PER SECOND
                                                  TIME IN HOURS,  AREA IN SQUARE MILES

                                             PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                AREA      STAGE     MAX STAGE
+                                                              6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA        36.   12.13           5.          2.          2.        .02
1
                                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                      INTERPOLATED TO
                                                                                   COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                     PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE         1.00     35.91    728.00      1.68      1.00     35.91    728.00       1.68

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .3322E+01 OUTFLOW= .2190E+01 BASIN STORAGE= .1182E-02 PERCENT ERROR=  34.1



 *** NORMAL END OF HEC-1 ***
```

```
1****************************************                                                   ****************************************
 *                                      *                                                   *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                   *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                                                   *    HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                 *                                                   *         609 SECOND STREET            *
 *                                      *                                                   *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   23MAR17  TIME  11:45:37  *                                                   *          (916) 756-1104              *
 *                                      *                                                   *                                      *
 ****************************************                                                   ****************************************




                                                          X     X  XXXXXXX   XXXXX           X
                                                          X     X  X        X     X         XX
                                                          X     X  X        X                X
                                                          XXXXXXX  XXXX     X        XXXXX   X
                                                          X     X  X        X                X
                                                          X     X  X        X     X          X
                                                          X     X  XXXXXXX   XXXXX          XXX




            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                                       HEC-1 INPUT                                                     PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post10
              2          ID   Description:          Drainage Area #1 Post-development Flow
              3          ID   Recurrence Interval:  10 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/23/2017
              6          ID   Total Area at Point of Interest: 15.7
                         *
                         *
                         *
                         *
              7          IT       1 23Mar17    0000    1800
```

```
  8          IO       5       0       0
  9          IN       5
             *
             * BA
             * Casino Master Plan

 10          KK      BA
 11          KO       0
 12          PB   3.605
 13          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 14          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 15          PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
 16          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 17          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 18          PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 19          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 20          PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 21          PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
 22          PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
 23          PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
 24          PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
 25          PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
 26          PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
 27          PI   0.045   0.055   0.072   0.122   0.378   0.089   0.062   0.049   0.042   0.037
 28          PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
 29          PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
 30          PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
 31          PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
 32          PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 33          PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 34          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
 35          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 36          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 37          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 38          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 39          PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
 40          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 41          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 42          BA  0.0245
 43          BF      -5    -0.1    1.05
 44          LS       0      80       0     .05      99       0
 45          UK     100   0.010   0.600       5
 46          UK     100   0.010   0.050      95
 47          RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                         HEC-1 INPUT                                        PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48          RD     582  0.0030   0.020   0.012    CIRC       2       0
```

```
          49           RD     582  0.0030   0.020   0.025    CIRC     2.5       0
          50           ZZ
1****************************************                                                ****************************************
 *                                       *                                                *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                                                *    HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                  *                                                *         609 SECOND STREET            *
 *                                       *                                                *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   23MAR17  TIME  11:45:37   *                                                *          (916) 756-1104              *
 *                                       *                                                *                                      *
 *****************************************                                                ****************************************



                       HEC-1 Input Filename: 16196post10
                       Description:          Drainage Area #1 Post-development Flow
                       Recurrence Interval:  10 year
                       Storm Duration:       24 hours
                       Date Compiled:        03/23/2017
                       Total Area at Point of Interest: 15.7

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     23Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     24   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *       BA   *
            *            *
            **************

  11 KO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                      RUNOFF SUMMARY
                                              FLOW IN CUBIC FEET PER SECOND
                                           TIME IN HOURS,  AREA IN SQUARE MILES

                                    PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION      FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                          6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                             BA        47.   12.12          6.          3.          3.        .02
1
                                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                 INTERPOLATED TO
                                                                              COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                        PEAK

                               (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                BA  MANE         1.00     46.58    727.00      2.35      1.00     46.58    727.00        2.35

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .4403E+01 OUTFLOW= .3076E+01 BASIN STORAGE= .1184E-02 PERCENT ERROR=  30.1



 *** NORMAL END OF HEC-1 ***
```

Post-development 10-year Storm Event
Alternative A Drainage Area #1

```
1****************************************                    ****************************************
 *                                       *                   *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                   *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                   *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                   *          609 SECOND STREET           *
 *                                       *                   *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   24MAR17  TIME  10:22:48   *                   *           (916) 756-1104             *
 *                                       *                   *                                      *
 *****************************************                   ****************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X       XXXXX    X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                        HEC-1 INPUT                                               PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post2
             2           ID   Description:          Casino Master Plan Post-development Flow
             3           ID   Recurrence Interval:  2 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/24/2017
             6           ID   Total Area at Point of Interest: 4.3
                         *
                         *
                         *
                         *
             7           IT       1 24Mar17    0000    1800
```

```
  8           IO       5       0       0
  9           IN       5
              *
              * DA2
              * Casino Master Plan

 10           KK     DA2
 11           KO       0
 12           PB   2.769
 13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
 17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
 20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
 22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
 23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
 24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
 25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
 26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
 27           PI   0.035   0.042   0.055   0.094   0.292   0.068   0.047   0.038   0.032   0.028
 28           PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
 29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
 30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
 31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 42           BA  0.0067
 43           BF      -3    -0.1    1.05
 44           LS       0      80       0     .05      99       0
 45           UK     100   0.010   0.600       5
 46           UK     100   0.010   0.050      95
 47           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                     PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
           49           RD     250  0.0030   0.020   0.007    CIRC       2       0
           50           ZZ
1*****************************************                                                   ***************************************
 *                                       *                                                   *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                   *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                                                   *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                                   *          609 SECOND STREET          *
 *                                       *                                                   *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  10:22:48   *                                                   *           (916) 756-1104            *
 *                                       *                                                   *                                     *
 *****************************************                                                   ***************************************


                       HEC-1 Input Filename: 16196post2
                       Description:          Casino Master Plan Post-development Flow
                       Recurrence Interval:  2 year
                       Storm Duration:       24 hours
                       Date Compiled:        03/24/2017
                       Total Area at Point of Interest: 4.3

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     24Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     25   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *       DA2  *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                                          RUNOFF SUMMARY
                                                                  FLOW IN CUBIC FEET PER SECOND
                                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                                  PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION        STATION      FLOW     PEAK                                                  AREA      STAGE     MAX STAGE
+                                                                          6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              DA2        10.   12.12          1.          1.          1.        .01
1
                                                         SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                             (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                 INTERPOLATED TO
                                                                                              COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                         PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA2  MANE         1.00     10.37    727.00      1.90      1.00     10.37    727.00       1.90

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .9092E+00 OUTFLOW= .6794E+00 BASIN STORAGE= .7719E-03 PERCENT ERROR=  25.2



 *** NORMAL END OF HEC-1 ***
```

Post-development 2-year Storm Event
Alternative A Drainage Area #2

```
1***************************************                                      ***************************************
 *                                     *                                      *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998             *                                      *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1               *                                      *          609 SECOND STREET          *
 *                                     *                                      *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  10:21:43   *                                    *           (916) 756-1104            *
 *                                     *                                      *                                     *
 ***************************************                                      ***************************************


                                         X     X  XXXXXXX   XXXXX           X
                                         X     X  X        X     X         XX
                                         X     X  X        X                X
                                         XXXXXXX  XXXX     X       XXXXX    X
                                         X     X  X        X                X
                                         X     X  X        X     X          X
                                         X     X  XXXXXXX   XXXXX          XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                        HEC-1 INPUT                                                 PAGE  1

         LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           1           ID   HEC-1 Input Filename: 16196post10
           2           ID   Description:          Casino Master Plan Post-development Flow
           3           ID   Recurrence Interval:  10 year
           4           ID   Storm Duration:       24 hours
           5           ID   Date Compiled:        03/24/2017
           6           ID   Total Area at Point of Interest: 4.3
                       *
                       *
                       *
                       *
           7           IT       1 24Mar17    0000    1800
```

```
   8         IO       5       0       0
   9         IN       5
             *
             * DA2
             * Casino Master Plan

  10         KK     DA2
  11         KO       0
  12         PB   3.608
  13         PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  14         PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  15         PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
  16         PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  17         PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  18         PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  19         PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  20         PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  21         PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
  22         PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
  23         PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
  24         PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
  25         PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
  26         PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
  27         PI   0.045   0.055   0.072   0.122   0.381   0.089   0.062   0.049   0.042   0.037
  28         PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
  29         PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
  30         PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
  31         PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
  32         PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  33         PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  34         PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
  35         PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  36         PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
  37         PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  38         PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  39         PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
  40         PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  41         PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  42         BA  0.0067
  43         BF      -5    -0.1    1.05
  44         LS       0      80       0     .05      99       0
  45         UK     100   0.010   0.600       5
  46         UK     100   0.010   0.050      95
  47         RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                          PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48         RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
          49           RD     250  0.0030   0.020   0.007    CIRC       2       0
          50           ZZ
1*****************************************                                                    ***************************************
 *                                       *                                                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                                                    *    HYDROLOGIC ENGINEERING CENTER    *
 *          VERSION 4.1                  *                                                    *          609 SECOND STREET          *
 *                                       *                                                    *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  10:21:43   *                                                    *           (916) 756-1104            *
 *                                       *                                                    *                                     *
 *****************************************                                                    ***************************************



                          HEC-1 Input Filename: 16196post10
                          Description:          Casino Master Plan Post-development Flow
                          Recurrence Interval:  10 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/24/2017
                          Total Area at Point of Interest: 4.3

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     24Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     25   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *       DA2  *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                    RUNOFF SUMMARY
                                            FLOW IN CUBIC FEET PER SECOND
                                         TIME IN HOURS,  AREA IN SQUARE MILES

                                        PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION       FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                             6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA2        14.   12.12           2.          1.          1.        .01
1
                                                 SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                     (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                      INTERPOLATED TO
                                                                                   COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                     PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA2  MANE         1.00     14.01    727.00      2.64      1.00     14.01    727.00       2.64

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1205E+01 OUTFLOW= .9442E+00 BASIN STORAGE= .7690E-03 PERCENT ERROR=  21.6



 *** NORMAL END OF HEC-1 ***
```

```
1***************************************                                 ***************************************
 *                                     *                                 *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                 *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998             *                                 *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1               *                                 *          609 SECOND STREET          *
 *                                     *                                 *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  11:26:21  *                                 *           (916) 756-1104            *
 *                                     *                                 *                                     *
 ***************************************                                 ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                        HEC-1 INPUT                                                   PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID   HEC-1 Input Filename: 16196post2
            2           ID   Description:          Casino Master Plan Post-development Flow
            3           ID   Recurrence Interval:  2 year
            4           ID   Storm Duration:       24 hours
            5           ID   Date Compiled:        03/24/2017
            6           ID   Total Area at Point of Interest: 5.8
                        *
                        *
                        *
                        *
            7           IT       1 24Mar17    0000    1800
```

```
     8           IO       5       0       0
     9           IN       5
                 *
                 * DA3
                 * Casino Master Plan

    10           KK     DA3
    11           KO       0
    12           PB   2.769
    13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
    17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
    20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
    22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
    23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
    24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
    25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
    26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
    27           PI   0.035   0.042   0.055   0.094   0.292   0.068   0.047   0.038   0.032   0.028
    28           PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
    29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
    30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
    31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    42           BA  0.0090
    43           BF      -3    -0.1    1.05
    44           LS       0      80       0     .05      99       0
    45           UK     100   0.010   0.600       5
    46           UK     100   0.010   0.050      95
    47           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                             HEC-1 INPUT                                               PAGE  2

  LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    48           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
          49           RD     250  0.0030   0.020   0.009    CIRC       2       0
          50           ZZ
1****************************************                                                    ***************************************
 *                                       *                                                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                                                    *    HYDROLOGIC ENGINEERING CENTER    *
 *          VERSION 4.1                  *                                                    *          609 SECOND STREET          *
 *                                       *                                                    *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  11:26:21   *                                                    *           (916) 756-1104            *
 *                                       *                                                    *                                     *
 *****************************************                                                    ***************************************



                      HEC-1 Input Filename: 16196post2
                      Description:          Casino Master Plan Post-development Flow
                      Recurrence Interval:  2 year
                      Storm Duration:       24 hours
                      Date Compiled:        03/24/2017
                      Total Area at Point of Interest: 5.8

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          1  MINUTES IN COMPUTATION INTERVAL
                       IDATE    24Mar17  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE    25   17  ENDING DATE
                      NDTIME       0559  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   29.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *       DA3  *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                RUNOFF SUMMARY
                                                        FLOW IN CUBIC FEET PER SECOND
                                                     TIME IN HOURS,  AREA IN SQUARE MILES

                                             PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                  AREA      STAGE     MAX STAGE
+                                                               6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA3        14.   12.12           2.          1.          1.        .01
1
                                                  SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                      (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                            INTERPOLATED TO
                                                                                         COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                      PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA3  MANE         1.00     13.85    727.00      1.93      1.00     13.85    727.00       1.93

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1221E+01 OUTFLOW= .9284E+00 BASIN STORAGE= .9693E-03 PERCENT ERROR=  23.9



 *** NORMAL END OF HEC-1 ***
```

Post-development 2-year Storm Event
Alternative A Drainage Area #3

```
1***************************************                             ***************************************
 *                                     *                             *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                           *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998             *                             *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1               *                             *          609 SECOND STREET          *
 *                                     *                             *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  11:30:15   *                           *           (916) 756-1104            *
 *                                     *                             *                                     *
 ***************************************                             ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                            HEC-1 INPUT                                              PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1          ID   HEC-1 Input Filename: 16196post10
             2          ID   Description:          Casino Master Plan Post-development Flow
             3          ID   Recurrence Interval:  10 year
             4          ID   Storm Duration:       24 hours
             5          ID   Date Compiled:        03/24/2017
             6          ID   Total Area at Point of Interest: 5.8
                        *
                        *
                        *
                        *
             7          IT       1 24Mar17    0000    1800
```

```
   8          IO       5       0       0
   9          IN       5
              *
              * DA3
              * Casino Master Plan

  10          KK     DA3
  11          KO       0
  12          PB   3.608
  13          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  14          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  15          PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
  16          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  17          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  18          PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  19          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  20          PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  21          PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
  22          PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
  23          PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
  24          PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
  25          PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
  26          PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
  27          PI   0.045   0.055   0.072   0.122   0.380   0.089   0.062   0.049   0.042   0.037
  28          PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
  29          PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
  30          PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
  31          PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
  32          PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  33          PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  34          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
  35          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  36          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
  37          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  38          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  39          PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
  40          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  41          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  42          BA  0.0090
  43          BF      -5    -0.1    1.05
  44          LS       0      80       0     .05      99       0
  45          UK     100   0.010   0.600       5
  46          UK     100   0.010   0.050      95
  47          RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                 HEC-1 INPUT                                        PAGE  2

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48          RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
           49           RD     250  0.0030   0.020   0.009    CIRC       2       0
           50           ZZ
1****************************************                                                  ****************************************
 *                                       *                                                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                                                 *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                                 *          609 SECOND STREET           *
 *                                       *                                                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   24MAR17  TIME  11:30:15   *                                                 *           (916) 756-1104             *
 *                                       *                                                 *                                      *
 ****************************************                                                  ****************************************


                    HEC-1 Input Filename: 16196post10
                    Description:          Casino Master Plan Post-development Flow
                    Recurrence Interval:  10 year
                    Storm Duration:       24 hours
                    Date Compiled:        03/24/2017
                    Total Area at Point of Interest: 5.8

  8 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           1  MINUTES IN COMPUTATION INTERVAL
                      IDATE     24Mar17  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     25   17  ENDING DATE
                     NDTIME        0559  ENDING TIME
                     ICENT           19  CENTURY MARK

                COMPUTATION INTERVAL     .02 HOURS
                     TOTAL TIME BASE   29.98 HOURS

       ENGLISH UNITS
            DRAINAGE AREA         SQUARE MILES
            PRECIPITATION DEPTH   INCHES
            LENGTH, ELEVATION     FEET
            FLOW                  CUBIC FEET PER SECOND
            STORAGE VOLUME        ACRE-FEET
            SURFACE AREA          ACRES
            TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *       DA3  *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                          RUNOFF SUMMARY
                                                                  FLOW IN CUBIC FEET PER SECOND
                                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                                    PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                                         6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              DA3        19.   12.12          2.          1.          1.        .01
1
                                                         SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                             (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                  INTERPOLATED TO
                                                                                               COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                             PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA3  MANE         1.00     18.58    727.00      2.70      1.00     18.58    727.00       2.70

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1619E+01 OUTFLOW= .1294E+01 BASIN STORAGE= .9663E-03 PERCENT ERROR=  20.0



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *             JUN   1998                *
 *          VERSION 4.1                  *
 *                                       *
 *  RUN DATE   24MAR17  TIME  12:00:46   *
 *                                       *
 *****************************************

 *****************************************
 *                                       *
 *    U.S. ARMY CORPS OF ENGINEERS       *
 *    HYDROLOGIC ENGINEERING CENTER      *
 *          609 SECOND STREET            *
 *       DAVIS, CALIFORNIA 95616         *
 *           (916) 756-1104              *
 *                                       *
 *****************************************


                  X     X  XXXXXXX   XXXXX           X
                  X     X  X        X     X         XX
                  X     X  X        X                X
                  XXXXXXX  XXXX     X        XXXXX   X
                  X     X  X        X                X
                  X     X  X        X     X          X
                  X     X  XXXXXXX   XXXXX          XXX


   THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

   THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
   THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
   NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
   DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
   KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                    HEC-1 INPUT                                                    PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID   HEC-1 Input Filename: 16196post2
            2           ID   Description:          Casino Master Plan Post-development Flow
            3           ID   Recurrence Interval:  2 year
            4           ID   Storm Duration:       24 hours
            5           ID   Date Compiled:        03/24/2017
            6           ID   Total Area at Point of Interest: 4
                        *
                        *
                        *
                        *
            7           IT       1 24Mar17    0000    1800
```

```
   8          IO       5       0       0
   9          IN       5
              *
              * DA4
              * Casino Master Plan

  10          KK     DA4
  11          KO       0
  12          PB   2.770
  13          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  14          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  15          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  16          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
  17          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  18          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  19          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
  20          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  21          PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  22          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
  23          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  24          PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
  25          PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
  26          PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
  27          PI   0.035   0.042   0.055   0.094   0.292   0.068   0.047   0.038   0.032   0.028
  28          PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
  29          PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
  30          PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
  31          PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  32          PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  33          PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  34          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  35          PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  36          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  37          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  38          PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  39          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  40          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  41          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  42          BA  0.0062
  43          BF      -3    -0.1    1.05
  44          LS       0      80       0     .05      99       0
  45          UK     100   0.010   0.600       5
  46          UK     100   0.010   0.050      95
  47          RD     100  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                 HEC-1 INPUT                                       PAGE  2

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48          RD     100  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
            49           RD     100  0.0030   0.030   0.006    TRAP     2.0     0.0
            50           ZZ
1*****************************************                                                   ***************************************
 *                                       *                                                   *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                   *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                                                   *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                                   *          609 SECOND STREET          *
 *                                       *                                                   *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  12:00:46   *                                                   *           (916) 756-1104            *
 *                                       *                                                   *                                     *
 *****************************************                                                   ***************************************


                          HEC-1 Input Filename: 16196post2
                          Description:          Casino Master Plan Post-development Flow
                          Recurrence Interval:  2 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/24/2017
                          Total Area at Point of Interest: 4

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     24Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     25   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
   10 KK    *       DA4  *
            *            *
            **************

   11 KO         OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                            RUNOFF SUMMARY
                                                    FLOW IN CUBIC FEET PER SECOND
                                                 TIME IN HOURS,  AREA IN SQUARE MILES

                                             PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION      FLOW     PEAK                                                 AREA      STAGE     MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                            DA4        11.   12.10          1.          1.          1.        .01
1
                                                     SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                         (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                          INTERPOLATED TO
                                                                                       COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT        PEAK    TIME TO     VOLUME       DT        PEAK    TIME TO     VOLUME
                                                    PEAK                                       PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

               DA4  MANE          .37     10.62    725.99      1.43      1.00     10.61    726.00       1.43

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .8417E+00 OUTFLOW= .4712E+00 BASIN STORAGE= .4740E-03 PERCENT ERROR=  44.0



 *** NORMAL END OF HEC-1 ***
```

Post-development 2-year Storm Event
Alternative A Drainage Area #4

```
1***************************************                        ***************************************
 *                                      *                        *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                        *   U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                        *   HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                        *         609 SECOND STREET           *
 *                                      *                        *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   24MAR17  TIME  11:59:45  *                        *         (916) 756-1104              *
 *                                      *                        *                                     *
 ***************************************                        ***************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X       XXXXX   X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                        HEC-1 INPUT                                         PAGE  1

  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

     1          ID   HEC-1 Input Filename: 16196post10
     2          ID   Description:          Casino Master Plan Post-development Flow
     3          ID   Recurrence Interval:  10 year
     4          ID   Storm Duration:       24 hours
     5          ID   Date Compiled:        03/24/2017
     6          ID   Total Area at Point of Interest: 4
                *
                *
                *
                *
     7          IT       1 24Mar17    0000    1800
```

```
  8           IO       5       0       0
  9           IN       5
              *
              * DA4
              * Casino Master Plan

 10           KK     DA4
 11           KO       0
 12           PB   3.608
 13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
 16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
 22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
 23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
 24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
 25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
 26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
 27           PI   0.045   0.055   0.072   0.122   0.381   0.089   0.062   0.049   0.042   0.037
 28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
 29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
 30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
 31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
 32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
 35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
 40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 42           BA  0.0062
 43           BF      -5    -0.1    1.05
 44           LS       0      80       0     .05      99       0
 45           UK     100   0.010   0.600       5
 46           UK     100   0.010   0.050      95
 47           RD     100  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                 HEC-1 INPUT                                         PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     100  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
          49           RD     100  0.0030   0.030   0.006    TRAP     2.0     0.0
          50           ZZ
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   24MAR17  TIME  11:59:45   *
 *                                       *
 *****************************************

 *****************************************
 *                                       *
 *    U.S. ARMY CORPS OF ENGINEERS       *
 *    HYDROLOGIC ENGINEERING CENTER      *
 *          609 SECOND STREET            *
 *       DAVIS, CALIFORNIA 95616         *
 *           (916) 756-1104              *
 *                                       *
 *****************************************
```

```
                        HEC-1 Input Filename: 16196post10
                        Description:          Casino Master Plan Post-development Flow
                        Recurrence Interval:  10 year
                        Storm Duration:       24 hours
                        Date Compiled:        03/24/2017
                        Total Area at Point of Interest: 4

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     24Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     25   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *       DA4  *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                RUNOFF SUMMARY
                                                        FLOW IN CUBIC FEET PER SECOND
                                                     TIME IN HOURS,  AREA IN SQUARE MILES

                                             PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION      FLOW     PEAK                                               AREA      STAGE     MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                            DA4        14.   12.10          2.          1.          1.        .01
1
                                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                   INTERPOLATED TO
                                                                                COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                      PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

               DA4  MANE          .33     14.33    725.87      1.86      1.00     14.26    726.00       1.86

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1115E+01 OUTFLOW= .6166E+00 BASIN STORAGE= .4673E-03 PERCENT ERROR=  44.7



*** NORMAL END OF HEC-1 ***
```

Post-development 10-year Storm Event
Alternative A Drainage Area #4

Post-development Subbasin Parameters

Subbasin:	BA
Mean Subbasin Elevation (ft):	450
Subbasin Area (Sq. Mi.):	0.1034375
Subbasin Area (acres):	66.2
Land Use:	Soil A:44% 1- Commercial/Highways/Parking
	Soil A:54% 14- Pasture/Parkland/Mowed Grass
	Soil A:2% 17- Open Oak/Pine Woodland/Grassland
Pervious Curve Number:	74
Pervious Overland Length (ft):	100
Pervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	57
Impervious Overland Length (ft):	100
Impervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	200
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.030
Representative Area (acres):	10.30
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	15.0
Collector #2 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	33.10
Width (ft)/Diameter (in) :	24.0
Sideslopes (ft/ft-H/V):	0
Collector #3 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	66.20
Width (ft)/Diameter (in) :	36.0
Sideslopes (ft/ft-H/V):	0

```
1***************************************                                    ***************************************
 *                                     *                                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                                    *         609 SECOND STREET           *
 *                                     *                                    *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:10:18  *                                    *          (916) 756-1104             *
 *                                     *                                    *                                     *
 ***************************************                                    ***************************************


                          X     X  XXXXXXX   XXXXX          X
                          X     X  X        X     X        XX
                          X     X  X        X               X
                          XXXXXXX  XXXX     X       XXXXX   X
                          X     X  X        X               X
                          X     X  X        X     X         X
                          X     X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                        HEC-1 INPUT                                                     PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1          ID   HEC-1 Input Filename: 16196post2-B
             2          ID   Description:          Casino Master Plan Post-development Flow – Alternative B
             3          ID   Recurrence Interval:  2 year
             4          ID   Storm Duration:       24 hours
             5          ID   Date Compiled:        03/27/2017
             6          ID   Total Area at Point of Interest: 66.2
                        *
                        *
                        *
                        *
             7          IT       1 27Mar17    0000    1800
```

```
     8           IO       5       0       0
     9           IN       5
                 *
                 * BA
                 * Casino Master Plan

    10           KK      BA
    11           KO       0
    12           PB   2.762
    13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
    17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
    20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
    22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
    23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
    24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
    25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
    26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
    27           PI   0.035   0.042   0.055   0.094   0.286   0.068   0.047   0.038   0.032   0.028
    28           PI   0.025   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
    29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
    30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
    31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
    42           BA  0.1034
    43           BF      -3    -0.1    1.05
    44           LS       0      74       0     .05      99       0
    45           UK     100   0.010   0.600      57
    46           UK     100   0.010   0.050      43
    47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                                  HEC-1 INPUT                                          PAGE  2

  LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    48           RD     900  0.0030   0.020   0.052    CIRC       2       0
```

```
           49           RD     900  0.0030   0.020   0.103    CIRC       3       0
           50           ZZ
1****************************************                                                 ****************************************
 *                                       *                                                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                                                 *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                                 *          609 SECOND STREET           *
 *                                       *                                                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:10:18   *                                                 *           (916) 756-1104             *
 *                                       *                                                 *                                      *
 ****************************************                                                 ****************************************



                           HEC-1 Input Filename: 16196post2-B
                           Description:          Casino Master Plan Post-development Flow - Alternative
                           Recurrence Interval:  2 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/27/2017
                           Total Area at Point of Interest: 66.2

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     27Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     28   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
   10 KK  *        BA  *
          *            *
          **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                    RUNOFF SUMMARY
                                            FLOW IN CUBIC FEET PER SECOND
                                         TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION      FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                           6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                             BA        64.   12.15          10.          5.          4.        .10
1
                                                 SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                     (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                   INTERPOLATED TO
                                                                                COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                      PEAK

                               (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                BA  MANE         1.00     63.42    729.00      1.10      1.00     63.42    729.00       1.10

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .8592E+01 OUTFLOW= .6067E+01 BASIN STORAGE= .5096E-02 PERCENT ERROR=  29.3



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************                               ****************************************
 *                                       *                               *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                               *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                               *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                               *          609 SECOND STREET           *
 *                                       *                               *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:09:41   *                               *           (916) 756-1104             *
 *                                       *                               *                                      *
 *****************************************                               ****************************************


                                          X     X  XXXXXXX   XXXXX           X
                                          X     X  X        X     X         XX
                                          X     X  X        X                X
                                          XXXXXXX  XXXX     X        XXXXX   X
                                          X     X  X        X                X
                                          X     X  X        X     X          X
                                          X     X  XXXXXXX   XXXXX          XXX


           THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

           THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
           THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
           NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
           DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
           KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                      HEC-1 INPUT                                                   PAGE  1

          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post10-B
             2           ID   Description:          Casino Master Plan Post-development Flow – Alternative B
             3           ID   Recurrence Interval:  10 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/27/2017
             6           ID   Total Area at Point of Interest: 66.2
                         *
                         *
                         *
                         *
             7           IT       1 27Mar17    0000    1800
             8           IO       5       0       0
```

```
  9           IN       5
              *
              * BA
              * Casino Master Plan

 10           KK      BA
 11           KO       0
 12           PB   3.599
 13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
 16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
 22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
 23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
 24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
 25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
 26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
 27           PI   0.045   0.055   0.072   0.122   0.372   0.088   0.062   0.049   0.042   0.037
 28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
 29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
 30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
 31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
 32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
 35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
 40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 42           BA  0.1034
 43           BF      -5    -0.1    1.05
 44           LS       0      74       0     .05      99       0
 45           UK     100   0.010   0.600      57
 46           UK     100   0.010   0.050      43
 47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                         PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     900  0.0030   0.020   0.052    CIRC       2       0
 49           RD     900  0.0030   0.020   0.103    CIRC       3       0
 50           ZZ
```

```
1****************************************                                      ***************************************
 *                                       *                                     *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                     *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                                     *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                     *         609 SECOND STREET           *
 *                                       *                                     *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:09:41   *                                     *          (916) 756-1104             *
 *                                       *                                     *                                     *
 ****************************************                                      ***************************************
```

```
                          HEC-1 Input Filename: 16196post10-B
                          Description:          Casino Master Plan Post-development Flow - Alternative
                          Recurrence Interval:  10 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/27/2017
                          Total Area at Point of Interest: 66.2

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     27Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     28   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *        BA  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                        RUNOFF SUMMARY
                                                FLOW IN CUBIC FEET PER SECOND
                                             TIME IN HOURS,  AREA IN SQUARE MILES

                                          PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION         FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                            6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA           90.   12.15          15.          7.          6.        .10
1
                                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                  INTERPOLATED TO
                                                                               COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT        PEAK    TIME TO     VOLUME       DT        PEAK    TIME TO     VOLUME
                                                      PEAK                                       PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE        1.00     89.54    729.00      1.72      1.00     89.54    729.00       1.72

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1230E+02 OUTFLOW= .9460E+01 BASIN STORAGE= .5123E-02 PERCENT ERROR=  23.0



 *** NORMAL END OF HEC-1 ***
```

```
1***************************************                      ***************************************
 *                                      *                     *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                     *   U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                     *   HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                     *         609 SECOND STREET           *
 *                                      *                     *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:08:44  *                     *          (916) 756-1104             *
 *                                      *                     *                                     *
 ***************************************                      ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                     HEC-1 INPUT                                                    PAGE  1

           LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1           ID   HEC-1 Input Filename: 16196post100
              2           ID   Description:          Casino Master Plan Post-development Flow – Alternative B
              3           ID   Recurrence Interval:  100 year
              4           ID   Storm Duration:       24 hours
              5           ID   Date Compiled:        03/27/2017
              6           ID   Total Area at Point of Interest: 66.2
                          *
                          *
                          *
                          *
              7           IT       1 27Mar17    0000    1800
              8           IO       5       0       0
```

```
     9           IN       5
                 *
                 * BA
                 * Casino Master Plan

    10           KK      BA
    11           KO       0
    12           PB   5.069
    13           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    14           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008
    15           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    16           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    17           PI   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
    18           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.010   0.010
    19           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
    20           PI   0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
    21           PI   0.011   0.011   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.012
    22           PI   0.013   0.013   0.013   0.013   0.013   0.013   0.014   0.014   0.014   0.014
    23           PI   0.014   0.015   0.015   0.015   0.015   0.015   0.016   0.016   0.016   0.016
    24           PI   0.017   0.017   0.017   0.018   0.018   0.019   0.019   0.019   0.020   0.020
    25           PI   0.021   0.021   0.022   0.023   0.023   0.024   0.025   0.026   0.027   0.028
    26           PI   0.029   0.030   0.032   0.034   0.036   0.038   0.041   0.045   0.049   0.055
    27           PI   0.064   0.077   0.101   0.172   0.526   0.125   0.087   0.070   0.059   0.052
    28           PI   0.047   0.043   0.040   0.037   0.035   0.033   0.031   0.030   0.028   0.027
    29           PI   0.026   0.025   0.024   0.024   0.023   0.022   0.022   0.021   0.021   0.020
    30           PI   0.020   0.019   0.019   0.018   0.018   0.018   0.017   0.017   0.017   0.016
    31           PI   0.016   0.016   0.016   0.015   0.015   0.015   0.015   0.014   0.014   0.014
    32           PI   0.014   0.014   0.013   0.013   0.013   0.013   0.013   0.013   0.013   0.012
    33           PI   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011   0.011   0.011
    34           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
    35           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
    36           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
    37           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008
    38           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    39           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    40           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    41           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    42           BA  0.1034
    43           BF     -10    -0.1    1.05
    44           LS       0      74       0     .05      99       0
    45           UK     100   0.010   0.600      57
    46           UK     100   0.010   0.050      43
    47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                                  HEC-1 INPUT                                             PAGE  2

  LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    48           RD     900  0.0030   0.020   0.052    CIRC       2       0
    49           RD     900  0.0030   0.020   0.103    CIRC       3       0
    50           ZZ
```

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1****************************************                                                     ****************************************
 *                                       *                                                     *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                     *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                                                     *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                                     *          609 SECOND STREET           *
 *                                       *                                                     *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:08:44   *                                                     *           (916) 756-1104             *
 *                                       *                                                     *                                      *
 ****************************************                                                     ****************************************



                           HEC-1 Input Filename: 16196post100
                           Description:          Casino Master Plan Post-development Flow - Alternative
                           Recurrence Interval:  100 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/27/2017
                           Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
            **************
            *            *
   10 KK    *       BA   *
            *            *
            **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                                 RUNOFF SUMMARY
                                                         FLOW IN CUBIC FEET PER SECOND
                                                      TIME IN HOURS,  AREA IN SQUARE MILES

                                               PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                   AREA      STAGE     MAX STAGE
+                                                                 6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA       139.   12.15          24.         12.         10.        .10
1
                                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                       INTERPOLATED TO
                                                                                    COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                      PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE         1.00    138.71    729.00      2.74      1.00    138.71    729.00       2.74

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1927E+02 OUTFLOW= .1510E+02 BASIN STORAGE= .5304E-02 PERCENT ERROR=  21.6



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************                           ***************************************
 *                                       *                           *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                           *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                           *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                           *         609 SECOND STREET           *
 *                                       *                           *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   07APR17  TIME  12:09:00   *                           *           (916) 756-1104            *
 *                                       *                           *                                     *
 *****************************************                           ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                            HEC-1 INPUT                                                 PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post2-DA1 B
              2          ID   Description:          Casino Master Plan Alternate B Post-development Flow DA
              3          ID   Recurrence Interval:  2 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/28/2017
              6          ID   Total Area at Point of Interest: 6.4
                         *
                         *
                         *
                         *
              7          IT       1 28Mar17    0000    1800
              8          IO       5       0       0
```

```
          9           IN       5
                      *
                      * DA1
                      * Casino Master Plan

         10           KK     DA1
         11           KO       0
         12           PB   2.769
         13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
         17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
         18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
         19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
         20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
         21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
         22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
         23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
         24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
         25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
         26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
         27           PI   0.035   0.042   0.055   0.094   0.292   0.068   0.047   0.038   0.032   0.028
         28           PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
         29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
         30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
         31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
         32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
         33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
         34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
         35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
         36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
         37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
         38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         42           BA    0.01
         43           BF      -3    -0.1    1.05
         44           LS       0      80       0     .05      99       0
         45           UK     100   0.010   0.600       5
         46           UK     100   0.010   0.050      95
         47           RD     200  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                    HEC-1 INPUT                                          PAGE  2

       LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

         48           RD     500  0.0030   0.020   0.005    CIRC       2       0
         49           RD     500  0.0030   0.020   0.010    CIRC       3       0
         50           ZZ
```

```
1**************************************                    **************************************
 *                                      *                    *                                    *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                    *   HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                    *        609 SECOND STREET           *
 *                                      *                    *     DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   07APR17  TIME  12:09:00  *                    *         (916) 756-1104             *
 *                                      *                    *                                    *
 **************************************                    **************************************



                          HEC-1 Input Filename: 16196post2-DA1 B
                          Description:          Casino Master Plan Alternate B Post-development Flow DA
                          Recurrence Interval:  2 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/28/2017
                          Total Area at Point of Interest: 6.4

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     28Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     29   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *       DA1  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                          RUNOFF SUMMARY
                                                  FLOW IN CUBIC FEET PER SECOND
                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                              PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION             FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                                 6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA1               15.    12.13          2.          1.          1.         .01
1
                                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                           INTERPOLATED TO
                                                                                        COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT        PEAK    TIME TO     VOLUME       DT        PEAK    TIME TO     VOLUME
                                                      PEAK                                       PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA1  MANE         1.00     15.26    728.00      1.78      1.00     15.26    728.00       1.78

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1357E+01 OUTFLOW= .9475E+00 BASIN STORAGE= .9248E-03 PERCENT ERROR=  30.1



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************                                     ****************************************
 *                                       *                                     *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                     *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                                     *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                     *          609 SECOND STREET           *
 *                                       *                                     *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   28MAR17  TIME  10:02:09   *                                     *          (916) 756-1104              *
 *                                       *                                     *                                      *
 *****************************************                                     ****************************************


                              X     X  XXXXXXX   XXXXX           X
                              X     X  X        X     X         XX
                              X     X  X        X                X
                              XXXXXXX  XXXX     X        XXXXX   X
                              X     X  X        X                X
                              X     X  X        X     X          X
                              X     X  XXXXXXX   XXXXX          XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                                   HEC-1 INPUT                                             PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post10-DA1 B
              2          ID   Description:          Casino Master Plan Alternate B Post-development Flow DA
              3          ID   Recurrence Interval:  10 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/28/2017
              6          ID   Total Area at Point of Interest: 6.4
                         *
                         *
                         *
                         *
              7          IT       1 28Mar17    0000    1800
```

```
       8           IO       5       0       0
       9           IN       5
                   *
                   * DA1
                   * Casino Master Plan

      10           KK     DA1
      11           KO       0
      12           PB   3.608
      13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
      14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
      15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
      16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
      17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
      18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
      19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
      20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
      21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
      22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
      23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
      24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
      25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
      26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
      27           PI   0.045   0.055   0.072   0.122   0.380   0.089   0.062   0.049   0.042   0.037
      28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
      29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
      30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
      31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
      32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
      33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
      34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
      35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
      36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
      37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
      38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
      39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
      40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
      41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
      42           BA    0.01
      43           BF      -5    -0.1    1.05
      44           LS       0      80       0     .05      99       0
      45           UK     100   0.010   0.600       5
      46           UK     100   0.010   0.050      95
      47           RD     200  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                    HEC-1 INPUT                                                PAGE  2

    LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

      48           RD     500  0.0030   0.020   0.005    CIRC       2       0
```

```
          49           RD     500  0.0030   0.020   0.010    CIRC       3       0
          50           ZZ
1*****************************************                                              ***************************************
 *                                       *                                              *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                              *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                                              *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                              *          609 SECOND STREET          *
 *                                       *                                              *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  10:02:09   *                                              *           (916) 756-1104            *
 *                                       *                                              *                                     *
 *****************************************                                              ***************************************


                         HEC-1 Input Filename: 16196post10-DA1 B
                         Description:          Casino Master Plan Alternate B Post-development Flow DA
                         Recurrence Interval:  10 year
                         Storm Duration:       24 hours
                         Date Compiled:        03/28/2017
                         Total Area at Point of Interest: 6.4

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN          1  MINUTES IN COMPUTATION INTERVAL
                        IDATE    28Mar17  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE    29   17  ENDING DATE
                       NDTIME       0559  ENDING TIME
                       ICENT          19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
   10 KK    *       DA1  *
            *            *
            **************

   11 KO         OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                      RUNOFF SUMMARY
                                              FLOW IN CUBIC FEET PER SECOND
                                           TIME IN HOURS,  AREA IN SQUARE MILES

                                         PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION        FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                             6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA1         20.   12.12          2.          1.          1.        .01
1
                                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                   INTERPOLATED TO
                                                                                COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                     PEAK

                                 (MIN)     (CFS)     (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA1  MANE         1.00     20.33    727.00      2.18      1.00     20.33    727.00       2.18

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1799E+01 OUTFLOW= .1164E+01 BASIN STORAGE= .9239E-03 PERCENT ERROR=  35.3



 *** NORMAL END OF HEC-1 ***
```

Post-development Subbasin Parameters

Subbasin:	BA
Mean Subbasin Elevation (ft):	450
Subbasin Area (Sq. Mi.):	0.1034375
Subbasin Area (acres):	66.2
Land Use:	Soil A:33% 1-Commercial/Highways/Parking
	Soil A:65% 14-Pasture/Parkland/Mowed Grass
	Soil A:2% 17- Open Oak/Pine Woodland/Grassland
Pervious Curve Number:	72
Pervious Overland Length (ft):	100
Pervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	67
Impervious Overland Length (ft):	100
Impervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	200
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.030
Representative Area (acres):	10.30
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	15.0
Collector #2 (pipe or channel):	pipe
Length (ft):	300
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	33.10
Width (ft)/Diameter (in) :	18.0
Sideslopes (ft/ft-H/V):	0
Collector #3 (pipe or channel):	pipe
Length (ft):	300
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	66.20
Width (ft)/Diameter (in) :	24.0
Sideslopes (ft/ft-H/V):	0

```
1****************************************                     ****************************************
 *                                       *                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                    *          609 SECOND STREET           *
 *                                       *                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:45:33   *                    *           (916) 756-1104             *
 *                                       *                    *                                      *
 ****************************************                     ****************************************


              X     X  XXXXXXX   XXXXX          X
              X     X  X        X     X        XX
              X     X  X        X               X
              XXXXXXX  XXXX     X       XXXXX   X
              X     X  X        X               X
              X     X  X        X     X         X
              X     X  XXXXXXX   XXXXX         XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                      HEC-1 INPUT                                             PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post2-D
              2          ID   Description:          Casino Master Plan Post-development Flow - Alternative D
              3          ID   Recurrence Interval:  2 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/27/2017
              6          ID   Total Area at Point of Interest: 66.2
                         *
                         *
                         *
                         *
              7          IT       1 27Mar17    0000    1800
              8          IO       5       0       0
```

```
IN       5
*
* BA
* Casino Master Plan

KK      BA
KO       0
PB   2.762
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
PI   0.035   0.042   0.055   0.094   0.286   0.068   0.047   0.038   0.032   0.028
PI   0.025   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
BA  0.1034
BF      -3    -0.1    1.05
LS       0      72       0     .05      99       0
UK     100   0.010   0.600      67
UK     100   0.010   0.050      33
RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
```

1 HEC-1 INPUT PAGE 2

```
LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

RD     300  0.0030   0.020   0.052    CIRC     1.5       0
RD     300  0.0030   0.020   0.103    CIRC       2       0
ZZ
```

```
1****************************************                    ***************************************
 *                                       *                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                    *    HYDROLOGIC ENGINEERING CENTER    *
 *          VERSION 4.1                  *                    *          609 SECOND STREET          *
 *                                       *                    *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  14:45:33   *                    *           (916) 756-1104            *
 *                                       *                    *                                     *
 *****************************************                    ***************************************



                            HEC-1 Input Filename: 16196post2-D
                            Description:          Casino Master Plan Post-development Flow - Alternative
                            Recurrence Interval:  2 year
                            Storm Duration:       24 hours
                            Date Compiled:        03/27/2017
                            Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
            **************
            *            *
   10 KK    *        BA  *
            *            *
            **************

   11 KO         OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                          RUNOFF SUMMARY
                                                  FLOW IN CUBIC FEET PER SECOND
                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                              PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION             FLOW     PEAK                                              AREA      STAGE     MAX STAGE
+                                                                 6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA              52.   12.13          8.          4.          3.         .10
1
                                            SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                        INTERPOLATED TO
                                                                                     COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                     PEAK

                                 (MIN)     (CFS)     (MIN)      (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE          .99     52.03    727.49       .95      1.00     51.99    728.00        .95

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .7235E+01 OUTFLOW= .5228E+01 BASIN STORAGE= .5102E-02 PERCENT ERROR=  27.7



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   27MAR17  TIME  14:47:10   *
 *                                       *
 *****************************************
```

```
***************************************
*                                     *
*    U.S. ARMY CORPS OF ENGINEERS     *
*    HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET          *
*       DAVIS, CALIFORNIA 95616       *
*           (916) 756-1104            *
*                                     *
***************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                        HEC-1 INPUT                                                     PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID   HEC-1 Input Filename: 16196post10-D
            2           ID   Description:          Casino Master Plan Post-development Flow - Alternative
            3           ID   Recurrence Interval:  10 year
            4           ID   Storm Duration:       24 hours
            5           ID   Date Compiled:        03/27/2017
            6           ID   Total Area at Point of Interest: 66.2
                        *
                        *
                        *
                        *
            7           IT       1 27Mar17    0000    1800
            8           IO       5       0       0
```

```
      9           IN       5
                  *
                  * BA
                  * Casino Master Plan

     10           KK      BA
     11           KO       0
     12           PB   3.599
     13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
     16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
     21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
     22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
     23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
     24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
     25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
     26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
     27           PI   0.045   0.055   0.072   0.122   0.372   0.088   0.062   0.049   0.042   0.037
     28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
     29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
     30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
     31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
     32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
     33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
     34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
     35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
     37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
     40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     42           BA  0.1034
     43           BF      -5    -0.1    1.05
     44           LS       0      72       0     .05      99       0
     45           UK     100   0.010   0.600      67
     46           UK     100   0.010   0.050      33
     47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                                  HEC-1 INPUT                                        PAGE  2

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

     48           RD     300  0.0030   0.020   0.052    CIRC     1.5       0
     49           RD     300  0.0030   0.020   0.103    CIRC       2       0
     50           ZZ
```

```
1*****************************************                         ***************************************
 *                                       *                         *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                         *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                         *    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1                *                         *          609 SECOND STREET          *
 *                                       *                         *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  14:47:10   *                         *           (916) 756-1104            *
 *                                       *                         *                                     *
 *****************************************                         ***************************************




                          HEC-1 Input Filename: 16196post10-D
                          Description:          Casino Master Plan Post-development Flow - Alternative
                          Recurrence Interval:  10 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/27/2017
                          Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                       ICENT          19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
           **************
           *            *
   10 KK   *        BA  *
           *            *
           **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+										
	HYDROGRAPH AT									
+		BA	73.	12.13	13.	6.	5.	.10		

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
BA	MANE	.93	73.34	728.29	1.53	1.00	73.09	728.00	1.53

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1066E+02 OUTFLOW= .8415E+01 BASIN STORAGE= .5143E-02 PERCENT ERROR= 21.0

*** NORMAL END OF HEC-1 ***

```
1***************************************                                                        ***************************************
 *                                      *                                                       *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                       *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                                                       *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                                                       *          609 SECOND STREET          *
 *                                      *                                                       *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  14:48:26  *                                                       *           (916) 756-1104            *
 *                                      *                                                       *                                     *
 ***************************************                                                        ***************************************


                                          X     X  XXXXXXX   XXXXX          X
                                          X     X  X        X     X        XX
                                          X     X  X        X               X
                                          XXXXXXX  XXXX     X       XXXXX   X
                                          X     X  X        X               X
                                          X     X  X        X     X         X
                                          X     X  XXXXXXX   XXXXX         XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                      HEC-1 INPUT                                                      PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post100-D
             2           ID   Description:          Casino Master Plan Post-development Flow - Alternative D
             3           ID   Recurrence Interval:  100 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/27/2017
             6           ID   Total Area at Point of Interest: 66.2
                         *
                         *
                         *
                         *
             7           IT       1 27Mar17    0000    1800
             8           IO       5       0       0
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    9           IN       5
                *
                * BA
                * Casino Master Plan

   10           KK      BA
   11           KO       0
   12           PB   5.069
   13           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
   14           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008
   15           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
   16           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
   17           PI   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
   18           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.010   0.010
   19           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
   20           PI   0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
   21           PI   0.011   0.011   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.012
   22           PI   0.013   0.013   0.013   0.013   0.013   0.013   0.014   0.014   0.014   0.014
   23           PI   0.014   0.015   0.015   0.015   0.015   0.015   0.016   0.016   0.016   0.016
   24           PI   0.017   0.017   0.017   0.018   0.018   0.019   0.019   0.019   0.020   0.020
   25           PI   0.021   0.021   0.022   0.023   0.023   0.024   0.025   0.026   0.027   0.028
   26           PI   0.029   0.030   0.032   0.034   0.036   0.038   0.041   0.045   0.049   0.055
   27           PI   0.064   0.077   0.101   0.172   0.526   0.125   0.087   0.070   0.059   0.052
   28           PI   0.047   0.043   0.040   0.037   0.035   0.033   0.031   0.030   0.028   0.027
   29           PI   0.026   0.025   0.024   0.024   0.023   0.022   0.022   0.021   0.021   0.020
   30           PI   0.020   0.019   0.019   0.018   0.018   0.018   0.017   0.017   0.017   0.016
   31           PI   0.016   0.016   0.016   0.015   0.015   0.015   0.015   0.014   0.014   0.014
   32           PI   0.014   0.014   0.013   0.013   0.013   0.013   0.013   0.013   0.013   0.012
   33           PI   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011   0.011   0.011
   34           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
   35           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
   36           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
   37           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008
   38           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
   39           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
   40           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
   41           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
   42           BA  0.1034
   43           BF     -10    -0.1    1.05
   44           LS       0      72       0     .05      99       0
   45           UK     100   0.010   0.600      67
   46           UK     100   0.010   0.050      33
   47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                                 HEC-1 INPUT                                          PAGE  2

 LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   48           RD     300  0.0030   0.020   0.052    CIRC     1.5       0
   49           RD     300  0.0030   0.020   0.103    CIRC       2       0
   50           ZZ
```

```
1***************************************                                            ***************************************
 *                                      *                                           *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                           *   U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                                           *   HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                           *         609 SECOND STREET           *
 *                                      *                                           *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:48:26  *                                           *          (916) 756-1104             *
 *                                      *                                           *                                     *
 ***************************************                                            ***************************************




                           HEC-1 Input Filename: 16196post100-D
                           Description:          Casino Master Plan Post-development Flow - Alternative
                           Recurrence Interval:  100 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/27/2017
                           Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *        BA  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                RUNOFF SUMMARY
                                                        FLOW IN CUBIC FEET PER SECOND
                                                     TIME IN HOURS,  AREA IN SQUARE MILES

                                              PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION        FLOW     PEAK                                               AREA      STAGE     MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA       117.   12.15          22.         11.          9.        .10
1
                                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                INTERPOLATED TO
                                                                                             COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                     PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE          .84    116.44    729.00      2.72      1.00    116.44    729.00        2.72

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1727E+02 OUTFLOW= .1501E+02 BASIN STORAGE= .5301E-02 PERCENT ERROR=  13.1



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************                    ***************************************
 *                                       *                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *   U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                    *   HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                    *         609 SECOND STREET           *
 *                                       *                    *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  11:35:13   *                    *          (916) 756-1104             *
 *                                       *                    *                                     *
 *****************************************                    ***************************************


                  X     X  XXXXXXX   XXXXX           X
                  X     X  X        X     X         XX
                  X     X  X        X                X
                  XXXXXXX  XXXX     X       XXXXX    X
                  X     X  X        X                X
                  X     X  X        X     X          X
                  X     X  XXXXXXX   XXXXX          XXX


  THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

  THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
  THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
  NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
  DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
  KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                         HEC-1 INPUT                                             PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post2-DA1 D
              2          ID   Description:          Casino Master Plan Alternate D Post-development Flow DA1
              3          ID   Recurrence Interval:  2 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/28/2017
              6          ID   Total Area at Point of Interest: 9.9
                         *
                         *
                         *
                         *
              7          IT       1 28Mar17    0000    1800
              8          IO       5       0       0
```

```
IN       5
*
* DA1
* Casino Master Plan

KK     DA1
KO       0
PB   2.768
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
PI   0.035   0.042   0.055   0.094   0.291   0.068   0.047   0.038   0.032   0.028
PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
BA  0.0154
BF      -3    -0.1    1.05
LS       0      80       0     .05      99       0
UK     100   0.010   0.600       5
UK     100   0.010   0.050      95
RD     200  0.0030   0.030   0.005    TRAP     2.0    15.0
```



```
LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

RD     500  0.0030   0.020   0.005    CIRC       2       0
RD     500  0.0030   0.020   0.010    CIRC       3       0
ZZ
```

```
1***************************************                                                 ***************************************
 *                                     *                                                 *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                 *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998              *                                                 *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1               *                                                 *          609 SECOND STREET          *
 *                                     *                                                 *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  11:35:13  *                                                 *           (916) 756-1104            *
 *                                     *                                                 *                                     *
 ***************************************                                                 ***************************************



                      HEC-1 Input Filename: 16196post2-DA1 D
                      Description:          Casino Master Plan Alternate D Post-development Flow DA
                      Recurrence Interval:  2 year
                      Storm Duration:       24 hours
                      Date Compiled:        03/28/2017
                      Total Area at Point of Interest: 9.9

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     28Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     29   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   29.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
          **************
          *            *
   10 KK  *      DA1   *
          *            *
          **************

   11 KO        OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                               RUNOFF SUMMARY
                                                       FLOW IN CUBIC FEET PER SECOND
                                                    TIME IN HOURS,  AREA IN SQUARE MILES

                                             PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION            FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA1              23.   12.13          3.          2.          1.        .02
1
                                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                     INTERPOLATED TO
                                                                                  COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                     PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA1  MANE        1.00     23.41    728.00      1.82      1.00     23.41    728.00        1.82

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2089E+01 OUTFLOW= .1491E+01 BASIN STORAGE= .1286E-02 PERCENT ERROR=  28.6



 *** NORMAL END OF HEC-1 ***
```

```
1****************************************                    ***************************************
 *                                      *                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                    *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                    *         609 SECOND STREET           *
 *                                      *                    *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  11:35:45  *                    *           (916) 756-1104            *
 *                                      *                    *                                     *
 ****************************************                    ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                         HEC-1 INPUT                                           PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post10-DA1 D
              2          ID   Description:          Casino Master Plan Alternate D Post-development Flow DA1
              3          ID   Recurrence Interval:  10 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/28/2017
              6          ID   Total Area at Point of Interest: 9.9
                         *
                         *
                         *
                         *
              7          IT       1 28Mar17    0000    1800
              8          IO       5       0       0
```

```
  9           IN       5
              *
              * DA1
              * Casino Master Plan

 10           KK     DA1
 11           KO       0
 12           PB   3.607
 13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
 16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
 22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
 23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
 24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
 25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
 26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
 27           PI   0.045   0.055   0.072   0.122   0.379   0.089   0.062   0.049   0.042   0.037
 28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
 29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
 30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
 31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
 32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
 35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
 40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 42           BA  0.0154
 43           BF      -5    -0.1    1.05
 44           LS       0      80       0     .05      99       0
 45           UK     100   0.010   0.600       5
 46           UK     100   0.010   0.050      95
 47           RD     200  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                         HEC-1 INPUT                                    PAGE  2

       LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     500  0.0030   0.020   0.005    CIRC       2       0
 49           RD     500  0.0030   0.020   0.010    CIRC       3       0
 50           ZZ
```

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1*****************************************                      ***************************************
 *                                        *                      *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                      *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998                *                      *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                  *                      *          609 SECOND STREET          *
 *                                        *                      *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  11:35:45    *                      *           (916) 756-1104            *
 *                                        *                      *                                     *
 *****************************************                      ***************************************


                    HEC-1 Input Filename: 16196post10-DA1 D
                    Description:          Casino Master Plan Alternate D Post-development Flow DA
                    Recurrence Interval:  10 year
                    Storm Duration:       24 hours
                    Date Compiled:        03/28/2017
                    Total Area at Point of Interest: 9.9

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     28Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     29   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** 
```

```
              **************
              *            *
   10 KK      *       DA1  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                                    RUNOFF SUMMARY
                                                            FLOW IN CUBIC FEET PER SECOND
                                                         TIME IN HOURS,  AREA IN SQUARE MILES

                                             PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION            FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                                 6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA1             32.   12.12           4.          2.          2.        .02
1
                                                    SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                        (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                    INTERPOLATED TO
                                                                                 COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                      PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA1  MANE         1.00     31.48    727.00      2.23      1.00     31.48    727.00        2.23


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2769E+01 OUTFLOW= .1828E+01 BASIN STORAGE= .1290E-02 PERCENT ERROR=  33.9



 *** NORMAL END OF HEC-1 ***
```

```
1****************************************                 ****************************************
 *                                      *                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                 *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                 *         609 SECOND STREET            *
 *                                      *                 *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   28MAR17  TIME  11:47:23  *                 *          (916) 756-1104              *
 *                                      *                 *                                      *
 ****************************************                 ****************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X       XXXXX   X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                            HEC-1 INPUT                                                  PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post2-D-DA2
             2           ID   Description:          Casino Master Plan Alternative D Post-development Flow
             3           ID   Recurrence Interval:  2 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/28/2017
             6           ID   Total Area at Point of Interest: 6.1
                         *
                         *
                         *
                         *
             7           IT       1 28Mar17    0000    1800
             8           IO       5       0       0
```

```
   9          IN       5
              *
              * DA2
              * Casino Master Plan

  10          KK     DA2
  11          KO       0
  12          PB   2.769
  13          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  14          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  15          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  16          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
  17          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  18          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  19          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
  20          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  21          PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  22          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
  23          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  24          PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
  25          PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
  26          PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
  27          PI   0.035   0.042   0.055   0.094   0.292   0.068   0.047   0.038   0.032   0.028
  28          PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
  29          PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
  30          PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
  31          PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  32          PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  33          PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  34          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  35          PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  36          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  37          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  38          PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  39          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  40          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  41          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  42          BA  0.0095
  43          BF      -3    -0.1    1.05
  44          LS       0      80       0     .05      99       0
  45          UK     100   0.010   0.600       5
  46          UK     100   0.010   0.050      95
  47          RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                         HEC-1 INPUT                                          PAGE  2

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48          RD     222  0.0030   0.030   0.008    TRAP     2.0    15.0
  49          RD     250  0.0030   0.020   0.015    CIRC       2       0
  50          ZZ
```

```
1***************************************                                     ***************************************
 *                                     *                                     *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                     *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998             *                                     *    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1              *                                     *          609 SECOND STREET          *
 *                                     *                                     *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  11:47:23   *                                     *           (916) 756-1104            *
 *                                     *                                     *                                     *
 ***************************************                                     ***************************************



                       HEC-1 Input Filename: 16196post2-D-DA2
                       Description:          Casino Master Plan Alternative D Post-development Flow
                       Recurrence Interval:  2 year
                       Storm Duration:       24 hours
                       Date Compiled:        03/28/2017
                       Total Area at Point of Interest: 6.1

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     28Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     29   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
             **************
             *            *
   10 KK     *       DA2  *
             *            *
             **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                      RUNOFF SUMMARY
                                              FLOW IN CUBIC FEET PER SECOND
                                           TIME IN HOURS,  AREA IN SQUARE MILES

                                              PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION             FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                                  6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA2               15.   12.12          2.          1.          1.        .01
1
                                                         SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                             (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                INTERPOLATED TO
                                                                                             COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                     PEAK

                                (MIN)     (CFS)     (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA2  MANE         1.00     14.75    727.00      1.99      1.00     14.75    727.00        1.99

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1289E+01 OUTFLOW= .1010E+01 BASIN STORAGE= .8558E-03 PERCENT ERROR=  21.6



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************                              ****************************************
 *                                       *                              *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                              *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                              *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                              *          609 SECOND STREET           *
 *                                       *                              *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   28MAR17  TIME  11:47:59   *                              *           (916) 756-1104             *
 *                                       *                              *                                      *
 *****************************************                              ****************************************


                                               X     X  XXXXXXX   XXXXX          X
                                               X     X  X        X     X        XX
                                               X     X  X        X               X
                                               XXXXXXX  XXXX     X       XXXXX   X
                                               X     X  X        X               X
                                               X     X  X        X     X         X
                                               X     X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                        HEC-1 INPUT                                                      PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1          ID   HEC-1 Input Filename: 16196post10-D-DA2
             2          ID   Description:          Casino Master Plan Alternative D Post-development Flow
             3          ID   Recurrence Interval:  10 year
             4          ID   Storm Duration:       24 hours
             5          ID   Date Compiled:        03/28/2017
             6          ID   Total Area at Point of Interest: 6.1
                        *
                        *
                        *
                        *
             7          IT       1 28Mar17    0000    1800
             8          IO       5       0       0
```

```
   9           IN       5
               *
               * DA2
               * Casino Master Plan

  10           KK     DA2
  11           KO       0
  12           PB   3.608
  13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
  16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
  22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
  23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
  24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
  25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
  26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
  27           PI   0.045   0.055   0.072   0.122   0.380   0.089   0.062   0.049   0.042   0.037
  28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
  29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
  30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
  31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
  32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
  35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
  37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
  40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  42           BA  0.0095
  43           BF      -5    -0.1    1.05
  44           LS       0      80       0     .05      99       0
  45           UK     100   0.010   0.600       5
  46           UK     100   0.010   0.050      95
  47           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                             HEC-1 INPUT                                         PAGE  2

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     222  0.0030   0.030   0.008    TRAP     2.0    15.0
  49           RD     250  0.0030   0.020   0.015    CIRC       2       0
  50           ZZ
```

```
1****************************************                        ****************************************
 *                                      *                        *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                        *     U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                        *     HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1               *                        *          609 SECOND STREET           *
 *                                      *                        *        DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  11:47:59  *                        *            (916) 756-1104            *
 *                                      *                        *                                      *
 ****************************************                        ****************************************
```

```
                      HEC-1 Input Filename: 16196post10-D-DA2
                      Description:          Casino Master Plan Alternative D Post-development Flow
                      Recurrence Interval:  10 year
                      Storm Duration:       24 hours
                      Date Compiled:        03/28/2017
                      Total Area at Point of Interest: 6.1

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     28Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     29   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
             **************
             *            *
   10 KK     *       DA2  *
             *            *
             **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                          RUNOFF SUMMARY
                                                                  FLOW IN CUBIC FEET PER SECOND
                                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                                      PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                 AREA      STAGE     MAX STAGE
+                                                                          6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                                  DA2        20.   12.12           2.          1.          1.        .01
1
                                                         SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                             (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                        INTERPOLATED TO
                                                                                                     COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT        PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                         PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA2  MANE         1.00     19.66    727.00      2.41      1.00     19.66    727.00        2.41

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1709E+01 OUTFLOW= .1223E+01 BASIN STORAGE= .8608E-03 PERCENT ERROR=  28.4

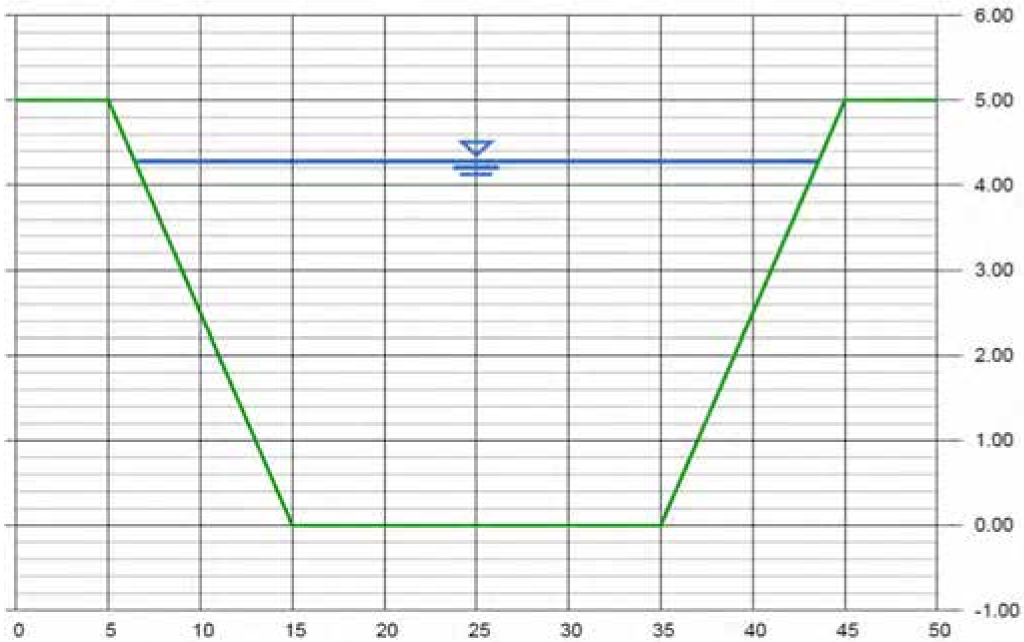


 *** NORMAL END OF HEC-1 ***
```

INFILTRATION TRENCH CALCULATIONS

Proposed Earthen Infiltration Channel

Determine the capacity of the proposed channel toconvey flow to the existing sandy gravel layer below the surface.



Using Darcy's Law: Q = A*k*i where: A = cross-sectional area, including space occupied by porous material
k = hydraulic conductivity
i = hydraulic gradient = h/d = drop in head / distance drop occurs
assume: minimum h = d; therefore, i = 1.0

Table 11.1 (Soil Engineering, 4th Edition): k = 0.1 cm/s

k = (0.1 cm/s)*(0.03281 ft/cm) = 0.0033 ft/s

Calculate Q diverted to existing sandy gravel layer (Q_D)

A = 55360 sf
width of trench = 20 ft
length of trench = 2768 ft

Q = 181.6 cfs

Alternative	2-year Peak Flow	10-year Peak Flow
A	60	80
B	39	53
C	60	80
D	38	52

As shown is the above table the proposed infiltration trench will be more than adequate to infiltrate the 2- and 10-year storms for Altrenatives A, B, C, and D.

Post-development Subbasin Parameters

Subbasin:	Basin E
Mean Subbasin Elevation (ft):	414
Subbasin Area (Sq. Mi.):	0.06328125
Subbasin Area (acres):	40.5
Land Use:	Soil A:42% Soil D:42% 1-Commercial/Highways/Parking
	Soil A:8% Soil D:8% 14-Pasture/Parkland/Mowed Grass
Pervious Curve Number:	84
Pervious Overland Length (ft):	200
Pervious Overland Slope (ft/ft):	0.005
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	20
Impervious Overland Length (ft):	200
Impervious Overland Slope (ft/ft):	0.005
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	285
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.030
Representative Area (acres):	3.00
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	15.0
Collector #2 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.020
Representative Area (acres):	20.25
Width (ft)/Diameter (in) :	18.0
Sideslopes (ft/ft-H/V):	0
Collector #3 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.020
Representative Area (acres):	40.50
Width (ft)/Diameter (in) :	24.0
Sideslopes (ft/ft-H/V):	0

```
1****************************************                            ****************************************
 *                                       *                            *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                            *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                            *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                            *         609 SECOND STREET            *
 *                                       *                            *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  11:09:29   *                            *          (916) 756-1104              *
 *                                       *                            *                                      *
 ****************************************                            ****************************************


                        X     X  XXXXXXX   XXXXX           X
                        X     X  X        X     X         XX
                        X     X  X        X                X
                        XXXXXXX  XXXX     X        XXXXX   X
                        X     X  X        X                X
                        X     X  X        X     X          X
                        X     X  XXXXXXX   XXXXX          XXX


  THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

  THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
  THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
  NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
  DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
  KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                        HEC-1 INPUT                                           PAGE  1

           LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1           ID   HEC-1 Input Filename: 16196postE
              2           ID   Description:          Casino Master Plan Alternative E Post-development Flow
              3           ID   Recurrence Interval:  2 year
              4           ID   Storm Duration:       24 hours
              5           ID   Date Compiled:        03/27/2017
              6           ID   Total Area at Point of Interest: 40.5
                          *
                          *
                          *
                          *
              7           IT       1 27Mar17    0000    1800
              8           IO       5       0       0
```

```
        9           IN       5
                    *
                    * Basin E
                    * Alternative E - Anderson, Ca

       10           KK  Basin
       11           KO       0
       12           PB   2.580
       13           PI   0.003   0.003   0.003   0.003   0.004   0.004   0.004   0.004   0.004   0.004
       14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
       15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
       16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
       17           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
       18           PI   0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
       19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
       20           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
       21           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
       22           PI   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
       23           PI   0.007   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008
       24           PI   0.008   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010
       25           PI   0.011   0.011   0.011   0.011   0.012   0.012   0.013   0.013   0.014   0.014
       26           PI   0.015   0.015   0.016   0.017   0.018   0.020   0.021   0.023   0.025   0.028
       27           PI   0.033   0.040   0.052   0.089   0.278   0.065   0.045   0.036   0.030   0.027
       28           PI   0.024   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.014   0.014
       29           PI   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011   0.010   0.010
       30           PI   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008
       31           PI   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007   0.007
       32           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
       33           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
       34           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
       35           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
       36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.004   0.004
       37           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
       38           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
       39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
       40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
       41           PI   0.004   0.004   0.004   0.004   0.003   0.003   0.003   0.003
       42           BA  0.0632
       43           BF      -3    -0.1    1.05
       44           LS       0      84       0     .05      99       0
       45           UK     200   0.005   0.600      27
       46           UK     200   0.005   0.050      73
       47           RD     285  0.0050   0.030   0.005    TRAP     2.0    15.0
1                                                     HEC-1 INPUT                                        PAGE  2

     LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

       48           RD     900  0.0050   0.020   0.031    CIRC     1.5       0
       49           RD     900  0.0050   0.020   0.063    CIRC       2       0
       50           ZZ
```

```
1***************************************                                  ***************************************
 *                                      *                                  *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *   U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                                  *   HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                  *        609 SECOND STREET            *
 *                                      *                                  *     DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   27MAR17  TIME  11:09:29  *                                  *        (916) 756-1104               *
 *                                      *                                  *                                     *
 ***************************************                                   ***************************************


                      HEC-1 Input Filename: 16196postE
                      Description:          Casino Master Plan Alternative E Post-development Flow
                      Recurrence Interval:  2 year
                      Storm Duration:       24 hours
                      Date Compiled:        03/27/2017
                      Total Area at Point of Interest: 40.5

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                COMPUTATION INTERVAL     .02 HOURS
                     TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *    Basin   *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                      RUNOFF SUMMARY
                                              FLOW IN CUBIC FEET PER SECOND
                                           TIME IN HOURS,  AREA IN SQUARE MILES

                                              PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION             FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                                  6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                          Basin          55.   12.18          8.          4.          4.        .06
1
                                          SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                              (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                     INTERPOLATED TO
                                                                                  COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                      PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

             Basin   MANE         1.00     54.50    731.00      1.52      1.00     54.50    731.00        1.52

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .7058E+01 OUTFLOW= .5118E+01 BASIN STORAGE= .5799E-02 PERCENT ERROR=  27.4


 *** NORMAL END OF HEC-1 ***
```

```
1***************************************                              ***************************************
 *                                     *                              *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                            *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                             *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                             *          609 SECOND STREET          *
 *                                     *                              *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  11:08:51   *                            *          (916) 756-1104             *
 *                                     *                              *                                     *
 ***************************************                              ***************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X       XXXXX    X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                              HEC-1 INPUT                                              PAGE  1

          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196postE
             2           ID   Description:          Casino Master Plan Alternative E Post-development Flow
             3           ID   Recurrence Interval:  10 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/27/2017
             6           ID   Total Area at Point of Interest: 40.5
                         *
                         *
                         *
                         *
             7           IT       1 27Mar17    0000    1800
             8           IO       5       0       0
```

```
    9           IN       5
                *
                * Basin E
                * Alternative E - Anderson, Ca

   10           KK  Basin
   11           KO       0
   12           PB   3.362
   13           PI   0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
   14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
   15           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
   16           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
   17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
   18           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
   19           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
   20           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
   21           PI   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
   22           PI   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009
   23           PI   0.009   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.011   0.011
   24           PI   0.011   0.011   0.011   0.012   0.012   0.012   0.012   0.013   0.013   0.013
   25           PI   0.014   0.014   0.015   0.015   0.015   0.016   0.016   0.017   0.018   0.018
   26           PI   0.019   0.020   0.021   0.022   0.024   0.025   0.027   0.030   0.033   0.037
   27           PI   0.043   0.052   0.068   0.116   0.362   0.084   0.059   0.047   0.040   0.035
   28           PI   0.031   0.029   0.026   0.025   0.023   0.022   0.021   0.020   0.019   0.018
   29           PI   0.017   0.017   0.016   0.016   0.015   0.015   0.014   0.014   0.014   0.013
   30           PI   0.013   0.013   0.012   0.012   0.012   0.012   0.011   0.011   0.011   0.011
   31           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009
   32           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008   0.008
   33           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007
   34           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
   35           PI   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006
   36           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
   37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.005   0.005
   38           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
   39           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
   40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
   41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
   42           BA  0.0632
   43           BF      -5    -0.1    1.05
   44           LS       0      84       0     .05      99       0
   45           UK     200   0.005   0.600      27
   46           UK     200   0.005   0.050      73
   47           RD     285  0.0050   0.030   0.005    TRAP     2.0    15.0
1                                                HEC-1 INPUT                                      PAGE  2

 LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   48           RD     900  0.0050   0.020   0.031    CIRC     1.5       0
   49           RD     900  0.0050   0.020   0.063    CIRC       2       0
   50           ZZ
```

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1***************************************                                            ***************************************
 *                                     *                                            *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                          *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998             *                                            *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1               *                                            *          609 SECOND STREET          *
 *                                     *                                            *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:08:51   *                                          *           (916) 756-1104            *
 *                                     *                                            *                                     *
 ***************************************                                            ***************************************



                          HEC-1 Input Filename: 16196postE
                          Description:          Casino Master Plan Alternative E Post-development Flow
                          Recurrence Interval:  10 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/27/2017
                          Total Area at Point of Interest: 40.5

   8 IO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN           1  MINUTES IN COMPUTATION INTERVAL
                      IDATE     27Mar17  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     28   17  ENDING DATE
                     NDTIME        0559  ENDING TIME
                     ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
            **************
            *            *
   10 KK    *    Basin   *
            *            *
            **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                  RUNOFF SUMMARY
                                                          FLOW IN CUBIC FEET PER SECOND
                                                       TIME IN HOURS,  AREA IN SQUARE MILES

                                                PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                 AREA      STAGE     MAX STAGE
+                                                                  6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                          Basin         76.   12.17          12.          6.          5.        .06
1
                                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                           INTERPOLATED TO
                                                                                        COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                      PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

             Basin   MANE         1.00     75.67    730.00      2.12      1.00     75.67    730.00        2.12


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .9563E+01 OUTFLOW= .7140E+01 BASIN STORAGE= .5988E-02 PERCENT ERROR=  25.3



 *** NORMAL END OF HEC-1 ***
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1*****************************************                          ***************************************
 *                                       *                          *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                          *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                          *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                          *          609 SECOND STREET          *
 *                                       *                          *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:07:57   *                          *          (916) 756-1104             *
 *                                       *                          *                                     *
 *****************************************                          ***************************************


                        X     X  XXXXXXX   XXXXX           X
                        X     X  X        X     X         XX
                        X     X  X        X                X
                        XXXXXXX  XXXX     X       XXXXX    X
                        X     X  X        X                X
                        X     X  X        X     X          X
                        X     X  XXXXXXX   XXXXX          XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                     HEC-1 INPUT                                          PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196postE
              2          ID   Description:          Casino Master Plan Alternative E Post-development Flow
              3          ID   Recurrence Interval:  100 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/27/2017
              6          ID   Total Area at Point of Interest: 40.5
                         *
                         *
                         *
                         *
              7          IT       1 27Mar17    0000    1800
              8          IO       5       0       0
```

```
     9           IN       5
                 *
                 * Basin E
                 * Alternative E - Anderson, Ca

    10           KK  Basin
    11           KO       0
    12           PB   4.702
    13           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.007
    14           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    15           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    16           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008   0.008
    17           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    18           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
    19           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
    20           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
    21           PI   0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
    22           PI   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.013   0.013   0.013
    23           PI   0.013   0.013   0.014   0.014   0.014   0.014   0.014   0.015   0.015   0.015
    24           PI   0.015   0.016   0.016   0.016   0.017   0.017   0.017   0.018   0.018   0.019
    25           PI   0.019   0.020   0.020   0.021   0.022   0.022   0.023   0.024   0.025   0.026
    26           PI   0.027   0.028   0.030   0.031   0.033   0.036   0.038   0.042   0.046   0.052
    27           PI   0.060   0.073   0.096   0.163   0.509   0.118   0.082   0.065   0.055   0.049
    28           PI   0.044   0.040   0.037   0.034   0.032   0.030   0.029   0.028   0.026   0.025
    29           PI   0.024   0.023   0.023   0.022   0.021   0.021   0.020   0.019   0.019   0.018
    30           PI   0.018   0.018   0.017   0.017   0.017   0.016   0.016   0.016   0.015   0.015
    31           PI   0.015   0.015   0.014   0.014   0.014   0.014   0.013   0.013   0.013   0.013
    32           PI   0.013   0.013   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011
    33           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
    34           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.009   0.009
    35           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
    36           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    37           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    38           PI   0.008   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    39           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    40           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    41           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    42           BA  0.0632
    43           BF     -10    -0.1    1.05
    44           LS       0      84       0     .05      99       0
    45           UK     200   0.005   0.600      27
    46           UK     200   0.005   0.050      73
    47           RD     285  0.0050   0.030   0.005    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                         PAGE  2

  LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    48           RD     900  0.0050   0.020   0.031    CIRC     1.5       0
    49           RD     900  0.0050   0.020   0.063    CIRC       2       0
    50           ZZ
```

```
1****************************************                                                         ***************************************
 *                                       *                                                         *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                         *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                                                         *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                                         *          609 SECOND STREET          *
 *                                       *                                                         *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:07:57   *                                                         *           (916) 756-1104            *
 *                                       *                                                         *                                     *
 *****************************************                                                         ***************************************


                         HEC-1 Input Filename: 16196postE
                         Description:          Casino Master Plan Alternative E Post-development Flow
                         Recurrence Interval:  100 year
                         Storm Duration:       24 hours
                         Date Compiled:        03/27/2017
                         Total Area at Point of Interest: 40.5

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *    Basin   *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                       RUNOFF SUMMARY
                                               FLOW IN CUBIC FEET PER SECOND
                                            TIME IN HOURS,  AREA IN SQUARE MILES

                                       PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                           6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                          Basin        115.   12.17          17.          9.          7.        .06
1
                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                              INTERPOLATED TO
                                                                           COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                     PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

             Basin   MANE         1.00    114.16    730.00      2.95      1.00    114.16    730.00       2.95

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1393E+02 OUTFLOW= .9953E+01 BASIN STORAGE= .6113E-02 PERCENT ERROR=  28.5



 *** NORMAL END OF HEC-1 ***
```

```
1***************************************                  ***************************************
 *                                     *                  *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                  *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998             *                  *    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1              *                  *          609 SECOND STREET          *
 *                                     *                  *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:52:33   *                  *           (916) 756-1104            *
 *                                     *                  *                                     *
 ***************************************                  ***************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X        XXXXX  X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


   THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

   THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
   THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
   NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
   DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
   KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                         HEC-1 INPUT                                          PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1          ID   HEC-1 Input Filename: 16196post-DE1
             2          ID   Description:          Casino Master Plan Alternative E Post-development Flow
             3          ID   Recurrence Interval:  2 year
             4          ID   Storm Duration:       24 hours
             5          ID   Date Compiled:        03/27/2017
             6          ID   Total Area at Point of Interest: 23.9
                        *
                        *
                        *
                        *
```

```
  7           IT       1 27Mar17    0000    1800
  8           IO       5       0       0
  9           IN       5
              *
              * Basin E
              * Alternative E - Anderson, Ca

 10           KK  Basin
 11           KO       0
 12           PB   2.581
 13           PI   0.003   0.003   0.003   0.003   0.004   0.004   0.004   0.004   0.004   0.004
 14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 17           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 18           PI   0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 20           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
 21           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 22           PI   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 23           PI   0.007   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 24           PI   0.008   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010
 25           PI   0.011   0.011   0.011   0.011   0.012   0.012   0.013   0.013   0.014   0.014
 26           PI   0.015   0.015   0.016   0.017   0.018   0.020   0.021   0.023   0.025   0.028
 27           PI   0.033   0.040   0.052   0.089   0.280   0.065   0.045   0.036   0.030   0.027
 28           PI   0.024   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.014   0.014
 29           PI   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011   0.010   0.010
 30           PI   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008
 31           PI   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007   0.007
 32           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 33           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 34           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 35           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.004   0.004
 37           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 38           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 41           PI   0.004   0.004   0.004   0.004   0.003   0.003   0.003   0.003
 42           BA  0.0373
 43           BF      -3    -0.1    1.05
 44           LS       0      84       0     .05      99       0
 45           UK     200   0.005   0.600      20
 46           UK     200   0.005   0.050      80
 47           RD     285  0.0050   0.030   0.005    TRAP     2.0    15.0
1                                       HEC-1 INPUT                                          PAGE  2

     LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

```
          48           RD     900  0.0050   0.020   0.025    CIRC     1.5       0
          49           RD     900  0.0050   0.020   0.037    CIRC       2       0
          50           ZZ
1****************************************                                                    ***************************************
 *                                       *                                                   *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                   *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                                                   *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                                   *          609 SECOND STREET          *
 *                                       *                                                   *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:52:33   *                                                   *           (916) 756-1104            *
 *                                       *                                                   *                                     *
 ****************************************                                                    ***************************************


                          HEC-1 Input Filename: 16196post-DE1
                          Description:          Casino Master Plan Alternative E Post-development Flow
                          Recurrence Interval:  2 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/27/2017
                          Total Area at Point of Interest: 23.9

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     27Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     28   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
```

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                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


             **************
             *            *
   10 KK     *    Basin   *
             *            *
             **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                          RUNOFF SUMMARY
                                                  FLOW IN CUBIC FEET PER SECOND
                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                        PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION       FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                              6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                          Basin          35.   12.18          5.          3.          2.        .04
1
                                              SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                  (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                      INTERPOLATED TO
                                                                                   COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                      PEAK

                                (MIN)     (CFS)     (MIN)      (IN)      (MIN)     (CFS)     (MIN)       (IN)

             Basin   MANE        1.00     35.24    731.00      1.71      1.00     35.24    731.00       1.71

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .4342E+01 OUTFLOW= .3406E+01 BASIN STORAGE= .3888E-02 PERCENT ERROR=  21.5
```

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*** NORMAL END OF HEC-1 ***
```

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1****************************************                         ***************************************
 *                                      *                         *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                         *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                         *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                         *          609 SECOND STREET          *
 *                                      *                         *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:53:26  *                         *           (916) 756-1104            *
 *                                      *                         *                                     *
 ****************************************                         ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                        HEC-1 INPUT                                                  PAGE  1

           LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1           ID   HEC-1 Input Filename: 16196post-DE1
              2           ID   Description:          Casino Master Plan Alternative E Post-development Flow
              3           ID   Recurrence Interval:  10 year
              4           ID   Storm Duration:       24 hours
              5           ID   Date Compiled:        03/27/2017
              6           ID   Total Area at Point of Interest: 23.9
                          *
                          *
                          *
                          *
              7           IT       1 27Mar17    0000    1800
              8           IO       5       0       0
```

```
      9            IN       5
                   *
                   * Basin E
                   * Alternative E - Anderson, Ca

     10            KK  Basin
     11            KO       0
     12            PB   3.364
     13            PI   0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     14            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     15            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     16            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     17            PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     18            PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     19            PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
     20            PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     21            PI   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
     22            PI   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009
     23            PI   0.009   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.011   0.011
     24            PI   0.011   0.011   0.011   0.012   0.012   0.012   0.012   0.013   0.013   0.013
     25            PI   0.014   0.014   0.015   0.015   0.015   0.016   0.016   0.017   0.018   0.018
     26            PI   0.019   0.020   0.021   0.022   0.024   0.025   0.027   0.030   0.033   0.037
     27            PI   0.043   0.052   0.068   0.116   0.364   0.084   0.059   0.047   0.040   0.035
     28            PI   0.031   0.029   0.026   0.025   0.023   0.022   0.021   0.020   0.019   0.018
     29            PI   0.017   0.017   0.016   0.016   0.015   0.015   0.014   0.014   0.014   0.013
     30            PI   0.013   0.013   0.012   0.012   0.012   0.012   0.011   0.011   0.011   0.011
     31            PI   0.011   0.010   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009
     32            PI   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008   0.008
     33            PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007
     34            PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     35            PI   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006
     36            PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     37            PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.005   0.005
     38            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     39            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     40            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     41            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     42            BA  0.0373
     43            BF      -5    -0.1    1.05
     44            LS       0      84       0     .05      99       0
     45            UK     200   0.005   0.600      20
     46            UK     200   0.005   0.050      80
     47            RD     285  0.0050   0.030   0.005    TRAP     2.0    15.0
1                                                    HEC-1 INPUT                                         PAGE  2

   LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

     48            RD     900  0.0050   0.020   0.025    CIRC     1.5       0
     49            RD     900  0.0050   0.020   0.037    CIRC       2       0
     50            ZZ
```

```
1*****************************************                     ****************************************
 *                                       *                     *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                     *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                     *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                     *          609 SECOND STREET           *
 *                                       *                     *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  11:53:26   *                     *           (916) 756-1104             *
 *                                       *                     *                                      *
 *****************************************                     ****************************************



                           HEC-1 Input Filename: 16196post-DE1
                           Description:          Casino Master Plan Alternative E Post-development Flow
                           Recurrence Interval:  10 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/27/2017
                           Total Area at Point of Interest: 23.9

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN          1  MINUTES IN COMPUTATION INTERVAL
                        IDATE    27Mar17  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     28   17  ENDING DATE
                       NDTIME       0559  ENDING TIME
                       ICENT          19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
            **************
            *            *
   10 KK    *    Basin   *
            *            *
            **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                     RUNOFF SUMMARY
                                             FLOW IN CUBIC FEET PER SECOND
                                          TIME IN HOURS,  AREA IN SQUARE MILES

                                         PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION        FLOW     PEAK                                              AREA      STAGE     MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                           Basin          49.   12.17          7.          4.          3.        .04
1
                                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                         INTERPOLATED TO
                                                                                      COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                     PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

             Basin   MANE         1.00     48.79    730.00      2.07      1.00     48.79    730.00        2.07


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .5842E+01 OUTFLOW= .4122E+01 BASIN STORAGE= .3957E-02 PERCENT ERROR=  29.4

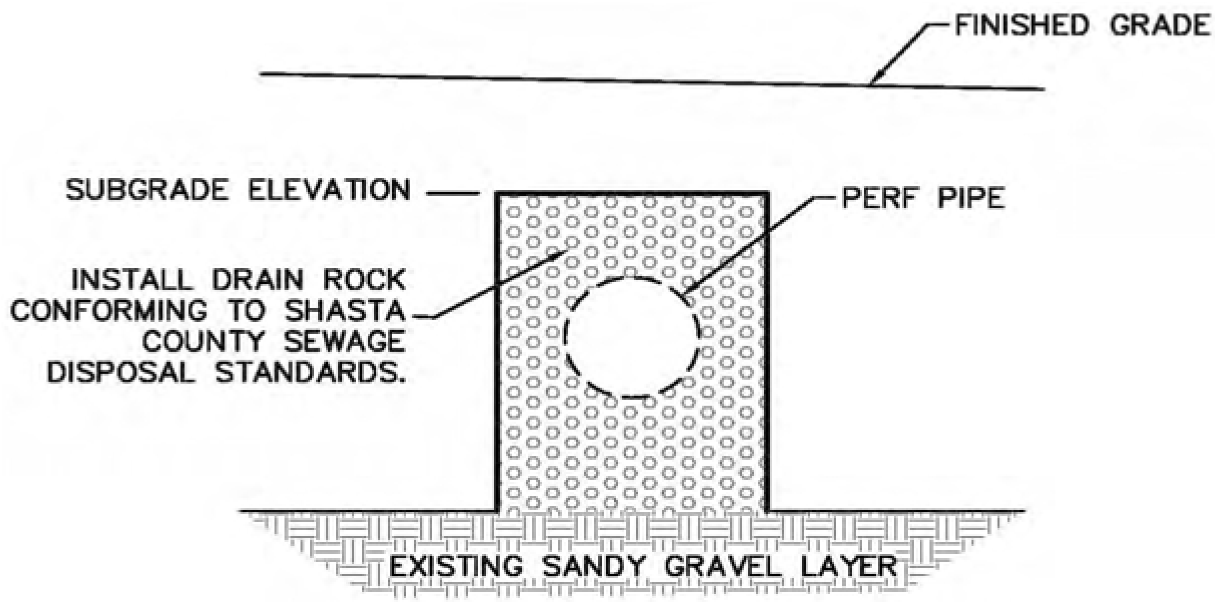


 *** NORMAL END OF HEC-1 ***
```

INFILTRATION TRENCH CALCULATIONS

DE#1

Determine the capacity of the proposed rock trench to convey flow to the existing sandy gravel layer below the surface.



Using Darcy's Law: Q = A*k*i where: A = cross-sectional area, including space occupied by porous material
k = hydraulic conductivity
i = hydraulic gradient = h/d = drop in head / distance drop occurs

assume: minimum h = d; therefore, i = 1.0

Table 11.1 (Soil Engineering, 4th Edition): k = 0.1 cm/s

k = (0.1 cm/s)*(0.03281 ft/cm) = 0.0033 ft/s

Calculate Q diverted to existing sandy gravel layer (Q_D)

		A =	11700 sf
		width of trench =	5 ft
Q =	38.4 cfs	length of trench =	2340 ft

The calculated 2-year peak flow for Alternative E is 35 cubic feet per second and the 10-year peak flow is 49 cubic feet per second. As shown in the above calculation the proposed infiltration trench is adequately sized to infiltrate the 2-year peak storm.

Appendix B

Grading and Earthwork Calculations

Alternative 'A' - Redding Racnheria Casino Master Plan Preliminary Earthwork Calculations

Area	Cut (Yd^3)	Fill (Yd^3)	*Adj. Fill (Yd^3)	Adj. Net (Yd^3)	
Onsite Earthwork	56,000	82,000	94,300	38,300	FILL
Offsite Drainage	38,000	0	0	38,000	CUT
Total	94,000	82,000	94,300	**300**	**Short Material**

***Notes:**
1. The adjusted fill volumes are assuming a 15% shrinkage factor
2. The site was boken into two portions, the Onsite Earthwork consists of the buildings, parking areas, access road and trapezoidal channel east of the access road. The Offsite drainage include the trapezoidal channel and infiltration wet pond west of the access road.

SHARRAH DUNLAP SAWYER INCORPORATED

Job No. 16.0196.000
Calc IS Checked Date 04/13/17
Job Name Casino Alternative B

Alternative 'B' - Redding Racnheria Casino Master Plan Preliminary Earthwork Calculations

Area	Cut (Yd^3)	Fill (Yd^3)	*Adj. Fill (Yd^3)	Adj. Net (Yd^3)	
Onsite Earthwork	46,000	70,000	80,500	34,500	FILL
Offsite Drainage	34,000	0	0	34,000	CUT
Total	80,000	70,000	80,500	**500**	**Short Material**

***Notes:**
1. The adjusted fill volumes are assuming a 15% shrinkage factor
2. The site was boken into two portions, the Onsite Earthwork consists of the buildings, parking areas, access road and trapezoidal channel east of the access road. The Offsite drainage include the trapezoidal channel and infiltration wet pond west of the access road.

SHARRAH DUNLAP SAWYER INCORPORATED

Page	1	Of	1		
Job No.	16.0196.000				
Calc	IS	Checked		Date	04/13/17
Job Name	Casino Alternative C				

Alternative 'C' - Redding Racnheria Casino Master Plan Preliminary Earthwork Calculations

Area	**Cut (Yd^3)**	**Fill (Yd^3)**	***Adj. Fill (Yd^3)**	**Adj. Net (Yd^3)**	
Onsite Earthwork	56,000	82,000	94,300	38,300	FILL
Offsite Drainage	38,000	0	0	38,000	CUT
Total	94,000	82,000	94,300	**300**	**Short Material**

***Notes:**

1. The adjusted fill volumes are assuming a 15% shrinkage factor
2. The site was boken into two portions, the Onsite Earthwork consists of the buildings, parking areas, access road and trapezoidal channel east of the access road. The Offsite drainage include the trapezoidal channel and infiltration wet pond west of the access road.

SHARRAH
DUNLAP
SAWYER

Job No. 16.0196.000
Calc IS Checked Date 04/13/17
Job Name Casino Alternative D

Alternative 'D' - Redding Racnheria Casino Master Plan Preliminary Earthwork Calculations

Area	**Cut (Yd^3)**	**Fill (Yd^3)**	***Adj. Fill (Yd^3)**	**Adj. Net (Yd^3)**	
Onsite Earthwork	42,000	65,000	74,750	32,750	FILL
Offsite Drainage	33,000	0	0	33,000	CUT
Total	75,000	65,000	74,750	**250**	**Excess Material**

***Notes:**
1. The adjusted fill volumes are assuming a 15% shrinkage factor
2. The site was boken into two portions, the Onsite Earthwork consists of the buildings, parking areas, access road and trapezoidal channel east of the access road. The Offsite drainage include the trapezoidal channel and infiltration wet pond west of the access road.

SHARRAH DUNLAP SAWYER INCORPORATED

Page	1	Of	1
Job No.	16.0196.000		
Calc	IS	Checked	Date 04/13/17
Job Name	Casino Alternative E		

Alternative 'E' - Redding Racnheria Casino Master Plan Preliminary Earthwork Calculations

Area	Cut (Yd^3)	Fill (Yd^3)	*Adj. Fill (Yd^3)	Adj. Net (Yd^3)	
Onsite Earthwork	18,000	120,000	138,000	120,000	FILL
Detention/Infiltration	120,000	0	0	120,000	CUT
Total	138,000	120,000	138,000	**0**	**Short Material**

***Notes:**

1. The adjusted fill volumes are assuming a 15% shrinkage factor
2. The site was boken into two portions, the Onsite Earthwork consists of the buildings, parking areas, access road and trapezoidal channel east of the access road. The Offsite drainage include the trapezoidal channel and infiltration wet pond west of the access road.

Civil Engineering | Structural Design | Landscape Architecture | Planning | Surveying | Presentation Graphics
6590 Lockheed Drive Redding, CA 96002 530.221.1792 voice 530.221.8369 fax info@sdsengineering.com

Appendix C

Retention / Infiltration Pond Sizing Calculations

SHARRAH DUNLAP SAWYER INCORPORATED

Job No. 16.0196.000

Calc IS Checked ______ Date 03/27/17

Job Nar Casino - Wet Pond Sizing

Alternative A Pond Sizing

1-year runoff:	1.24	inches
2-year runoff:	1.43	inches
85 percentile storm:	1.34	inches
85% Volume =	320809	cubic feet
Pond Volume =	**641617**	**cubic feet**

Note: The pool volume of the Wet Pond shall be twice the volume of the 85 percentile storm (Per CASQA California Stormwater BMP Handbook)

Project Area: 66.2 acres

Alternative B Pond Sizing

1-year runoff:	1.00	inches
2-year runoff:	1.10	inches
85 percentile storm:	1.05	inches
85% Volume =	252321	cubic feet
Pond Volume =	**504643**	**cubic feet**

Note: The pool volume of the Wet Pond shall be twice the volume of the 85 percentile storm (Per CASQA California Stormwater BMP Handbook)

Project Area: 66.2 acres

Alternative C Pond Sizing

1-year runoff:	1.24	inches
2-year runoff:	1.43	inches
85 percentile storm:	1.34	inches
85% Volume =	320809	cubic feet
Pond Volume =	**641617**	**cubic feet**

Note: The pool volume of the Wet Pond shall be twice the volume of the 85 percentile storm (Per CASQA California Stormwater BMP Handbook)

Project Area: 66.2 acres

Alternative D Pond Sizing

1-year runoff:	0.92	inches
2-year runoff:	0.95	inches
85 percentile storm:	0.94	inches
85% Volume =	224686	cubic feet
Pond Volume =	**449372**	**cubic feet**

Note: The pool volume of the Wet Pond shall be twice the volume of the 85 percentile storm (Per CASQA California Stormwater BMP Handbook)

Project Area: 66.2 acres

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Design Considerations

- Area Required
- Slope
- Water Availability
- Aesthetics
- Environmental Side-effects

Description

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling. The schematic diagram is of an on-line pond that includes detention for larger events, but this is not required in all areas of the state.

Targeted Constituents

☑	Sediment	■
☑	Nutrients	▲
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

California Experience

Caltrans constructed a wet pond in northern San Diego County (I-5 and La Costa Blvd.). Largest issues at this site were related to vector control, vegetation management, and concern that endangered species would become resident and hinder maintenance activities.

Advantages

- If properly designed, constructed and maintained, wet basins can provide substantial aesthetic/recreational value and wildlife and wetlands habitat.

- Ponds are often viewed as a public amenity when integrated into a park setting.

- Due to the presence of the permanent wet pool, properly designed and maintained wet basins can provide significant water quality improvement across a relatively broad spectrum of constituents including dissolved nutrients.

- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Some concern about safety when constructed where there is public access.

- Mosquito and midge breeding is likely to occur in ponds.

- Cannot be placed on steep unstable slopes.

- Need for base flow or supplemental water if water level is to be maintained.

- Require a relatively large footprint

- Depending on volume and depth, pond designs may require approval from the State Division of Safety of Dams

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.

- Use a draw down time of 48 hours in most areas of California. Draw down times in excess of 48 hours may result in vector breeding, and should be used only after coordination with local vector control authorities. Draw down times of less than 48 hours should be limited to BMP drainage areas with coarse soils that readily settle and to watersheds where warming may be detrimental to downstream fisheries.

- Permanent pool volume equal to twice the water quality volume.

- Water depth not to exceed about 8 feet.

- Wetland vegetation occupying no more than 25% of surface area.

- Include energy dissipation in the inlet design and a sediment forebay to reduce resuspension of accumulated sediment and facilitate maintenance.

- A maintenance ramp should be included in the design to facilitate access to the forebay for maintenance activities and for vector surveillance and control.

- To facilitate vector surveillance and control activities, road access should be provided along at least one side of BMPs that are seven meters or less in width. Those BMPs that have shoreline-to-shoreline distances in excess of seven meters should have perimeter road access on both sides or be designed such that no parcel of water is greater than seven meters from the road.

Construction/Inspection Considerations

- In areas with porous soils an impermeable liner may be required to maintain an adequate permanent pool level.
- Outlet structures and piping should be installed with collars to prevent water from seeping through the fill and causing structural failure.
- Inspect facility after first large storm to determine whether the desired residence time has been achieved.

Performance

The observed pollutant removal of a wet pond is highly dependent on two factors: the volume of the permanent pool relative to the amount of runoff from the typical event in the area and the quality of the base flow that sustains the permanent pool. A recent study (Caltrans, 2002) has documented that if the permanent pool is much larger than the volume of runoff from an average event, then displacement of the permanent pool by the wet weather flow is the primary process. A statistical comparison of the wet pond discharge quality during dry and wet weather shows that they are not significantly different. Consequently, there is a relatively constant discharge quality during storms that is the same as the concentrations observed in the pond during ambient (dry weather) conditions. Consequently, for most constituents the performance of the pond is better characterized by the average effluent concentration, rather than the "percent reduction," which has been the conventional measure of performance. Since the effluent quality is essentially constant, the percent reduction observed is mainly a function of the influent concentrations observed at a particular site.

The dry and wet weather discharge quality is, therefore, related to the quality of the base flow that sustains the permanent pool and of the transformations that occur to those constituents during their residence in the basin. One could potentially expect a wide range of effluent concentrations at different locations even if the wet ponds were designed according to the same guidelines, if the quality of the base flow differed significantly. This may explain the wide range of concentration reductions reported in various studies.

Concentrations of nutrients in base flow may be substantially higher than in urban stormwater runoff. Even though these concentrations may be substantially reduced during the residence time of the base flow in the pond, when this water is displaced by wet weather flows, concentrations may still be quite elevated compared to the levels that promote eutrophication in surface water systems. Consequently comparing influent and effluent nutrient concentrations during wet weather can make the performance seem highly variable.

Relatively small perennial flows may often substantially exceed the wet weather flow treated. Consequently, one should also consider the load reduction observed under ambient conditions when assessing the potential benefit to the receiving water.

Siting Criteria

Wet ponds are a widely applicable stormwater management practice and can be used over a broad range of storm frequencies and sizes, drainage areas and land use types. Although they have limited applicability in highly urbanized settings and in arid climates, they have few other restrictions. Wet basins may be constructed on- or off-line and can be sited at feasible locations along established drainage ways with consistent base flow. An off-line design is preferred. Wet basins are often utilized in smaller sub-watersheds and are particularly appropriate in areas with residential land uses or other areas where high nutrient loads are considered to be potential problems (e.g., golf courses).

Ponds do not consume a large area (typically 2–3 percent of the contributing drainage area); however, these facilities are generally large. Other practices, such as filters or swales, may be "squeezed" into relatively unusable land, but ponds need a relatively large continuous area. Wet basins are typically used in drainage basins of more than ten acres and less than one square mile (Schueler et al., 1992). Emphasis can be placed in siting wet basins in areas where the pond can also function as an aesthetic amenity or in conjunction with other stormwater management functions.

Wet basin application is appropriate in the following settings: (1) where there is a need to achieve a reasonably high level of dissolved contaminant removal and/or sediment capture; (2) in small to medium-sized regional tributary areas with available open space and drainage areas greater than about 10 ha (25 ac.); (3) where base flow rates or other channel flow sources are relatively consistent year-round; (4) in residential settings where aesthetic and wildlife habitat benefits can be appreciated and maintenance activities are likely to be consistently undertaken.

Traditional wet extended detention ponds can be applied in most regions of the United States, with the exception of arid climates. In arid regions, it is difficult to justify the supplemental water needed to maintain a permanent pool because of the scarcity of water. Even in semi-arid Austin, Texas, one study found that 2.6 acre-feet per year of supplemental water was needed to maintain a permanent pool of only 0.29 acre-feet (Saunders and Gilroy, 1997). Seasonal wet ponds (i.e., ponds that maintain a permanent pool only during the wet season) may prove effective in areas with distinct wet and dry seasons; however, this configuration has not been extensively evaluated.

Wet ponds may pose a risk to cold water systems because of their potential for stream warming. When water remains in the permanent pool, it is heated by the sun. A study in Prince George's County, Maryland, found that stormwater wet ponds heat stormwater by about 9°F from the inlet to the outlet (Galli, 1990).

Additional Design Guidelines

Specific designs may vary considerably, depending on site constraints or preferences of the designer or community. There are several variations of the wet pond design, including constructed wetlands, and wet extended detention ponds. Some of these design alternatives are intended to make the practice adaptable to various sites and to account for regional constraints and opportunities. In conventional wet ponds, the open water area comprises 50% or more of the total surface area of the pond. The permanent pool should be no deeper than 2.5 m (8 feet) and should average 1.2 – 2 m (4-6 feet) deep. The greater depth of this configuration helps limit the extent of the vegetation to an aquatic bench around the perimeter of the pond with a nominal depth of about 1 foot and variable width. This shallow bench also protects the banks from erosion, enhances habitat and aesthetic values, and reduces the drowning hazard.

The wet extended detention pond combines the treatment concepts of the dry extended detention pond and the wet pond. In this design, the water quality volume is detained above the permanent pool and released over 24 hours. In addition to increasing the residence time, which improves pollutant removal, this design also attenuates peak runoff rates. Consequently, this design alternative is recommended.

Pretreatment incorporates design features that help to settle out coarse sediment particles. By removing these particles from runoff before they reach the large permanent pool, the maintenance burden of the pond is reduced. In ponds, pretreatment is achieved with a sediment forebay. A sediment forebay is a small pool (typically about 10 percent of the volume of the permanent pool). Coarse particles remain trapped in the forebay, and maintenance is performed on this smaller pool, eliminating the need to dredge the entire pond.

There are a variety of sizing criteria for determining the volume of the permanent pool, mostly related to the water quality volume (i.e., the volume of water treated for pollutant removal) or the average storm size in a particular area. In addition, several theoretical approaches to determination of permanent pool volume have been developed. However, there is little empirical evidence to support these designs. Consequently, a simplified method (i.e., permanent pool volume equal to twice the water quality volume) is recommended.

Other design features do not increase the volume of a pond, but can increase the amount of time stormwater remains in the device and eliminate short-circuiting. Ponds should always be designed with a length-to-width ratio of at least 1.5:1, where feasible. In addition, the design should incorporate features to lengthen the flow path through the pond, such as underwater berms designed to create a longer route through the pond. Combining these two measures helps ensure that the entire pond volume is used to treat stormwater. Wet ponds with greater amounts of vegetation often have channels through the vegetated areas and contain dead areas where stormwater is restricted from mixing with the entire permanent pool, which can lead to less pollutant removal. Consequently, a pond with open water comprising about 75% of the surface area is preferred.

Design features are also incorporated to ease maintenance of both the forebay and the main pool of ponds. Ponds should be designed with a maintenance access to the forebay to ease this relatively routine (every 5–7 year) maintenance activity. In addition, ponds should generally have a drain to draw down the pond for vegetation harvesting or the more infrequent dredging of the main cell of the pond.

Cold climates present many challenges to designers of wet ponds. The spring snowmelt may have a high pollutant load and a large volume to be treated. In addition, cold winters may cause freezing of the permanent pool or freezing at inlets and outlets. Finally, high salt concentrations in runoff resulting from road salting, and sediment loads from road sanding, may impact pond vegetation as well as reduce the storage and treatment capacity of the pond.

One option to deal with high pollutant loads and runoff volumes during the spring snowmelt is the use of a seasonally operated pond to capture snowmelt during the winter and retain the permanent pool during warmer seasons. In this option, proposed by Oberts (1994), the pond has two water quality outlets, both equipped with gate valves. In the summer, the lower outlet is closed. During the fall and throughout the winter, the lower outlet is opened to draw down the permanent pool. As the spring melt begins, the lower outlet is closed to provide detention for the melt event. The manipulation of this system requires some labor and vigilance; a careful maintenance agreement should be confirmed.

Several other modifications may help to improve the performance of ponds in cold climates. Designers should consider planting the pond with salt-tolerant vegetation if the facility receives road runoff. In order to counteract the effects of freezing on inlet and outlet structures, the use of inlet and outlet structures that are resistant to frost, including weirs and larger diameter pipes, may be useful. Designing structures on-line, with a continuous flow of water through the pond, will also help prevent freezing of these structures. Finally, since freezing of the permanent pool can reduce the effectiveness of pond systems, it is important to incorporate extended detention into the design to retain usable treatment area above the permanent pool when it is frozen.

Summary of Design Recommendations

(1) Facility Sizing – The basin should be sized to hold the permanent pool as well as the required water quality volume. The volume of the permanent pool should equal twice the water quality volume.

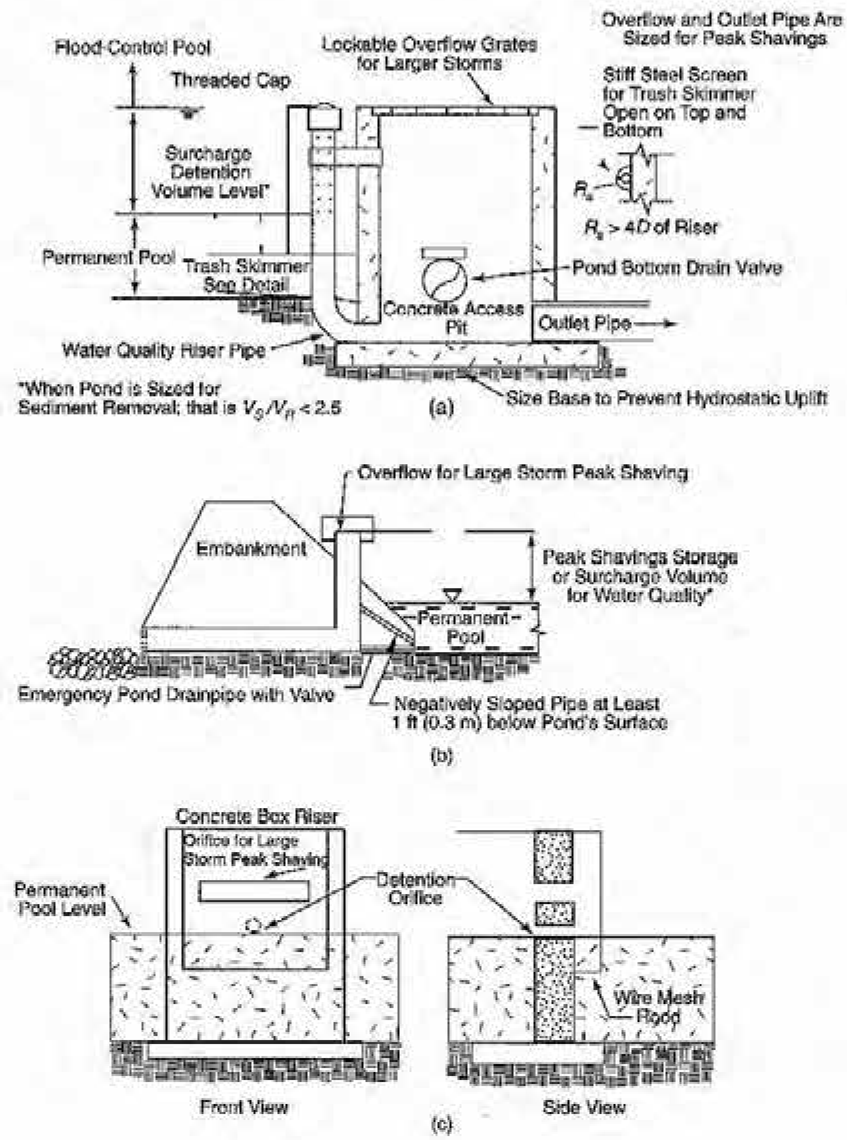
(2) Pond Configuration - The wet basin should be configured as a two stage facility with a sediment forebay and a main pool. The basins should be wedge-shaped, narrowest at the inlet and widest at the outlet. The minimum length to width ratio should be 1.5 where feasible. The perimeter of all permanent pool areas with depths of 4.0 feet or greater should be surrounded by an aquatic bench. This bench should extend inward 5-10 feet from the perimeter of the permanent pool and should be no more than 18 inches below normal depth. The area of the bench should not exceed about 25% of pond surface. The depth in the center of the basin should be 4 – 8 feet deep to prevent vegetation from encroaching on the pond open water surface.

(3) Pond Side Slopes - Side slopes of the basin should be 3:1 (H:V) or flatter for grass stabilized slopes. Slopes steeper than 3:1 should be stabilized with an appropriate slope stabilization practice.

(4) Sediment Forebay - A sediment forebay should be used to isolate gross sediments as they enter the facility and to simplify sediment removal. The sediment forebay should consist of a separate cell formed by an earthen berm, gabion, or loose riprap wall. The forebay should be sized to contain 15 to 25% of the permanent pool volume and should be at least 3 feet deep. Exit velocities from the forebay should not be erosive. Direct maintenance access should be provided to the forebay. The bottom of the forebay may be hardened (concrete) to make sediment removal easier. A fixed vertical sediment depth marker should be installed in the forebay to measure sediment accumulation.

(5) Outflow Structure - Figure 2 presents a schematic representation of suggested outflow structures. The outlet structure should be designed to drain the water quality volume over 24 hours with the orifice sized according to the equation presented in the Extended Detention Basin fact sheet. The facility should have a separate drain pipe with a manual valve that can completely or partially drain the pond for maintenance purposes. To allow for possible sediment accumulation, the submerged end of the pipe should be protected, and the drain pipe should be sized to drain the pond within 24 hours. The valve should be located at a point where it can be operated in a safe and convenient manner.

For on-line facilities, the principal and emergency spillways must be sized to provide 1.0 foot of freeboard during the 25-year event and to safely pass the 100-year flood. The embankment should be designed in accordance with all relevant specifications for small dams.



(6) Splitter Box - When the pond is designed as an off-line facility, a splitter structure is used to isolate the water quality volume. The splitter box, or other flow diverting approach, should be designed to convey the 25-year event while providing at least 1.0 foot of freeboard along pond side slopes.

(7) Vegetation - A plan should be prepared that indicates how aquatic and terrestrial areas will be vegetatively stabilized. Wetland vegetation elements should be placed along the aquatic bench or in the shallow portions of the permanent pool. The optimal elevation for planting of wetland vegetation is within 6 inches vertically of the normal pool elevation. A list of some wetland vegetation native to California is presented in Table 1.

Table 1 California Wetland Vegetation	
Botanical Name	**Common Name**
BACCHARIS SALICIFOLIA	MULE FAT
FRANKENIA GRANDIFOLIA	HEATH
SALIX GOODINGII	BLACK WILLOW
SALIX LASIOLEPIS	ARROYO WILLOW
SAMUCUS MEXICANUS	MEXICAN ELDERBERRY
HAPLOPAPPUS VENETUS	COAST GOLDENBRUSH
DISTICHIS SPICATA	SALT GRASS
LIMONIUM CALIFORNICUM	COASTAL STATICE
ATRIPLEX LENTIFORMIS	COASTAL QUAIL BUSH
BACCHARIS PILULARIS	CHAPARRAL BROOM
MIMULUS LONGIFLORUS	MONKEY FLOWER
SCIRPUS CALIFORNICUS	BULRUSH
SCIRPUS ROBUSTUS	BULRUSH
TYPHA LATIFOLIA	BROADLEAF CATTAIL
JUNCUS ACUTUS	RUSH

Maintenance

The amount of maintenance required for a wet pond is highly dependent on local regulatory agencies, particular health and vector control agencies. These agencies are often extremely concerned about the potential for mosquito breeding that may occur in the permanent pool. Even though mosquito fish (*Gambusia affinis*) were introduced into a wet pond constructed by Caltrans in the San Diego area, mosquito breeding was routinely observed during inspections. In addition, the vegetation at this site became sufficiently dense on the bench around the edge of the pool that mosquito fish were unable to enter this area to feed upon the mosquito larvae. The vegetation at this site was particularly vigorous because of the high nutrient concentrations in the perennial base flow (15.5 mg/L NO_3-N) and the mild climate, which permitted growth year round. Consequently, the vector control agency required an annual harvest of vegetation to address this situation. This harvest can be very expensive.

On the other hand, routine harvesting may increase nutrient removal and prevent the export of these constituents from dead and dying plants falling in the water. A previous study (Faulkner and Richardson, 1991) documented dramatic reductions in nutrient removal after the first several years of operation and related it to the vegetation achieving a maximum density. That content then decreases through the growth season, as the total biomass increases. In effect, the total amount of nutrients/m2 of wetland remains essentially the same from June through September, when the plants start to put the P back into the rhizomes. Therefore harvesting should occur between June and September. Research also suggests that harvesting only the foliage is less effective, since a very small percentage of the removed nutrients is taken out with harvesting.

Since wet ponds are often selected for their aesthetic considerations as well as pollutant removal, they are often sited in areas of high visibility. Consequently, floating litter and debris are removed more frequently than would be required simply to support proper functioning of the pond and outlet. This is one of the primary maintenance activities performed at the Central Market Pond located in Austin, Texas. In this type of setting, vegetation management in the area surrounding the pond can also contribute substantially to the overall maintenance requirements.

One normally thinks of sediment removal as one of the typical activities performed at stormwater BMPs. This activity does not normally constitute one of the major activities on an annual basis. At the concentrations of TSS observed in urban runoff from stable watersheds, sediment removal may only be required every 20 years or so. Because this activity is performed so infrequently, accurate costs for this activity are lacking.

In addition to regular maintenance activities needed to maintain the function of wet ponds, some design features can be incorporated to ease the maintenance burden. In wet ponds, maintenance reduction features include techniques to reduce the amount of maintenance needed, as well as techniques to make regular maintenance activities easier.

One potential maintenance concern in wet ponds is clogging of the outlet. Ponds should be designed with a non-clogging outlet such as a reverse-slope pipe, or a weir outlet with a trash rack. A reverse-slope pipe draws from below the permanent pool extending in a reverse angle up to the riser and establishes the water elevation of the permanent pool. Because these outlets draw water from below the level of the permanent pool, they are less likely to be clogged by floating debris.

Typical maintenance activities and frequencies include:

- Schedule semiannual inspections for burrows, sediment accumulation, structural integrity of the outlet, and litter accumulation.
- Remove accumulated trash and debris in the basin at the middle and end of the wet season. The frequency of this activity may be altered to meet specific site conditions and aesthetic considerations.
- Where permitted by the Department of Fish and Game or other agency regulations, stock wet ponds/constructed wetlands regularly with mosquito fish (*Gambusia spp.*) to enhance natural mosquito and midge control.
- Introduce mosquito fish and maintain vegetation to assist their movements to control mosquitoes, as well as to provide access for vector inspectors. An annual vegetation harvest in summer appears to be optimum, in that it is after the bird breeding season, mosquito fish can provide the needed control until vegetation reaches late summer density, and there is time for re-growth for runoff treatment purposes before the wet season. In certain cases, more frequent plant harvesting may be required by local vector control agencies.

- Maintain emergent and perimeter shoreline vegetation as well as site and road access to facilitate vector surveillance and control activities.

- Remove accumulated sediment in the forebay and regrade about every 5-7 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Sediment removal may not be required in the main pool area for as long as 20 years.

Cost

Construction Cost

Wet ponds can be relatively inexpensive stormwater practices; however, the construction costs associated with these facilities vary considerably. Much of this variability can be attributed to the degree to which the existing topography will support a wet pond, the complexity and amount of concrete required for the outlet structure, and whether it is installed as part of new construction or implemented as a retrofit of existing storm drain system.

A recent study (Brown and Schueler, 1997) estimated the cost of a variety of stormwater management practices. The study resulted in the following cost equation, adjusting for inflation:

$$C = 24.5^{V0.705}$$

where:

C = Construction, design and permitting cost;

V = Volume in the pond to include the 10-year storm (ft^3).

Using this equation, typical construction costs are:

$45,700 for a 1 acre-foot facility

$232,000 for a 10 acre-foot facility

$1,170,000 for a 100 acre-foot facility

In contrast, Caltrans (2002) reported spending over $448,000 for a pond with a total permanent pool plus water quality volume of only 1036 m^3 (0.8 ac.-ft.), while the City of Austin spent $584,000 (including design) for a pond with a permanent pool volume of 3,100 m^3 (2.5 ac.-ft.). The large discrepancies between the costs of these actual facilities and the model developed by Brown and Schueler indicate that construction costs are highly site specific, depending on topography, soils, subsurface conditions, the local labor, rate and other considerations.

Maintenance Cost

For ponds, the annual cost of routine maintenance has typically been estimated at about 3 to 5 percent of the construction cost; however, the published literature is almost totally devoid of actual maintenance costs. Since ponds are long-lived facilities (typically longer than 20 years), major maintenance activities are unlikely to occur during a relatively short study.

Caltrans (2002) estimated annual maintenance costs of $17,000 based on three years of monitoring of a pond treating runoff from 1.7 ha. Almost all the activities are associated with the annual vegetation harvest for vector control. Total cost at this site falls within the 3-5% range reported above; however, the construction costs were much higher than those estimated by Brown and Schueler (1997). The City of Austin has been reimbursing a developer about $25,000/yr for wet pond maintenance at a site located at a very visible location. Maintenance costs are mainly the result of vegetation management and litter removal. On the other hand, King County estimates annual maintenance costs at about $3,000 per pond; however, this cost likely does not include annual extensive vegetation removal. Consequently, maintenance costs may vary considerably at sites in California depending on the aggressiveness of the vegetation management in that area and the frequency of litter removal.

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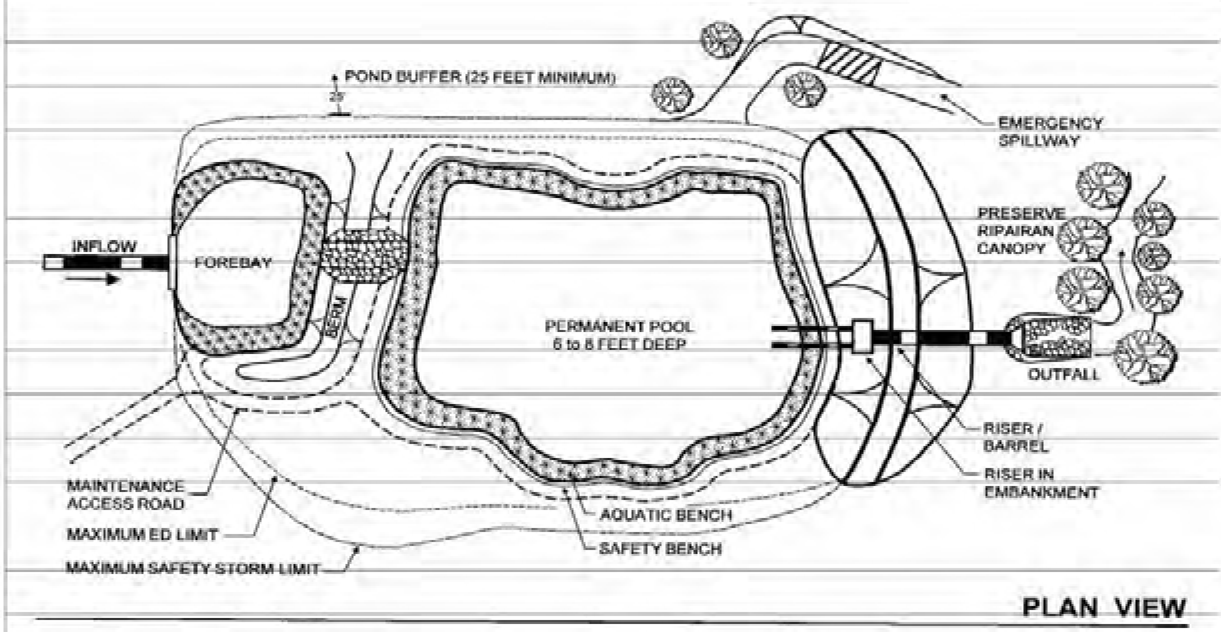
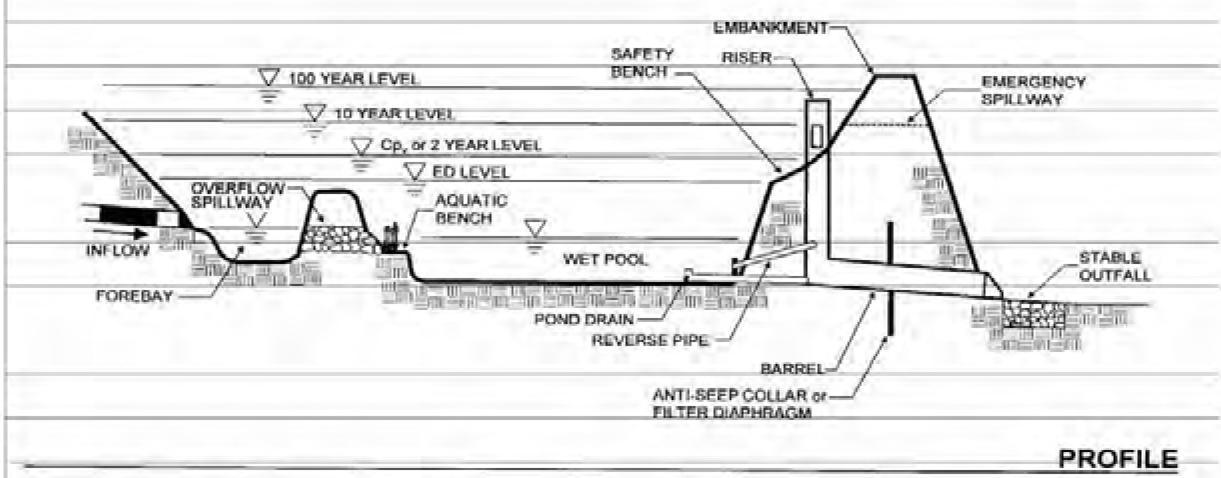

POND BUFFER (25 FEET MINIMUM)
EMERGENCY SPILLWAY
PRESERVE RIPAIRAN CANOPY
INFLOW
FOREBAY
BERM
PERMANENT POOL 6 to 8 FEET DEEP
OUTFALL
RISER / BARREL
RISER IN EMBANKMENT
MAINTENANCE ACCESS ROAD
MAXIMUM ED LIMIT
MAXIMUM SAFETY STORM LIMIT
AQUATIC BENCH
SAFETY BENCH
PLAN VIEW


EMBANKMENT
SAFETY BENCH
RISER
100 YEAR LEVEL
10 YEAR LEVEL
Cp, or 2 YEAR LEVEL
ED LEVEL
EMERGENCY SPILLWAY
OVERFLOW SPILLWAY
AQUATIC BENCH
INFLOW
WET POOL
STABLE OUTFALL
FOREBAY
POND DRAIN
REVERSE PIPE
BARREL
ANTI-SEEP COLLAR or FILTER DIAPHRAGM
PROFILE

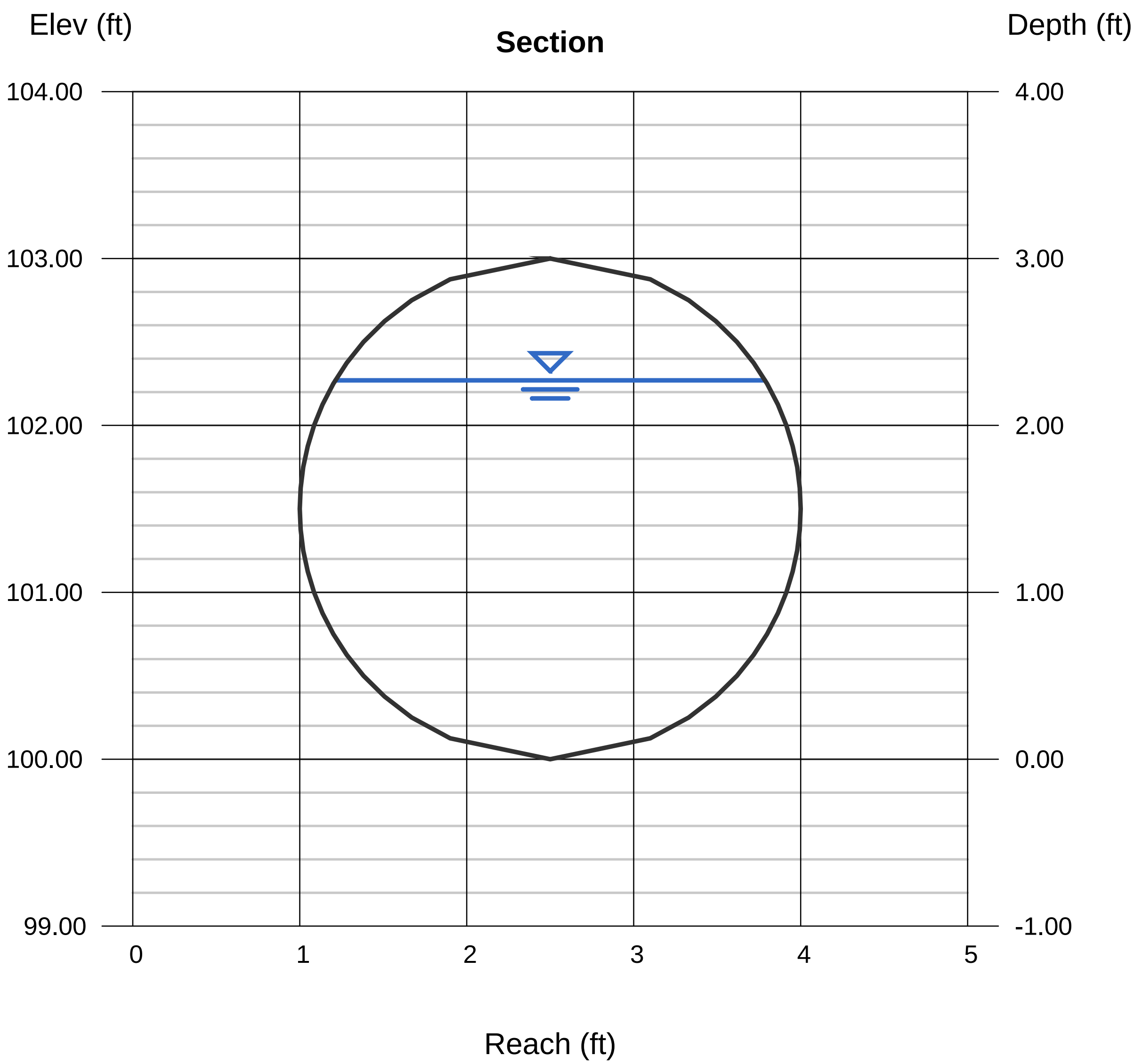
Appendix D

Drainage Structure Sizing

Channel Report

Alternative A: Drainage Area #1

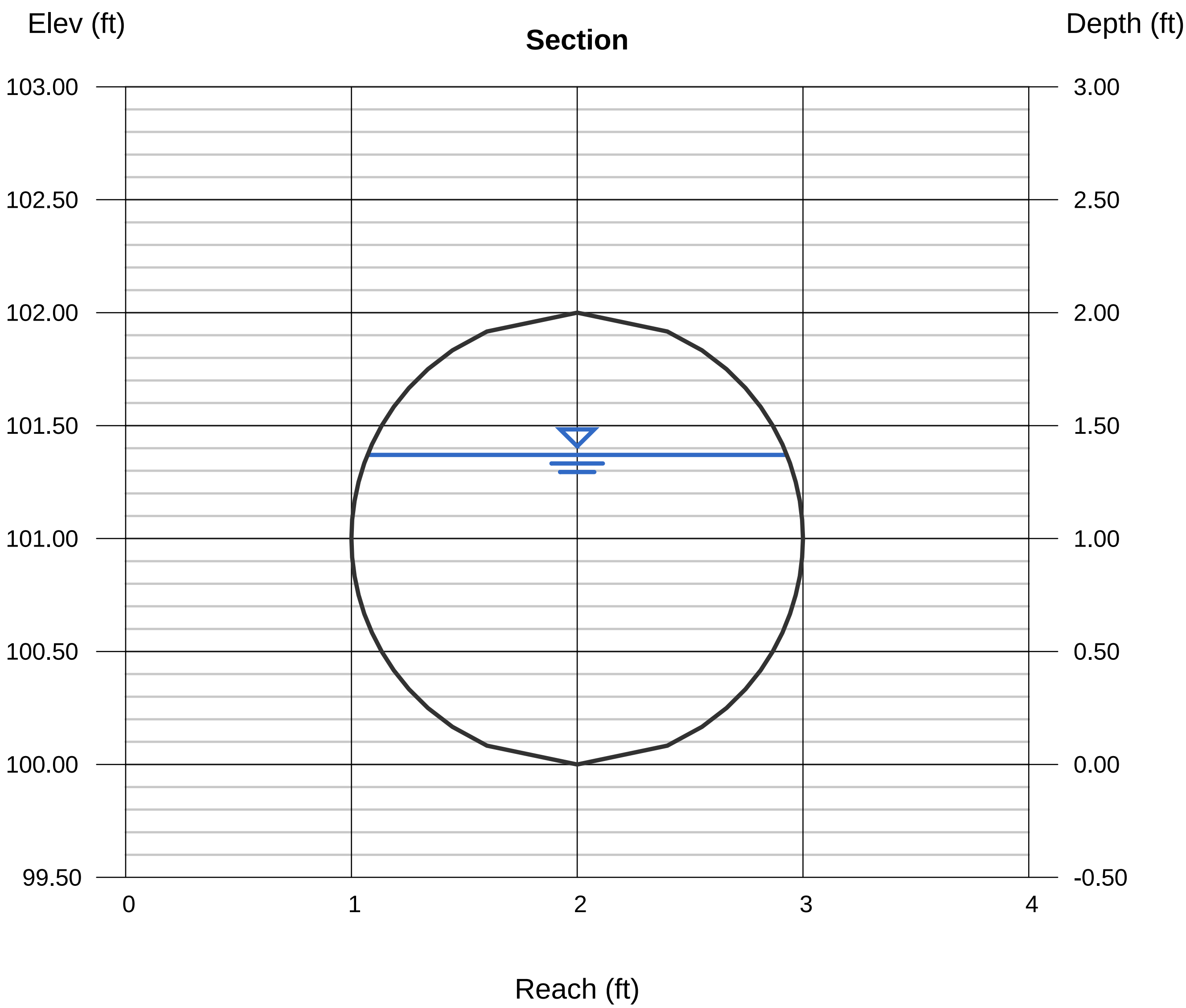
Circular		**Highlighted**	
Diameter (ft)	= 3.00	Depth (ft)	= 2.27
		Q (cfs)	= 47.00
		Area (sqft)	= 5.74
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 8.19
Slope (%)	= 0.50	Wetted Perim (ft)	= 6.33
N-Value	= 0.012	Crit Depth, Yc (ft)	= 2.24
		Top Width (ft)	= 2.57
Calculations		EGL (ft)	= 3.31
Compute by:	Known Q		
Known Q (cfs)	= 47.00		



Channel Report

Alternative A: Drainage Areas #2 and #4

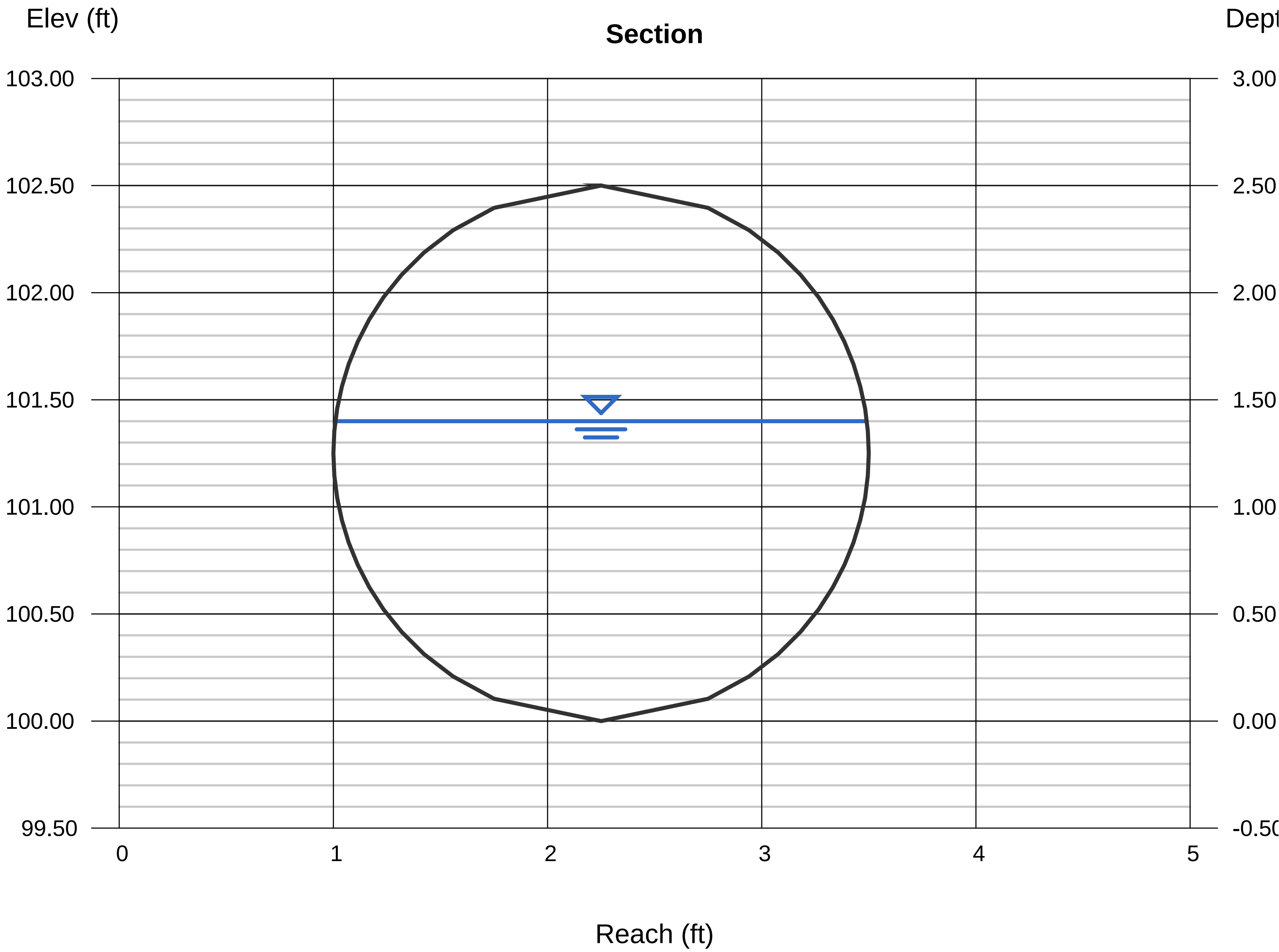
Circular		**Highlighted**	
Diameter (ft)	= 2.00	Depth (ft)	= 1.37
		Q (cfs)	= 14.00
		Area (sqft)	= 2.29
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 6.10
Slope (%)	= 0.50	Wetted Perim (ft)	= 3.90
N-Value	= 0.012	Crit Depth, Yc (ft)	= 1.35
		Top Width (ft)	= 1.86
Calculations		EGL (ft)	= 1.95
Compute by:	Known Q		
Known Q (cfs)	= 14.00		



Channel Report

Alternative A: Drainage Area #3

Circular		**Highlighted**	
Diameter (ft)	= 2.50	Depth (ft)	= 1.40
		Q (cfs)	= 19.00
		Area (sqft)	= 2.84
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 6.69
Slope (%)	= 0.50	Wetted Perim (ft)	= 4.24
N-Value	= 0.012	Crit Depth, Yc (ft)	= 1.48
		Top Width (ft)	= 2.48
Calculations		EGL (ft)	= 2.10
Compute by:	Known Q		
Known Q (cfs)	= 19.00		



Channel Report

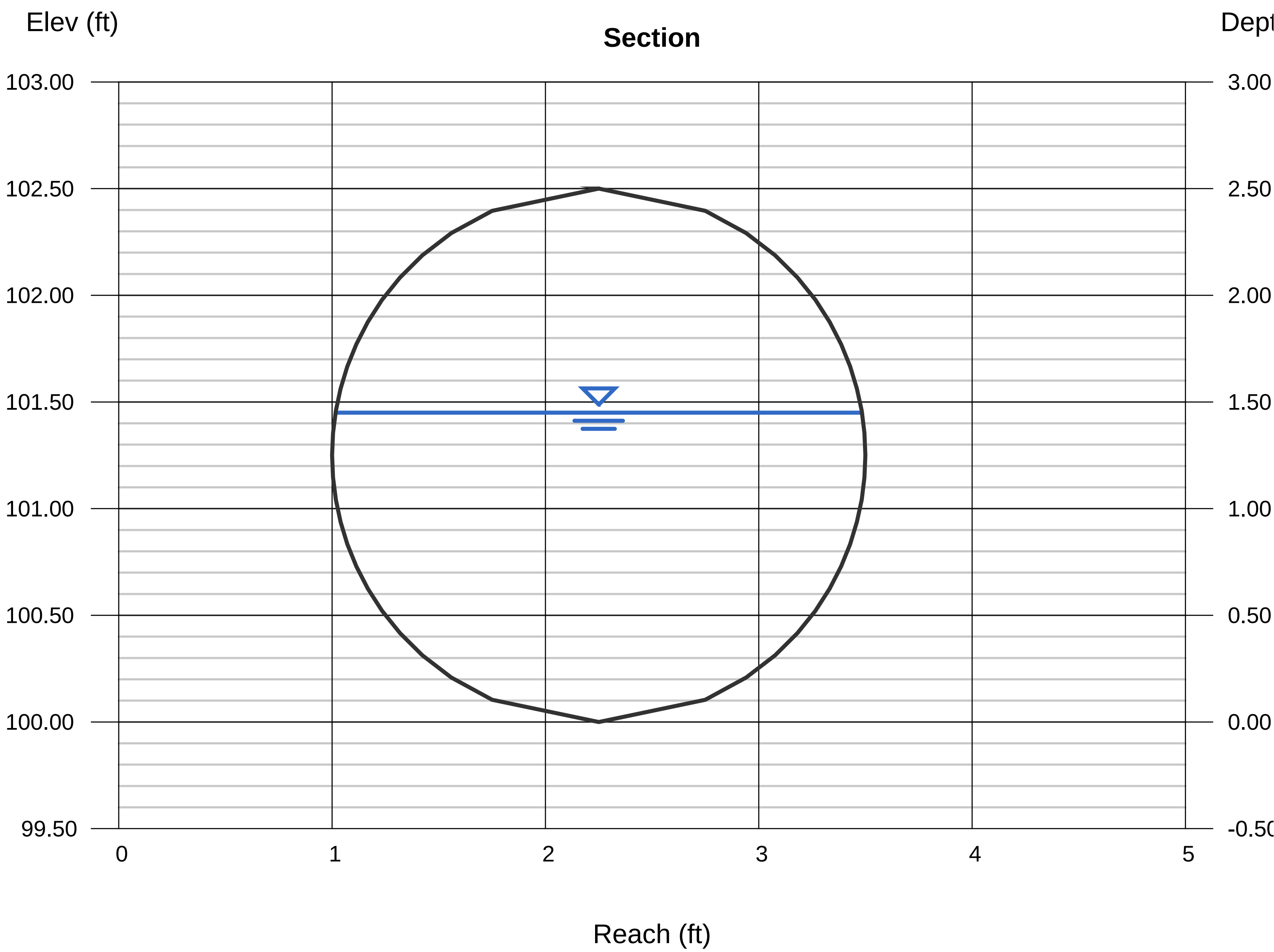
Alternative B: Drainage Area #1

Circular
Diameter (ft) = 2.50

Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.012

Calculations
Compute by: Known Q
Known Q (cfs) = 20.00

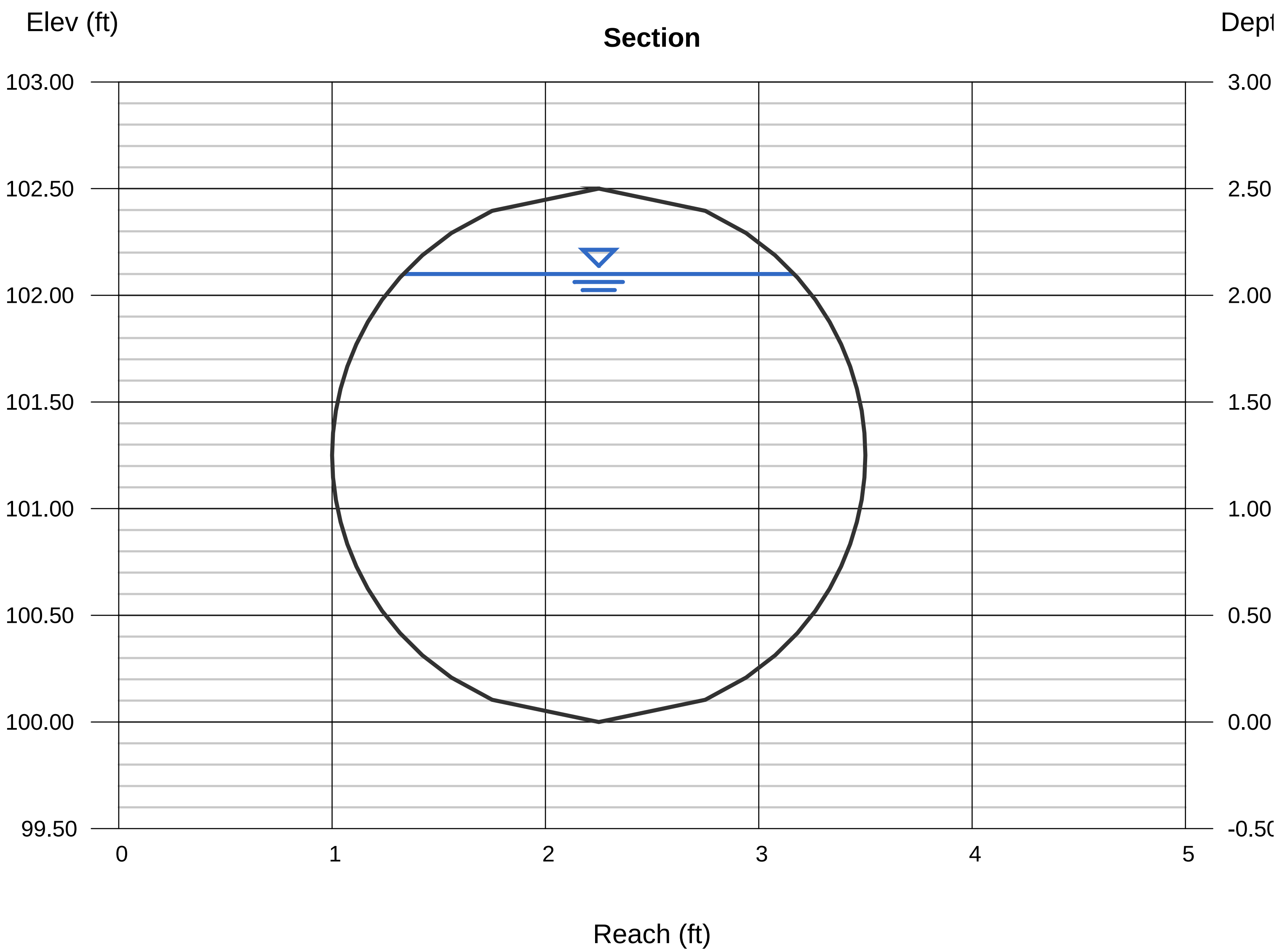
Highlighted
Depth (ft) = 1.45
Q (cfs) = 20.00
Area (sqft) = 2.96
Velocity (ft/s) = 6.75
Wetted Perim (ft) = 4.34
Crit Depth, Yc (ft) = 1.52
Top Width (ft) = 2.47
EGL (ft) = 2.16



Channel Report

Alternative D: Drainage Area #1

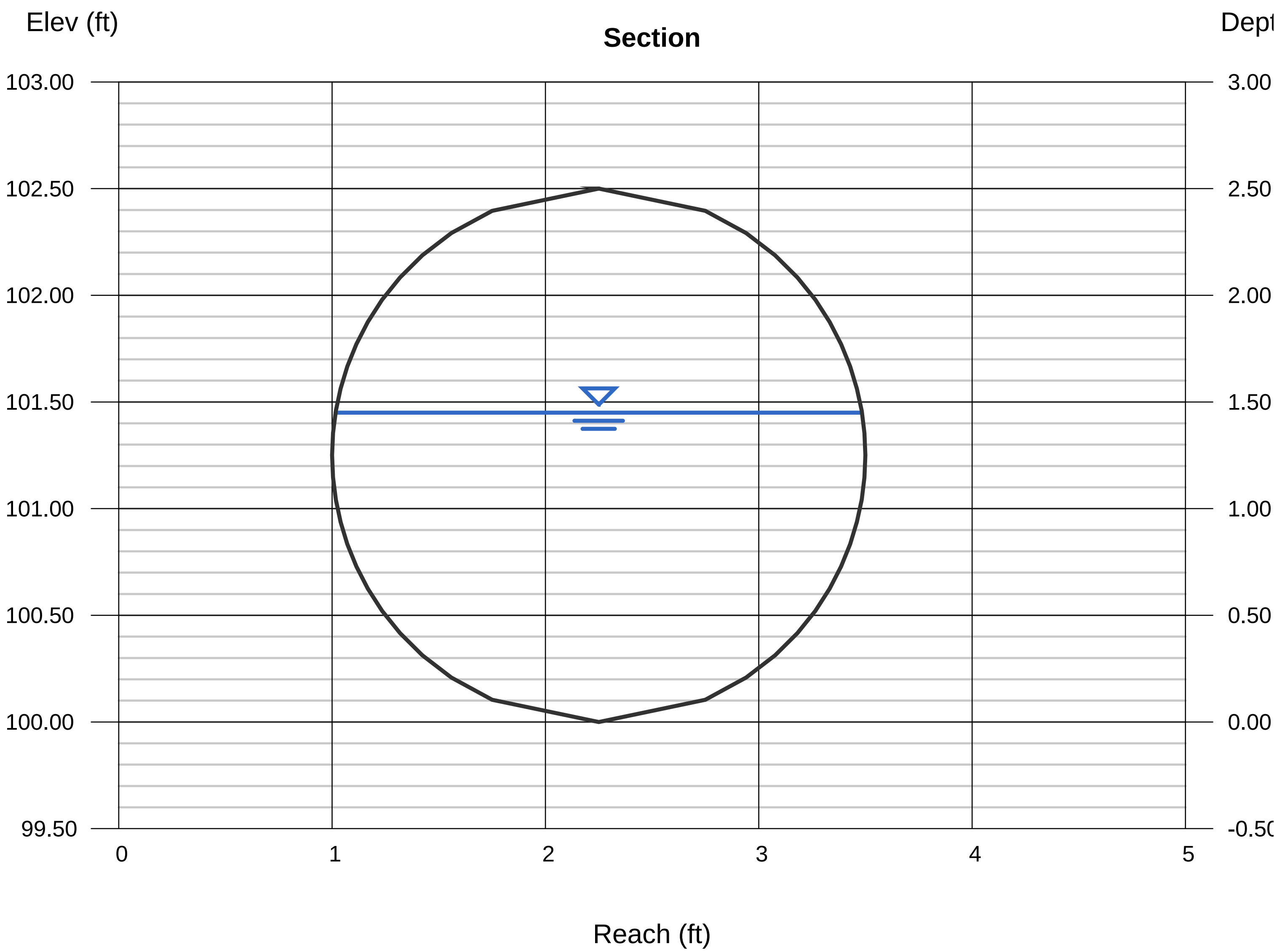
Circular		**Highlighted**	
Diameter (ft)	= 2.50	Depth (ft)	= 2.10
		Q (cfs)	= 32.00
		Area (sqft)	= 4.40
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 7.27
Slope (%)	= 0.50	Wetted Perim (ft)	= 5.80
N-Value	= 0.012	Crit Depth, Yc (ft)	= 1.93
		Top Width (ft)	= 1.83
Calculations		EGL (ft)	= 2.92
Compute by:	Known Q		
Known Q (cfs)	= 32.00		



Channel Report

Alternative D: Drainage Area #2

Circular		**Highlighted**	
Diameter (ft)	= 2.50	Depth (ft)	= 1.45
		Q (cfs)	= 20.00
		Area (sqft)	= 2.96
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 6.75
Slope (%)	= 0.50	Wetted Perim (ft)	= 4.34
N-Value	= 0.012	Crit Depth, Yc (ft)	= 1.52
		Top Width (ft)	= 2.47
Calculations		EGL (ft)	= 2.16
Compute by:	Known Q		
Known Q (cfs)	= 20.00		



Channel Report

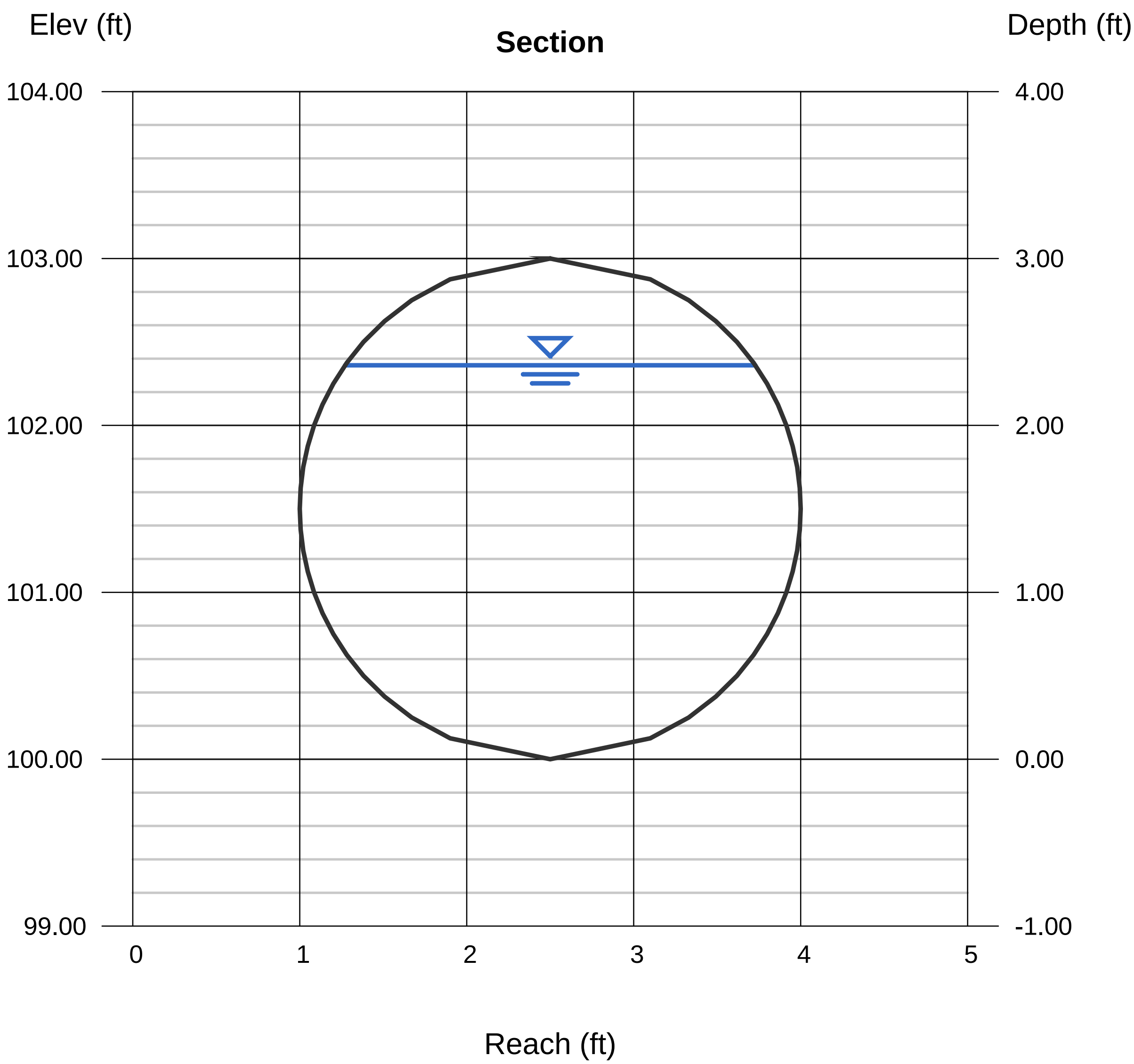
Alternative E: Drainage Area #1

Circular
Diameter (ft) = 3.00

Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.012

Calculations
Compute by: Known Q
Known Q (cfs) = 49.00

Highlighted
Depth (ft) = 2.36
Q (cfs) = 49.00
Area (sqft) = 5.98
Velocity (ft/s) = 8.20
Wetted Perim (ft) = 6.56
Crit Depth, Yc (ft) = 2.28
Top Width (ft) = 2.45
EGL (ft) = 3.41



Channel Report

Proposed Earthen Infiltration Channel

Trapezoidal

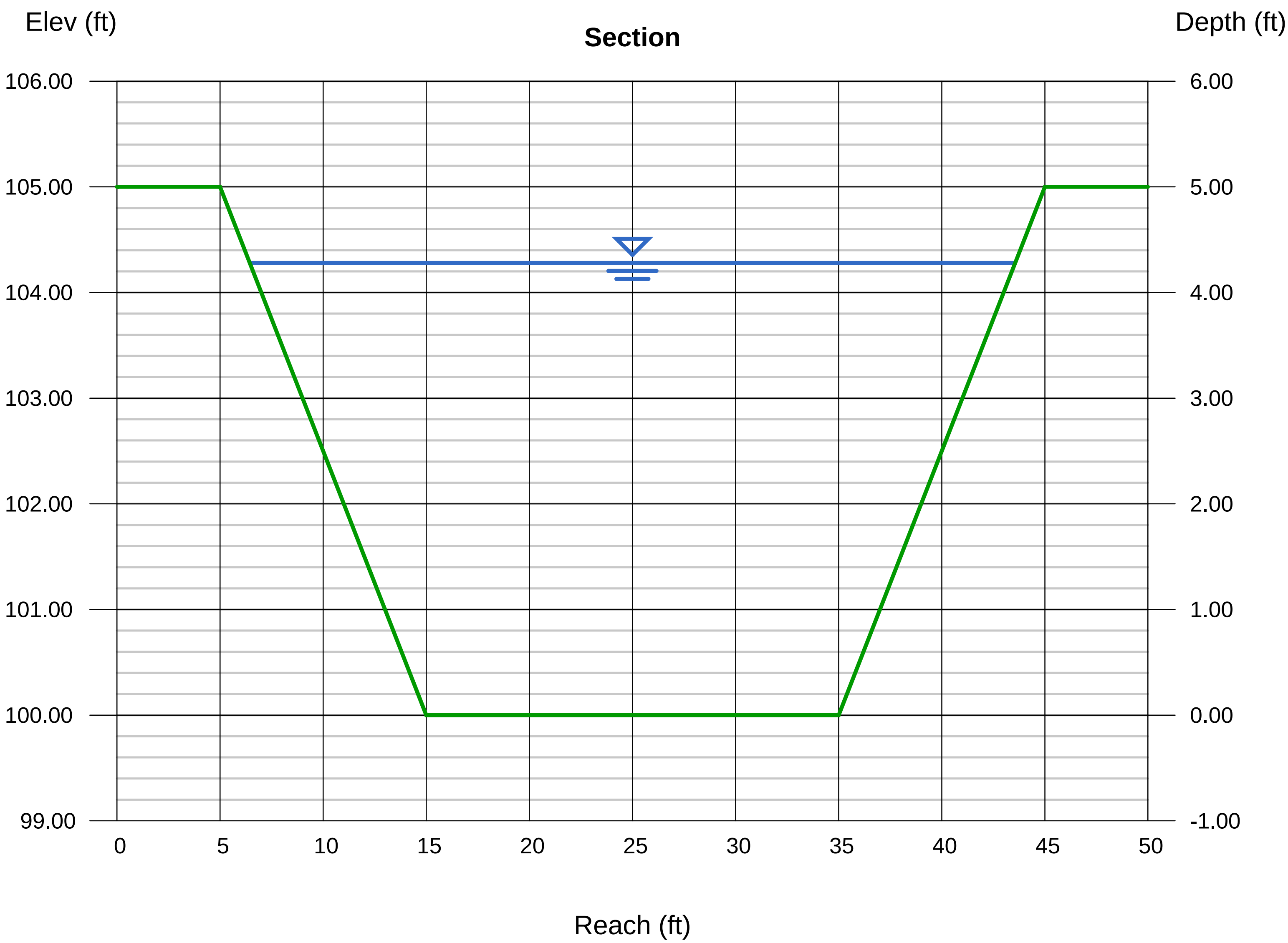
Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 5.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.40
N-Value	= 0.035

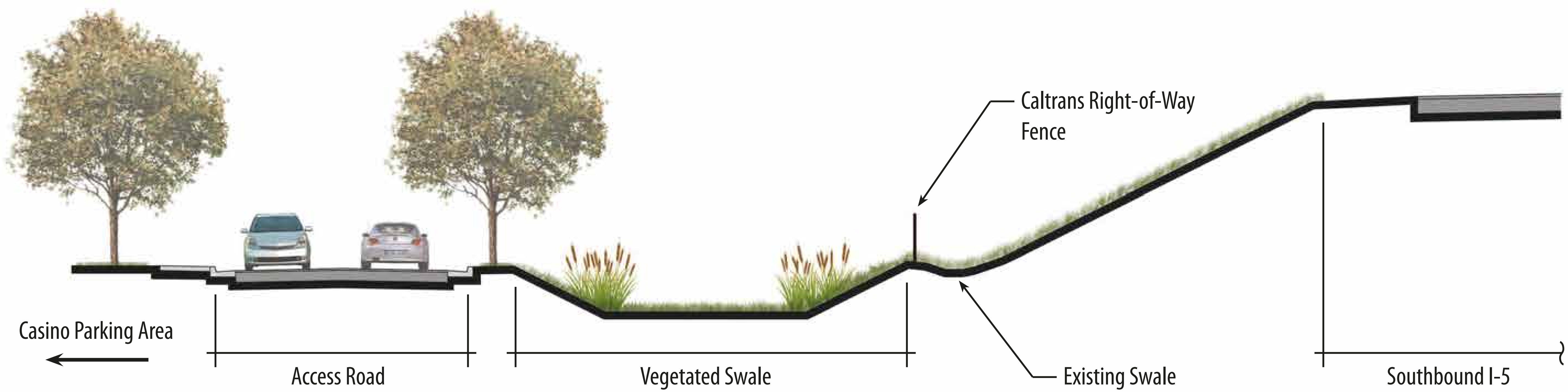
Calculations

Compute by:	Known Q
Known Q (cfs)	= 700.00

Highlighted

Depth (ft)	= 4.28
Q (cfs)	= 700.00
Area (sqft)	= 122.24
Velocity (ft/s)	= 5.73
Wetted Perim (ft)	= 39.14
Crit Depth, Yc (ft)	= 3.03
Top Width (ft)	= 37.12
EGL (ft)	= 4.79




Caltrans Right-of-Way Fence
Casino Parking Area
Access Road
Vegetated Swale
Existing Swale
Southbound I-5

NOT TO SCALE

Vegetated Swale

TC-30

Design Considerations

- Tributary Area
- Area Required
- Slope
- Water Availability

Targeted Constituents

☑	Sediment	▲
☑	Nutrients	●
☑	Trash	●
☑	Metals	▲
☑	Bacteria	●
☑	Oil and Grease	▲
☑	Organics	▲

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems.

California Experience

Caltrans constructed and monitored six vegetated swales in southern California. These swales were generally effective in reducing the volume and mass of pollutants in runoff. Even in the areas where the annual rainfall was only about 10 inches/yr, the vegetation did not require additional irrigation. One factor that strongly affected performance was the presence of large numbers of gophers at most of the sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- If properly designed, vegetated, and operated, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant collateral water quality benefits.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible.

Limitations

- Can be difficult to avoid channelization.
- May not be appropriate for industrial sites or locations where spills may occur
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.
- Swales are mores susceptible to failure if not properly maintained than other treatment BMPs.

Design and Sizing Guidelines

- Flow rate based design determined by local requirements or sized so that 85% of the annual runoff volume is discharged at less than the design rainfall intensity.
- Swale should be designed so that the water level does not exceed 2/3rds the height of the grass or 4 inches, which ever is less, at the design treatment rate.
- Longitudinal slopes should not exceed 2.5%
- Trapezoidal channels are normally recommended but other configurations, such as parabolic, can also provide substantial water quality improvement and may be easier to mow than designs with sharp breaks in slope.
- Swales constructed in cut are preferred, or in fill areas that are far enough from an adjacent slope to minimize the potential for gopher damage. Do not use side slopes constructed of fill, which are prone to structural damage by gophers and other burrowing animals.
- A diverse selection of low growing, plants that thrive under the specific site, climatic, and watering conditions should be specified. Vegetation whose growing season corresponds to the wet season are preferred. Drought tolerant vegetation should be considered especially for swales that are not part of a regularly irrigated landscaped area.
- The width of the swale should be determined using Manning's Equation using a value of 0.25 for Manning's n.

Construction/Inspection Considerations

- Include directions in the specifications for use of appropriate fertilizer and soil amendments based on soil properties determined through testing and compared to the needs of the vegetation requirements.
- Install swales at the time of the year when there is a reasonable chance of successful establishment without irrigation; however, it is recognized that rainfall in a given year may not be sufficient and temporary irrigation may be used.
- If sod tiles must be used, they should be placed so that there are no gaps between the tiles; stagger the ends of the tiles to prevent the formation of channels along the swale or strip.
- Use a roller on the sod to ensure that no air pockets form between the sod and the soil.
- Where seeds are used, erosion controls will be necessary to protect seeds for at least 75 days after the first rainfall of the season.

Performance

The literature suggests that vegetated swales represent a practical and potentially effective technique for controlling urban runoff quality. While limited quantitative performance data exists for vegetated swales, it is known that check dams, slight slopes, permeable soils, dense grass cover, increased contact time, and small storm events all contribute to successful pollutant removal by the swale system. Factors decreasing the effectiveness of swales include compacted soils, short runoff contact time, large storm events, frozen ground, short grass heights, steep slopes, and high runoff velocities and discharge rates.

Conventional vegetated swale designs have achieved mixed results in removing particulate pollutants. A study performed by the Nationwide Urban Runoff Program (NURP) monitored three grass swales in the Washington, D.C., area and found no significant improvement in urban runoff quality for the pollutants analyzed. However, the weak performance of these swales was attributed to the high flow velocities in the swales, soil compaction, steep slopes, and short grass height.

Another project in Durham, NC, monitored the performance of a carefully designed artificial swale that received runoff from a commercial parking lot. The project tracked 11 storms and concluded that particulate concentrations of heavy metals (Cu, Pb, Zn, and Cd) were reduced by approximately 50 percent. However, the swale proved largely ineffective for removing soluble nutrients.

The effectiveness of vegetated swales can be enhanced by adding check dams at approximately 17 meter (50 foot) increments along their length (See Figure 1). These dams maximize the retention time within the swale, decrease flow velocities, and promote particulate settling. Finally, the incorporation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.

Only 9 studies have been conducted on all grassed channels designed for water quality (Table 1). The data suggest relatively high removal rates for some pollutants, but negative removals for some bacteria, and fair performance for phosphorus.

Table 1 Grassed swale pollutant removal efficiency data

	Removal Efficiencies (% Removal)						
Study	TSS	TP	TN	NO_3	Metals	Bacteria	Type
Caltrans 2002	77	8	67	66	83-90	-33	dry swales
Goldberg 1993	67.8	4.5	-	31.4	42–62	-100	grassed channel
Seattle Metro and Washington Department of Ecology 1992	60	45	-	-25	2–16	-25	grassed channel
Seattle Metro and Washington Department of Ecology, 1992	83	29	-	-25	46–73	-25	grassed channel
Wang et al., 1981	80	-	-	-	70–80	-	dry swale
Dorman et al., 1989	98	18	-	45	37–81	-	dry swale
Harper, 1988	87	83	84	80	88–90	-	dry swale
Kercher et al., 1983	99	99	99	99	99	-	dry swale
Harper, 1988.	81	17	40	52	37–69	-	wet swale
Koon, 1995	67	39	-	9	-35 to 6	-	wet swale

While it is difficult to distinguish between different designs based on the small amount of available data, grassed channels generally have poorer removal rates than wet and dry swales, although some swales appear to export soluble phosphorus (Harper, 1988; Koon, 1995). It is not clear why swales export bacteria. One explanation is that bacteria thrive in the warm swale soils.

Siting Criteria

The suitability of a swale at a site will depend on land use, size of the area serviced, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the swale system (Schueler et al., 1992). In general, swales can be used to serve areas of less than 10 acres, with slopes no greater than 5 %. Use of natural topographic lows is encouraged and natural drainage courses should be regarded as significant local resources to be kept in use (Young et al., 1996).

Selection Criteria (NCTCOG, 1993)

- Comparable performance to wet basins
- Limited to treating a few acres
- Availability of water during dry periods to maintain vegetation
- Sufficient available land area

Research in the Austin area indicates that vegetated controls are effective at removing pollutants even when dormant. Therefore, irrigation is not required to maintain growth during dry periods, but may be necessary only to prevent the vegetation from dying.

The topography of the site should permit the design of a channel with appropriate slope and cross-sectional area. Site topography may also dictate a need for additional structural controls. Recommendations for longitudinal slopes range between 2 and 6 percent. Flatter slopes can be used, if sufficient to provide adequate conveyance. Steep slopes increase flow velocity, decrease detention time, and may require energy dissipating and grade check. Steep slopes also can be managed using a series of check dams to terrace the swale and reduce the slope to within acceptable limits. The use of check dams with swales also promotes infiltration.

Additional Design Guidelines

Most of the design guidelines adopted for swale design specify a minimum hydraulic residence time of 9 minutes. This criterion is based on the results of a single study conducted in Seattle, Washington (Seattle Metro and Washington Department of Ecology, 1992), and is not well supported. Analysis of the data collected in that study indicates that pollutant removal at a residence time of 5 minutes was not significantly different, although there is more variability in that data. Therefore, additional research in the design criteria for swales is needed. Substantial pollutant removal has also been observed for vegetated controls designed solely for conveyance (Barrett et al, 1998); consequently, some flexibility in the design is warranted.

Many design guidelines recommend that grass be frequently mowed to maintain dense coverage near the ground surface. Recent research (Colwell et al., 2000) has shown mowing frequency or grass height has little or no effect on pollutant removal.

Summary of Design Recommendations

1) The swale should have a length that provides a minimum hydraulic residence time of at least 10 minutes. The maximum bottom width should not exceed 10 feet unless a dividing berm is provided. The depth of flow should not exceed 2/3rds the height of the grass at the peak of the water quality design storm intensity. The channel slope should not exceed 2.5%.

2) A design grass height of 6 inches is recommended.

3) Regardless of the recommended detention time, the swale should be not less than 100 feet in length.

4) The width of the swale should be determined using Manning's Equation, at the peak of the design storm, using a Manning's n of 0.25.

5) The swale can be sized as both a treatment facility for the design storm and as a conveyance system to pass the peak hydraulic flows of the 100-year storm if it is located "on-line." The side slopes should be no steeper than 3:1 (H:V).

6) Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible. If flow is to be introduced through curb cuts, place pavement slightly above the elevation of the vegetated areas. Curb cuts should be at least 12 inches wide to prevent clogging.

7) Swales must be vegetated in order to provide adequate treatment of runoff. It is important to maximize water contact with vegetation and the soil surface. For general purposes, select fine, close-growing, water-resistant grasses. If possible, divert runoff (other than necessary irrigation) during the period of vegetation

establishment. Where runoff diversion is not possible, cover graded and seeded areas with suitable erosion control materials.

Maintenance

The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely. The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover.

Maintenance activities should include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Cuttings should be removed from the channel and disposed in a local composting facility. Accumulated sediment should also be removed manually to avoid concentrated flows in the swale. The application of fertilizers and pesticides should be minimal.

Another aspect of a good maintenance plan is repairing damaged areas within a channel. For example, if the channel develops ruts or holes, it should be repaired utilizing a suitable soil that is properly tamped and seeded. The grass cover should be thick; if it is not, reseed as necessary. Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Residuals (e.g., silt, grass cuttings) must be disposed in accordance with local or State requirements. Maintenance of grassed swales mostly involves maintenance of the grass or wetland plant cover. Typical maintenance activities are summarized below:

- Inspect swales at least twice annually for erosion, damage to vegetation, and sediment and debris accumulation preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the swale is ready for winter. However, additional inspection after periods of heavy runoff is desirable. The swale should be checked for debris and litter, and areas of sediment accumulation.

- Grass height and mowing frequency may not have a large impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

- Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.

- Sediment accumulating near culverts and in channels should be removed when it builds up to 75 mm (3 in.) at any spot, or covers vegetation.

- Regularly inspect swales for pools of standing water. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g. debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained.

Cost

Construction Cost

Little data is available to estimate the difference in cost between various swale designs. One study (SWRPC, 1991) estimated the construction cost of grassed channels at approximately \$0.25 per ft^2. This price does not include design costs or contingencies. Brown and Schueler (1997) estimate these costs at approximately 32 percent of construction costs for most stormwater management practices. For swales, however, these costs would probably be significantly higher since the construction costs are so low compared with other practices. A more realistic estimate would be a total cost of approximately \$0.50 per ft^2, which compares favorably with other stormwater management practices.

Table 2 Swale Cost Estimate (SEWRPC, 1991)

Component	Unit	Extent	Unit Cost Low	Unit Cost Moderate	Unit Cost High	Total Cost Low	Total Cost Moderate	Total Cost High
Mobilization / Demobilization-Light	Swale	1	$107	$274	$441	$107	$274	$441
Site Preparation								
Clearing[b]	Acre	0.5	$2,200	$3,800	$5,400	$1,100	$1,900	$2,700
Grubbing[c]	Acre	0.25	$3,800	$5,200	$6,600	$950	$1,300	$1,650
General Excavation[d]	Yd^3	372	$2.10	$3.70	$5.30	$781	$1,376	$1,972
Level and Till[e]	Yd^2	1,210	$0.20	$0.35	$0.50	$242	$424	$605
Sites Development								
Salvaged Topsoil Seed, and Mulch[f]	Yd^2	1,210	$0.40	$1.00	$1.60	$484	$1,210	$1,936
Sod[g]	Yd^2	1,210	$1.20	$2.40	$3.60	$1,452	$2,904	$4,356
Subtotal	--	--	--	--	--	$5,116	$9,388	$13,660
Contingencies	Swale	1	25%	25%	25%	$1,279	$2,347	$3,415
Total	--	--	--	--	--	$6,395	$11,735	$17,075

Source: (SEWRPC, 1991)

Note: Mobilization/demobilization refers to the organization and planning involved in establishing a vegetative swale.

[a] Swale has a bottom width of 1.0 foot, a top width of 10 feet with 1:3 side slopes, and a 1,000-foot length.

[b] Area cleared = (top width + 10 feet) x swale length.

[c] Area grubbed = (top width x swale length).

[d] Volume excavated = (0.67 x top width x swale depth) x swale length (parabolic cross-section).

[e] Area tilled = $\left(\text{top width} + \frac{8(\text{swale depth}^2)}{3(\text{top width})}\right)$ x swale length (parabolic cross-section).

[f] Area seeded = area cleared x 0.5.

[g] Area sodded = area cleared x 0.5.

Table 3 Estimated Maintenance Costs (SEWRPC, 1991)

Component	Unit Cost	Swale Size (Depth and Top Width)		Comment
		1.5 Foot Depth, One-Foot Bottom Width, 10-Foot Top Width	3-Foot Depth, 3-Foot Bottom Width, 21-Foot Top Width	
Lawn Mowing	$0.85 / 1,000 ft^2/ mowing	$0.14 / linear foot	$0.21 / linear foot	Lawn maintenance area=(top width + 10 feet) x length. Mow eight times per year
General Lawn Care	$9.00 / 1,000 ft^2/ year	$0.18 / linear foot	$0.28 / linear foot	Lawn maintenance area = (top width + 10 feet) x length
Swale Debris and Litter Removal	$0.10 / linear foot / year	$0.10 / linear foot	$0.10 / linear foot	-
Grass Reseeding with Mulch and Fertilizer	$0.30 / yd^2	$0.01 / linear foot	$0.01 / linear foot	Area revegetated equals 1% of lawn maintenance area per year
Program Administration and Swale Inspection	$0.15 / linear foot / year, plus $25 / inspection	$0.15 / linear foot	$0.15 / linear foot	Inspect four times per year
Total	--	**$0.58 / linear foot**	**$ 0.75 / linear foot**	--

Maintenance Cost

Caltrans (2002) estimated the expected annual maintenance cost for a swale with a tributary area of approximately 2 ha at approximately $2,700. Since almost all maintenance consists of mowing, the cost is fundamentally a function of the mowing frequency. Unit costs developed by SEWRPC are shown in Table 3. In many cases vegetated channels would be used to convey runoff and would require periodic mowing as well, so there may be little additional cost for the water quality component. Since essentially all the activities are related to vegetation management, no special training is required for maintenance personnel.

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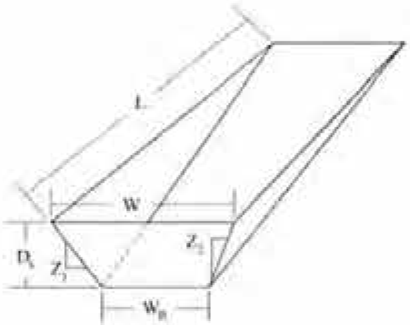
(a) **Cross section of swale with check dam.**



(b) **Dimensional view of swale impoundment area.**

Notation:
L = Length of swale impoundment area per check dam (ft)
D_S = Depth of check dam (ft)
S_S = Bottom slpe of swale (ft/ft)
W = Top width of check dam (ft)
W_B = Bottom width of check dam (ft)
$Z_{1\&2}$ = Ratio of horizontal to vertical change in swale side slope (ft/ft)

Appendix E – References

The following documents were utilized as primary reference documents in developing the Redding Rancheria Casino Master Plan, Grading and Drainage Study

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APPENDIX D

BIOLOGICAL RESOURCES DOCUMENTS

USFWS Biological Assessment

BIOLOGICAL ASSESSMENT

U.S. FISH AND WILDLIFE SERVICE

REDDING RANCHERIA FEE-TO-TRUST AND CASINO PROJECT

JULY 2018

NEPA LEAD AGENCY:

U.S. Department of the Interior
Bureau of Indian Affairs
Pacific Region Office
2800 Cottage Way # W2820
Sacramento, CA 95825

BIOLOGICAL ASSESSMENT
U.S. FISH AND WILDLIFE SERVICE

REDDING RANCHERIA
FEE-TO-TRUST AND CASINO PROJECT

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BIOLOGICAL ASSESSMENT
REDDING RANCHERIA FEE-TO-TRUST AND CASINO PROJECT

LIST OF FIGURES

LIST OF ATTACHMENTS

1.0 INTRODUCTION

The purpose of this Biological Assessment (BA) is to address the effects of the Redding Rancheria Tribe (Tribe) Fee-to-Trust and Casino Project (Proposed Project) on species listed as endangered or threatened under the Endangered Species Act (ESA). The Proposed Project is subject to federal discretionary approvals, including the acquisition of the 232-acre site adjacent to the southern border of the City of Redding, California (Strawberry Fields Site; Action Area) into federal trust status by the Bureau of Indian Affairs (BIA) for the purposes of gaming (Proposed Action).

An Environmental Impact Statement (EIS) has been prepared by the BIA pursuant to the National Environmental Policy Act (NEPA) to assess potential environmental effects of the Proposed Action. This BA serves as the environmental document for the determinations made by the EIS and corresponding conservation measures regarding federally listed species, and addresses the Proposed Action's compliance with Section 7 of the ESA. A separate BA/Essential Fish Habitat Assessment (EFHA) has been prepared for the National Marine Fisheries Service (NMFS) pursuant to Section 7 of the ESA.

1.1 PURPOSE AND NEED

The purpose and need for the Proposed Action is to promote the economic development and self-sufficiency of the Tribe, consistent with the BIA's "Self Determination" policy.

The Tribe's current Rancheria consists of eleven parcels comprising approximately 11.41 acres, merely 37 percent of the original Rancheria that was established by the BIA. Not all of these parcels are held in trust. The Tribe's existing Win-River Resort and Casino is located within the Rancheria, approximately two miles from the Strawberry Fields Site. Expansion of the existing Win-River Resort and Casino within the current Rancheria is not desirable due to the lack of developable land and the presence of Clear Creek and the Anderson – Cottonwood Canal that limit physical expansion.

Implementation of the Proposed Action is needed to assist the Tribe in meeting the following objectives:

- Restore the land base of the Tribe;
- Ensure the Tribe's gaming operations remain competitive in the gaming market and meets the economic needs of the Tribe and its growing membership;
- Locate additional tribal services and housing on the existing Rancheria;
- Strengthen the socioeconomic status of Tribe; and
- Ensure that the Strawberry Fields Site, which is within the traditional territory of the Tribe, is adequately maintained and protected for future generations and that the Tribe has the ability to exercise its jurisdiction as a sovereign tribal government over the Strawberry Fields Site.

1.2 PROPOSED PROJECT COMPONENTS

The Proposed Project, identified as Alternative A in the EIS, includes the following components:

- Transfer of the approximately 232-acre Strawberry Fields Site to federal trust status (Proposed Action) for gaming purposes;
- Subsequent development of the trust property with uses including, but not limited to, a casino, 250-room hotel, conference and event centers, restaurants, retail facilities, parking, and other supporting facilities;
- Development of on-site infrastructure improvements needed to support the casino, including water, sewer, and stormwater infrastructure;
- Stabilization of the eastern bank of the Sacramento River along the northwestern property boundary using the windrow rock slope protection (RSP) method, which involves removal of existing stream bank material above the ordinary high water mark (OHWM) and placement of a row of appropriately-sized rock boulders over the existing alluvium up to at least the floodwater surface elevation of the river, after which the river-side and top-surface of the boulders will be covered with native alluvium and the top surface further covered with a minimum of 18 inches of native loam;
- Improvement of off-site access roads to access the site from either the north or the north and south; and
- Closure of the existing Win-River Casino and the redevelopment of the facility into tribal services and housing uses.

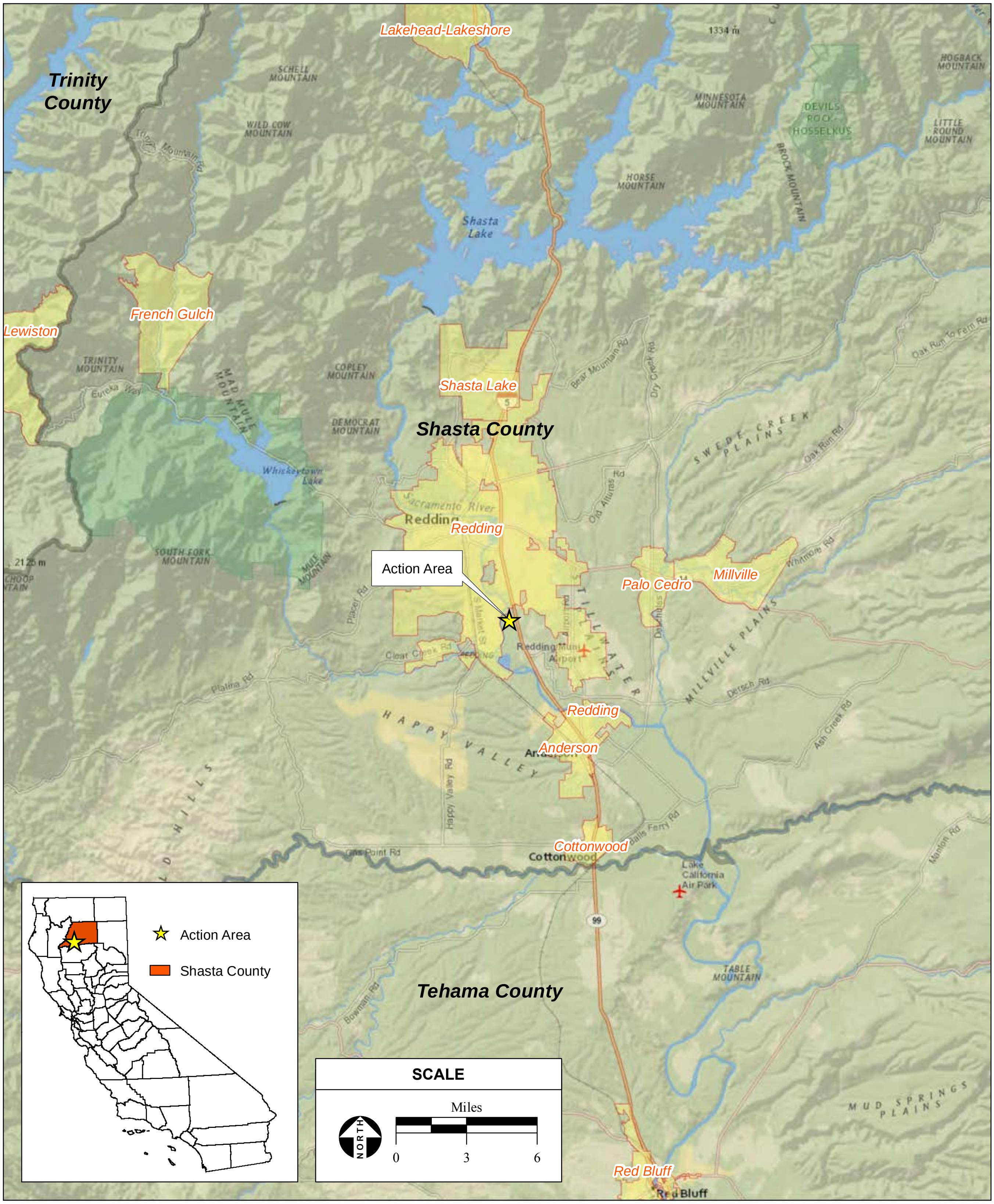
1.3 ACTION AREA

The Action Area is located within southern Shasta County (County), bordering the City of Redding (City) (**Figures 1** and **2**). The approximately 232-acre property is comprised of seven tax parcels and is bound by private property to the north, the Sacramento River to the west, Interstate 5 (I-5), a major north-south transportation corridor, to the east, and private property to the south, which is currently zoned for agricultural use. Elevation ranges from 440 to 454 feet above mean sea level. A site plan is shown in **Figure 3**.

2.0 METHODOLOGY

The following information was obtained and reviewed in support of the analysis contained in this BA:

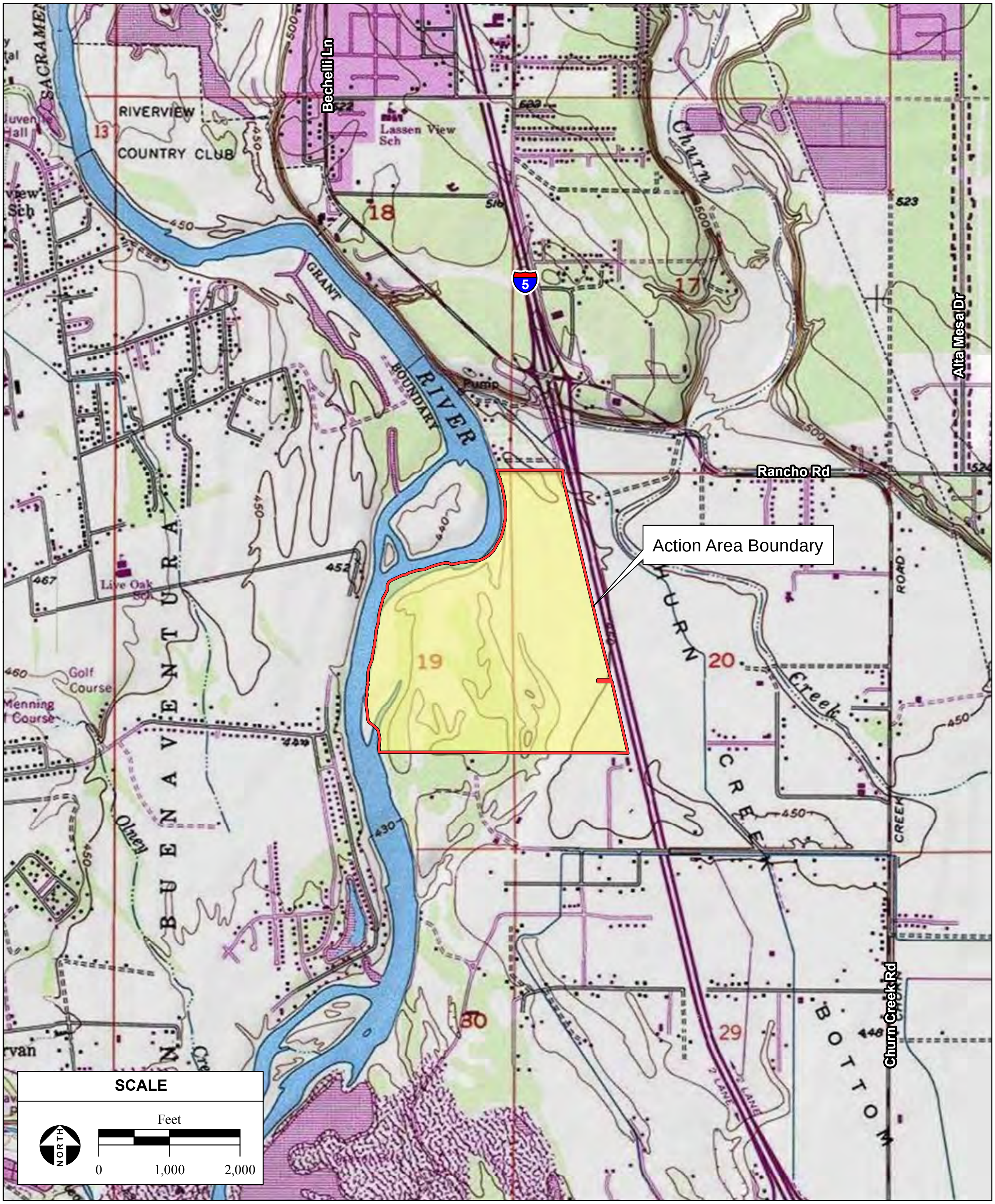
- United States Fish and Wildlife Service (USFWS) Official Species List, dated July 26, 2017 of special-status species with the potential to occur on or be affected by projects on the Enterprise United States Geological Survey (USGS) 7.5-minute topographic quadrangle (quad; USFWS, 2017a) (**Attachment A**);
- California Native Plant Society (CNPS) query, dated July 26, 2017, of special-status plant species (California Rare Plant Rank [CRPR]) known to occur on the Enterprise USGS 7.5 minute topographic quad (CNPS, 2017; **Attachment A**);



SOURCE: NatGeo, 2017; AES, Date: 8/8/2017

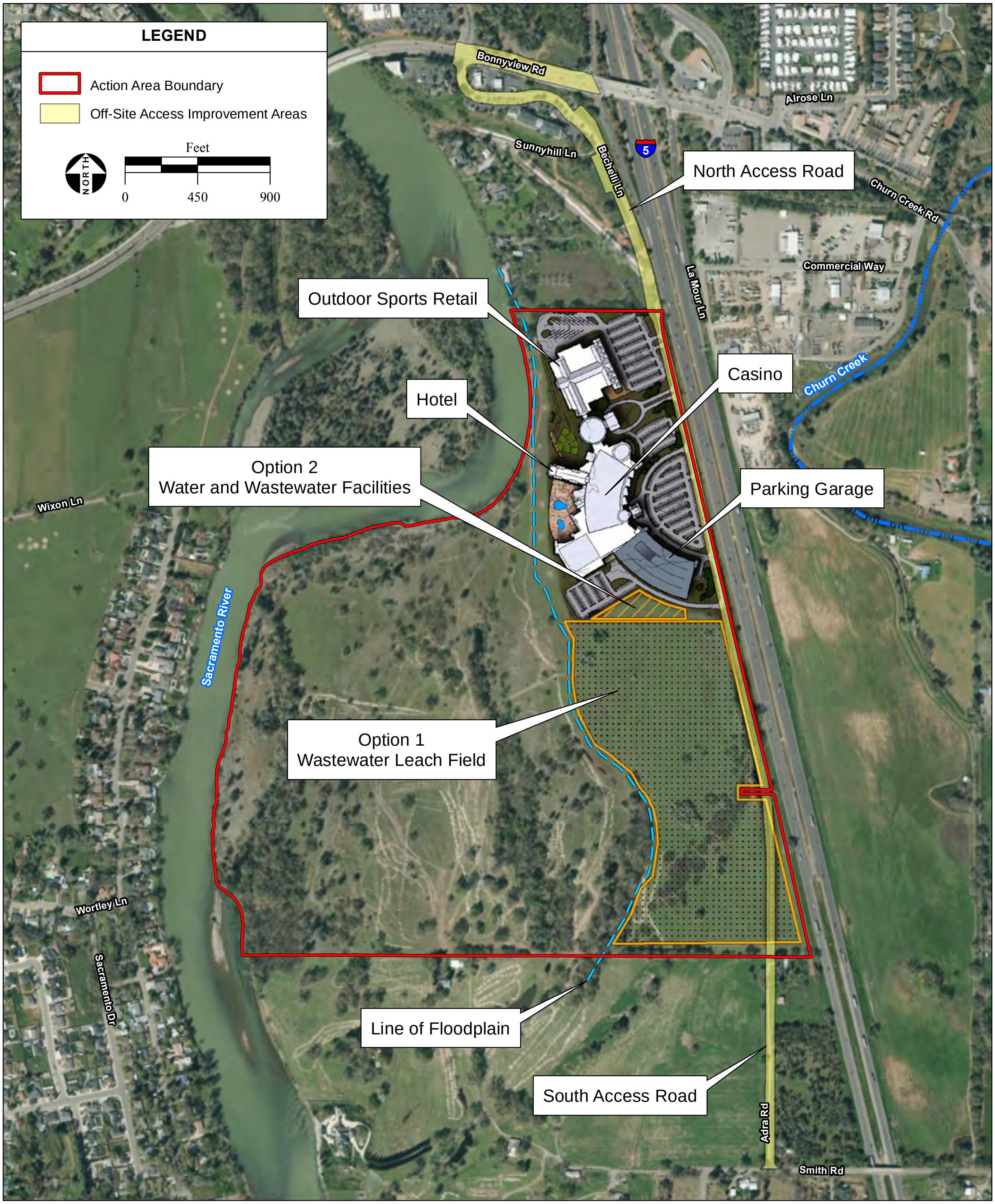
Redding Rancheria Fee-to-Trust USFWS BA / 214584

Figure 1
Regional Location



SOURCE: "Enterprise, CA" USGS 7.5 Minute Topographic Quadrangle,
T31N, R4W, Section 18, 19, & 20, Mt. Diablo Baseline & Meridian;
ESRI Data, 2016; AES, 8/8/2017

Figure 2
Site and Vicinity



SOURCE: USDA aerial photograph, 7/26/2014; ESRI Data, 2016; AES, 10/4/2017

Figure 3
Site Plan

- California Natural Diversity Database (CNDDB) query, dated July 26, 2017, of special-status species known to occur on the Enterprise USGS 7.5 minute topographic quad (CDFW, 2017a; **Attachment A**);
- USFWS National Wetlands Inventory (NWI) map of wetland features on the Action Area (USFWS, 2017b);
- Jurisdictional wetland delineation of aquatic features on the Strawberry Fields Site by U.S. Army Corps of Engineers (USACE);USACE, 2017);
- A critical habitat map (USFWS, 2017c);
- Biological Resources Assessment on the Strawberry Fields Study Area by North State Resources, Inc. (NSR, 2007a; **Attachment B**); and
- Biological Resources Assessment on the Strawberry Fields Study Area for the California Red-Legged Frog (CRLF) by North State Resources, Inc. (NSR, 2007b; **Attachment C**).

2.1 BIOLOGICAL SURVEYS

Biological resource surveys and focused botanical surveys of the Action Area were conducted on April 25, 2007, May 3, 2007, May 9, 2007, June 27, 2007, May 16, 2016, and March 13, 2017. Surveys assessed habitat types, federally listed species, suitable habitat for federally listed species, and wetlands and Waters of the U.S. Species and habitat types were classified using the *Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities* (CDFW, 2000), *Botanical Survey Guidelines of the California Native Plant Society* (CNPS, 2001), and *The Jepson Manual* (Baldwin, 2012). Protocol-level surveys for CRLF and Valley Elderberry Longhorn Beetle (VELB) were conducted (**Attachment B** and **Attachment C**) in accordance with the USFWS *Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (USFWS, 2005) and *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS, 1999).

2.2 ANALYSIS

An analysis to determine federally listed species that may have the potential to occur within the Action Area was conducted. Habitat requirements for each species were assessed and compared to the type and quality of habitats observed during surveys. Species with no potential to occur within the Action Area were ruled out based on lack of suitable habitat, elevation range, substrate/soils, and/or geographic distribution.

3.0 ENVIRONMENTAL SETTING

3.1 TOPOGRAPHY, CLIMATE, AND SOIL TYPES

The Action Area is located within the northern portion of the Sacramento Valley on relatively level terrain above the Sacramento River. The region has a high mean temperature of 96° F and a low mean temperature of 39° F, and the average annual rainfall is approximately 24 inches (Wunderground, 2016).

The Action Area is comprised of seven soil types: Churn loam, Churn gravelly loam, cobbly alluvial land, Reiff fine sandy loam, riverwash, Tehama loam, and Tujunga loamy sand.

3.2 HABITAT TYPES

Terrestrial Habitat Types

Five terrestrial habitats were identified within the Action Area (**Figure 4**): non-native annual grassland, valley foothill riparian, valley oak woodland, riverine, and foothill pine woodland. The majority of the Action Area is comprised of non-native annual grassland (approximately 74 percent). Terrestrial habitats are discussed below. Site photographs are included in **Figure 5**.

Non-native Annual Grassland

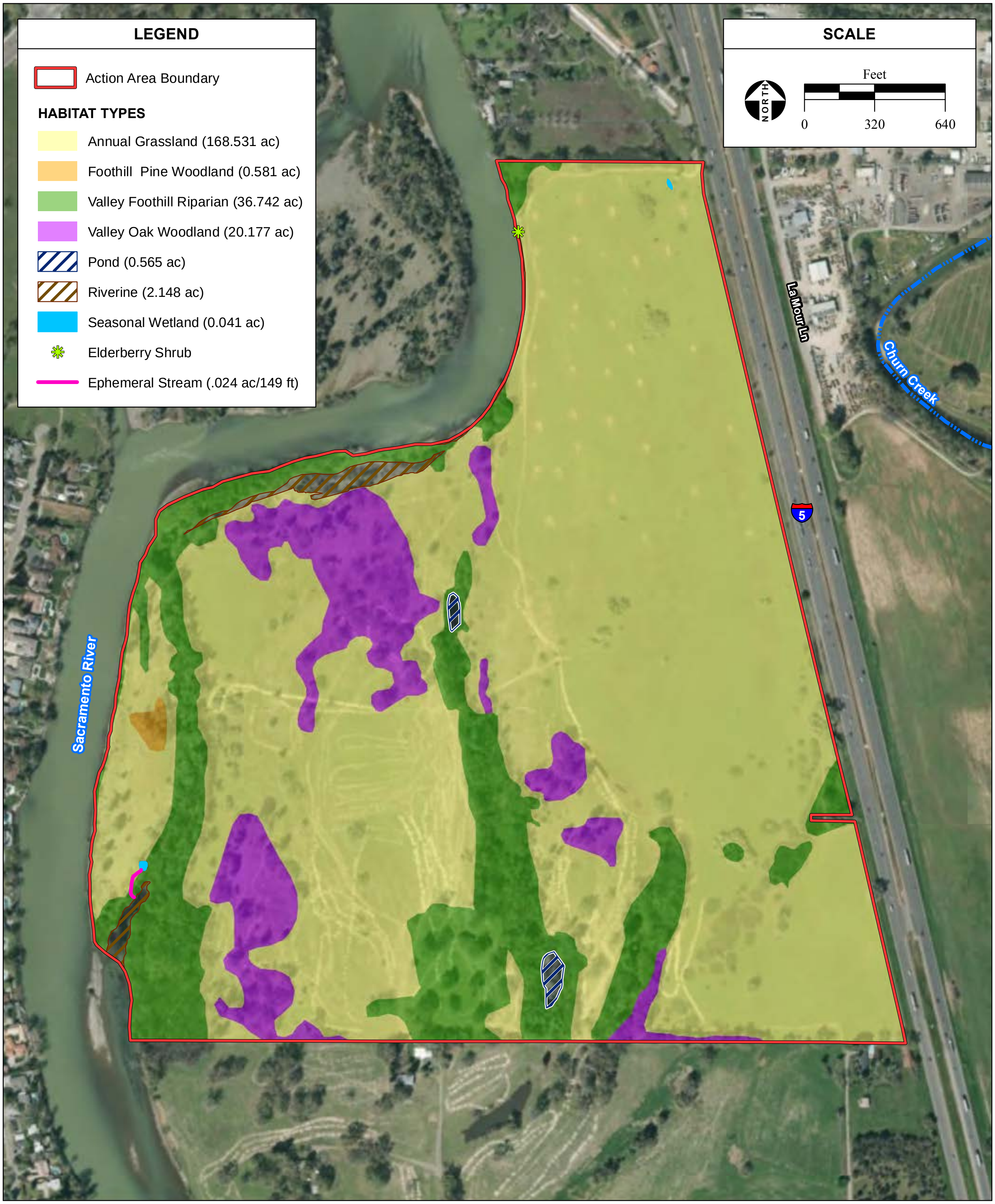
Non-native annual grassland is the dominant habitat type on the Action Area. The dominant grassland species include: European silver hairgrass (*Aira caryophyllea*), medusahead (*Taeniatherum caput-medusae*), yellow star-thistle (*Centaurea solstitialis*), soft chess (*Bromus hordeaceus*), Spanish lotus (*Lotus purshianus*), rattail fescue (*Vulpia myuros*), black mustard (*Brassica nigra*), ripgut brome (*Bromus diandrus*), and winter vetch (*Vicia villosa*). Native plants were observed only on the gravel bar and on the riverwash land type, and include showy milkweed (*Asclepias speciosa*), California brickellbush (*Brickellia californica*), yerba santa (*Eriodictyon californicum*), naked-stemmed buckwheat (*Eriogonum nudum*), Oregon false goldenaster (*Heterotheca oregona*), woolly-fruited lomatium (*Lomatium dasycarpum*), and silver bush lupine (*Lupinus albifrons*). Small stands of Himalayan blackberry (*Rubus armeniacus*) and narrowleaf willow (*Salix exigua*) are found scattered throughout this habitat.

Foothill Pine Woodland

The foothill pine woodland occurs in the western portion of the Action Area near the Sacramento River on an old adjacent gravel bar. This habitat is dominated by tall foothill pine (*Pinus sabiniana*), whiteleaf manzanita (*Arctostaphylos manzanita*), Himalayan blackberry, and poison oak (*Toxicodendron diversilobum*). The grass species that are present are similar to those found in the non-native annual grassland habitat and include California brickellbush, California poppy (*Eschscholzia californica*), ripgut brome, European silver hairgrass, naked-stemmed buckwheat, rattail fescue, soft chess, and yellow star-thistle.

Riverine

The riverine habitat on the Action Area contains a backwater of the Sacramento River and a portion of the floodplain habitat. The main channel of the Sacramento River runs adjacent to the Action Area. The river contains an ordinary high water mark (OHWM) throughout the year, but due to the seasonal scouring caused by changing water volume and velocity, most plant species are unable to establish. Approximately 325 linear feet of backwater and approximately 950 linear feet of floodplain habitat from the Sacramento River occur on the site. The backwater provides suitable juvenile rearing habitat for



SOURCE: USDA aerial photograph, 7/26/2014; ESRI Data, 2016; AES, 8/30/2017

Figure 4
Habitat Types

PHOTO 1: Taken in the northwestern part of the Strawberry Fields Site, looking east.

PHOTO 2: On-site riverine habitat, looking east.

PHOTO 3: Taken in the southwestern part of the Strawberry Fields Site, looking east.

PHOTO 4: Taken in the central part of the Strawberry Fields Site, looking north.

PHOTO 5: Taken in the southwestern part of the Strawberry Fields Site, looking north.

SOURCE: AES, 8/30/2017

Figure 5
Site Photographs

various aquatic species, however, does not generally contain the primary constituent elements associated with other life stage usages (i.e. no spawning flows or gravels). The floodplain habitat is a depositional area (i.e. gravel bar) on the outside of a bend in the river that inundates during periods of high water.

Valley Foothill Riparian

Valley foothill riparian habitat is present primarily in the southern and western portions of the Action Area. Dominant vegetation include black locust (*Robinia pseudoacacia*), California black walnut (*Juglans californica*), Fremont cottonwood (*Populus fremontii*), tree-of-heaven (*Ailanthus altissima*), and valley oak (*Quercus lobata*). The vegetative understory is dominated by arroyo willow (*Salix lasiolepis*), blue elderberry (*Sambucus cerulea*), California wild grape (*Vitis californica*), California coffeeberry (*Frangula californica*), Himalayan blackberry, narrowleaf willow (*Salix exigua*), and oleander (*Nerium oleander*). The presence of grass species is low but includes California pipevine (*Aristolochia californica*), goose grass (*Galium aparine*), California mugwort (*Artemisia douglasiana*), and Santa Barbara sedge (*Carex barbarae*).

Valley Oak Woodland

Valley oak woodland is found throughout the central portions of the Action Area and is dominated by valley oak. Other tree species occurring in this plant community include Oregon ash (*Fraxinus latifolia*), foothill pine, and interior live oak (*Quercus wislizeni*). Shrub species are not common in this habitat type; however, several were identified, including California coffeeberry, Himalayan blackberry, blue elderberry, and poison oak. Grassland species identified include black mustard, California poppy, European silver hairgrass, slender oat (*Avena barbata*), rattail fescue, ripgut brome, soft chess, and yellow star-thistle.

Aquatic Habitat Types

Three aquatic habitats were identified within the Action Area (**Figure 4**): seasonal wetlands; ephemeral stream; and ponds.

Seasonal Wetlands

Two seasonal wetlands (totaling approximately 0.041 acres) were identified in the Action Area. The wetland located in the northeast corner of the site exhibits indicators of wetland hydrology (sediment deposits), hydric soils (uncommon redoximorphic concentrations), and is dominated by several types of hydrophytes including hairy purslane speedwell (*Veronica peregrina*), smooth horsetail (*Equisetum laevigatum*), and bermuda grass (*Cynodon dactylon*). The second wetland is located in the southwest portion of the site and exhibits similar indicators, and is connected directly to the Sacramento River by an ephemeral stream.

Ephemeral Stream

An ephemeral stream was identified within the Action Area (approximately 149 linear feet), and intermittently conveys water from the Sacramento River to the second seasonal wetland during high flow events. Ephemeral streams generally contain water only during high flows, flooding, or extreme rain events, and seasonally dry out. The ephemeral stream does not connect to the Sacramento River year round and does not contain fish-rearing habitat during years of average or below average rainfall.

Ponds

Two open water ponds (totaling approximately 0.57 acres) were identified in the Action Area, and are located in the valley foothill riparian habitat in the south central parts of the site. Both contain standing water and various hydrophilic/aquatic vegetation species.

3.3 WETLANDS AND WATERS OF THE U.S.

A jurisdictional delineation of the aquatic features within the Action Area was conducted on June 15, 16, and 21, in 2006, and was re-verified and updated on December 16, 2016 and March 13, 2017. The delineation methodology included field observations and identifying positive indicators of hydrophytic vegetation, hydrology, and soils, as outlined in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987). Other potential Waters of the U.S. were determined based on the presence of an OHWM and/or the qualification of the feature as a tributary to Waters of the U.S. A preliminary jurisdictional determination was issued by USACE on March 20, 2017, and included the aquatic features and riverine habitat types shown in **Figure 4** (USACE, 2017).

3.4 CRITICAL HABITAT

Designated critical habitat for steelhead (Northern California Distinct Population Segment [DPS]), Chinook salmon (Central Valley Spring-Run and Winter-Run), and Green sturgeon (Southern DPS) occurs in the Sacramento River adjacent to the Action Area, and in the riverine habitat on-site (USFWS, 2017c; NOAA, 2005; NMFS, 2004; NMFS, 2015). The backwater of the riverine habitat provides seasonal habitat for juvenile rearing but does not contain the elements necessary for other life-stage uses. Similarly, the floodplain of the riverine habitat would be inundated only during periods of high water flow. The lateral extent of the critical habitat is defined by the OHWM or, in areas where the OHWM cannot be defined, the lateral extent is defined by the bankfull elevation (33 CFR 329.11). A separate BA/EFHA has been prepared for NMFS pursuant to Section 7 of the ESA.

3.5 OBSERVED WILDLIFE

Wildlife species observed on the Action Area during surveys include the black tailed jack rabbit (*Lepus californicus*), mule deer (*Odocoileus hemionus),* western grey squirrel (*Sciurus griseus*), red-tailed hawk (*Buteo jamaicensis*), western scrub jay (*Aphelocoma californica*), killdeer (*Charadrius vociferus*), great blue heron (*Ardea herodias*), American crow (*Corvus brachyrhynchos*), Canada goose (*Branta* *canadensis*), Brewer's blackbird (*Euphagus cyanocephalus*), and western meadowlark (*Sturnella neglecta*). Bald eagles (*Haliaeetus leucocephalus*) were observed foraging on the site, but not nesting.

3.6 FEDERALLY LISTED SPECIES

Based on biological desktop review and survey results, the following federally listed wildlife species have the potential to occur within the Action Area: valley elderberry longhorn beetle (*Desmocerus californicus dimorphus;* VELB), and California red-legged frog (*Rana draytonii;* CRLF) (USFWS, 2017a; CDFW, 2017a). No suitable habitat for federally listed plants was observed within the Action Area (USFWS, 2017a; CNPS, 2017; CDFW, 2017a).

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*; VELB)

FEDERAL STATUS – THREATENED
STATE STATUS – NONE

The USFWS formally designated the VELB as threatened in 1980. VELB are completely dependent on the elderberry (*Sambucus* spp.) as a host plant, and are found throughout California's Central Valley (USFWS, 2006). Typical VELB habitat consists of riparian forests with an understory of elderberry shrubs (USFWS, 1999). The USFWS considers elderberry shrubs with a basal stem diameter larger than 1-inch as suitable VELB habitat (USFWS, 1999).

Female VELB lay eggs in the crevices of elderberry bark. Upon hatching, larvae tunnel into elderberry stems and feed. Larvae remain within the soft pith of the elderberry plant and feed for 1 to 2 years. Adults emerge from pupation during spring as the elderberry begins to flower. Adult VELB feed on the elderberry foliage until breeding occurs.

A VELB protocol-level survey in 2007 recorded 13 elderberry shrubs with VELB exit holes (**Attachment B**). All elderberry shrubs with exit holes indentified during the 2007 survey were located within valley foothill riparian and valley oak woodland habitats, which occur primarily in the areas along the Sacramento River and in the southern portion of the Action Area. However, during the 2016 and 2017 surveys, only one elderberry shrub was observed within the Action Area; the previously recorded shrubs could not be located. The shrubs identified in 2007 may have been eradicated due to recent drought conditions or on-going cattle grazing. The singular elderberry shrub identified during the recent 2016-2017 surveys is located in the northwestern portion of the site along the Sacramento River, and does not contain indicators of VELB presence (**Figure 4**).

California Red-Legged Frog (*Rana draytonii*; CRLF)

FEDERAL STATUS – THREATENED

STATE STATUS – SPECIES OF SPECIAL CONCERN

The USFWS formally designated the CRLF as threatened in 1996. The historic range of CRLF extended from the coast of Marin County to the inland area of Redding, Shasta County, southward to northwestern Baja California, Mexico. CRLF requires aquatic breeding areas embedded within a matrix of riparian and upland dispersal habitats. All life history stages are most likely to be encountered in and around coastal lagoons, marshes, springs, permanent and semi-permanent natural ponds, ponded and backwater portions of streams, and artificial impoundments such as stock ponds, irrigation ponds, and siltation ponds.

The breeding period for CRLF is from November to March and the species requires 11 to 30 weeks of permanent water for larval development (USFWS, 2011). Juveniles can occur in slow moving, shallow riffle zones in creeks or along the margins of ponds. Eggs are typically deposited in permanent pools, attached to emergent vegetation (Zeiner et al., 1989). During periods of wet weather, some individuals make nightly overland excursions through upland habitats. CRLF may move up to one mile throughout a wet season (USFWS, 2011). Summer habitat for CRLF include spaces under boulders or rocks and organic debris, such as downed trees or logs; industrial debris; and agricultural features such as drains, watering troughs, abandoned sheds, or hay-ricks (USFWS, 2011).

CRLF occurrence is predominately determined by the presence of perennial or near perennial water, and a lack of aquatic predators. Aquatic predators to CRLF include bullfrogs (*Rana catesbeiana*), crayfish (*Pacifastacus leniusculus* and *Procambarus clarkii*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), and other larger fish species that hunt frogs or larvae. CRLF will also utilize small mammal burrows in or under vegetation, willow root wads, and the undersides debris within the riparian zone (Jennings, 1994).

Potential CRLF upland habitats on site consist of valley oak woodland, valley foothill riparian, foothill pine woodland, and non-native annual grassland. Potential CRLF breeding habitats within the Action Area consist of the two pond features and the riverine area of the Sacramento River. A protocol-level survey identified bullfrogs in the pond features, and did not detect CRLF on-site (**Attachment C**). The riverine habitat lacks permanent water year-round, and contains fish during times of high water. Additionally, CNDDB records indicate the nearest known occurrence of CRLF to be approximately 33 miles south southwest of the project site (CDFW, 2017b).

4.0 EFFECTS OF THE ACTION

4.1 CRITICAL HABITAT

Designated critical habitat for steelhead (Northern California DPS), Chinook salmon (Central Valley Spring-Run and Winter-Run), and green sturgeon (Southern DPS) occurs in the Sacramento River adjacent to the Action Area, and in the riverine habitat on site (USFWS, 2017c; NOAA, 2005). The section of riverine habitat may provide seasonal habitat for juvenile rearing but does not contain the elements necessary for other life-stage uses. Designated critical habitat does not occur within the area of impact. In accordance with federal and United States Environmental Protection Agency (USEPA) requirements, the Tribe would obtain coverage under the National Pollutant Discharge Elimination System (NPDES) General Construction Permit, which would require the implementation of a Stormwater Pollution Prevention Plan (SWPPP) and Best Management Practices (BMPs) to prevent contaminated run-off from entering the Sacramento River. Additionally, the stormwater plan for Alternative A includes Low Impact Development (LID) features that would filter pollutants from stormwater run-off during operation of the project. Impacts to surface water quality are discussed in more detail in the separate BA/EFHA prepared for NMFS. As stated therein, with the implementation of LID measures incorporated into the project design, impacts to water quality in the Sacramento River would be less than significant. Thus, the Proposed Action will have no effect on critical habitat.

4.2 FEDERALLY LISTED SPECIES

No suitable habitat for federally listed plant species occurs within the Action Area. Two federally listed wildlife species have the potential to occur within the Action Area: VELB and CRLF. Potential effects to VELB and CRLF are discussed below.

Valley Elderberry Longhorn Beetle

Effects

During the 2016 and 2017 biological surveys, only one elderberry shrub was observed within the Action Area. The single elderberry shrub was located in the northwestern portion of the site along the Sacramento River, approximately 100 feet from the development footprint (**Figure 3**), but did not contain indicators of VELB presence at the time of survey (**Figure 4**). Although unlikely, if VELB were to be present at the time of construction of the Proposed Project or implementation of the bank stabilization measures, construction-related activities have the potential to cause VELB mortality. Potential adverse effects to VELB and its host plant would be avoided or minimized to less-than-significant levels with implementation of the conservation measures identified below. With the implementation of the conservation measures, the Proposed Action may affect but is not likely to adversely affect VELB.

Conservation Measures

The following conservation measures, consistent with USFWS Framework (USFWS, 2017d), will be implemented prior to commencement of construction activities occurring within 50 meters (164 feet) of VELB or the elderberry shrub:

A. The elderberry shrub located on the northwest portion of the Strawberry Fields Site along the Sacramento River shall be fenced or flagged for avoidance. Construction activities potentially impacting the shrub (e.g., trenching) shall apply a buffer of at least 6 meters (20 feet) from the drip-line. To the degree feasible, activities occurring within 50 meters (164 feet) of an elderberry shrub shall be limited to the season when VELB are not active (August to February).

B. Should mechanical weed removal occur within the drip-line of the elderberry shrub, it shall be limited to the season when adults are not active (August to February) and shall avoid damaging the elderberry.

C. Construction staging areas shall be located a minimum of 30 feet away from the elderberry shrub. Temporary stockpiling of excavated or imported material shall occur in approved construction staging areas. Excess excavated soil shall be used onsite or disposed of at a regional landfill or other appropriate facility.

D. A qualified biologist shall provide training for construction personnel. Training shall include the status of the VELB, its host plant and habitat, the need to avoid damaging the elderberry shrub, and the possible penalties for noncompliance.

E. Herbicides shall not be used within the drip-line of the shrub. Insecticides shall not be used within 30 meters (98 feet) of the elderberry shrub. Chemicals shall be applied using a backpack sprayer or similar direct application method.

F. A qualified biologist shall monitor the work area at project-appropriate intervals to assure avoidance and conservation measures are being implemented. The amount and duration of monitoring depend on project-specifics and shall be discussed with USFWS.

G. Should removal of the elderberry shrub be necessary as part of the bank stabilization measures, the shrub will be relocated following USFWS protocols (USFWS, 1999) to suitable riparian habitat approximately 1,800 feet southwest of its original location, as approved by USFWS. Additionally, two credits will be purchased from a USFWS-approved conservation bank. After relocation, monitoring and annual reporting will occur for five years. Additional mitigation may be required pursuant to consultation with USFWS.

California Red-Legged Frog

Effects

A protocol-level survey did not detect CRLF or indicators of CRLF within the Action Area (**Attachment C**). Poor to marginal breeding habitat was observed in the pond features and riverine habitat, and poor to marginal upland habitat was observed in the wetland areas and terrestrial habitats. Permanent water and emergent vegetation was absent from the riverine habitat for egg-laying, and the pond features contained bullfrogs; known predators of CRLF. CRLF are not commonly found in habitats containing bullfrogs. Additionally, the Action Area is located within the northernmost extent of the historic range of CRLF but is outside the current known range. The nearest recorded CNDDB occurrence of CRLF is approximately

33 miles southwest (CDFW, 2017b). The potential for CRLF occurrence within the Action Area is very low.

Although unlikely, if CRLF were to be present in the area of impact at the time of construction of the Proposed Project, construction-related activities have the potential to cause CRLF mortality. Potential adverse effects to CRLF would be avoided or minimized to less-than-significant levels with implementation of the conservation measures identified below. With the implementation of the conservation measures, the Proposed Action may affect but is not likely to adversely affect CRLF.

Conservation Measures

A. A qualified biologist shall conduct a preconstruction habitat assessment survey for CRLF following Appendix D of USFWS (2005) *Revised Guidance of Site Assessments and Field Surveys for the California Red-legged Frog*. The survey shall be conducted no less than 14 days and no more than 30 days prior to the beginning of ground disturbance, construction activities, and/or project activities likely to impact the CRLF. The survey will be conducted in areas of potential CRLF habitat on and within 200 feet of the Action Area. If CRLF is detected within or immediately adjacent to the Action Area, the USFWS shall be contacted immediately to determine the best course of action.

B. Should CRLF be identified during surveys, additional silt fencing shall be installed after surveys have been completed to further protect this species from construction impacts. The fencing shall remain in place until construction activities cease. If identified on-site, USFWS shall be contacted for additional consultation.

C. Prior to the start of construction, the Tribe shall retain a qualified biologist to conduct an informational meeting to educate all construction staff on the CRLF. This training will include a description of the CRLF and its habitat needs; an explanation of the status of the species and its protection under the ESA; and a list of the measures being taken to reduce effects to the species during project construction and implementation. The training will include a handout containing training information. The project manager will use this handout to train additional construction personnel that were not in attendance at the first meeting, prior to starting work on the project.

4.3 INTERRELATED AND INTERDEPENDENT EFFECTS

Interrelated and interdependent effects are direct or indirect effects that occur as a result of activities that are closely affiliated with a project in areas outside proposed project area. Such actions include road or utility improvements off-site that would not be constructed but for implementation of the Proposed Project. Only those activities that would not require a separate federal action and would otherwise not be addressed for compliance with Section 7 of the ESA will be addressed in this BA.

Off-site Traffic Mitigation Improvements

Implementation of the Proposed Project would require construction of off-site traffic mitigation improvements. A detailed description of off-site traffic mitigation for each alternative is provided in Section 5.8 of the EIS. Off-site traffic mitigation improvements are conceptual at this time. Design and construction plans would be prepared after an alternative has been selected for development.

Traffic mitigation improvements are recommended at the following study intersections:

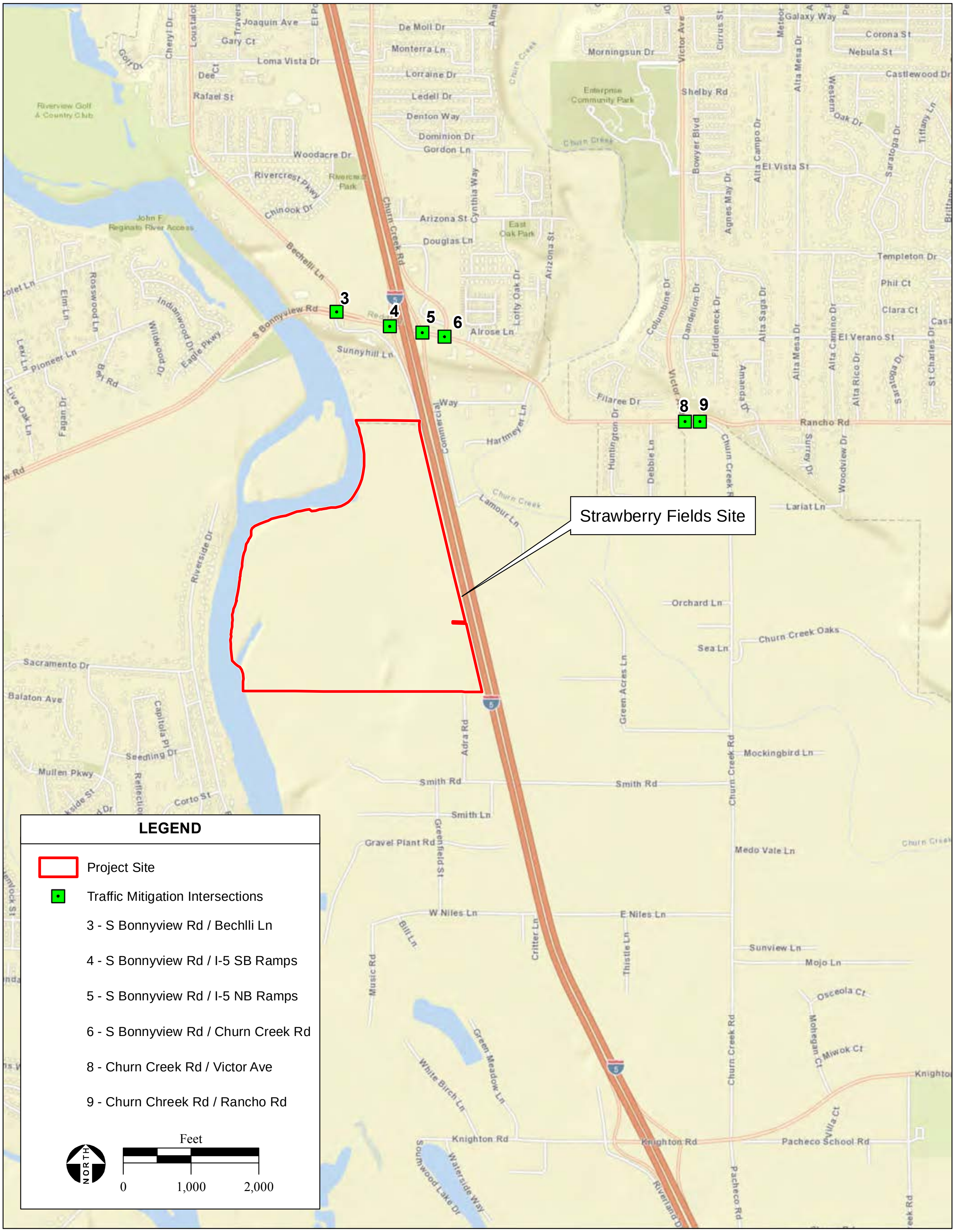
- South Bonnyview Road / Bechelli Lane (Intersection 3);
- South Bonnyview Road / Interstate 5 (I-5) Southbound (SB) Ramps (Intersection 4);
- South Bonnyview Road / I-5 Northbound (NB) Ramps (Intersection 5);
- South Bonnyview Road / Churn Creek Road (Intersection 6);
- Churn Creek Road / Victor Avenue (Intersection 8); and
- Churn Creek Road / Rancho Road (Intersection 9).

Off-site traffic mitigation would require obtaining approvals and permits from the City of Redding, Caltrans, and/or Shasta County, and may be subject to CEQA, which requires additional environmental review prior to approval. Implementation of permitting and CEQA requirements would further reduce the potential for significant adverse impacts from off-site construction projects.

Surveys of the potentially affected areas for the proposed traffic mitigation, with the exception of the South Bonnyview Road / Churn Creek Road intersection, were conducted by AES biologist Nicholas Bonzey. These surveys were conducted on foot. Intersections 3, 4, 5, 6, 8 and 9 (South Bonnyview Road / Bechelli Lane, South Bonnyview Road / I-5 SB Ramps, South Bonnyview Road / I-5 NB Ramps, South Bonnyview Road / Churn Creek Road, Churn Creek Road / Victor Avenue and Churn Creek Road / Rancho Road) are currently paved and developed with predominately fenced ruderal/disturbed shoulders and/or roadsides on one or both sides of the road (for intersection numbers and locations, refer to **Figure 6**). Ruderal/disturbed areas contain sparse vegetation consisting predominately of non-native grass species, and the areas are heavily disturbed by vehicle traffic. No federally listed plant or animal species have the potential to occur within the off-site traffic improvements. Construction of off-site traffic improvements would result in no effect to federally listed species.

Off-site Utility/Infrastructure Improvements

Off-site utility connections are an optional project component and involve tying the Action Area into the City of Redding's water and wastewater system with new pipeline connections. Connecting to the municipal water supply infrastructure would require the construction of approximately 777 linear feet of pipeline from the site to an existing water main at the intersection of Bechelli Lane and the driveway leading west to 5170 Bechelli Lane. Connection to the existing wastewater treatment system would require 702 linear feet of sewer force main pipeline between an on-site lift station and the existing



SOURCE: ESRI WorldStreetmap, 2017; AES, 7/18/2018

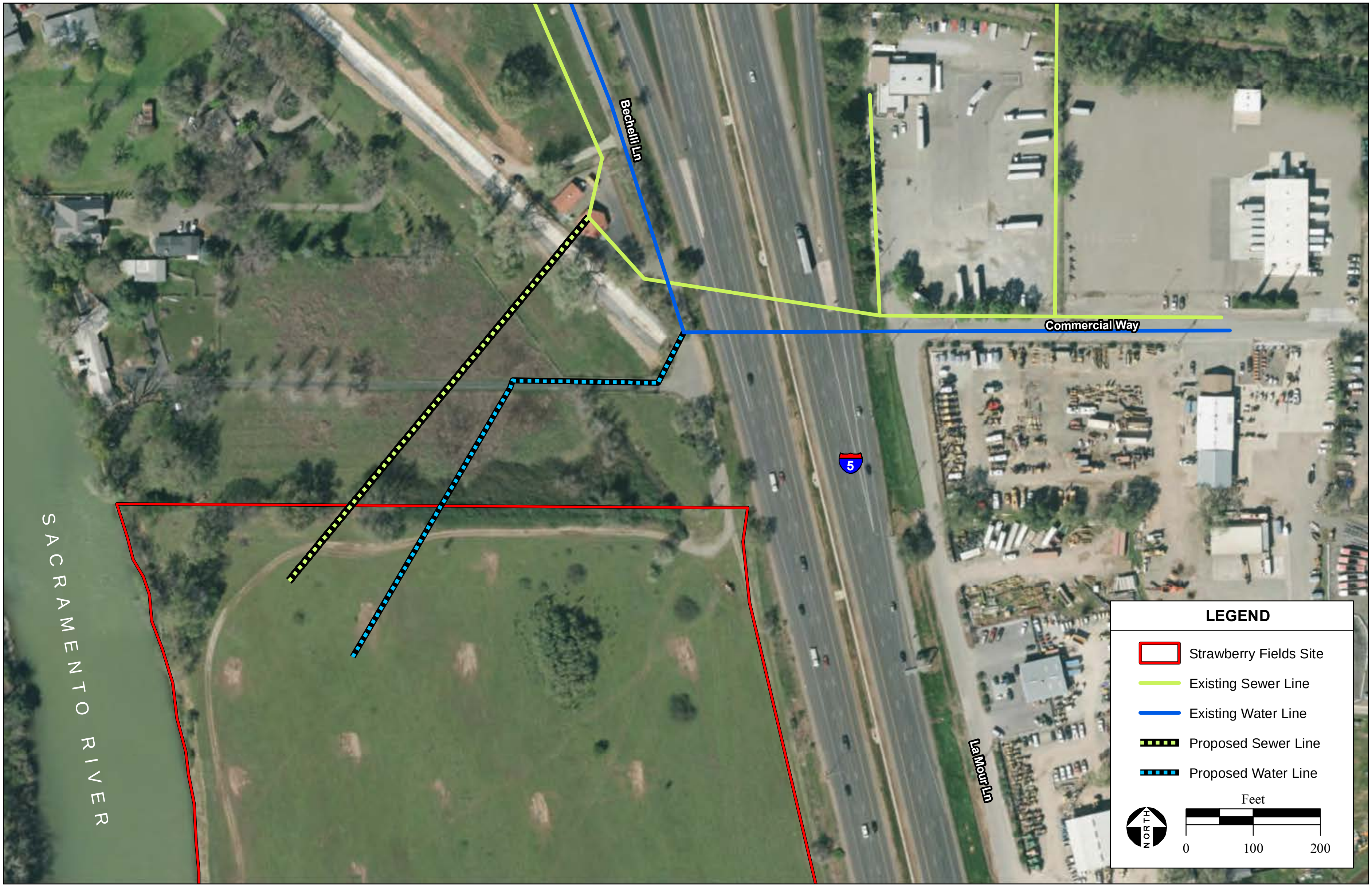
Figure 6
Traffic Mitigation Locations

Sunnyhill Lift Station, located at 5100 Bechelli Lane (see **Figure 7**). The Proposed Project would also require utility service connections with Redding Electric Utility (REU) for electricity and PG&E for natural gas service. The electrical connection would be made with existing overhead REU electrical lines that run along the northern boundary of the Strawberry Fields Site. A PG&E main natural gas line exists approximately 1,100 feet north of the Strawberry Fields Site at the southern edge of the Hilton Garden Inn parking lot.

Construction of pipeline connections and underground electricity transmission upgrades would require grading, excavation, trenching, laying of pipe, and the placement of backfill material to construct the connection to existing water, wastewater, electricity, and natural gas utilities. The proposed utility improvements would extend through non-native annual grassland, dominated by ruderal species. Although unlikely, if CRLF were to be present in the area of impact at the time of construction of the Proposed Project, construction-related activities have the potential to cause CRLF mortality. Potential adverse effects to CRLF would be avoided or minimized to less-than-significant levels with implementation of the conservation measures identified above. Additionally, utilities would be installed underground and construction areas would be restored to pre-project conditions, thus there would be no permanent habitat conversion and potential impacts to biological resources would be limited to disturbance from short-term construction. Construction of proposed utility improvements is not likely to adversely affect federally listed species.

5.0 CONCLUSIONS

Construction activities associated with the Proposed Action will have **no effect** on critical habitat. With compliance with the conservation measures outlined in this BA, construction activities associated with the Proposed Action **may affect but are not likely to adversely affect** VELB and CRLF and associated habitats.



SOURCE: City of Redding 2016 SRTA Imagery, 3/2016; Coleman Engineering Feasability Study, 7/14/17; AES, 10/6/2017

Figure 7
Off-site Water Supply and
Wastewater Treatment and Disposal Improvements

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ATTACHMENTS

ATTACHMENT A

USFWS, CDFW, CNPS OFFICIAL SPECIES LISTS

USFWS IPaC Resource List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: July 18, 2018
Consultation Code: 08ESMF00-2017-SLI-2734
Event Code: 08ESMF00-2018-E-07999
Project Name: Redding

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2017-SLI-2734

Event Code: 08ESMF00-2018-E-07999

Project Name: Redding

Project Type: ** OTHER **

Project Description: Tribal fee-to-trust

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/40.52930951202774N122.3594509873035W

Counties: Shasta, CA

Endangered Species Act Species

There is a total of 8 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850 Habitat assessment guidelines: https://ecos.fws.gov/ipac/guideline/assessment/population/436/office/11420.pdf	Threatened

Crustaceans

NAME	STATUS
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
Slender Orcutt Grass *Orcuttia tenuis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1063	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

CDFW CNDDB Species List

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Enterprise (4012253))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Candidate Endangered	G2G3	S1S2	SSC
Agrostis hendersonii Henderson's bent grass	PMPOA040K0	None	None	G2Q	S2	3.2
Branchinecta lynchi vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
Cryptantha crinita silky cryptantha	PDBOR0A0Q0	None	None	G2	S2	1B.2
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T2	S2	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Great Valley Valley Oak Riparian Forest Great Valley Valley Oak Riparian Forest	CTT61430CA	None	None	G1	S1.1	
Great Valley Willow Scrub Great Valley Willow Scrub	CTT63410CA	None	None	G3	S3.2	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
Juncus leiospermus var. leiospermus Red Bluff dwarf rush	PMJUN011L2	None	None	G2T2	S2	1B.1
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G5	S3S4	
Lathyrus sulphureus var. argillaceus dubious pea	PDFAB25101	None	None	G5T1T2	S1S2	3
Legenere limosa legenere	PDCAM0C010	None	None	G2	S2	1B.1
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G4	S3S4	
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Margaritifera falcata western pearlshell	IMBIV27020	None	None	G4G5	S1S2	
Oncorhynchus mykiss irideus pop. 11 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
Oncorhynchus tshawytscha pop. 6 chinook salmon - Central Valley spring-run ESU	AFCHA0205A	Threatened	Threatened	G5	S1	
Oncorhynchus tshawytscha pop. 7 chinook salmon - Sacramento River winter-run ESU	AFCHA0205B	Endangered	Endangered	G5	S1	

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Orcuttia tenuis slender Orcutt grass	PMPOA4G050	Threatened	Endangered	G2	S2	1B.1
Rana boylii foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	G3	S3	SSC
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S2	
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC
Trilobopsis roperi Shasta chaparral	IMGASA2030	None	None	G1	S1	

Record Count: 25

CNPS Plant List

CNPS California Native Plant Society

Plant List

Inventory of Rare and Endangered Plants

6 matches found. *Click on scientific name for details*

Search Criteria

Found in Quad 4012253

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Blooming Period	CA Rare Plant Rank	State Listing Status	Federal Listing Status
Agrostis hendersonii	Henderson's bent grass	Apr-Jun	3.2		
Cryptantha crinita	silky cryptantha	Apr-May	1B.2		
Juncus leiospermus var. leiospermus	Red Bluff dwarf rush	Mar-Jun	1B.1		
Legenere limosa	legenere	Apr-Jun	1B.1		
Orcuttia tenuis	slender Orcutt grass	May-Sep(Oct)	1B.1	CE	FT
Sidalcea celata	Redding checkerbloom	Apr-Aug	3		

Suggested Citation

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 18 July 2018].

Search the Inventory

Simple Search
Advanced Search
Glossary

Information

About the Inventory
About the Rare Plant Program
CNPS Home Page
About CNPS
Join CNPS

Contributors

The Calflora Database
The California Lichen Society
California Natural Diversity Database
The Jepson Flora Project
The Consortium of California Herbaria
CalPhotos

Questions and Comments

rareplants@cnps.org

ATTACHMENT B

NSR BIOLOGICAL RESOURCES ASSESSMENT OF THE STRAWBERRY FIELDS STUDY AREA

STRAWBERRY FIELDS STUDY AREA

Biological Resources Assessment

November 7, 2007

Prepared for:
Redding Rancheria Tribe

Prepared by:
North State Resources, Inc.

NSR No. 50780

North State Resources, Inc.

STRAWBERRY FIELDS STUDY AREA

Biological Resources Assessment

November 7, 2007

Prepared for:
Redding Rancheria Tribe
Attn: Mr. Neal Malmsten
2000 Redding Rancheria Road
Redding, CA 96001

Prepared by:
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500 Orient Street, Suite 150
Chico, CA 95928
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NSR No. 50780

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1. INTRODUCTION

On behalf of the Redding Rancheria Tribe, North State Resources, Inc. (NSR) conducted a biological resources assessment of the approximately 225.86-acre Strawberry Fields Study Area, hereinafter referred to as the "study area." The purpose of this assessment is to document the biological resources in the vicinity of the study area, including a general description of the terrestrial and aquatic habitats and identification of potentially occurring special-status plant and wildlife species. The results of plant and wildlife surveys within the study area are included in this biological resources assessment.

1.1 STUDY AREA LOCATION

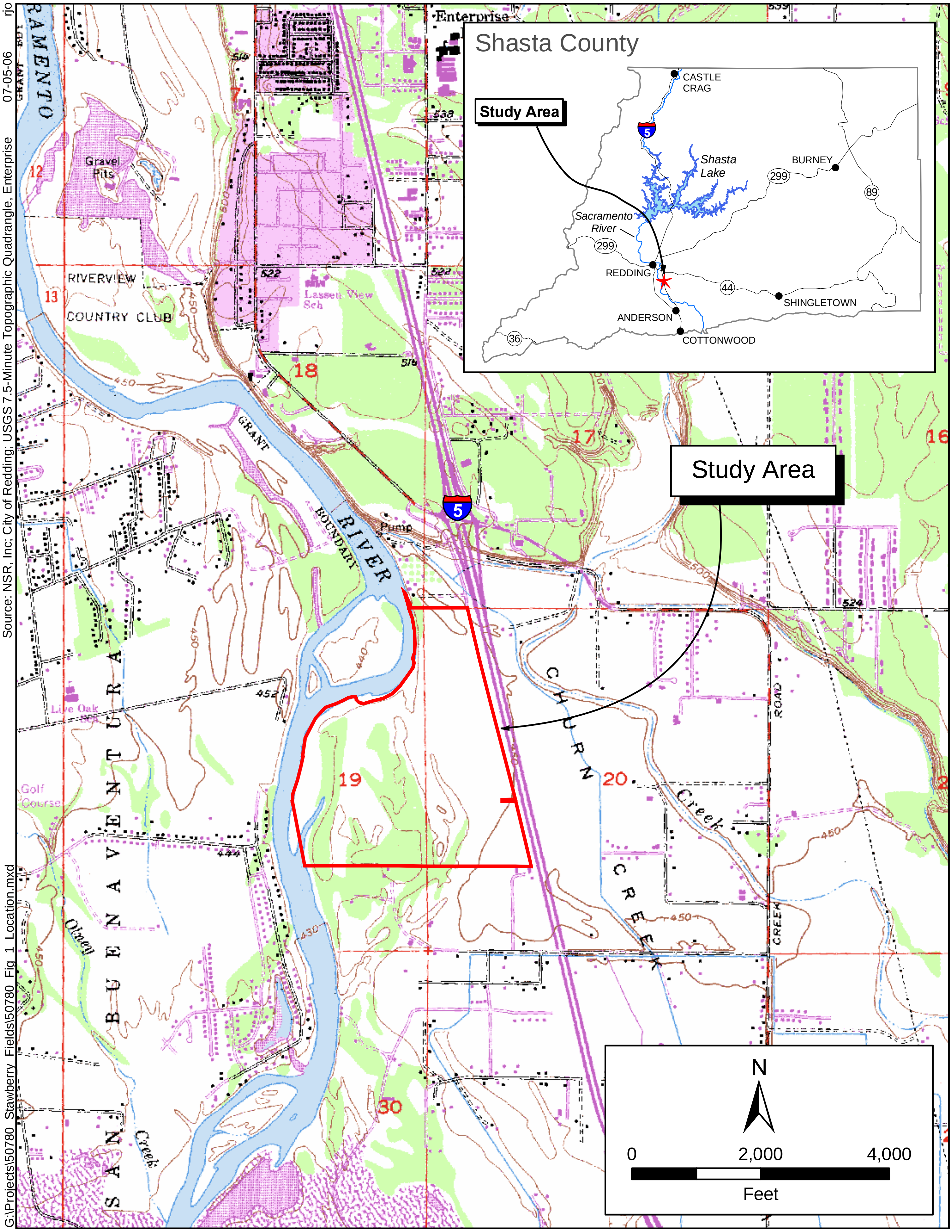
The study area is located south of the City of Redding in Shasta County, California and can be found within the *Enterprise*, *California* U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Township 31 North, Range 4 West, Sections 19 and 20). The central western and eastern boundaries of the study area are located at approximately 40º 31' 67"N latitude by 122° 21' 53"W longitude and 40º 31' 67"N latitude by 122° 20' 81"W longitude, respectively. A map of the study area is presented as Figure 1.

2. METHODS

2.1 LITERATURE REVIEW

For the purposes of this assessment, special-status plant species are defined as vascular plants that are: (1) listed as endangered or threatened under the federal Endangered Species Act (or formally proposed, or candidates, for listing); (2) listed as endangered or threatened under the California Endangered Species Act (or candidates for listing); and/or (3) listed as rare under the California Native Plant Protection Act. "Other" special-status plant species include those considered by the California Native Plant Society (CNPS) to be rare, threatened, or endangered in California and elsewhere (Lists 1B and 2).

Special-status fish and wildlife species include those that are: (1) designated as endangered or threatened by the state and/or federal governments (i.e., "listed species") under the California Endangered Species Act and/or federal Endangered Species Act, respectively; (2) proposed for federal listing status as endangered or threatened; and/or (3) designated as candidates for state or federal listing status as endangered or threatened. "Other" special-status fish and wildlife species are identified by the California Department of Fish and Game (CDFG) as California Fully Protected Species or California Species of Special Concern. For potentially occurring special-status wildlife resources, emphasis is on resident or breeding species rather than on seasonally occurring species.



North State Resources, Inc.

Strawberry Fields Study Area

Figure 1
Study Area and Vicinity

Investigations into the occurrence and potential for occurrence of special-status plant and wildlife species in the study area included conducting: database searches; field reconnaissance and limited protocol-level surveys for special-status plant and wildlife species; and review of pertinent environmental documents and technical studies.

The *List of Endangered and Threatened Species That May Occur in, or be Affected by Projects in the Enterprise, California USGS quadrangle and Shasta County, California* (U.S. Fish and Wildlife Service 2007b) was reviewed for federally listed plant and wildlife species known to occur or suspected of occurring in the vicinity of the study area (Appendix A).

The California Natural Diversity Database (CNDDB) was reviewed for records of special-status plant and wildlife species in the *Enterprise, California* and eight surrounding USGS quadrangles (California Department of Fish and Game 2007a). The CNDDB is a database consisting of historical observations of special-status plant species, wildlife species, and special plant communities. It is limited to reported sightings and is not a comprehensive list of special-status plant and wildlife species that may occur in a particular area. A copy of the search results is included as Appendix B.

Another database search was performed from a query of the online *CNPS Inventory of Rare and Endangered Plants of California* (California Native Plant Society 2007). The query was conducted for documented special-status plant species occurrences in the *Enterprise, California* USGS quadrangle and the eight surrounding quadrangles. The results of this query are included as Appendix C.

Additionally, the following documents were reviewed: *Endangered and Threatened Animals of California* (California Department of Fish and Game 2006a), *Special Animals* (California Department of Fish and Game 2007b), *Endangered, Threatened, and Rare Plants of California* (California Department of Fish and Game 2006b), and *Special Vascular Plants, Bryophytes, and Lichens List* (California Department of Fish and Game 2006c).

2.2 FIELD REVIEW/SURVEYS

Botany

A pre-field botanical review of the study area was conducted in general accordance with *Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities* (California Department of Fish and Game 2000) and *Botanical Survey Guidelines of the California Native Plant Society* (California Native Plant Society 2001a). Per botanical survey guidance, a target list of special-status plant species with the potential to occur within the study area was developed, in part, through a review of the previously mentioned environmental documents, technical studies, and databases. Local botanical expertise, herbarium database records, and regional floras were also used to develop a target list.

Prior to initiating field surveys, Mr. Colby J. Boggs, NSR botanist/plant ecologist, reviewed the habitat requirements and morphological features specific to each plant taxon on the target list. Protocol-level field surveys were conducted on April 25, May 3, May 9, and June 27, 2007. These dates coincide with the blooming/identifiable periods for all of the special-status plant species on the target list determined to have potential to occur within the study area. Field surveys were conducted

and all areas of the study area were viewed to the degree necessary to determine the presence/absence of special-status plant species and suitable habitat. All plant species detected within the study area were identified utilizing the nomenclature in *The Jepson Manual* (Hickman 1993).

Wildlife

Focused wildlife surveys were conducted for California red-legged frog (*Rana aurora draytonii*) and valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*). Ms. Ginger Bolen, NSR biologist conducted the California red-legged frog site assessment on August 17 and 20, and September 11, 2006, and May 7 and 10, 2007. Mr. Paul Kirk, NSR biologist conducted protocol-level VELB surveys on June 27, 28, and 29, and August 2, 2007.

2.2.1.1 ***California Red-Legged Frog Assessment***

A California Red-Legged frog site assessment was conducted using the guidelines set forth in *Revised Guidance on Site Assessments and Field Surveys for California Red-legged Frog* (U. S. Fish and Wildlife Service 2005). Information for the assessment was gathered through a combination of literature review, database searches, review of topographic mapping and aerial photography, and field visits to the site. The literature review identified the historic and current range of the California red-legged frog and provided information on specific habitat preferences of the species. The CNDDB records for Shasta County (California Department of Fish and Game 2007a) and the USFWS *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002) provided information regarding the known existing and historic populations of California red-legged frogs in the study area region.

A review of topographic mapping and aerial photography provided information regarding vegetation communities and land uses occurring near the study area. The study area and publicly accessible areas of the surrounding vicinity were characterized and evaluated for the presence of potentially suitable habitat for the California red-legged frog. A detailed California red-legged frog habitat assessment was prepared by NSR as a separate report (North State Resources 2007a).

2.2.1.2 ***Valley Longhorn Elderberry Beetle Survey***

Mr. Boggs, NSR botanist/plant ecologist conducted a reconnaissance level survey, noting the location of elderberry shrubs on an aerial map, as part of the botanical survey efforts in April and May 2007. Subsequently, Mr. Kirk, NSR biologist used the resulting aerial map to conduct the protocol-level VELB survey (U.S. Fish and Wildlife Service 1999) on June 27, June 28, and June 29, and August 2, 2007. The study area was surveyed on foot, and all areas were viewed to the degree necessary to locate all previously noted elderberry shrubs and to detect the presence of additional elderberry shrubs. Two elderberry shrubs in the southwest section of the study area were deeply embedded within Himalayan blackberry (*Rubus discolor*) brambles and were inaccessible for close inspection.

For each of the accessible elderberry shrubs, all stems measuring one inch or greater in diameter at ground level were counted, assessed for the presence of exit holes, and assigned to a size class (i.e., stems 1-3", 3-5", and >5"). For the few shrubs inaccessible for close inspection, binoculars were used to collect information to the greatest extent practicable. The vegetation community occurring in the immediate vicinity of all surveyed shrubs was recorded. The locations of all surveyed elderberry

shrubs were mapped using a Pathfinder Pro Global Positioning System (GPS) capable of sub-meter accuracy (NAD 27 projection). All spatial data were entered into a Geographic Information Systems (GIS) application and overlain onto a digital orthorectified aerial photograph.

3. RESULTS

3.1 General Setting

The study area is located on a level terrace with the general topography gently sloping west towards the Sacramento River. Elevations range from approximately 430 to 450 feet above mean sea level. The area has a Mediterranean climate with cool, wet winters and hot, dry summers. Average precipitation is approximately 25 to 35 inches per year and falls almost exclusively as rain between October and April. Mean January maximum temperature is 52° F and mean July maximum temperature is 95° F (Western Regional Climate Center 2006).

Vegetation and Associated Wildlife

The vegetation or habitat types present within the study area include riverine, annual grassland, valley oak woodland, and valley foothill riparian (Mayer and Laudenslayer 1988) as well as foothill pine (Sawyer and Keeler-Wolf 1995) as shown on Figure 2. Waters of the United States are present within these plant communities and are addressed briefly in Section 4. A description for each of these plant communities is provided below.

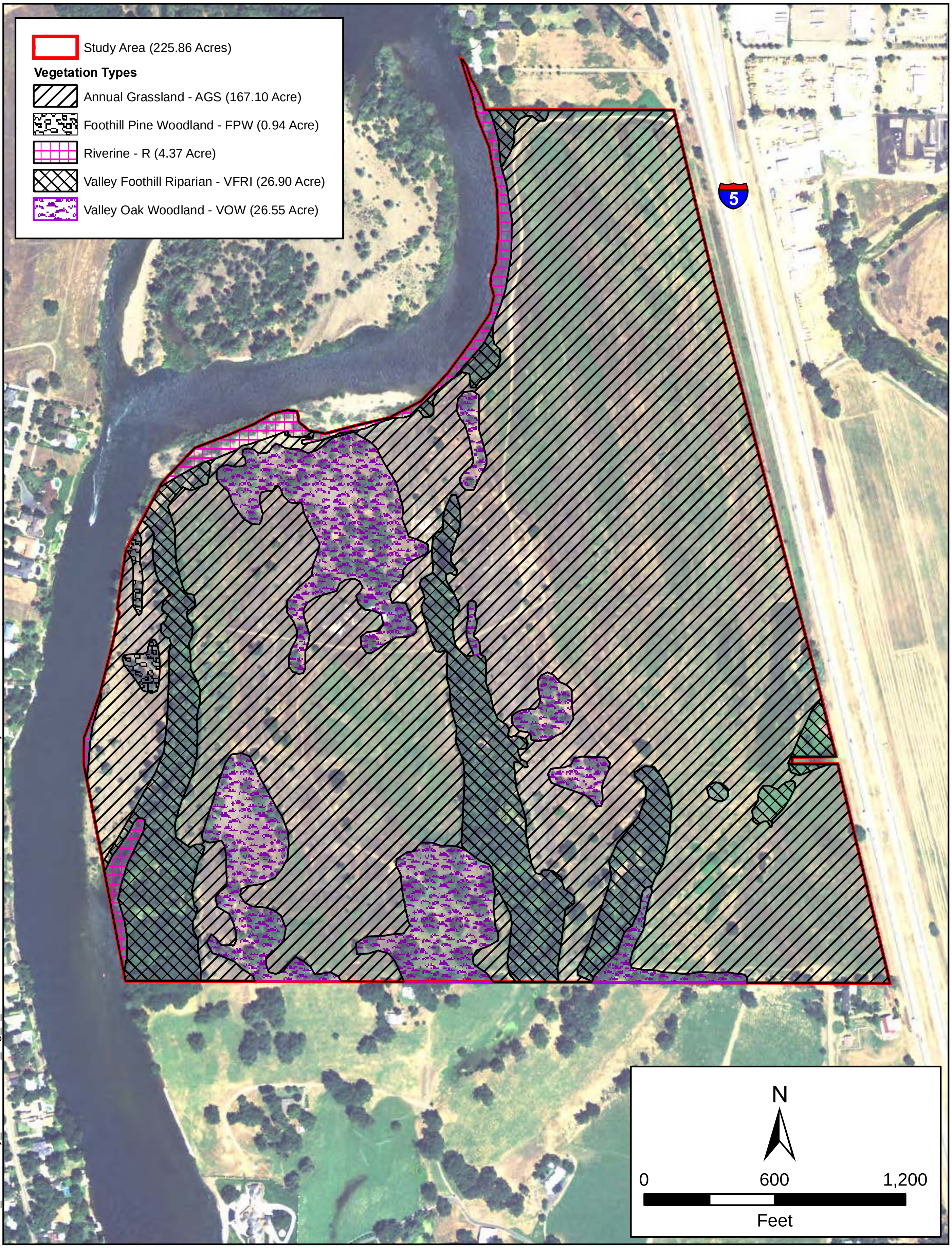
Riverine

Riverine habitat (4.37 acres) consists of the active channel and backwater area of the Sacramento River located along the western boundary of the study area. Riverine habitat is typically characterized by continually flowing water and boulder, cobble, gravel, and/or sand substrates. A dominant plant community within this habitat is absent due to the constant flow of water and movement of soil material (i.e., scour and deposition). However, seasonal fluctuations in water volume and velocity can allow the establishment of some vegetation along banks and on exposed gravel bars; most notably, primary successional species such as willows (*Salix* spp.).

Wildlife. The riverine habitat is suitable year-round for resident and anadromous fishes. Amphibians and reptiles expected to occur include the Pacific chorus frog (*Pseudacris regilla*), western toad (*Bufo boreas*), bullfrog (*Rana catesbeiana*), and northwestern pond turtle (*Clemmys marmorata marmorata*). In addition, birds such as the mallard (*Anas platyrhynchos*), great blue heron (*Ardea herodias*), osprey (*Pandion haliaetus*), and belted kingfisher (*Ceryle alcyon*) may forage here. Bats such as the little brown myotis (*Myotis lucifugus*), forage above this habitat during summer evenings.

Annual Grassland

Annual grassland habitat (167.10 acres) occurring within the study area is dominated by non-native annual grasses, and non-native annual and perennial herbaceous plants. This plant community occurs on all soil map units and the land type present on the site with minor differences in species composition based on location (e.g., greater abundance of native perennial species present on old gravel bar adjacent to the Sacramento River than on the terrace composed of moderately deep, sandy loam soil adjacent to I-5). Regardless of location, the dominant non-native grasses include European



50780_Strawberry_Fields\50780_Fig_2_WHR.mxd Source: NSR, Inc. 07-10-06 rjo

North State Resources, Inc.

Strawberry Fields Study Area

Figure 2
Vegetation Types

silver hairgrass (*Aira caryophyllea*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), medusahead (*Taeniatherum caput-medusae*) and rattail fescue (*Vulpia myuros*), and the dominant non-native herbaceous plants include black mustard (*Brassica nigra*), yellow star-thistle (*Centaurea solstitialis*), Spanish lotus (*Lotus purshianus*), and winter vetch (*Vicia villosa*). Native plant species include California poppy (*Eschscholzia californica*) and vinegar weed (*Trichostema lanceolatum*). Native plants occurring only on the gravel bar and on the Riverwash land type include showy milkweed (*Asclepias speciosa*), California brickellbush (*Brickellia californica*), yerba santa (*Eriodictyon californicum*), naked-stemmed buckwheat (*Eriogonum nudum*), Oregon false goldenaster (*Heterotheca oregana*), woolly-fruited lomatium (*Lomatium dasycarpum*), and silver bush lupine (*Lupinus albifrons*). Small stands of Himalayan blackberry (*Rubus discolor*) and narrowleaf willow (*Salix exigua*) as well as a few lone whiteleaf manzanita (*Arctostaphylos viscida*), foothill pine (*Pinus sabiniana*), valley oak (*Quercus lobata*), and blue elderberry (*Sambucus mexicana*) are found scattered throughout this habitat.

Wildlife. Annual grasslands are productive wildlife habitat. Grassland bird species, such as the mourning dove (*Zenaida macroura*), savannah sparrow (*Passerculus sandwichensis*), and white-crowned sparrow (*Zonotrichia leucophrys*) as well as rodents, including the California ground squirrel (*Spermophilus beecheyi)*, Botta's pocket gopher (*Thomomys bottae*), and deer mouse (*Peromyscus maniculatus*), forage on the seed crop this community provides. These species, in turn, attract predators such as the gopher snake (*Pituophis catenifer*), American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), and coyote (*Canis latrans*). Other common grassland species include the western meadowlark (*Sturnella neglecta*) and black-tailed hare (*Lepus californicus*). Reptile species expected to occur here include the western fence lizard (*Sceloporus occidentalis*), western skink (*Eumeces skiltonianus*), western rattlesnake (*Crotalus viridis*), and yellow-bellied racer (*Coluber constrictor mormon*).

Valley Oak Woodland

Valley oak woodland habitat (26.55 acres) occurring within the study area is dominated by valley oak. Other tree species occurring in this plant community include Oregon ash (*Fraxinus latifolia*), foothill pine (*Pinus sabiniana*), and interior live oak (*Quercus wislizenii*). Shrubs are sparse in this habitat but include California coffeeberry (*Rhamnus californica*), Himalayan blackberry, and poison-oak (*Toxicodendron diversilobum*). The valley oak woodland habitat is an ecological extension of the annual grassland plant community with the only significant difference being the presence of a tree canopy with an approximate foliar cover of 50-60%. The grasses and herbaceous plants occurring in this habitat are similar to those present in the annual grassland plant community. Grasses and herbaceous plants present in the valley oak woodland habitat include European silver hairgrass, slender oat (*Avena barbata*), black mustard, ripgut brome, soft chess, yellow star-thistle, California poppy, and rattail fescue. Plant species occurring only under the canopy of valley oak include goose grass (*Galium aparine*) and hare barley (*Hordeum murinum* ssp. *leporinum*).

Wildlife. The valley oak woodland provides food and cover for a variety birds including red-shouldered hawk (*Buteo lineatus*), California quail (*Callipepla californica*), acorn woodpecker (*Melanerpes formicivorus*), western scrub-jay (*Aphelocoma californica*), and great horned owl (*Bubo

virginianus). Other common animals include black-tailed deer (*Odocoileus hemionus*), opossum (*Didelphis virginianus*), California ground squirrel, and western fence lizard.

Valley Foothill Riparian

Valley foothill riparian habitat (26.90 acres) occurring within the study area is dominated by tree-of-heaven (*Ailanthus altissima*), California black walnut (*Juglans californica*), Fremont cottonwood (*Populus fremontii*), valley oak, and black locust (*Robinia pseudoacacia*). Other trees present in this plant community include white alder (*Alnus rhombifolia*), Oregon ash, mulberry (*Morus alba*), foothill pine, and interior live oak. Shrubs and vines form an understory layer in the valley foothill riparian habitat with an approximate foliar cover of 90-100% in some areas and includes oleander (*Nerium oleander*), California coffeeberry, Himalayan blackberry, narrowleaf willow, arroyo willow (*Salix lasiolepis*), blue elderberry, and California wild grape (*Vitis californica*). Accordingly, grasses and herbaceous plants occurring in this plant community exhibit low percent cover in the understory layer. However, these plants are present and include California pipevine (*Aristolochia californica*), mugwort (*Artemisia douglasiana*), Santa Barbara sedge (*Carex barbarae*), and goose grass.

Wildlife. Riparian communities are among the most important habitats for wildlife because of their high floristic and structural diversity, high biomass (and therefore high food abundance), and high water availability. In addition to providing breeding, foraging, and roosting habitat for a diverse array of animals, riparian communities provide movement corridors for some species, connecting a variety of habitats throughout a region.

The leaf litter, fallen tree branches, and logs associated with the riparian community in the study area provide cover for the western toad and Pacific chorus frog. The western fence lizard, western skink, and southern alligator lizard (*Elgaria multicarinata webbi*) are also expected to occur here, as are several snake species, including the western rattlesnake, yellow-bellied racer, and common kingsnake (*Lampropeltis getulus*).

The willows in the riparian community attract a number of bird species. Many of these species are year-round residents, breeding in the riparian community in the spring and summer and using it for cover and foraging habitat during the non-breeding season. Common species nesting and foraging, primarily in the riparian tree canopy, include the bushtit (*Psaltriparus minimus*), white-breasted nuthatch (*Sitta carolinensis*), and Nuttall's and downy woodpeckers (*Picoides nuttallii* and *Picoides pubescens*, respectively). Other resident species, such as the spotted towhee (*Pipilo maculatus*) and song sparrow (*Melospiza melodia*), nest and forage on or very close to the ground, usually in dense vegetation. Several species of raptors, including the Cooper's hawk (*Accipiter cooperii*) and western screech owl (*Otus kennicottii*), nest in riparian communities and remain there year-round.

In addition to the permanent residents, numerous species of neotropical migrants occur in this community from spring through fall, with many potentially breeding on the site, including the ash-throated flycatcher (*Myiarchus cinerascens*), olive-sided flycatcher (*Contopus cooperi*), western wood-pewee (*Contopus sordidulus*), warbling vireo (*Vireo gilvus*), Swainson's thrush (*Catharus ustulatus*) and black-headed grosbeak (*Pheucticus melanoleucus*).

A variety of mammals also occurs in riparian communities. Small mammals, such as the Botta's pocket gopher, and deer mouse, may burrow or find refuge in dense grass or brushy thickets. Mule

deer frequently use riparian habitats, and predators, such as the raccoon (*Procyon lotor*), long-tailed weasel (*Mustela frenata*) and coyote, are attracted to riparian areas by the abundance of prey and cover. In addition, the taller trees provide daytime roosts for nocturnal species such as the raccoon and Virginia opossum.

Foothill Pine Woodland

The foothill pine woodland plant community (0.94 acre) occurs on an old gravel bar adjacent to the Sacramento River in the western portion of the study area and is dominated by foothill pine. Other tree species occurring in this plant community include valley oak and interior live oak. Shrubs are sparse in this habitat but include whiteleaf manzanita, Himalayan blackberry, and poison-oak. The foothill pine woodland habitat is an ecological extension of the annual grassland plant community with the only significant difference being the presence of a tree canopy with an approximate foliar cover of 50-60%. The grasses and herbaceous plants occurring in this habitat are similar to those present in the annual grassland and valley oak woodland plant communities. Grasses and herbaceous plants present in the foothill pine woodland habitat include European silver hairgrass, California brickellbush, ripgut brome, soft chess, yellow star-thistle, naked-stemmed buckwheat, California poppy, and rattail fescue.

Wildlife. The foothill pine woodland community is small inclusion within the annual grassland on the gravel bar between the river and a strip of valley foothill woodland. The wildlife species expected in this community would be a subset of those found in the annual grassland and valley foothill woodland habitats.

Soils

The *Soil Survey of Shasta County Area, California* (U.S. Department of Agriculture and Soil Conservation Service 1974) identifies five soil map units and one land type within the study area:

- ***CcA – Churn loam, 0 to 3% slopes***. The Churn series consists of well-drained and moderately well-drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically light yellowish-brown, medium acid gravelly loam about nine inches thick. The subgroup taxonomy for the Churn series is *Ultic Haploxeralfs*. The Churn loam soil unit is well-drained and has moderately slow permeability. Runoff is slow, and the hazard of erosion is none to slight for this soil unit. The Churn loam soil map unit is classified as non-hydric with hydric inclusions in the form of cobbly alluvial lands associated with drainageways (USDA Soil Conservation Service 1992).

- ***CeA – Churn gravelly loam, 0 to 3% slopes.*** The Churn series consists of well-drained and moderately well-drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically light yellowish-brown, medium acid gravelly loam about nine inches thick. The subgroup taxonomy for the Churn series is *Ultic Haploxeralfs*. The Churn gravelly loam soil unit is well-drained and has moderately slow permeability. Runoff is slow, and the hazard of erosion is none to slight for this soil unit. The Churn gravelly loam soil map unit is classified as non-hydric with hydric inclusions in the form of cobbly alluvial lands associated with drainageways (USDA Soil Conservation Service 1992).

- ***RgA – Reiff fine sandy loam, 0 to 3% slopes.*** The Reiff series consists of well-drained and moderately well-drained soils that formed in recent alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically grayish-brown and brown, slightly acid fine sandy loam about 18 inches thick. The subgroup taxonomy for the Reiff series is *Typic Xerorthents*. The Reiff fine sandy loam soil unit is well-drained and has moderately rapid permeability. Runoff is very slow, and the hazard of erosion is none to slight for this soil unit. The Reiff fine sandy loam soil map unit is classified as non-hydric (USDA Soil Conservation Service 1992).

- ***Rw – Riverwash.*** The Riverwash land type is excessively drained and is associated with stream channels and adjacent areas subject to continuous or frequent flooding (U.S. Department of Agriculture and Soil Conservation Service 1974). Permeability is rapid, runoff is very slow, and the hazard of erosion is very high for this land type. Binomial subgroup taxonomy does not apply to land types. The Riverwash land type is classified as hydric and is associated with floodplain channels (USDA Soil Conservation Service 1992).

- ***TbA – Tehama loam, 0 to 3% slopes.*** The Tehama series consists of well-drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is pale brown, medium acid and slightly acid loam about 30 inches thick. The subgroup taxonomy for the Tehama series is *Typic Haploxeralfs*. The Tehama loam soil unit is well-drained and has slow permeability. Runoff is very slow, and the hazard of erosion is none to slight for this soil unit. The Tehama loam soil map unit is classified as non-hydric with hydric inclusions in the form of unnamed ponded features associated with depressions (USDA Soil Conservation Service 1992).

- ***TfA – Tujunga loamy sand, 0 to 3% slopes.*** The Tujunga series consists of somewhat excessively drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically pale brown, slightly acid loamy sand about 14 inches thick. The subgroup taxonomy for the Tujunga series is *Typic Xeropsamments*. The Tujunga loamy sand soil unit is somewhat excessively drained and has rapid permeability. Runoff is very slow, and the hazard of erosion is none to slight for this soil unit. The Tujunga loamy sand soil map unit is classified as non-hydric with hydric inclusions in the form of cobbly alluvial lands and riverwash associated with drainageways and floodplain channels, respectively (USDA Soil Conservation Service 1992).

Waters of the U.S.

NSR conducted a delineation of waters of the United States in accordance with U.S. Army Corps of Engineers (USACE) methodology and regulatory guidance letters within the study area on June 15, June 16, and June 21, 2006. A total of 4.419 acres of waters of the United States features were delineated within the study area that includes seasonal wetland (0.029 acre), riverine/perennial stream (4.366 acres), and intermittent stream (0.024 acre, 149 linear feet) habitat. A separate report was prepared by NSR on April 19, 2007 (North State Resources 2007b).

3.2 REGIONAL SPECIES OF CONCERN

Vegetation or habitat types found in the study area region potentially support special-status plant and wildlife species (Appendix D). Appendix D provides a general comparison of habitat requirements for each species and the general habitats present in the study area. Some of the special-status plants

and animals occurring near the study area are found in habitat types that are not present on-site, such as vernal pools. Therefore, these species are not considered in further detail as part of this assessment. For those species for which generally suitable habitat was determined to be present with the study area, the results of the reconnaissance-level survey were used to determine the likelihood of their presence on the site (Tables 1 and 2).

Special-Status Plant Species

Fourteen special-status vascular plant species were initially considered for analysis (Appendix D). Based upon geographic location, local botanical knowledge, and habitat parameters present within the study area, suitable habitat for four special-status plants was determined to occur in the study area (Table 1).

Table 1. Special-Status Plant Species Potentially Occurring in the Study Area

Common Name (*Scientific Name*)	Status[1] (FED/ST /CNPS)	General Habitat Description / Elevation Range	Typical Blooming Period	Comments
Fox sedge *Carex vulpinoidea*	--/--/2.2	Freshwater marshes and swamps, and riparian woodland / 98-3,937 feet	May-June	**Surveys negative, presumed absent.** Suitable habitat occurs within the seasonal wetland in the southwest portion of the study area.
Silky cryptantha *Cryptantha crinita*	--/--/1B.2	Gravelly streambeds within cismontane woodland, lower montane coniferous forest, riparian scrub, riparian woodland, and valley and foothill grassland / 278-984 feet	April-May	**Surveys negative, presumed absent.** Suitable habitat occurs within gravelly substrate present on gravel bars and old channels.
Red Bluff dwarf rush *Juncus leiospermus* var. *leiospermus*	--/--/1B.1	Meadows and seeps, vernal pools; vernally mesic areas within chaparral, cismontane woodland, and valley and foothill grassland / 115-3,346 feet	March-May	**Surveys negative, presumed absent.** Suitable habitat occurs within the ponded area in the northeast corner of the study area.
Ahart's paronychia *Paronychia ahartii*	--/--/1B.1	Cismontane woodland, valley and foothill grassland and vernal pools / 90-1,530 feet	March-June	**Surveys negative, presumed absent.** Suitable habitat occurs within valley oak woodland and foothill grassland on the study area.

Status Codes[1]:
FED = Federal
ST = State
Federal & State Codes:
E = Endangered; T = Threatened

CNPS = California Native Plant Society
CNPS Codes:
List 1B = Rare, Threatened or Endangered in CA and Elsewhere;
List 2 = Rare, Threatened or Endangered in CA, but more common elsewhere

Special-Status Wildlife Species

Sixty five (65) special-status wildlife species were initially considered for analysis (Appendix D). Based upon location and habitat parameters, twenty-nine (29) special-status wildlife species were identified as having the potential to occur in the study area. Table 2 presents a list of these species and their likelihood of occurrence. Special-status designation and general habitat requirements for each species are provided in the table. Conclusions presented in this table are based on the

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	**Status[1] (Fed/State)**	**General Habitat Description**	**Comments**
Federal or State Listed Species			
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Elderberry shrubs associated with riparian forests that occur along rivers and streams.	**Present.** Protocol level surveys detected VELB exit holes on numerous 12 elderberry shrubs.
Green sturgeon, southern DPS *Acipenser medirostris*	T/SC	Spawn in Sacramento and Feather rivers; juveniles are thought to rear mainly in the estuary. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock. Spawn in the mainstem Sacramento River when temperatures range between 46-60 °F.	**Present**. Known to occur in the Sacramento River throughout all accessible reaches upstream at least to Anderson-Cottonwood Irrigation District dam near Redding, California.
Steelhead, California Central Valley DPS *Oncorhynchus mykiss* Critical Habitat	T/--	Spawn and rear in freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**. Occur in the mainstem Sacramento River and tributary streams. Adults migrate upstream during the fall/winter and spawn from winter to early spring. Juveniles rear in natal areas for 1-2 years before migrating to the ocean. Suitable spawning and rearing habitat exists in the Sacramento River.
Central Valley spring-run ESU Chinook salmon *Oncorhynchus tshawytscha* Critical Habitat Essential Fish Habitat	T/T	Freshwater rivers and streams. (Sacramento River and its tributaries)	**Present.** Occur in the mainstem Sacramento River and its major perennial tributary streams. Adults migrate upstream during the spring and spawn from mid-August to mid-October. Suitable spawning and rearing habitat exists in the Sacramento River.
Sacramento River winter-run ESU Chinook salmon *Oncorhynchus tshawytscha* Critical Habitat Essential Fish Habitat	E/E	Freshwater rivers and streams. (Sacramento River and its tributaries)	**Present**. Occur in the mainstem Sacramento River. Adults migrate upstream during the winter and spawn from mid-April to August. Suitable spawning and rearing habitat exists in the Sacramento River.
California red-legged frog *Rana aurora draytonii*	T/SC	Require aquatic habitat for breeding, also uses a variety of other habitat types including riparian and upland areas. Adults utilize dense, shrubby or emergent vegetation associated with deep-water pools with fringes of cattails & dense stands of overhanging vegetation.	**Absent.** Protocol level surveys did not detect this species (North State Resources 2007a).

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	**Status[1] (Fed/State)**	**General Habitat Description**	**Comments**
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	C/--	Nesting habitat is cottonwood/willow riparian forest. Occurs only along the upper Sacramento Valley portion of the Sacramento River, the Feather River in Sutter Co., the south fork of the Kern River in Kern Co., and along the Santa Ana, Amargosa, and lower Colorado rivers	**Absent.** Presently there are no known breeding pairs along the Sacramento River north of Red Bluff, CA. The site does not have sufficiently dense riparian forest to support breeding.
Bald eagle *Haliaeetus leucocephalus*	T/E	Forages on live and dead fish and nests in large trees or snags. Requires large bodies of water, including ocean shorelines, lake margins, and large, open river courses for foraging, nesting, and wintering habitat.	**Present**. Incidental observations of eagles foraging over the site. No nests reported or observed on the site.
Bank swallow *Riparia riparia*	--/T	Colonial nester on vertical banks or cliffs with fine-textured soils near water.	**Present**. Bank swallows and colony of nests observed on cut-bank of Sacramento River.
Other Special-Status Species			
River lamprey *(Lampetra ayresii)*	--/SC	The biology of river lampreys has not been studied in California, general habitat and life history thought to be similar to Pacific lamprey.	**Present**. Occur in the mainstem Sacramento River and tributary streams.
Central Valley fall/late-fall run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Essential Fish Habitat	--/SC	Freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**. Occur in the mainstem Sacramento River and tributary streams. Adults migrate upstream during the fall and spawn from mid-October to February. Suitable spawning and rearing habitat exists in the Sacramento River.
Hardhead (*Mylopharodon conocephalus*)	--/SC	Quiet deep pools of large, warm, clear streams over rocks or sand.	**Present**. Occur in the mainstem Sacramento River and tributary streams.
Western spadefoot toad *Spea hammondii*	--/SC	Grasslands with temporary pools.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Northwestern pond turtle *Clemmys marmorata marmorata*	--/SC	Slow water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Require an upland oviposition site in the vicinity of the aquatic site	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Double-crested cormorant *Phalacrocorax auritus*	--/SC	Inland lakes; fresh, salt and estuarine waters.	**May be present as migrant**. Suitable breeding habitat does not occur on the site or surrounding area.

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Comments
Merlin *Falco columbarius*	--/SC	Frequents ocean shorelines, lake margins, and large, open river courses near tree stands for both nesting and wintering habitat. Does not breed in California.	**May be present as migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
Western burrowing owl *Athene cunicularia hypugaea*	--/SC	Open habitats, dry grasslands and ruderal habitats with ground squirrel burrows.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Sharp-shinned hawk *Accipiter striatus*	--/SC	Typically nests in dense conifer stands near water, winters in woodlands. Forages in many habitats in winter and migration.	**May be present as migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
Cooper's hawk *Accipiter cooperii*	--/SC	Nests in woodlands, forages in many habitats in winter and migration.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Ferruginous hawk *Buteo regalis*	--/SC	Forages in grasslands and occasionally in other open habitats during migration and winter.	**May be present as rare migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
Prairie falcon *Falco mexicanus*	--/SC	Occurs in open habitats such as grasslands, desert scrub, rangelands and croplands. Nests on open cliffs.	**May be present as rare migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
White-tailed kite *Elanus leucurus*	--/FP	Nests in lowlands with dense oak or riparian stands near open areas, forages over grassland, meadows, cropland and marshes.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Osprey *Pandion haliaetus*	--/SC	Ocean shorelines, lake margins and large, open river courses for both nesting and wintering habitat.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
California yellow warbler *Dendroica petechia brewsteri*	--/SC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Yellow-breasted chat *Icteria virens*	--/SC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Loggerhead shrike *Lanius ludovicianus*	--/SC	Prefers open habitats with scatters shrubs and trees throughout the Central Valley of California. Nests in shrubs and trees.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Ringtail *Bassariscus astutus*	--/FP	Riparian habitats and in brush stands of most forest and shrub habitats. Nests in rock recesses, hollow trees, logs, snags, abandoned burrows or woodrat nests.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Pallid bat *Antrozous pallidus*	--/SC	Forages over many habitats; roosts in buildings, large oaks or redwoods, rocky outcrops and rocky crevices in mines and caves, and under bridges. Roosts must protect from high temperatures	**May be present as forager**. Site does not contain suitable breeding roosts.

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Comments
Western mastiff bat *Eumops perotis*	--/SC	Roosts in cliff faces, rock outcrops, and buildings. Forages in open habitats. Needs vertical face to take flight.	**May be present as forager**. Site does not contain suitable breeding roosts.

[1]Status Codes:

Federal and State Codes: E = Endangered; T = Threatened; SC = Species of Special Concern: FP = Fully Protected

knowledge of local professional biologists and historic survey information. All special-status wildlife species potentially breeding in the study area are discussed in detail below. A list of all wildlife species observed is presented in Appendix E.

3.3 DETAILED EVALUATION OF SPECIAL-STATUS PLANT SPECIES

No federal or state listed plant species have the potential to occur within the study area. There were four other special-status plant species determined to have the potential to occur in the study area: fox sedge (*Carex vulpinoidea*), silky cryptantha (*Cryptantha crinita*), Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*), and Ahart's paronychia (*Paronychia ahartii*). The status, habitat parameters, geographic distribution, and rationale for potential to occur on the site for each of these plant taxa is discussed below.

Fox sedge (*Carex vulpinoidea*). Federal Status: None; State Status: None; CNPS Status: List 2.2. This species is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be "Rare, Threatened or Endangered in California, but more common elsewhere."

Fox sedge is a tufted perennial in the sedge family (Cyperaceae). This species is known to occur in freshwater marshes and swamps and in riparian woodlands (California Native Plant Society 2001b). Fox sedge typically occurs at elevations between 98 and 3,937 feet above mean sea level and the blooming period is generally from May to June. Past experience specific to fox sedge in the Redding area has indicated that the optimal window of opportunity to observe this species occurs in late May.

Fox sedge is known to occur in the Inner North Coast Ranges, Cascade Range, and northern Sacramento Valley within Butte, Glenn, Shasta, Siskiyou, and Tehama counties (California Native Plant Society 2006; Tibor 2001). CNDDB records indicate that there is one occurrence of this species within five miles of the study area (California Department of Fish and Game 2007a).

Areas of potentially suitable habitat include the open water features located in the central and southern portions of the study area as well as the seasonal wetland in the southwest portion of the study area. These features have habitat and hydrology parameters, such as typical riparian plant species associates and duration of inundation and/or soil saturation, respectively, that qualify as sufficient to represent characteristic microhabitat attributes for fox sedge. Therefore, this species remained a target species for protocol-level botanical survey.

Silky Cryptantha (*Cryptantha crinita*). Federal Status: None; State Status: None; CNPS Status: List 1B. This species is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be "Rare, Threatened or Endangered in CA and Elsewhere."

Silky cryptantha is a small, annual in the borage family (Boraginaceae). This species is known to occur on sand and gravel deposits associated with intermittent and, occasionally, perennial streams (Nakamura and Nelson 2001) within cismontane woodland, lower montane coniferous forest, riparian scrub, riparian woodland, and valley and foothill grassland from elevations between 278 and 984 feet above mean sea level (Tibor 2001). Silky cryptantha typically occurs below 1,000 feet in elevation and the blooming period is generally from April to May (Nakamura and Nelson 2001). Past

experience specific to silky cryptantha in the Redding area has indicated that the optimal window of opportunity to observe this species in bloom occurs between late April and mid-May.

Silky cryptantha is restricted to the interior regions of northern California and is known to occur in the northern Sacramento Valley within Shasta and Tehama counties (Nakamura and Nelson 2001). CNDDB records indicate that there are three occurrences of this species within five miles of the study area (California Department of Fish and Game 2007a).

An area of potentially suitable habitat includes the gravel bar found along the Sacramento River along the western boundary of the site. Therefore, this species remained a target species for botanical survey efforts due to the presence of the gravel bar along the river, and attributes thereof, considered to have the potential to support populations of silky cryptantha.

Red Bluff Dwarf Rush (*Juncus leiospermus* var. *leiospermus*). Federal Status: None; State Status: None; CNPS Status: List 1B. This plant taxon is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be "Rare, Threatened or Endangered in CA and Elsewhere."

Red Bluff dwarf rush is a small, reddish grass-like annual in the rush family (Juncaceae). This plant taxon is known to occur in a variety of seasonally moist habitats that include meadows and seeps, vernal pools, and vernally mesic areas within chaparral, cismontane woodland, and valley and foothill grassland from elevations between 115 and 3,350 feet above mean sea level . It is often found in small, sparsely vegetated micro-habitats (e.g., tire ruts, gopher mounds). Red Bluff dwarf rush typically occurs between 200 and 1,000 feet in elevation and the blooming period is typically from April to early June (Nakamura and Nelson 2001). Past experience specific to Red Bluff dwarf rush in the Redding area has indicated that the optimal window of opportunity to observe this plant taxon in bloom occurs between late April and mid-May.

Red Bluff dwarf rush is restricted to the interior regions of northern California and is known to occur in the northern Sacramento Valley and surrounding foothills of the Cascade Range within Butte, Shasta, and Tehama counties (California Native Plant Society 2001b; Nakamura and Nelson 2001). Disjunct populations of Red Bluff dwarf rush also occur in the northeast corner of Shasta County and southern Lassen County. CNDDB records indicate that there are twelve occurrences of this species within five miles of the study area (California Department of Fish and Game 2007a).

An area of potential habitat includes the ponded area in the northeast corner of the study area This area remains mesic due to seepage from the Anderson Cottonwood Irrigation District canal. An unpaved road in this mesic area contains relatively unvegetated zones which represent characteristic microhabitat attributes for Red Bluff dwarf rush. Therefore, this taxon remained a target taxon for botanical survey efforts due to the presence of seasonally ponded features, and attributes thereof, considered to have the potential to support populations of Red Bluff dwarf rush.

Ahart's paronychia (*Paronychia ahartii*). Federal Status: None; State Status: None; CNPS Status: List 1B. This plant taxon is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be "Rare, Threatened or Endangered in CA and Elsewhere."

Ahart's paronychia is a small, inconspicuous annual in the carnation family (Caryophyllaceae). This plant taxon grows in cismontane woodland, and valley and foothill grassland from elevations between 90 and 1,530 feet above mean sea level. It is endemic to California and is threatened by habitat loss. Regionally, it is found in slightly wet areas that are sparsely vegetated.

CNDDB records that regional occurrences of this species indicate that there are no occurrences of this species within five miles of the study area (California Department of Fish and Game 2007a).

3.4 Detailed Evaluation of Special-Status Wildlife Species

Federal or State Listed Wildlife Species

Valley Elderberry Longhorn Beetle (VELB) (*Desmocerus californicus dimorphus*). Federal Status: Threatened; State Status: None. The USFWS formally listed the VELB as *threatened* on August 8, 1980 (45 FR 52803 52807). Critical Habitat was also designated at this time (45 FR 52803 52807). Changed land use in the riverside habitats to which it is restricted is the primary threat to this beetle.

The VELB is an insect endemic to the foothills and Central Valley of California. It inhabits riparian and associated upland habitats where elderberry (*Sambucus* spp.), its host plant, grows. Specifically, its range extends throughout the Central Valley and adjacent foothills up to the 3,000 foot elevation level to the east and the Central Valley watershed to the west (U.S. Fish and Wildlife Service 1999). VELB habitat consists of riparian forests whose dominant plant species include cottonwood (*Populus* spp.), sycamore (*Platanus* spp.), valley oak (*Quercus lobata*.), and willow (*Salix* spp.), with an understory of elderberry shrubs (U.S. Fish and Wildlife Service 1991). Elderberry shrubs with a basal stem diameters larger than 1 inch are considered by the USFWS as suitable VELB habitat (U.S. Fish and Wildlife Service 1999).

The VELB life cycle is intimately connected to its habitat, elderberry shrubs. Following mating, the female lays her eggs in crevices in the elderberry bark. Upon hatching (after about 10 days), the larvae bore into the pith of the shrub and feed inside stems larger than 1 inch in diameter for 1 to 2 years until they mature. They emerge as adults during the spring via exit holes chewed through the bark. The adult beetles feed on the elderberry foliage until they mate, completing the cycle. Adults are active from March to June.

The study area has large areas of riparian forest containing elderberry shrubs and CNDDB records indicate an occurrence of VELB within five miles of the site.

Green Sturgeon, Southern DPS (*Acipenser medirostris*). Federal Status: Threatened; State Status: Species of Special Concern.

Relatively little is known about green sturgeon in the Sacramento River compared to its relative the white sturgeon (*Acipenser transmontanus*). Adult green sturgeon generally migrate into rivers between late-February and late-July. Spawning takes place in deep, fast water from March to July when water temperatures range from 46 °F to 60 °F. Juveniles may rear in the river for 1 to 3 years before migrating to the estuary, primarily during the summer and fall. Once in the estuary young sturgeon adopt an oceanic foraging habit, which may last from 3 to 13 years before returning for their first spawning season (Moyle 2002).

Green sturgeon use streams, rivers, and estuarine habitat as well as marine waters during their life cycle. Like the white sturgeon, green sturgeon prefer to spawn in lower to middle reaches of large rivers with swift currents and large cobble; no nest is built, adults broadcast spawn into the water column. The fertilized eggs sink and attach to the bottom to hatch. Research indicates that water flow is one of the key determinants of larval survival (Moyle 2002).

In the final determination to list the southern DPS as threatened under FESA, NMFS identified the reduction of available spawning habitat due to construction of barriers along the Sacramento and Feather rivers as being the principal threat to green sturgeon in the southern DPS (71 FR 17757). Other threats include, but are not limited to, insufficient flow rates, increased water temperature, water diversion, non-native species, poaching, pesticide and heavy metal contamination, and local fishing.

California Central Valley DPS Steelhead *(Onchorynchus mykiss)* Federal Status: Threatened; State Status: None.

Steelhead possess one of the most complex life history patterns of the Pacific salmonid species. Steelhead typically refers to the anadromous form of rainbow trout. Similar to other Pacific salmon, steelhead adults spawn in freshwater and spend a part of their life history at sea. However, unlike Chinook salmon, steelhead exhibit a variety of life history strategies during their freshwater rearing period and as adults may spawn more than once during their life. The typical life history pattern for steelhead is to rear in freshwater streams for two years followed by up to two or three years of residency in the marine environment. However, juvenile steelhead may rear in freshwater from one to four years (Busby et al. 1997; Moyle 2002).

Steelhead populations inhabiting the upper Sacramento River basin belong to the Central Valley steelhead DPS as defined by Good et al. (1997). These steelhead populations generally exhibit a life history pattern typical of a fall/winter run. This species historically has provided a popular sport fishery throughout the Sacramento River and its tributaries; however, at present naturally-produced steelhead remain at relatively low levels throughout their range in the Central Valley (Hallock 1989; McEwan 2001).

Steelhead adults may enter the Sacramento River and its tributaries from August through March, but peak migration generally occurs from October through February. Spawning begins in late December and can extend into early-April. Steelhead spawn in gravel and small cobble substrates usually associated with riffle and run habitat types. The upper mainstem Sacramento River is known to provide suitable spawning and juvenile rearing habitat for steelhead. The Sacramento River in the vicinity of the project may be used by steelhead during all life stages, including spawning and egg incubation.

Critical habitat designations for listed anadromous salmonids published in September 2005 (70 FR 52488) were finalized as part of the recent status reviews and are restricted to the species' anadromous range, which is coextensive with the steelhead-only DPS delineations described in that notice (71 FR 834). Designated critical habitat for Central Valley steelhead DPS includes all river reaches accessible to steelhead in the Sacramento and San Joaquin rivers and their tributaries, which includes the Sacramento River adjacent to the action area.

Central Valley Spring-run Chinook Salmon ESU *(Onchorynchus tshawytscha* Federal Status: Threatened; State Status: Threatened.

Spring-run Chinook salmon migrate upstream during the spring beginning in March, hold over in deep pools of the mainstem river and its large perennial tributaries, where fish can access cold headwaters, during the summer months, and spawn from mid-August through mid-October. Most of the spring run in the Sacramento River Basin ascend and spawn in the principal tributary streams (Mill, Deer, Clear, and Butte creeks, and the Feather River). Egg incubation occurs from mid-August through mid-January. Spring-run in the Sacramento River exhibit an ocean-type life history, emigrating as fry, sub-yearlings, and yearlings. Based on observations at Red Bluff Diversion Dam, spring-run emigration from the upper Sacramento River typically occurs from November through April (Vogel and Marine 1991; (Johnson, Weigand, and Fisher 1992)). Although some spring-run salmon may spawn in the Sacramento River between Red Bluff and Keswick Dam, it is thought that most have hybridized with fall-run salmon due to overlapping spawning periods, lack of spatial separation, and redd superimposition (California Department of Fish and Game 1998).

Central Valley spring-run ESU Chinook salmon populations in the Sacramento River and its tributaries have remained relatively depressed; however, some modest increases have occurred in their principal spawning tributaries such as Deer, Mill, and Butte Creeks (California Department of Fish and Game 2004). Spring-run Chinook salmon spawning in the mainstem Sacramento River and nearby tributaries such as Clear Creek and Battle Creek remain relatively depressed (California Department of Fish and Game 2004).

Designated critical habitat for Central Valley spring-run Chinook salmon includes the San Francisco Bay-Delta estuary, mainstem Sacramento River upstream to Keswick Dam and most of the Sacramento Valley's perennial tributaries with established spring salmon runs, including the Feather River and Feather River Hatchery. Designated critical habitat for Central Valley spring-run Chinook salmon includes all river reaches accessible to the species in the Sacramento and San Joaquin Rivers and their tributaries in California, which includes the Sacramento River adjacent to the property.

Sacramento River Winter-run Chinook Salmon ESU *(Onchorynchus tshawytscha)*. Federal Status: Endangered; State Status: Endangered.

Historically, winter-run Chinook salmon spawned in the cold spring-fed headwaters of the upper Sacramento, Pit, McCloud, and Calaveras rivers (U.S. Fish and Wildlife Service 1995). Following construction of Shasta Dam, deep water releases during the summer months provided suitable cold water conditions for winter-run Chinook salmon spawning and rearing downstream of the dam. In response to these conditions, which increased total coldwater spawning habitat available to the winter run, the population increased. In 1969, the winter run exceeded 100,000 salmon; however, during the early 1990's, run size estimates have ranged from about 1,400 fish to as low as about 200 fish in some years. The Sacramento River winter-run Chinook salmon population has exhibited a continuing recovery from the extremely low adult returns observed in the early 1990's. Recent spawning populations range from about 7,000 to 8,000 (California Department of Fish and Game 2004); however, these levels remain well below draft recovery goals established for this run (National Marine Fisheries Service 2004).

Winter-run Chinook salmon begin their migration up the Sacramento River in December and may spawn from mid-April through mid-August with a peak in spawning occurring from late May through June (Vogel and Marine 1991; Moyle 2002). Winter-run Chinook salmon spawning and juvenile rearing areas include the river reach adjacent to the project site (D. Killam, CDFG, unpublished data).

The egg incubation period extends from mid-April through mid-September. Juvenile winter-run Chinook salmon are known to rear in suitable habitats of the upper Sacramento River, including that adjacent to the project site.

The critical habitat designation includes the Sacramento-San Joaquin Delta and the Sacramento River, within all accessible reaches, including that reach adjacent to the action area. Constituent elements of anadromous salmonid critical habitat is considered to include seasonal timing and volume of stream flows sufficient to allow the fish to migrate, reproduce and rear; suitable streambed and bank conditions to support spawning, incubation, and larval development; suitable water quantity and quality and floodplain connectivity to form and maintain physical habitat to support juvenile development, growth, and mobility; natural cover such as shade, submerged and overhanging vegetation and large wood, log jams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; and finally, freshwater migration corridors free of obstruction with water quantities and quality and natural cover that support juvenile and adult fish migration and survival (69 FR 71880).

California Red-legged Frog (*Rana aurora draytonii).* Federal Status: Threatened; State Status: Species of Special Concern. The California red-legged frog inhabits quiet pools of streams, marshes, and ponds. All life history stages are most likely to be encountered in and around breeding sites, which include coastal lagoons, marshes, springs, permanent and semi permanent natural ponds, and ponded and backwater portions of streams, as well as artificial impoundments such as stock ponds, irrigation ponds, and siltation ponds. This species breeds from March to July; females lay 750 to 4000 eggs in clusters, attached to vegetation 7 to 15 cm (2 to 6 in) below the water surface. Juveniles can occur in slow moving, shallow riffle zones in creeks or along the margins of ponds. Eggs are typically deposited in permanent pools, attached to emergent vegetation (Zeiner, Laudenslayer, and Mayer 1989)

The historic range of the California red-legged frog extended along the coast from the vicinity of Point Reyes National Seashore, Marin County, and inland from the vicinity of Redding, Shasta County, southward to northwestern Baja California, Mexico. The species has lost approximately 70 percent of its former range; California red-legged frogs are locally abundant in the San Francisco Bay area and the central coast, but only isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse ranges (50 CFR Part 17 14626).

NSR staff conducted a USFWS protocol-level site assessment for California red-legged frog, and produced a separate detailed report (North State Resources 2007a). NSR staff did not observe any California red-legged frogs during the USFWS protocol-level surveys, but did conclude that the seasonal pond in the central region of the site provides suitable breeding habitat. The nearest known records of California red-legged frog are from Thomes Creek and Sunflower Gulch on Red Bank Creek, approximately 33 miles south southwest of the project site.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*). Federal Status: Candidate; State Status: Endangered. The western yellow-billed cuckoo is a federal candidate for listing. It is generally considered a neotropical migrant that arrives in California to begin breeding in June.

In northern California it prefers riparian forests, containing willow (*Salix* spp.) and Fremont cottonwood (*Populus fremontii*) (Laymon 1998). It is also found in orchards adjacent to river bottoms. The western yellow-billed cuckoo feeds primarily on large insects but also occasionally takes small frogs, lizards, eggs, and young birds. The species is known to be an interspecific brood parasite, laying eggs in the nests of at least 11 other bird species (Hughes 1999). Major declines among western populations in twentieth century due to habitat loss and fragmentation, local extinctions, and low colonization rates; now extremely rare in most areas . There are approximately 30 pairs breeding in California. The nearest known breeding pairs are approximately 30 miles south of the project site along the Sacramento River (Laymon 1998).

Bald Eagle (*Haliaeetus leucocephalus*). Federal status: Delisted (previously endangered); State status: Endangered. The bald eagle is a large soaring bird; in North America, it is second in size only to the California condor (*Gymnogyps californianus*). Most of the annual food requirements of a bald eagle is derived from or obtained around aquatic habitats. The food most often consumed consists of fish, water birds, and small to medium-sized mammals. Because of the dietary association, nesting territories are usually found near water.

Perches are used primarily during the day for resting, preening, and hunting, and may include human-made structures such as power poles. Roosting areas contain a night communal roosting tree that is easily accessible to the large birds and tall enough to provide safety from threats from the ground. Bald eagle nests and roosts are usually found where human activity is infrequent or muted. In California, breeding pairs are found mostly in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties (U.S. Fish and Wildlife Service 2007a).

The USFWS delisted the bald eagle in 2007, and attributes the recovery of the species to reduction in use of organochlorine pesticides and habitat conservation (U.S. Fish and Wildlife Service 2007a). NSR staff have have incidentally observed bald eagles foraging over the project site, but have not observed them nesting on the project site.

Bank Swallow (*Riparia riparia*). Federal status: None; State status: Threatened. Bank swallows are found primarily in riparian and other lowland habitats in the Central Valley, typically between April and September. They nest colonially and inhabit isolated places where fine-textured or sandy, vertical bluffs or riverbanks are available in which to dig burrows. Bank swallows forage over open riparian areas, brushland, grassland, and cropland.

The species' range in California is estimated to be have been reduced by 50 percent since 1900 (Zeiner et al. 1990a). Now, only 110 to 120 colonies remain within the state. Perhaps 75 percent of the current breeding population in California occurs along the banks of the Sacramento and Feather rivers in the northern Central Valley in areas where the rivers still meander in a mostly natural state. About 50 to 60 colonies remain along the middle Sacramento River, and 15 to 25 colonies occur along the lower Feather River. Other colonies persist along the central coast from Monterey to San

Mateo counties and in northeastern California in Shasta, Siskiyou, Lassen, Plumas, and Modoc counties (Zeiner et al. 1990a).

Other Special-Status Wildlife Species

River Lamprey *(Lampetra ayresii)* Federal Status: None; State Status: Species of Special Concern. River lamprey are anadromous; like salmon they are born in freshwater streams, migrate to the ocean, and return to fresh water as mature adults to spawn. Also like the salmon, lampreys do not feed during their spawning migration. Mating pairs of lamprey construct a nest by digging together using rapid vibrations of their tails and by moving stones using their suction mouths. They enter streams from July to October; spawning takes place the following spring when water temperatures are between 50° and 62.6°F. They ascend rivers by alternately swimming upstream in brief spurts and resting by sucking and holding on to rocks. Spawning takes place in low-gradient reaches of streams with gravel and sandy bottoms. Adults die within 4 days of spawning, after depositing from 10,000 to 100,000 very small-sized eggs in their nest. The young hatch in 2 to 3 weeks and swim to areas of low-velocity water where sediments are soft and rich in dead plant materials. They quickly burrow into the muddy bottom, where they filter the mud and water, eating microscopic plants (mostly diatoms) and animals.

Juvenile lamprey will stay burrowed in the mud for 3 to 6 years, moving only rarely to new areas. After a 2-month metamorphosis, triggered by unknown factors, they metamorphose into an adult morphology averaging 4.5 inches long. Newly metamorphosed lampreys migrate downstream during winter and spring high flow events. Adult river lampreys are thought to spend from 2 to 12 months in the estuary or ocean before returning to the rivers to spawn. River lamprey are known to occur in the Sacramento River (Moyle 2002).

Central Valley Fall/Late-fall Run Chinook Salmon ESU (Oncorhynchus tshawytscha) Federal Status: None; State Status: Species of Special Concern. The Central Valley fall/late-fall run ESU Chinook salmon comprises the largest present day population of Chinook salmon in the Central Valley. Fall-run Chinook salmon begin to enter the Sacramento River in July and the run builds through the late summer and fall months peaking by late-September and October (Vogel and Marine 1991). Spawning occurs throughout the upper Sacramento River and in a majority of its tributaries from mid-October through December (Vogel and Marine 1991; Moyle 2002). Spawning densities of fall run salmon are very high in the Sacramento River from near Red Bluff to Keswick Dam (D. Killam, CDFG, personal communication). Juvenile fall-run Chinook salmon rear throughout the Sacramento River and its tributaries. Juvenile fall run fry may emigrate to the estuary from shortly after they hatch through the spring and summer months following their birth.

The late-fall run component of this Chinook salmon ESU enters the Sacramento-San Joaquin estuary and ascends Central Valley streams after the fall run, usually from late-October through March (Vogel and Marine 1991). Spawning begins in January and is usually complete by late-April. Late-fall run spawning densities are greatest in the upper Sacramento River from Red Bluff to Keswick Dam. Both fall and late-fall run salmon use the spawning habitat of the mainstem river adjacent to the study area (CDFG, unpublished data). Juvenile late-fall run salmon rear in the upper Sacramento

River from late-April through the following winter before emigrating to the estuary (Vogel and Marine 1991; Moyle 2002).

Large numbers of the fall run and late-fall run salmon are spawned and reared by state and federal fish hatcheries in California's Central Valley. The number of hatchery-produced fish may greatly exceed the number naturally produced fall/late-fall run Chinook salmon in some Central Valley streams which has led to concern over the viability of certain tributary populations. These runs support valuable and popular ocean and river commercial and sport fisheries.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a federal fisheries management plan (FMP). EFH refers to those waters and substrates necessary for the spawning, breeding, feeding, or growth to maturity. Central Valley spring-run ESU Chinook salmon, Central Valley fall/late-fall run ESU Chinook salmon, and Sacramento River winter-run ESU Chinook salmon are all managed under a FMP and are therefore subject to protection under MSA.

The Sacramento River is designated by the National Marine Fisheries Service (NMFS) to contain EFH for Chinook salmon, as defined by the Magnuson-Stevens Fisheries Conservation and Management Act of 1994, as amended. EFH refers to those waters and substrates necessary for spawning, breeding, feeding, or growth to maturity. Freshwater EFH for salmon consists of four major components: spawning and incubation habitat; juvenile rearing habitat; juvenile migration corridors; and adult migration corridors and adult holding habitat (Pacific Fishery Management Council 2003).

The Sacramento River adjacent to the project site provides all four major components of freshwater EFH for salmon. Adult Chinook salmon migrate to and are known to spawn within all suitable habitats adjacent to the project site. Fry and juveniles are known to occur in suitable rearing habitats nearly year round. Medium to large cobbles and boulders dominate the river bottom in these habitats, providing suitable cover and refuge for rearing salmonids.

Hardhead *(Mylopharodon conocephalus)* Federal Status: None; State Status: Species of Special Concern. Hardhead were identified as a California Species of Special Concern in 1995 (Moyle et al. 1995). Hardhead are listed as a Class 3 species of special concern. Class 3 species are those fish species occupying much of their native range, but that were formerly more widespread or abundant within that range. Included in this classification are taxa with very restricted distributions (e.g., Eagle Lake tui chub). The populations of such species need to be assessed periodically (i.e., every 5 years) and included in long-term plans for protected waterways.

Hardhead are large cyprinids that closely resemble Sacramento pikeminnow and are widely distributed in low- to mid-elevation streams in the Sacramento–San Joaquin drainage. Hardhead typically inhabit undisturbed areas of larger low- to mid-elevation streams, although they are also found in the mainstem Sacramento River at low elevations and in its tributaries to about 4,921 feet . They prefer clear, deep pools and runs with slow velocities and occur in streams where summer temperatures reach in excess of 68°F (Moyle 2002).

Historically, hardhead have been regarded as widespread and abundant in central California and are still widely distributed in foothill streams. The specific risk to hardhead is their increasingly isolated populations, making them vulnerable to localized extinctions. Hardhead also tend to be absent from streams where introduced species dominate (Mayden, Rainboth, and Buth 1991; Moyle and Daniels 1982), and from streams that have been severely altered by human activity (Baltz and Moyle 1993).

Western Spadefoot Toad (*Spea hammondi*). Federal status: None; State Status: Species of Special Concern. Historically, the western spadefoot toad ranged from Redding to northwestern Baja, California. It has been extirpated from many locations within this range. Since 1990, there have been sightings in Alameda, Butte, Calaveras, Fresno, Kern, Kings, Los Angeles, Madera, Merced, Monterey, Orange, Placer, Riverside, Sacramento, San Benito, San Diego, San Joaquin, San Luis Obispo, Santa Barbara, Stanislaus, Tulare, Ventura, and Yolo counties (U.S. Fish and Wildlife Service 2007c).

The western spadefoot toad occurs primarily in grassland locations, but occasional populations also occur in valley-foothill hardwood woodlands. Some populations persist for a few years in orchard-vineyard habitats (Zeiner, Laudenslayer, and Mayer 1989). The species is found at elevations below 3,000 feet but can occur up to 4,500 feet. Western spadefoot toads breed in temporary pools from January to May. Water temperatures in these pools must be between 48ºF and 86ºF. Eggs are deposited on plant stems or on pieces of detritus in temporary rain pools or, less frequently, in pools in ephemeral stream courses (U.S. Fish and Wildlife Service 2007c).

Western spadefoot toads are extremely sensitive to low frequency noises and vibrations. These disturbances cause western spadefoot toads to break dormancy and emerge from their burrows (Dimmitt and Ruibal 1980).

Northwestern Pond Turtle (*Clemmys marmorata marmorata*). Federal Status: None; State Status: Species of Special Concern. The northwestern pond turtle is found in the quiet waters of ponds, marshes, creeks, and irrigation ditches. This species requires basking sites such as partially submerged logs, rocks, mats of floating vegetation, or open mud banks. They frequently bask on logs or other objects out of the water when water temperatures are low and air temperatures are greater than water temperatures. When air temperatures become too warm, western pond turtles water bask by lying in the warmer surface water layer with their heads out of the water. Hibernation in colder areas is passed underwater in bottom mud (Zeiner, Laudenslayer, and Mayer 1989). Mating typically occurs in late April or early May, but may occur year-round. Nests are located in an upland location that may be a considerable distance from the aquatic site (up to ¼ mile) (California Department of Fish and Game 1994). Hatchling turtles are thought to emerge from the nest and move to the aquatic site in the spring. Today, the northwestern pond turtle occurs in 90% of its historic range in the Central Valley and west of the Sierra Nevada mountains, but in greatly reduced numbers (Jennings and Hayes 1994). It occurs from the Oregon border south to the American Basin in the Central Valley, where it intergrades with southwestern pond turtle.

Western Burrowing Owl (*Athene cunicularia hypugaea*). Federal status: None; State status: Species of Special Concern. The western burrowing owl inhabits open, dry grasslands and deserts, as well as open stages of pinyon-juniper and ponderosa pine. The nesting season is between February 1 and August 31. Western burrowing owls typically nest in abandoned rodent burrows, particularly

those of California ground squirrels, which they modify each year. Burrowing owls forage in open grassland areas adjacent to nest sites. The species has also been documented in open areas near human habitation, especially airports and golf courses. The Central Valley and surrounding foothill regions of California provide year-round habitat for the western burrowing owl.

The study area has the general habitat requirements for the burrowing owl, but NSR staff did not note rodent activity and burrows during the site visits. There are no recorded CNDDB occurrences of the western burrowing owl within a 5-mile radius of the study area (California Department of Fish and Game 2007a).

Cooper's Hawk (*Accipiter cooperii*). Federal status: None; State status: Species of Special Concern. Cooper's hawks prefer landscapes where wooded areas occur in patches and groves facilitating the ambush hunting tactics employed by this species. The species preys upon medium-sized birds (e.g., jays, doves, and quail) and occasionally takes small mammals and reptiles. Breeding pairs in California prefer nest sites within dense stands of live oak woodland or riparian areas, and prey heavily on young birds during the nesting season. Cooper's hawks are breeding residents throughout most of the wooded areas in California, but populations have declined in recent decades (Zeiner et al. 1990a).

Cooper's hawks have the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

White-tailed Kite (*Elanus leucurus*). Federal Status: None; State Status: Fully Protected Species. The white-tailed kite can be found in association with the herbaceous and open stages of a variety of habitat types, including open grasslands, meadows, emergent wetlands, and agricultural lands. Nests are constructed near the top of dense oaks, willows, or other tree stands located adjacent to foraging areas. The species forages in undisturbed, open grasslands, meadows, farmlands and emergent wetlands. White-tailed kite are seldom observed more than 0.5 mi (0.8 km) from an active nest during the breeding season (Zeiner et al. 1990a). The white-tailed kite is found year-round in both the coastal zones and lowlands of the Central Valley in California.

White-tailed kites have the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

Osprey (*Pandion haliaetus*). Federal Status: None; State Status: Species of Special Concern. In California, osprey are common summer residents and breeders but are less common in winter. Osprey breed primarily in scattered locations throughout northern California from the Cascade Ranges south to Lake Tahoe, and along the coast south to Marin County. They nest and roost on exposed treetops, towers, pilings, or similar structures near lakes, reservoirs, rivers, estuaries, and the open sea coast. They forage over fish-bearing bodies of water. Current threats to the species include degradation of aquatic environments such as rivers and lakes and loss of nesting structures such as trees to timber harvest and other activities (Zeiner et al. 1990a).

Osprey have the potential to nest within the study area in the riparian area along the Sacramento River. There are two CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

California Yellow Warbler (*Dendroica petechia brewsteri*). Federal Status: None; State Status: Species of Special Concern. The yellow warbler is a long-distance migrant, usually arriving in California in April and leaving by October. The species breeds from mid-April to early August, building an open cup nest in a tree or shrub. Foraging patterns typically involve gleaning and hovering for insects and spiders. The yellow warbler occurs as a summer resident in northern California. It is usually found in dense riparian deciduous habitats with cottonwoods, willows, alders, and other small trees and shrubs typical of open-canopy riparian woodlands.

Yellow warblers have the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

Yellow-breasted Chat (Ictera virens); Federal Status: None; State Status; Species of Special Concern. The yellow-breasted chat is a neotropical migrant that occurs in riparian or marsh habitats throughout California. They are found in dense, brushy thickets near water and in the thick understory of riparian woodlands. Forage patterns usually involve gleaning insects, spiders, and berries from the foliage of shrubs and low trees. Nests are often low to the ground in dense shrubs along streams. They occur as summer breeding residents in the Sacramento River Valley and its tributaries (Zeiner et al. 1990a).

Yellow-breated chat has the potential to nest within the study area in the riparian forest along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

Loggerhead Shrike (*Lanius ludovicianus*). Federal Status: None; State Status: Species of Special Concern. The loggerhead shrike prefers open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches located in open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper, juniper, desert riparian, and Joshua tree habitats. Loggerhead shrikes skewer their prey to thorns or barbs on barbed-wire fences. The purpose of this trait may be to help kill the prey or to cache the food for latter consumption. Loggerhead shrikes are found in lowlands and foothills throughout California (Zeiner et al. 1990a).

Loggerhead shrike has the potential to nest within the study area within the valley oak woodland. NSR staff did not observe this species or any nests during site visits.

Ringtail (*Bassiriscus astutus*). Federal Status: None; Federal Status: Fully Protected Species. The ringtail occurs in various riparian habitats in and brush stands of most forest and shrub habitats. Nocturnal, and primarily carnivorous, ringtails mainly eat small mammals but also feed on birds, reptiles, insects, and fruit. They forage on the ground, among rocks, and in trees; usually near water.

Hollow trees and logs, cavities in rocky areas, and other recesses are used for cover. The ringtail is widely distributed in California (Zeiner et al. 1990b).

Ringtail has the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species during site visits.

3.5 FIELD REVIEW/SURVEYS

During the field reconnaissance and protocol-level surveys, the study area was inspected to identify plant and wildlife special-status species and/or potential habitat for these species in the study area. Lists of all plant and wildlife species observed are presented in Appendix E.

Botany

No special-status vascular plant species were detected as a result of botanical survey efforts. A list of all plant species observed is presented in Appendix E.

Wildlife

3.5.1.1 ***NSR staff California Red-Legged Frog Assessment***

NSR staff conducted a USFWS protocol-level site assessment for California red-legged frog, and produced a separate detailed report (North State Resources 2007a). NSR staff did not observe any California red-legged frogs during the USFWS protocol-level surveys, but did conclude that the seasonal pond in the central region of the site provides suitable breeding habitat.

3.5.1.2 ***Valley Elderberry Longhorn Beetle Surveys***

Sixty two (62) elderberry shrubs with stems measuring 1-inch or greater in diameter at ground level were detected during the surveys. Nearly all of the recorded elderberry shrubs are located within the valley foothill riparian and valley oak woodland habitat types in the southwest and south central section of the study area (Figure 3 in map pocket). Several of the elderberry shrubs are within the 100-foot buffer zone just south of the boundary at the southwest corner of the study area. Two of the 62 elderberry shrubs were deeply embedded within Himalayan blackberry brambles and were inaccessible for close inspection. Field survey data for the 62 elderberry shrubs are presented in a table in Appendix F.

Exit holes characteristic of VELB (e.g. exit hole oval to circular, approximately ¼ inch in diameter, and without beveled edges; exit hole on stem greater than one inch in diameter and within six feet from ground) were detected on 13 of the 60 elderberry shrubs that were accessible for close inspection. These 13 elderberry shrubs are located within valley foothill riparian and valley oak woodland habitats in the southwest and south central section of the study area (Figure 3 in map pocket). All of the 36 observed VELB exit holes are within six feet above ground level and located in live stems greater than 1-inch in diameter. There were both new exit holes, characterized by sharp hole edges and light colored wood, and older exit holes, characterized by the gradual sealing of the hole due to cambial growth (See photographs in Appendix G).

3.5.1.3 ***Incidental Special-Status Wildlife Observations***

NSR staff made incidental field observations of 30 wildlife species including one special-status species; bank swallow (Appendix E). NSR botanist/plant ecologist, Mr. Boggs and NSR biologist, Ms. Bolen observed a colony of bank swallows nesting in the cut-bank of the Sacramento River within the northern portion of the study area (Figure 3 in map pocket).

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APPENDIX A

U.S. Fish and Wildlife Service Species List

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

April 26, 2007

Document Number: 070426124401

Michael Gorman
North State Resources, Inc.
500 Orient St. Suite 150
Chico, CA 95928

Subject: Species List for Strawberry Fields Property

Dear: Mr.

We are sending this official species list in response to your April 26, 2007 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 25, 2007.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found at www.fws.gov/sacramento/es/branches.htm.

Endangered Species Division

TAKE PRIDE IN AMERICA

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 070426124401

Database Last Updated: March 5, 2007

Quad Lists

Listed Species

Invertebrates

Branchinecta conservatio
- *Conservancy fairy shrimp (E)*

Branchinecta lynchi
- *Critical habitat, vernal pool fairy shrimp (X)*
- *vernal pool fairy shrimp (T)*

Desmocerus californicus dimorphus
- *valley elderberry longhorn beetle (T)*

Lepidurus packardi
- *Critical habitat, vernal pool tadpole shrimp (X)*
- *vernal pool tadpole shrimp (E)*

Pacifastacus fortis
- *Shasta crayfish (E)*

Fish

Acipenser medirostris
- *green sturgeon (T) (NMFS)*

Hypomesus transpacificus
- *delta smelt (T)*

Oncorhynchus mykiss
- *Central Valley steelhead (T) (NMFS)*
- *Critical habitat, Central Valley steelhead (X) (NMFS)*

Oncorhynchus tshawytscha
- *Central Valley spring-run chinook salmon (T) (NMFS)*
- *Critical Habitat, Central Valley spring-run chinook (X) (NMFS)*
- *Critical habitat, winter-run chinook salmon (X) (NMFS)*
- *winter-run chinook salmon, Sacramento River (E) (NMFS)*

Amphibians

Rana aurora draytonii
- *California red-legged frog (T)*

Birds

Haliaeetus leucocephalus
- *bald eagle (T)*

Strix occidentalis caurina
- *northern spotted owl (T)*

Plants

Orcuttia tenuis
- *Critical habitat, slender Orcutt grass (X)*
- *slender Orcutt grass (T)*

Candidate Species

Fish

Oncorhynchus tshawytscha

Central Valley fall/late fall-run chinook salmon (C) (NMFS)
Critical habitat, Central Valley fall/late fall-run chinook (C) (NMFS)

Birds

Coccyzus americanus occidentalis

Western yellow-billed cuckoo (C)

Quads Containing Listed, Proposed or Candidate Species:

BALLS FERRY (628B)
COTTONWOOD (629A)
OLINDA (629B)
BELLA VISTA (646B)
PALO CEDRO (646C)
PROJECT CITY (647A)
SHASTA DAM (647B)
REDDING (647C)
ENTERPRISE (647D)

County Lists

Shasta County

Listed Species

Invertebrates

Branchinecta lynchi

Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardi

Critical habitat, vernal pool tadpole shrimp (X)
vernal pool tadpole shrimp (E)

Pacifastacus fortis

Shasta crayfish (E)

Fish

Hypomesus transpacificus

delta smelt (T)

Oncorhynchus mykiss

Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha

Central Valley spring-run chinook salmon (T) (NMFS)
Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)

winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii

California red-legged frog (T)

Birds

Haliaeetus leucocephalus

bald eagle (T)

Strix occidentalis caurina

Critical habitat, northern spotted owl (X)

northern spotted owl (T)

Plants

Orcuttia tenuis

Critical habitat, slender Orcutt grass (X)

slender Orcutt grass (T)

Tuctoria greenei

Critical habitat, Greene's tuctoria (=Orcutt grass) (X)

Greene's tuctoria (=Orcutt grass) (E)

Candidate Species

Fish

Oncorhynchus tshawytscha

Central Valley fall/late fall-run chinook salmon (C) (NMFS)

Critical habitat, Central Valley fall/late fall-run chinook (C) (NMFS)

Birds

Coccyzus americanus occidentalis

Western yellow-billed cuckoo (C)

Mammals

Martes pennanti

fisher (C)

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.

(C) *Candidate* - Candidate to become a proposed species.

(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.

(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our critical habitat page for maps.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 25, 2007.

APPENDIX B

CNDDB Query Results

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
1	***Agelaius tricolor*** tricolored blackbird	ABPBXB0020			G2G3	S2	SC
2	***Agrostis hendersonii*** Henderson's bent grass	PMPOA040K0			G1Q	S1.1	3.2
3	***Anthicus antiochensis*** Antioch Dunes anthicid beetle	IICOL49020			G1	S1	
4	***Anthicus sacramento*** Sacramento anthicid beetle	IICOL49010			G1	S1	
5	***Antrozous pallidus*** pallid bat	AMACC10010			G5	S3	SC
6	***Branchinecta lynchi*** vernal pool fairy shrimp	ICBRA03030	Threatened		G3	S2S3	
7	***Carex scoparia*** pointed broom sedge	PMCYP03C90			G5	S2S3	2.2
8	***Carex vulpinoidea*** fox sedge	PMCYP03EN0			G5	S2.2	2.2
9	***Castilleja rubicundula ssp. rubicundula*** pink creamsacs	PDSCR0D482			G5T2	S2.2	1B.2
10	***Clarkia borealis ssp. borealis*** northern clarkia	PDONA05062			G3T2	S2.3	1B.3
11	***Cryptantha crinita*** silky cryptantha	PDBOR0A0Q0			G1	S1.1	1B.2
12	***Desmocerus californicus dimorphus*** valley elderberry longhorn beetle	IICOL48011	Threatened		G3T2	S2	
13	***Emys (=Clemmys) marmorata marmorata*** northwestern pond turtle	ARAAD02031			G3G4T3	S3	SC
14	***Euderma maculatum*** spotted bat	AMACC07010			G4	S2S3	SC
15	***Fluminicola seminalis*** Nugget Pebblesnail	IMGASG3110			G2	S1S2	
16	***Gratiola heterosepala*** Boggs Lake hedge-hyssop	PDSCR0R060		Endangered	G3	S3.1	1B.2
17	***Great Valley Cottonwood Riparian Forest***	CTT61410CA			G2	S2.1	
18	***Great Valley Mixed Riparian Forest***	CTT61420CA			G2	S2.2	
19	***Great Valley Valley Oak Riparian Forest***	CTT61430CA			G1	S1.1	
20	***Great Valley Willow Scrub***	CTT63410CA			G3	S3.2	
21	***Haliaeetus leucocephalus*** bald eagle	ABNKC10010	Threatened	Endangered	G5	S2	
22	***Hydromantes shastae*** Shasta salamander	AAAAD09030		Threatened	G1G2	S1S2	
23	***Juncus leiospermus var. leiospermus*** Red Bluff dwarf rush	PMJUN011L2			G2T2	S2.2	1B.1
24	***Lanx patelloides*** Kneecap Lanx	IMGASL7030			G1	S1	
25	***Legenere limosa*** legenere	PDCAM0C010			G2	S2.2	1B.1
26	***Lepidurus packardi*** vernal pool tadpole shrimp	ICBRA10010	Endangered		G3	S2S3	

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
27	***Limnanthes floccosa ssp. bellingeriana*** Bellinger's meadowfoam	PDLIM02041			G4T2	S1.1	1B.2
28	***Linderiella occidentalis*** California linderiella	ICBRA06010			G3	S2S3	
29	***Martes pennanti (pacifica) DPS*** Pacific fisher	AMAJF01021	Candidate		G5	S2S3	SC
30	***Monadenia troglodytes troglodytes*** Shasta sideband (snail)	IMGASC7090			G1G2	S1S2	
31	***Neviusia cliftonii*** Shasta snow-wreath	PDROS14020			G2	S2.2	1B.2
32	***Oncorhynchus tshawytscha spring-run*** spring-run chinook salmon	AFCHA0205A	Threatened	Threatened	G5T1Q	S1	
33	***Oncorhynchus tshawytscha winter run*** chinook salmon winter run	AFCHA0205B	Endangered	Endangered	G5T1Q	S1	
34	***Orcuttia tenuis*** slender orcutt grass	PMPOA4G050	Threatened	Endangered	G3	S3.1	1B.1
35	***Pandion haliaetus*** osprey	ABNKC01010			G5	S3	SC
36	***Paronychia ahartii*** Ahart's paronychia	PDCAR0L0V0			G2	S2.1	1B.1
37	***Riparia riparia*** bank swallow	ABPAU08010		Threatened	G5	S2S3	
38	***Trilobopsis roperi*** Shasta Chaparral	IMGASA2030			G1	S1	
39	***Viburnum ellipticum*** oval-leaved viburnum	PDCPR07080			G5	S2.3	2.3

APPENDIX C

CNPS Query Results

CNPS Inventory of Rare and Endangered Plants

Status: Plant Press Manager window with 15 items - Thu, Apr. 26, 2007 12:43 c

Reformat list as: Standard List - with Plant Press controls

ECOLOGICAL REPORT

scientific	family	life form	blooming	communities	elevation	CNPS
Agrostis hendersonii	Poaceae	annual herb	Apr-May	•Valley and foothill grassland (VFGrs) (mesic) •Vernal pools (VnPls)	70 - 305 meters	List 3.2
Anomobryum julaceum	Bryaceae	moss	•Broadleafed upland forest (BUFrs) •Lower montane coniferous forest (LCFrs) •North Coast coniferous forest (NCFrs)/damp rock and soil on outcrops, usually on roadcuts	100 - 1000 meters	List 2.2	
Carex scoparia	Cyperaceae	perennial herb	May	•Great Basin scrub (GBScr)(mesic)	130 - 1000 meters	List 2.2
Carex vulpinoidea	Cyperaceae	perennial herb	May-Jun	•Marshes and swamps (MshSw)(freshwater) •Riparian woodland (RpWld)	30 - 1200 meters	List 2.2
Castilleja rubicundula ssp. rubicundula	Scrophulariaceae	annual herb	Apr-Jun	•Chaparral (Chprl) (openings) •Cismontane woodland (CmWld) •Meadows and seeps (Medws) •Valley and foothill grassland (VFGrs)/serpentinite	20 - 900 meters	List 1B.2
Clarkia borealis ssp. borealis	Onagraceae	annual	Jun-Sep	•Chaparral (Chprl) •Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs)	400 - 1340 meters	List 1B.3
Cryptantha crinita	Boraginaceae	annual herb	Apr-May	•Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs) •Riparian forest (RpFrs) •Riparian woodland (RpWld) •Valley and foothill grassland (VFGrs)/gravelly streambeds	85 - 1215 meters	List 1B.2
				•Marshes and swamps		

Gratiola heterosepala	Scrophulariaceae	annual herb	Apr-Aug	(MshSw)(lake margins) •Vernal pools (VnPls)/clay	10 - 2375 meters	List 1B.2
Juncus leiospermus var. leiospermus	Juncaceae	annual herb	Mar-May	•Chaparral (Chprl) •Cismontane woodland (CmWld) •Meadows and seeps (Medws) •Valley and foothill grassland (VFGrs) •Vernal pools (VnPls)/vernally mesic	35 - 1020 meters	List 1B.1
Lathyrus sulphureus var. argillaceus	Fabaceae	perennial herb	Apr	•Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs) •Upper montane coniferous forest (UCFrs)	150 - 305 meters	List 3
Legenere limosa	Campanulaceae	annual herb	Apr-Jun	•Vernal pools (VnPls)	1 - 880 meters	List 1B.1
Neviusia cliftonii	Rosaceae	perennial deciduous shrub	Apr-Jun	•Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs) •Riparian woodland (RpWld)/ often streamsides; sometimes carbonate, volcanic, or metavolcanic	300 - 500 meters	List 1B.2
Orcuttia tenuis	Poaceae	annual herb	May-Sep(Oct) Months in parentheses are uncommon.	•Vernal pools (VnPls)	35 - 1760 meters	List 1B.1
Paronychia ahartii	Caryophyllaceae	annual herb	Mar-Jun	•Cismontane woodland (CmWld) •Valley and foothill grassland (VFGrs) •Vernal pools (VnPls)	30 - 510 meters	List 1B.1
Viburnum ellipticum	Caprifoliaceae	perennial deciduous shrub	May-Jun	•Chaparral (Chprl) •Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs)	215 - 1400 meters	List 2.3

APPENDIX D

Special-Status Species Considered for Analysis

Summary of Special-Status Species Review – Plants

Common Name *Scientific Name*	Status[1] (Fed/State/CNPS)	General Habitat Description/Elevation	Blooming Period	General Habitat Within Study Area (Present/ Absent)
Federal or State Listed Species				
Boggs Lake hedge-hyssop *Gratiola heterosepala*	--/E/1B.2	Clay soils within marshes and swamps (lake margins), vernal pools / 30-7,792 feet	April-August	**Absent.**
Slender Orcutt grass *Orcuttia tenuis*	T/E/1B.1	Vernal pools / 114-5,774 feet	May-October	**Absent**
Greene's tuctoria *Tuctoria greenei*	E/R/1B.1	Vernal pools / 98-3510 feet.	May-July	**Absent**
Other Special-Status Species				
Slender silver-moss *Anomobryum julaceum*	--/--/2.2	Damp rock and soil on outcrops within broadleafed upland forest, lower montane coniferous forest, North coast coniferous forest with; usually on roadcuts / 300-3,000 feet	Moss	**Absent**
Pointed broom sedge *Carex scoparia*	--/--/2.2	Mesic areas within Great Basin scrub / 426 – 3280 feet	May	**Absent**
Fox sedge *Carex vulpinoidea*	--/--/2.2	Freshwater marshes and swamps, and riparian woodland / 98-3,937 feet	May-June	**Present**
Pink creamsacs *Castilleja rubicundula* ssp. *rubicundula*	--/--/1B	Serpentinite soils within chaparral openings, cismontane woodland, meadows, seeps and valley and foothill grassland / 60-2,700 feet	April-June	**Absent.**
Northern clarkia *Clarkia borealis* ssp. *borealis*	--/--/1B.3	Chaparral, cismontane woodland, and lower montane coniferous forest / 1,312-4,396 feet	June-September	**Absent**
Silky cryptantha *Cryptantha crinita*	--/--/1B.2	Gravelly streambeds within cismontane woodland, lower montane coniferous forest, riparian scrub, riparian woodland, and valley and foothill grassland / 278-984 feet	April-May	**Present.** Gravelly substrate present on gravel bars and old channels.
Red Bluff dwarf rush *Juncus leiospermus* var. *leiospermus*	--/--/1B.1	Meadows and seeps, vernal pools; Vernally mesic areas within chaparral, cismontane woodland, and valley and foothill grassland / 115-3,346 feet	March-May	**Present.** Foothill grassland present.
Legenere *Legenere limosa*	--/--/1B.1	Vernal pools / 3-2,887 feet	April-June	**Absent**
Shasta snow wreath *Neviusia cliftonii*	--/--/1B.2	Often on streamsides within lower montane coniferous forest and riparian woodland / 984-1,640 feet	April-May	**Absent**
Ahart's nailwort *Paronychia ahartii*	--/--/1B.1	Cismontane woodland, valley and foothill grassland and vernal pools / 90-1,530 feet	March-June	**Present.** Valley oak woodland and foothill grassland present.
Oval-leaved viburnum *Viburnum ellipticum*	--/--/2.3	Chaparral, cismontane woodland, and lower montane coniferous forest / 705-4,593 feet	May-June	**Absent**

Summary of Special-Status Species Review – Wildlife

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Federal or State Listed Species				
Invertebrates				
Conservancy fairy shrimp *Branchinecta lynchi*	T/--	Vernal pool crustaceans live in vernal pools, swales, and ephemeral freshwater habitats. None are known to occur in riverine waters or marine waters.	Absent	Although seasonal wetlands occur in the study area, the site does not occur in a natural vernal pool setting and occurrences of listed vernal pool species do not occur near the study area.
Vernal pool fairy shrimp *Branchinecta conservatio*	E/--	Vernal pool crustaceans live in vernal pools, swales, and ephemeral freshwater habitats. None are known to occur in riverine waters or marine waters.	Absent	Although seasonal wetlands occur in the study area, the site does not occur in a natural vernal pool setting and occurrences of listed vernal pool species do not occur near the study area.
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Elderberry shrubs associated with riparian forests that occur along rivers and streams.	**Present**	Elderberry shrubs occur in the study area.
Vernal pool tadpole shrimp *Lepidurus packardi*	E/--	Vernal pool crustaceans live in vernal pools, swales, and ephemeral freshwater habitats. None are known to occur in riverine waters or marine waters.	Absent	Although seasonal wetlands occur in the study area, the site does not occur in a natural vernal pool landscape and occurrences of listed vernal pool species do not occur near the study area.
Shasta crayfish *Pacifastacus fortis*	E/--	Pit River, Fall River and Hat Creek drainages in Shasta County	Absent	Watersheds in which the species occur do not occur in the study area. Thus, this species is eliminated from further consideration.
Fish				
Green sturgeon, southern DPS (*Acipenser medirostris*)	T/SC	Spawn in Sacramento and Feather rivers; juveniles are thought to rear mainly in the estuary.	**Present**	Suitable habitat occurs in the Sacramento River.
Delta smelt (*Hypomesus transpacificus*)	T/T	Estuarine systems in the Sacramento-San Joaquin Delta.	Absent	Suitable habitat not present.
Steelhead, California Central Valley DPS (*Oncorhynchus mykiss*) Critical Habitat	T/--	Spawn and rear in freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**	Suitable spawning, rearing, and migration habitat occurs in the Sacramento River.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Central Valley spring-run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Critical Habitat	T/T	Freshwater rivers and streams. (Sacramento River and its tributaries)	**Present**	Suitable spawning, rearing, and migration habitat occurs in the Sacramento River.
Sacramento River winter-run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Critical Habitat	E/E	Freshwater river and streams. (Sacramento River and its tributaries)	**Present**	Suitable spawning, rearing, and migration habitat occurs in the Sacramento River.
Amphibians				
Shasta salamander *Hydromantes shastae*	--/T	Moist limestone fissures and caves, in volcanic and other rock outcroppings, and under woody debris in mixed pine-hardwood stands.	Absent	Limestone outcrops do not occur within the study area. Thus, this species is eliminated from further consideration.
California red-legged frog *Rana aurora draytonii*	T/SC	Require aquatic habitat for breeding, also uses a variety of other habitat types including riparian and upland areas. Adults utilize dense, shrubby or emergent vegetation associated with deep-water pools with fringes of cattails & dense stands of overhanging vegetation.	**Present**	One perennial pond occurs in the study area.
Birds				
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	C/E	Nesting habitat is cottonwood/willow riparian forest. Occurs only along the upper Sacramento Valley portion of the Sacramento River, the Feather River in Sutter Co., the south fork of the Kern River in Kern Co., and along the Santa Ana, Amargosa, and lower Colorado rivers	**Present**	Extensive cottonwood/willow riparian forest habitat occurs in the study area.
Willow flycatcher *Empidonax traillii*	--/E	Rare summer resident in wet meadow and montane riparian habitats at 2,000 to 8,000 feet elevation. No longer known to nest in Sacramento Valley but migrates through the north state region in spring and fall.	Absent	Suitable habitat not present.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
American peregrine falcon *Falco peregrinus anatum*	D/E, FP	Forages in many habitats; requires cliffs for nesting.	Absent	Suitable habitat not present.
Greater sandhill crane *Grus canadensis tabida*	--/T, FP	Wetlands required for breeding; forage in nearby pastures, fields, and meadows.	Absent	Suitable habitat not present.
Bald eagle *Haliaeetus leucocephalus*	T/E	Forages on live and dead fish and nests in large trees or snags. Requires large bodies of water, including ocean shorelines, lake margins, and large, open river courses for foraging, nesting, and wintering habitat.	**Present**	The Sacramento River runs along the western edge of the property and provides suitable foraging habitat.
Bank swallow *Riparia riparia*	--/T	Colonial nester on vertical banks or cliffs with fine-textured soils near water.	**Present**	Vertical banks are present along the Sacramento River along the northwestern boundary of the site.
Northern spotted owl *Strix occidentalis caurina* Critical habitat	T/--	In northern California, resides in large stands of old growth, multi-layered mixed conifer, redwood, and Douglas-fir habitats	Absent	Dense, mixed conifer forest is not present.
Mammals				
California wolverine *Gulo gulo luteus*	--/T, FP	A variety of habitats within the elevations of 1,600 and 14,200 ft. Most commonly inhabits open terrain above timberline.	Absent	Suitable habitat not present.
Pacific fisher *Martes pennanti pacifica*	C/SC	Dens and forages in intermediate to large stands of old-growth forests or mixed stands of old-growth and mature trees with greater than 50% canopy closure. May use riparian corridors for movement.	Absent	Suitable habitat not present.
Sierra Nevada red fox *Vulpes vulpes nector*	--/T	Red fir and lodgepole pine forests in the sub-alpine zone and alpine fell-fields of the Sierra Nevada.	Absent	Suitable habitat not present.
Other Special-Status Species				
Fish				
River lamprey *(Lampetra ayresii)*	--/SC	The biology of river lampreys has not been studied in California, general habitat and life history thought to be similar to Pacific lamprey.	**Present**	Suitable habitat occurs in the Sacramento River.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Central Valley fall/late-fall run ESU Chinook salmon (*Oncorhynchus tshawytscha*)	SC/SC	Freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**	Suitable habitat occurs in the Sacramento River.
Hardhead (*Mylopharodon conocephalus*)	--/SC	Quiet deep pools of large, warm, clear streams over rocks or sand.	**Present**	Suitable habitat occurs in the Sacramento River.
Pit roach *Lavinia symmetricus mitrulus*	--/SC	Small, warm, intermittent streams in the upper Pit River and its tributaries and tributaries to Goose Lake.	Absent	Study area outside the upper Pit River watershed.
McCloud River redband trout *Oncorhynchus mykiss ssp.*	--/SC	McCloud River and its tributaries, Swamp Creek and Trout Creek.	Absent	Study area is outside the McCloud River watershed.
Sacramento splittail *Pogonichthys macrolepidotus*	--/SC	Shallow, dead-end sloughs with submerged vegetation.	Absent	Native, non-game species; historically occurred near Redding, however, range is not thought to presently extend above Red Bluff.
Longfin smelt *Spirinchus thaleichthys*	--/SC	Sloughs of Suisun Bay and Delta.	Absent	Suitable habitat not present.
Amphibians				
Tailed frog *Ascaphus truei*	--/SC	Clear, rocky, swift, cool perennial streams in densely forested habitats.	Absent	Suitable habitat not present.
Foothill yellow-legged frog *Rana boylii*	--/SC	Rocky streams in a variety of habitats. Found in coast ranges.	Absent	Suitable habitat not present.
Cascades frog *Rana cascadae*	--/SC	Open coniferous forests along the sunny, rocky banks of ponds, lakes, streams, and meadow potholes. From 2,600 to 9,000 feet in elevation in Cascades and Trinity Mountains.	Absent	Suitable habitat not present.
Western spadefoot toad *Spea hammondii*	--/SC	Grasslands with temporary pools.	**Present**	One intermittent pool is located within a grassland in the northeast section of the site.
Reptiles				
Northwestern pond turtle *Clemmys marmorata marmorata*	--/SC	Slow water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Require an upland oviposition site in the vicinity of the aquatic site	**Present**	One perennial pond occurs on the project site.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Birds				
Long-billed curlew *Numenius americanus*	--/SC	Large coastal estuaries, upland herbaceous areas, and croplands. Breeds in wet meadow habitat.	Absent	Suitable habitat not present.
Double-crested cormorant *Phalacrocorax auritus*	--/SC	Inland lakes; fresh, salt and estuarine waters.	**Present**	Suitable nesting habitat not present on site due to level of human disturbance. May occur as a forager.
White-faced ibis *Plegadis chihi*	--/SC	A rare visitor to the Central Valley, this species nests and forages in freshwater marshes.	Absent	Suitable habitat not present.
California spotted owl *Strix occidentalis occidentalis*	--/SC	Dense, multi-layered mixed conifer, redwood, and Douglas-fir habitats with large overstory trees.	Absent	Conifer forest not present in study area.
Merlin *Falco columbarius*	--/SC	Frequents ocean shorelines, lake margins, and large, open river courses near tree stands for both nesting and wintering habitat. Does not breed in California.	**Present**	Woodlands provide suitable habitat.
Long-eared owl *Asio otus*	--/SC	Dense riparian and live oak thickets near meadow edges, and nearby woodland and forest habitats; also found in dense conifer stands at higher elevations.	Absent	Dense vegetation and meadows do not occur within the study area.
Western burrowing owl *Athene cunicularia hypugaea*	--/SC	Open habitats, dry grasslands and ruderal habitats with ground squirrel burrows.	**Present**	Suitable habitat present, however, there are no known occurrences in the area.
Golden eagle *Aquila chrysaetos*	--/SC/FP	Breeds on cliffs or in large trees or electrical towers, forages in open areas.	Absent	Open habitats and cliffs do not occur in the study area. Thus, this species is eliminated from further consideration
Sharp-shinned hawk *Accipiter striatus*	--/SC	Typically nests in dense conifer stands near water, winters in woodlands. Forages in many habitats in winter and migration.	**Present**	Unlikely to nest in area but may occur as a winter migrant.
Cooper's hawk *Accipiter cooperii*	--/SC	Nests in woodlands, forages in many habitats in winter and migration.	**Present**	Suitable nesting and foraging habitat is present in the project.
Northern goshawk *Accipiter gentilis*	--/SC	Breeds in dense, mature conifer and deciduous forests, interspersed with meadows, other openings and riparian areas; nesting habitat includes north-facing slopes near water.	Absent	Dense coniferous forests do not occur in the study area.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Ferruginous hawk *Buteo regalis*	--/SC	Forages in grasslands and occasionally in other open habitats during migration and winter.	**Present**	May be rare as migrant.
Northern harrier *Circus cyaneus*	--/SC	Forages in marshes, grasslands, and ruderal habitats; nests in extensive marshes and wet fields or grasslands.	Absent	Open grasslands or marshlands do not occur in the study area. Thus, this species is eliminated from further consideration
Prairie falcon *Falco mexicanus*	--/SC	Occurs in open habitats such as grasslands, desert scrub, rangelands and croplands. Nests on open cliffs.	**Present**	May be rare as migrant.
White-tailed kite *Elanus leucurus*	--/FP	Nests in lowlands with dense oak or riparian stands near open areas, forages over grassland, meadows, cropland and marshes.	**Present**	Woodlands and riparian forest provided suitable habitat.
Osprey *Pandion haliaetus*	--/SC	Ocean shorelines, lake margins and large, open river courses for both nesting and wintering habitat.	**Present**	Riparian habitat or large bodies of water occur in and near the study area
Black swift *Cypseloides niger*	--/SC	Nests in moist crevice or cave or sea cliffs above the surf, or on cliffs behind, or adjacent to, waterfalls in deep canyons; forages widely over many habitats.	Absent	Cliffs, deep canyons not present in Project vicinity. Thus, this species is eliminated from further consideration
Vaux's swift *Chaetura vauxi*	--/SC	Prefers redwood and Douglas-fir habitats, nests in hollow trees and snags or, occasionally, in chimneys; forages aerially.	Absent	Neither redwood nor Douglas-fir habitat is present. Thus, this species is eliminated from further consideration
Purple martin *Progne subis*	--/SC	Breeding habitat includes old-growth, multi-layered, open forest and woodland with snags; forages over riparian areas, forest, and woodlands	Absent	Multi-layered old growth does not occur in the study area. Thus, this species is eliminated from further consideration
Tricolored blackbird *Agelaius tricolor*	--/SC	Breeds near fresh water in dense emergent vegetation. Forages in grassland and cropland.	Absent	Dense emergent vegetation does not occur in the wetlands occuring in the study area. Foraging habitat is not available. Thus, this species is eliminated from further consideration.
California yellow warbler *Dendroica petechia brewsteri*	--/SC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	**Present**	Riparian habitat occurs in and near the study area.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Yellow-breasted chat *Icteria virens*	--/SC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	**Present**	Riparian habitat occurs in and near the study area.
Bell's Sage Sparrow *Amphispiza belli belli*	--/SC	Nests in shrublands, preferably coastal scrub but is tolerant to a variety of shrublands. Irregular in its northern range of the western Shasta and Trinity Counties	Absent	Mixed chaparral occurs in the study area. Study area located near northernmost range of species
Loggerhead shrike *Lanius ludovicianus*	--/SC	Prefers open habitats with scatters shrubs and trees throughout the Central Valley of California. Nests in shrubs and trees.	**Present**	Open shrub/tree habitat occurs in the study area
Mammals				
Ringtail *Bassariscus astutus*	--/FP	Riparian habitats and in brush stands of most forest and shrub habitats. Nests in rock recesses, hollow trees, logs, snags, abandoned burrows or woodrat nests.	**Present**	Riparian habitat occurs in and near the study area.
Sierra Nevada snowshoe hare *Lepus americanus tahoensis*	--/SC	Boreal zones, typically inhabiting riparian communities with thickets of deciduous trees and shrubs above 4,800 ft. They also inhabit thickets of young conifers and chaparral.	Absent	Study area is below the required elevation for suitable habitat.
Townsend's western big-eared bat *Corynorhinus townsendii*	--/SC	Roosts in colonies in caves, mines, tunnels, or buildings in mesic habitats. The species forages along habitat edges, gleaning insects from bushes and trees. Habitat must include appropriate roosting, maternity and hibernacula sites free from disturbance by humans.	Absent	Roosting habitat is not present.
Pallid bat *Antrozous pallidus*	--/SC	Forages over many habitats; roosts in buildings, large oaks or redwoods, rocky outcrops and rocky crevices in mines and caves, and under bridges. Roosts must protect from high temperatures	**Present**	Roosting habitat does not occur within the study area; however suitable foraging habitat occurs in the study area.
Spotted bat *Euderma maculatum*	--/SC	Ponderosa pine region of the western highlands. Prefers cracks/crevices of high cliffs and canyons for roosting.	Absent	Ponderosa pine habitat not present and the project is located out of the current range of this species. Thus, this species is eliminated from further consideration

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Western mastiff bat *Eumops perotis*	--/SC	Roosts in cliff faces, rock outcrops, and buildings. Forages in open habitats. Needs vertical face to take flight.	**Present**	Roosting habitat does not occur within the study area; however suitable foraging habitat occurs in the study area.
American badger *Taxidea taxus*	--/SC	Herbaceous, shrub, and open stages of most habitats with dry, friable soils.	Absent	Suitable habitat does not occur within the study area.

[1]**Status and Habitat Codes:** Absent means general habitat is not present and no further work needed. Present means general habitat is present and species may be present.
Federal and State Codes: E = Endangered; T = Threatened; C = Candidate; Species of Special Concern (State); D = Delisted (status to be monitored for 5 years); FP = California Fully Protected Species. CNPS Codes: List 1B = Rare, Threatened or Endangered in CA and Elsewhere; List 2 = Rare, Threatened or Endangered in CA, but more common elsewhere.

APPENDIX E

Plant and Wildlife Species Observed

Plant Species Observed on the Strawberry Fields Study Area

Observers: Colby Boggs and Paul Kirk

Dates: April 25, May 3, May 9, and June 27, 2007

Annual Grassland		
Scientific name	**Common name**	**Family**
Aira caryophyllea	Silver European hairgrass	Poaceae
Amsinckia menziesii var. *intermedia*	Common fiddleneck	Boraginaceae
Brassica nigra	Black mustard	Brassicaceae
Brickellia californica	California brickellbush	Asteraceae
Bromus diandrus	Ripgut brome	Poaceae
Bromus hordeaceus	Soft brome	Poaceae
Bromus madritensis ssp. *rubens*	Red brome	Poaceae
Capsella bursa-pastoris	Shepherd's purse	Brassicaceae
Castilleja attenuata	Valley tassels	Scrophulariaceae
Centaurea solstitialis	Yellow star-thistle	Asteraceae
Cerastium glomeratum	Sticky mouse-eared chickweed	Caryophyllaceae
Chamomilla suaveolens	Pineapple weed	Asteraceae
Cichorium intybus	Chicory	Asteraceae
Cirsium vulgare	Bull thistle	Asteraceae
Convolvulus arvensis	Bindweed	Convolvulaceae
Cryptantha flaccida	Flaccid cryptantha	Boraginaceae
Cynodon dactylon	Bermuda grass	Poaceae
Cyperus eragrostis	Tall flatsedge	Cyperaceae
Dipsacus fullonum	Wild teasel	Dipsacaceae
Elymus elymoides	Squirreltail	Poaceae
Eriodictyon californicum	Yerba santa	Hydrophyllaceae
Eriogonum luteolum	Golden buckwheat	Polygonaceae
Eriogonum nudum	Naked eriogonum	Polygonaceae
Eriogonum sphaerocephalum	Round-headed buckwheat	Polygonaceae
Eriogonum vimineum	Wicker buckwheat	Polygonaceae
Eriophyllum lanatum	Woolly sunflower	Asteraceae
Erodium botrys	Long-beaked stork's bill	Geraniaceae
Erodium cicutarium	Red-stemmed filaree	Geraniaceae
Eschscholzia californica	California poppy	Papaveraceae
Filago californica	California herba impia	Asteraceae
Fraxinus latifolia	Oregon ash	Oleaceae
Grindelia camporum	Great valley gumweed	Asteraceae
Heterotheca oregona	Oregon goldenaster	Asteraceae
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley	Poaceae
Hordeum murinum ssp. *leporinum*	Foxtail barley	Poaceae
Hypochaeris glabra	Smooth cat's-ear	Asteraceae
Juncus effusus	Common bog rush	Juncaceae
Keckiella breviflora	Gaping keckiella	Scrophulariaceae
Leontodon taraxacoides	Hawkbit	Asteraceae
Lolium multiflorum	Italian ryegrass	Poaceae
Lomatium dasycarpum	Woolly-fruited lomatium	Apiaceae
Lotus humistratus	Short-podded lotus	Fabaceae

Annual Grassland (cont.)		
Scientific name	**Common name**	**Family**
Lupinus albifrons	Silver bush lupine	Fabaceae
Lupinus bicolor	Miniature lupine	Fabaceae
Mentzelia laevicaulis	Smooth-stem blazing star	Loasaceae
Petrorhagia dubia	Grass pink	Caryophyllaceae
Plagiobothrys fulvus	Fulvous popcorn flower	Boraginaceae
Plantago erecta	Erect plantain	Plantaginaceae
Raphanus raphanistrum	Jointed charlock	Brassicaceae
Rubus discolor	Himalayan blackberry	Rosaceae
Sagina apetala	Dwarf pearlwort	Caryophyllaceae
Salix exigua	Narrow-leaved willow	Salicaceae
Senecio vulgaris	Old man of spring	Asteraceae
Silybum marianum	Milk thistle	Asteraceae
Sonchus oleraceus	Common sow thistle	Asteraceae
Sorghum halepense	Johnson grass	Poaceae
Spergularia rubra	Ruby sandspurry	Caryophyllaceae
Symphytum officinale	Comfrey	Boraginaceae
Taraxacum officinale	Common dandelion	Asteraceae
Trifolium dubium	Shamrock	Fabaceae
Trifolium hirtum	Rose clover	Fabaceae
Trifolium microcephalum	Small-head field clover	Fabaceae
Trifolium repens	White clover	Fabaceae
Veronica peregrina ssp. *xalapensis*	Purslane speedwell	Scrophulariaceae
Vicia villosa	Winter vetch	Fabaceae
Vulpia myuros	Rattail fescue	Poaceae

Valley Foothill Riparian		
Acacia dealbata	Silver wattle	Fabaceae
Agrostis exarata	Spike bentgrass	Poaceae
Ailanthus altissima	Tree-of-heaven	Simaroubaceae
Alnus rhombifolia	White alder	Betulaceae
Aristolochia californica	Pipevine	Aristolochiaceae
Artemisia douglasiana	Mugwort	Asteraceae
Asparagus officinalis ssp. *officinalis*	Asparagus	Liliaceae
Barbarea orthoceras	Winter cress	Brassicaceae
Brassica nigra	Black mustard	Brassicaceae
Brickellia californica	California brickellbush	Asteraceae
Briza minor	Small quaking grass	Poaceae
Bromus diandrus	Ripgut brome	Poaceae
Bromus hordeaceus	Soft brome	Poaceae
Carduus pycnocephalus	Italian plumeless thistle	Asteraceae
Carex integra	Smooth-beaked sedge	Cyperaceae
Carex nudata	Torrent sedge	Cyperaceae
Cercis occidentalis	Western redbud	Fabaceae
Cyperus eragrostis	Tall flatsedge	Cyperaceae
Datura wrightii	Toluaca	Solanaceae
Dipsacus fullonum	Wild teasel	Dipsacaceae
Echinochloa crus-galli	Barnyard grass	Poaceae
Elymus elymoides	Squirreltail	Poaceae
Epilobium brachycarpum	Tall annual willowherb	Onagraceae

Valley Foothill Riparian (cont.)		
Scientific name	**Common name**	**Family**
Equisetum laevigatum	Smooth scouring rush	Equisetaceae
Eriogonum vimineum	Wicker buckwheat	Polygonaceae
Festuca rubra	Red fescue	Poaceae
Ficus carica	Common fig	Moraceae
Fraxinus latifolia	Oregon ash	Oleaceae
Galium aparine	Goose grass	Rubiaceae
Geranium molle	Dove's foot geranium	Geraniaceae
Gnaphalium californicum	California everlasting	Asteraceae
Hordeum murinum	Barley	Poaceae
Iris pseudacorus	Water iris	Iridaceae
Juglans californica	California black walnut	Juglandaceae
Juncus effusus	Common bog rush	Juncaceae
Juncus saximontanus	Rocky mountain rush	Juncaceae
Lactuca serriola	Prickly lettuce	Asteraceae
Leontodon taraxacoides	Hawkbit	Asteraceae
Lolium multiflorum	Italian ryegrass	Poaceae
Melilotus alba	White sweetclover	Fabaceae
Morus alba	Mulberry	Moraceae
Paspalum dilatatum	Dallis grass	Poaceae
Phytolacca americana	Pokeweed	Phytolaccaceae
Pinus ponderosa	Ponderosa pine	Pinaceae
Pinus sabiniana	Gray pine	Pinaceae
Plantago lanceolata	English plantain	Plantaginaceae
Plectritis ciliosa	Long-spurred plectritis	Valerianaceae
Polygonum lapathifolium	Willow weed	Polygonaceae
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Salicaceae
Quercus lobata	Valley oak	Fagaceae
Quercus wislizenii	Interior live oak	Fagaceae
Rhamnus californica	California coffeeberry	Rhamnaceae
Robinia pseudoacacia	Black locust	Fabaceae
Rubus discolor	Himalayan blackberry	Rosaceae
Rumex acetosella	Common sheep sorrel	Polygonaceae
Salix exigua	Narrow-leaved willow	Salicaceae
Salix gooddingii	Goodding's black willow	Salicaceae
Salix lasiolepis	Arroyo willow	Salicaceae
Sambucus mexicana	Blue elderberry	Caprifoliaceae
Saponaria officinalis	Bouncing bet	Caryophyllaceae
Setaria pumila	Yellow bristle grass	Poaceae
Silybum marianum	Milk thistle	Asteraceae
Sonchus oleraceus	Common sow thistle	Asteraceae
Stellaria media	Common chickweed	Caryophyllaceae
Torilis arvensis	Field hedge-parsley	Apiaceae
Toxicodendron diversilobum	Poison oak	Anacardiaceae
Ulmus minor	Smoothleaf elm	Ulmaceae
Verbascum thapsus	Woolly mullein	Scrophulariaceae
Vicia villosa	Winter vetch	Fabaceae
Vitis californica	California wild grape	Vitaceae
Vulpia myuros	Rattail fescue	Poaceae

Foothill Pine		
Scientific name	**Common name**	**Family**
Ailanthus altissima	Tree-of-heaven	Simaroubaceae
Anthoxanthum aristatum	Annual vernal grass	Poaceae
Arctostaphylos manzanita	Big leaved manzanita	Ericaceae
Avena barbata	Slender wild-oat	Poaceae
Brickellia californica	California brickellbush	Asteraceae
Briza minor	Small quaking grass	Poaceae
Eriodictyon californicum	Yerba santa	Hydrophyllaceae
Gilia capitata	Blue field-gilia	Polemoniaceae
Heterotheca oregona	Oregon goldenaster	Asteraceae
Juglans californica	California black walnut	Juglandaceae
Lepidium virginicum	Wild pepper-grass	Brassicaceae
Linaria genistifolia ssp. *dalmatica*	Dalmatian toad-flax	Scrophulariaceae
Lupinus albifrons	Silver bush lupine	Fabaceae
Petrorhagia dubia	Grass pink	Caryophyllaceae
Pinus sabiniana	Gray pine	Pinaceae
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Salicaceae
Quercus wislizenii	Interior live oak	Fagaceae
Raphanus raphanistrum	Jointed charlock	Brassicaceae
Salix gooddingii	Goodding's black willow	Salicaceae
Spartium junceum	Gorse	Fabaceae
Verbascum blattaria	Moth mullein	Scrophulariaceae

Valley Oak Woodland		
Camissonia contorta	Contorted sun-cup	Onagraceae
Chenopodium ambrosioides	Mexican tea	Chenopodiaceae
Cryptantha flaccida	Flaccid cryptantha	Boraginaceae
Heterotheca grandiflora	Telegraph weed	Asteraceae
Marrubium vulgare	Horehound	Lamiaceae
Morus alba	Mulberry	Moraceae
Orobanche fasciculata	Clustered broom-rape	Orobanchaceae
Phacelia heterophylla ssp. *virgata*	Virgate phacelia	Hydrophyllaceae
Rhamnus tomentella	Hoary coffeeberry	Rhamnaceae
Vitis californica	California wild grape	Vitaceae

Intermittent Pool and Pond		
Digitaria sanguinalis	Crabgrass	Poaceae
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley	Poaceae
Juncus bufonius	Toad rush	Juncaceae
Lemna minor	Common duckweed	Lemnaceae
Lolium multiflorum	Italian ryegrass	Poaceae
Lotus corniculatus	Birdfoot trefoil	Fabaceae
Poa annua	Annual blue grass	Poaceae
Polygonum arenastrum	Common knotweed	Polygonaceae
Veronica peregrina ssp. *xalapensis*	Purslane speedwell	Scrophulariaceae

Wildlife Species Observed on the Strawberry Fields Study Area

Observer: Colby Boggs, Ginger Bolen, and Heather Kelly
Dates: April 25, May 3, May 9, May 10, June 27, and November 2, 2007

Common name	***Scientific name***
Pacific chorus frog	*Pseudacris regilla*
bullfrog	*Rana catesbeiana*
alligator lizard	*Elgaria* sp.
fence lizard	*Sceloporus occidentalis*
mallard duck	*Anas platyrhynchos*
scrub jay	*Aphelocoma californica*
great egret	*Ardea alba*
Canada goose	*Branta canadensis*
red-tailed hawk	*Buteo jamaicensis*
California quail	*Callipepla californica*
turkey vulture	*Cathartes aura*
killdeer	*Charadrius vociferus*
red-shafted flicker	*Colaptes auratus*
acorn woodpecker	*Melanerpes formicivorus*
song sparrow	*Melospiza melodia*
downy woodpecker	*Picoides pubescens*
spotted towhee	*Pipilo maculatus*
western tanager	*Piranga ludoviciana*
blue-gray gnatcatcher	*Polioptila caerulea*
bushtits	*Psaltriparus minimus*
bank swallow	*Riparia riparia*
black phoebe	*Sayornis nigricans*
red breasted nuthatch (migrant)	*Sitta canadensis*
American robin	*Turdus migratorius*
western kingbird	*Tyrannus verticalis*
mourning dove	*Zenaida macroura*
coyote	*Canis latrans*
black-tailed jack rabbit	*Lepus californicus*
mule deer	*Odocoileus hemionus*
grey squirrel	*Sciurus griseus*

APPENDIX F

Summary Table of VELB Survey Data

Summary Table of VELB Survey Data from the Strawberry Fields Study Area.

Observer: Paul Kirk
Survey Dates: June 27, June 28, June 29, and August 2, 2007

Elderberry Shrub Number	# Exit Holes	Stems 1-3”	Stems 3-5”	Stems >5”	Approximate Shrub Ht. (ft)	Riparian Location?	Associated Habitat
1	0	0	0	1	12	No	Annual grassland
2	0	0	8	3	18	Yes	Valley foothill riparian
3	0	6	9	8	18	Yes	Valley foothill riparian
4	4	2	4	11	20	No	Valley oak woodland
5	1	0	4	3	15	No	Valley oak woodland
6	0	0	1	1	20	No	Valley oak woodland
7	0	0	0	1	25	No	Valley oak woodland
8	0	0	0	1	15	No	Valley oak woodland
9	0	0	0	2	46	Yes	Valley foothill riparian
10	0	0	1	3	18	Yes	Valley foothill riparian
11	0	3	2	0	18	Yes	Valley foothill riparian
12	0	1	0	0	12	Yes	Valley foothill riparian
13	NS[1]	≥ 1	NS[1]	NS[1]	18	Yes	Valley foothill riparian
14	NS[1]	≥ 1	NS[1]	NS[1]	18	Yes	Valley foothill riparian
15	0	0	0	1	20	No	Valley oak woodland
16	0	2	0	2	15	No	Valley oak woodland
17	0	2	1	2	12	No	Valley oak woodland
18	0	0	0	2	12	No	Valley oak woodland
19	0	4	5	2	18	No	Valley oak woodland
20	1	1	1	3	20	No	Valley oak woodland
21	0	4	0	2	15	No	Valley oak woodland
22	0	4	2	4	18	Yes	Valley foothill riparian
23	0	6	6	1	18	Yes	Valley foothill riparian
24	0	6	4	2	15	Yes	Valley foothill riparian
25	0	4	6	2	18	Yes	Valley foothill riparian
26	0	0	0	2	18	No	Valley oak woodland
27	0	0	1	0	15	No	Valley oak woodland
28	3	1	1	3	18	No	Valley oak woodland
29	3	0	0	8	16	No	Valley oak woodland
30	0	1	2	9	18	Yes	Valley foothill riparian
31	0	3	3	0	12	Yes	Valley foothill riparian

Elderberry Shrub Number	# Exit Holes	Stems 1-3”	Stems 3-5”	Stems >5”	Approximate Shrub Ht. (ft)	Riparian Location?	Associated Habitat
32	0	1	0	0	10	Yes	Valley foothill riparian
33	2	0	2	0	12	Yes	Valley foothill riparian
34	0	1	0	0	8	Yes	Valley foothill riparian
35	0	2	0	0	8	Yes	Valley foothill riparian
36	0	7	5	1	15	Yes	Valley foothill riparian
37	7	3	1	3	18	Yes	Valley foothill riparian
38	0	3	1	3	14	Yes	Valley foothill riparian
40[2]	0	1	0	2	15	Yes	Valley foothill riparian
41	0	1	0	0	10	Yes	Valley foothill riparian
42	0	1	1	0	15	Yes	Valley foothill riparian
43	3	4	1	0	12	Yes	Valley foothill riparian
44	0	0	1	0	12	Yes	Valley foothill riparian
45	0	1	0	0	8	Yes	Valley foothill riparian
47[2]	0	1	5	6	18	Yes	Valley foothill riparian
48	0	1	0	0	12	No	Annual grassland
49	0	14	4	3	16	No	Riverine
50	0	6	2	1	12	No	Riverine
51	0	3	1	0	15	No	Annual grassland
52	0	3	0	1	18	Yes	Valley foothill riparian
53	0	0	1	2	15	Yes	Valley foothill riparian
54	0	1	1	1	20	Yes	Valley foothill riparian
55	6	1	3	9	20	Yes	Valley foothill riparian
56	1	1	1	1	12	Yes	Valley foothill riparian
57	0	1	0	1	16	Yes	Valley foothill riparian
58	0	0	1	0	14	Yes	Valley foothill riparian
59	0	0	2	2	16	No	Valley oak woodland
60	1	0	0	4	16	No	Valley oak woodland
62	0	1	0	0	9	Yes	Valley foothill riparian
61	1	1	1	2	20	No	Valley oak woodland
63	0	4	1	2	12	Yes	Valley foothill riparian
64	3	1	2	5	15	Yes	Valley foothill riparian

[1] These shrubs are overgrown with Himalayan blackberry and were not surveyed (NS) for exit holes. Stem count and shrub height were estimated using binoculars.
[2] Break in sequence due to duplicate GPS recording.

APPENDIX G

Representative Photographs of VELB Exit Holes

Representative Photographs of VELB Exit Holes Observed at the Strawberry Fields Study Area

Photographs taken on June 29 and August 2, 2007

Photograph 1. Old VELB exit hole on elderberry stem (shrub #37). This shrub had seven exit holes on three different stems.

Photograph 2. Recent VELB exit hole with clean edges on elderberry stem (shrub # 55).

ATTACHMENT C

NSR CALIFORNIA RED-LEGGED FROG SITE ASSESSMENT OF THE STRAWBERRY FIELDS STUDY AREA

STRAWBERRY FIELDS STUDY AREA

California Red-Legged Frog Site Assessment

November 6, 2007

Prepared for:
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NSR 50780

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CALIFORNIA RED-LEGGED FROG SITE ASSESSMENT

1.0 INTRODUCTION

This California red-legged frog (*Rana aurora draytonii*) site assessment was conducted on behalf of the Redding Rancheria Tribe for the Strawberry Fields Study Area (study area). The study area is located south of the City of Redding, Shasta County, California and can be found within the *Enterprise, California* U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Township 31 North, Range 4 West, Sections 19 and 20). The western and eastern extent of the study area are located at approximately 40º 31’ 67”N latitude by 122° 21’ 53”W longitude and 40º 31’ 67”N latitude by 122° 20’ 81”W longitude, respectively. A map of the study area is presented as Figure 1.

2.0 PROJECT DESCRIPTION

No project is currently proposed; however, the Redding Rancheria Tribe has requested an analysis of potential constraints to development of the study area.

3.0 ENVIRONMENTAL SETTING

The study area is currently undeveloped. The area has been used to grow strawberries in the past; however, it is not currently under cultivation and has been fallow for several years. Several dirt roads/trails traverse the site. The study area is bounded on the west by the Sacramento River and on the east by I-5. Rural residential neighborhoods serve as the northern and southern boundaries.

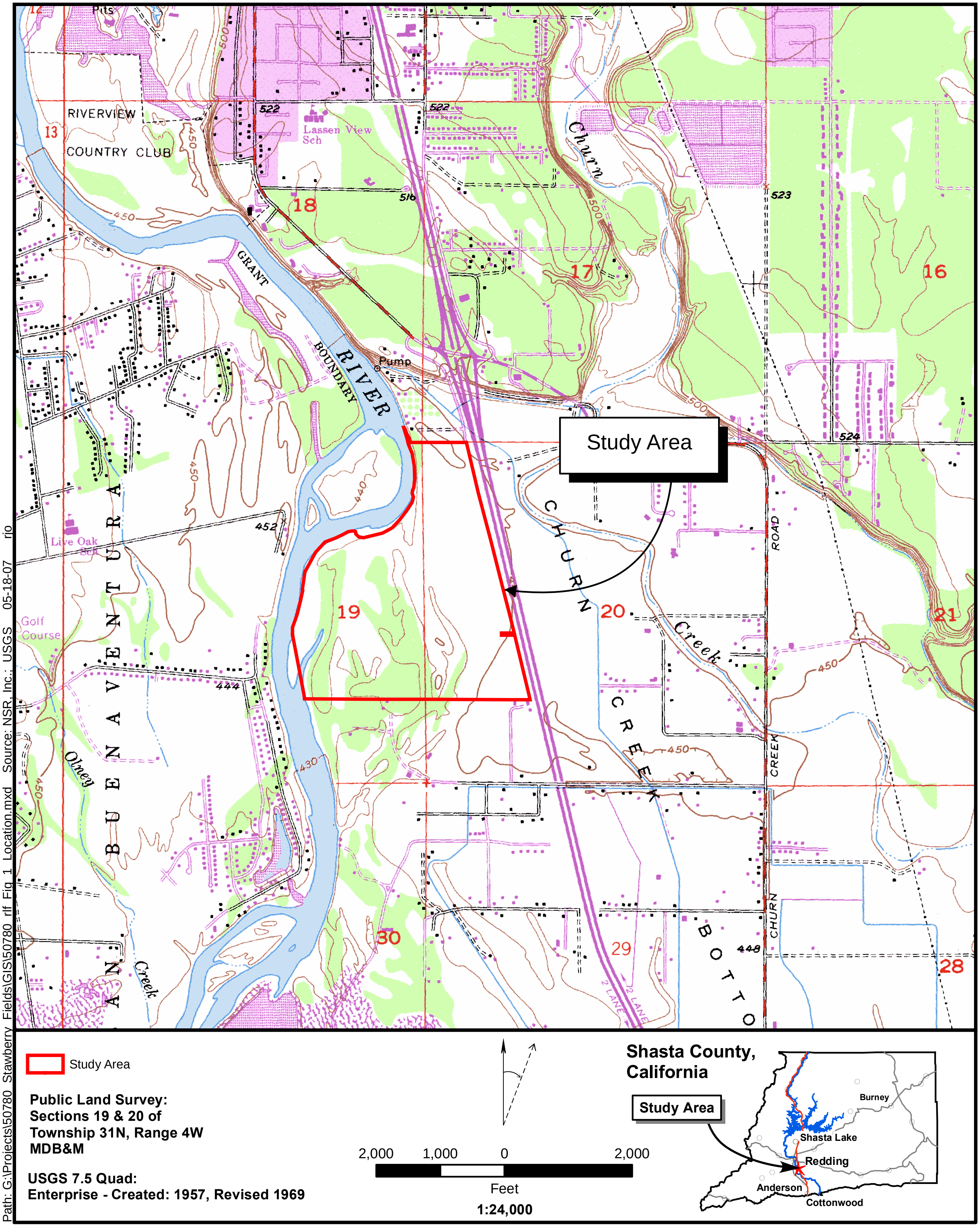
The topography in the study area is mostly flat with elevations ranging from approximately 430 to 450 feet above mean sea level. Plant communities consist of valley oak woodland, annual grassland, valley foothill riparian, foothill pine woodland, and riverine (Mayer and Laudenslayer 1988).

North State Resources, Inc. (NSR) conducted a delineation of waters of the United States occurring within the study area boundary on June 15, 16, and 21, 2006. A separate wetland delineation report was submitted to the U.S. Army Corps of Engineers (ACOE) for verification on April 23, 2007.

4.0 CALIFORNIA RED-LEGGED FROG BIOLOGY

RANGE OF THE CALIFORNIA RED-LEGGED FROG

Historically, the California red-legged frog ranged from Point Reyes National Seashore in Marin County inland to the Central Valley and the Redding vicinity and south to northwestern Baja California,



Path: G:\Projects\50780 Stawberry Fields\GIS\50780_rlf_Fig_1_Location.mxd Source: NSR, Inc.; USGS 05-18-07 rio

Figure 1
Project Location and Vicinity Map

Mexico. It occurred in 46 counties in California. Today, that range has been reduced to 31 counties (U.S. Fish and Wildlife Service 2005a). Populations outside of the San Francisco Bay area and central coast areas are isolated, and the species is predominantly extirpated from the southern Transverse and Peninsular ranges in California, although some populations persist. A map of the historical and current range of the California red-legged frog is presented as Figure 2. The study area is located within the historical range of the California red-legged frog but not within its currently known range (U.S. Fish and Wildlife Service 2002).

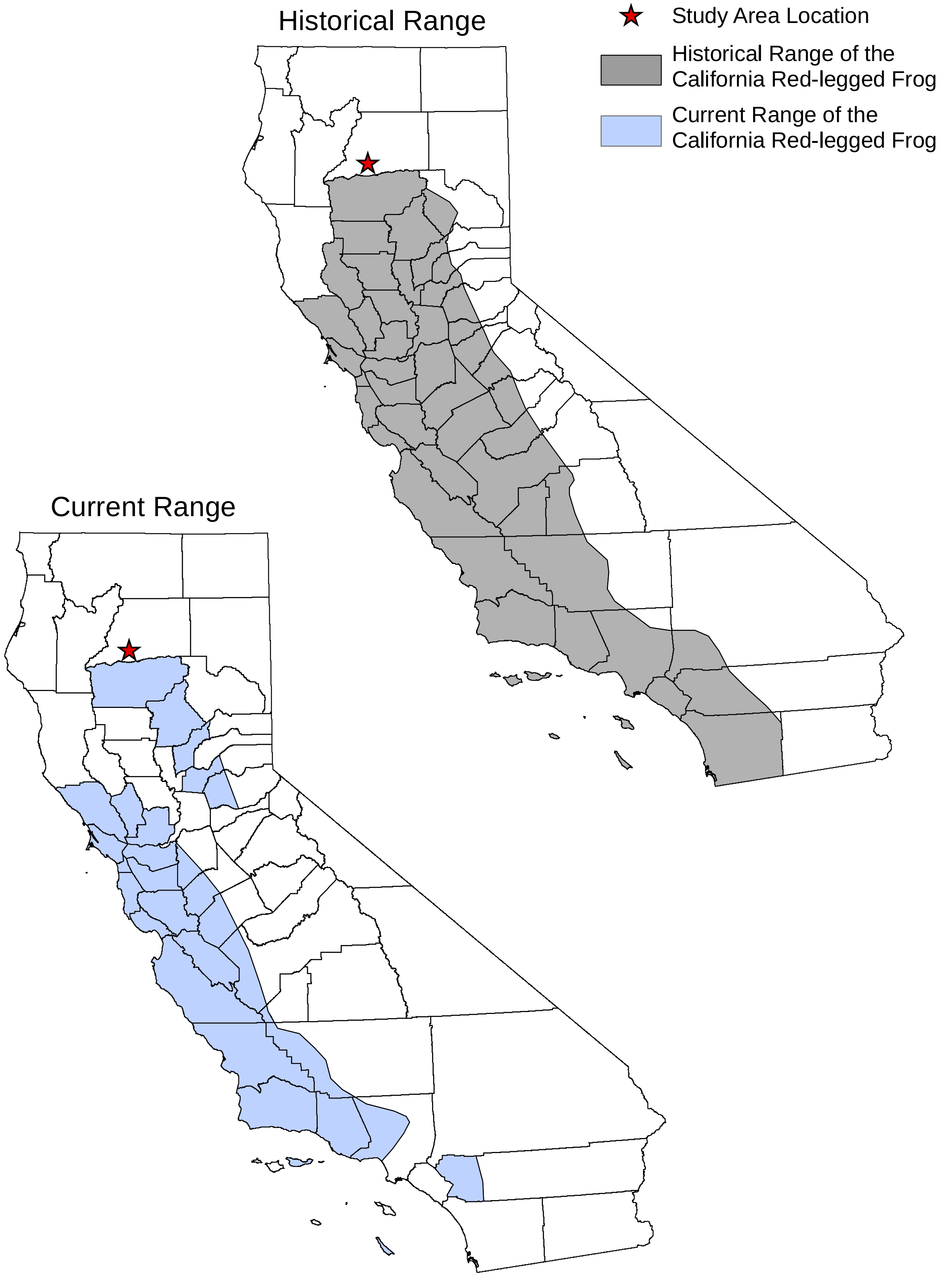
LIFE HISTORY

The California red-legged frog is a member of the family Ranidae within the order Anura, and is one of two subspecies of the red-legged frog (*Rana aurora*) (U.S. Fish and Wildlife Service 2000). The red-legged frog is the largest native frog in the western United States (Wright and Wright 1949), with adults obtaining a length of 3.4 to 5.4 inches from the tip of the snout to the rear of the vent (Jennings and Hayes 1994). Adult red-legged frogs have prominent dorsolateral folds, a bright red dorsum, and a well-defined stripe running along the upper lip. Juvenile frogs are 1.5 to 3.4 inches from the tip of the snout to the rear of the vent and have the same coloration as adults except that the dorsolateral folds are normally yellow or orange colored, especially in very young individuals (Stebbins 2003). Larval frogs range from 0.6 to 3.1 inches in length.

Adult California red-legged frogs have been observed to breed from late November through early May after the onset of warm rains (Storer 1925; Jennings and Hayes 1994). Females attach an egg mass of 2,000 to 6,000 moderate-sized (0.08 to 0.11 inch diameter) eggs to an emergent vegetation brace such as stems of tules (*Scirpus* spp.) and annual grasses (Poaceae), or roots of willows (*Salix* spp.) just below the water surface (Livezey and Wright 1947; Storer 1925).

Embryos of California red-legged frogs hatch 6 to 14 days after fertilization and the resulting larvae require 3.5 to 7 months to attain metamorphosis at a total length of 2.6 to 3.4 inches (Storer 1925). Larvae are thought to graze on algae, but they are rarely observed because they are often concealed in submergent vegetation or detritus (Jennings and Hayes 1994). Most larvae metamorphose into juvenile frogs between July and September. Post-metamorphic frogs grow rapidly by feeding on a wide variety of invertebrates. Adult frogs apparently eat a variety of animal prey including invertebrates, small fishes, frogs, and small mammals (Hayes and Tennant 1985; Arnold and Halliday 1986).

California red-legged frogs have been observed in a number of aquatic habitats throughout their historic range. The key to their occurrence in these habitats is the presence of perennial, or near perennial, water and the general lack of introduced aquatic predators such as crayfish (*Pacifastacus leniusculus* and *Procambarus clarkii*), bullfrogs (*Rana catesbeiana*), bluegill (*Lepomis macrochirus*), and other centrarchid fishes such as largemouth bass (*Micropterus salmoides*). In addition to aquatic habitats, juvenile and adult California red-legged frogs use areas of riparian vegetation within a few yards of water. The species also uses small mammal burrows in or under vegetation, willow root wads, and the undersides of old boards and other debris within the riparian zone (Jennings and Hayes 1994).



Source: U.S. Fish and Wildlife Service. 2002. Recovery plan for the California red-legged frog (Rana aurora draytonii). Portland: U.S. Fish and Wildlife Service.

50780_Strawberry_Fields\GIS\50780_Fig2_RLF_range Source: NSR Inc. 05-18-07 rio

Figure 2
Historical and Current Range of the California Red-legged Frog

5.0 METHODOLOGY

SITE ASSESSMENT

This California red-legged frog site assessment was conducted in accordance with the U.S. Fish and Wildlife Service (USFWS) *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (U.S. Fish and Wildlife Service 2005b). Information for the assessment was gathered through a combination of literature review, database searches, review of topographic mapping and aerial photography, and field visits to the site. The literature review identified the historic and current range of the California red-legged frog and provided information on specific habitat preferences of the species. The California Department of Fish and Game (CDFG) *California Natural Diversity Data Base* (CNDDB) records for Shasta County (California Department of Fish and Game 2003) and the USFWS *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002) provided information regarding the known existing and historic populations of California red-legged frogs in the study area region.

A review of topographic mapping and aerial photography provided information regarding vegetation communities and land uses occurring in the vicinity. NSR biologist Ginger Bolen conducted the field assessment on August 17 and 20, and September 11, 2006, and May 7 and 10, 2007. The study area and publicly accessible areas of the surrounding vicinity were characterized and evaluated for the presence of potentially suitable habitat for the California red-legged frog. Aquatic habitats were mapped and characterized (e.g., ponds vs. creeks, pool vs. riffle, ephemeral vs. permanent, vegetation type and characteristics, water depth, substrate, and description of bank), and the presence of bullfrogs and other aquatic predators documented (see Appendices A and B). Upland habitats were also characterized (e.g., vegetation communities, land uses, and potential barriers to California red-legged frog movements).

CALIFORNIA RED-LEGGED FROG IDENTIFICATION

Identification of all amphibians was done visually in situ, as handling of the California red-legged frog in any life stage is not permitted without a valid 10(a)(1)(A) permit. Positive diagnostic marks used to identify adult California red-legged frogs include prominent dorsolateral folds, bright red dorsum, and a well-defined stripe running along the upper lip. Positive diagnostic marks used to identify California red-legged frog tadpoles include eyes set well in from the outline of the head [contrasts with chorus frogs (*Pseudacris* spp.)] and generally mottled body and tail with few or no distinct black spots on tail fins (contrasts with bullfrogs).

6.0 RESULTS

REGIONAL ASSESSMENT

Historically, the California red-legged frog was found in Shasta County and several other counties in the region. In the 1960s, California red-legged frogs were found in Glenn County east of Elk Creek and in many drainages in Colusa County. In 1986 and 1987, California red-legged frogs were reported in Sunflower Gulch and Cottonwood Creek, west of Red Bluff (Tehama County). Subsequent surveys documented no red-legged frogs but did document bullfrogs, a predator of the red-legged frog (U.S. Fish and Wildlife Service 2002). California red-legged frogs historically occupied portions of the western slope of the Sierra Nevada from Shasta County south to Tulare County, but these populations have been fragmented and nearly eliminated (U.S. Fish and Wildlife Service 2002).

A review of the CNDDB and communications with the USFWS did not reveal any reported occurrences of the species within 5 miles of the study area (Peter Trenham, pers. comm. 2006). The nearest documented occurrence was recorded in 1986 in Sunflower Gulch (Tehama County), a tributary to Red Bank Creek approximately 36 miles southwest of the study area (U.S. Fish and Wildlife Service 2002).

STUDY AREA ASSESSMENT

Upland habitats within the study area boundary consist of valley oak woodland, valley foothill riparian, foothill pine woodland, and annual grassland. Aquatic habitat in the area includes two open water/pond features and a perennial stream (Sacramento River). Each of these features was assessed for suitability as California red-legged frog habitat and each is discussed in more detail below. These features are identified in Figure 3 and the corresponding Site Assessment Data Sheets are provided as Appendix A.

Perennial Stream

Location 12 (Sacramento River)

The Sacramento River basin encompasses approximately 27,210 square miles and includes the entire land area drained by the Sacramento River (Appendix B, Photograph 12). This area includes all watershed tributaries to the Sacramento River that are north of the Cosumnes River watershed. The study area is located in the upper Sacramento River, which drains approximately 6,500 square miles and has an average annual discharge of 7.1 million acre feet.

In the study area, the hydrology and water quality of the Sacramento River is largely dictated by the operations at Shasta Dam, approximately 13 river miles upstream. The aquatic habitat is comprised of an alternating sequence of riffle and run habitats consisting primarily of medium to large cobble substrates with areas of smaller spawning sized gravels (1-4 inches). The Sacramento River in the study area is approximately 500 feet wide and 5 feet deep at bank full. Habitat composition along the banks varies from relatively open grasslands to densely vegetated over-hanging riparian habitat that includes arroyo willow (*Salix lasiolepis*), valley oak (*Quercus lobata*), Fremont cottonwood (*Populus fremontii*), and Himalayan blackberry (*Rubus discolor*).

Location 2 (Sacramento River Backwater)

Location 2 is a low-gradient backwater of the Sacramento River with a substrate of cobble and muck (Appendix B, Photograph 2). It is approximately 100 feet-wide and 3 feet deep at bank full. The banks are steep and well vegetated with a variety of primarily riparian species including willow, Himalayan blackberry, valley oak, and yellowflag iris (*Iris pseudacorus*). The channel bottom is covered in submergent vegetation.

Figure 3
California Red-legged Frog Assessment Locations

Open Water

Location 1 (Pond)

Location 1 is an approximately 0.17-acre perennial pond (Appendix B, Photograph 1). The pond has a muck/organic substrate and reaches a depth of approximately 3 feet. The banks of the pond are heavily vegetated and shade the perimeter of the feature. Vegetation present on the banks includes Himalayan blackberry, willows, and California grape (*Vitus californica*). Submergent vegetation covers much of the pond bottom. Downed branches are also present in the pond.

Location 3 (Pond)

Location 3 is an approximately 0.40-acre perennial pond (Appendix B, Photograph 3). The pond has a muck and cobble substrate and reaches a depth of approximately 2 feet. The banks of the pond are vegetated and the overstory shades most of the feature. Vegetation present on the banks includes Himalayan blackberry, Fremont cottonwood, foothill pine (*Pinus sabiniana*), and willows. Duckweed (*Lemna minor*) covers the surface of the pond. Downed branches are also present in the pond. Several bullfrogs were observed during the site assessment.

LOCAL ASSESSMENT

The local assessment area (the area within a 1-mile radius of the study area boundary) includes rural residential, urban, and agriculture. Aquatic habitats in this area include open water, perennial stream, and agricultural ditch. Each feature assessed for suitability as California red-legged frog habitat is discussed in more detail below. These features are identified in Figure 3 and the corresponding Site Assessment Data Sheets are provided in Appendix A.

Open Water

Location 4

Location 4 is a remnant overflow channel of the Sacramento River (Appendix B, Photograph 4). Although the channel no longer functions to contain overflows from the river, water is present along stretches of the channel (possibly a result of a high ground water level and/or runoff) including an approximately 20-foot x 30-foot pond and the stretch of the channel from Location 4 south to the river. At the time of the assessment, physical access to the site was not permitted; therefore, a visual assessment was completed from the study area boundary. The ponded area lacks overstory vegetation but emergent vegetation is present and the banks are well vegetated with grasses. Maximum pond depth appears to be approximately 1-2 feet. It is unclear whether the pond is ephemeral or permanent. The associated stretch of channel appears to function as an intermittent stream. The stream banks have a sparse overstory of oak and small willows and an understory of grasses.

Location 5 (Constructed Impoundment)

Location 5 is an approximately 3.5-acre constructed impoundment hydrologically connected to the Sacramento River by a small ditch (Appendix B, Photograph 5). It is surrounded by rural residential development and has only a narrow strip of vegetation along the banks. Species present include willow, valley oak, pine (*Pinus* sp.), tree-of-heaven (*Ailanthus altissima*), and Himalayan blackberry as well as ornamentals. The pond appears to function as a stormwater detention basin and reaches depths of at least 2 feet. The surface is partially covered by lily pads (*Nymphaea* sp.) and algal mats. The site is used for sport fishing by local residents and likely supports both bluegill and bass.

Location 9 (Constructed Impoundment)

Location 9 is an approximately 0.41-acre City of Redding detention basin with a soil substrate (Appendix B, Photograph 9). Overstory vegetation is present only on the southern bank of the pool [interior live oak (*Quercus wislizenii*) and a small cottonwood] and provides little shading. One willow is also present at the northern end of the feature. The remainder of the banks are well vegetated with grasses. Spikerush (*Eleocharis* sp.) is abundant throughout the feature.

Perennial Stream

Location 6 (Olney Creek)

Olney Creek is a low-gradient perennial stream that drains to the Sacramento River (Appendix B, Photograph 6). The creek reaches depths of approximately 2 feet. The streambed is a combination of sand, gravel, and cobble and includes occasional pools. The banks are densely vegetated with riparian species, including willow, tree-of-heaven, Himalayan blackberry, and valley oak, that partially shade the feature. Emergent vegetation is present and includes scouring rush (*Equisetum hyemale*). Numerous bullfrogs were observed during the site assessment.

Location 7 (Churn Creek)

Churn Creek originates near Project City north of Redding and flows south in a narrow drainage area immediately east of and paralleling the Sacramento River (Appendix B, Photograph 7). It has little to no natural flow during the summer. During the winter, it can carry substantial flows compared to its drainage area due to the abundance of precipitation occurring at the very north end of the Sacramento Valley where it originates. Churn Creek has a well-developed alluvial floodplain, known locally as "Churn Creek Bottom", which continues approximately 5 miles upstream from its confluence with the Sacramento River. The streambed is composed of gravel and cobble and pools are present. In the assessment area, vegetation along the banks varies from open grassland to dense riparian including species such as valley oak, willow, and interior live oak. Emergent vegetation present in the creek includes nut sedge (*Cyperus* sp.) and water primrose (*Ludwigia* sp.). Non-native, resident fish species present in Churn Creek include the spotted bass (*Micropterus punctulatus*), largemouth bass, green sunfish (*Lepomis cyanellus*), and channel catfish (*Ictalurus punctatus*).

Agricultural Ditch

Location 8 (Churn Creek Lateral)

The Churn Creek Lateral is part of the Anderson-Cottonwood Irrigation District (ACID) (Appendix B, Photograph 8). Within the assessment area, the ditch is approximately 10 feet wide and 4 feet deep at bank full. Vegetation along the banks varies from primarily grasses and crops to riparian species, including willow and valley oak. The substrate is variously concrete and soil. Where a soil substrate occurs, submergent vegetation is present. Flows in the lateral are determined by ACID water allocations.

Location 10

Location 10 is an agricultural ditch approximately 10 feet wide and 2 feet deep at bank full (Appendix B, Photograph 10). Vegetation along the banks varies from primarily grasses to riparian species, including willow, valley oak, interior live oak, California grape, and cattails (*Typha* sp.). The ditch substrate is soil. Flows in the ditch are likely determined by ACID water allocations.

Location 11

Location 11 is an agricultural ditch approximately 6 feet wide and 2 feet deep at bank full (Appendix B, Photograph 11). The banks are densely vegetated with riparian species including willow, valley oak, and Himalayan blackberry. The ditch substrate is soil. The ditch does not appear to be in use as it was dry at the time of the assessment and a thick layer of detritus had accumulated.

7.0 SUMMARY

NSR conducted a California red-legged frog site assessment for the Strawberry Fields Study Area in Shasta County, California. The site assessment was conducted in accordance with the USFWS *Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (2005b).

The study area is located within the northernmost extent of the historical range of the California red-legged frog but is not within its currently known range. A review of the CNDDB (California Department of Fish and Game 2003) did not reveal any reported occurrences of the species within 5 miles of the study area and the nearest recorded occurrence (approximately 36 miles southwest of the study area) was documented over 20 years ago (U.S. Fish and Wildlife Service 2002).

However, aquatic habitats in the study area, especially the pond at Location 1, may provide suitable breeding habitat for the California red-legged frog, although bullfrogs, predators of the red-legged frog, were observed at both ponds in the study area. The pond at Location 1 appears to hold water for a sufficient period and at a sufficient depth to provide breeding habitat for the California red-legged frog. It is bordered by riparian vegetation, contains submerged vegetation, and is located near a perennial water source (Sacramento River).

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APPENDIX A

Habitat Assessment Data Sheets

APPENDIX B

Assessment Site Photos

STRAWBERRY FIELDS STUDY AREA

REPRESENTATIVE PHOTOGRAPHS

Photograph 1 - Pond

Photograph 2 – Sacramento River Backwater

Photograph 3 – Pond

Photograph 4 – Pond/Intermittent Creek

Photograph 5 – Constructed Impoundment

Photograph 6 – Olney Creek

Photograph 7 – Churn Creek

Photograph 8 – Churn Creek Lateral

Photograph 9 – Detention Basin

Photograph 10 – Agricultural Ditch

Photograph 11 – Agricultural Ditch

Photograph 12 – Sacramento River

NMFS BIOLOGICAL ASSESSMENT

BIOLOGICAL ASSESSMENT AND ESSENTIAL FISH HABITAT ASSESSMENT

NATIONAL MARINE AND FISHERIES SERVICE

REDDING RANCHERIA FEE-TO-TRUST AND CASINO PROJECT

JULY 2018

NEPA LEAD AGENCY:

U.S. Department of the Interior
Bureau of Indian Affairs
Pacific Region Office
2800 Cottage Way # W2820
Sacramento, CA 95825

BIOLOGICAL ASSESSMENT AND ESSENTIAL FISH HABITAT ASSESSMENT

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REDDING RANCHERIA FEE-TO-TRUST AND CASINO PROJECT

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LIST OF ATTACHMENTS

1.0 INTRODUCTION

The purpose of this Biological Assessment (BA) / Essential Fish Habitat (EFH) Assessment (EFHA) is to address the effect of the Redding Rancheria Tribe (Tribe) Fee-to-Trust and Casino Project (Proposed Project) on EFH designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and species listed as endangered or threatened by National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA). The Proposed Project is subject to federal discretionary approvals, including the acquisition of the 232-acre site adjacent to the southern border of the City of Redding, California (Strawberry Fields Site; Action Area) into federal trust status by the Bureau of Indian Affairs (BIA) for the purposes of gaming (Proposed Action).

An Environmental Impact Statement (EIS) has been prepared by the BIA pursuant to the National Environmental Policy Act (NEPA) to assess potential environmental effects of the Proposed Action. This BA/EFHA serves as the environmental document for the determinations made by the EIS and corresponding conservation measures regarding federally listed species, and addresses the Proposed Action's compliance with Section 7 of the ESA. A separate BA has been prepared for the United States Fish and Wildlife Service (USFWS) pursuant to Section 7 of the ESA.

1.1 PURPOSE AND NEED

The purpose and need for the Proposed Action is to promote the economic development and self-sufficiency of the Tribe, consistent with the BIA's "Self Determination" policy.

The Tribe's current Rancheria consists of eleven parcels comprising approximately 11.41 acres, merely 37 percent of the original Rancheria that was established by the BIA. Not all of these parcels are held in trust. The Tribe's existing Win-River Resort and Casino is located within the Rancheria, approximately two miles from the Strawberry Fields Site. Expansion of the existing Win-River Resort and Casino within the current Rancheria is not desirable due to the lack of developable land and the presence of Clear Creek and the Anderson – Cottonwood Canal that limit physical expansion.

Implementation of the Proposed Action is needed to assist the Tribe in meeting the following objectives:

- Restore the land base of the Tribe;
- Ensure the Tribe's gaming operations remain competitive in the gaming market and meets the economic needs of the Tribe and its growing membership;
- Locate additional tribal services and housing on the existing Rancheria;
- Strengthen the socioeconomic status of Tribe; and
- Ensure that the Strawberry Fields Site, which is within the traditional territory of the Tribe, is adequately maintained and protected for future generations and that the Tribe has the ability to exercise its jurisdiction as a sovereign tribal government over the Strawberry Fields Site.

1.2 Action Area

The Action Area is located within southern Shasta County (County), bordering the City of Redding (City) (**Figures 1** and **2**). The approximately 232-acre property is comprised of seven tax parcels and is bound by Bechelli Lane to the north, the Sacramento River to the west, and private property to the south, which is currently zoned for agricultural use. East of the site is Interstate 5 (I-5), a major north-south transportation corridor. Elevation ranges from 440 to 454 feet above mean sea level. A site plan is shown in **Figure 3**.

1.3 Proposed Project Components

The Proposed Project, identified as Alternative A in the EIS, includes the following components:

- Transfer of the approximately 232-acre Strawberry Fields Site to federal trust status (Proposed Action) for gaming purposes;
- Subsequent development of the trust property with uses including, but not limited to, a casino, 250-room hotel, conference and event centers, restaurants, retail facilities, parking, and other supporting facilities;
- Development of on-site infrastructure improvements needed to support the casino, including water, sewer, and stormwater infrastructure;
- Improvement of off-site access roads to access the site from either the north or the north and south;
- Stabilization of the eastern bank of the Sacramento River using the windrow rock slope protection (RSP) method, which involves removal of existing stream bank material above the ordinary high water mark (OHWM) and placement of a row of appropriately-sized rock boulders over the existing alluvium up to at least the floodwater surface elevation of the river, after which the river-side and top-surface of the boulders are then covered with native alluvium and the top surface is further covered with a minimum of 18 inches of native loam; and
- Closure of the existing Win-River Casino and the redevelopment of the facility into tribal services and housing uses.

A site plan for the proposed facilities is shown in **Figure 3**. Additional detail regarding the proposed grading and drainage plan and water supply /wastewater treatment facilities is provided below:

Grading and Drainage

The Strawberry Fields Site is relatively flat and generally drains southwesterly from Interstate 5 towards the Sacramento River. The development area is outside of the 100-year floodplain and the designated floodway of the Sacramento River. However, during storm events smaller than a 100 year event, approximately 600-700 cubic feet per second will flow through the site from east of Interstate 5. This flow comes from Churn Creek, spills over Interstate 5 and is conveyed overland to the Sacramento River.

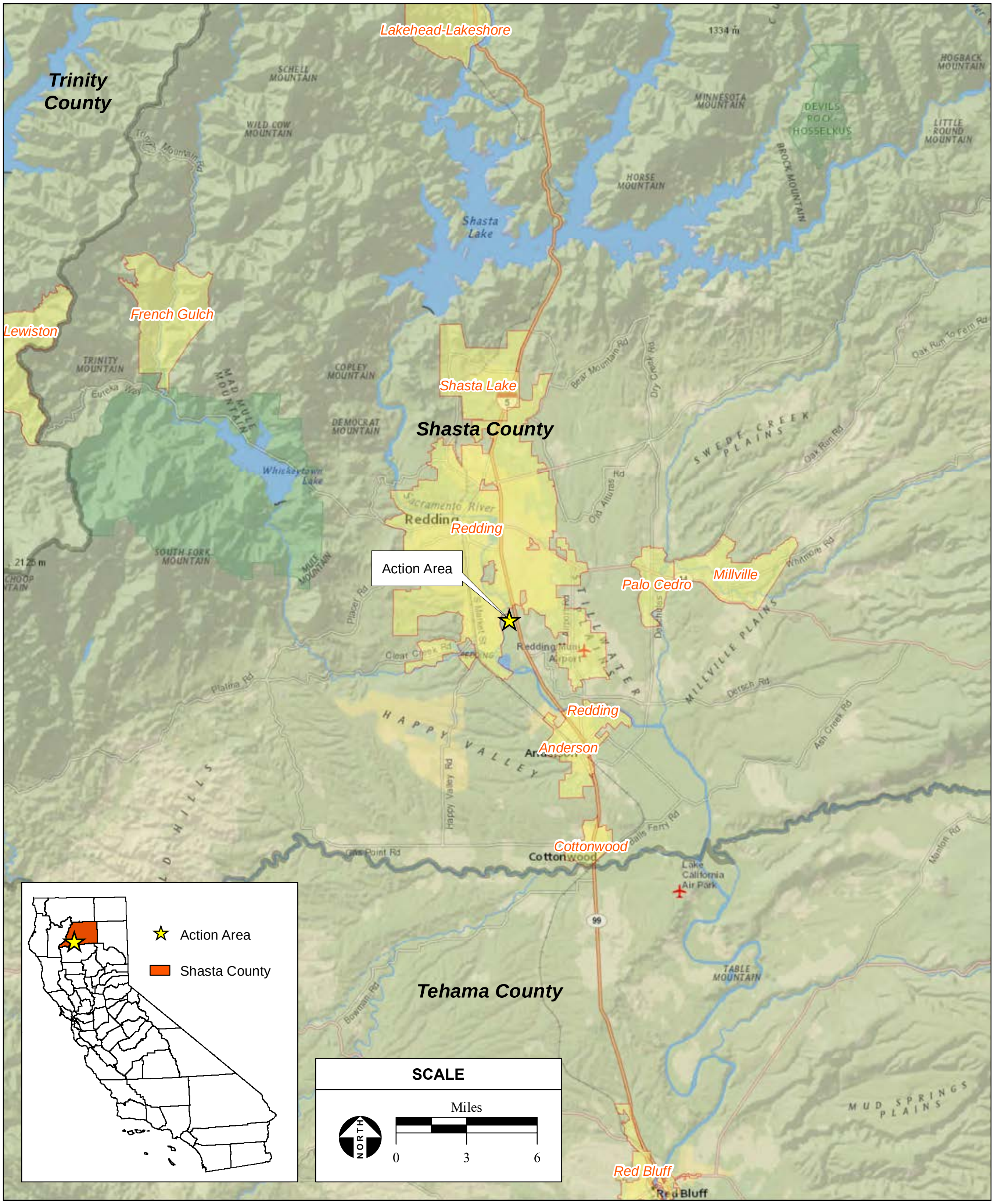
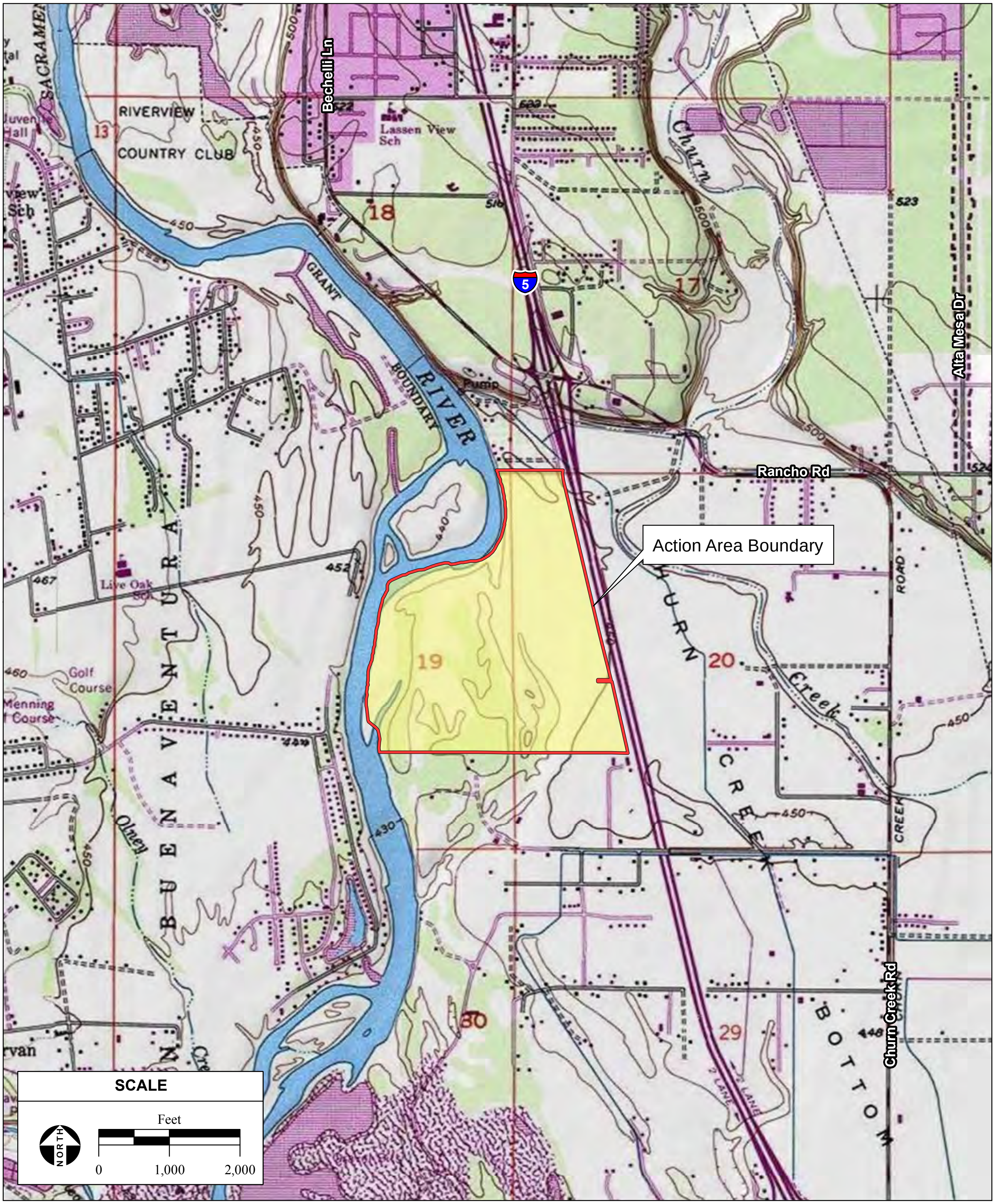


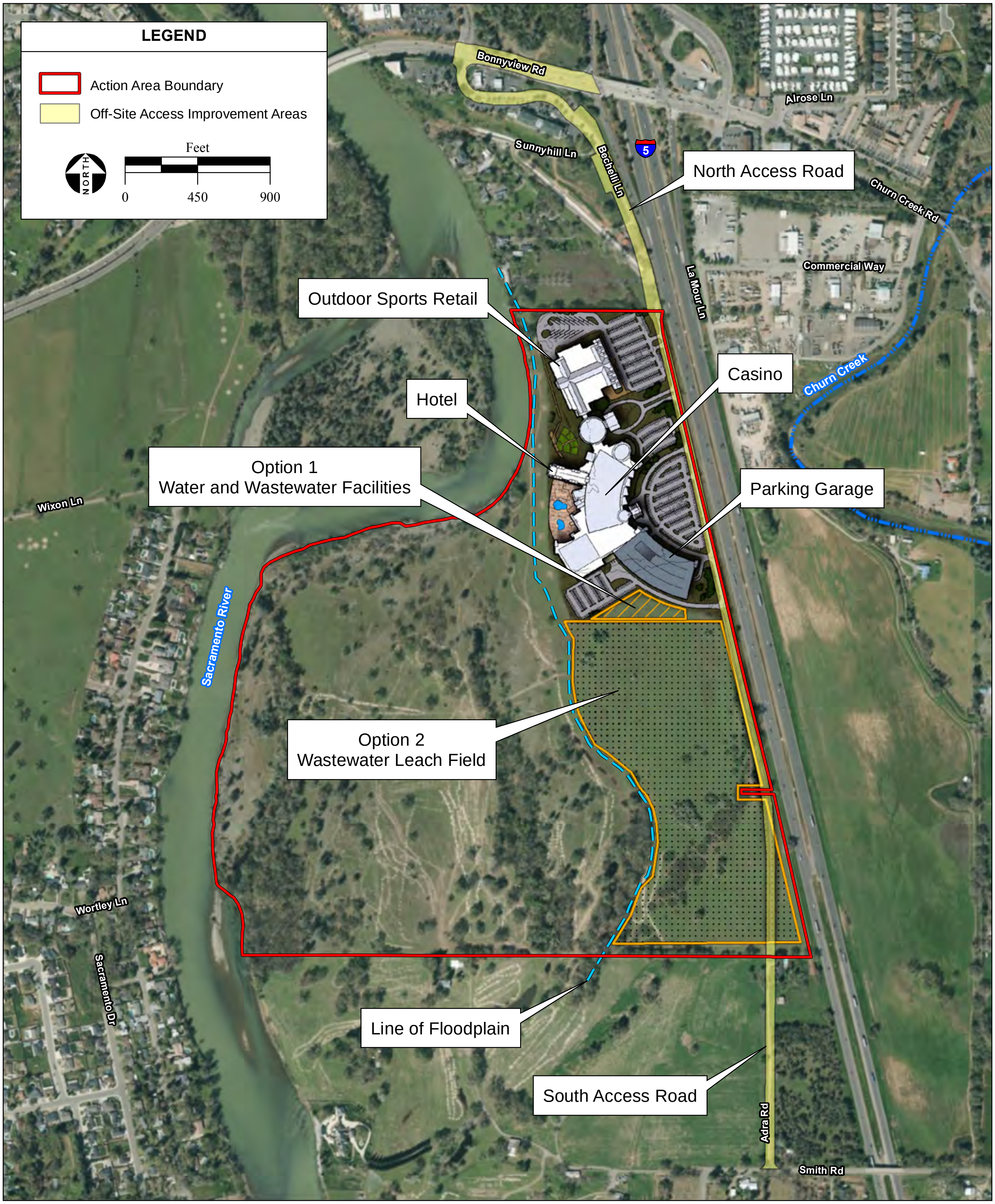
Figure 1
Regional Location



SOURCE: "Enterprise, CA" USGS 7.5 Minute Topographic Quadrangle, T31N, R4W, Section 18, 19, & 20, Mt. Diablo Baseline & Meridian; ESRI Data, 2016; AES, 10/4/2017

Redding Rancheria Fee-to-Trust NMFS BA-EFHA / 214584

Figure 2
Site and Vicinity



SOURCE: USDA aerial photograph, 7/26/2014; ESRI Data, 2016; AES, 10/9/2017

Figure 3
Site Plan

As discussed in the Grading and Drainage Study (**Attachment A**), surface parking lots would be constructed with a west-to-east slope toward storm drain inlets, which would be placed at appropriate intervals to capture runoff and convey it via an underground storm drain system. Catch basin insert filters will be installed at select area drains to capture sediment, debris, trash, oil and grease from stormwater. These filters would clean the stormwater during low flows, and have no standing water, minimizing bacteria and odor problems. A 40-foot wide, 5-foot deep vegetated swale is proposed to run north to south between the access road within the site and Interstate 5. This vegetated swale would convey project runoff, provide stormwater filtration and infiltration, as well as provide a bypass channel for the 600-700 cubic feet per second flow coming westerly from Churn Creek during extreme rain events. The vegetated swale would pass south of the proposed development through a box culvert under the access road and to a 65,000 cubic-foot water quality retention as shown in Figure A4 of **Attachment A**. The proposed water quality retention pond has been sized in accordance with the California Stormwater Quality Association (CASQA) California Stormwater Best Management Practice (BMP) Handbook for New Development and Redevelopment, and would retain water and allow infiltration into the native alluvial soil during a typical rain event. During rare extreme runoff events, the wet pond will spill and runoff will make its way south to the Sacramento River. The wet pond will be submerged when the Sacramento River is flooding.

Water Supply and Wastewater Treatment

There are two options proposed to supply water to the Proposed Project, and two options proposed for wastewater treatment and disposal. These options are summarized below.

Water Supply Option 1: Off-site

Under Water Supply Option 1, water supply to serve the Proposed Project would be provided through a connection to the City of Redding's municipal water supply infrastructure. Connection to the City's water system is described in more detail under the discussion of interrelated and interdependent effects in **Section 4.3**. The City's water system would meet the demands of the Proposed Project and would provide required fire protection flows.

Water Supply Option 2: On-site

Under Water Supply Option 2, potable water supply to serve the Proposed Project would be provided through the installation of groundwater wells on the Strawberry Fields Site. Recycled water from on-site wastewater treatment would be reused for indoor non-potable uses (such as toilet flushing) and for landscape irrigation. The proposed groundwater wells would be drilled to a depth of between 300 and 600 feet, which is anticipated to produce water of sufficient quantity and quality. According to consultation with local jurisdictions, groundwater in the area is a reliable water source (refer to Appendix B of the EIS).

Wastewater Treatment and Disposal: Off-site

Under Wastewater Option 1, wastewater treatment would be provided by the City of Redding via connection to the City's conveyance system and wastewater treatment plant (WWTP). Connection to the existing treatment system from the Strawberry Fields Site to the Sunnyhill Lift Station is described in more detail under the discussion of interrelated and interdependent effects in **Section 4.3**. From the Sunnyhill Lift Station, wastewater from the Proposed Project would be conveyed to the City's Stillwater WWTP for treatment and disposal.

Wastewater Treatment and Disposal: On-site

Under Wastewater Option 2, wastewater would be treated at an on-site WWTP, located to the south of the casino and hotel (**Figure 3**). The WWTP would be sized to treat the peak flows resulting from the Proposed Project. An immersed membrane bioreactor (MBR) system would be used to produce tertiary-treated water for reuse or disposal. The MBR is a state-of-the-art system that consists of utilizing a biological reactor and microfiltration in one unit process. The ability of an MBR to eliminate secondary clarification and to operate at higher suspended solids concentrations gives the system the ability to react to wide variations in flows as would be expected at gaming facilities on weekends or holidays. A detailed description of the proposed on-site WWTP under Option 2 is presented in Appendix B of the EIS.

Recycled water from the on-site WWTP would be used for toilet flushing and landscape irrigation, and all reclaimed water would meet the equivalent of State standards governing the use of recycled water as described in Title 22 of the California Code of Regulations (CCR). A recycled water storage tank would be constructed to hold one to two days of peak treated water reuse demand.

On-site leach fields would be used to dispose of excess treated wastewater effluent by distributing it underground through a network of perforated pipes or infiltration chambers. The proposed leach field would be located in the southeast area of the Strawberry Fields Site, entirely outside of the floodplain of the Sacramento River, as shown on **Figure 3**. The size of the leach field would be approximately 45 acres, which includes a replacement leach field area of 100 percent in the event of leach field failure, and a 20 percent contingency to avoid oversaturation of the soil and to handle high peak flows.

2.0 METHODOLOGY

Prior to conducting the biological surveys within the Action Area, the following information was obtained and reviewed:

- USFWS Official Species List, dated July 26, 2017 of federally listed species with the potential to occur on or be affected by projects on the Enterprise United States Geological Survey (USGS) 7.5-minute topographic quadrangle (quad; USFWS, 2017a; **Attachment B**);

- California Native Plant Society (CNPS) query, dated July 26, 2017, of special-status plant species known to occur on the Enterprise USGS 7.5 minute topographic quad (CNPS, 2017a) (**Attachment B**);
- California Natural Diversity Database (CNDDB) query, dated July 26, 2017, of federally listed species known to occur on the Enterprise USGS 7.5 minute topographic quad (CDFW, 2017a) (**Attachment B**);
- USFWS National Wetlands Inventory (NWI) map of wetland features on the Action Area (USFWS, 2017c);
- A critical habitat map (USFWS, 2017c);
- Biological Resources Assessment on the Strawberry Fields Study Area, dated November 7, 2007, by North State Resources, Inc. (NSR, 2007; **Attachment C**); and
- Consultation of NMFS federally listed fish species, critical habitat, and Essential Fish Habitat (EFH; NOAA, 2005; NMFS, 2004; NMFS, 2015).

2.1 BIOLOGICAL SURVEYS

Biological resource surveys and focused botanical surveys of the Action Area were conducted on April 25, 2007 (**Attachment B**). Additional surveys were conducted on May 3, 2007, May 9, 2007, June 27, 2007, May 16, 2016, and March 13, 2017. Surveys assessed habitat types, federally listed species, suitable habitat for federally listed species, and wetlands and Waters of the U.S. Species and habitat types were classified using the *Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities* (CDFW, 2000), *Botanical Survey Guidelines of the California Native Plant Society* (CNPS, 2001), and *The Jepson Manual* (Baldwin et al., 2012).

2.2 ANALYSIS

An analysis was conducted to determine federally listed fish species that may have the potential to occur within the Action Area or within downstream waterways that may be affected by the Proposed Action. Habitat requirements for fish species were assessed and compared to the type and quality of habitats observed during surveys. Federally listed fish species with no potential to occur within the Action Area or downstream waterways that may be affected by the Proposed Action were ruled out based on lack of suitable habitat and/or geographic distribution.

3.0 ENVIRONMENTAL SETTING

3.1 TOPOGRAPHY AND CLIMATE

The Action Area is located within the northern portion of the Sacramento Valley on relatively level terrain above the Sacramento River. The western site boundary is an almost vertical embankment adjacent to the Sacramento River. The region has a high mean temperature of 96° F and a low mean temperature of 39° F, and the average annual rainfall is approximately 24 inches (Wunderground, 2016).

3.2 HABITAT TYPES

Five terrestrial habitats were identified within the Action Area (**Figure 4**): non-native annual grassland, valley foothill riparian, valley oak woodland, riverine, and foothill pine woodland. Three aquatic habitats were identified within the Action Area (**Figure 4**): seasonal wetlands; ephemeral stream; and ponds. Of the eight total habitat types identified in the Action Area, the riverine habitat has the potential to seasonally support significant fish species. The other aquatic features do not contain sufficient water or substrate to support significant fish species. Additionally, the Sacramento River adjacent to the project site provides all four major components of freshwater EFH for Chinook salmon. Habitats with the potential to support federally listed fish species are discussed below. Site photographs are included in **Figure 5**.

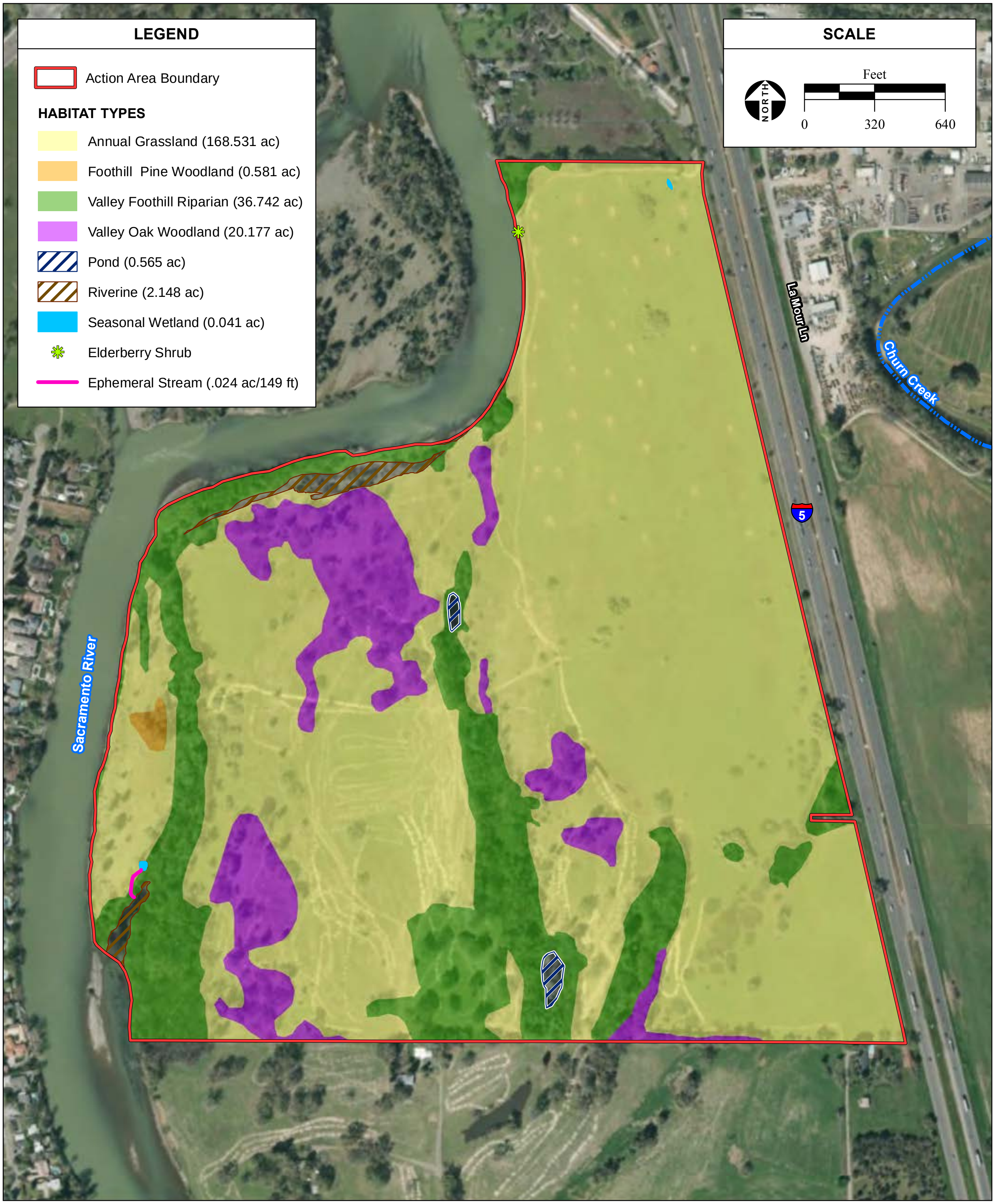
3.3 POTENTIAL FISH HABITAT

The main channel of the Sacramento River runs adjacent to the Action Area. Approximately 2.15 acres of riverine habitat occur on the Action Area. The riverine habitat contains a backwater of the Sacramento River and a portion of the floodplain habitat. Approximately 325 linear feet of backwater and approximately 950 linear feet of floodplain habitat from the Sacramento River occur on the site. The Sacramento River contains an ordinary high water mark (OHWM) throughout the year, but due to the seasonal scouring caused by changing water volume and velocity, most plant species are unable to establish. Adult Chinook salmon migrate to and are known to spawn in the Sacramento River in the region of the Action Area. The backwater of the riverine habitat provides suitable juvenile rearing habitat for various aquatic species, however, does not generally contain the primary constituent elements associated with other life stage usages (i.e. no spawning flows or gravels). The floodplain habitat is a depositional area (i.e. gravel bar) on the outside of a bend in the river that inundates during periods of high water.

3.4 CRITICAL HABITAT AND ESSENTIAL FISH HABITAT

Designated critical habitat for steelhead (Northern California Distinct Population Segment [DPS]), Chinook salmon (Central Valley Spring-Run and Winter-Run), and Green sturgeon (Southern DPS) occurs in the Sacramento River adjacent to the Action Area, and in the riverine habitat on-site (USFWS, 2017c; NOAA, 2005; NMFS, 2004; NMFS, 2015). The backwater of the riverine habitat provides seasonal habitat for juvenile rearing but does not contain the elements necessary for other life-stage uses. Similarly, the floodplain area of the riverine habitat would be inundated only during periods of high water flow. The lateral extent of the critical habitat is defined by the OHWM or, in areas where the OHWM cannot be defined, the lateral extent is defined by the bankfull elevation (33 CFR 329.11).

The Sacramento River is designated by NMFS as EFH for Chinook salmon, as defined by the Magnuson-Stevens Fisheries Conservation and Management Act (MSMA). EFH refers to those waters and substrates necessary for spawning, breeding, feeding, or growth to maturity. Freshwater EFH for salmon consists of four major components: spawning and incubation habitat; juvenile rearing habitat; juvenile



SOURCE: USDA aerial photograph, 7/26/2014; ESRI Data, 2016; AES, 10/4/2017

Figure 4
Habitat Types

PHOTO 1: Adjacent Sacramento River.

PHOTO 2: On-site riverine habitat, looking east.

PHOTO 3: Adjacent Sacramento River.

SOURCE: AES, 10/4/2017

Figure 5
Site Photographs

migration corridors; and adult migration corridors and adult holding habitat (Pacific Fishery Management Council, 1999). The lateral extent for EFH is the same as the lateral extent for critical habitat, as defined by the OHWM or bankfull elevation (33 CFR 329.11).

3.5 FEDERALLY LISTED FISH SPECIES

Based on biological desktop review and survey results, the following federally listed fish species have the potential to occur within or adjacent to the Action Area: Steelhead (*Oncorhynchus mykiss;* Northern California DPS), Chinook salmon (*Oncorhynchus tshawytscha;* Central Valley Spring-Run and Sacramento River Winter-Run), and Green sturgeon *(Acipenser medirostris;* Southern DPS).

Steelhead (*Oncorhynchus mykis*s) – Northern California DPS

FEDERAL STATUS – THREATENED
STATE STATUS – NONE

The northern California steelhead (*Oncorhynchus mykiss*) DPS includes naturally spawned anadromous steelhead originating below natural and manmade impassable barriers in California coastal river basins from Redwood Creek to and including the Gualala River (NOAA, 2005). The range can include portions of Amador, Alameda, Butte, Calaveras, Contra Costa, Colusa, Glenn, Mariposa, Merced, Nevada, Placer, Sacramento, San Joaquin, Shasta, Solano, Stanislaus, Sutter, Tehama, Tuolumne, Yolo, and Yuba counties.

Adult steelhead begin their migration from the ocean in the late fall through early winter and typically arrive at their spawning grounds between December and April, spawning shortly after arrival. Unlike other Pacific Coast salmonid species, steelhead do not usually die after spawning. Spawning takes place in relatively shallow water, typically in glides and shallow runs at depths ranging from 0.2 m to 1.0 m. Preferred spawning substrate consists of gravel ranging from 0.3 cm to 10 cm in diameter. The optimum temperature for egg development is 9 to 11 degrees Celsius (° C; 48 to 52 degrees Fahrenheit [° F]). After emergence, fry seek shallow edge water habitat for several months after which they disperse into suitable mid-channel habitat. Optimum juvenile growth and survival occurs at temperatures ranging from 13 to 17° C (55 to 64° F) with dissolved oxygen levels greater than 9 milligrams per liter (mg/L). Juveniles remain in the freshwater environment for one to two years where they forage mainly on aquatic invertebrates prior to migrating to the Pacific Ocean. They typically spend one to three years in near shore saltwater and occasionally pelagic habitat foraging on crustaceans, small fish, and squid before reaching maturity and returning to their natal streams to spawn (Moyle, 2002a; Moyle, 2002b; McEwan et al., 1996).

The riverine habitat on-site and the Sacramento River adjacent to the site contain suitable habitat and are listed as critical habitat for this species (USFWS, 2017b).

Chinook Salmon (*Oncorhynchus tshawytsha*) – Sacramento River Winter-Run ESU

FEDERAL STATUS – ENDANGERED
STATE STATUS – ENDANGERED

Chinook salmon are the largest and most abundant salmonid species that occur in California. Chinook are anadromous, but unlike steelhead, Chinook die after a single spawning event. This evolutionary significant unit (ESU) spawns in the upper Sacramento River. Chinook salmon are generally thought to exhibit two basic life history patterns; the stream-type and the ocean-type. Winter-run Chinook exhibit a "stream-type" life history dependent on year-round, cool, freshwater habitat for both adults and juveniles, which regularly spend more than a year in rivers before out-migration to the Pacific Ocean (Williams, 2006). Winter-run Chinook typically migrate from the ocean into the freshwater environment in early to late winter. Spawning occurs within a few days or weeks of arrival at the spawning grounds. They migrate upstream before reaching sexual maturity during the spring and summer months. Hatched juveniles reside in spawning streams for at least one year before returning to marine habitats. Winter-run Chinook achieve sexual maturity in the freshwater environment.

The riverine habitat on site and the Sacramento River adjacent to the site contain suitable habitat and are listed as critical habitat for this species (USFWS, 2017b).

Chinook Salmon (*Oncorhynchus tshawytsha*) – Central Valley Spring-Run ESU

FEDERAL STATUS – THREATENED
STATE STATUS –THREATENED

Chinook in the California Central Valley spring-run ESU are a spring-run species. Spring-run Chinook exhibit a "stream-type" life history that is dependent upon year-round, cool, freshwater habitat for both adults (which arrive in spring and mature while over-summering in foothill streams) and juveniles, which regularly spend more than a year in rivers before out-migration (Williams, 2006). Spring-run Chinook typically migrate from the ocean into the freshwater environment in early to late spring in full maturity. This ESU spawns in the Sacramento River and several of its tributaries. Spawning occurs within a few days or weeks of arrival at the spawning grounds. Spawning occurs in large deep pools in tributaries with moderate velocities and a large bubble curtain at the head. Spring-run spawning and rearing habitat is restricted to the higher elevation portions of the Central Valley where cool summer temperatures can be found in snow melt-fed rivers. Juveniles migrate from spawning grounds to the Pacific Ocean.

The riverine habitat on-site and the Sacramento River adjacent to the site contain suitable habitat and are listed as critical habitat for this species (USFWS, 2017b).

Green Sturgeon (*Acipenser medirostris*) – Southern DPS

FEDERAL STATUS – THREATENED
STATE STATUS – NONE

Green sturgeon use streams, rivers, and estuarine habitat as well as marine waters during their life cycle. This species reaches sexual maturity after 15 years with the southern DPS spawning every 3-4 years primarily in the Sacramento River. Adult green sturgeon generally migrate into rivers between late-February and late-July, and spawning occurs in deep, fast water from March to July. Suitable habitat for spawning includes deep pools with small to medium gravel, cobble, or boulder substrate. Research indicates that water flow is one of the main determinants of successful larval survival (Moyle, 2002).

Water flow and water temperatures between 11-18 °C are also important features for spawning and successful embryotic growth. Males can fertilize the eggs of multiple females and post-spawning fish often remain in the Sacramento River until fall or winter. Eggs incubate for approximately 9 days and remain near the hatching area for 18-35 days before dispersing. Juveniles may rear in the river for 1 to 3 years before migrating to the estuary, primarily during the summer and fall. Once in the marine environment, sub-adult and adults will spend most of their life in coastal habitat.

The riverine habitat on-site and the Sacramento River adjacent to the site contain suitable habitat and are listed as critical habitat for this species (USFWS, 2017b).

4.0 EFFECTS OF THE ACTION

4.1 CRITICAL HABITAT AND ESSENTIAL FISH HABITAT

Designated critical habitat for steelhead (Northern California DPS), Chinook salmon (Central Valley Spring-Run and Winter-Run), and green sturgeon (Southern DPS) occurs in the Sacramento River adjacent to the Action Area, and in the riverine habitat on site (USFWS, 2017b; NOAA, 2005). The Sacramento River is designated by NMFS as EFH for Chinook salmon, as defined by the MSMA. The section of riverine habitat may provide seasonal habitat for juvenile rearing but does not contain the elements necessary for other life-stage uses. Designated critical habitat and EFH do not occur within the area of impact, and adjacent critical habitat and EFH will not be directly impacted. Indirect effects to critical habitat and EFH are discussed below.

Water Quality

Construction

Construction of the Proposed Project would include ground-disturbing activities such as clearing and grubbing, mass grading, and excavation, which could lead to erosion of topsoil. Erosion from construction could increase sediment discharge to surface waters during storm events thereby degrading downstream water quality. Construction activities, typical of other development projects, would also include the routine use of potentially hazardous construction materials such as concrete washings, solvents, paint, oil, and grease, which may spill onto the ground and be picked up by stormwater.

Erosion control measures will be implemented in compliance with the National Pollutant Discharge Elimination System (NPDES) General Construction Permit for construction activities. A Stormwater Pollution Prevention Plan (SWPPP) will be developed prior to any ground disturbance and would include Best Management Practices (BMPs) to reduce potential surface water contamination during storm events. Implementation of BMPs incorporated into the SWPPP would reduce or prevent adverse effects to the local and regional watershed from construction activities on the Strawberry Fields Site. Therefore, construction activities associated with the Proposed Project would not result in a significant adverse effects to water quality in the Sacramento River.

Operation

Implementation of the Proposed Project would alter the existing drainage pattern of the Action Area and increase stormwater runoff as a result of increased impervious surfaces in the northern portion of the site. This increase in impervious surfaces could impact the quantity and quality of stormwater runoff. The Proposed Project would convert up to approximately 37 acres of pastureland into a hotel and casino complex, sports retail facility, surface roads, and parking areas, which would result in an increase in stormwater runoff over pre-development rates during 2-, 10-, and 100-year storm events.

Due to the increase in surface water runoff, one retention pond in the southern portion of the Action Area is included in the project design. The wet pond would have a capacity of 615,000 cubic feet. The wet pond is sized to accommodate twice the runoff volume of the 85th percentile storm and would allow for infiltration of stormwater into the native soil. When the Sacramento River is at flood stage, the wet pond will be submerged. Runoff would be conveyed to this wet pond via a 40-foot wide, 5-foot deep vegetated swale that would run north to south along Interstate 5 (I-5), and between I-5 and the access road under Site Access Option 2; the vegetated swale would also provide stormwater filtration and infiltration and would provide a bypass channel for 600 to 700 cfs of runoff flowing westerly from Churn Creek during extreme precipitation events. The maximum flow that the vegetated swale would be able to infiltrate is approximately 182 cfs, which is more than the 100-year peak flow of 174 cfs. A box culvert would be required if Site Access Option 2 is selected to allow the vegetated swale to pass beneath the South Access Road.

As described in **Attachment A** and in **Section 1.3**, the Proposed Project has been designed to accommodate the infiltration of stormwater into the native on-site soil instead of the Sacramento River. Low Impact Development (LID) BMPs, including the aforementioned vegetated swale and retention pond, have been incorporated within the design of the stormwater drainage system for the Proposed Project. Other LID BMPs incorporated in the project design to filter pollutants from stormwater run-off during operation of the Proposed Project include: the use of catch basin insert filters in parking lots and landscaped areas, which filter stormwater during periods of low flow by capturing contaminants and larger debris, thereby improving the quality of runoff before it enters the underground storm drain system; the use of infiltration trenches in place of underground storm drain pipes where feasible, which consist of perforated pipes placed in a drain rock-filled trenches, and would simulate the natural runoff absorption and filtration conditions that prevailed on the Action Area prior to development; and the use of pervious pavements in parking and outdoor pedestrian areas, which reduce runoff volume while providing treatment.

Sacramento River Streambank Stabilization

The east bank of the Sacramento River in the vicinity of the Strawberry Fields Site is actively eroding during periods of very high flow. Streambank stabilization measures have been incorporated within the project design to slow the rate of erosion and reduce sedimentation. Thus, these elements of the project design would have a potentially beneficial impact on the surface water quality of the Sacramento River in the vicinity of the Action Area by reducing the amount of fine sediment discharged into the river. Additionally, due to the relatively minimal extent of the material that would be added and the resulting changes to the Sacramento River's orientation that would occur as a result of these measures, streambank stabilization would not exacerbate rates of streambank erosion at locations downstream. Further, the NPDES General Construction Permit, SWPPP, and BMPs would further prevent contaminated run-off from entering the Sacramento River. The stabilization measures will have no effect on critical habitat or EFH.

4.2 FEDERALLY LISTED FISH SPECIES

Based on biological desktop review and survey results, federally listed Steelhead, Chinook salmon, and green sturgeon have the potential to occur within the on-site riverine habitat and the adjacent Sacramento River. Approximately 2.15 acres of riverine habitat occur in the Action Area. The riverine habitat contains a seasonal backwater of the Sacramento River and a portion of the floodplain. The backwater of the riverine habitat may seasonally provide suitable juvenile rearing habitat for various aquatic species, however, does not generally contain the primary constituent elements associated with other life stage usages (i.e. no spawning flows or gravel). Similarly, the floodplain habitat is a depositional area that only inundates during periods of high water. The main channel of the Sacramento River adjacent to the Action Area contains habitat for all life stages of fish species.

The riverine habitat and Sacramento River do not occur within the area of impact, and adjacent fish habitat will not be directly impacted. Additionally, the Proposed Action would not result in adverse effects to water quality in the Sacramento River as discussed above under the heading of *Critical Habitat and Essential Fish Habitat*; thus the quality of habitat for federally listed fish species within the Sacramento River watershed would not be adversely affected by the Proposed Action. The Proposed Action will have no effect on federally listed fish species.

4.3 INTERRELATED AND INTERDEPENDENT EFFECTS

Interrelated and interdependent effects are direct or indirect effects that occur as a result of activities that are closely affiliated with a project in areas outside proposed project area. Such actions include road or utility improvements off-site that would not be constructed but for implementation of the Proposed Project. Only those activities that would not require a separate federal action and would otherwise not be addressed for compliance with Section 7 of the ESA will be addressed in this BA.

Off-site Traffic Improvements

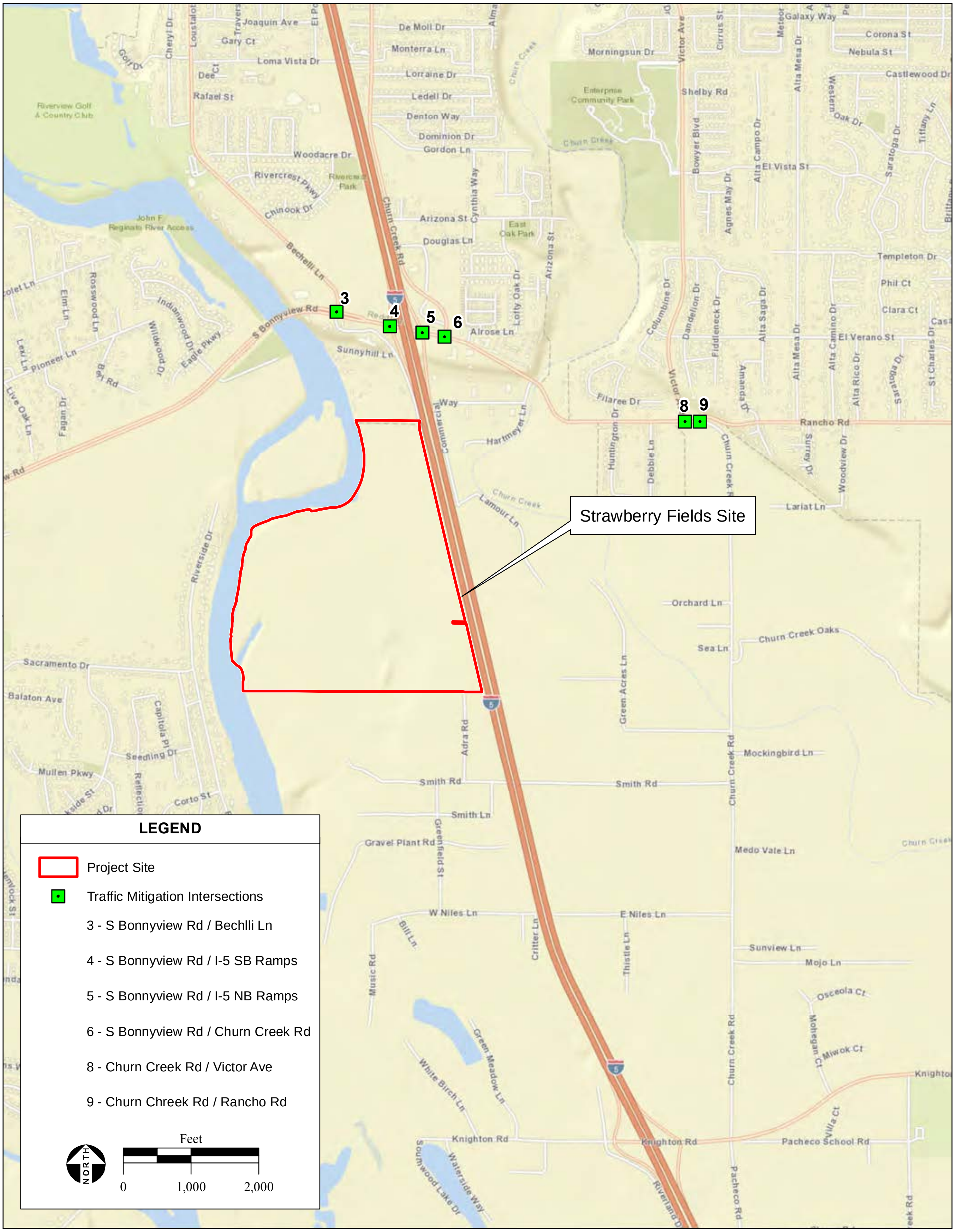
Implementation of the Proposed Project would require construction of off-site traffic mitigation improvements. A detailed description of off-site traffic mitigation for each alternative is provided in Section 5.8 of the EIS. Off-site traffic mitigation improvements are conceptual at this time. Design and construction plans would be prepared after an alternative has been selected for development.

Traffic mitigation improvements are recommended at the following study intersections:

- South Bonnyview Road / Bechelli Lane (Intersection 3);
- South Bonnyview Road / Interstate 5 (I-5) Southbound (SB) Ramps (Intersection 4);
- South Bonnyview Road / I-5 Northbound (NB) Ramps (Intersection 5);
- South Bonnyview Road / Churn Creek Road (Intersection 6);
- Churn Creek Road / Victor Avenue (Intersection 8); and
- Churn Creek Road / Rancho Road (Intersection 9).

Off-site traffic mitigation would require obtaining approvals and permits from the City of Redding, Caltrans, and/or Shasta County, which requires additional environmental review prior to approval. Implementation of permitting and CEQA requirements would further reduce the potential for significant adverse impacts from off-site construction projects.

Surveys of the potentially affected areas for the proposed traffic mitigation, with the exception of the South Bonnyview Road / Churn Creek Road intersection, were conducted by an AES biologist on June 29, 2017. These surveys were conducted on foot. Intersections 3, 4, 5, 6, 8 and 9 (South Bonnyview Road / Bechelli Lane, South Bonnyview Road / I-5 SB Ramps, South Bonnyview Road / I-5 NB Ramps, South Bonnyview Road / Churn Creek Road, Churn Creek Road / Victor Avenue and Churn Creek Road / Rancho Road) are currently paved and developed with ruderal/disturbed shoulders and/or roadsides on one or both sides of the road (for intersection numbers and locations, refer to **Figure 6**). Ruderal/disturbed areas contain sparse vegetation consisting predominately of non-native grass species, and the areas are heavily disturbed by vehicle traffic. No federally-listed fish species have the potential to occur within the off-site traffic improvement areas.



SOURCE: ESRI WorldStreetmap, 2017; AES, 7/18/2018

Redding Rancheria Fee-to-Trust NMFS BA-EFHA / 214584 ■

Figure 6
Traffic Mitigation Locations

Drainage features, including curbs, gutters, storm drains, and/or culverts, have been incorporated within the design of the planned improvements to Bechelli Lane and Adra Way. These features would convey stormwater runoff associated with the improved road segments to either the City of Redding's stormwater management system or to the on-site drainage features, which are each adequately sized to both retain all runoff and provide sufficient stormwater quality control. Combined with the NPDES General Construction Permit, SWPPP, and BMPs, these design elements would ensure that the impacts to regional stormwater runoff and surface water quality would be less than significant. Construction of off-site traffic improvements is not likely to adversely affect federally listed fish species.

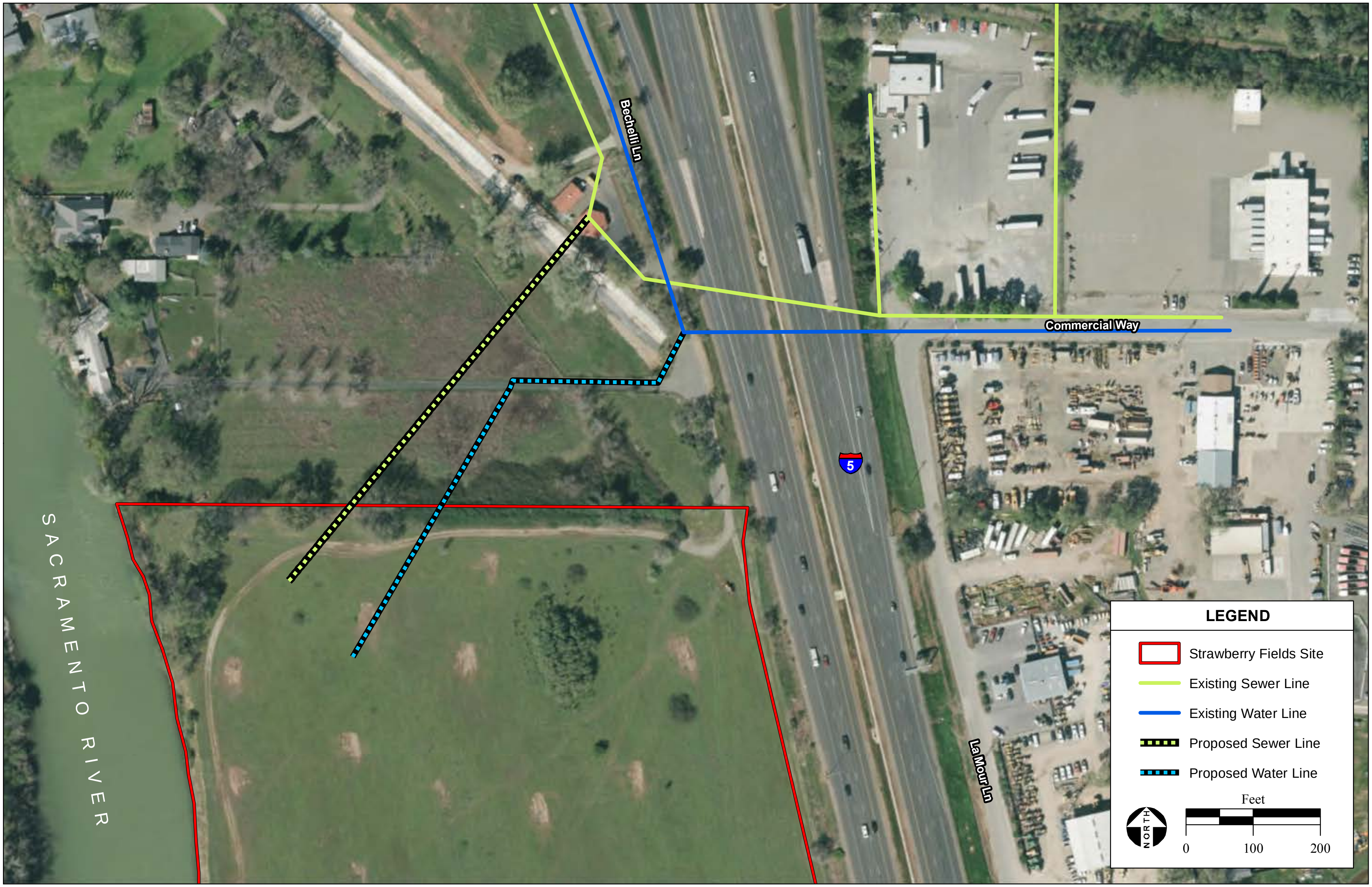
Off-site Utility/Infrastructure Improvements

Off-site utility connections are an optional project component and involve tying the Action Area into the City of Redding's water and wastewater system with new pipeline connections. Connecting to the municipal water supply infrastructure would require the construction of approximately 777 linear feet of pipeline from the site to an existing water main at the intersection of Bechelli Lane and the driveway leading west to 5170 Bechelli Lane. Connection to the existing wastewater treatment system would require 702 linear feet of sewer force main pipeline between an on-site lift station and the existing Sunnyhill Lift Station, located at 5100 Bechelli Lane (see **Figure 7**). The Proposed Project would also require utility service connections with Redding Electric Utility (REU) for electricity and PG&E for natural gas service. The electrical connection would be made with existing overhead REU electrical lines that run along the northern boundary of the Strawberry Fields Site. A PG&E main natural gas line exists approximately 1,100 feet north of the Strawberry Fields Site at the southern edge of the Hilton Garden Inn parking lot.

Construction of pipeline connections and underground electricity transmission upgrades would require grading, excavation, trenching, laying of pipe, and the placement of backfill material to construct the connection to existing water, wastewater, electricity, and natural gas utilities. The proposed utility improvements would extend through non-native annual grassland, dominated by ruderal species, and would not directly affect critical habitat, EFH, or federally listed fish species. Indirect effects to water quality would be avoided through implementation of an NPDES General Construction Permit, SWPPP, and BMPs. Construction of proposed utility improvements will have no effect on federally listed fish species.

5.0 CONCLUSIONS

The Proposed Action will not impact the on-site riverine habitat or the adjacent Sacramento River. Compliance with the NPDES program and implementation of the proposed storm water plan including LID measures would avoid potential impacts to water quality in the Sacramento River. The Proposed Action will have **no effect** on critical habitat, EFH, or federally listed fish species.



SOURCE: City of Redding 2016 SRTA Imagery, 3/2016; Coleman Engineering Feasability Study, 7/14/17; AES, 10/11/2017

Figure 7
Off-site Water Supply and
Wastewater Treatment and Disposal Improvements

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ATTACHMENTS

ATTACHMENT A

REDDING RANCHERIA CASINO MASTER PLAN DRAFT GRADING AND DRAINAGE STUDY

REDDING RANCHERIA CASINO MASTER PLAN

DRAFT GRADING AND DRAINAGE STUDY

PREPARATION DATE:
FEBRUARY 9, 2018

PREPARED FOR:

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Section 1 – Project Description

1.1 Purpose

The purpose of this analysis is to assess the development potential of the undeveloped property described in Section 1.2 as the Proposed Project. This analysis will address project grading, drainage, and stormwater management for the Proposed Project and the project alternatives.

1.2 Project Description

The Redding Rancheria has submitted an application to the Department of the Interior requesting the placement of approximately 232 acres of fee land in trust by the United States upon which the Tribe would construct a casino resort (Proposed Project). The facility would include an approximately 70,000 square foot casino, an approximately 250-room hotel, an event/convention center, a retail center, and associated parking and infrastructure and would be located at the south end of Bechelli Lane in Redding, CA (see Figure 1). The new facility would replace the Tribe's existing casino located at 2100 Redding Rancheria Road in Redding, CA (near the intersection of State Highway 273 and Canyon Road).

This analysis will address the Proposed Project as well as five alternatives, including one off-site alternative, on an equal level basis in both the build out year and cumulative year (likely 2035). Alternatives to be addressed within this report will include the following:

- Alternative A - Proposed Project
- Alternative B – No Big Box Retail
- Alternative C - Reduced Intensity Alternative – smaller casino and hotel
- Alternative D - Non-Gaming Alternative –Convention Center and Hotel
- Alternative E - Alternative Site (in the City of Anderson)

1.3 Project Alternatives

1.3.1. Alternative A - Proposed Project

Alternative A includes the construction of an approximately 70,000 square foot casino, an approximately 250-room hotel, an event/convention center, a retail center, associated parking and infrastructure, and 130,000 square feet of big box retail. Alternative A will be constructed at the Proposed Project Site located at the south end of Bechelli Lane in Redding, CA (see Figure 1). Access to the Project Site from the north will include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south will include a road connection to Smith Road south of the Project Site (see Figure 6).

1.3.2. Alternative B – No Big Box Retail

Alternative B is identical to Alternative A with the exception that Alternative B does not include the 130,000 square feet of big box retail. Alternative B includes the construction of an approximately 70,000 square foot casino, an approximately 250-room hotel, an event/convention center, and associated parking and infrastructure. Alternative B will be constructed at the Proposed Project Site located at the south end of Bechelli Lane in Redding, CA (see Figure 1). Access to the Project Site from the north will include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south will include a road connection to Smith Road south of the Project Site (see Figure 6).

1.3.3. Alternative C – Reduced Intensity Alternative

Alternative C includes the construction of an approximately 57,000 square foot casino, an approximately 250-room hotel, an event/convention center, a retail center, and associated parking and infrastructure, as well as 130,000 square feet of big box retail. The limits of disturbance and project footprint for Alternative C are approximately the same as that of Alternative A. Alternative C will be constructed at the Proposed Project Site located at the south end of Bechelli Lane in Redding, CA (see Figure 1). Access to the Project Site from the north will include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south will include a road connection to Smith Road south of the Project Site (see Figure 6).

1.3.4. Alternative D – Non-Gaming Alternative

Alternative D includes the construction of an approximately 128-room hotel, a retail center, and associated parking and infrastructure, as well as 120,000 square feet of big box retail. Alternative D will be constructed at the Proposed Project Site located at the south end of Bechelli Lane in Redding, CA (see Figure 1). Access to the Project Site from the north will include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south will include a road connection to Smith Road south of the Project Site (see Figure 6).

1.3.5. Alternative E – Alternative Site

Alternative E includes the construction of an approximately 70,000 square foot casino, an approximately 250-room hotel, an event/convention center, a retail center, and associated parking and infrastructure, as well as 120,000 square feet of big box retail. Alternative E will be constructed at an Alternate Project Site located north of North Street and west of Interstate 5 in Anderson California (see Figure 7). Access to the Alternate Project Site will include a road connection to Oak Street as shown on Figure E1.

Section 2 – Existing Site Conditions

2.1 Proposed Project Site – Alternatives A thru D

The Proposed Project site topography is relatively flat with the site sloping from north to south in the uplands portion adjacent to Interstate 5, and the remaining portions of the site sloping from northeast to southwest toward the river. The elevation (NAVD 88) varies on site from a high of roughly 455 feet above mean sea level on the north east corner of the project to a low point of roughly 430 feet above mean sea level near the Sacramento River on the south west corner of the project. In the uplands portion of the site adjacent to Interstate 5, the site slopes from north to south at less than 0.5%. Surface drainage from Interstate 5 is collected in the median and east side of the roadway, then conveyed through a series of pipes across the traveled way to a roadside earth ditch that runs from north to south along the project's eastern boundary. Toward the southern portion of the project site, a natural swale conveys the storm water runoff from the project site as well as the Interstate 5 storm water runoff in a south westerly direction toward the Sacramento River. See Figure 3 for existing topography and existing drainage.

A majority of the uplands portion (eastern portion of the site near Interstate 5) of the Site are either a sandy loam, or loamy sand. The soils found in these uplands portions of the project are excessively drained to well drained soils with rapid to moderately rapid permeability. The majority of the soil located in the lower areas near the river in the southwest portion of the project is riverwash or cobbly alluvium that is subjected to frequent flooding. These soils have highly variable characteristics, and typically are excessively drained with very rapid permeability. The potential for subsurface or surface stormwater infiltration for both the uplands and the lower areas of the Proposed Project site is excellent.

According to the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map #06089C1561G and #06089C1563G, a majority of the Proposed Project site is located within one of two different flood zones from the Sacramento River to the west. A majority of the lowlands portion of the site is located in a special flood hazard area within the 100 year flood plain which means that these areas are subject to inundation during the 100-year event. The uplands portion of the site adjacent to Interstate 5 is located within Zone X. Zone X is defined as an area that lies within the 500 year (0.2% annual chance of flood) flood zone, and may have less than 1' of flooding during a 100-year event. The FEMA 100 year flood plain from the Sacramento River is shown on Figure 3.

FEMA Flood Insurance Rate Map #06089C1561G and #06089C1563G, shows that there is potential overflow from Churn Creek to the Sacramento River. This flow may come from Churn Creek, may spill over Interstate 5 and then would be conveyed overland to the Sacramento River. This potential is discussed in detail in Section 4.1. The FEMA 100 year flood plain from Churn Creek is shown on Figure 3.

Several regulatory agencies have jurisdiction of portions of the Sacramento River, but their jurisdiction falls west of the FEMA 100 year flood plain line. The Agencies and their jurisdictional lines are as follows:

- The Central Valley Flood Protection Board – The Designated Floodway Line refers to the channel of the stream and that portion of the adjoining floodplain reasonably required providing for the passage of a design flood; it is also the floodway between existing levees as adopted by the Central Valley Flood Protection Board (formerly the Reclamation Board) or the Legislature. The Designated Floodway Line follows the FEMA 100 year flood plain line, or is located west of the FEMA 100 year flood plain line adjacent to the Proposed Project site.
- The California State Lands Commission (CSLC) – The CSLC has jurisdiction and management authority over all un-granted tidelands, submerged lands and the beds of navigable lakes and waterways. The CSLC jurisdictional line lies west of the FEMA 100 year flood plain line adjacent to the Proposed Project site.

The eastern bank of the Sacramento River is actively eroding in areas adjacent to the proposed development during exceptionally high river flows. See Section 6.2 streambank erosion details and streambank stabilization recommendations.

2.2 Alternative Project Site – Alternative E

The Alternative Project site topography is relatively flat with the site generally sloping easterly towards the Tormey Drain and Interstate 5. The Tormey Drain bisects the site and runs from southwest to northeast to a box culvert under Interstate 5. The portion of the site located north of the Tormey Drain generally flows from north to south with a high elevation (NAVD 88) at the northwest corner of roughly 420 feet above mean sea level to a low point the easterly project boundary of 413 feet above mean sea level. The portion of the site located south of the Tormey Drain generally flows from south to north with a high elevation along the southerly site boundary of roughly 420 feet above mean sea level to a low point the easterly project boundary of 413 feet above mean sea level. The site generally has slopes less than 0.5%. Surface drainage from surrounding areas west of the project are collected and conveyed via the Tormey Drain through the site eastward under Interstate 5. The site is also bisected by Oak Street running north and south. The portion of the site located west of Oak Street will remain undeveloped and be used for a material borrow area and stormwater infiltration and storage.

Soils types were determined using the *Web Soil Survey* provided by the United States Department of Agriculture Soil Conservation Service and Forest Service. It was determined from the Web Soil Survey that the site consists of Hydrologic Soil Group A and D.

According to the FEMA Flood Insurance Rate Map #06089C1935G, a majority of the Alternative Project site is located within the special flood hazard area within the 100 year flood plain which means that these areas are subject to inundation during the 100-year event. The FEMA 100 year flood plain from the Tormey Drain is shown on Figure E4.

Section 3 – Grading and Drainage

3.1 Proposed Project Access

The proposed project will be accessed from the north by extending Bechelli Lane and from the south by a new road connection to Smith Road as described in the Access Alternative Concepts Memorandum prepared by Kimley-Horn dated July 7, 2017.

3.1.1 Proposed Project Access from the North

As described in the Access Alternative Concepts Memorandum the Proposed Project Site will require significant improvements to the intersection of South Bonneyview Road and Bechelli Lane including road widening and construction of a three lane roundabout at the intersection. The intersection will require numerous retaining walls to accommodate the roundabout footprint and sidewalk extension.

Widening Bechilli Lane to access the Proposed Project Site as described in the Access Alternative Concepts Memorandum would require significant grading, retaining walls, and relocation/extension of existing facilities to avoid impacting the City of Redding's Sunnyhill Wastewater Pump Station infrastructure and the Anderson Cottonwood Irrigation District's (ACID) canal. Significant grading will be required to maintain access to the adjacent residential properties, Sunnyhill Wastewater Pump Station and the ACID canal. Additional grading may be required to mitigate the 28 lost parking spaces eliminated by the Bechelli Lane widening as described in the Access Alternatives Concepts Memorandum.

3.1.2 Proposed Project Access from the South

As described in the Access Alternative Concepts Memorandum, a Shasta County Standard "Major Local Rural" road will be constructed south to Smith Road. At the intersection of Smith Road, a Shasta County Standard Road Connection will be constructed. These improvements will require minimal grading beyond the typical roadway infrastructure (street improvements, pedestrian facilities, drainage and other utility infrastructure, etc.). The road will be designed to follow the existing terrain where possible, and minimize the roadway grading footprint and impact. It is anticipated that the access road will extend approximately 3,500 feet south to Smith Road and the grading footprint will be approximately 5 acres.

3.2 Alternative A – Proposed Project Grading

The grading for Alternative A has been designed to be a balanced earthwork operation, meaning the cut and fill quantities will be the same and there is no import or export of material required. The finished floor elevations (including basements) for each of the buildings were established based upon the adjacent top of bank elevation of the Sacramento River west of the development. The finished floor elevations (including basements) are approximately 3 feet above the adjacent top of bank elevation and the FEMA 100-year water surface elevation.

The parking lots are graded generally to flow from west to east at approximately 2% cross slope towards the access road with runoff being collected and conveyed in the underground storm drain system. The grades in the parking lots have been designed to have a minimum of approximately 1% slope and a maximum of approximately 4%, see Figure A3. For safety all access routes from the building sites to the access road will be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot will be approximately 1-foot above the FEMA 100-year floodplain elevation. Since the development site is entirely out of the FEMA 100-year floodplain the soil removal will not change the FEMA 100-year flood delineation.

The access road runs north and south along the project's easterly boundary (adjacent to Interstate 5), see Figure A1. The profile of the access road has been designed to match the existing grade to minimize earthwork from Bechelli Lane at the north to Smith Road at the south.

A 40-feet wide, 5-foot deep vegetated swale has been designed to run north to south between the access road and Interstate 5 approximately 1,000 feet south of the project's northerly line. This vegetated swale will convey project runoff, provide stormwater filtration and infiltration, as well as provide a bypass channel for the 600-700 cubic feet per second flow that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale then passes through a large box culvert under the access road and to a 650,000 cubic foot wet pond as shown on Figure A4.

The wet pond is sized per the California Stormwater Quality Association (CASQA) California Stormwater BMP Handbook for New Development and Redevelopment, see calculations in Appendix C. The wet pond will store water and allow for infiltration into the native soil.

Table 3.1 - Grading Quantities – Alternative A

Disturbance Area	57 acres	See Figure A1 & A2
Volume of Cut	94,000 cubic yards	See Figure A5
Volume of Fill (Adjusted for Material shrink)	94,000 cubic yards	See Figure A5
Infiltration / Wet Pond size	650,000 cubic feet	See Figure A4 & A6

See Figures A1-A6 for Alternative A grading and drainage Exhibits.

3.3 Alternative B – No Big Box Retail Grading

The grading for Alternative B has been designed to be a balanced earthwork operation. The finished floor elevations for each of the buildings were established based upon the adjacent top of bank elevation of the Sacramento River west of the development. The finished floor elevations (including basements) are approximately 2 to 3 feet above the adjacent top of bank elevation and the FEMA 100-year water surface elevation.

The parking lots are graded generally to flow from west to east at approximately 2% cross slope towards the access road with runoff being collected and conveyed in the underground storm drain system. The grades in the parking lots have been designed to have a minimum of approximately 1% slope and a maximum of approximately 4%, see Figure B3. For safety all access routes from the building sites to the access road will be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot will be approximately 1-foot above the FEMA 100-year floodplain elevation. Since the development site is entirely out of the FEMA 100-year floodplain the soil removal will not change the FEMA 100-year flood delineation.

The access road runs north and south along the project's easterly boundary (adjacent to Interstate 5), see Figure B1. The profile of the access road has been designed to match the existing grade to minimize earthwork from Bechelli Lane at the north to Smith Road at the south.

A 40-feet wide, 5-foot deep vegetated swale has been designed to run north to south between the access road and Interstate 5 approximately 1,000 feet south of the project's northerly line. This vegetated swale will convey project runoff, provide stormwater filtration and infiltration, as well as provide a bypass channel for the 600-700 cubic feet per second flow that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale then passes through a large box culvert under the access road and to a 510,000 cubic foot wet pond as shown on Figure B4.

The wet pond is sized per the CASQA California Stormwater BMP Handbook for New Development and Redevelopment, see calculations in Appendix C. The wet pond will store water and allow for infiltration into the native soil.

Table 3.2 - Grading Quantities – Alternative B

Disturbance Area	48 acres	See Figure B1 & B2
Volume of Cut	80,000 cubic yards	See Figure B5
Volume of Fill (Adjusted for Material shrink)	80,000 cubic yards	See Figure B5
Infiltration / Wet Pond size	510,000 cubic feet	See Figure B4 & B6

See Figures B1-B6 for Alternative B grading and drainage Exhibits.

3.4 Alternative C – Reduced Intensity Alternative

The grading for Alternative C has been designed to be a balanced earthwork operation. The finished floor elevations for each of the buildings were established based upon the adjacent top of bank elevation of the Sacramento River west of the development. The finished floor elevations (including basements) are approximately 3 feet above the adjacent top of bank elevation and the FEMA 100-year water surface elevation.

The parking lots are graded generally to flow from west to east at approximately 2% cross slope towards the access road with runoff being collected and conveyed in the underground storm drain system. The grades in the parking lots have been designed to have a minimum of approximately 1% slope and a maximum of approximately 4%, see Figure C3. For safety all access routes from the building sites to the access road will be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot will be approximately 1-foot above the FEMA 100-year floodplain elevation. Since the development site is entirely out of the FEMA 100-year floodplain the soil removal will not change the FEMA 100-year flood delineation.

The access road runs north and south along the project's easterly boundary (adjacent to Interstate 5), see Figure C1. The profile of the access road has been designed to match the existing grade to minimize earthwork from Bechelli Lane at the north to Smith Road at the south.

A 40-feet wide, 5-foot deep vegetated swale has been designed to run north to south between the access road and Interstate 5 approximately 1,000 feet south of the project's northerly line. This vegetated swale will convey project runoff, provide stormwater filtration and infiltration, as well as provide a bypass channel for the 600-700 cubic feet per second flow that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale then passes through a large box culvert under the access road and to a 650,000 cubic foot wet pond as shown on Figure C4.

The wet pond is sized per the CASQA California Stormwater BMP Handbook for New Development and Redevelopment, see calculations in Appendix C. The wet pond will store water and allow for infiltration into the native soil.

Table 3.3 - Grading Quantities – Alternative C

DISTURBANCE AREA	57 ACRES	SEE FIGURE C1 & C2
VOLUME OF CUT	94,000 CUBIC YARDS	SEE FIGURE C5
VOLUME OF FILL (ADJUSTED FOR MATERIAL SHRINK)	94,000 CUBIC YARDS	SEE FIGURE C5
INFILTRATION / WET POND SIZE	650,000 CUBIC FEET	SEE FIGURE C4 & C6

See Figures C1-C6 for Alternative C grading and drainage Exhibits.

3.5 Alternative D – Non-Gaming Alternative

The grading for Alternative D has been designed to be a balanced earthwork operation. The finished floor elevations for each of the buildings were established based upon the adjacent top of bank elevation of the Sacramento River west of the development. The finished floor elevations are approximately 3 feet above the adjacent top of bank elevation and the FEMA 100-year water surface elevation.

The parking lots are graded generally to flow from west to east at approximately 2% cross slope towards the access road with runoff being collected and conveyed in the underground storm drain system. The grades in the parking lots have been designed to have a minimum of approximately 1% slope and a maximum of approximately 4%, see Figure D3. For safety all access routes from the building sites to the access road will be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot will be approximately 1-foot above the FEMA 100-year floodplain elevation. Since the development site is entirely out of the FEMA 100-year floodplain the soil removal will not change the FEMA 100-year flood delineation.

The access road runs north and south along the project's easterly boundary (adjacent to Interstate 5), see Figure D1. The profile of the access road has been designed to match the existing grade to minimize earthwork from Bechelli Lane at the north to Smith Road at the south.

A 40-feet wide, 5-foot deep vegetated swale has been designed to run north to south between the access road and Interstate 5 approximately 1,000 feet south of the project's northerly line. This vegetated swale will convey project runoff, provide stormwater filtration and infiltration, as well as provide a bypass channel for the 600-700 cubic feet per second flow that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale then passes through a large box culvert under the access road and to a 450,000 cubic foot wet pond as shown on Figure D4.

The wet pond is sized per the CASQA California Stormwater BMP Handbook for New Development and Redevelopment, see calculations in Appendix C. The wet pond will store water and allow for infiltration into the native soil.

Table 3.4 - Grading Quantities – Alternative D

DISTURBANCE AREA	39 ACRES	SEE FIGURE D1 & D2
VOLUME OF CUT	75,000 CUBIC YARDS	SEE FIGURE D5
VOLUME OF FILL (ADJUSTED FOR MATERIAL SHRINK)	75,000 CUBIC YARDS	SEE FIGURE D5
INFILTRATION / WET POND SIZE	450,000 CUBIC FEET	SEE FIGURE D4 & D6

See Figures D1-D6 for Alternative D grading and drainage Exhibits.

3.6 Alternative E – Alternative Site

The grading for Alternative E has been designed to be a balanced earthwork operation. The finished floor elevations for each of the buildings were established based upon the FEMA 100-year water surface elevation of the Tormey Drain that runs southwest to north east through the middle of the project. The finished floor elevations (including basements) are approximately 2 to 3 feet above the FEMA 100-year water surface elevation of the Tormey Drain.

The parking lots are graded generally to flow from west to east at approximately 2% cross slope towards the access road with runoff being collected and conveyed in the underground storm drain system. The grades in the parking lots have been designed to have a minimum of approximately 1% slope and a maximum of approximately 4%, see Figure E2.

The access road runs north and south along the project's easterly boundary (adjacent to Interstate 5), see Figure E1. Since the project proposes a large amount of fill within the 100-year flood plain, an excavation equal to that fill volume must be constructed in order to prevent additional flooding and mitigate for the proposed fill within the flood plain. Two large retention ponds will be constructed along the southern portion of the project, a large pond on the west side of Oak Street, and a smaller one on the east side of Oak Street.

Table 3.5 - Grading Quantities – Alternative E

DISTURBANCE AREA	52 ACRES	SEE FIGURE E1
VOLUME OF CUT	138,000 CUBIC YARDS	SEE FIGURE E2
VOLUME OF FILL (ADJUSTED FOR MATERIAL SHRINK)	138,000 CUBIC YARDS	SEE FIGURE E2
RETENTION POND SIZE	99,000 CUBIC FEET	SEE FIGURE E4

See Figures E1-E4 for Alternative E grading and drainage Exhibits.

3.7 Cumulative Project Grading Impacts

The proposed project and all the alternatives will be designed in such a way that the grading will be a balanced earthwork operation, meaning the cut and fill quantities will be the same and there is no import or export of material required. There will be no fill placed in the FEMA 100-year floodplain. There will be no adverse impacts on the existing FEMA 100-year floodplain as a result of the project grading.

Additionally, hazardous materials that FEMA has identified as being "extremely hazardous or vulnerable to flood conditions" will not be stored within the 500-year floodplain of the proposed development.

For safety all access routes from the building sites to the access road will be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot will be approximately 1-foot above the FEMA 100-year floodplain elevation. Since the development site is entirely out of the FEMA 100-year floodplain the soil removal will not change the FEMA 100-year flood delineation.

Section 4 – Hydrology and Hydraulics – Proposed Site

4.1 Description of Existing Watershed Characteristics

The site for Alternatives A, B, C, and D is relatively flat and generally drains southwesterly from Interstate 5 towards the Sacramento River. The 232 -acre site is a part of the Sacramento River Basin and consists of pastureland and scattered oak trees. Soils types were determined using the *Web Soil Survey* provided by the United States Department of Agriculture Soil Conservation Service and Forest Service. It was determined from the Web Soil Survey that the site consists of Hydrologic Soil Group A.

The current FEMA Flood Insurance Rate Map (FIRM) identifies that the developed area of the proposed project is outside of the 100-year floodplain but within the 500-year floodplain. The State Central Valley Flood Protection Board Floodway Map shows that the proposed project is outside of the designated floodway. Figures A7, B7, C7, and D7 show both the FEMA 100-year floodplain and the designated floodway as compared to the project.

In this area an estimated flow of 600 to 700 cubic feet per second at a depth of approximately 9 inches, as identified by a State of California Department of Water Resources work map, could cross Interstate 5 from the east (Churn Creek). This hydrologic and hydraulic model of Churn Creek shows that Churn Creek could overtop Interstate 5, and that could cause shallow overflow across the project site. In discussions with Brett Ditzler with Caltrans, there are no historical records of this section of Interstate 5 ever overtopping. Caltrans found a note in their files stating that not even in the large rainfall event of 1964, did Churn Creek overtop I-5. However, in the event that this might happen all the alternatives have been designed to convey possible floodwaters from Churn Creek that may overtop Interstate 5 via a large newly constructed vegetated swale that parallels Interstate 5 and discharges into the proposed infiltration wet pond south of the proposed development. The vegetated swale has been sized to convey the possible overflow from Churn Creek. The proposed channel has been oversized by 35% to accommodate increases in peak runoff that might occur in the future.

4.2 Methodology

Hydrology Calculations were prepared using engineering industry standard methodology and the on-site storm drain conveyance system will be designed using local jurisdiction requirements regarding storm event. Peak flows for the 2-, 10-, and 100-year storm events for a 24-hour period were estimated using the United States Army Corp of Engineers flood hydrograph package HEC-1 to model rainfall runoff. Rainfall estimates are discussed in detail within the *City of Redding Department of Public Works Hydrology Manual*. An excerpt from the manual discussing the calculation of Redding Area design storms can be found in Appendix A. Existing peak flows can be in found in Table 4.1. The Rational Method was used to estimate the proposed size of the on-site storm drain conveyance system. The Darcy Equation was used to estimate the amount of infiltration that will be achieved in the proposed storm drain conveyance and infiltration system.

4.2.1 Alternative Studies

There are two hydrologic studies that encompass the project area; The Army Corps of Engineers Comprehensive Study (Sacramento and San Joaquin River Basins Comprehensive Study – 2002) and the current FEMA 100-year floodplain (2011). The intent of the Army Corps of Engineers Comprehensive Study was to inventory resource conditions within the Sacramento and San Joaquin River Basins and to analyze problems and opportunities for flood management and ecosystem restoration. The flood delineation for the Army Corps of Engineers Comprehensive Study (Sacramento and San Joaquin River Basins Comprehensive Study – 2002) used a “composite floodplain” concept, which considers a combination of several flood events, each shaping the floodplain at different locations at different times. The flood events considered ranged from the from the 2-year to the 500-year storm event. However, the 10- and 500-year events were not computed or mapped between Redding and Deer Creek (which is located just upstream of Woodson Bridge in Corning, California approximately 70 river miles downstream of the proposed development). Each flood event was combined for the maximum extent of the composite floodplain for a conservative approach. The composite floodplain, ACOE Comprehensive Study Line, shown (the pink area shown in the California Department of Water Resources Best Available Maps) does not include the operational effects of headwaters reservoirs. The ACOE study recognizes that Shasta Reservoir has 1.3 million acre-feet of flood control space and operates for the Sacramento River at Keswick (upstream of the proposed development) and Bend Bridge (30 miles downstream of the project in Red Bluff, California). Between Keswick and Bend there are several unregulated tributaries that generate significant inflows to the Sacramento River. There are no significant unregulated tributaries between the project and Shasta Dam, so Shasta Reservoir completely regulates the river flow at the project location.

The ACOE floodplain composite line in the area of the proposed development has no elevation associated with it as the river profiles end at Woodson Bridge. Extensive topographic data was collected south of the Woodson Bridge, producing 2-foot contour mapping whereas the study north of Woodson Bridge is much less detailed. The study north of Woodson Bridge used topography in the overbank areas that was derived from USGS 30-meter (roughly 98-feet) digital elevation models with 10-foot contour intervals. The detail of the floodplain model is dependent on the detail of the overbank topography. In the development area the existing topography varies a few feet; therefore, using USGS 30-meter topography with 10-foot contour intervals would not pick up the existing detailed terrain. The ACOE Comprehensive Study Line is not consistent with the known existing topography of the proposed development and was not studied in detail in the region of the proposed project.

The current FEMA 100-year floodplain, effective March 17, 2011, is based on a detailed study with detailed cross sections for the Sacramento River throughout the Redding Area. These cross sections show flood elevations for the 100-year storm event. The current FEMA 100-year floodplain follows the existing topography in the project development area. In discussions with Raul Barba of the California Department of Water resources regarding the ACOE Comprehensive Study Line, it was stated that the FEMA 100-year Floodplain shown on the Flood Insurance Maps is the regulatory line regarding flood elevations and special building requirements. Additionally, as stated on the FEMA website, FEMA does not have setback guidelines from river channels. If no part of the structure falls within the FEMA 100-year floodplain, there are no special building requirements. If there is an encroachment, then FEMA has very specific requirements that must be followed. Since the proposed development does not encroach into the FEMA 100-year floodplain, there are no special requirements.

For all these reasons and consistent with our telephone conversations with Raul Barba of the California Department of Water resources we are using the well-studied and documented FEMA 100-year floodplain as the best available and regulatory 100-year floodplain for this project. All hydrology exhibits clearly show that no part of the proposed development falls within the FEMA 100-year floodplain.

4.3 Results of Analysis

The existing condition peak flows for Alternatives A through D were calculated and are summarized in Table 4.1. These flows were calculated for the overall developable project area (66.2-acres) which is shown in Figure A6. The HEC-1 input parameters and hydrologic calculations can be found in Appendix A.

Table 4.1: Estimated Existing Condition Peak Flows

Storm Event	Existing Condition Peak Flow, cfs
2-YEAR	3
10-YEAR	7
100-YEAR	19

With development the post-developed runoff will be captured by onsite inlets and conveyed by a series of perforated storm drain pipe and drain rock infiltration trenches to the sandy loam or gravel layer below or to the proposed vegetated swale along the frontage road.

In order to convey the potential overflow from Churn Creek, a vegetated swale will be constructed between the proposed frontage road and Interstate 5. This proposed vegetated swale will be approximately 40-feet wide and 5-feet deep and is shown in Appendix D. It will have a longitudinal slope of 0.4 percent to encourage infiltration to the sandy gravelly layer below. The vegetated swale will convey the onsite runoff, and when necessary the potential overflow from Churn Creek, from the project to a proposed water quality retention facility and ultimately to the Sacramento River. The proposed swale along with the water quality retention facility will act as an infiltration trench and infiltration basin and wet pond. Preliminary calculations can be found in Appendix D.

6.2.1 Alternative A – Proposed Project

With development of the proposed project, the site will develop into 18% rooftop, sidewalks, and parking lot. Table 4.2 summarizes the peak flows from the post-development condition. The HEC-1 input parameters and hydrologic calculations can be found in Appendix A.

Table 4.2: Estimated Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs
2-YEAR	87
10-YEAR	118
100-YEAR	174

In the post-development condition the on-site drainage basin will be broken into four separate drainage areas, Drainage Area #1, Drainage Area #2, Drainage Area #3, and Drainage Area #4. These drainage areas are shown in Figure A7. Each drainage area is less than 25 acres so a design storm of 10 years was used to estimate the size of the storm drain pipe.

Drainage Area #1 is approximately 16 acres in size and will drain the runoff from the proposed north parking lot, entry, and Big Box Retail. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will range from 15 to 36 inches in size.

Drainage Area #2 is approximately 4 acres in size and will drain the runoff from approximately half of the east side of the proposed casino. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will be a maximum of 24 inches in size.

Drainage Area #3 is approximately 6 acres in size and will drain the runoff from the remainder of the east side of the casino. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will range from 15 to 30 inches in size.

Drainage Area #4 is approximately 4 acres in size and will drain the runoff from the proposed south parking lot. A series of inlets and perforated storm drain pipe will collect and convey the runoff to the Sacramento River. The perforated storm drain pipe will be a maximum of 24 inches in size and will be placed within a drain rock infiltration trench three feet wide. This infiltration trench will infiltrate 1.3 cubic feet per second of the peak flow.

Table 4.3 summarizes the post-development peak flows for each drainage area for the 2- and 10- year events.

Table 4.3: Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs			
	Drainage Area #1	Drainage Area #2	Drainage Area #3	Drainage Area #4
2-YEAR	36	10	14	11
10-YEAR	47	14	19	14

The proposed infiltration channel will be sized to convey the overflow from Churn Creek to the Sacramento River. The channel has a 20-foot bottom, 2:1 side slopes, with a longitudinal slope of 0.4 percent. This large flat channel will also convey the on-site stormwater that does not infiltrate to the proposed water quality detention pond. Using Darcy's Law the maximum flow that the proposed channel can infiltrate was calculated to be approximately 182 cubic feet per second as shown in Appendix A, which is larger than the calculated 100-year peak flow of 174 cubic feet per second. Comparing this calculated flow to the peak flows shown in Table 4.2 the proposed channel has the ability to infiltrate the 2-, 10-, and 100-year events.

Peak flow and infiltration calculations can be found in Appendix D. Pipe and infiltration trench sizing calculations can be found in Appendix D.

6.2.2 Alternative B – No Big Box Retail

With development of the proposed project, the site will develop into 13% rooftop, sidewalks, and parking lot. Table 4.4 summarizes the peak flows from the post-development condition. The HEC-1 input parameters and hydrologic calculations can be found in Appendix A.

Table 4.4: Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs
2-YEAR	64
10-YEAR	90
100-YEAR	139

In the post-development condition the on-site drainage basin will be broken into four separate drainage areas, Drainage Area #1, Drainage Area #2, Drainage Area #3, and Drainage Area #4. These drainage areas are shown in Figure B7. Each drainage area is less than 25 acres so a design storm of 10 years was used to estimate the storm drain pipe diameter.

Drainage Area #1 is approximately 6.5 acres in size and will drain the runoff from the proposed north parking lot and entry. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will range from 15 to 30 inches in size.

Drainage Areas #2, #3, and #4 are the same as Alternative A.

Table 4.5 summarizes the post-development peak flows for each drainage area for the 2- and 10- year events.

Table 4.5: Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs			
	Drainage Area #1	Drainage Area #2	Drainage Area #3	Drainage Area #4
2-YEAR	15	10	14	11
10-YEAR	20	14	19	14

The maximum flow that the proposed channel can infiltrate was calculated to be approximately 182 cubic feet per second as shown in Appendix A, which is much larger than the calculated peak flows shown in Tables 4.4 and 4.5. Therefore the proposed channel has the ability to infiltrate the 2-, 10-, and 100-year events.

Peak flow and infiltration calculations can be found in Appendix D. Pipe and infiltration trench sizing calculations can be found in Appendix D.

6.2.3 Alternative C – Reduced Intensity Alternative

Hydrologically and hydraulically speaking, Alternative C is the same as Alternative A.

6.2.4 Alternative D – Non-Gaming Alternative

With development of the proposed project, the site will develop into 10% rooftop, sidewalks, and parking lot. Table 4.6 summarizes the peak flows from the post-development condition. The HEC-1 input parameters and hydrologic calculations can be found in Appendix A.

Table 4.6: Estimated Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs
2-YEAR	52
10-YEAR	73
100-YEAR	117

In the post-development condition, the on-site drainage basin will be broken into two separate drainage areas, Drainage Area #1 and Drainage Area #2. These drainage areas are shown on Figure D7. Each drainage area is less than 25 acres, so a design storm of 10 years was used to estimate the storm drain pipe diameter.

Drainage Area #1 is approximately 10 acres in size and will drain the runoff from the proposed north parking lot and Big Box Retail. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will range from 15 to 30 inches in size.

Drainage Area #2 is approximately 6 acres in size and will drain the runoff from the proposed hotel and south parking lot. A series of inlets and storm drain pipe will collect and convey the runoff to the proposed infiltration channel. The storm drain pipe will be a maximum of 30 inches in size.

Table 4.7 summarizes the post-development peak flows for each drainage area for the 2- and 10- year events.

Table 4.7: Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs	
	Drainage Area #1	Drainage Area #2
2-YEAR	23	15
10-YEAR	32	20

The maximum flow that the proposed channel can infiltrate was calculated to be approximately 182 cubic feet per second as shown in Appendix A, which is much larger than the calculated peak flows shown in Tables 4.6 and 4.7. Therefore, the proposed channel has the ability to infiltrate the 2-, 10-, and 100-year events.

Peak flow and infiltration calculations can be found in Appendix D. Pipe and infiltration trench sizing calculations can be found in Appendix D.

6.3 Cumulative Project Drainage Impacts

As seasonal precipitation patterns may be changing, and rainfall may become more concentrated and intense the following has been considered in the hydraulic design of the storm drain conveyance system to accommodate future peak flows:

- The on-site storm drain system will be oversized by at least 25%, leaving additional capacity for future conditions.
- The design of the storm drain pipe system provides infiltration into the loam soil, however the calculations neglect the infiltration into the ground by the proposed LID features; vegetated swales, retention pond, and infiltration trenches which is a conservative approach and adds additional capacity to the system.

The flow in the Sacramento River adjacent to the project is almost entirely regulated by the upstream releases from Shasta Dam and Keswick Dam. The project drainage system has been designed in such a way that there will be no increase in flows downstream. This will be accomplished using infiltrations trenches, an infiltration wet pond, and numerous other stormwater quality BMPs that encourage groundwater infiltration as described in Section 6.1.

Surrounding development will be subject to the City of Redding's City Council Policy 1806, the City of Redding Storm Water Quality Improvement Plan, and the City of Redding Phase II NPDES Permit in regard to both stormwater quality and quantity. The City of Redding's City Council Policy 1806 requires that proposed development address peak flows to maintain pre-development levels at all locations downstream of the project. Both the City of Redding Storm Water Quality Improvement Plan and the City of Redding Phase II NPDES Permit require proposed development to incorporate Low Impact Development (LID) Best Management Practices (BMPs) to improve stormwater quality in the runoff to mitigate for the increased impervious area. Development surrounding the proposed project will not negatively impact Stormwater quality or quantity.

All of the proposed project alternatives have been designed to convey the estimated 600-700 cubic feet per second that might overtop Interstate 5 from Churn Creek (east of Interstate 5), as described in Section 4.1. This flow will be conveyed by constructing a large vegetated swale along the project's easterly boundary that will allow the estimated 600-700 cfs to bypass the proposed development and be conveyed to the Sacramento River. The development will have no negative impact on the flooding that occurs in the neighborhoods of the Churn Creek area as it is not tributary to the Churn Creek Watershed and will not impede the potential Interstate 5 overflow. Any future watershed development upstream of the proposed development will be required to mitigate for any future increases in impervious area to maintain pre-development conditions per local jurisdiction and state standards and regulations.

No levees will be constructed as part of this project and ground elevations will not be increased within the FEMA 100-year floodplain. Therefore there will be no loss of existing floodplain storage volume.

There will be no adverse impacts to stormwater quality or stormwater quantity to locations downstream as a result of the proposed project development and drainage system.

Section 5 – Hydrology and Hydraulics – Alternative Site

5.1 Description of Existing Watershed Characteristics

The Alternative E site is relatively flat and generally drains easterly towards the Tormey Drain and Interstate 5. The 40.5-acre site is a part of the Tormey Drain Basin and consists of pastureland and scattered oak trees. Soils types were determined using the *Web Soil Survey* provided by the United States Department of Agriculture Soil Conservation Service and Forest Service. It was determined from the Web Soil Survey that the site consists of Hydrologic Soil Group A and D.

The current FEMA FIRM identifies that the proposed project is within the Tormey Drain 100-year floodplain. The Flood Insurance Study provided by FEMA shows that the 100-year peak flow at Oak Street is 744 cubic feet per second and at Interstate 5 is 788 cubic feet per second. Figure E4 shows FEMA 100-year floodplain.

5.2 Methodology

Peak flows for the 2-, 10-, and 100-year storm events for a 24-hour period were estimated using the United States Army Corp of Engineers flood hydrograph package HEC-1 to model rainfall runoff. Existing peak flows can be in Table 5.1. The Rational Method was used to estimate the proposed size of the on-site storm drain conveyance system. The Darcy Equation was used to estimate the amount of infiltration that will be utilized in the proposed storm drain conveyance system.

5.3 Results of Analysis

The existing condition peak flows for Alternative E were calculated and are summarized in Table 5.1.

Table 5.1: Estimated Existing Condition Peak Flows

Storm Event	Existing Condition Peak Flow, cfs
2-YEAR	4
10-YEAR	8
100-YEAR	21

With development of the proposed project, the site will develop into 84% rooftop, sidewalks, and parking lot. Table 5.2 summarizes the peak flows from the post-development condition.

Table 5.2: Estimated Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs
2-YEAR	55
10-YEAR	76
100-YEAR	115

Post-developed runoff will be captured by onsite inlets and conveyed by a series of perforated storm drain pipe and drain rock infiltration trenches to the proposed retention pond located in the southeast of the project site. Approximately 24 acres of the site (Drainage Area #1) will be conveyed by the proposed on-site system. A series of inlets and perforated storm drain pipe will collect and convey the runoff to the proposed retention pond. The perforated storm drain pipe will be a maximum of 36 inches in size and will be placed within a drain rock infiltration trench five feet wide. This infiltration trench will infiltrate 38 cubic feet per second of the peak flow. Table 5.3 summarizes the post-development peak flows for Drainage Area #1 for the 2- and 10- year events.

Table 5.3: Post-development Peak Flows

Storm Event	Post-development Peak Flow, cfs
	Drainage Area #1
2-YEAR	35
10-YEAR	49

This site has approximately 58 acre-feet of storage within the 100-year floodplain. With development of the project it is estimated that 36 acre-feet of the floodplain will be filled. This will require filing a Letter of Map Revision - Fill with FEMA. This storage will be relocated to the southeast portion of the site on both sides of Oak Street. The bottom of the proposed retention pond will be set at the flowline of the Tormey Drain (elevation 410) and the top of the pond will be at the ground elevation of 416 feet. The proposed pond depicted will have a volume of 62 acre-feet. Figure E4 shows the location of the proposed retention pond.

5.4 Cumulative Impact of Alternative Site Grading & Drainage

The proposed alternative site will be designed in such a way that the grading will be a balanced earthwork operation, meaning the cut and fill quantities will be the same and there is no import or export of material required. The grading design of the alternative site will require fill to be placed in the FEMA 100-year floodplain in order to get the building finished floors a minimum of one foot above the 100-year flood elevation of the Tormey Drain. The project has been designed in such a way that the volume of fill placed within the FEMA 100-year floodplain will be mitigated by an equal volume of cut (detention/ infiltration basins) within the FEMA 100-year floodplain. This will maintain pre-development flood levels at all locations upstream and downstream of the project.

The project drainage system has been designed in such a way that there will be no increase in flows downstream. This will be accomplished using infiltrations trenches, infiltration/detention basins, and numerous other stormwater quality BMPs that encourage groundwater infiltration as described in Section 6.1.

Surrounding development will be subject to the City of Anderson's policy to demonstrate "No Net" offsite downstream drainage effects as a result of any proposed development. The City of Anderson is a Phase II NPDES community and any proposed development will be required to incorporate Low Impact Development (LID) Best Management Practices (BMPs) to improve stormwater quality in the runoff to mitigate for the increased impervious area. Development surrounding the proposed project will not negatively impact Stormwater quality or quantity.

There will be no adverse impacts to stormwater quality or stormwater quantity to locations downstream as a result of the alternative site development and drainage system.

Section 6 – Stormwater Quality

6.1 Stormwater Quality Best Management Practices

During urban development two important changes occur, first a portion of the vegetated, pervious ground cover is converted to impervious surfaces. Vegetated soil both absorbs rain water, and helps to remove pollutants, providing a natural purification system. This natural absorption purification system is blocked by the newly developed impervious surface. The second important change of urban development is the addition of new pollutants, such as vehicle emissions, pesticides, trash, and other contaminants that come along with development. Because of these changes, storm water runoff leaving a site in a newly developed or redeveloped area may be considerably greater in volume, velocity and level of pollutants. The proposed project will incorporate numerous stormwater quality and quantity BMPs into the project design and landscaping to reduce pollutants and leaving the site, including but not limited to the following:

- Catch Basin Filters
- Infiltration Trenches (Perforated storm drain pipe with drain rock)
- Vegetated Swales
- Bio-filtration Swales
- Natural Water Quality Retention Basins
- Wet Ponds
- Pervious Pavements

6.1.1 Catch Basin Filters

Catch Basin insert filters will be installed at select area drains and catch basins on-site. These inlet filters are designed to capture sediment, debris, trash, oil and grease from storm water. These filters clean the storm water during low flows, and have no standing water which minimizes any bacteria and odor problems. The system consists of a fabric filter that is placed inside the area drain or catch basin. This fabric is permeable so that the water may pass through leaving the pollutants & debris behind. The filters require regular maintenance, and must be checked regularly. The debris and contaminants can be removed and disposed of properly, the filter can be then be reused.

All of the alternatives will utilize catch basin inlet filters where feasible in the parking and landscape areas to improve the water quality of the runoff prior to entering the underground storm drain system.

6.1.2 Infiltration Trenches

Where feasible, Infiltration Trenches will be built as opposed to solid wall underground storm drain systems. Perforated pipe will be installed in a drain rock backfilled trench which will allow the low storm water flows to flow through the drain rock. The drain rock acts as a filter removing sediment and other contaminants. Most of the storm water will absorb into the ground which simulates the pre-development natural absorption and purification condition that existed prior to development. These infiltration trenches will be constructed in areas that have favorable soil conditions to promote stormwater infiltration. The entire site consists of Hydrologic Soil Group A soils, which provides excellent infiltration and absorption.

6.1.3 Vegetated Swales

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems. The 40 foot wide vegetated swale provides filtration through proposed vegetation and infiltration for stormwater runoff.

6.1.4 Wet Ponds

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling.

The wet pond will be located at the southern portion of the Proposed Project site and runoff will be conveyed to the wet pond via the vegetated swale (40’ vegetated swale) described in Section 6.1.3. The wet pond will retain water and allow infiltration into the native alluvial soil during a typical rain event. During rare extreme runoff events, the wet pond will spill and runoff will make its way south to the Sacramento River. The wet pond will be submerged when the Sacramento River is flooding.

6.1.5 Pervious Pavements

Pervious paving is used for light vehicle loading in parking areas and in outdoor pedestrian areas. The term describes a system comprising a load-bearing, durable surface together with an underlying layered structure that temporarily stores water prior to infiltration or drainage to a controlled outlet. The surface can itself be porous such that water infiltrates across the entire surface of the material (e.g., grass and gravel surfaces, porous concrete and porous asphalt), or can be built up of impermeable blocks separated by spaces and joints, through which the water can drain. This latter system is termed ‘permeable’ paving.

Advantages of pervious pavements are that they reduce runoff volume while providing treatment and are unobtrusive resulting in a high level of acceptability.

Pervious pavement was not used in the stormwater quality or stormwater quantity mitigation calculations. However pervious pavement could be implemented on the proposed project to further improve the stormwater quality. Pervious pavements could be used in parking areas, courtyard areas, pedestrian areas or any other areas where feasible. Pervious pavements may be any of the following:

- Porous Concrete
- Porous Asphalt
- Pavers
- Gravel Surfaces

6.1.6 Green Roofs

When used in appropriate climates, green roofs can significantly reduce the amount of rain water that would otherwise run off an impervious roof surface. However, green roofs are not a viable option due to Redding's climate. Redding experiences cold, wet winters with dry, hot summers. Green roofs have been attempted in some projects around the Redding area but have fallen into disrepair as the amount of water to keep plants thriving in the harsh summer is counterproductive to the intent of the LID.

6.2 Sacramento River Streambank Stabilization

The eastern streambank of the Sacramento River (westerly project boundary) has a layer of loam that easily erodes with high river flows, see the photos below. As shown in the photos, there is an approximate 2:1 slope that contains cobble and established vegetation. This slope extends to the bottom of the riverbed and appears stable. As shown in the photos, the top 4 feet to 8 feet of the streambank contains a layer of loam that shows evidence of erosion and instability when it is exposed to high river flows as it was in early 2017.

Sacramento River eastern bank (Facing north)

Sacramento River eastern bank (Facing north)

Sacramento River eastern bank (Facing north)

6.2.1 Streambank Stabilization Recommendations

The upper loam portion of the riverbank should be stabilized using the ‘Windrow Rock Slope Protection’ method as described on page 16 of “California Bank and Shore Rock Slope Protection Design” Third Edition – Internet October 2000. This involves removal of existing stream bank material above the ordinary high-water mark and placement of a wide row of appropriately sized rock (boulders) over the existing cobbly alluvium up to at least the flood water surface elevation of the river. The river-side and top surface of the boulders is then covered with native cobbly alluvium, and the top surface is further covered with a minimum of 18 inches of native loam up to the desired finished surface elevation. This “hardened” bank will reduce erosion but will not increase the flow energy because the channel roughness coefficient and geometry will remain relatively the same. The ACOE Comprehensive Study stated that the HEC-RAS model in the upper Sacramento River “was not highly sensitive to changes in channel roughness”. The roughness coefficient used by both the ACOE study and FEMA in the channel was 0.035. The roughness coefficient values for boulders range from 0.035-0.05. See Figure 6.1 below.

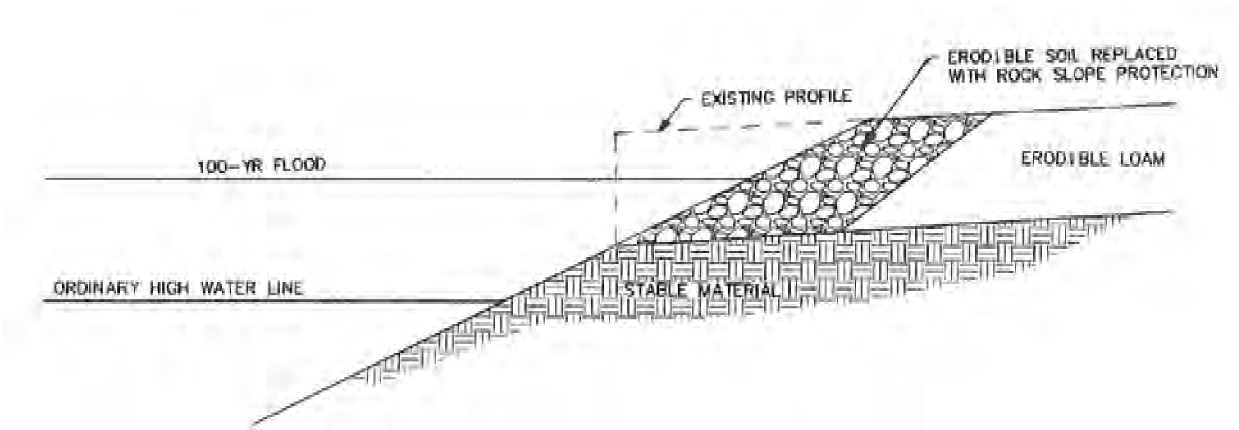
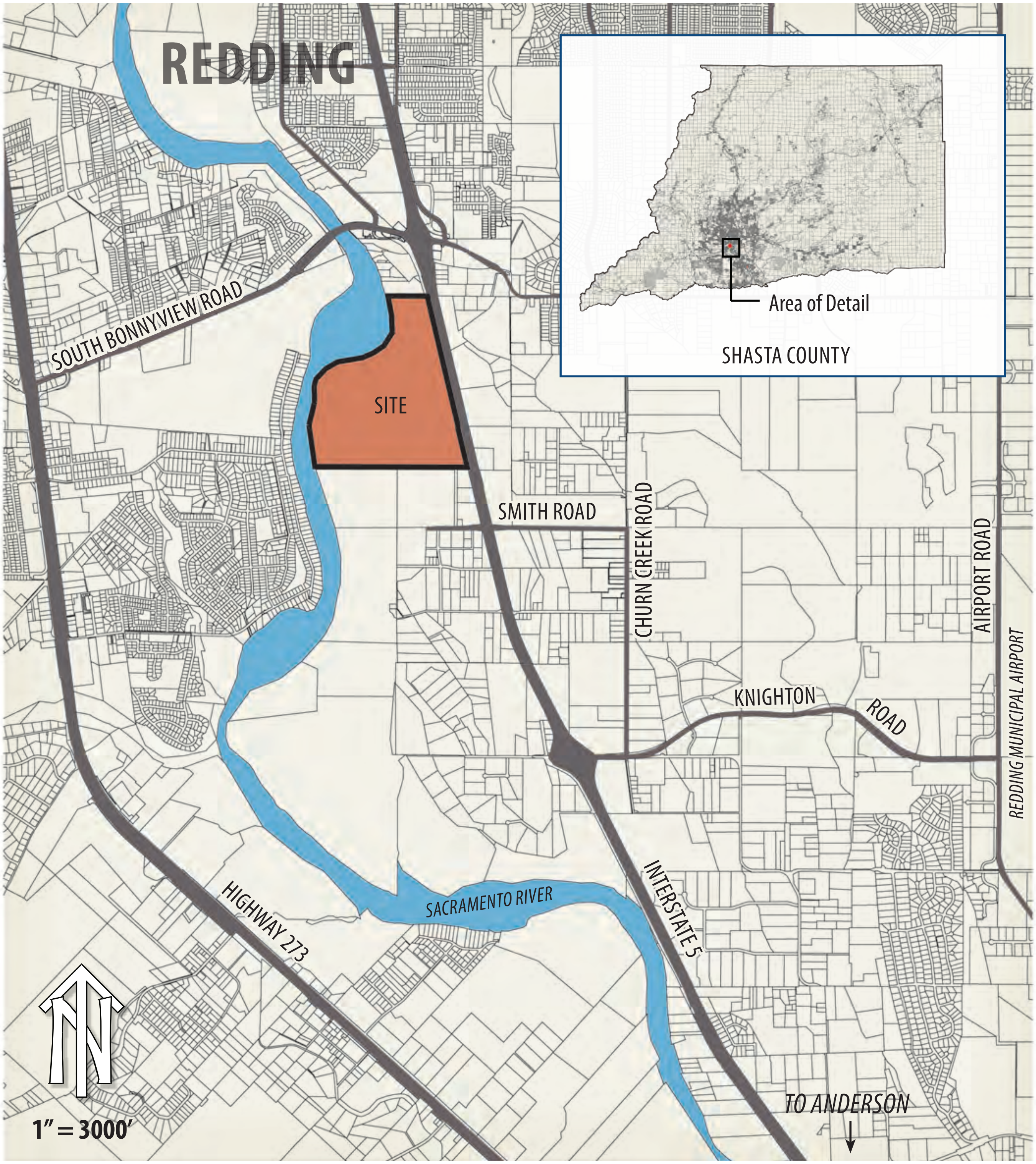


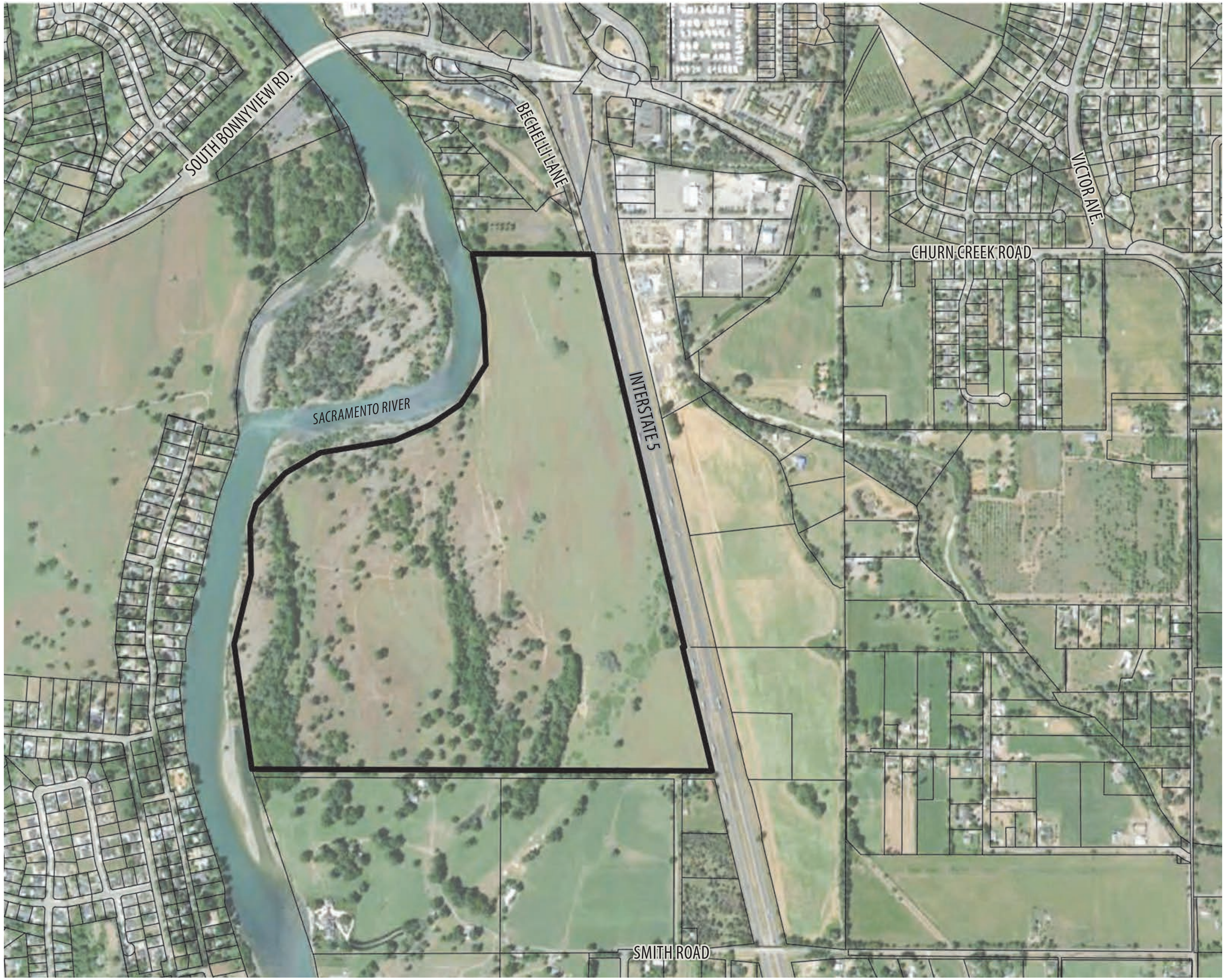
Figure 6.1: Streambank Stabilization

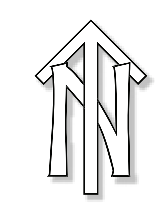
Figures



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE 1
PROPOSED PROJECT - ALT 'A', 'B', 'C', & 'D'
LOCATION MAP





1" = 800'

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FIGURE 2
PROPOSED PROJECT
ENLARGED LOCATION MAP WITH AERIAL

REDDING RANCHERIA
CASINO MASTER PLAN

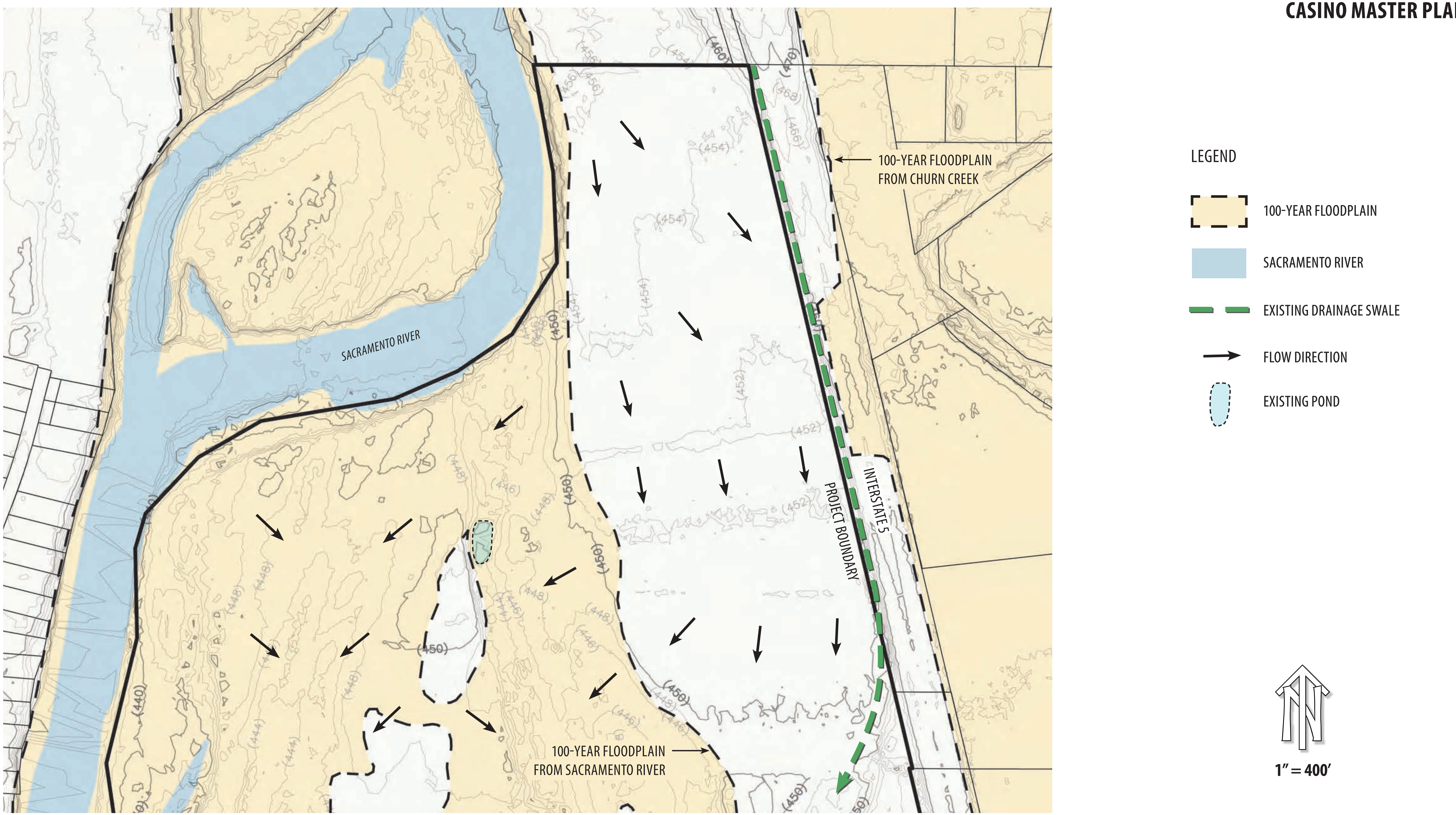

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FIGURE 3
PROPOSED PROJECT
EXISTING TOPOGRAPHY

1" = 400'

FIGURE 4
PROPOSED PROJECT AERIAL AND TOPOGRAPHY

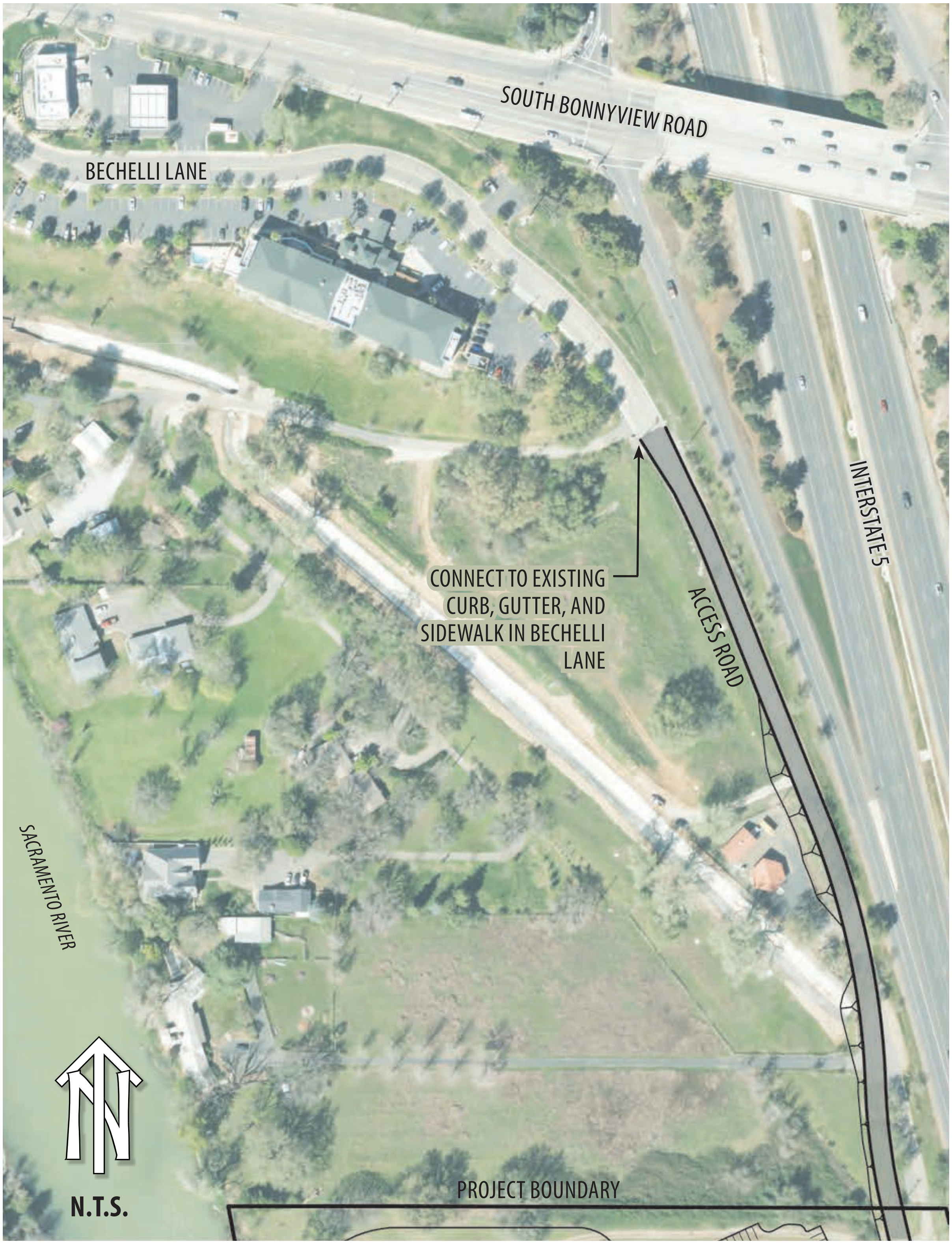

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FIGURE 5
PROPOSED PROJECT
NORTH ROAD CONNECTION

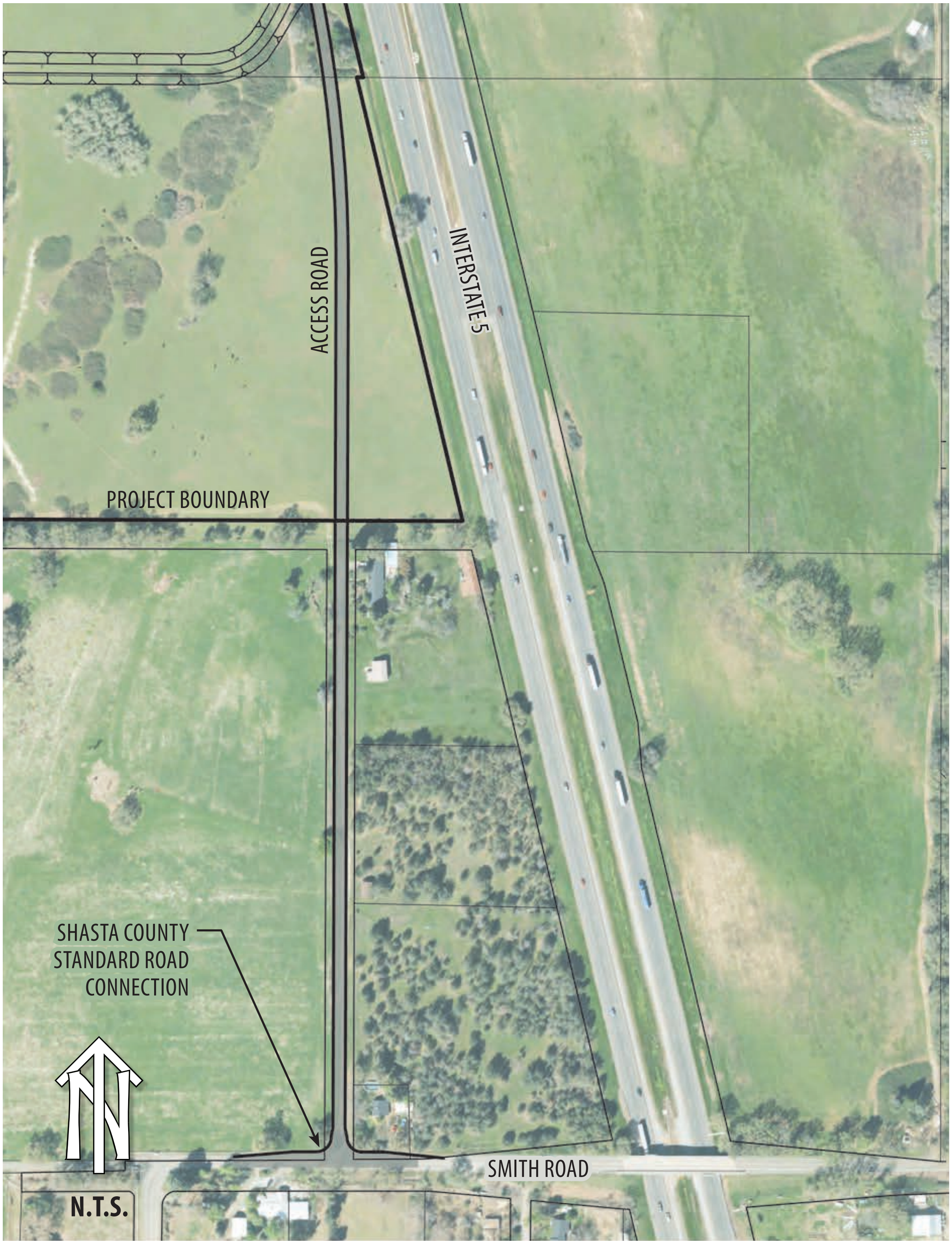

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FIGURE 6
PROPOSED PROJECT SOUTH ROAD CONNECTION

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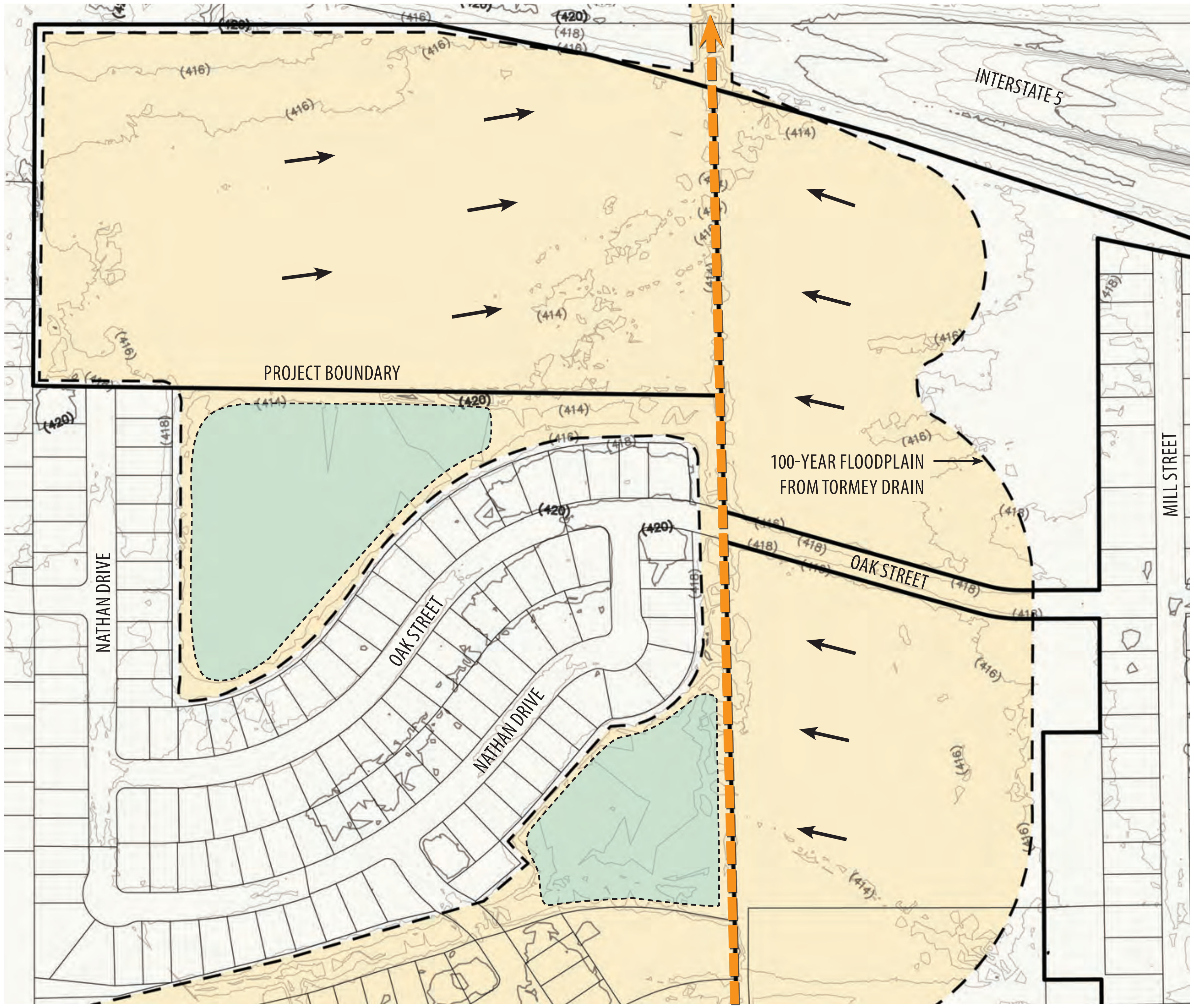
DUNLAP
SAWYER
INCORPORATED

FIGURE 7
PROPOSED PROJECT - ALT 'E'
LOCATION MAP



LEGEND

100-YEAR FLOODPLAIN

TORMEY DRAIN

FLOW DIRECTION

EXISTING POND

1" = 300'

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FIGURE 8
ALT SITE
EXISTING TOPOGRAPHY

FIGURE 9
ALT SITE
AERIAL AND TOPOGRAPHY

Figures – Alternative A

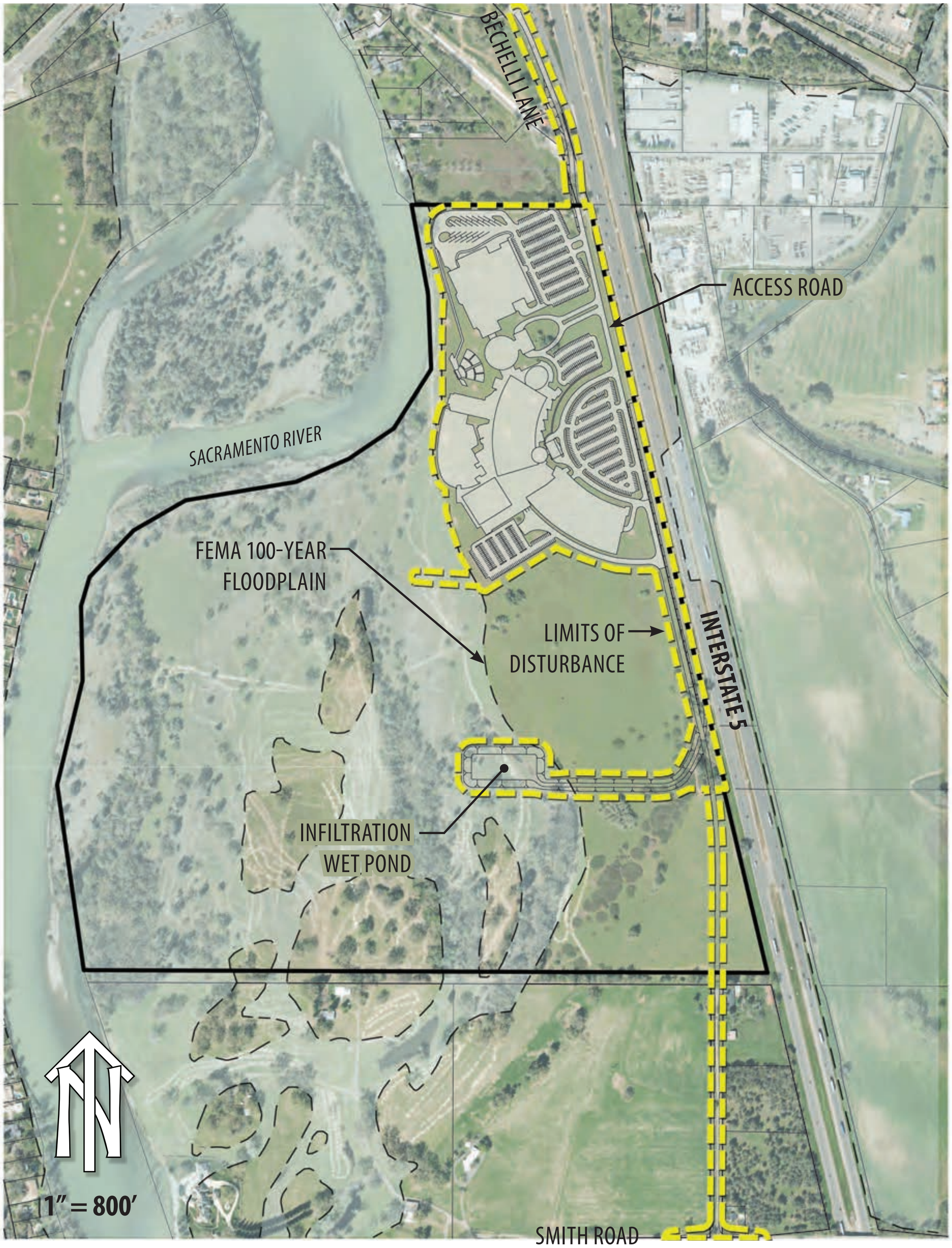

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FIGURE A1
PROPOSED PROJECT - ALT 'A'
OVERALL DISTURBANCE LIMITS

REDDING RANCHERIA CASINO MASTER PLAN

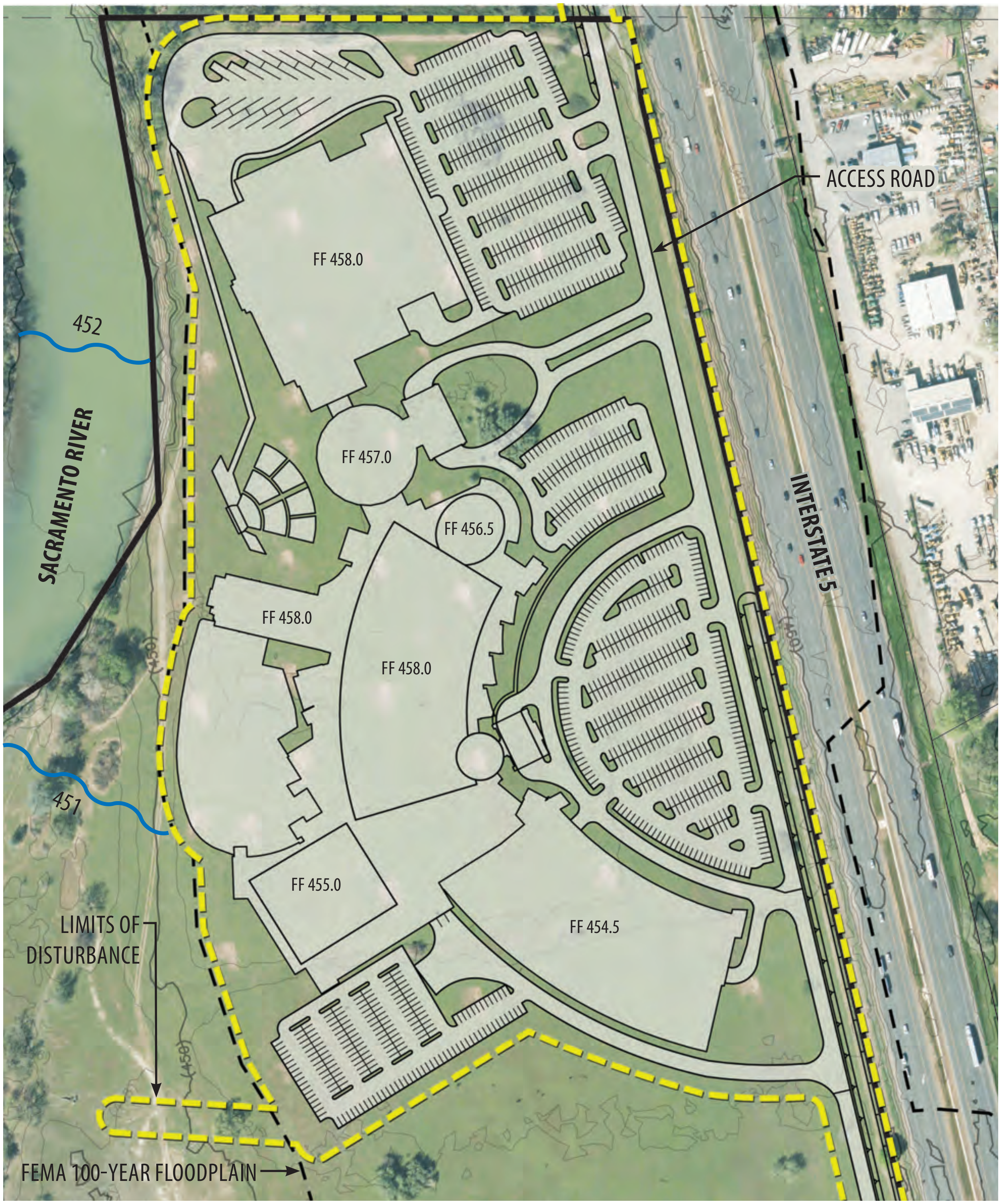

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FIGURE A2
PROPOSED PROJECT - ALT 'A'
ONSITE DISTURBANCE LIMITS

REDDING RANCHERIA CASINO MASTER PLAN

SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE A3
PROPOSED PROJECT - ALT 'A'
ONSITE GRADING

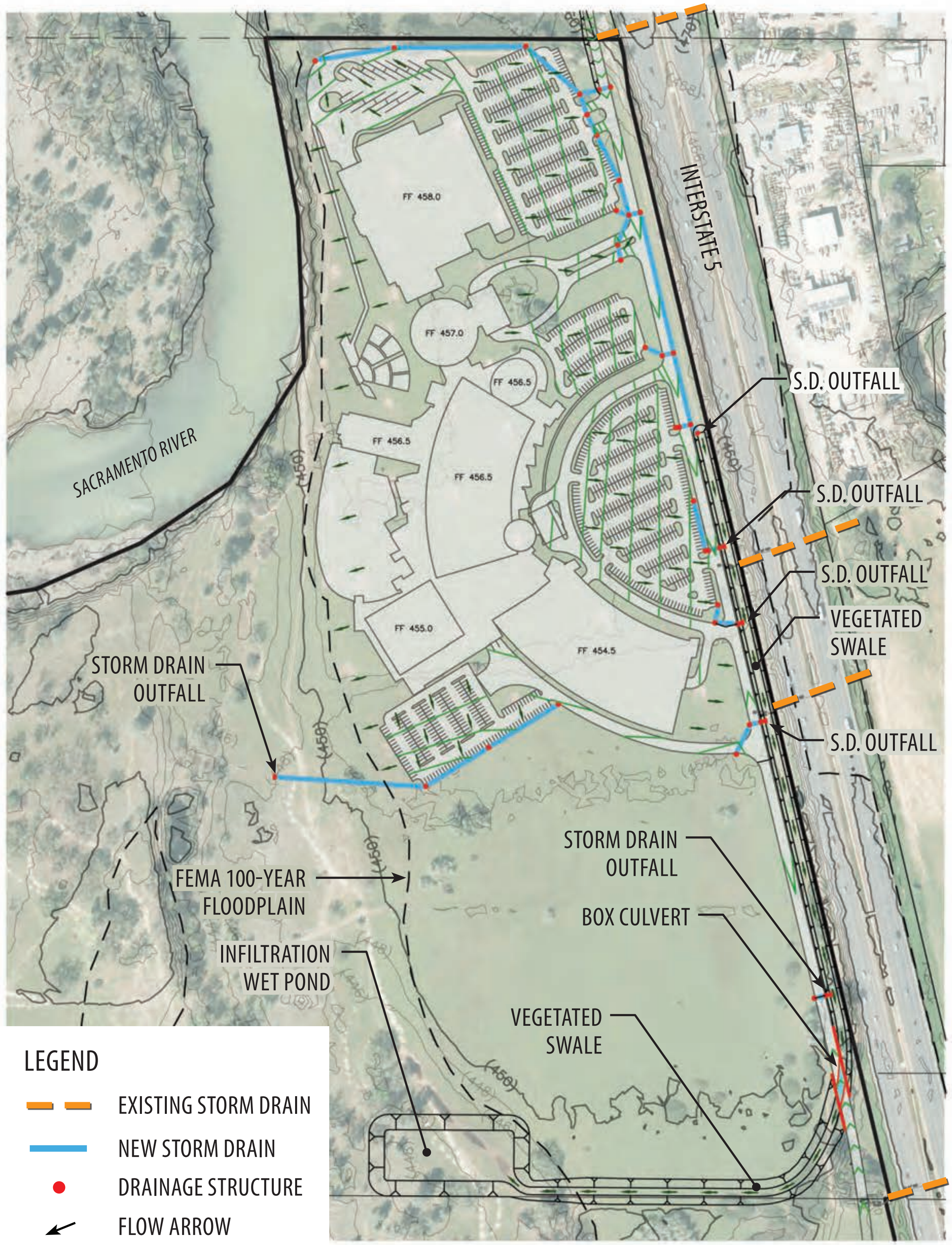

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FIGURE A4
PROPOSED PROJECT - ALT 'A'
OVERALL GRADING

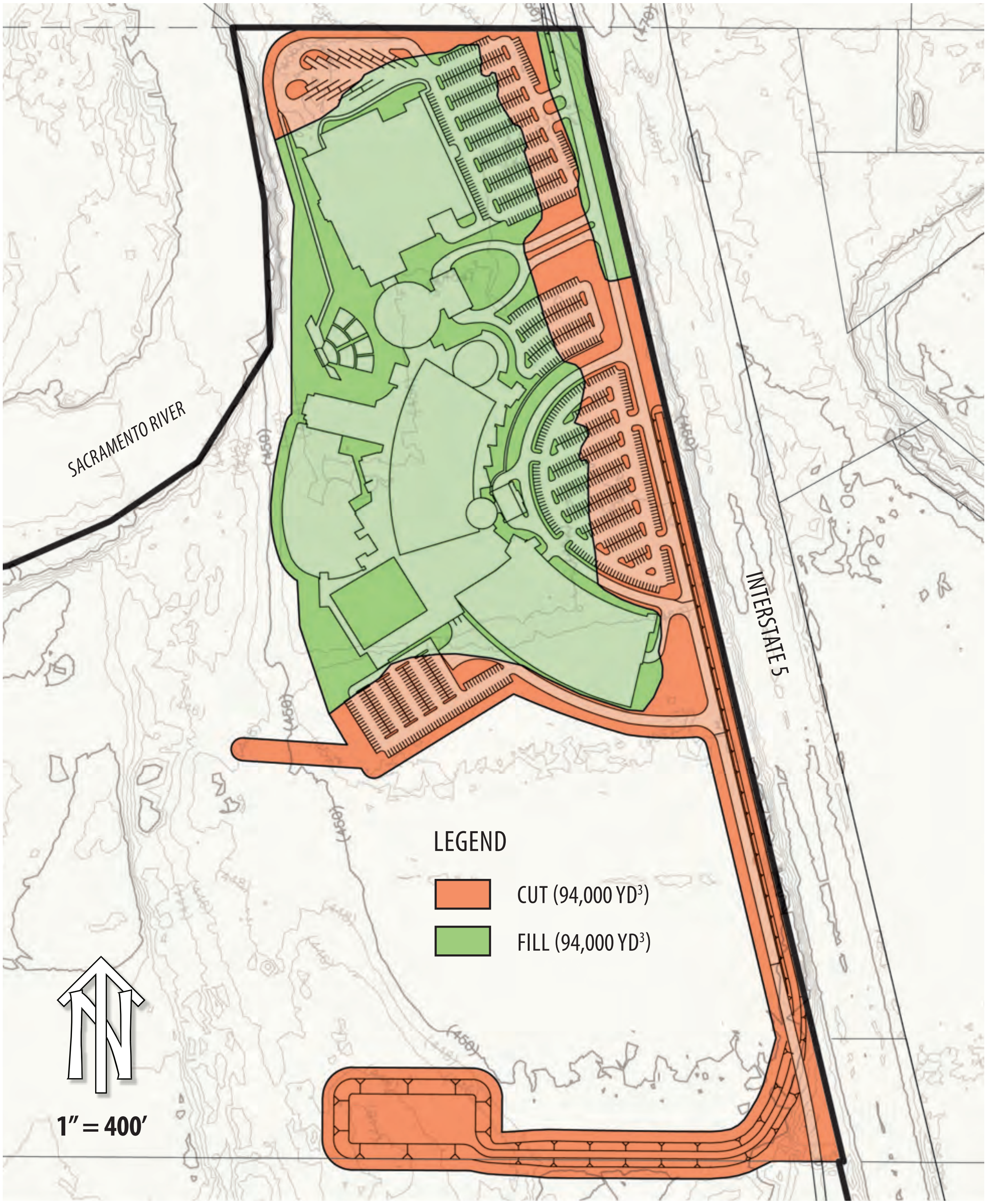

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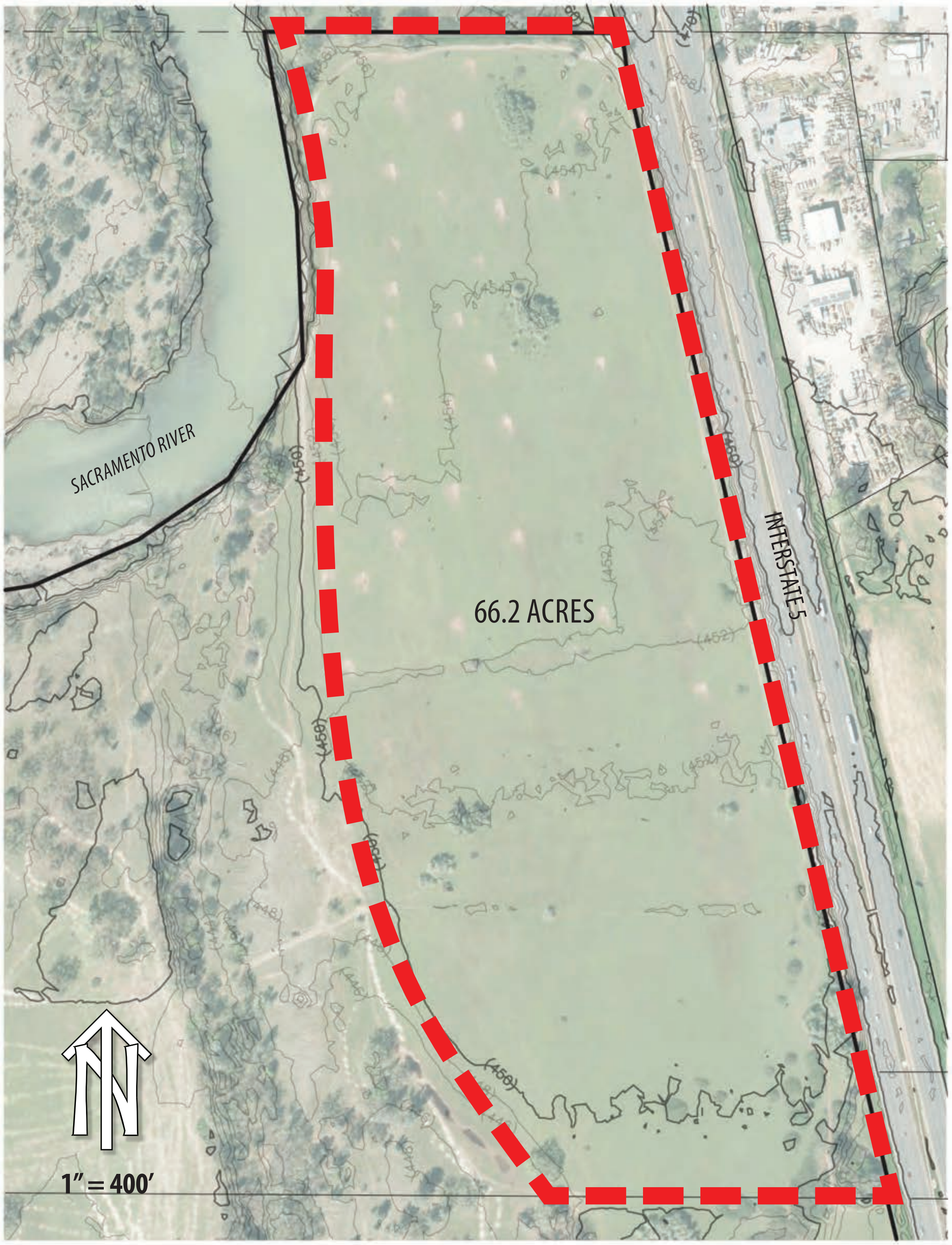
FIGURE A5
PROPOSED PROJECT - ALT 'A'
CUT FILL DIAGRAM



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DUNLAP
SAWYER
INCORPORATED

FIGURE A6
OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'A'
EXISTING CONDITION

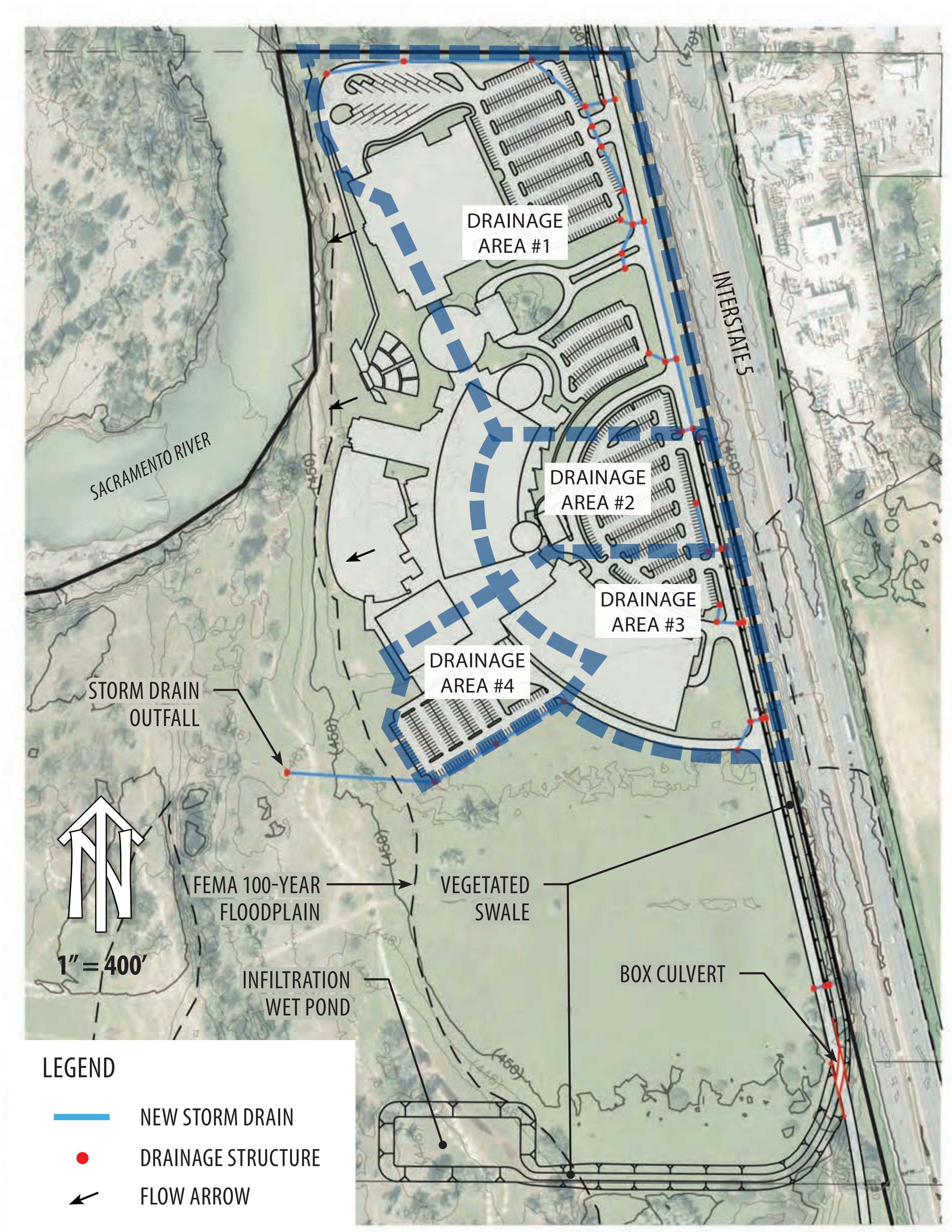
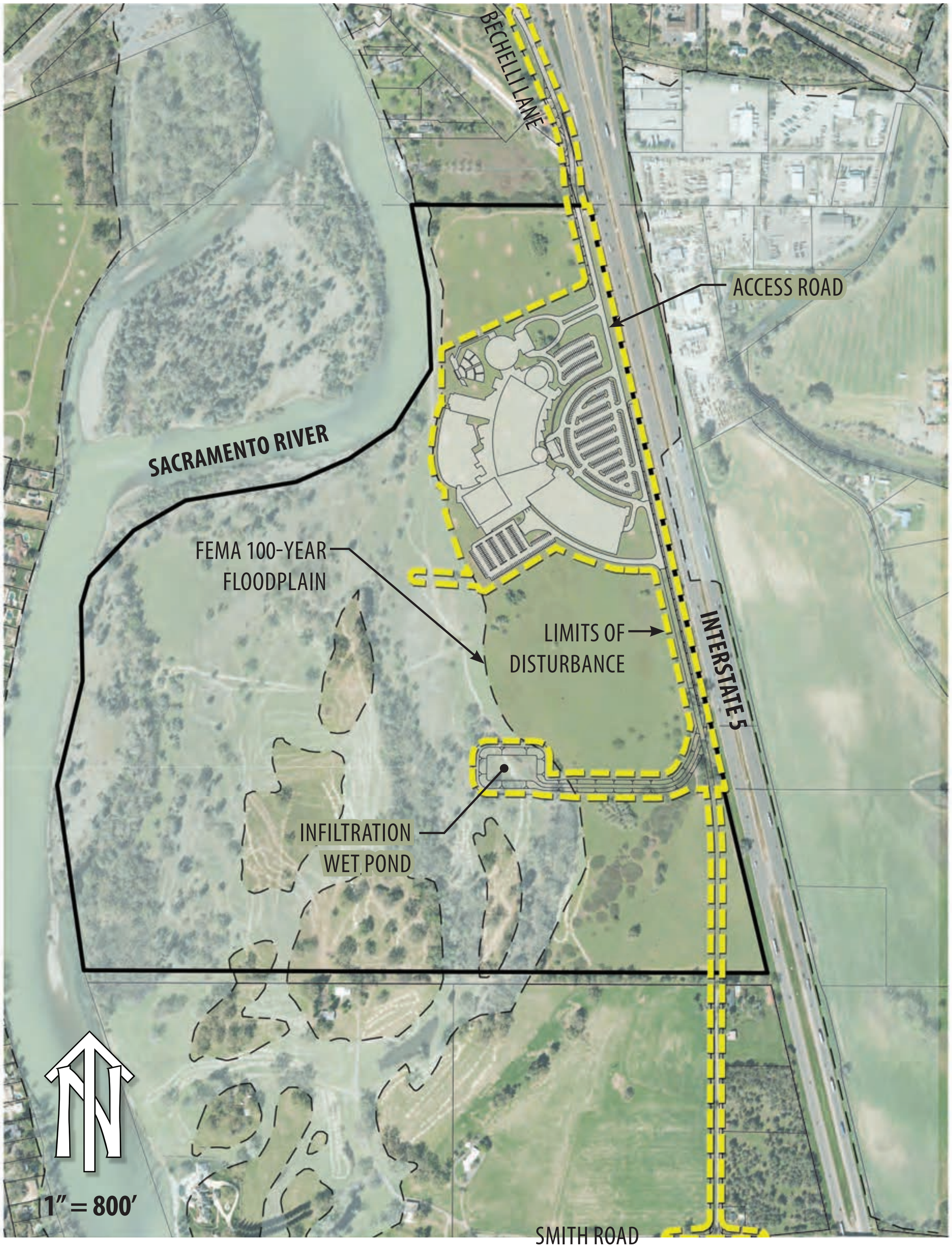


FIGURE A7
PROPOSED PROJECT - ALT 'A'
STORMWATER MANAGEMENT

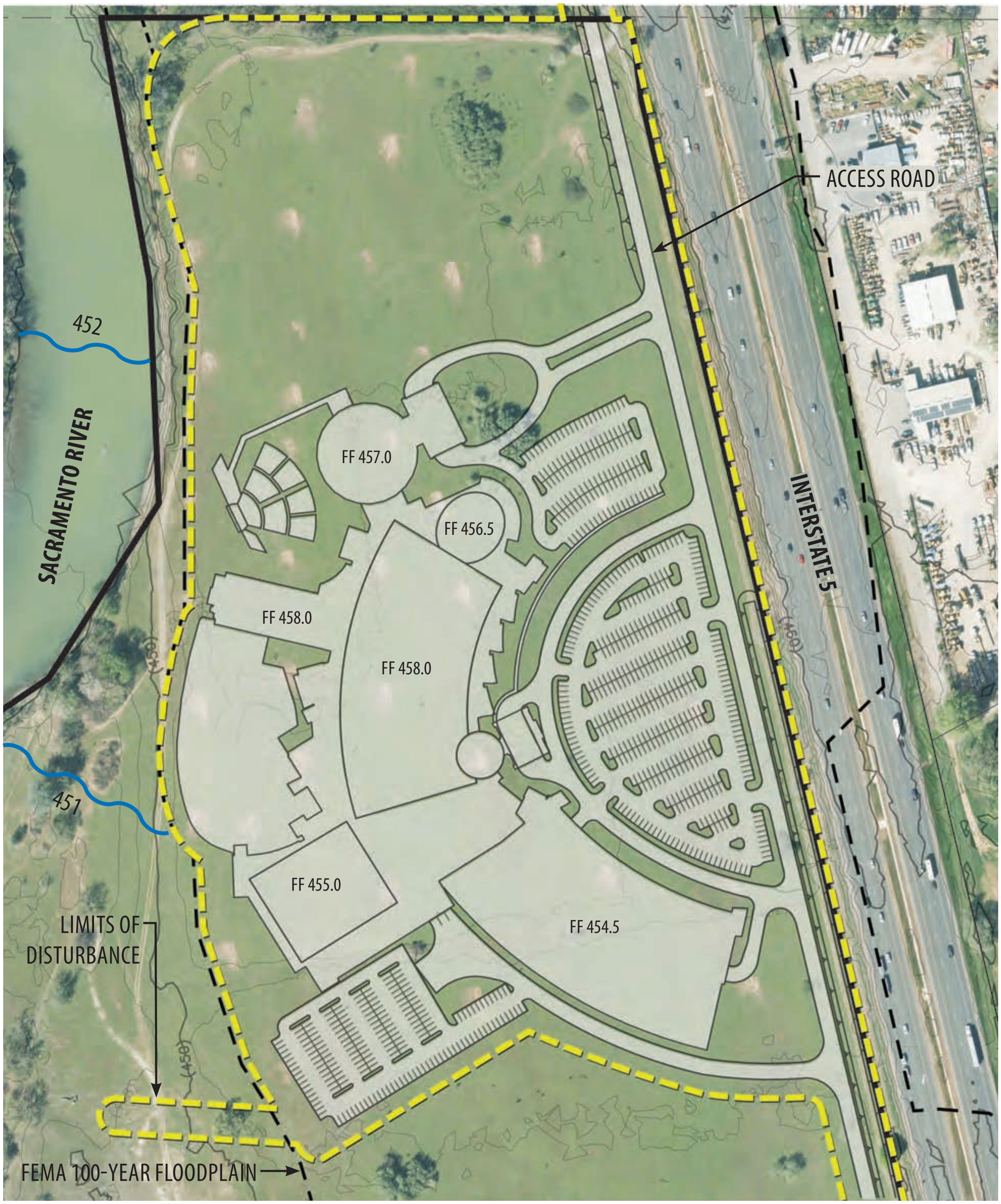
Figures – Alternative B



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE B1
PROPOSED PROJECT - ALT 'B'
OVERALL DISTURBANCE LIMITS

REDDING RANCHERIA
CASINO MASTER PLAN

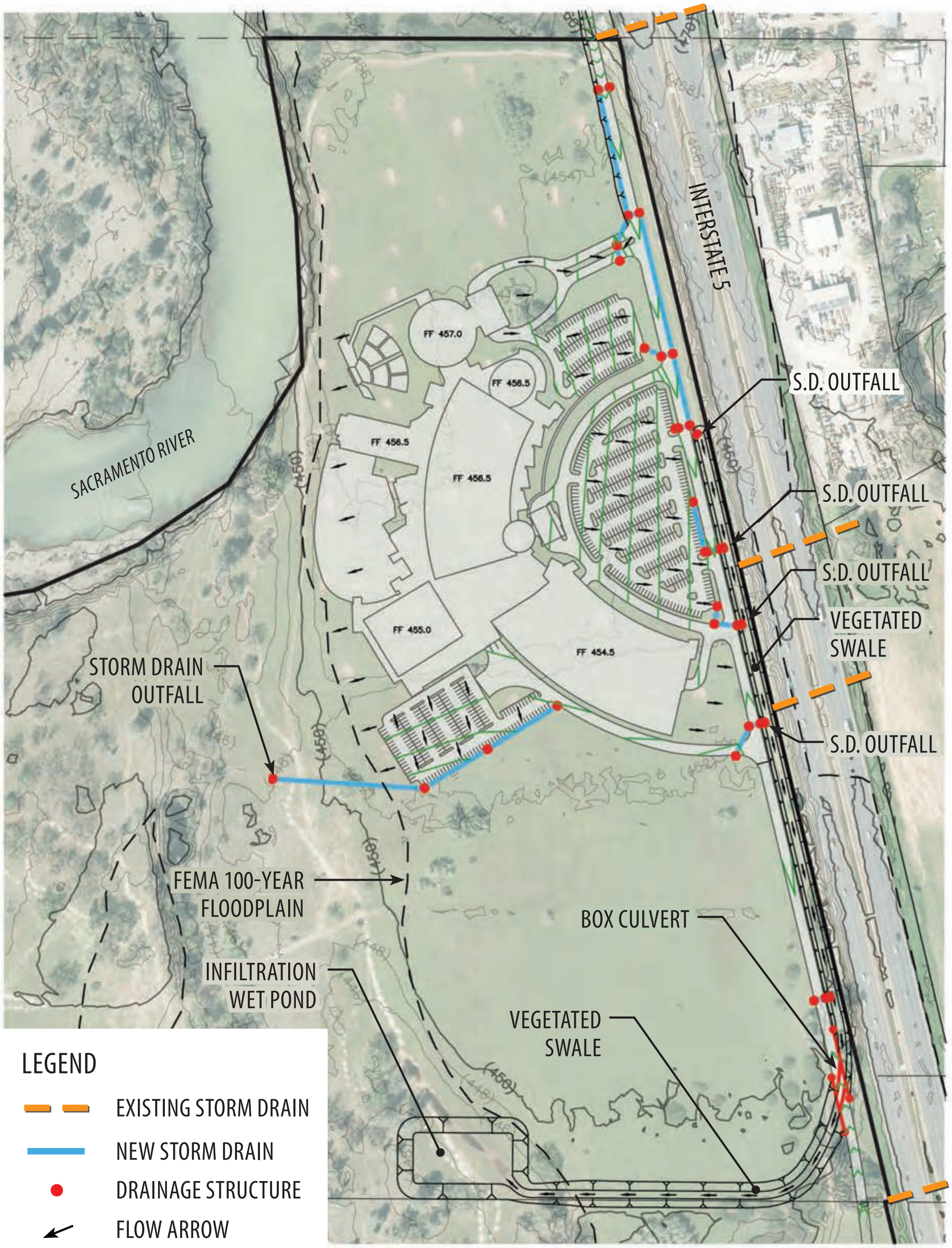


SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE B2
PROPOSED PROJECT - ALT 'B'
ONSITE DISTURBANCE LIMITS

SHARRAH DUNLAP SAWYER INCORPORATED

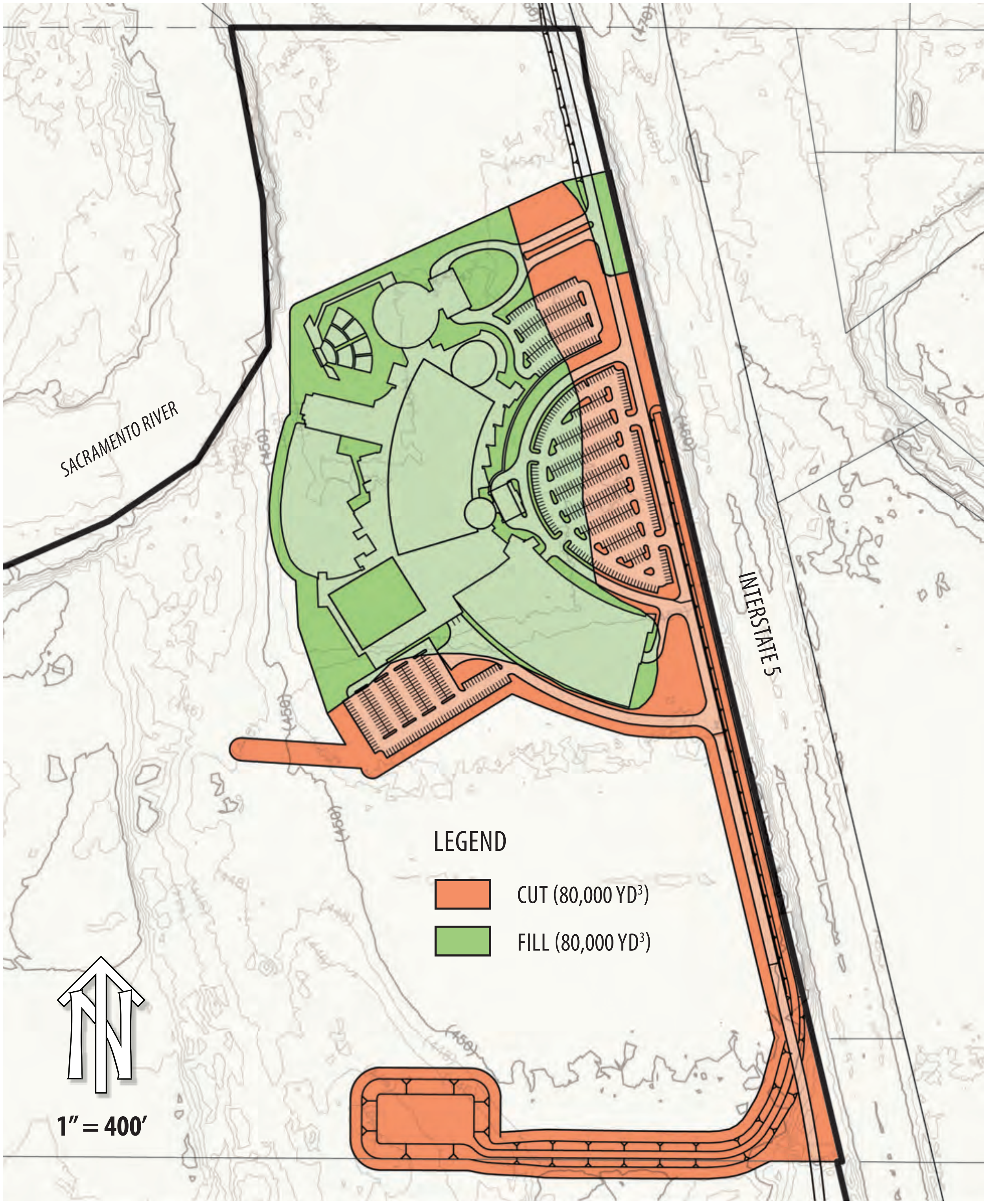
FIGURE B3
PROPOSED PROJECT - ALT 'B'
ONSITE GRADING



SHARRAH DUNLAP SAWYER INCORPORATED

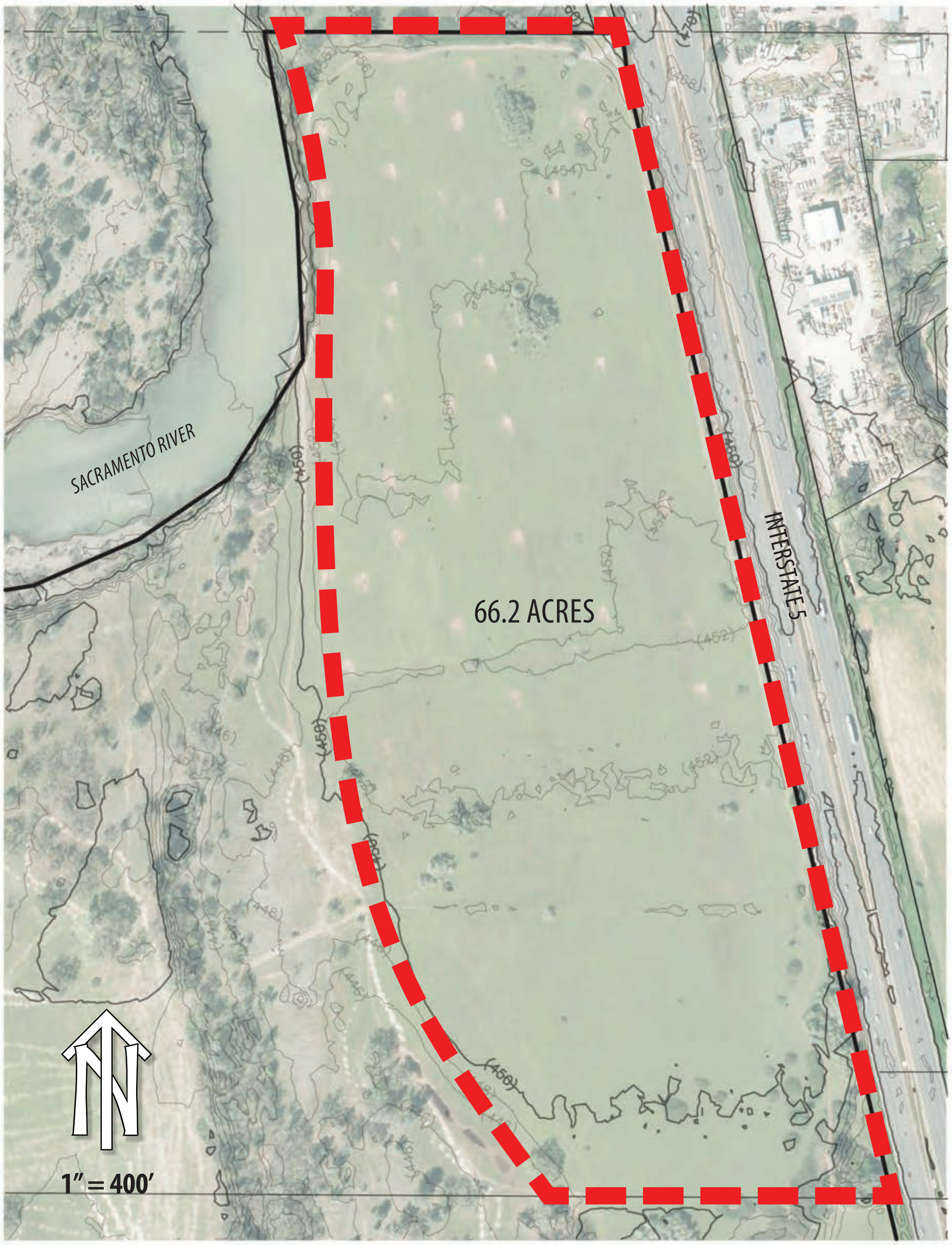
FIGURE B4
PROPOSED PROJECT - ALT 'B'
OVERALL GRADING

REDDING RANCHERIA CASINO MASTER PLAN



SHARRAH DUNLAP SAWYER INCORPORATED

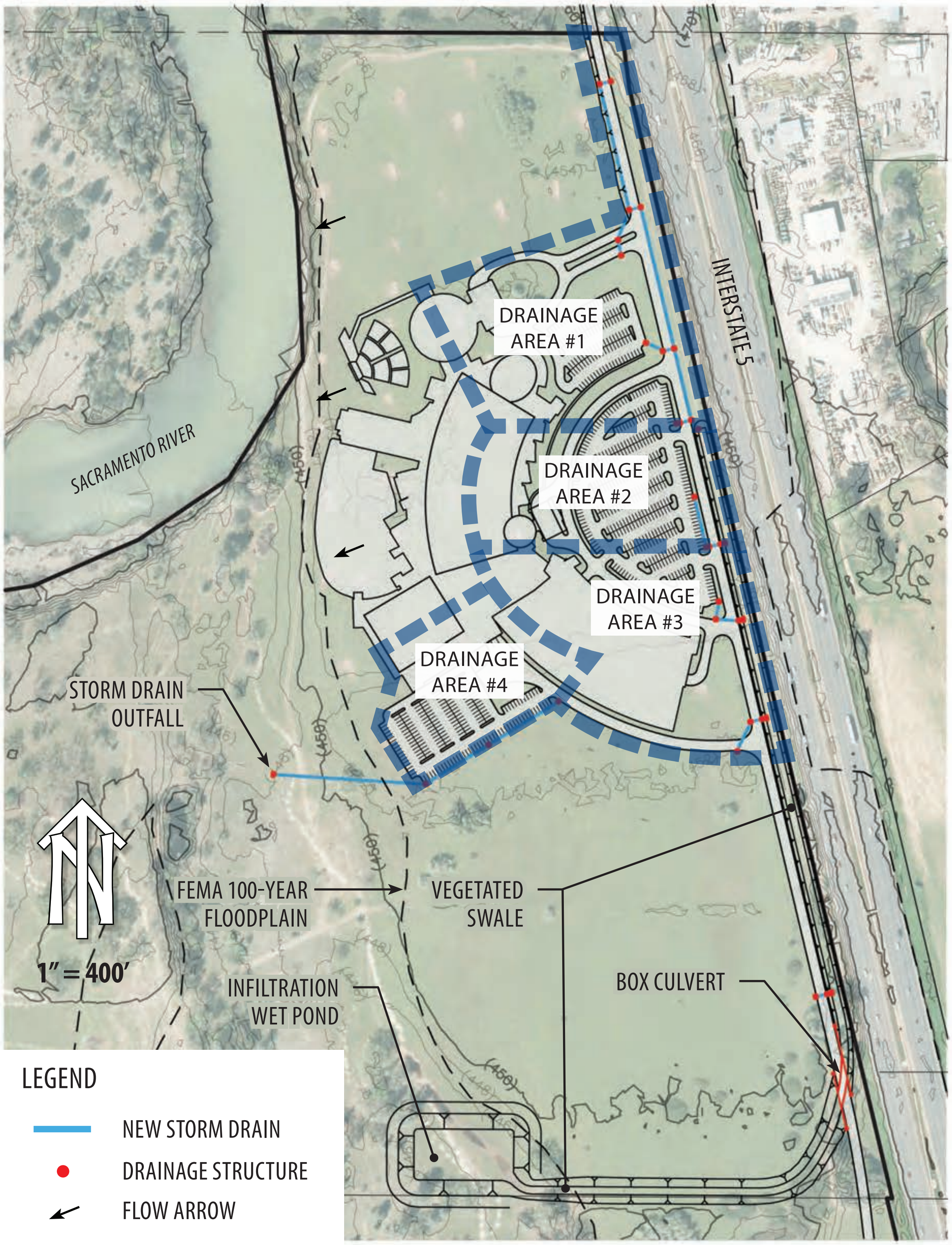
FIGURE B5
PROPOSED PROJECT - ALT 'B'
CUT FILL DIAGRAM



SHARRAH
DUNLAP
SAWYER
INCORPORATED

FIGURE B6
OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'B'
EXISTING CONDITION

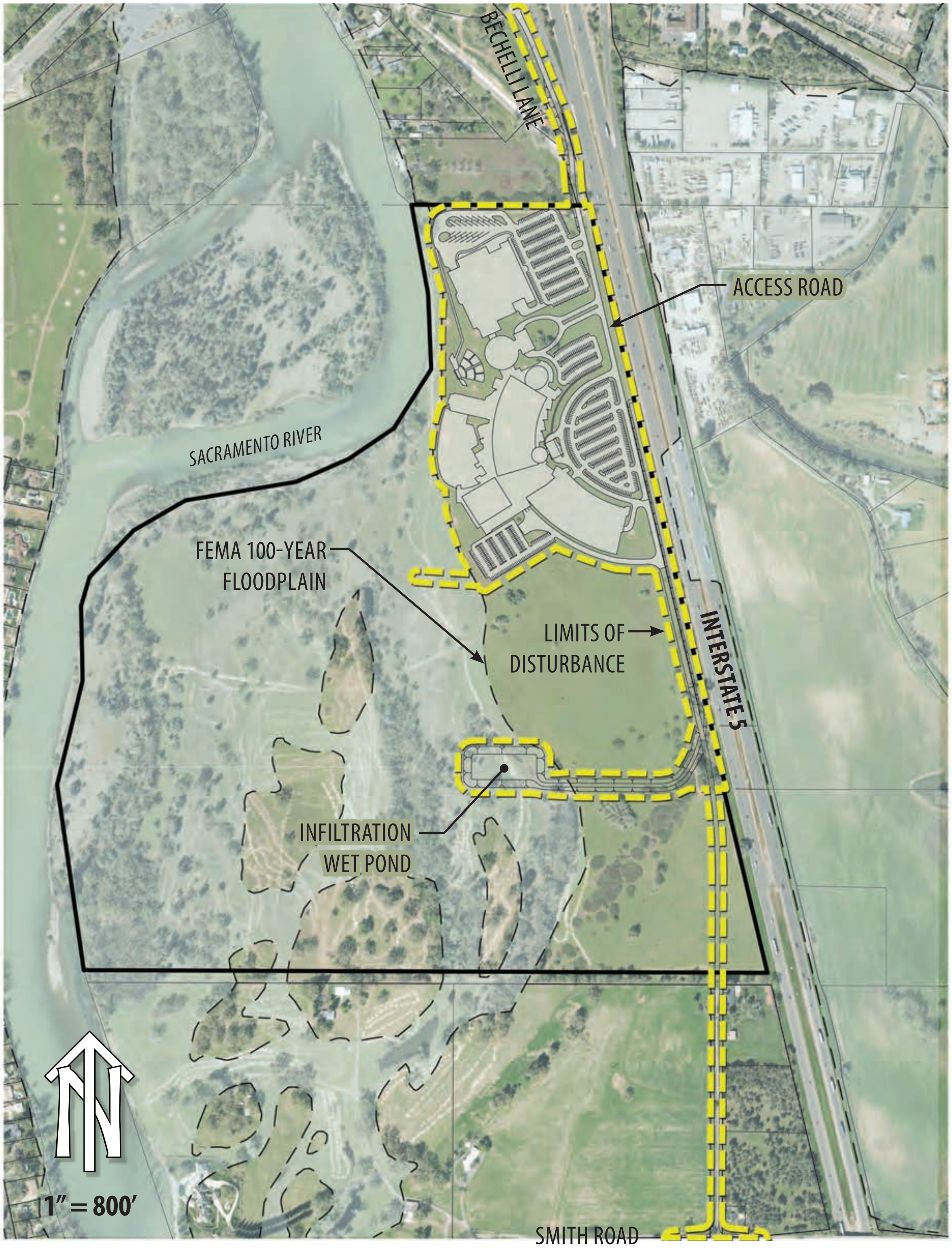
REDDING RANCHERIA
CASINO MASTER PLAN



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE B7
PROPOSED PROJECT - ALT 'B'
STORMWATER MANAGEMENT

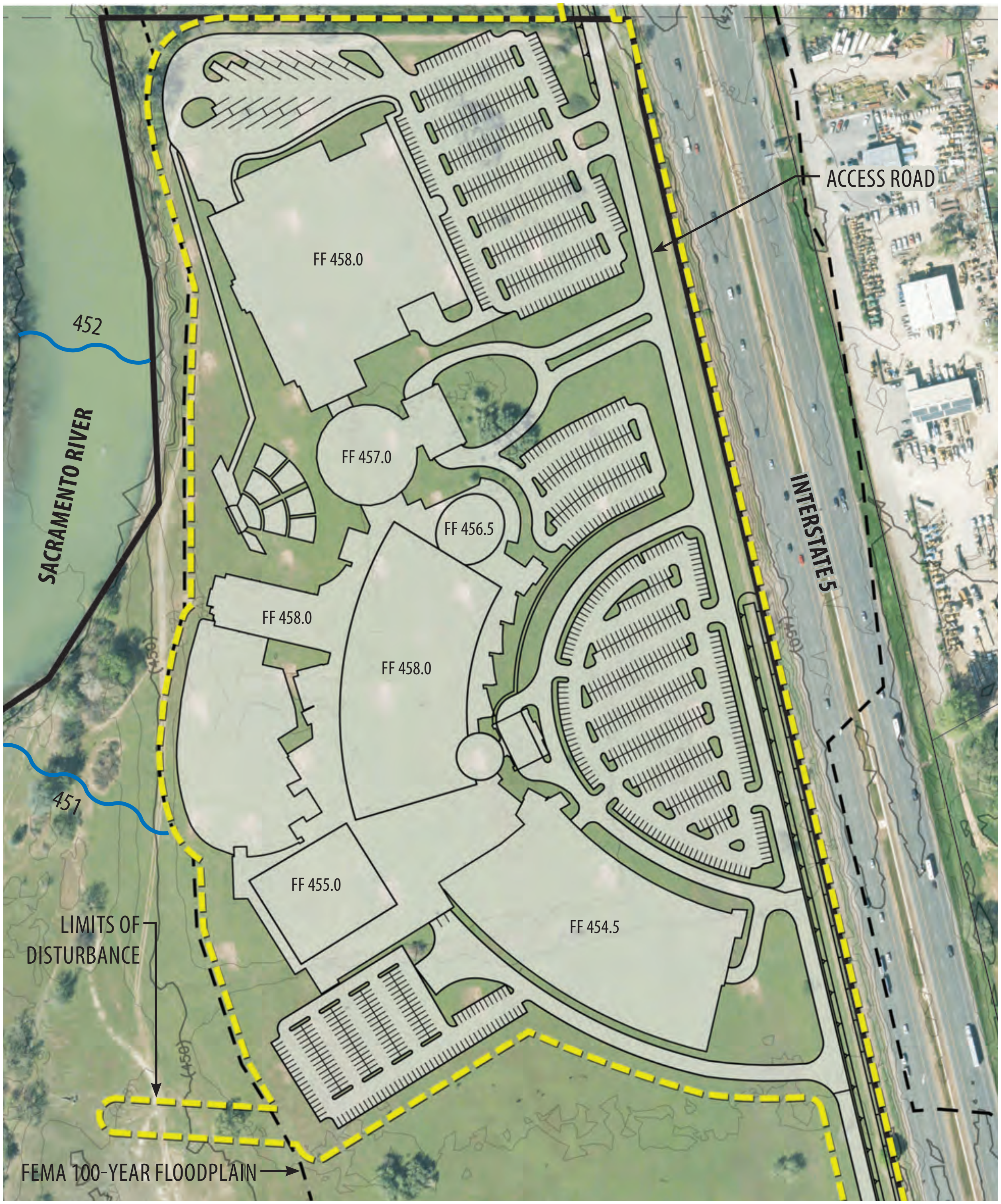
Figures – Alternative C



SHARRAH DUNLAP SAWYER INCORPORATED

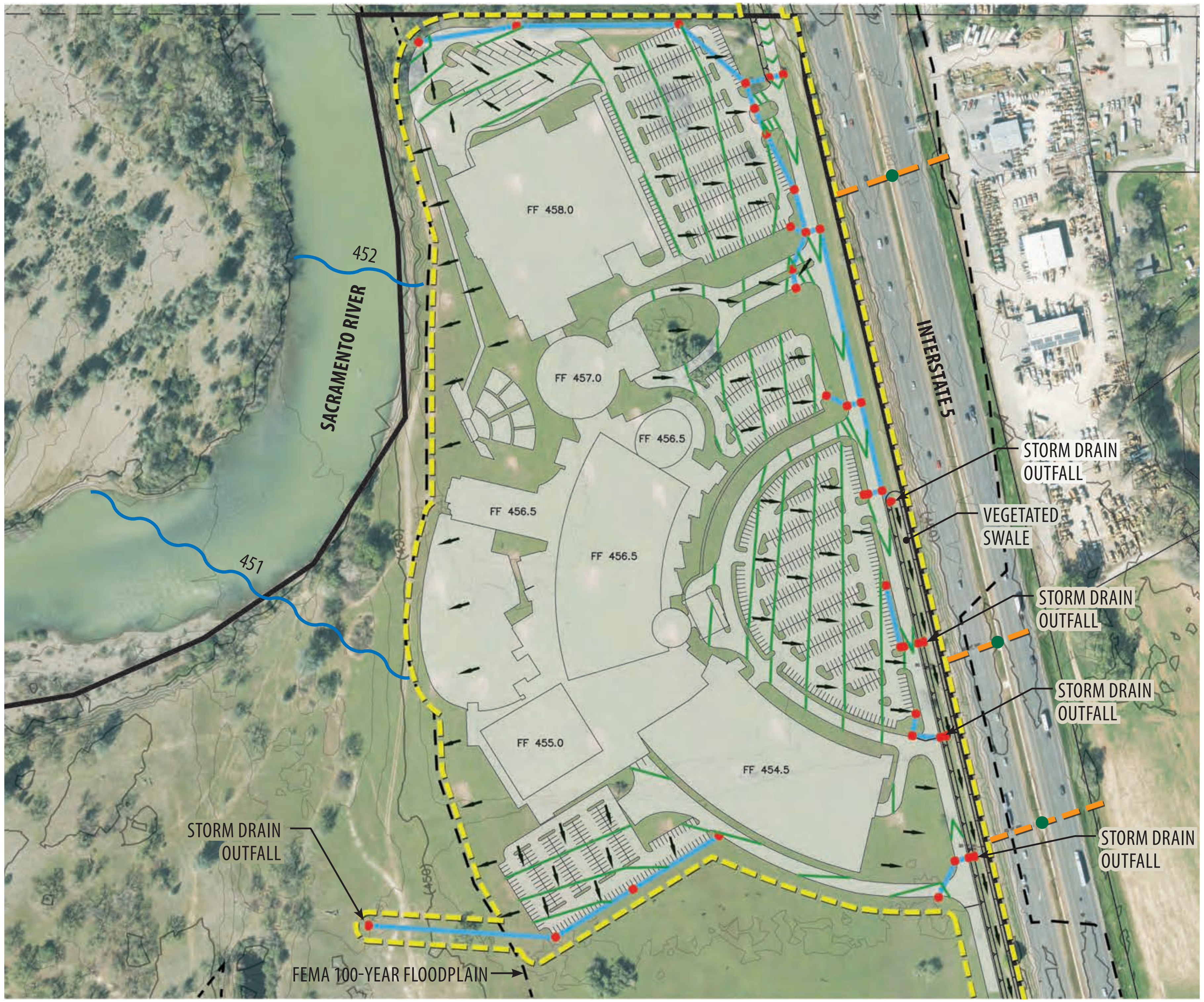
FIGURE C1
PROPOSED PROJECT - ALT 'C'
OVERALL DISTURBANCE LIMITS

REDDING RANCHERIA
CASINO MASTER PLAN



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE C2
PROPOSED PROJECT - ALT 'C'
ONSITE DISTURBANCE LIMITS



LEGEND

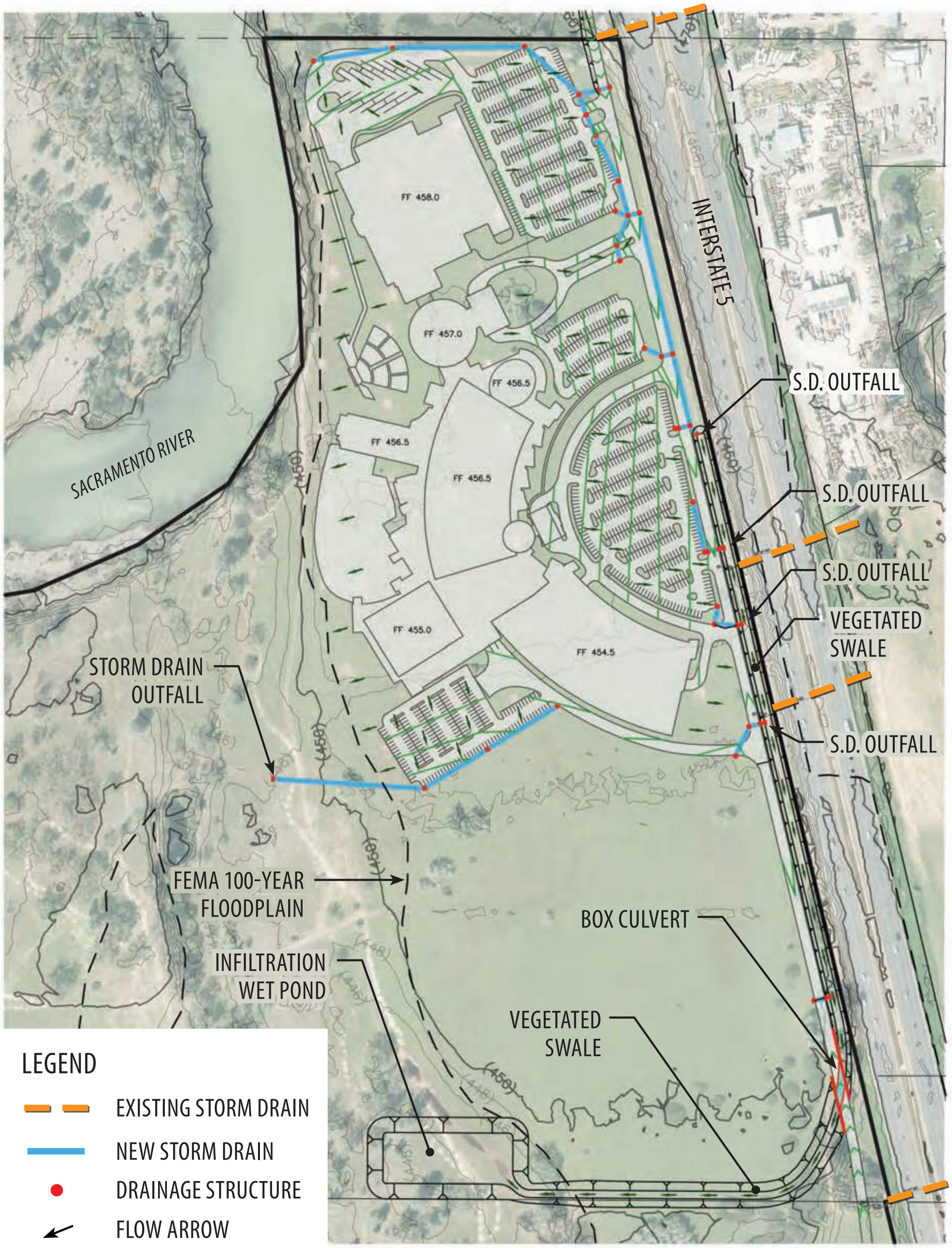
- FINISH GRADE CONTOUR
- NEW STORM DRAIN
- EXISTING STORM DRAIN
- DRAINAGE STRUCTURE
- EXISTING DRAINAGE STRUCTURE
- 452 FEMA 100 YEAR FLOOD ELEVATION
- FLOW DIRECTION

NOT TO SCALE

SHARRAH DUNLAP SAWYER INCORPORATED

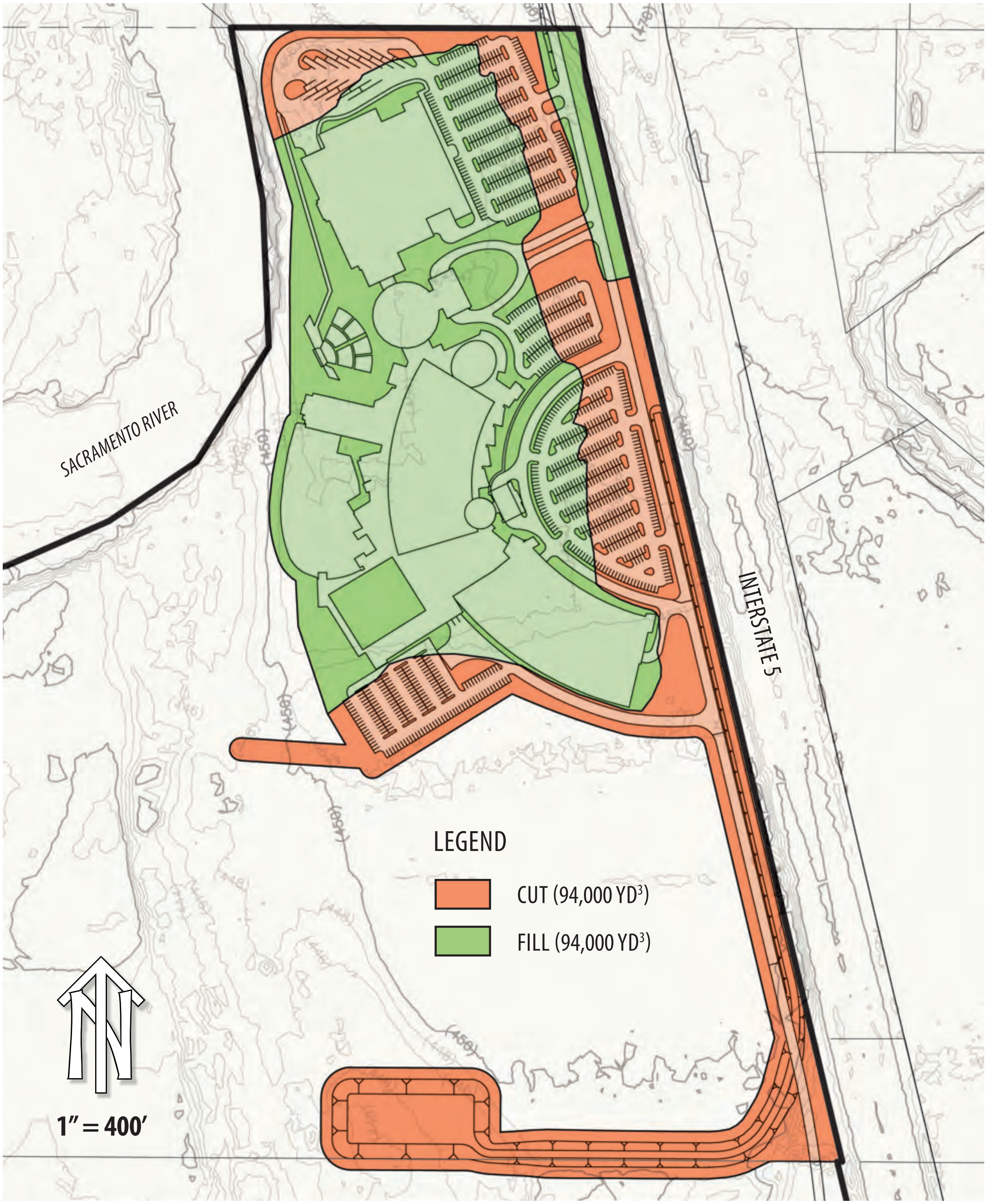
FIGURE C3
PROPOSED PROJECT - ALT 'C'
ONSITE GRADING

REDDING RANCHERIA
CASINO MASTER PLAN



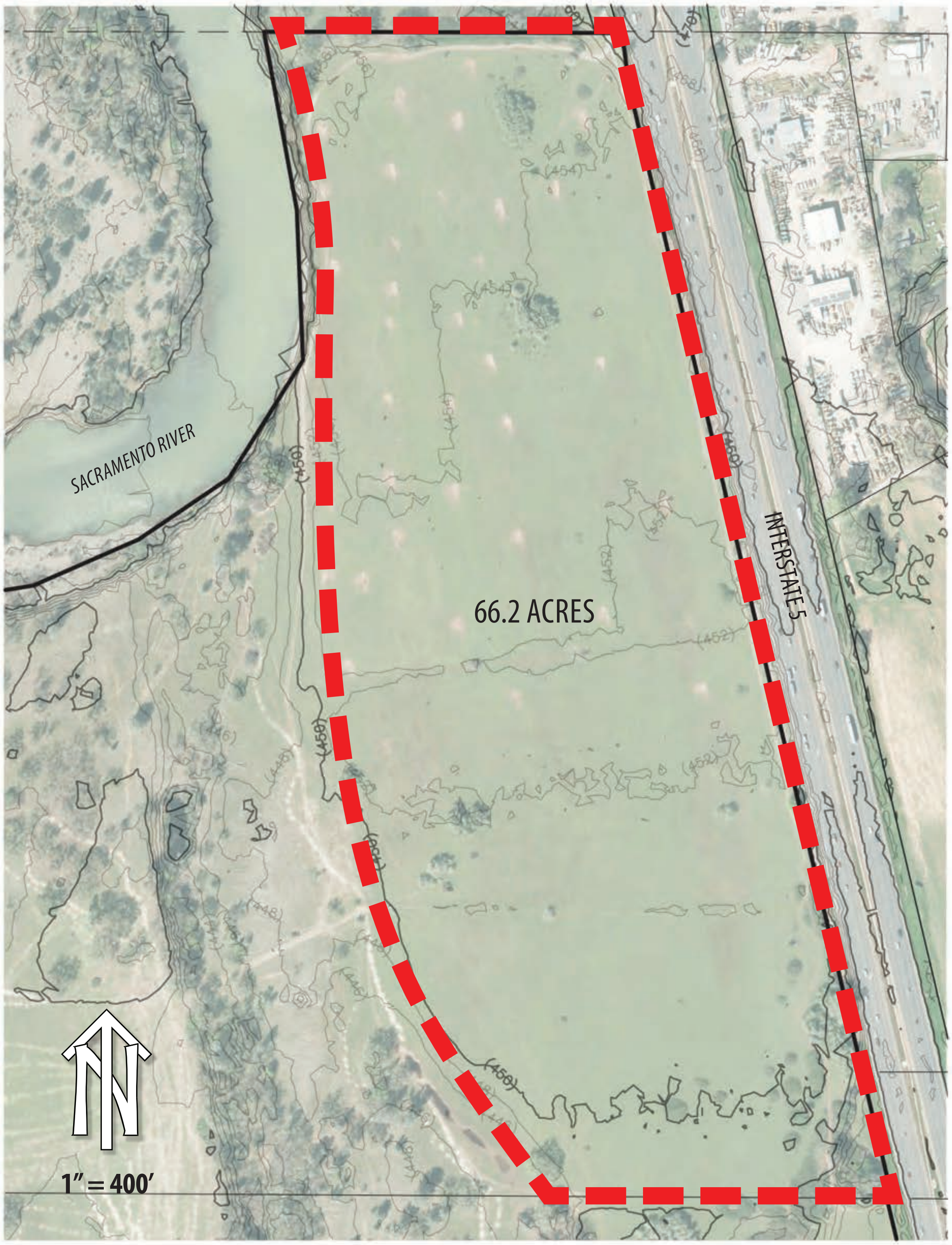
SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE C4
PROPOSED PROJECT - ALT 'C'
OVERALL GRADING



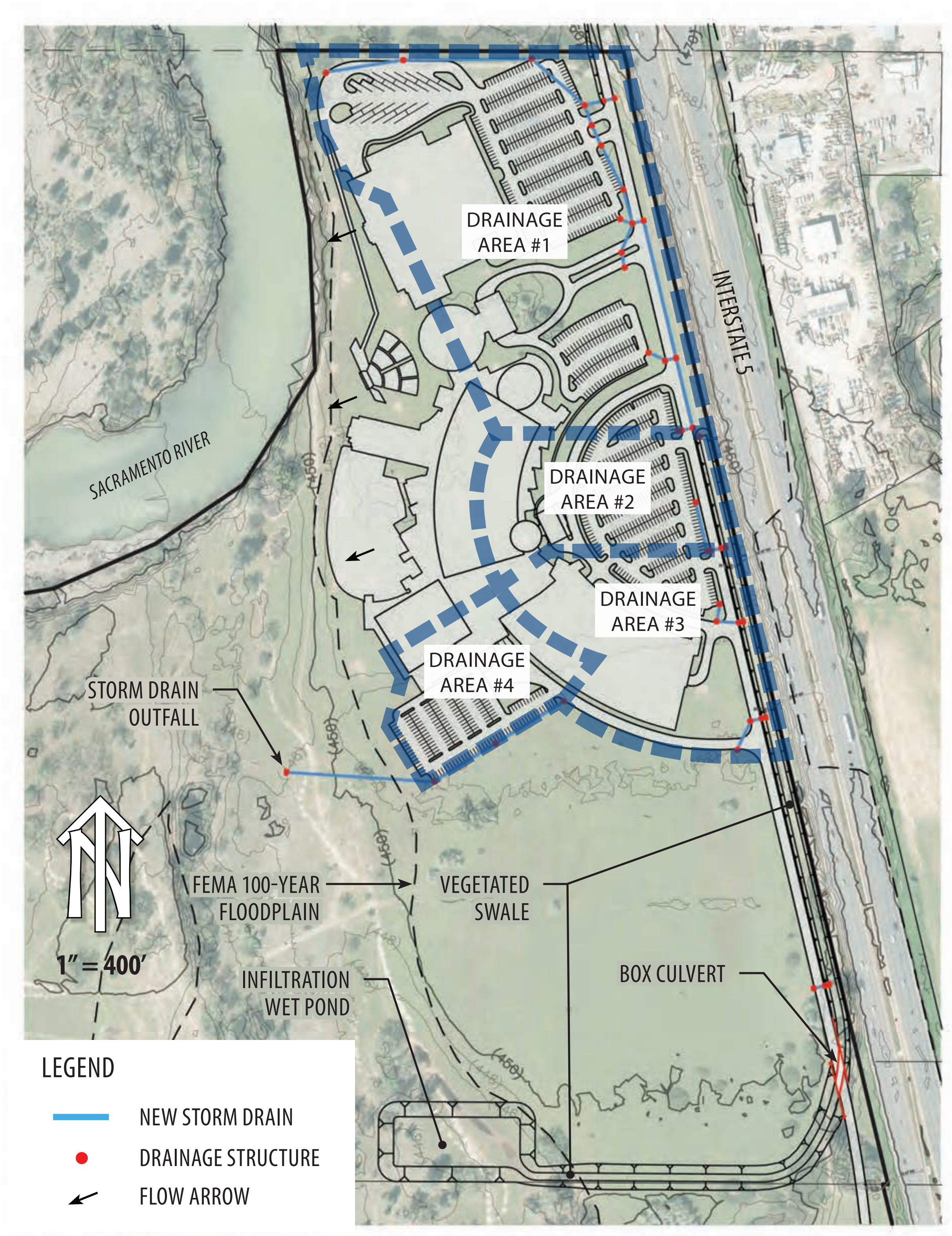
SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE C5
PROPOSED PROJECT - ALT 'C'
CUT FILL DIAGRAM



SHARRAH DUNLAP SAWYER INCORPORATED

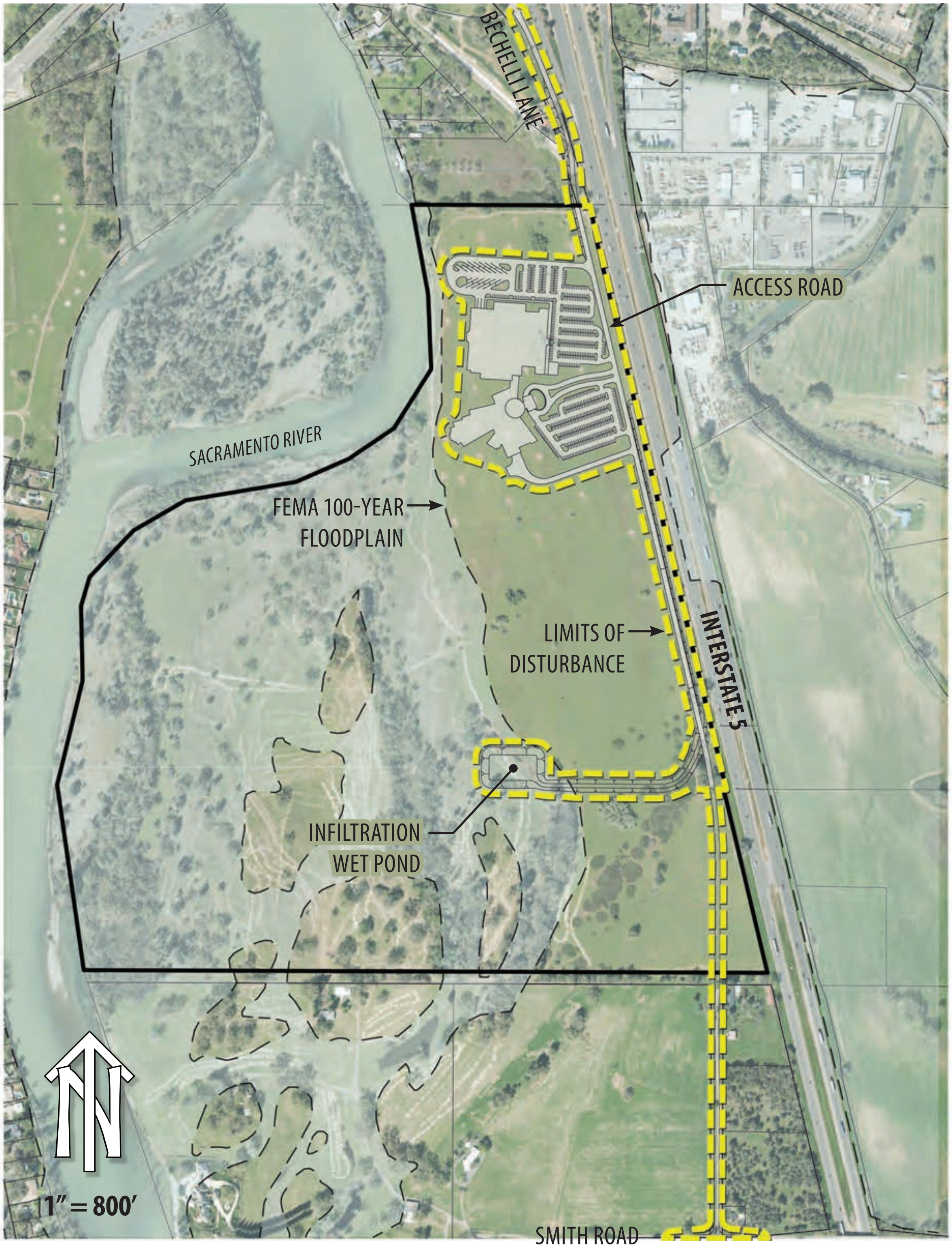
FIGURE C6
OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'C'
EXISTING CONDITION



SHARRAH DUNLAP SAWYER INCORPORATED

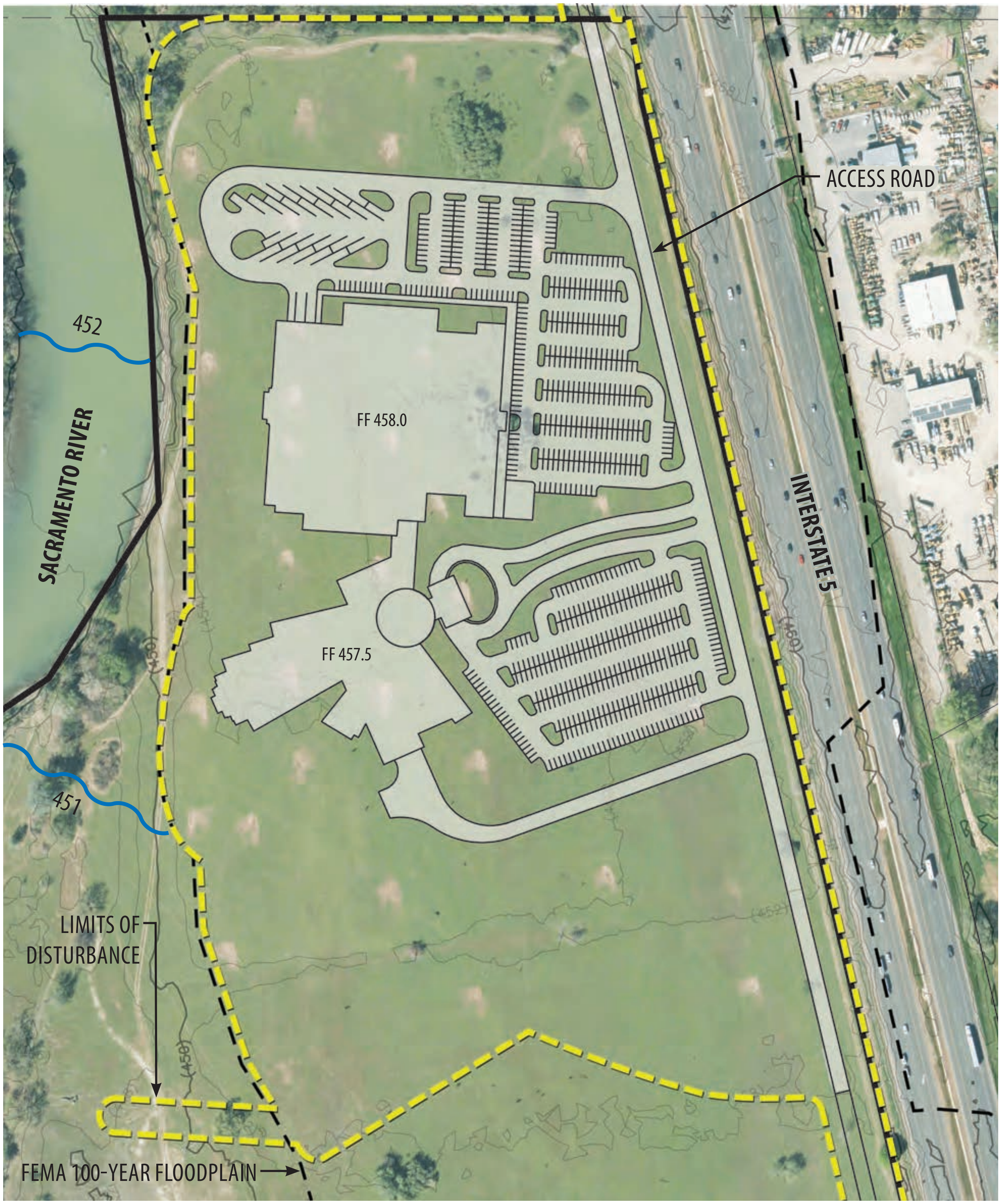
FIGURE C7
PROPOSED PROJECT - ALT 'C'
STORMWATER MANAGEMENT

Figures – Alternative D



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE D1
PROPOSED PROJECT - ALT 'D'
OVERALL DISTURBANCE LIMITS



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE D2
PROPOSED PROJECT - ALT 'D'
ONSITE DISTURBANCE LIMITS

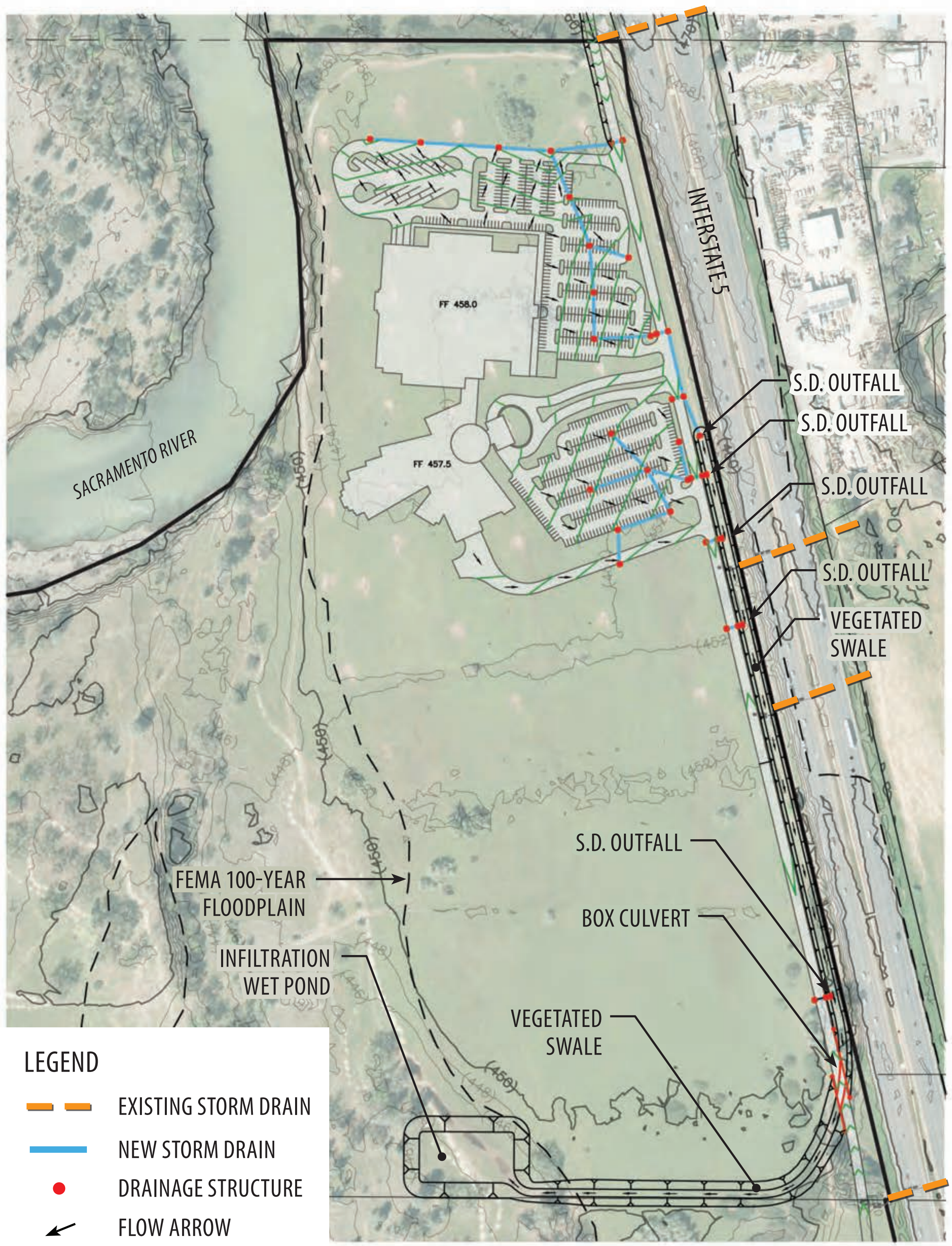
LEGEND

- FINISH GRADE CONTOUR
- NEW STORM DRAIN
- EXISTING STORM DRAIN
- DRAINAGE STRUCTURE
- EXISTING DRAINAGE STRUCTURE
- 452 FEMA 100 YEAR FLOOD ELEVATION
- FLOW DIRECTION

NOT TO SCALE

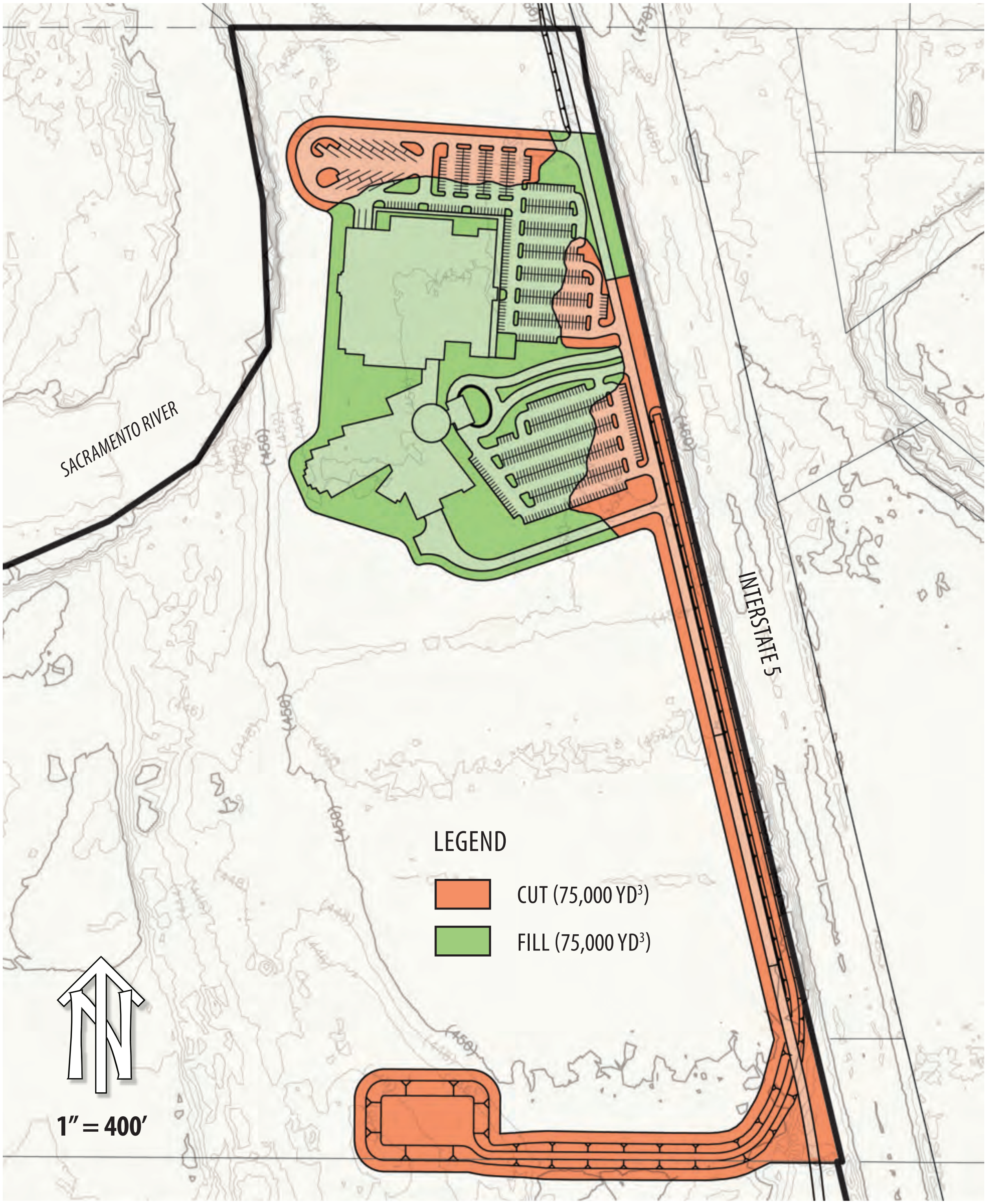
SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE D3
PROPOSED PROJECT - ALT 'D'
ONSITE GRADING



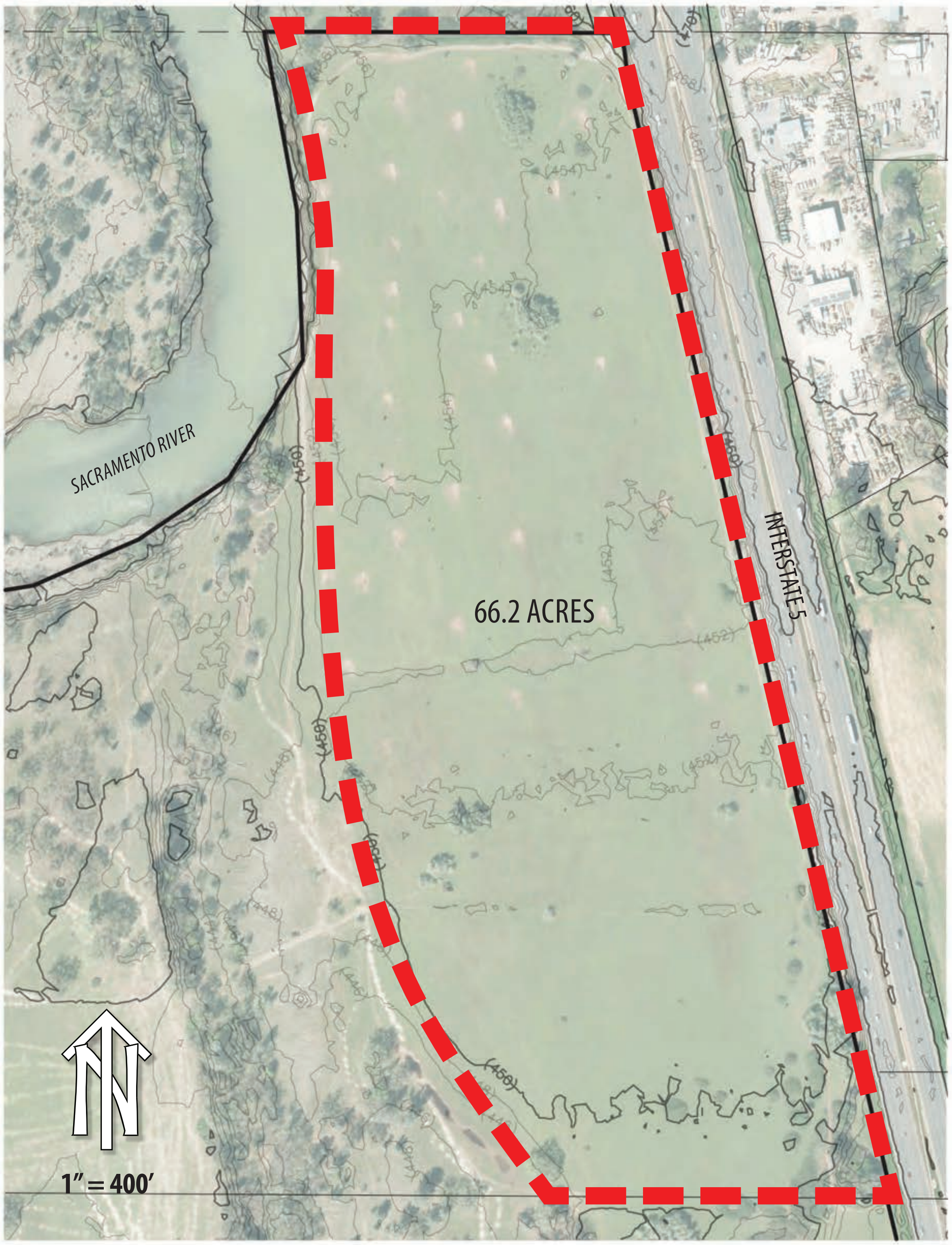
SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE D4
PROPOSED PROJECT - ALT 'D'
OVERALL GRADING



SHARRAH DUNLAP SAWYER INCORPORATED

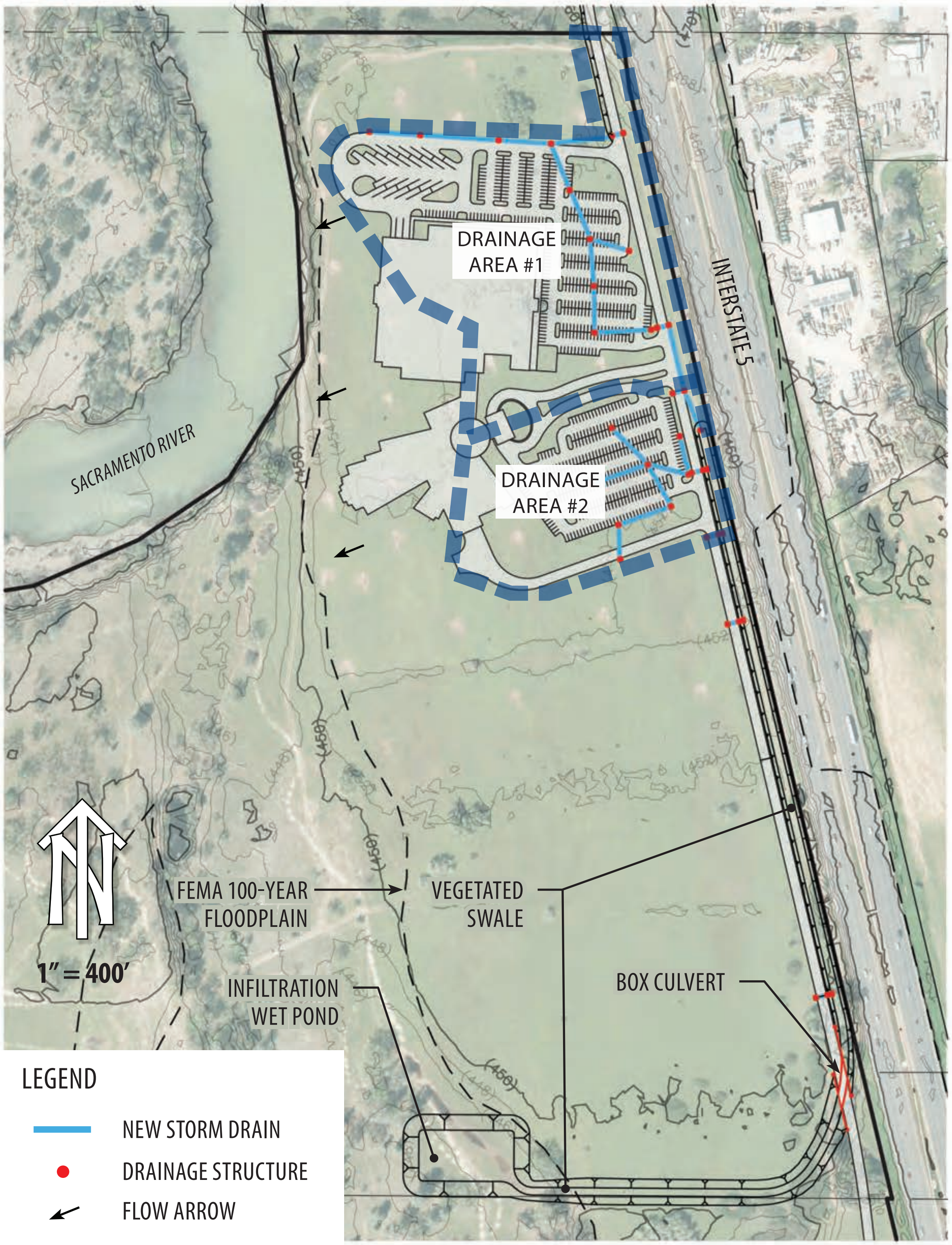
FIGURE D5
PROPOSED PROJECT - ALT 'D'
CUT FILL DIAGRAM



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE D6
OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'D'
EXISTING CONDITION

REDDING RANCHERIA
CASINO MASTER PLAN

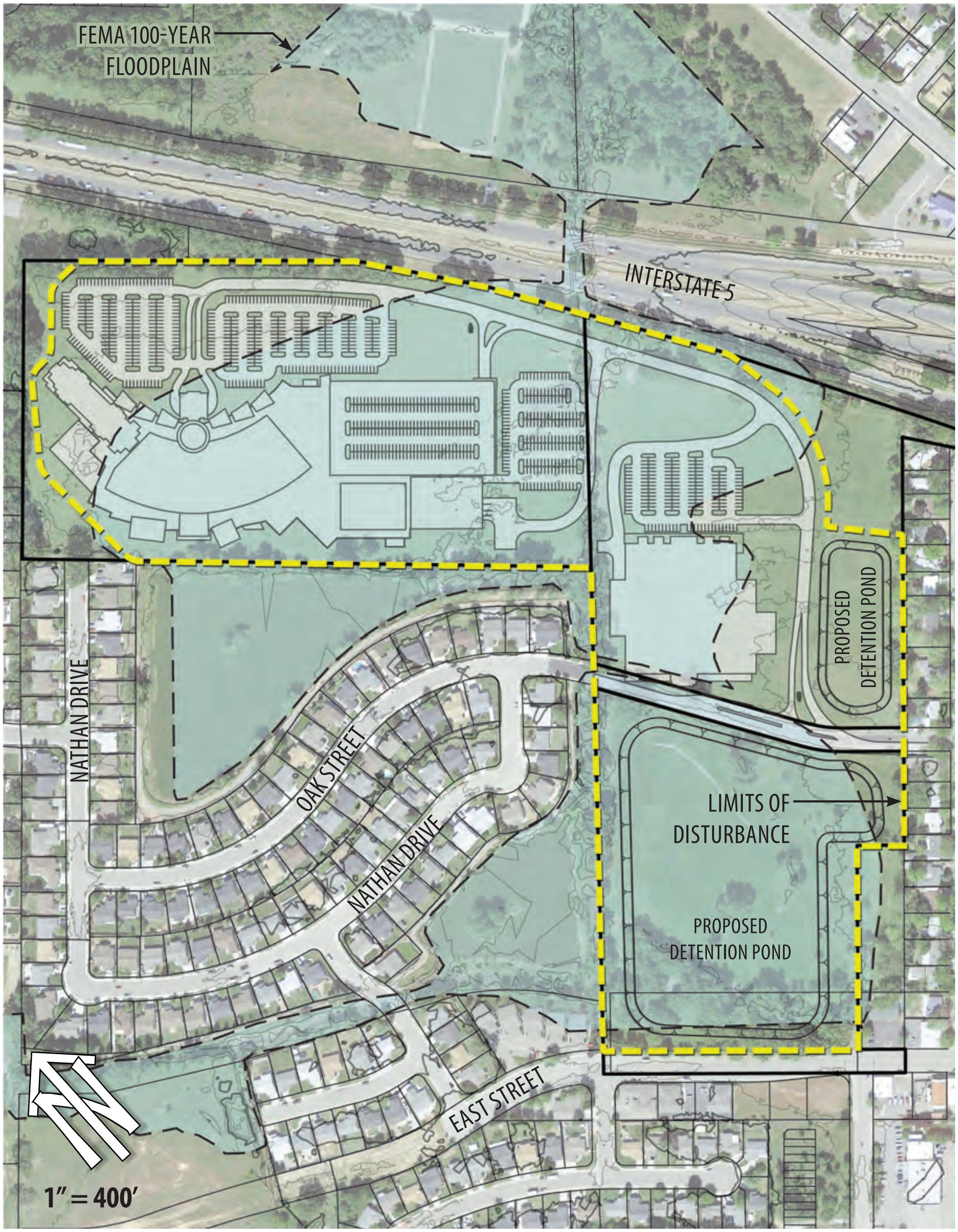


SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE D7
PROPOSED PROJECT - ALT 'D'
STORMWATER MANAGEMENT

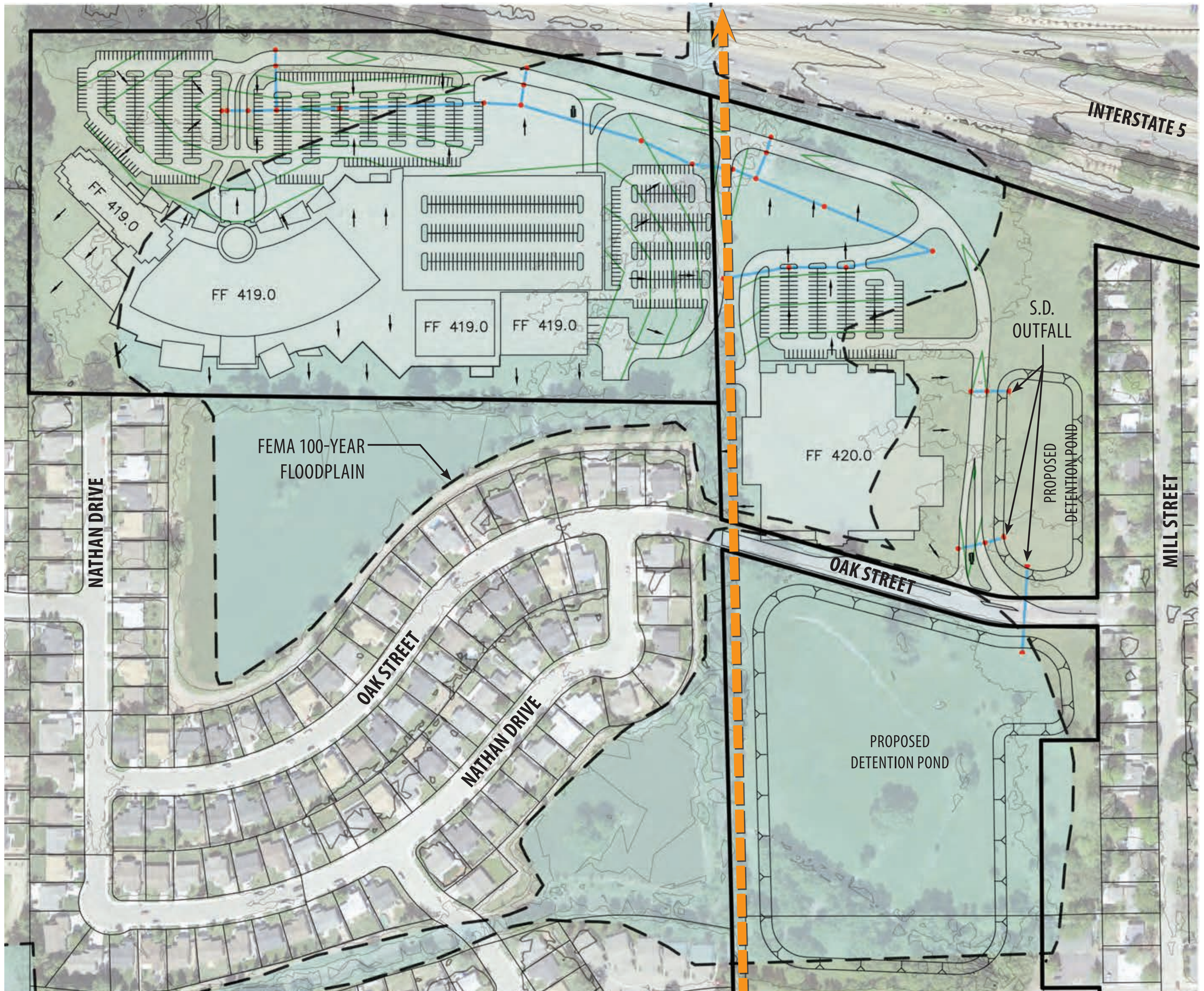
Figures – Alternative E

REDDING RANCHERIA
CASINO MASTER PLAN



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE E1
PROPOSED PROJECT - ALT 'E'
OVERALL DISTURBANCE LIMITS



LEGEND

FINISH GRADE CONTOUR

NEW STORM DRAIN

TORMEY DRAIN

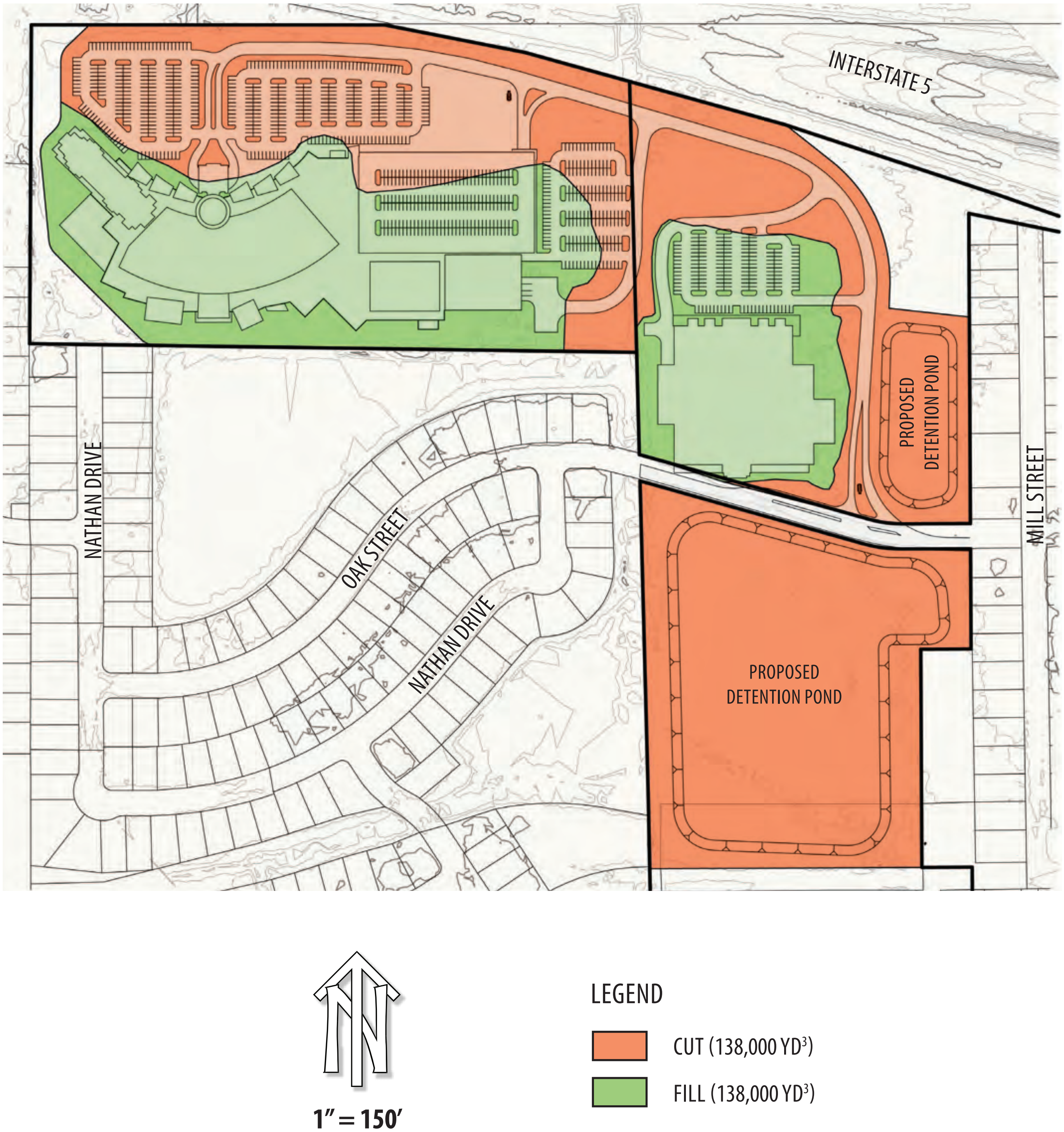
DRAINAGE STRUCTURE

FLOW DIRECTION

NOT TO SCALE

SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE E2
PROPOSED PROJECT - ALT 'E'
ONSITE GRADING



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE E3
PROPOSED PROJECT - ALT 'E'
CUT FILL DIAGRAM

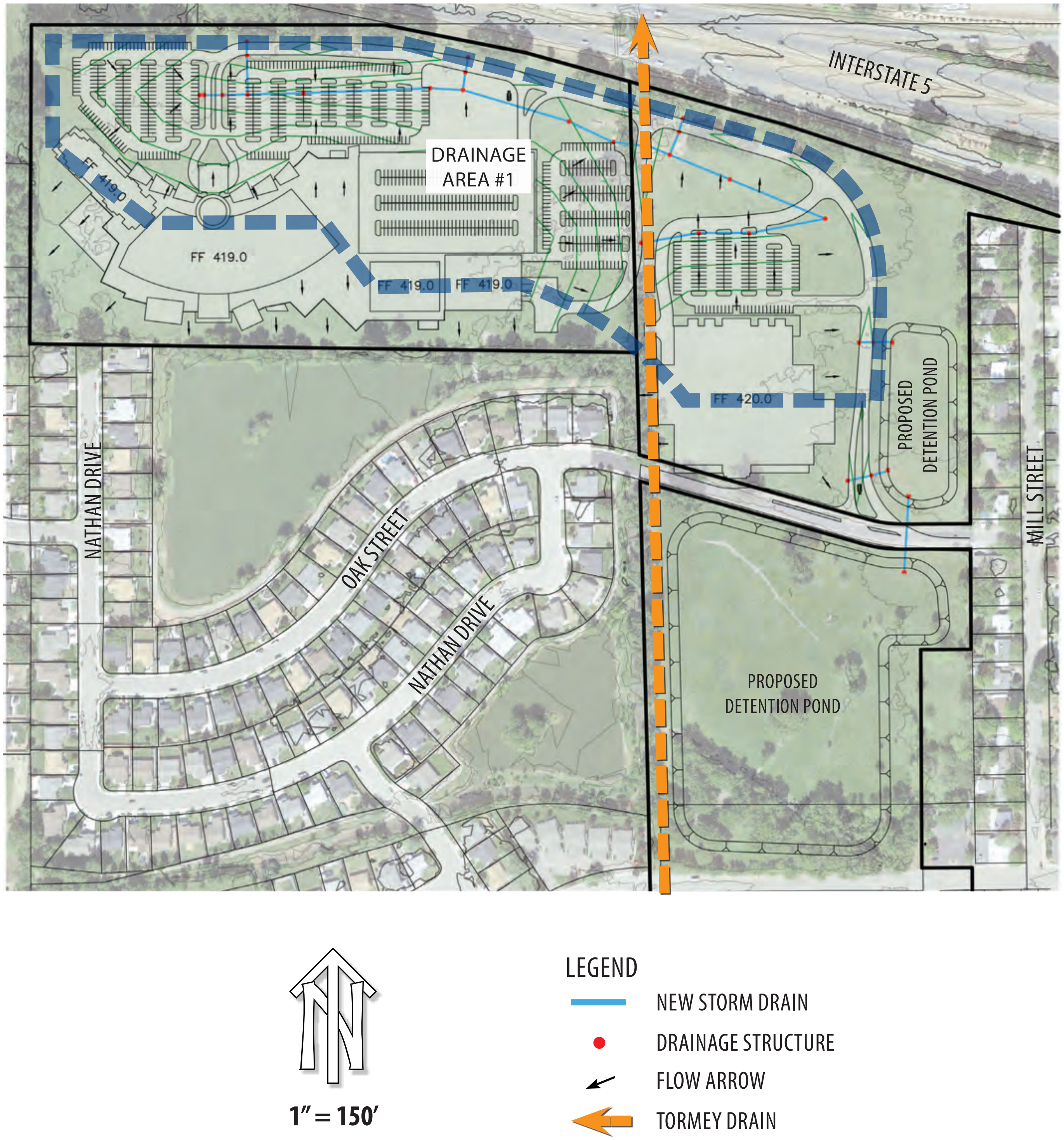


FIGURE E4
PROPOSED PROJECT - ALT 'E'
STORMWATER MANAGEMENT

Appendix A

Hydrology and Hydraulic Calculations

Existing Condition Subbasin Parameters

Subbasin:	BA
Mean Subbasin Elevation (ft):	450
Subbasin Area (Sq. Mi.):	0.1034375
Subbasin Area (acres):	66.2
Land Use:	Soil A:61% 14- Pasture/Parkland/Mowed Grass Soil A:39% 17- Open Oak/Pine Woodland/Grassland
Pervious Curve Number:	66
Pervious Overland Length (ft):	300
Pervious Overland Slope (ft/ft):	0.003
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	98
Impervious Overland Length (ft):	300
Impervious Overland Slope (ft/ft):	0.003
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	700
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.040
Representative Area (acres):	10.30
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	20.0
Collector #2 (pipe or channel):	street
Length (ft):	995
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.040
Representative Area (acres):	33.10
Width (ft)/Diameter (in) :	3.0
Sideslopes (ft/ft-H/V):	20.0
Collector #3 (pipe or channel):	street
Length (ft):	995
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.040
Representative Area (acres):	66.20
Width (ft)/Diameter (in) :	4.0
Sideslopes (ft/ft-H/V):	20.0

```
1***************************************
 *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *            JUN   1998               *
 *          VERSION 4.1                *
 *                                     *
 *  RUN DATE   23MAR17  TIME  10:47:16  *
 *                                     *
 ***************************************
```

```
***************************************
*                                     *
*    U.S. ARMY CORPS OF ENGINEERS     *
*    HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET          *
*       DAVIS, CALIFORNIA 95616       *
*           (916) 756-1104            *
*                                     *
***************************************
```

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X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
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```
THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
```

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1                                   HEC-1 INPUT                                        PAGE  1

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   2         ID   Description:          Casino Master Plan Pre-development Flow
   3         ID   Recurrence Interval:  2 year
   4         ID   Storm Duration:       24 hours
   5         ID   Date Compiled:        03/23/2017
   6         ID   Total Area at Point of Interest: 66.2
             *
             *
             *
             *
   7         IT       1 23Mar17    0000    1800
   8         IO       5       0       0
```

```
   9        IN      5
            *
            * BA
            * Casino Master Plan Alternates A-D

  10        KK     BA
  11        KO      0
  12        PB  2.762
  13        PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
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  21        PI  0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  22        PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
  23        PI  0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  24        PI  0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
  25        PI  0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
  26        PI  0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
  27        PI  0.035   0.042   0.055   0.094   0.286   0.068   0.047   0.038   0.032   0.028
  28        PI  0.025   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
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  38        PI  0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  39        PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  40        PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  41        PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  42        BA 0.1034
  43        BF     -1   -0.01     1.1
  44        LS      0      66       0     .05      99       0
  45        UK    300   0.003   0.600      98
  46        UK    300   0.003   0.050       2
  47        RD    700  0.0030   0.040   0.016    TRAP     2.0    20.0
1                                            HEC-1 INPUT                                        PAGE  2

 LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48        RD    995  0.0030   0.040   0.052    TRAP     3.0    20.0
  49        RD    995  0.0030   0.040   0.103    TRAP     4.0    20.0
  50        ZZ
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1***************************************                    ***************************************
 *                                      *                   *                                     *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                   *   U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                   *   HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                 *                   *         609 SECOND STREET           *
 *                                      *                   *      DAVIS, CALIFORNIA 95616        *
 * RUN DATE   23MAR17  TIME  10:47:16   *                   *          (916) 756-1104             *
 *                                      *                   *                                     *
 ***************************************                    ***************************************


                      HEC-1 Input Filename: 16196pre2
                      Description:          Casino Master Plan Pre-development Flow
                      Recurrence Interval:  2 year
                      Storm Duration:       24 hours
                      Date Compiled:        03/23/2017
                      Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     23Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     24   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                       ICENT          19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

       ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
            TEMPERATURE            DEGREES FAHRENHEIT

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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                 **************
                 *            *
   10 KK         *       BA   *
                 *            *
                 **************

   11 KO              OUTPUT CONTROL VARIABLES
                            IPRNT           5  PRINT CONTROL
                            IPLOT           0  PLOT CONTROL
                            QSCAL          0.  HYDROGRAPH PLOT SCALE

          *** ROFGRD - MAXIMUM NUMBER OF DX INTERVALS REACHED. MDX=201
           THIS MAY AFFECT ACCURACY OF KW SOLUTION TO REDUCE ERRORS SHORTEN OVERLANDFLOW LENGTH PLANE 1.
1
                                                         RUNOFF SUMMARY
                                                  FLOW IN CUBIC FEET PER SECOND
                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                             PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN   MAXIMUM    TIME OF
          OPERATION        STATION           FLOW     PEAK                                           AREA     STAGE    MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                               BA             3.    18.27           2.          1.          1.        .10
1
                                            SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                               INTERPOLATED TO
                                                                            COMPUTATION INTERVAL
            ISTAQ    ELEMENT       DT        PEAK    TIME TO    VOLUME      DT       PEAK    TIME TO      VOLUME
                                                       PEAK                                    PEAK

                                 (MIN)      (CFS)     (MIN)      (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE         1.00       2.66   1096.00       .42      1.00      2.66   1096.00        .42

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2643E+01 OUTFLOW= .2305E+01 BASIN STORAGE= .8765E-01 PERCENT ERROR=   9.5


 *** NORMAL END OF HEC-1 ***
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1*****************************************           ****************************************
 *                                       *           *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *           *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *           *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *           *          609 SECOND STREET           *
 *                                       *           *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   23MAR17  TIME  10:55:33   *           *           (916) 756-1104             *
 *                                       *           *                                      *
 *****************************************           ****************************************

                  X     X  XXXXXXX   XXXXX          X
                  X     X  X        X     X        XX
                  X     X  X        X               X
                  XXXXXXX  XXXX     X       XXXXX   X
                  X     X  X        X               X
                  X     X  X        X     X         X
                  X     X  XXXXXXX   XXXXX         XXX

 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                     HEC-1 INPUT                                              PAGE  1

      LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

        1        ID   HEC-1 Input Filename: 16196pre10
        2        ID   Description:          Casino Master Plan Pre-development Flow
        3        ID   Recurrence Interval:  10 year
        4        ID   Storm Duration:       24 hours
        5        ID   Date Compiled:        03/23/2017
        6        ID   Total Area at Point of Interest: 66.2
                 *
                 *
                 *
                 *
        7        IT       1 23Mar17    0000    1800
```

```
   8          IO       5       0       0
   9          IN       5
              *
              * BA
              * Casino Master Plan Alternates A-D

  10          KK      BA
  11          KO       0
  12          PB   3.599
  13          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  14          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  15          PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
  16          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  17          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  18          PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  19          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  20          PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  21          PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
  22          PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
  23          PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
  24          PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
  25          PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
  26          PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
  27          PI   0.045   0.055   0.072   0.122   0.372   0.088   0.062   0.049   0.042   0.037
  28          PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
  29          PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
  30          PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
  31          PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
  32          PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  33          PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  34          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
  35          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  36          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
  37          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  38          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  39          PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
  40          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  41          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  42          BA  0.1034
  43          BF      -1   -0.01     1.1
  44          LS       0      66       0     .05      99       0
  45          UK     300   0.003   0.600      98
  46          UK     300   0.003   0.050       2
  47          RD     700  0.0030   0.040   0.016    TRAP     2.0    20.0
1                                       HEC-1 INPUT                                     PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48          RD     995  0.0030   0.040   0.052    TRAP     3.0    20.0
```

```
          49           RD     995  0.0030   0.040   0.103    TRAP     4.0     20.0
          50           ZZ
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN   1998                *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   23MAR17  TIME  10:55:33   *
*                                       *
*****************************************

*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*         609 SECOND STREET             *
*      DAVIS, CALIFORNIA 95616          *
*          (916) 756-1104               *
*                                       *
*****************************************


                    HEC-1 Input Filename: 16196pre10
                    Description:          Casino Master Plan Pre-development Flow
                    Recurrence Interval:  10 year
                    Storm Duration:       24 hours
                    Date Compiled:        03/23/2017
                    Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     23Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     24   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   29.98 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

             **************
             *            *
  10 KK      *       BA   *
             *            *
             **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                    RUNOFF SUMMARY
                                            FLOW IN CUBIC FEET PER SECOND
                                         TIME IN HOURS,  AREA IN SQUARE MILES

                                           PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM    TIME OF
          OPERATION       STATION          FLOW     PEAK                                             AREA      STAGE    MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA            7.   16.03            5.          2.          2.         .10
1
                                                 SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                     (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                  INTERPOLATED TO
                                                                               COMPUTATION INTERVAL
            ISTAQ    ELEMENT       DT       PEAK    TIME TO     VOLUME      DT      PEAK   TIME TO     VOLUME
                                                      PEAK                                   PEAK

                                  (MIN)     (CFS)     (MIN)      (IN)      (MIN)    (CFS)    (MIN)      (IN)

                 BA  MANE          1.00      6.55    962.00       .82       1.00     6.55   962.00       .82

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .4999E+01 OUTFLOW= .4546E+01 BASIN STORAGE= .9902E-01 PERCENT ERROR=   7.1


*** NORMAL END OF HEC-1 ***
```

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   23MAR17  TIME  10:56:13   *
 *                                       *
 *****************************************

***************************************
*                                     *
*    U.S. ARMY CORPS OF ENGINEERS     *
*    HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET          *
*       DAVIS, CALIFORNIA 95616       *
*           (916) 756-1104            *
*                                     *
***************************************

X      X  XXXXXXX   XXXXX           X
X      X  X        X     X         XX
X      X  X        X                X
XXXXXXX   XXXX     X         XXXXX  X
X      X  X        X                X
X      X  X        X     X          X
X      X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                  HEC-1 INPUT                                   PAGE  1

        LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          1        ID   HEC-1 Input Filename: 16196pre100
          2        ID   Description:          Casino Master Plan Pre-development Flow
          3        ID   Recurrence Interval:  100 year
          4        ID   Storm Duration:       24 hours
          5        ID   Date Compiled:        03/23/2017
          6        ID   Total Area at Point of Interest: 66.2
                   *
                   *
                   *
                   *
          7        IT       1 23Mar17    0000    1800
```

```
   8        IO       5       0       0
   9        IN       5
            *
            * BA
            * Casino Master Plan Alternates A-D

  10        KK      BA
  11        KO       0
  12        PB   5.069
  13        PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  14        PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008
  15        PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  16        PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  17        PI   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  18        PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.010   0.010
  19        PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  20        PI   0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
  21        PI   0.011   0.011   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.012
  22        PI   0.013   0.013   0.013   0.013   0.013   0.013   0.014   0.014   0.014   0.014
  23        PI   0.014   0.015   0.015   0.015   0.015   0.015   0.016   0.016   0.016   0.016
  24        PI   0.017   0.017   0.017   0.018   0.018   0.019   0.019   0.019   0.020   0.020
  25        PI   0.021   0.021   0.022   0.023   0.023   0.024   0.025   0.026   0.027   0.028
  26        PI   0.029   0.030   0.032   0.034   0.036   0.038   0.041   0.045   0.049   0.055
  27        PI   0.064   0.077   0.101   0.172   0.526   0.125   0.087   0.070   0.059   0.052
  28        PI   0.047   0.043   0.040   0.037   0.035   0.033   0.031   0.030   0.028   0.027
  29        PI   0.026   0.025   0.024   0.024   0.023   0.022   0.022   0.021   0.021   0.020
  30        PI   0.020   0.019   0.019   0.018   0.018   0.018   0.017   0.017   0.017   0.016
  31        PI   0.016   0.016   0.016   0.015   0.015   0.015   0.015   0.014   0.014   0.014
  32        PI   0.014   0.014   0.013   0.013   0.013   0.013   0.013   0.013   0.013   0.012
  33        PI   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011   0.011   0.011
  34        PI   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
  35        PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  36        PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  37        PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008
  38        PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  39        PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  40        PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  41        PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  42        BA  0.1034
  43        BF      -1   -0.01     1.1
  44        LS       0      66       0     .05      99       0
  45        UK     300   0.003   0.600      98
  46        UK     300   0.003   0.050       2
  47        RD     700  0.0030   0.040   0.016    TRAP     2.0    20.0
1                                       HEC-1 INPUT                                            PAGE  2

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48        RD     995  0.0030   0.040   0.052    TRAP     3.0    20.0
```

```
          49           RD     995  0.0030   0.040   0.103    TRAP     4.0    20.0
          50           ZZ
1*****************************************                                                    ****************************************
 *                                       *                                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                  *                                                    *          609 SECOND STREET           *
 *                                       *                                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   23MAR17  TIME  10:56:13   *                                                    *          (916) 756-1104              *
 *                                       *                                                    *                                      *
*****************************************                                                     ****************************************


                    HEC-1 Input Filename: 16196pre100
                    Description:          Casino Master Plan Pre-development Flow
                    Recurrence Interval:  100 year
                    Storm Duration:       24 hours
                    Date Compiled:        03/23/2017
                    Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                         NMIN          1  MINUTES IN COMPUTATION INTERVAL
                        IDATE    23Mar17  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     24  17  ENDING DATE
                       NDTIME       0559  ENDING TIME
                        ICENT         19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *       BA   *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                  RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                      TIME IN HOURS,  AREA IN SQUARE MILES

                                       PEAK    TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD     BASIN    MAXIMUM    TIME OF
          OPERATION        STATION     FLOW     PEAK                                          AREA      STAGE    MAX STAGE
+                                                          6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             BA        19.    14.35         12.         5.          4.         .10
1
                                    SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                        (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                     INTERPOLATED TO
                                                                  COMPUTATION INTERVAL
            ISTAQ    ELEMENT     DT       PEAK    TIME TO    VOLUME      DT       PEAK    TIME TO      VOLUME
                                                   PEAK                                    PEAK

                                (MIN)     (CFS)    (MIN)      (IN)     (MIN)     (CFS)    (MIN)        (IN)

                 BA  MANE        1.00     18.61    861.00     1.69      1.00     18.61    861.00       1.69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1013E+02 OUTFLOW= .9309E+01 BASIN STORAGE= .1035E+00 PERCENT ERROR=   7.1


*** NORMAL END OF HEC-1 ***
```

Existing Condition Subbasin Parameters

Subbasin:	Basin E
Mean Subbasin Elevation (ft):	414
Subbasin Area (Sq. Mi.):	0.06328125
Subbasin Area (acres):	40.5
Land Use:	Soil A:75% Soil D:25% 14-Pasture/Parkland/Mowed Grass
Pervious Curve Number:	73
Pervious Overland Length (ft):	200
Pervious Overland Slope (ft/ft):	0.005
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	98
Impervious Overland Length (ft):	200
Impervious Overland Slope (ft/ft):	0.005
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	672
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.040
Representative Area (acres):	3.00
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	20.0
Collector #2 (pipe or channel):	street
Length (ft):	672
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.040
Representative Area (acres):	20.25
Width (ft)/Diameter (in) :	3.0
Sideslopes (ft/ft-H/V):	20.0
Collector #3 (pipe or channel):	street
Length (ft):	672
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.040
Representative Area (acres):	40.50
Width (ft)/Diameter (in) :	4.0
Sideslopes (ft/ft-H/V):	20.0

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   27MAR17  TIME  10:57:25   *
 *                                       *
 *****************************************

 ***************************************
 *                                     *
 *    U.S. ARMY CORPS OF ENGINEERS     *
 *    HYDROLOGIC ENGINEERING CENTER    *
 *          609 SECOND STREET          *
 *       DAVIS, CALIFORNIA 95616       *
 *           (916) 756-1104            *
 *                                     *
 ***************************************

X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                    HEC-1 INPUT                                    PAGE  1

         LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           1         ID   HEC-1 Input Filename: 16196preE
           2         ID   Description:          Casino Master Plan Alternative E Pre-development Flow
           3         ID   Recurrence Interval:  2 year
           4         ID   Storm Duration:       24 hours
           5         ID   Date Compiled:        03/27/2017
           6         ID   Total Area at Point of Interest: 40.5
                     *
                     *
                     *
                     *
           7         IT        1 27Mar17    0000    1800
```

```
  8         IO      5       0       0
  9         IN      5
            *
            * Basin E
            * Alternative E - Anderson, Ca

 10         KK  Basin
 11         KO      0
 12         PB  2.580
 13         PI  0.003   0.003   0.003   0.003   0.004   0.004   0.004   0.004   0.004   0.004
 14         PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 15         PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 16         PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 17         PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 18         PI  0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 19         PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 20         PI  0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
 21         PI  0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 22         PI  0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 23         PI  0.007   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 24         PI  0.008   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010
 25         PI  0.011   0.011   0.011   0.011   0.012   0.012   0.013   0.013   0.014   0.014
 26         PI  0.015   0.015   0.016   0.017   0.018   0.020   0.021   0.023   0.025   0.028
 27         PI  0.033   0.040   0.052   0.089   0.278   0.065   0.045   0.036   0.030   0.027
 28         PI  0.024   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.014   0.014
 29         PI  0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011   0.010   0.010
 30         PI  0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008
 31         PI  0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007   0.007
 32         PI  0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 33         PI  0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 34         PI  0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 35         PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 36         PI  0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.004   0.004
 37         PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 38         PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 39         PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 40         PI  0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 41         PI  0.004   0.004   0.004   0.004   0.003   0.003   0.003   0.003
 42         BA 0.0632
 43         BF     -1   -0.01     1.1
 44         LS      0      73       0     .05      99       0
 45         UK    200   0.005   0.600      98
 46         UK    200   0.005   0.050       2
 47         RD    672  0.0050   0.040   0.005    TRAP     2.0    20.0
1                                         HEC-1 INPUT                                       PAGE  2

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48         RD    672  0.0050   0.040   0.032    TRAP     3.0    20.0
```

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         49           RD     672  0.0050   0.040   0.063    TRAP     4.0    20.0
         50           ZZ
1*****************************************                                                      *****************************************
 *                                       *                                                      *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                      *    U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998                *                                                      *    HYDROLOGIC ENGINEERING CENTER      *
 *          VERSION 4.1                  *                                                      *          609 SECOND STREET            *
 *                                       *                                                      *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   27MAR17  TIME  10:57:25   *                                                      *           (916) 756-1104              *
 *                                       *                                                      *                                       *
 *****************************************                                                      *****************************************


                         HEC-1 Input Filename: 16196postE
                         Description:          Casino Master Plan Alternative E Pre-development Flow
                         Recurrence Interval:  2 year
                         Storm Duration:       24 hours
                         Date Compiled:        03/27/2017
                         Total Area at Point of Interest: 40.5

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          1  MINUTES IN COMPUTATION INTERVAL
                       IDATE    27Mar17  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME       0559  ENDING TIME
                       ICENT         19  CENTURY MARK

                   COMPUTATION INTERVAL    .02 HOURS
                        TOTAL TIME BASE  29.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT
```

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*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *   Basin    *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT            5  PRINT CONTROL
                       IPLOT            0  PLOT CONTROL
                       QSCAL           0.  HYDROGRAPH PLOT SCALE
1
                                                            RUNOFF SUMMARY
                                                     FLOW IN CUBIC FEET PER SECOND
                                                  TIME IN HOURS,  AREA IN SQUARE MILES

                                            PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION        STATION           FLOW      PEAK                                           AREA      STAGE      MAX STAGE
+                                                                  6-HOUR      24-HOUR     72-HOUR

         HYDROGRAPH AT
+                          Basin               4.    14.82             2.          1.          1.        .06
1
                                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                     INTERPOLATED TO
                                                                                  COMPUTATION INTERVAL
             ISTAQ    ELEMENT       DT        PEAK    TIME TO     VOLUME        DT      PEAK    TIME TO      VOLUME
                                                        PEAK                                       PEAK

                                   (MIN)      (CFS)      (MIN)      (IN)      (MIN)      (CFS)    (MIN)       (IN)

              Basin   MANE         1.00       3.54    889.00       .62       1.00       3.54    889.00        .62

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2184E+01 OUTFLOW= .2074E+01 BASIN STORAGE= .2573E-01 PERCENT ERROR=   3.8


*** NORMAL END OF HEC-1 ***
```

```
1****************************************                    ****************************************
 *                                      *                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *     U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998               *                    *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                    *         609 SECOND STREET            *
 *                                      *                    *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   27MAR17  TIME  10:58:10  *                    *          (916) 756-1104              *
 *                                      *                    *                                      *
****************************************                    ****************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X       XXXXX   X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                      HEC-1 INPUT                                              PAGE  1

        LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          1         ID   HEC-1 Input Filename: 16196preE
          2         ID   Description:          Casino Master Plan Alternative E Pre-development Flow
          3         ID   Recurrence Interval:  10 year
          4         ID   Storm Duration:       24 hours
          5         ID   Date Compiled:        03/27/2017
          6         ID   Total Area at Point of Interest: 40.5
                    *
                    *
                    *
                    *
          7         IT       1 27Mar17    0000    1800
```

```
   8          IO       5       0       0
   9          IN       5
              *
              * Basin E
              * Alternative E - Anderson, Ca

  10          KK  Basin
  11          KO       0
  12          PB   3.362
  13          PI   0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  14          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  15          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  16          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  17          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  18          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  19          PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  20          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  21          PI   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  22          PI   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  23          PI   0.009   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.011   0.011
  24          PI   0.011   0.011   0.011   0.012   0.012   0.012   0.012   0.013   0.013   0.013
  25          PI   0.014   0.014   0.015   0.015   0.015   0.016   0.016   0.017   0.018   0.018
  26          PI   0.019   0.020   0.021   0.022   0.024   0.025   0.027   0.030   0.033   0.037
  27          PI   0.043   0.052   0.068   0.116   0.362   0.084   0.059   0.047   0.040   0.035
  28          PI   0.031   0.029   0.026   0.025   0.023   0.022   0.021   0.020   0.019   0.018
  29          PI   0.017   0.017   0.016   0.016   0.015   0.015   0.014   0.014   0.014   0.013
  30          PI   0.013   0.013   0.012   0.012   0.012   0.012   0.011   0.011   0.011   0.011
  31          PI   0.011   0.010   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009
  32          PI   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008   0.008
  33          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007
  34          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  35          PI   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006
  36          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  37          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.005   0.005
  38          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  39          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  40          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  41          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  42          BA  0.0632
  43          BF      -1   -0.01     1.1
  44          LS       0      73       0     .05      99       0
  45          UK     200   0.005   0.600      98
  46          UK     200   0.005   0.050       2
  47          RD     672  0.0050   0.040   0.005    TRAP     2.0    20.0
1                                         HEC-1 INPUT                                PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48          RD     672  0.0050   0.040   0.032    TRAP     3.0    20.0
```

```
         49           RD     672  0.0050    0.040    0.063    TRAP     4.0     20.0
         50           ZZ
1****************************************                                                   ****************************************
 *                                       *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                  *                                                  *          609 SECOND STREET           *
 *                                       *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  10:58:10   *                                                  *          (916) 756-1104              *
 *                                       *                                                  *                                      *
 ****************************************                                                   ****************************************

                    HEC-1 Input Filename: 16196postE
                    Description:          Casino Master Plan Alternative E Pre-development Flow
                    Recurrence Interval:  10 year
                    Storm Duration:       24 hours
                    Date Compiled:        03/27/2017
                    Total Area at Point of Interest: 40.5

    8 IO         OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT         HYDROGRAPH TIME DATA
                        NMIN          1  MINUTES IN COMPUTATION INTERVAL
                       IDATE    27Mar17  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE    28   17  ENDING DATE
                      NDTIME       0559  ENDING TIME
                       ICENT         19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

             **************
             *            *
   10 KK     *    Basin   *
             *            *
             **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT            5  PRINT CONTROL
                        IPLOT            0  PLOT CONTROL
                        QSCAL           0.  HYDROGRAPH PLOT SCALE
1
                                                               RUNOFF SUMMARY
                                                       FLOW IN CUBIC FEET PER SECOND
                                                    TIME IN HOURS,  AREA IN SQUARE MILES

                                                PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD       BASIN     MAXIMUM     TIME OF
         OPERATION         STATION              FLOW    PEAK                                             AREA      STAGE     MAX STAGE
+                                                                   6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                           Basin                  8.   13.80          5.          2.          1.          .06
1
                                                      SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                          (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                      INTERPOLATED TO
                                                                                   COMPUTATION INTERVAL
           ISTAQ     ELEMENT       DT        PEAK     TIME TO     VOLUME       DT        PEAK     TIME TO      VOLUME
                                                        PEAK                                        PEAK

                                  (MIN)     (CFS)      (MIN)       (IN)      (MIN)     (CFS)     (MIN)        (IN)

           Basin     MANE          1.00      8.28     828.00       1.08       1.00      8.28    828.00        1.08

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .3810E+01 OUTFLOW= .3642E+01 BASIN STORAGE= .2725E-01 PERCENT ERROR=   3.7


*** NORMAL END OF HEC-1 ***
```

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *             JUN   1998               *
 *          VERSION 4.1                 *
 *                                      *
 *  RUN DATE   27MAR17  TIME  10:58:57  *
 *                                      *
 ****************************************

 ****************************************
 *                                      *
 *     U.S. ARMY CORPS OF ENGINEERS     *
 *     HYDROLOGIC ENGINEERING CENTER    *
 *          609 SECOND STREET           *
 *       DAVIS, CALIFORNIA 95616        *
 *           (916) 756-1104             *
 *                                      *
 ****************************************


              X     X  XXXXXXX   XXXXX           X
              X     X  X        X     X         XX
              X     X  X        X                X
              XXXXXXX  XXXX     X        XXXXX   X
              X     X  X        X                X
              X     X  X        X     X          X
              X     X  XXXXXXX   XXXXX          XXX


     THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

     THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
     THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
     NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
     DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
     KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                 HEC-1 INPUT                                       PAGE  1

     LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

        1          ID    HEC-1 Input Filename: 16196preE
        2          ID    Description:          Casino Master Plan Alternative E Pre-development Flow
        3          ID    Recurrence Interval:  100 year
        4          ID    Storm Duration:       24 hours
        5          ID    Date Compiled:        03/27/2017
        6          ID    Total Area at Point of Interest: 40.5
                   *
                   *
                   *
                   *
        7          IT       1 27Mar17    0000    1800
```

```
   8          IO      5       0       0
   9          IN      5
              *
              * Basin E
              * Alternative E - Anderson, Ca

  10          KK  Basin
  11          KO      0
  12          PB  4.702
  13          PI  0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.007
  14          PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  15          PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  16          PI  0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008   0.008
  17          PI  0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  18          PI  0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  19          PI  0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  20          PI  0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  21          PI  0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
  22          PI  0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.013   0.013   0.013
  23          PI  0.013   0.013   0.014   0.014   0.014   0.014   0.014   0.015   0.015   0.015
  24          PI  0.015   0.016   0.016   0.016   0.017   0.017   0.017   0.018   0.018   0.019
  25          PI  0.019   0.020   0.020   0.021   0.022   0.022   0.023   0.024   0.025   0.026
  26          PI  0.027   0.028   0.030   0.031   0.033   0.036   0.038   0.042   0.046   0.052
  27          PI  0.060   0.073   0.096   0.163   0.509   0.118   0.082   0.065   0.055   0.049
  28          PI  0.044   0.040   0.037   0.034   0.032   0.030   0.029   0.028   0.026   0.025
  29          PI  0.024   0.023   0.023   0.022   0.021   0.021   0.020   0.019   0.019   0.018
  30          PI  0.018   0.018   0.017   0.017   0.017   0.016   0.016   0.016   0.015   0.015
  31          PI  0.015   0.015   0.014   0.014   0.014   0.014   0.013   0.013   0.013   0.013
  32          PI  0.013   0.013   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011
  33          PI  0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
  34          PI  0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.009   0.009
  35          PI  0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  36          PI  0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  37          PI  0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  38          PI  0.008   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  39          PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  40          PI  0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  41          PI  0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  42          BA 0.0632
  43          BF     -1   -0.01     1.1
  44          LS      0      73       0     .05      99       0
  45          UK    200   0.005   0.600      98
  46          UK    200   0.005   0.050       2
  47          RD    672  0.0050   0.040   0.005    TRAP     2.0    20.0
1                                        HEC-1 INPUT                                         PAGE  2

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9.......10

  48          RD    672  0.0050   0.040   0.032    TRAP     3.0    20.0
```

```
          49           RD     672  0.0050   0.040   0.063    TRAP     4.0    20.0
          50           ZZ
1*****************************************                                                   *****************************************
 *                                       *                                                   *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                   *    U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998                *                                                   *    HYDROLOGIC ENGINEERING CENTER      *
 *          VERSION 4.1                  *                                                   *          609 SECOND STREET            *
 *                                       *                                                   *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   27MAR17  TIME  10:58:57   *                                                   *          (916) 756-1104               *
 *                                       *                                                   *                                       *
 *****************************************                                                   *****************************************



                           HEC-1 Input Filename: 16196postE
                           Description:          Casino Master Plan Alternative E Pre-development Flow
                           Recurrence Interval:  100 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/27/2017
                           Total Area at Point of Interest: 40.5

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                       ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *    Basin   *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                           RUNOFF SUMMARY
                                                    FLOW IN CUBIC FEET PER SECOND
                                                 TIME IN HOURS,  AREA IN SQUARE MILES

                                            PEAK    TIME OF      AVERAGE FLOW FOR MAXIMUM PERIOD        BASIN     MAXIMUM    TIME OF
         OPERATION        STATION           FLOW     PEAK                                                AREA      STAGE    MAX STAGE
+                                                                  6-HOUR      24-HOUR      72-HOUR

         HYDROGRAPH AT
+                          Basin              21.   13.03             9.          3.           3.         .06
1
                                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                  INTERPOLATED TO
                                                                               COMPUTATION INTERVAL
           ISTAQ    ELEMENT       DT        PEAK    TIME TO      VOLUME       DT        PEAK    TIME TO      VOLUME
                                                     PEAK                                        PEAK

                                (MIN)      (CFS)      (MIN)       (IN)      (MIN)      (CFS)     (MIN)        (IN)

           Basin    MANE         1.00      20.79     782.00       1.98       1.00      20.79    782.00        1.98

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .7076E+01 OUTFLOW= .6662E+01 BASIN STORAGE= .2647E-01 PERCENT ERROR=   5.5


*** NORMAL END OF HEC-1 ***
```

Existing Condition 100-year Storm Event
Alternative E

Post-development Subbasin Parameters

Subbasin:	BA
Mean Subbasin Elevation (ft):	450
Subbasin Area (Sq. Mi.):	0.1034375
Subbasin Area (acres):	66.2
Land Use:	Soil A:62% 1-Commercial/Highways/Parking
	Soil A:36% 14-Pasture/Parkland/Mowed Grass
	Soil A:2% 17- Open Oak/Pine Woodland/Grassland
Pervious Curve Number:	76
Pervious Overland Length (ft):	100
Pervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	40
Impervious Overland Length (ft):	100
Impervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	200
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.030
Representative Area (acres):	10.30
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	15.0
Collector #2 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	33.10
Width (ft)/Diameter (in) :	24.0
Sideslopes (ft/ft-H/V):	0
Collector #3 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	66.20
Width (ft)/Diameter (in) :	36.0
Sideslopes (ft/ft-H/V):	0

```
1****************************************                                                            ***************************************
 *                                      *                                                            *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                           *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                                                            *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                                                            *          609 SECOND STREET          *
 *                                      *                                                            *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   07APR17  TIME  11:24:36   *                                                           *           (916) 756-1104            *
 *                                      *                                                            *                                     *
 ****************************************                                                            ***************************************


                              X     X  XXXXXXX   XXXXX          X
                              X     X  X        X     X        XX
                              X     X  X        X               X
                              XXXXXXX  XXXX     X       XXXXX   X
                              X     X  X        X               X
                              X     X  X        X     X         X
                              X     X  XXXXXXX   XXXXX         XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                             HEC-1 INPUT                                         PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post2
              2          ID   Description:          Casino Master Plan Post-development Flow
              3          ID   Recurrence Interval:  2 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        04/07/2017
              6          ID   Total Area at Point of Interest: 66.2
                         *
                         *
                         *
                         *
              7          IT       1 07Apr17    0000    1800
              8          IO       5       0       0
```

```
   9           IN       5
               *
               * BA
               * Casino Master Plan

  10           KK      BA
  11           KO       0
  12           PB   2.762
  13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
  17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
  20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
  23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
  25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
  26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
  27           PI   0.035   0.042   0.055   0.094   0.286   0.068   0.047   0.038   0.032   0.028
  28           PI   0.025   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
  29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
  30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
  31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  42           BA  0.1034
  43           BF      -3    -0.1    1.05
  44           LS       0      76       0     .05      99       0
  45           UK     100   0.010   0.600      40
  46           UK     100   0.010   0.050      60
  47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                            PAGE  2

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     900  0.0030   0.020   0.052    CIRC       2       0
  49           RD     900  0.0030   0.020   0.103    CIRC       3       0
  50           ZZ
```

```
1****************************************                            ****************************************
 *                                       *                            *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                            *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                            *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                            *         609 SECOND STREET            *
 *                                       *                            *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   07APR17  TIME  11:24:36   *                            *          (916) 756-1104              *
 *                                       *                            *                                      *
 ****************************************                            ****************************************




                           HEC-1 Input Filename: 16196post2
                           Description:          Casino Master Plan Post-development Flow
                           Recurrence Interval:  2 year
                           Storm Duration:       24 hours
                           Date Compiled:        04/07/2017
                           Total Area at Point of Interest: 66.2

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE      7Apr17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      8   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *        BA  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                    RUNOFF SUMMARY
                                            FLOW IN CUBIC FEET PER SECOND
                                         TIME IN HOURS,  AREA IN SQUARE MILES

                                        PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD       BASIN     MAXIMUM     TIME OF
          OPERATION       STATION       FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                              6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA        87.   12.15          13.          7.          6.        .10
1
                                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                    INTERPOLATED TO
                                                                                 COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT        PEAK    TIME TO     VOLUME       DT        PEAK    TIME TO     VOLUME
                                                      PEAK                                       PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE        1.00     86.72    729.00      1.42      1.00     86.72    729.00       1.42

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1054E+02 OUTFLOW= .7838E+01 BASIN STORAGE= .4305E-02 PERCENT ERROR=  25.6



 *** NORMAL END OF HEC-1 ***



                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                    INTERPOLATED TO
                                                                                 COMPUTATION INTERVAL
```

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
BA	MANE	1.00	86.23	729.00	1.43	1.00	86.23	729.00	1.43

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1037E+02 OUTFLOW= .7681E+01 BASIN STORAGE= .4190E-02 PERCENT ERROR= 25.9

*** NORMAL END OF HEC-1 ***

```
1****************************************                   ***************************************
 *                                       *                  *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                  *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                  *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                  *         609 SECOND STREET           *
 *                                       *                  *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   23MAR17  TIME  11:00:15   *                  *          (916) 756-1104             *
 *                                       *                  *                                     *
 ****************************************                   ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                   HEC-1 INPUT                                                 PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post10
             2           ID   Description:          Casino Master Plan Post-development Flow
             3           ID   Recurrence Interval:  10 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/23/2017
             6           ID   Total Area at Point of Interest: 66.2
                         *
                         *
                         *
                         *
             7           IT       1 23Mar17    0000    1800
             8           IO       5       0       0
```

```
      9           IN       5
                  *
                  * BA
                  * Casino Master Plan

     10           KK      BA
     11           KO       0
     12           PB   3.599
     13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
     16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
     21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
     22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
     23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
     24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
     25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
     26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
     27           PI   0.045   0.055   0.072   0.122   0.372   0.088   0.062   0.049   0.042   0.037
     28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
     29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
     30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
     31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
     32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
     33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
     34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
     35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
     37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
     40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     42           BA  0.1034
     43           BF      -5    -0.1    1.05
     44           LS       0      76       0     .05      99       0
     45           UK     100   0.010   0.600      40
     46           UK     100   0.010   0.050      60
     47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                             HEC-1 INPUT                                        PAGE  2

   LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

     48           RD     900  0.0030   0.020   0.052    CIRC       2       0
     49           RD     900  0.0030   0.020   0.103    CIRC       3       0
     50           ZZ
```

```
1***************************************                             ***************************************
 *                                      *                             *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                             *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                             *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                             *          609 SECOND STREET          *
 *                                       *                             *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   23MAR17  TIME  11:00:15   *                             *           (916) 756-1104            *
 *                                       *                             *                                     *
 ***************************************                              ***************************************



                       HEC-1 Input Filename: 16196post10
                       Description:          Casino Master Plan Post-development Flow
                       Recurrence Interval:  10 year
                       Storm Duration:       24 hours
                       Date Compiled:        03/23/2017
                       Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     23Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     24   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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           **************
           *            *
  10 KK    *        BA  *
           *            *
           **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                        RUNOFF SUMMARY
                                                FLOW IN CUBIC FEET PER SECOND
                                             TIME IN HOURS,  AREA IN SQUARE MILES

                                         PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION        FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                            6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA        118.   12.15          18.          9.          8.        .10
1
                                                     SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                         (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                              INTERPOLATED TO
                                                                                           COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                     PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE         1.00    117.46    729.00      1.92      1.00    117.46    729.00       1.92


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1459E+02 OUTFLOW= .1059E+02 BASIN STORAGE= .4445E-02 PERCENT ERROR=  27.4



 *** NORMAL END OF HEC-1 ***
```

(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
INTERPOLATED TO
COMPUTATION INTERVAL

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
BA	MANE	1.00	86.23	729.00	1.43	1.00	86.23	729.00	1.43

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1037E+02 OUTFLOW= .7681E+01 BASIN STORAGE= .4190E-02 PERCENT ERROR= 25.9

*** NORMAL END OF HEC-1 ***

```
1****************************************                                                      ****************************************
 *                                      *                                                      *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                      *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                      *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                                      *         609 SECOND STREET            *
 *                                      *                                                      *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   23MAR17  TIME  11:01:41  *                                                      *          (916) 756-1104              *
 *                                      *                                                      *                                      *
 ****************************************                                                      ****************************************


                                       X     X  XXXXXXX   XXXXX          X
                                       X     X  X        X     X        XX
                                       X     X  X        X               X
                                       XXXXXXX  XXXX     X       XXXXX   X
                                       X     X  X        X               X
                                       X     X  X        X     X         X
                                       X     X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                   HEC-1 INPUT                                                     PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID   HEC-1 Input Filename: 16196post100
            2           ID   Description:          Casino Master Plan Post-development Flow
            3           ID   Recurrence Interval:  100 year
            4           ID   Storm Duration:       24 hours
            5           ID   Date Compiled:        03/23/2017
            6           ID   Total Area at Point of Interest: 66.2
                        *
                        *
                        *
                        *
            7           IT       1 23Mar17    0000    1800
```

```
   8          IO       5       0       0
   9          IN       5
              *
              * BA
              * Casino Master Plan

  10          KK      BA
  11          KO       0
  12          PB   5.069
  13          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  14          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008
  15          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  16          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  17          PI   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  18          PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.010   0.010
  19          PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  20          PI   0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
  21          PI   0.011   0.011   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.012
  22          PI   0.013   0.013   0.013   0.013   0.013   0.013   0.014   0.014   0.014   0.014
  23          PI   0.014   0.015   0.015   0.015   0.015   0.015   0.016   0.016   0.016   0.016
  24          PI   0.017   0.017   0.017   0.018   0.018   0.019   0.019   0.019   0.020   0.020
  25          PI   0.021   0.021   0.022   0.023   0.023   0.024   0.025   0.026   0.027   0.028
  26          PI   0.029   0.030   0.032   0.034   0.036   0.038   0.041   0.045   0.049   0.055
  27          PI   0.064   0.077   0.101   0.172   0.526   0.125   0.087   0.070   0.059   0.052
  28          PI   0.047   0.043   0.040   0.037   0.035   0.033   0.031   0.030   0.028   0.027
  29          PI   0.026   0.025   0.024   0.024   0.023   0.022   0.022   0.021   0.021   0.020
  30          PI   0.020   0.019   0.019   0.018   0.018   0.018   0.017   0.017   0.017   0.016
  31          PI   0.016   0.016   0.016   0.015   0.015   0.015   0.015   0.014   0.014   0.014
  32          PI   0.014   0.014   0.013   0.013   0.013   0.013   0.013   0.013   0.013   0.012
  33          PI   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011   0.011   0.011
  34          PI   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
  35          PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  36          PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  37          PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008
  38          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  39          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  40          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  41          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  42          BA  0.1034
  43          BF     -10    -0.1    1.05
  44          LS       0      76       0     .05      99       0
  45          UK     100   0.010   0.600      40
  46          UK     100   0.010   0.050      60
  47          RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                         HEC-1 INPUT                                          PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48          RD     900  0.0030   0.020   0.052    CIRC       2       0
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           49           RD     900  0.0030   0.020   0.103    CIRC       3       0
           50           ZZ
1*****************************************                                                    ****************************************
 *                                       *                                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                  *                                                    *          609 SECOND STREET           *
 *                                       *                                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   23MAR17  TIME  11:01:41   *                                                    *           (916) 756-1104             *
 *                                       *                                                    *                                      *
 *****************************************                                                    ****************************************



                     HEC-1 Input Filename: 16196post100
                     Description:          Casino Master Plan Post-development Flow
                     Recurrence Interval:  100 year
                     Storm Duration:       24 hours
                     Date Compiled:        03/23/2017
                     Total Area at Point of Interest: 66.2

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     23Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     24   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
  10 KK       *       BA   *
              *            *
              **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                          RUNOFF SUMMARY
                                                                  FLOW IN CUBIC FEET PER SECOND
                                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                                      PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                AREA      STAGE     MAX STAGE
+                                                                          6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA       174.   12.15          28.         14.         12.        .10
1
                                                         SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                             (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                  INTERPOLATED TO
                                                                                               COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                       PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE         1.00    173.82    729.00      3.20      1.00    173.82    729.00       3.20

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2200E+02 OUTFLOW= .1764E+02 BASIN STORAGE= .4494E-02 PERCENT ERROR=  19.8



 *** NORMAL END OF HEC-1 ***
```

Post-development 100-year Storm Event
Alternative A

```
1*****************************************                        ***************************************
 *                                       *                        *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                        *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                        *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                        *          609 SECOND STREET          *
 *                                       *                        *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   23MAR17  TIME  11:47:01   *                        *           (916) 756-1104            *
 *                                       *                        *                                     *
 *****************************************                        ***************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X       XXXXX   X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


     THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

     THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
     THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
     NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
     DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
     KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                           HEC-1 INPUT                                             PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1          ID   HEC-1 Input Filename: 16196post2
             2          ID   Description:          Drainage Area #1 Post-development Flow
             3          ID   Recurrence Interval:  2 year
             4          ID   Storm Duration:       24 hours
             5          ID   Date Compiled:        03/23/2017
             6          ID   Total Area at Point of Interest: 15.7
                        *
                        *
                        *
                        *
             7          IT       1 23Mar17    0000    1800
             8          IO       5       0       0
```

```
   9           IN       5
               *
               * BA
               * Casino Master Plan

  10           KK      BA
  11           KO       0
  12           PB   2.767
  13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
  17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
  20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
  23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
  25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
  26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
  27           PI   0.035   0.042   0.055   0.094   0.290   0.068   0.047   0.038   0.032   0.028
  28           PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
  29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
  30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
  31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  42           BA  0.0245
  43           BF      -3    -0.1    1.05
  44           LS       0      80       0     .05      99       0
  45           UK     100   0.010   0.600       5
  46           UK     100   0.010   0.050      95
  47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                       HEC-1 INPUT                                              PAGE  2

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     582  0.0030   0.020   0.012    CIRC       2       0
  49           RD     582  0.0030   0.020   0.025    CIRC     2.5       0
  50           ZZ
```

```
1****************************************                                  ****************************************
 *                                       *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                  *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                                  *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                  *          609 SECOND STREET          *
 *                                       *                                  *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   23MAR17  TIME  11:47:01   *                                  *           (916) 756-1104            *
 *                                       *                                  *                                      *
 ****************************************                                  ****************************************



                           HEC-1 Input Filename: 16196post2
                           Description:          Drainage Area #1 Post-development Flow
                           Recurrence Interval:  2 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/23/2017
                           Total Area at Point of Interest: 15.7

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     23Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     24   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
             **************
             *            *
   10 KK     *        BA  *
             *            *
             **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                          RUNOFF SUMMARY
                                                                  FLOW IN CUBIC FEET PER SECOND
                                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                                      PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                 AREA      STAGE     MAX STAGE
+                                                                          6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA        36.   12.13          5.          2.          2.        .02
1
                                                    SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                        (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                              INTERPOLATED TO
                                                                                           COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                       PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE         1.00     35.91    728.00      1.68      1.00     35.91    728.00       1.68

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .3322E+01 OUTFLOW= .2190E+01 BASIN STORAGE= .1182E-02 PERCENT ERROR=  34.1



 *** NORMAL END OF HEC-1 ***
```

```
1***************************************                                                  ***************************************
 *                                     *                                                  *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                                                 *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                                                 *         609 SECOND STREET           *
 *                                     *                                                  *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   23MAR17  TIME  11:45:37  *                                                 *          (916) 756-1104             *
 *                                     *                                                  *                                     *
 ***************************************                                                  ***************************************


                              X     X  XXXXXXX   XXXXX          X
                              X     X  X        X     X        XX
                              X     X  X        X               X
                              XXXXXXX  XXXX     X       XXXXX   X
                              X     X  X        X               X
                              X     X  X        X     X         X
                              X     X  XXXXXXX   XXXXX         XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                                      HEC-1 INPUT                                                  PAGE  1

           LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1           ID   HEC-1 Input Filename: 16196post10
              2           ID   Description:          Drainage Area #1 Post-development Flow
              3           ID   Recurrence Interval:  10 year
              4           ID   Storm Duration:       24 hours
              5           ID   Date Compiled:        03/23/2017
              6           ID   Total Area at Point of Interest: 15.7
                          *
                          *
                          *
                          *
              7           IT       1 23Mar17    0000    1800
```

```
   8           IO       5       0       0
   9           IN       5
               *
               * BA
               * Casino Master Plan

  10           KK      BA
  11           KO       0
  12           PB   3.605
  13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
  16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
  22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
  23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
  24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
  25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
  26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
  27           PI   0.045   0.055   0.072   0.122   0.378   0.089   0.062   0.049   0.042   0.037
  28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
  29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
  30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
  31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
  32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
  35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
  37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
  40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  42           BA  0.0245
  43           BF      -5    -0.1    1.05
  44           LS       0      80       0     .05      99       0
  45           UK     100   0.010   0.600       5
  46           UK     100   0.010   0.050      95
  47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                                  HEC-1 INPUT                                     PAGE  2

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     582  0.0030   0.020   0.012    CIRC       2       0
```

```
           49           RD     582  0.0030   0.020   0.025    CIRC     2.5       0
           50           ZZ
1*****************************************                                          ***************************************
 *                                       *                                          *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                          *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                                          *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                          *          609 SECOND STREET          *
 *                                       *                                          *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   23MAR17  TIME  11:45:37   *                                          *           (916) 756-1104            *
 *                                       *                                          *                                     *
 *****************************************                                          ***************************************


                           HEC-1 Input Filename: 16196post10
                           Description:          Drainage Area #1 Post-development Flow
                           Recurrence Interval:  10 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/23/2017
                           Total Area at Point of Interest: 15.7

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     23Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     24   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
   10 KK    *       BA   *
            *            *
            **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                    RUNOFF SUMMARY
                                            FLOW IN CUBIC FEET PER SECOND
                                         TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
       OPERATION       STATION     FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                      6-HOUR     24-HOUR     72-HOUR

       HYDROGRAPH AT
+                           BA       47.   12.12          6.          3.          3.        .02
1
                                     SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                         (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                INTERPOLATED TO
                                                                             COMPUTATION INTERVAL
         ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                  PEAK                                      PEAK

                              (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

              BA  MANE         1.00     46.58    727.00      2.35      1.00     46.58    727.00       2.35

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .4403E+01 OUTFLOW= .3076E+01 BASIN STORAGE= .1184E-02 PERCENT ERROR=  30.1



 *** NORMAL END OF HEC-1 ***
```

Post-development 10-year Storm Event
Alternative A Drainage Area #1

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   24MAR17  TIME  10:22:48   *
 *                                       *
 *****************************************

 *****************************************
 *                                       *
 *    U.S. ARMY CORPS OF ENGINEERS       *
 *    HYDROLOGIC ENGINEERING CENTER      *
 *          609 SECOND STREET            *
 *       DAVIS, CALIFORNIA 95616         *
 *            (916) 756-1104             *
 *                                       *
 *****************************************

          X     X  XXXXXXX   XXXXX           X
          X     X  X        X     X         XX
          X     X  X        X                X
          XXXXXXX  XXXX     X        XXXXX   X
          X     X  X        X                X
          X     X  X        X     X          X
          X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                    HEC-1 INPUT                                            PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID   HEC-1 Input Filename: 16196post2
            2           ID   Description:          Casino Master Plan Post-development Flow
            3           ID   Recurrence Interval:  2 year
            4           ID   Storm Duration:       24 hours
            5           ID   Date Compiled:        03/24/2017
            6           ID   Total Area at Point of Interest: 4.3
                        *
                        *
                        *
                        *
            7           IT       1 24Mar17    0000    1800
```

```
   8          IO       5       0       0
   9          IN       5
              *
              * DA2
              * Casino Master Plan

  10          KK     DA2
  11          KO       0
  12          PB   2.769
  13          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  14          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  15          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  16          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
  17          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  18          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  19          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
  20          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  21          PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  22          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
  23          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  24          PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
  25          PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
  26          PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
  27          PI   0.035   0.042   0.055   0.094   0.292   0.068   0.047   0.038   0.032   0.028
  28          PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
  29          PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
  30          PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
  31          PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  32          PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  33          PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  34          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  35          PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  36          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  37          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  38          PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  39          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  40          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  41          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  42          BA  0.0067
  43          BF      -3    -0.1    1.05
  44          LS       0      80       0     .05      99       0
  45          UK     100   0.010   0.600       5
  46          UK     100   0.010   0.050      95
  47          RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                         HEC-1 INPUT                                          PAGE  2

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48          RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
          49          RD     250  0.0030   0.020   0.007    CIRC       2       0
          50          ZZ
1*****************************************                                                    ***************************************
 *                                       *                                                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                                                    *    HYDROLOGIC ENGINEERING CENTER    *
 *          VERSION 4.1                  *                                                    *          609 SECOND STREET          *
 *                                       *                                                    *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  10:22:48   *                                                    *           (916) 756-1104            *
 *                                       *                                                    *                                     *
 *****************************************                                                    ***************************************



                         HEC-1 Input Filename: 16196post2
                         Description:          Casino Master Plan Post-development Flow
                         Recurrence Interval:  2 year
                         Storm Duration:       24 hours
                         Date Compiled:        03/24/2017
                         Total Area at Point of Interest: 4.3

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     24Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     25   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
   10 KK    *       DA2  *
            *            *
            **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                          RUNOFF SUMMARY
                                                  FLOW IN CUBIC FEET PER SECOND
                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                          PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION         FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                              6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA2          10.   12.12           1.          1.          1.        .01
1
                                                    SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                        (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                          INTERPOLATED TO
                                                                                       COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                       PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA2  MANE         1.00     10.37    727.00      1.90      1.00     10.37    727.00       1.90

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .9092E+00 OUTFLOW= .6794E+00 BASIN STORAGE= .7719E-03 PERCENT ERROR=  25.2



 *** NORMAL END OF HEC-1 ***
```

```
1***************************************                              ***************************************
 *                                     *                              *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                              *   U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                              *   HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1               *                              *         609 SECOND STREET          *
 *                                     *                              *      DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  10:21:43  *                              *          (916) 756-1104            *
 *                                     *                              *                                     *
 ***************************************                              ***************************************


                     X     X  XXXXXXX   XXXXX           X
                     X     X  X        X     X         XX
                     X     X  X        X                X
                     XXXXXXX  XXXX     X        XXXXX   X
                     X     X  X        X                X
                     X     X  X        X     X          X
                     X     X  XXXXXXX   XXXXX          XXX


           THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

           THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
           THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
           NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
           DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
           KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                                   HEC-1 INPUT                                              PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID   HEC-1 Input Filename: 16196post10
            2           ID   Description:          Casino Master Plan Post-development Flow
            3           ID   Recurrence Interval:  10 year
            4           ID   Storm Duration:       24 hours
            5           ID   Date Compiled:        03/24/2017
            6           ID   Total Area at Point of Interest: 4.3
                        *
                        *
                        *
                        *
            7           IT       1 24Mar17    0000    1800
```

```
  8           IO       5       0       0
  9           IN       5
              *
              * DA2
              * Casino Master Plan

 10           KK     DA2
 11           KO       0
 12           PB   3.608
 13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
 16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
 22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
 23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
 24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
 25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
 26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
 27           PI   0.045   0.055   0.072   0.122   0.381   0.089   0.062   0.049   0.042   0.037
 28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
 29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
 30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
 31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
 32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
 35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
 40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 42           BA  0.0067
 43           BF      -5    -0.1    1.05
 44           LS       0      80       0     .05      99       0
 45           UK     100   0.010   0.600       5
 46           UK     100   0.010   0.050      95
 47           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                           HEC-1 INPUT                                            PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
           49           RD     250  0.0030   0.020   0.007    CIRC       2       0
           50           ZZ
1****************************************                                                   ****************************************
 *                                       *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                  *                                                  *          609 SECOND STREET           *
 *                                       *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   24MAR17  TIME  10:21:43   *                                                  *           (916) 756-1104             *
 *                                       *                                                  *                                      *
 ****************************************                                                   ****************************************



                            HEC-1 Input Filename: 16196post10
                            Description:          Casino Master Plan Post-development Flow
                            Recurrence Interval:  10 year
                            Storm Duration:       24 hours
                            Date Compiled:        03/24/2017
                            Total Area at Point of Interest: 4.3

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     24Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     25   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
   10 KK    *       DA2  *
            *            *
            **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                   RUNOFF SUMMARY
                                           FLOW IN CUBIC FEET PER SECOND
                                        TIME IN HOURS,  AREA IN SQUARE MILES

                                    PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION    FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                       6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                            DA2        14.   12.12          2.          1.          1.        .01
1
                                                 SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                     (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                     INTERPOLATED TO
                                                                                  COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                      PEAK

                               (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

               DA2  MANE         1.00     14.01    727.00      2.64      1.00     14.01    727.00       2.64

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1205E+01 OUTFLOW= .9442E+00 BASIN STORAGE= .7690E-03 PERCENT ERROR=  21.6



 *** NORMAL END OF HEC-1 ***
```

Post-development 10-year Storm Event
Alternative A Drainage Area #2

```
1****************************************                    ****************************************
 *                                      *                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                    *          609 SECOND STREET           *
 *                                      *                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   24MAR17  TIME  11:26:21  *                    *           (916) 756-1104             *
 *                                      *                    *                                      *
 ****************************************                    ****************************************


                          X     X  XXXXXXX   XXXXX           X
                          X     X  X        X     X         XX
                          X     X  X        X                X
                          XXXXXXX  XXXX     X       XXXXX    X
                          X     X  X        X                X
                          X     X  X        X     X          X
                          X     X  XXXXXXX   XXXXX          XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                             HEC-1 INPUT                                                PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post2
             2           ID   Description:          Casino Master Plan Post-development Flow
             3           ID   Recurrence Interval:  2 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/24/2017
             6           ID   Total Area at Point of Interest: 5.8
                         *
                         *
                         *
                         *
             7           IT       1 24Mar17    0000    1800
```

```
   8           IO       5       0       0
   9           IN       5
               *
               * DA3
               * Casino Master Plan

  10           KK     DA3
  11           KO       0
  12           PB   2.769
  13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
  17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
  20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
  23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
  25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
  26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
  27           PI   0.035   0.042   0.055   0.094   0.292   0.068   0.047   0.038   0.032   0.028
  28           PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
  29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
  30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
  31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  42           BA  0.0090
  43           BF      -3    -0.1    1.05
  44           LS       0      80       0     .05      99       0
  45           UK     100   0.010   0.600       5
  46           UK     100   0.010   0.050      95
  47           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                    HEC-1 INPUT                                            PAGE  2

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
          49           RD     250  0.0030   0.020   0.009    CIRC       2       0
          50           ZZ
1*****************************************                                                  ***************************************
 *                                       *                                                  *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                                                  *    HYDROLOGIC ENGINEERING CENTER    *
 *          VERSION 4.1                  *                                                  *          609 SECOND STREET          *
 *                                       *                                                  *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  11:26:21   *                                                  *           (916) 756-1104            *
 *                                       *                                                  *                                     *
 *****************************************                                                  ***************************************



                           HEC-1 Input Filename: 16196post2
                           Description:          Casino Master Plan Post-development Flow
                           Recurrence Interval:  2 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/24/2017
                           Total Area at Point of Interest: 5.8

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     24Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     25   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *       DA3  *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                 RUNOFF SUMMARY
                                                         FLOW IN CUBIC FEET PER SECOND
                                                      TIME IN HOURS,  AREA IN SQUARE MILES

                                                 PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION       FLOW     PEAK                                                 AREA      STAGE     MAX STAGE
+                                                                  6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA3        14.   12.12          2.          1.          1.        .01
1
                                                     SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                         (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                              INTERPOLATED TO
                                                                                           COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                      PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA3  MANE         1.00     13.85    727.00      1.93      1.00     13.85    727.00       1.93

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1221E+01 OUTFLOW= .9284E+00 BASIN STORAGE= .9693E-03 PERCENT ERROR=  23.9



 *** NORMAL END OF HEC-1 ***
```

Post-development 2-year Storm Event
Alternative A Drainage Area #3

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *         609 SECOND STREET             *
 *                                       *                    *      DAVIS, CALIFORNIA 95616          *
 *  RUN DATE   24MAR17  TIME  11:30:15   *                    *          (916) 756-1104               *
 *                                       *                    *                                       *
 *****************************************                    *****************************************


                              X     X  XXXXXXX   XXXXX          X
                              X     X  X        X     X        XX
                              X     X  X        X               X
                              XXXXXXX  XXXX     X       XXXXX   X
                              X     X  X        X               X
                              X     X  X        X     X         X
                              X     X  XXXXXXX   XXXXX         XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                           HEC-1 INPUT                                                   PAGE  1

           LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1            ID   HEC-1 Input Filename: 16196post10
             2            ID   Description:          Casino Master Plan Post-development Flow
             3            ID   Recurrence Interval:  10 year
             4            ID   Storm Duration:       24 hours
             5            ID   Date Compiled:        03/24/2017
             6            ID   Total Area at Point of Interest: 5.8
                          *
                          *
                          *
                          *
             7            IT       1 24Mar17    0000    1800
```

```
   8           IO       5       0       0
   9           IN       5
               *
               * DA3
               * Casino Master Plan

  10           KK     DA3
  11           KO       0
  12           PB   3.608
  13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
  16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
  22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
  23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
  24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
  25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
  26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
  27           PI   0.045   0.055   0.072   0.122   0.380   0.089   0.062   0.049   0.042   0.037
  28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
  29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
  30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
  31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
  32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
  35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
  37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
  40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  42           BA  0.0090
  43           BF      -5    -0.1    1.05
  44           LS       0      80       0     .05      99       0
  45           UK     100   0.010   0.600       5
  46           UK     100   0.010   0.050      95
  47           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                        PAGE  2

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
          49           RD     250  0.0030   0.020   0.009    CIRC       2       0
          50           ZZ
1****************************************                                                      ****************************************
 *                                       *                                                      *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                      *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                                                      *    HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                  *                                                      *          609 SECOND STREET           *
 *                                       *                                                      *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   24MAR17  TIME  11:30:15   *                                                      *           (916) 756-1104             *
 *                                       *                                                      *                                      *
 ****************************************                                                      ****************************************



                           HEC-1 Input Filename: 16196post10
                           Description:          Casino Master Plan Post-development Flow
                           Recurrence Interval:  10 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/24/2017
                           Total Area at Point of Interest: 5.8

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     24Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     25   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


             **************
             *            *
   10 KK     *       DA3  *
             *            *
             **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                       RUNOFF SUMMARY
                                               FLOW IN CUBIC FEET PER SECOND
                                            TIME IN HOURS,  AREA IN SQUARE MILES

                                         PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION         FLOW     PEAK                                           AREA      STAGE     MAX STAGE
+                                                             6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                            DA3           19.   12.12           2.          1.          1.        .01
1
                                                 SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                     (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                   INTERPOLATED TO
                                                                                COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                     PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

               DA3  MANE         1.00     18.58    727.00      2.70      1.00     18.58    727.00       2.70

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1619E+01 OUTFLOW= .1294E+01 BASIN STORAGE= .9663E-03 PERCENT ERROR=  20.0



 *** NORMAL END OF HEC-1 ***
```

Post-development 10-year Storm Event
Alternative A Drainage Area #3

```
1****************************************                                  ****************************************
 *                                       *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                  *         609 SECOND STREET            *
 *                                       *                                  *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   24MAR17  TIME  12:00:46   *                                  *          (916) 756-1104              *
 *                                       *                                  *                                      *
 ****************************************                                  ****************************************


                                  X     X  XXXXXXX   XXXXX           X
                                  X     X  X        X     X         XX
                                  X     X  X        X                X
                                  XXXXXXX  XXXX     X        XXXXX   X
                                  X     X  X        X                X
                                  X     X  X        X     X          X
                                  X     X  XXXXXXX   XXXXX          XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                           HEC-1 INPUT                                                       PAGE  1

           LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1           ID   HEC-1 Input Filename: 16196post2
              2           ID   Description:          Casino Master Plan Post-development Flow
              3           ID   Recurrence Interval:  2 year
              4           ID   Storm Duration:       24 hours
              5           ID   Date Compiled:        03/24/2017
              6           ID   Total Area at Point of Interest: 4
                          *
                          *
                          *
                          *
              7           IT       1 24Mar17    0000    1800
```

```
  8           IO       5       0       0
  9           IN       5
              *
              * DA4
              * Casino Master Plan

 10           KK     DA4
 11           KO       0
 12           PB   2.770
 13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
 17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
 20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
 22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
 23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
 24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
 25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
 26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
 27           PI   0.035   0.042   0.055   0.094   0.292   0.068   0.047   0.038   0.032   0.028
 28           PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
 29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
 30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
 31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 42           BA  0.0062
 43           BF      -3    -0.1    1.05
 44           LS       0      80       0     .05      99       0
 45           UK     100   0.010   0.600       5
 46           UK     100   0.010   0.050      95
 47           RD     100  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                           HEC-1 INPUT                                          PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     100  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
           49           RD     100  0.0030   0.030   0.006    TRAP     2.0     0.0
           50           ZZ
1****************************************                                                  ****************************************
 *                                       *                                                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                                                 *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                                 *          609 SECOND STREET           *
 *                                       *                                                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   24MAR17  TIME  12:00:46   *                                                 *           (916) 756-1104             *
 *                                       *                                                 *                                      *
 ****************************************                                                  ****************************************



                            HEC-1 Input Filename: 16196post2
                            Description:          Casino Master Plan Post-development Flow
                            Recurrence Interval:  2 year
                            Storm Duration:       24 hours
                            Date Compiled:        03/24/2017
                            Total Area at Point of Interest: 4

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     24Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     25   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  10 KK     *       DA4  *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                          RUNOFF SUMMARY
                                                  FLOW IN CUBIC FEET PER SECOND
                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                           PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION       FLOW     PEAK                                           AREA      STAGE     MAX STAGE
+                                                            6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                             DA4        11.   12.10          1.          1.          1.        .01
1
                                               SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                   (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                        INTERPOLATED TO
                                                                                     COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                   PEAK                                     PEAK

                               (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

               DA4  MANE          .37     10.62    725.99      1.43      1.00     10.61    726.00       1.43

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .8417E+00 OUTFLOW= .4712E+00 BASIN STORAGE= .4740E-03 PERCENT ERROR=  44.0



 *** NORMAL END OF HEC-1 ***
```

Post-development 2-year Storm Event
Alternative A Drainage Area #4

```
1***************************************                         ***************************************
 *                                     *                         *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                        *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                        *    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1               *                        *          609 SECOND STREET          *
 *                                     *                         *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  11:59:45  *                        *           (916) 756-1104            *
 *                                     *                         *                                     *
 ***************************************                         ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                        HEC-1 INPUT                                          PAGE  1

           LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1            ID   HEC-1 Input Filename: 16196post10
             2            ID   Description:          Casino Master Plan Post-development Flow
             3            ID   Recurrence Interval:  10 year
             4            ID   Storm Duration:       24 hours
             5            ID   Date Compiled:        03/24/2017
             6            ID   Total Area at Point of Interest: 4
                          *
                          *
                          *
                          *
             7            IT       1 24Mar17    0000    1800
```

```
         8           IO       5       0       0
         9           IN       5
                     *
                     * DA4
                     * Casino Master Plan

        10           KK     DA4
        11           KO       0
        12           PB   3.608
        13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
        14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
        15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
        16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
        17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
        18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
        19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
        20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
        21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
        22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
        23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
        24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
        25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
        26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
        27           PI   0.045   0.055   0.072   0.122   0.381   0.089   0.062   0.049   0.042   0.037
        28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
        29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
        30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
        31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
        32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
        33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
        34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
        35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
        36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
        37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
        38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
        39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
        40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
        41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
        42           BA  0.0062
        43           BF      -5    -0.1    1.05
        44           LS       0      80       0     .05      99       0
        45           UK     100   0.010   0.600       5
        46           UK     100   0.010   0.050      95
        47           RD     100  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                     HEC-1 INPUT                                        PAGE  2

      LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

        48           RD     100  0.0030   0.030   0.005    TRAP     2.0    15.0
```

```
          49           RD     100  0.0030   0.030   0.006    TRAP     2.0     0.0
          50           ZZ
1*****************************************                                                   ***************************************
 *                                       *                                                   *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                   *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                                                   *    HYDROLOGIC ENGINEERING CENTER    *
 *          VERSION 4.1                  *                                                   *          609 SECOND STREET          *
 *                                       *                                                   *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   24MAR17  TIME  11:59:45   *                                                   *           (916) 756-1104            *
 *                                       *                                                   *                                     *
 *****************************************                                                   ***************************************



                          HEC-1 Input Filename: 16196post10
                          Description:          Casino Master Plan Post-development Flow
                          Recurrence Interval:  10 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/24/2017
                          Total Area at Point of Interest: 4

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     24Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     25   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  10 KK     *       DA4  *
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                           RUNOFF SUMMARY
                                                   FLOW IN CUBIC FEET PER SECOND
                                                TIME IN HOURS,  AREA IN SQUARE MILES

                                           PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION         FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                              6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA4          14.   12.10          2.          1.          1.         .01
1
                                                     SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                         (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                           INTERPOLATED TO
                                                                                        COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                    PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA4  MANE          .33     14.33    725.87      1.86      1.00     14.26    726.00       1.86

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1115E+01 OUTFLOW= .6166E+00 BASIN STORAGE= .4673E-03 PERCENT ERROR=  44.7



 *** NORMAL END OF HEC-1 ***
```

Post-development 10-year Storm Event
Alternative A Drainage Area #4

Post-development Subbasin Parameters

Subbasin:	BA
Mean Subbasin Elevation (ft):	450
Subbasin Area (Sq. Mi.):	0.1034375
Subbasin Area (acres):	66.2
Land Use:	Soil A:44% 1-Commercial/Highways/Parking Soil A:54% 14-Pasture/Parkland/Mowed Grass Soil A:2% 17- Open Oak/Pine Woodland/Grassland
Pervious Curve Number:	74
Pervious Overland Length (ft):	100
Pervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	57
Impervious Overland Length (ft):	100
Impervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	200
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.030
Representative Area (acres):	10.30
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	15.0
Collector #2 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	33.10
Width (ft)/Diameter (in) :	24.0
Sideslopes (ft/ft-H/V):	0
Collector #3 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	66.20
Width (ft)/Diameter (in) :	36.0
Sideslopes (ft/ft-H/V):	0

```
1****************************************                              ****************************************
 *                                       *                              *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                              *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                              *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                              *          609 SECOND STREET           *
 *                                       *                              *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:10:18   *                              *           (916) 756-1104             *
 *                                       *                              *                                      *
 *****************************************                              ****************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X       XXXXX   X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                             HEC-1 INPUT                                                  PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID   HEC-1 Input Filename: 16196post2-B
            2           ID   Description:          Casino Master Plan Post-development Flow – Alternative B
            3           ID   Recurrence Interval:  2 year
            4           ID   Storm Duration:       24 hours
            5           ID   Date Compiled:        03/27/2017
            6           ID   Total Area at Point of Interest: 66.2
                        *
                        *
                        *
                        *
            7           IT        1 27Mar17    0000    1800
```

```
      8           IO       5       0       0
      9           IN       5
                  *
                  * BA
                  * Casino Master Plan

     10           KK      BA
     11           KO       0
     12           PB   2.762
     13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
     17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
     20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
     22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
     23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
     24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
     25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
     26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
     27           PI   0.035   0.042   0.055   0.094   0.286   0.068   0.047   0.038   0.032   0.028
     28           PI   0.025   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
     29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
     30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
     31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
     32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     42           BA  0.1034
     43           BF      -3    -0.1    1.05
     44           LS       0      74       0     .05      99       0
     45           UK     100   0.010   0.600      57
     46           UK     100   0.010   0.050      43
     47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                                  HEC-1 INPUT                                        PAGE  2

   LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

     48           RD     900  0.0030   0.020   0.052    CIRC       2       0
```

```
           49           RD     900  0.0030   0.020   0.103    CIRC       3       0
           50           ZZ
1****************************************                                                  ***************************************
 *                                       *                                                  *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                                                  *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                                  *          609 SECOND STREET          *
 *                                       *                                                  *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  14:10:18   *                                                  *           (916) 756-1104            *
 *                                       *                                                  *                                     *
 ****************************************                                                  ***************************************


                           HEC-1 Input Filename: 16196post2-B
                           Description:          Casino Master Plan Post-development Flow - Alternative
                           Recurrence Interval:  2 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/27/2017
                           Total Area at Point of Interest: 66.2

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     27Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     28   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
   10 KK    *       BA   *
            *            *
            **************

   11 KO         OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                         RUNOFF SUMMARY
                                                 FLOW IN CUBIC FEET PER SECOND
                                              TIME IN HOURS,  AREA IN SQUARE MILES

                                          PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION      FLOW     PEAK                                               AREA      STAGE     MAX STAGE
+                                                            6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                             BA        64.   12.15          10.          5.          4.        .10
1
                                        SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                            (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                   INTERPOLATED TO
                                                                                COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                     PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                BA  MANE         1.00     63.42    729.00      1.10      1.00     63.42    729.00       1.10

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .8592E+01 OUTFLOW= .6067E+01 BASIN STORAGE= .5096E-02 PERCENT ERROR=  29.3



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************                               ***************************************
 *                                       *                               *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                               *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                               *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                               *          609 SECOND STREET          *
 *                                       *                               *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  14:09:41   *                               *           (916) 756-1104            *
 *                                       *                               *                                     *
 *****************************************                               ***************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X        XXXXX  X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                    HEC-1 INPUT                                                    PAGE  1

           LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1           ID   HEC-1 Input Filename: 16196post10-B
              2           ID   Description:          Casino Master Plan Post-development Flow – Alternative B
              3           ID   Recurrence Interval:  10 year
              4           ID   Storm Duration:       24 hours
              5           ID   Date Compiled:        03/27/2017
              6           ID   Total Area at Point of Interest: 66.2
                          *
                          *
                          *
                          *
              7           IT       1 27Mar17    0000    1800
              8           IO       5       0       0
```

```
     9           IN       5
                 *
                 * BA
                 * Casino Master Plan

    10           KK      BA
    11           KO       0
    12           PB   3.599
    13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
    16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
    22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
    23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
    24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
    25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
    26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
    27           PI   0.045   0.055   0.072   0.122   0.372   0.088   0.062   0.049   0.042   0.037
    28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
    29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
    30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
    31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
    32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
    33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
    35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
    37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
    40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    42           BA  0.1034
    43           BF      -5    -0.1    1.05
    44           LS       0      74       0     .05      99       0
    45           UK     100   0.010   0.600      57
    46           UK     100   0.010   0.050      43
    47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                              HEC-1 INPUT                                          PAGE  2

  LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    48           RD     900  0.0030   0.020   0.052    CIRC       2       0
    49           RD     900  0.0030   0.020   0.103    CIRC       3       0
    50           ZZ
```

```
1***************************************                                                    ***************************************
 *                                      *                                                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                    *   U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                                                    *   HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                 *                                                    *         609 SECOND STREET           *
 *                                      *                                                    *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:09:41  *                                                    *          (916) 756-1104             *
 *                                      *                                                    *                                     *
 ****************************************                                                    ***************************************



                           HEC-1 Input Filename: 16196post10-B
                           Description:          Casino Master Plan Post-development Flow - Alternative
                           Recurrence Interval:  10 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/27/2017
                           Total Area at Point of Interest: 66.2

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     27Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     28   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *        BA  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                              RUNOFF SUMMARY
                                                                      FLOW IN CUBIC FEET PER SECOND
                                                                   TIME IN HOURS,  AREA IN SQUARE MILES

                                               PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                                      6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA        90.   12.15          15.          7.          6.        .10
1
                                                             SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                                 (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                    INTERPOLATED TO
                                                                                                 COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                          PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE         1.00     89.54    729.00      1.72      1.00     89.54    729.00       1.72

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1230E+02 OUTFLOW= .9460E+01 BASIN STORAGE= .5123E-02 PERCENT ERROR=  23.0



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************                    ***************************************
 *                                       *                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *   U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                    *   HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                    *         609 SECOND STREET           *
 *                                       *                    *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:08:44   *                    *         (916) 756-1104              *
 *                                       *                    *                                     *
 *****************************************                    ***************************************


                     X     X  XXXXXXX   XXXXX           X
                     X     X  X        X     X         XX
                     X     X  X        X                X
                     XXXXXXX  XXXX     X        XXXXX   X
                     X     X  X        X                X
                     X     X  X        X     X          X
                     X     X  XXXXXXX   XXXXX          XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                    HEC-1 INPUT                                                    PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post100
             2           ID   Description:          Casino Master Plan Post-development Flow – Alternative B
             3           ID   Recurrence Interval:  100 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/27/2017
             6           ID   Total Area at Point of Interest: 66.2
                         *
                         *
                         *
                         *
             7           IT       1 27Mar17    0000    1800
             8           IO       5       0       0
```

```
   9           IN       5
               *
               * BA
               * Casino Master Plan

  10           KK      BA
  11           KO       0
  12           PB   5.069
  13           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  14           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008
  15           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  16           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  17           PI   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  18           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.010   0.010
  19           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  20           PI   0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
  21           PI   0.011   0.011   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.012
  22           PI   0.013   0.013   0.013   0.013   0.013   0.013   0.014   0.014   0.014   0.014
  23           PI   0.014   0.015   0.015   0.015   0.015   0.015   0.016   0.016   0.016   0.016
  24           PI   0.017   0.017   0.017   0.018   0.018   0.019   0.019   0.019   0.020   0.020
  25           PI   0.021   0.021   0.022   0.023   0.023   0.024   0.025   0.026   0.027   0.028
  26           PI   0.029   0.030   0.032   0.034   0.036   0.038   0.041   0.045   0.049   0.055
  27           PI   0.064   0.077   0.101   0.172   0.526   0.125   0.087   0.070   0.059   0.052
  28           PI   0.047   0.043   0.040   0.037   0.035   0.033   0.031   0.030   0.028   0.027
  29           PI   0.026   0.025   0.024   0.024   0.023   0.022   0.022   0.021   0.021   0.020
  30           PI   0.020   0.019   0.019   0.018   0.018   0.018   0.017   0.017   0.017   0.016
  31           PI   0.016   0.016   0.016   0.015   0.015   0.015   0.015   0.014   0.014   0.014
  32           PI   0.014   0.014   0.013   0.013   0.013   0.013   0.013   0.013   0.013   0.012
  33           PI   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011   0.011   0.011
  34           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
  35           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  36           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  37           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008
  38           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  39           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  40           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  41           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  42           BA  0.1034
  43           BF     -10    -0.1    1.05
  44           LS       0      74       0     .05      99       0
  45           UK     100   0.010   0.600      57
  46           UK     100   0.010   0.050      43
  47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                         PAGE  2

LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     900  0.0030   0.020   0.052    CIRC       2       0
  49           RD     900  0.0030   0.020   0.103    CIRC       3       0
  50           ZZ
```

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1*****************************************                                   ****************************************
 *                                       *                                   *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                   *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                                   *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                   *          609 SECOND STREET           *
 *                                       *                                   *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:08:44   *                                   *           (916) 756-1104             *
 *                                       *                                   *                                      *
 *****************************************                                   ****************************************



                          HEC-1 Input Filename: 16196post100
                          Description:          Casino Master Plan Post-development Flow - Alternative
                          Recurrence Interval:  100 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/27/2017
                          Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
           **************
           *            *
   10 KK   *        BA  *
           *            *
           **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                    RUNOFF SUMMARY
                                            FLOW IN CUBIC FEET PER SECOND
                                         TIME IN HOURS,  AREA IN SQUARE MILES

                                           PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                              6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA       139.   12.15          24.         12.         10.        .10
1
                                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                    INTERPOLATED TO
                                                                                 COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                     PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE         1.00    138.71    729.00      2.74      1.00    138.71    729.00        2.74

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1927E+02 OUTFLOW= .1510E+02 BASIN STORAGE= .5304E-02 PERCENT ERROR=  21.6



 *** NORMAL END OF HEC-1 ***
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```
1*****************************************                    ***************************************
 *                                       *                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                    *          609 SECOND STREET          *
 *                                       *                    *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   07APR17  TIME  12:09:00   *                    *           (916) 756-1104            *
 *                                       *                    *                                     *
 *****************************************                    ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


    THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

    THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
    THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
    NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
    DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
    KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                        HEC-1 INPUT                                          PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1          ID   HEC-1 Input Filename: 16196post2-DA1 B
             2          ID   Description:          Casino Master Plan Alternate B Post-development Flow DA
             3          ID   Recurrence Interval:  2 year
             4          ID   Storm Duration:       24 hours
             5          ID   Date Compiled:        03/28/2017
             6          ID   Total Area at Point of Interest: 6.4
                        *
                        *
                        *
                        *
             7          IT       1 28Mar17    0000    1800
             8          IO       5       0       0
```

```
  9           IN       5
              *
              * DA1
              * Casino Master Plan

 10           KK     DA1
 11           KO       0
 12           PB   2.769
 13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
 17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
 20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
 22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
 23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
 24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
 25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
 26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
 27           PI   0.035   0.042   0.055   0.094   0.292   0.068   0.047   0.038   0.032   0.028
 28           PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
 29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
 30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
 31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 42           BA    0.01
 43           BF      -3    -0.1    1.05
 44           LS       0      80       0     .05      99       0
 45           UK     100   0.010   0.600       5
 46           UK     100   0.010   0.050      95
 47           RD     200  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                HEC-1 INPUT                                PAGE  2

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     500  0.0030   0.020   0.005    CIRC       2       0
 49           RD     500  0.0030   0.020   0.010    CIRC       3       0
 50           ZZ
```

```
1***************************************                               ***************************************
 *                                     *                               *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                               *   U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998              *                               *   HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1               *                               *        609 SECOND STREET            *
 *                                     *                               *     DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   07APR17  TIME  12:09:00  *                               *         (916) 756-1104              *
 *                                     *                               *                                     *
 ***************************************                               ***************************************



                     HEC-1 Input Filename: 16196post2-DA1 B
                     Description:          Casino Master Plan Alternate B Post-development Flow DA
                     Recurrence Interval:  2 year
                     Storm Duration:       24 hours
                     Date Compiled:        03/28/2017
                     Total Area at Point of Interest: 6.4

   8 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          1  MINUTES IN COMPUTATION INTERVAL
                      IDATE    28Mar17  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     29   17  ENDING DATE
                     NDTIME       0559  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *       DA1  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                            RUNOFF SUMMARY
                                                    FLOW IN CUBIC FEET PER SECOND
                                                 TIME IN HOURS,  AREA IN SQUARE MILES

                                              PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION             FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA1              15.   12.13          2.          1.          1.        .01
1
                                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                      INTERPOLATED TO
                                                                                   COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT        PEAK    TIME TO     VOLUME      DT        PEAK    TIME TO     VOLUME
                                                      PEAK                                      PEAK

                                 (MIN)     (CFS)     (MIN)      (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA1  MANE         1.00     15.26    728.00      1.78      1.00     15.26    728.00       1.78

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1357E+01 OUTFLOW= .9475E+00 BASIN STORAGE= .9248E-03 PERCENT ERROR=  30.1



 *** NORMAL END OF HEC-1 ***
```

```
1***************************************                                     ***************************************
 *                                      *                                     *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                     *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                                     *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                                     *          609 SECOND STREET          *
 *                                      *                                     *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  10:02:09  *                                     *          (916) 756-1104             *
 *                                      *                                     *                                     *
 ***************************************                                     ***************************************


                                         X     X  XXXXXXX   XXXXX          X
                                         X     X  X        X     X        XX
                                         X     X  X        X               X
                                         XXXXXXX  XXXX     X       XXXXX   X
                                         X     X  X        X               X
                                         X     X  X        X     X         X
                                         X     X  XXXXXXX   XXXXX         XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                          HEC-1 INPUT                                                PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post10-DA1 B
             2           ID   Description:          Casino Master Plan Alternate B Post-development Flow DA
             3           ID   Recurrence Interval:  10 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/28/2017
             6           ID   Total Area at Point of Interest: 6.4
                         *
                         *
                         *
                         *
             7           IT       1 28Mar17    0000    1800
```

```
  8           IO       5       0       0
  9           IN       5
              *
              * DA1
              * Casino Master Plan

 10           KK     DA1
 11           KO       0
 12           PB   3.608
 13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
 16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
 22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
 23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
 24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
 25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
 26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
 27           PI   0.045   0.055   0.072   0.122   0.380   0.089   0.062   0.049   0.042   0.037
 28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
 29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
 30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
 31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
 32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
 35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
 40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 42           BA    0.01
 43           BF      -5    -0.1    1.05
 44           LS       0      80       0     .05      99       0
 45           UK     100   0.010   0.600       5
 46           UK     100   0.010   0.050      95
 47           RD     200  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                          HEC-1 INPUT                                           PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     500  0.0030   0.020   0.005    CIRC       2       0
```

```
          49           RD     500  0.0030   0.020   0.010    CIRC       3       0
          50           ZZ
1****************************************                                                   ****************************************
 *                                       *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *          VERSION 4.1                  *                                                  *          609 SECOND STREET           *
 *                                       *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   28MAR17  TIME  10:02:09   *                                                  *           (916) 756-1104             *
 *                                       *                                                  *                                      *
 ****************************************                                                   ****************************************


                      HEC-1 Input Filename: 16196post10-DA1 B
                      Description:          Casino Master Plan Alternate B Post-development Flow DA
                      Recurrence Interval:  10 year
                      Storm Duration:       24 hours
                      Date Compiled:        03/28/2017
                      Total Area at Point of Interest: 6.4

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          1  MINUTES IN COMPUTATION INTERVAL
                       IDATE    28Mar17  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     29   17  ENDING DATE
                      NDTIME       0559  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
   10 KK    *       DA1  *
            *            *
            **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                   RUNOFF SUMMARY
                                           FLOW IN CUBIC FEET PER SECOND
                                        TIME IN HOURS,  AREA IN SQUARE MILES

                                    PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION       FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                      6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA1        20.   12.12          2.          1.          1.        .01
1
                                              SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                  (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                         INTERPOLATED TO
                                                                                      COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                       PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA1  MANE         1.00     20.33    727.00      2.18      1.00     20.33    727.00       2.18

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1799E+01 OUTFLOW= .1164E+01 BASIN STORAGE= .9239E-03 PERCENT ERROR=  35.3



 *** NORMAL END OF HEC-1 ***
```

Post-development Subbasin Parameters

Subbasin:	BA
Mean Subbasin Elevation (ft):	450
Subbasin Area (Sq. Mi.):	0.1034375
Subbasin Area (acres):	66.2
Land Use:	Soil A:33% 1-Commercial/Highways/Parking Soil A:65% 14-Pasture/Parkland/Mowed Grass Soil A:2% 17- Open Oak/Pine Woodland/Grassland
Pervious Curve Number:	72
Pervious Overland Length (ft):	100
Pervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	67
Impervious Overland Length (ft):	100
Impervious Overland Slope (ft/ft):	0.010
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	200
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.030
Representative Area (acres):	10.30
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	15.0
Collector #2 (pipe or channel):	pipe
Length (ft):	300
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	33.10
Width (ft)/Diameter (in) :	18.0
Sideslopes (ft/ft-H/V):	0
Collector #3 (pipe or channel):	pipe
Length (ft):	300
Slope (ft/ft):	0.0030
Roughness (Mannings n):	0.020
Representative Area (acres):	66.20
Width (ft)/Diameter (in) :	24.0
Sideslopes (ft/ft-H/V):	0

```
1****************************************                          ***************************************
 *                                      *                          *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                          *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998              *                          *    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1               *                          *          609 SECOND STREET          *
 *                                      *                          *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  14:45:33  *                          *          (916) 756-1104             *
 *                                      *                          *                                     *
 ****************************************                          ***************************************

                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X       XXXXX   X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX

            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                HEC-1 INPUT                                                        PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post2-D
              2          ID   Description:          Casino Master Plan Post-development Flow - Alternative D
              3          ID   Recurrence Interval:  2 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/27/2017
              6          ID   Total Area at Point of Interest: 66.2
                         *
                         *
                         *
                         *
              7          IT       1 27Mar17    0000    1800
              8          IO       5       0       0
```

```
          9           IN       5
                      *
                      * BA
                      * Casino Master Plan

         10           KK      BA
         11           KO       0
         12           PB   2.762
         13           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
         17           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
         18           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
         19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
         20           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
         21           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
         22           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
         23           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
         24           PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
         25           PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
         26           PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
         27           PI   0.035   0.042   0.055   0.094   0.286   0.068   0.047   0.038   0.032   0.028
         28           PI   0.025   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
         29           PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
         30           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
         31           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
         32           PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
         33           PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
         34           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
         35           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
         36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
         37           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
         38           PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         41           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
         42           BA  0.1034
         43           BF      -3    -0.1    1.05
         44           LS       0      72       0     .05      99       0
         45           UK     100   0.010   0.600      67
         46           UK     100   0.010   0.050      33
         47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                                    HEC-1 INPUT                                        PAGE  2

        LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

         48           RD     300  0.0030   0.020   0.052    CIRC     1.5       0
         49           RD     300  0.0030   0.020   0.103    CIRC       2       0
         50           ZZ
```

```
1****************************************                     ***************************************
 *                                       *                     *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                     *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                     *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                     *          609 SECOND STREET          *
 *                                       *                     *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  14:45:33   *                     *           (916) 756-1104            *
 *                                       *                     *                                     *
 *****************************************                     ***************************************


                       HEC-1 Input Filename: 16196post2-D
                       Description:          Casino Master Plan Post-development Flow - Alternative
                       Recurrence Interval:  2 year
                       Storm Duration:       24 hours
                       Date Compiled:        03/27/2017
                       Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** 
```

```
              **************
              *            *
   10 KK      *        BA  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                                 RUNOFF SUMMARY
                                                         FLOW IN CUBIC FEET PER SECOND
                                                      TIME IN HOURS,  AREA IN SQUARE MILES

                                              PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                               AREA      STAGE     MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA        52.   12.13          8.          4.          3.        .10
1
                                                  SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                      (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                        INTERPOLATED TO
                                                                                     COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                     PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE          .99     52.03    727.49       .95      1.00     51.99    728.00         .95


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .7235E+01 OUTFLOW= .5228E+01 BASIN STORAGE= .5102E-02 PERCENT ERROR=  27.7



 *** NORMAL END OF HEC-1 ***
```

```
1****************************************                    ****************************************
 *                                      *                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                    *          609 SECOND STREET           *
 *                                      *                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  14:47:10  *                    *           (916) 756-1104             *
 *                                      *                    *                                      *
 ****************************************                    ****************************************


                           X     X  XXXXXXX   XXXXX          X
                           X     X  X        X     X        XX
                           X     X  X        X               X
                           XXXXXXX  XXXX     X       XXXXX   X
                           X     X  X        X               X
                           X     X  X        X     X         X
                           X     X  XXXXXXX   XXXXX         XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                   HEC-1 INPUT                                         PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1          ID   HEC-1 Input Filename: 16196post10-D
             2          ID   Description:          Casino Master Plan Post-development Flow - Alternative
             3          ID   Recurrence Interval:  10 year
             4          ID   Storm Duration:       24 hours
             5          ID   Date Compiled:        03/27/2017
             6          ID   Total Area at Point of Interest: 66.2
                        *
                        *
                        *
                        *
             7          IT       1 27Mar17    0000    1800
             8          IO       5       0       0
```

```
  9           IN       5
              *
              * BA
              * Casino Master Plan

 10           KK      BA
 11           KO       0
 12           PB   3.599
 13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
 16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
 22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
 23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
 24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
 25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
 26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
 27           PI   0.045   0.055   0.072   0.122   0.372   0.088   0.062   0.049   0.042   0.037
 28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
 29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
 30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
 31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
 32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
 35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
 40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 42           BA  0.1034
 43           BF      -5    -0.1    1.05
 44           LS       0      72       0     .05      99       0
 45           UK     100   0.010   0.600      67
 46           UK     100   0.010   0.050      33
 47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                              HEC-1 INPUT                                        PAGE  2

   LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     300  0.0030   0.020   0.052    CIRC     1.5       0
 49           RD     300  0.0030   0.020   0.103    CIRC       2       0
 50           ZZ
```

```
1***************************************                                                   ***************************************
 *                                      *                                                   *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                   *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998               *                                                   *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                                                   *          609 SECOND STREET          *
 *                                      *                                                   *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  14:47:10  *                                                   *           (916) 756-1104            *
 *                                      *                                                   *                                     *
 ***************************************                                                   ***************************************



                        HEC-1 Input Filename: 16196post10-D
                        Description:          Casino Master Plan Post-development Flow - Alternative
                        Recurrence Interval:  10 year
                        Storm Duration:       24 hours
                        Date Compiled:        03/27/2017
                        Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
            **************
            *            *
   10 KK    *        BA  *
            *            *
            **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                          RUNOFF SUMMARY
                                                                  FLOW IN CUBIC FEET PER SECOND
                                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                                    PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                 AREA      STAGE     MAX STAGE
+                                                                         6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA        73.   12.13          13.          6.          5.        .10
1
                                                         SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                             (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                  INTERPOLATED TO
                                                                                               COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                     PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE          .93     73.34    728.29      1.53      1.00     73.09    728.00       1.53

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1066E+02 OUTFLOW= .8415E+01 BASIN STORAGE= .5143E-02 PERCENT ERROR=  21.0



 *** NORMAL END OF HEC-1 ***
```

```
1****************************************                       ***************************************
 *                                       *                      *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                      *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                      *    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1                *                      *          609 SECOND STREET          *
 *                                       *                      *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  14:48:26   *                      *           (916) 756-1104            *
 *                                       *                      *                                     *
 ****************************************                       ***************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X       XXXXX   X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


      THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

      THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
      THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
      NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
      DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
      KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                        HEC-1 INPUT                                                  PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post100-D
              2          ID   Description:          Casino Master Plan Post-development Flow - Alternative D
              3          ID   Recurrence Interval:  100 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/27/2017
              6          ID   Total Area at Point of Interest: 66.2
                         *
                         *
                         *
                         *
              7          IT       1 27Mar17    0000    1800
              8          IO       5       0       0
```

```
   9           IN       5
               *
               * BA
               * Casino Master Plan

  10           KK      BA
  11           KO       0
  12           PB   5.069
  13           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  14           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008
  15           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  16           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  17           PI   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  18           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.010   0.010
  19           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  20           PI   0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
  21           PI   0.011   0.011   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.012
  22           PI   0.013   0.013   0.013   0.013   0.013   0.013   0.014   0.014   0.014   0.014
  23           PI   0.014   0.015   0.015   0.015   0.015   0.015   0.016   0.016   0.016   0.016
  24           PI   0.017   0.017   0.017   0.018   0.018   0.019   0.019   0.019   0.020   0.020
  25           PI   0.021   0.021   0.022   0.023   0.023   0.024   0.025   0.026   0.027   0.028
  26           PI   0.029   0.030   0.032   0.034   0.036   0.038   0.041   0.045   0.049   0.055
  27           PI   0.064   0.077   0.101   0.172   0.526   0.125   0.087   0.070   0.059   0.052
  28           PI   0.047   0.043   0.040   0.037   0.035   0.033   0.031   0.030   0.028   0.027
  29           PI   0.026   0.025   0.024   0.024   0.023   0.022   0.022   0.021   0.021   0.020
  30           PI   0.020   0.019   0.019   0.018   0.018   0.018   0.017   0.017   0.017   0.016
  31           PI   0.016   0.016   0.016   0.015   0.015   0.015   0.015   0.014   0.014   0.014
  32           PI   0.014   0.014   0.013   0.013   0.013   0.013   0.013   0.013   0.013   0.012
  33           PI   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011   0.011   0.011
  34           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
  35           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  36           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  37           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008
  38           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  39           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  40           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  41           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  42           BA  0.1034
  43           BF     -10    -0.1    1.05
  44           LS       0      72       0     .05      99       0
  45           UK     100   0.010   0.600      67
  46           UK     100   0.010   0.050      33
  47           RD     200  0.0030   0.030   0.016    TRAP     2.0    15.0
1                                           HEC-1 INPUT                                         PAGE  2

LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     300  0.0030   0.020   0.052    CIRC     1.5       0
  49           RD     300  0.0030   0.020   0.103    CIRC       2       0
  50           ZZ
```

```
1****************************************                              ***************************************
 *                                       *                              *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                              *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                              *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                              *          609 SECOND STREET          *
 *                                       *                              *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  14:48:26   *                              *           (916) 756-1104            *
 *                                       *                              *                                     *
 *****************************************                              ***************************************


                          HEC-1 Input Filename: 16196post100-D
                          Description:          Casino Master Plan Post-development Flow - Alternative
                          Recurrence Interval:  100 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/27/2017
                          Total Area at Point of Interest: 66.2

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *        BA  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                RUNOFF SUMMARY
                                                        FLOW IN CUBIC FEET PER SECOND
                                                     TIME IN HOURS,  AREA IN SQUARE MILES

                                                  PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION                 FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                                    6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                              BA                  117.   12.15         22.         11.          9.        .10
1
                                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                         INTERPOLATED TO
                                                                                      COMPUTATION INTERVAL
            ISTAQ    ELEMENT       DT        PEAK    TIME TO     VOLUME       DT        PEAK    TIME TO     VOLUME
                                                      PEAK                                       PEAK

                                  (MIN)     (CFS)     (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                 BA  MANE          .84    116.44    729.00      2.72      1.00    116.44    729.00        2.72

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1727E+02 OUTFLOW= .1501E+02 BASIN STORAGE= .5301E-02 PERCENT ERROR=  13.1



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************                     ****************************************
 *                                       *                     *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                     *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                     *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1                *                     *          609 SECOND STREET           *
 *                                       *                     *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   28MAR17  TIME  11:35:13   *                     *           (916) 756-1104             *
 *                                       *                     *                                      *
 *****************************************                     ****************************************


                                X     X  XXXXXXX   XXXXX          X
                                X     X  X        X     X        XX
                                X     X  X        X               X
                                XXXXXXX  XXXX     X       XXXXX   X
                                X     X  X        X               X
                                X     X  X        X     X         X
                                X     X  XXXXXXX   XXXXX         XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                        HEC-1 INPUT                                                  PAGE  1

           LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1            ID   HEC-1 Input Filename: 16196post2-DA1 D
             2            ID   Description:          Casino Master Plan Alternate D Post-development Flow DA1
             3            ID   Recurrence Interval:  2 year
             4            ID   Storm Duration:       24 hours
             5            ID   Date Compiled:        03/28/2017
             6            ID   Total Area at Point of Interest: 9.9
                          *
                          *
                          *
                          *
             7            IT       1 28Mar17    0000    1800
             8            IO       5       0       0
```

```
      9          IN       5
                 *
                 * DA1
                 * Casino Master Plan

     10          KK     DA1
     11          KO       0
     12          PB   2.768
     13          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     14          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     15          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     16          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
     17          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     18          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     19          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
     20          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     21          PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
     22          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
     23          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
     24          PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
     25          PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
     26          PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
     27          PI   0.035   0.042   0.055   0.094   0.291   0.068   0.047   0.038   0.032   0.028
     28          PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
     29          PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
     30          PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
     31          PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
     32          PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     33          PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     34          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     35          PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     36          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     37          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     38          PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     39          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     40          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     41          PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
     42          BA  0.0154
     43          BF      -3    -0.1    1.05
     44          LS       0      80       0     .05      99       0
     45          UK     100   0.010   0.600       5
     46          UK     100   0.010   0.050      95
     47          RD     200  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                    HEC-1 INPUT                                                 PAGE  2

   LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

     48          RD     500  0.0030   0.020   0.005    CIRC       2       0
     49          RD     500  0.0030   0.020   0.010    CIRC       3       0
     50          ZZ
```

```
1****************************************                                                  ***************************************
 *                                       *                                                  *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                                                  *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                                  *          609 SECOND STREET          *
 *                                       *                                                  *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  11:35:13   *                                                  *           (916) 756-1104            *
 *                                       *                                                  *                                     *
 ****************************************                                                  ***************************************



                        HEC-1 Input Filename: 16196post2-DA1 D
                        Description:          Casino Master Plan Alternate D Post-development Flow DA
                        Recurrence Interval:  2 year
                        Storm Duration:       24 hours
                        Date Compiled:        03/28/2017
                        Total Area at Point of Interest: 9.9

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     28Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     29   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
          **************
          *            *
   10 KK  *       DA1  *
          *            *
          **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                              RUNOFF SUMMARY
                                                      FLOW IN CUBIC FEET PER SECOND
                                                   TIME IN HOURS,  AREA IN SQUARE MILES

                                               PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION               FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                                  6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                          DA1                 23.   12.13          3.          2.          1.         .02
1
                                                  SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                      (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                    INTERPOLATED TO
                                                                                 COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                      PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

               DA1  MANE         1.00     23.41    728.00      1.82      1.00     23.41    728.00       1.82

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2089E+01 OUTFLOW= .1491E+01 BASIN STORAGE= .1286E-02 PERCENT ERROR=  28.6



 *** NORMAL END OF HEC-1 ***
```

```
1***************************************                                                      ***************************************
 *                                       *                                                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                                                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                                                    *         609 SECOND STREET             *
 *                                       *                                                    *      DAVIS, CALIFORNIA 95616          *
 *  RUN DATE   28MAR17  TIME  11:35:45   *                                                    *          (916) 756-1104               *
 *                                       *                                                    *                                       *
 ***************************************                                                      ***************************************


                                            X     X  XXXXXXX   XXXXX          X
                                            X     X  X        X     X        XX
                                            X     X  X        X               X
                                            XXXXXXX  XXXX     X        XXXXX  X
                                            X     X  X        X               X
                                            X     X  X        X     X         X
                                            X     X  XXXXXXX   XXXXX         XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                      HEC-1 INPUT                                                      PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post10-DA1 D
             2           ID   Description:          Casino Master Plan Alternate D Post-development Flow DA1
             3           ID   Recurrence Interval:  10 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/28/2017
             6           ID   Total Area at Point of Interest: 9.9
                         *
                         *
                         *
                         *
             7           IT       1 28Mar17    0000    1800
             8           IO       5       0       0
```

```
      9           IN       5
                  *
                  * DA1
                  * Casino Master Plan

     10           KK     DA1
     11           KO       0
     12           PB   3.607
     13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
     16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
     21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
     22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
     23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
     24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
     25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
     26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
     27           PI   0.045   0.055   0.072   0.122   0.379   0.089   0.062   0.049   0.042   0.037
     28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
     29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
     30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
     31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
     32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
     33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
     34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
     35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
     36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
     37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
     39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
     40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
     42           BA  0.0154
     43           BF      -5    -0.1    1.05
     44           LS       0      80       0     .05      99       0
     45           UK     100   0.010   0.600       5
     46           UK     100   0.010   0.050      95
     47           RD     200  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                    HEC-1 INPUT                                          PAGE  2

   LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

     48           RD     500  0.0030   0.020   0.005    CIRC       2       0
     49           RD     500  0.0030   0.020   0.010    CIRC       3       0
     50           ZZ
```

```
1***************************************
 *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *             JUN   1998              *
 *           VERSION 4.1               *
 *                                     *
 *  RUN DATE   28MAR17  TIME  11:35:45   *
 *                                     *
 ***************************************
```

```
***************************************
*                                     *
*    U.S. ARMY CORPS OF ENGINEERS     *
*    HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET          *
*       DAVIS, CALIFORNIA 95616       *
*           (916) 756-1104            *
*                                     *
***************************************
```

```
                    HEC-1 Input Filename: 16196post10-DA1 D
                    Description:          Casino Master Plan Alternate D Post-development Flow DA
                    Recurrence Interval:  10 year
                    Storm Duration:       24 hours
                    Date Compiled:        03/28/2017
                    Total Area at Point of Interest: 9.9

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     28Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     29   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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             **************
             *            *
   10 KK     *       DA1  *
             *            *
             **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                          RUNOFF SUMMARY
                                                                  FLOW IN CUBIC FEET PER SECOND
                                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                              AREA      STAGE     MAX STAGE
+                                                                          6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA1        32.   12.12          4.          2.          2.        .02
1
                                                          SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                              (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                   INTERPOLATED TO
                                                                                                COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                     PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA1  MANE         1.00     31.48    727.00      2.23      1.00     31.48    727.00       2.23

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2769E+01 OUTFLOW= .1828E+01 BASIN STORAGE= .1290E-02 PERCENT ERROR=  33.9



 *** NORMAL END OF HEC-1 ***
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1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *             JUN   1998                *
 *          VERSION 4.1                  *
 *                                       *
 *  RUN DATE   28MAR17  TIME  11:47:23   *
 *                                       *
 *****************************************
```

```
 ***************************************
 *                                     *
 *    U.S. ARMY CORPS OF ENGINEERS     *
 *    HYDROLOGIC ENGINEERING CENTER    *
 *          609 SECOND STREET          *
 *       DAVIS, CALIFORNIA 95616       *
 *           (916) 756-1104            *
 *                                     *
 ***************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X       XXXXX   X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                            HEC-1 INPUT                                                    PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1          ID   HEC-1 Input Filename: 16196post2-D-DA2
             2          ID   Description:          Casino Master Plan Alternative D Post-development Flow
             3          ID   Recurrence Interval:  2 year
             4          ID   Storm Duration:       24 hours
             5          ID   Date Compiled:        03/28/2017
             6          ID   Total Area at Point of Interest: 6.1
                        *
                        *
                        *
                        *
             7          IT       1 28Mar17    0000    1800
             8          IO       5       0       0
```

```
   9            IN       5
                *
                * DA2
                * Casino Master Plan

  10            KK     DA2
  11            KO       0
  12            PB   2.769
  13            PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  14            PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  15            PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  16            PI   0.004   0.004   0.004   0.004   0.004   0.004   0.005   0.005   0.005   0.005
  17            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  18            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  19            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
  20            PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  21            PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  22            PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008
  23            PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  24            PI   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.011   0.011   0.011
  25            PI   0.011   0.012   0.012   0.012   0.013   0.013   0.014   0.014   0.015   0.015
  26            PI   0.016   0.017   0.017   0.018   0.019   0.021   0.022   0.024   0.027   0.030
  27            PI   0.035   0.042   0.055   0.094   0.292   0.068   0.047   0.038   0.032   0.028
  28            PI   0.026   0.023   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.015
  29            PI   0.014   0.014   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011
  30            PI   0.011   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009   0.009
  31            PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  32            PI   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  33            PI   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  34            PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  35            PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  36            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  37            PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  38            PI   0.005   0.005   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  39            PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  40            PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  41            PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  42            BA  0.0095
  43            BF      -3    -0.1    1.05
  44            LS       0      80       0     .05      99       0
  45            UK     100   0.010   0.600       5
  46            UK     100   0.010   0.050      95
  47            RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                                  HEC-1 INPUT                                     PAGE  2

 LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48            RD     222  0.0030   0.030   0.008    TRAP     2.0    15.0
  49            RD     250  0.0030   0.020   0.015    CIRC       2       0
  50            ZZ
```

```
1***************************************                    ***************************************
 *                                       *                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                    *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                    *          609 SECOND STREET          *
 *                                       *                    *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  11:47:23   *                    *           (916) 756-1104            *
 *                                       *                    *                                     *
 *****************************************                    ***************************************


                          HEC-1 Input Filename: 16196post2-D-DA2
                          Description:          Casino Master Plan Alternative D Post-development Flow
                          Recurrence Interval:  2 year
                          Storm Duration:       24 hours
                          Date Compiled:        03/28/2017
                          Total Area at Point of Interest: 6.1

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     28Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     29   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
           **************
           *            *
   10 KK   *       DA2  *
           *            *
           **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                              RUNOFF SUMMARY
                                                      FLOW IN CUBIC FEET PER SECOND
                                                   TIME IN HOURS,  AREA IN SQUARE MILES

                                            PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION           FLOW     PEAK                                           AREA      STAGE     MAX STAGE
+                                                               6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA2             15.   12.12          2.          1.          1.        .01
1
                                                 SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                     (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                     INTERPOLATED TO
                                                                                  COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                      PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA2  MANE         1.00     14.75    727.00      1.99      1.00     14.75    727.00        1.99

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1289E+01 OUTFLOW= .1010E+01 BASIN STORAGE= .8558E-03 PERCENT ERROR=  21.6



 *** NORMAL END OF HEC-1 ***
```

```
1****************************************                    ****************************************
 *                                      *                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                    *          609 SECOND STREET           *
 *                                      *                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   28MAR17  TIME  11:47:59  *                    *          (916) 756-1104              *
 *                                      *                    *                                      *
 ****************************************                    ****************************************


                        X     X  XXXXXXX   XXXXX           X
                        X     X  X        X     X         XX
                        X     X  X        X                X
                        XXXXXXX  XXXX     X       XXXXX    X
                        X     X  X        X                X
                        X     X  X        X     X          X
                        X     X  XXXXXXX   XXXXX          XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                          HEC-1 INPUT                                            PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post10-D-DA2
             2           ID   Description:          Casino Master Plan Alternative D Post-development Flow
             3           ID   Recurrence Interval:  10 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/28/2017
             6           ID   Total Area at Point of Interest: 6.1
                         *
                         *
                         *
                         *
             7           IT       1 28Mar17    0000    1800
             8           IO       5       0       0
```

```
     9           IN       5
                 *
                 * DA2
                 * Casino Master Plan

    10           KK     DA2
    11           KO       0
    12           PB   3.608
    13           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    15           PI   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006   0.006   0.006
    16           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    18           PI   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    19           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    20           PI   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    21           PI   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009
    22           PI   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010   0.010
    23           PI   0.010   0.010   0.010   0.011   0.011   0.011   0.011   0.011   0.012   0.012
    24           PI   0.012   0.012   0.012   0.013   0.013   0.013   0.013   0.014   0.014   0.014
    25           PI   0.015   0.015   0.016   0.016   0.017   0.017   0.018   0.018   0.019   0.020
    26           PI   0.021   0.022   0.023   0.024   0.025   0.027   0.029   0.032   0.035   0.039
    27           PI   0.045   0.055   0.072   0.122   0.380   0.089   0.062   0.049   0.042   0.037
    28           PI   0.033   0.030   0.028   0.026   0.025   0.023   0.022   0.021   0.020   0.019
    29           PI   0.019   0.018   0.017   0.017   0.016   0.016   0.015   0.015   0.015   0.014
    30           PI   0.014   0.014   0.013   0.013   0.013   0.012   0.012   0.012   0.012   0.012
    31           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010   0.010
    32           PI   0.010   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.009
    33           PI   0.009   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008
    34           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007
    35           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
    36           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
    37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    38           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
    39           PI   0.006   0.006   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005
    40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
    42           BA  0.0095
    43           BF      -5    -0.1    1.05
    44           LS       0      80       0     .05      99       0
    45           UK     100   0.010   0.600       5
    46           UK     100   0.010   0.050      95
    47           RD     222  0.0030   0.030   0.005    TRAP     2.0    15.0
1                                              HEC-1 INPUT                                   PAGE  2

 LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    48           RD     222  0.0030   0.030   0.008    TRAP     2.0    15.0
    49           RD     250  0.0030   0.020   0.015    CIRC       2       0
    50           ZZ
```

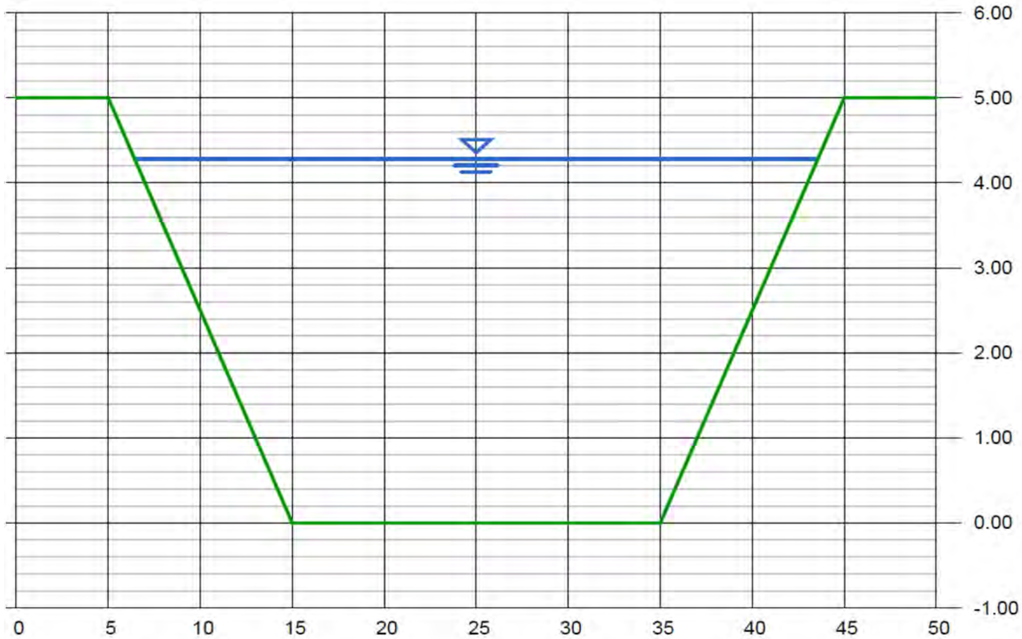
```
1***************************************                                                        ***************************************
 *                                     *                                                        *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                      *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998             *                                                        *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1               *                                                        *          609 SECOND STREET          *
 *                                     *                                                        *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   28MAR17  TIME  11:47:59   *                                                      *           (916) 756-1104            *
 *                                     *                                                        *                                     *
 ***************************************                                                        ***************************************


                             HEC-1 Input Filename: 16196post10-D-DA2
                             Description:          Casino Master Plan Alternative D Post-development Flow
                             Recurrence Interval:  10 year
                             Storm Duration:       24 hours
                             Date Compiled:        03/28/2017
                             Total Area at Point of Interest: 6.1

    8 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           1  MINUTES IN COMPUTATION INTERVAL
                        IDATE     28Mar17  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     29   17  ENDING DATE
                       NDTIME        0559  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .02 HOURS
                         TOTAL TIME BASE   29.98 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *       DA2  *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                          RUNOFF SUMMARY
                                                                  FLOW IN CUBIC FEET PER SECOND
                                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                                       PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                                          6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             DA2        20.   12.12          2.          1.          1.        .01
1
                                                         SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                             (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                   INTERPOLATED TO
                                                                                                COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT        PEAK    TIME TO     VOLUME       DT        PEAK    TIME TO     VOLUME
                                                      PEAK                                        PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

                DA2  MANE         1.00     19.66    727.00      2.41      1.00     19.66    727.00        2.41


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1709E+01 OUTFLOW= .1223E+01 BASIN STORAGE= .8608E-03 PERCENT ERROR=  28.4



 *** NORMAL END OF HEC-1 ***
```

INFILTRATION TRENCH CALCULATIONS

Proposed Earthen Infiltration Channel

Determine the capacity of the proposed channel toconvey flow to the existing sandy gravel layer below the surface.



Using Darcy's Law: $Q = A*k*i$ where: A = cross-sectional area, including space occupied by porous material
k = hydraulic conductivity
i = hydraulic gradient = h/d = drop in head / distance drop occurs
assume: minimum h = d; therefore, i = 1.0

Table 11.1 (Soil Engineering, 4th Edition): k = 0.1 cm/s

k = (0.1 cm/s)*(0.03281 ft/cm) = 0.0033 ft/s

Calculate Q diverted to existing sandy gravel layer (Q_D)

A =	55360	sf
width of trench =	20	ft
length of trench =	2768	ft

Q = 181.6 cfs

Alternative	2-year Peak Flow	10-year Peak Flow
A	60	80
B	39	53
C	60	80
D	38	52

As shown is the above table the proposed infiltration trench will be more than adequate to infiltrate the 2- and 10-year storms for Altrenatives A, B, C, and D.

Post-development Subbasin Parameters

Subbasin:	Basin E
Mean Subbasin Elevation (ft):	414
Subbasin Area (Sq. Mi.):	0.06328125
Subbasin Area (acres):	40.5
Land Use:	Soil A:42% Soil D:42% 1-Commercial/Highways/Parking
	Soil A:8% Soil D:8% 14-Pasture/Parkland/Mowed Grass
Pervious Curve Number:	84
Pervious Overland Length (ft):	200
Pervious Overland Slope (ft/ft):	0.005
Pervious Overland Roughness (overland n):	0.600
Pervious Area (%):	20
Impervious Overland Length (ft):	200
Impervious Overland Slope (ft/ft):	0.005
Pervious Overland Roughness (overland n):	0.050
Impervious Area (%):	N0
Ineffective Area (%):	N0
Collector #1(street or rivulet):	street
Length (ft):	285
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.030
Representative Area (acres):	3.00
Width (ft)/Diameter (in) :	2.0
Sideslopes (ft/ft-H/V):	15.0
Collector #2 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.020
Representative Area (acres):	20.25
Width (ft)/Diameter (in) :	18.0
Sideslopes (ft/ft-H/V):	0
Collector #3 (pipe or channel):	pipe
Length (ft):	900
Slope (ft/ft):	0.0050
Roughness (Mannings n):	0.020
Representative Area (acres):	40.50
Width (ft)/Diameter (in) :	24.0
Sideslopes (ft/ft-H/V):	0

```
1****************************************                    ****************************************
 *                                      *                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                    *          609 SECOND STREET           *
 *                                      *                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  11:09:29  *                    *           (916) 756-1104             *
 *                                      *                    *                                      *
 ****************************************                    ****************************************


                       X     X  XXXXXXX   XXXXX          X
                       X     X  X        X     X        XX
                       X     X  X        X               X
                       XXXXXXX  XXXX     X       XXXXX   X
                       X     X  X        X               X
                       X     X  X        X     X         X
                       X     X  XXXXXXX   XXXXX         XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                      HEC-1 INPUT                                      PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1          ID   HEC-1 Input Filename: 16196postE
             2          ID   Description:          Casino Master Plan Alternative E Post-development Flow
             3          ID   Recurrence Interval:  2 year
             4          ID   Storm Duration:       24 hours
             5          ID   Date Compiled:        03/27/2017
             6          ID   Total Area at Point of Interest: 40.5
                        *
                        *
                        *
                        *
             7          IT       1 27Mar17    0000    1800
             8          IO       5       0       0
```

```
   9           IN       5
               *
               * Basin E
               * Alternative E - Anderson, Ca

  10           KK  Basin
  11           KO       0
  12           PB   2.580
  13           PI   0.003   0.003   0.003   0.003   0.004   0.004   0.004   0.004   0.004   0.004
  14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  17           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  18           PI   0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  20           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
  21           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  22           PI   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  23           PI   0.007   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  24           PI   0.008   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010
  25           PI   0.011   0.011   0.011   0.011   0.012   0.012   0.013   0.013   0.014   0.014
  26           PI   0.015   0.015   0.016   0.017   0.018   0.020   0.021   0.023   0.025   0.028
  27           PI   0.033   0.040   0.052   0.089   0.278   0.065   0.045   0.036   0.030   0.027
  28           PI   0.024   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.014   0.014
  29           PI   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011   0.010   0.010
  30           PI   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008
  31           PI   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007   0.007
  32           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
  33           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  34           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  35           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.004   0.004
  37           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  38           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
  41           PI   0.004   0.004   0.004   0.004   0.003   0.003   0.003   0.003
  42           BA  0.0632
  43           BF      -3    -0.1    1.05
  44           LS       0      84       0     .05      99       0
  45           UK     200   0.005   0.600      27
  46           UK     200   0.005   0.050      73
  47           RD     285  0.0050   0.030   0.005    TRAP     2.0    15.0
1                                                   HEC-1 INPUT                                         PAGE  2

LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     900  0.0050   0.020   0.031    CIRC     1.5       0
  49           RD     900  0.0050   0.020   0.063    CIRC       2       0
  50           ZZ
```

```
1****************************************                 ****************************************
 *                                       *                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *                 *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                 *          609 SECOND STREET           *
 *                                       *                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  11:09:29   *                 *           (916) 756-1104             *
 *                                       *                 *                                      *
 ****************************************                 ****************************************



                     HEC-1 Input Filename: 16196postE
                     Description:          Casino Master Plan Alternative E Post-development Flow
                     Recurrence Interval:  2 year
                     Storm Duration:       24 hours
                     Date Compiled:        03/27/2017
                     Total Area at Point of Interest: 40.5

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
   10 KK      *    Basin   *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                          RUNOFF SUMMARY
                                                  FLOW IN CUBIC FEET PER SECOND
                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                          PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION          FLOW     PEAK                                            AREA      STAGE     MAX STAGE
+                                                                6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                         Basin            55.   12.18          8.          4.          4.        .06
1
                                                 SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                     (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                          INTERPOLATED TO
                                                                                       COMPUTATION INTERVAL
           ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                      PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

            Basin   MANE         1.00     54.50    731.00      1.52      1.00     54.50    731.00       1.52

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .7058E+01 OUTFLOW= .5118E+01 BASIN STORAGE= .5799E-02 PERCENT ERROR=  27.4



 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************                              ***************************************
 *                                       *                              *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                              *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                              *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                              *          609 SECOND STREET          *
 *                                       *                              *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:08:51   *                              *          (916) 756-1104             *
 *                                       *                              *                                     *
 *****************************************                              ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                        HEC-1 INPUT                                            PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196postE
             2           ID   Description:          Casino Master Plan Alternative E Post-development Flow
             3           ID   Recurrence Interval:  10 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/27/2017
             6           ID   Total Area at Point of Interest: 40.5
                         *
                         *
                         *
                         *
             7           IT       1 27Mar17    0000    1800
             8           IO       5       0       0
```

```
   9          IN       5
              *
              * Basin E
              * Alternative E - Anderson, Ca

  10          KK  Basin
  11          KO       0
  12          PB   3.362
  13          PI   0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  14          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  15          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  16          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  17          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  18          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  19          PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
  20          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  21          PI   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  22          PI   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  23          PI   0.009   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.011   0.011
  24          PI   0.011   0.011   0.011   0.012   0.012   0.012   0.012   0.013   0.013   0.013
  25          PI   0.014   0.014   0.015   0.015   0.015   0.016   0.016   0.017   0.018   0.018
  26          PI   0.019   0.020   0.021   0.022   0.024   0.025   0.027   0.030   0.033   0.037
  27          PI   0.043   0.052   0.068   0.116   0.362   0.084   0.059   0.047   0.040   0.035
  28          PI   0.031   0.029   0.026   0.025   0.023   0.022   0.021   0.020   0.019   0.018
  29          PI   0.017   0.017   0.016   0.016   0.015   0.015   0.014   0.014   0.014   0.013
  30          PI   0.013   0.013   0.012   0.012   0.012   0.012   0.011   0.011   0.011   0.011
  31          PI   0.011   0.010   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009
  32          PI   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008   0.008
  33          PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007
  34          PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  35          PI   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006
  36          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  37          PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.005   0.005
  38          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  39          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  40          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  41          PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
  42          BA  0.0632
  43          BF      -5    -0.1    1.05
  44          LS       0      84       0     .05      99       0
  45          UK     200   0.005   0.600      27
  46          UK     200   0.005   0.050      73
  47          RD     285  0.0050   0.030   0.005    TRAP     2.0    15.0
1                                         HEC-1 INPUT                                      PAGE  2

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48          RD     900  0.0050   0.020   0.031    CIRC     1.5       0
  49          RD     900  0.0050   0.020   0.063    CIRC       2       0
  50          ZZ
```

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1****************************************                    ***************************************
 *                                       *                   *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                   *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                   *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                   *          609 SECOND STREET          *
 *                                       *                   *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:08:51   *                   *           (916) 756-1104            *
 *                                       *                   *                                     *
 *****************************************                   ***************************************


                       HEC-1 Input Filename: 16196postE
                       Description:          Casino Master Plan Alternative E Post-development Flow
                       Recurrence Interval:  10 year
                       Storm Duration:       24 hours
                       Date Compiled:        03/27/2017
                       Total Area at Point of Interest: 40.5

   8 IO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN           1  MINUTES IN COMPUTATION INTERVAL
                      IDATE     27Mar17  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     28   17  ENDING DATE
                     NDTIME        0559  ENDING TIME
                     ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                       TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
             **************
             *            *
   10 KK     *    Basin   *
             *            *
             **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                          RUNOFF SUMMARY
                                                                  FLOW IN CUBIC FEET PER SECOND
                                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                                      PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                AREA      STAGE     MAX STAGE
+                                                                          6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                          Basin         76.   12.17          12.          6.          5.        .06
1
                                                           SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                               (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                                    INTERPOLATED TO
                                                                                                 COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                     PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

             Basin   MANE         1.00     75.67    730.00      2.12      1.00     75.67    730.00        2.12

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .9563E+01 OUTFLOW= .7140E+01 BASIN STORAGE= .5988E-02 PERCENT ERROR=  25.3



 *** NORMAL END OF HEC-1 ***
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1****************************************                     ***************************************
 *                                       *                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                    *          609 SECOND STREET          *
 *                                       *                    *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:07:57   *                    *           (916) 756-1104            *
 *                                       *                    *                                     *
 ****************************************                     ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                    HEC-1 INPUT                                                 PAGE  1

          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196postE
             2           ID   Description:          Casino Master Plan Alternative E Post-development Flow
             3           ID   Recurrence Interval:  100 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/27/2017
             6           ID   Total Area at Point of Interest: 40.5
                         *
                         *
                         *
                         *
             7           IT       1 27Mar17    0000    1800
             8           IO       5       0       0
```

```
   9           IN       5
               *
               * Basin E
               * Alternative E - Anderson, Ca

  10           KK  Basin
  11           KO       0
  12           PB   4.702
  13           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.007
  14           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  15           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  16           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.008   0.008   0.008   0.008
  17           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  18           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.009   0.009   0.009   0.009
  19           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  20           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010
  21           PI   0.010   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.011
  22           PI   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.013   0.013   0.013
  23           PI   0.013   0.013   0.014   0.014   0.014   0.014   0.014   0.015   0.015   0.015
  24           PI   0.015   0.016   0.016   0.016   0.017   0.017   0.017   0.018   0.018   0.019
  25           PI   0.019   0.020   0.020   0.021   0.022   0.022   0.023   0.024   0.025   0.026
  26           PI   0.027   0.028   0.030   0.031   0.033   0.036   0.038   0.042   0.046   0.052
  27           PI   0.060   0.073   0.096   0.163   0.509   0.118   0.082   0.065   0.055   0.049
  28           PI   0.044   0.040   0.037   0.034   0.032   0.030   0.029   0.028   0.026   0.025
  29           PI   0.024   0.023   0.023   0.022   0.021   0.021   0.020   0.019   0.019   0.018
  30           PI   0.018   0.018   0.017   0.017   0.017   0.016   0.016   0.016   0.015   0.015
  31           PI   0.015   0.015   0.014   0.014   0.014   0.014   0.013   0.013   0.013   0.013
  32           PI   0.013   0.013   0.012   0.012   0.012   0.012   0.012   0.012   0.012   0.011
  33           PI   0.011   0.011   0.011   0.011   0.011   0.011   0.011   0.010   0.010   0.010
  34           PI   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.009   0.009
  35           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009   0.009
  36           PI   0.009   0.009   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  37           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
  38           PI   0.008   0.008   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  39           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  40           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
  41           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
  42           BA  0.0632
  43           BF     -10    -0.1    1.05
  44           LS       0      84       0     .05      99       0
  45           UK     200   0.005   0.600      27
  46           UK     200   0.005   0.050      73
  47           RD     285  0.0050   0.030   0.005    TRAP     2.0    15.0
1                                                HEC-1 INPUT                                                  PAGE  2

      LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  48           RD     900  0.0050   0.020   0.031    CIRC     1.5       0
  49           RD     900  0.0050   0.020   0.063    CIRC       2       0
  50           ZZ
```

```
1***************************************                          ***************************************
 *                                     *                          *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                          *   U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998             *                          *   HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1               *                          *         609 SECOND STREET          *
 *                                     *                          *      DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:07:57  *                          *          (916) 756-1104            *
 *                                     *                          *                                     *
 ***************************************                          ***************************************


                           HEC-1 Input Filename: 16196postE
                           Description:          Casino Master Plan Alternative E Post-development Flow
                           Recurrence Interval:  100 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/27/2017
                           Total Area at Point of Interest: 40.5

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
             **************
             *            *
   10 KK     *    Basin   *
             *            *
             **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
1
                                                            RUNOFF SUMMARY
                                                    FLOW IN CUBIC FEET PER SECOND
                                                 TIME IN HOURS,  AREA IN SQUARE MILES

                                               PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                 AREA      STAGE     MAX STAGE
+                                                               6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                          Basin        115.   12.17          17.          9.          7.        .06
1
                                                      SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                          (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                           INTERPOLATED TO
                                                                                        COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                      PEAK

                                 (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

             Basin   MANE         1.00    114.16    730.00      2.95      1.00    114.16    730.00        2.95

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1393E+02 OUTFLOW= .9953E+01 BASIN STORAGE= .6113E-02 PERCENT ERROR=  28.5



 *** NORMAL END OF HEC-1 ***
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```
1****************************************                                                  ****************************************
 *                                      *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                                  *          609 SECOND STREET           *
 *                                      *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  11:52:33  *                                                  *           (916) 756-1104             *
 *                                      *                                                  *                                      *
 ****************************************                                                  ****************************************


                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX          XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                                       HEC-1 INPUT                                                    PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1           ID   HEC-1 Input Filename: 16196post-DE1
             2           ID   Description:          Casino Master Plan Alternative E Post-development Flow
             3           ID   Recurrence Interval:  2 year
             4           ID   Storm Duration:       24 hours
             5           ID   Date Compiled:        03/27/2017
             6           ID   Total Area at Point of Interest: 23.9
                         *
                         *
                         *
                         *
```

```
  7           IT       1 27Mar17    0000    1800
  8           IO       5       0       0
  9           IN       5
              *
              * Basin E
              * Alternative E - Anderson, Ca

 10           KK  Basin
 11           KO       0
 12           PB   2.581
 13           PI   0.003   0.003   0.003   0.003   0.004   0.004   0.004   0.004   0.004   0.004
 14           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 15           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 16           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 17           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 18           PI   0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 19           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 20           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.006   0.006   0.006   0.006
 21           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 22           PI   0.006   0.006   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 23           PI   0.007   0.007   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 24           PI   0.008   0.009   0.009   0.009   0.009   0.009   0.010   0.010   0.010   0.010
 25           PI   0.011   0.011   0.011   0.011   0.012   0.012   0.013   0.013   0.014   0.014
 26           PI   0.015   0.015   0.016   0.017   0.018   0.020   0.021   0.023   0.025   0.028
 27           PI   0.033   0.040   0.052   0.089   0.280   0.065   0.045   0.036   0.030   0.027
 28           PI   0.024   0.022   0.020   0.019   0.018   0.017   0.016   0.015   0.014   0.014
 29           PI   0.013   0.013   0.012   0.012   0.012   0.011   0.011   0.011   0.010   0.010
 30           PI   0.010   0.010   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008
 31           PI   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007   0.007   0.007
 32           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006
 33           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 34           PI   0.006   0.006   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 35           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 36           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.004   0.004
 37           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 38           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 39           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 40           PI   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004   0.004
 41           PI   0.004   0.004   0.004   0.004   0.003   0.003   0.003   0.003
 42           BA  0.0373
 43           BF      -3    -0.1    1.05
 44           LS       0      84       0     .05      99       0
 45           UK     200   0.005   0.600      20
 46           UK     200   0.005   0.050      80
 47           RD     285  0.0050   0.030   0.005    TRAP     2.0    15.0
1                                                       HEC-1 INPUT                                             PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

```
          48           RD     900  0.0050   0.020   0.025    CIRC     1.5       0
          49           RD     900  0.0050   0.020   0.037    CIRC       2       0
          50           ZZ
1*****************************************                                                  ***************************************
 *                                       *                                                  *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                                                  *    HYDROLOGIC ENGINEERING CENTER    *
 *          VERSION 4.1                  *                                                  *          609 SECOND STREET          *
 *                                       *                                                  *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:52:33   *                                                  *           (916) 756-1104            *
 *                                       *                                                  *                                     *
 *****************************************                                                  ***************************************


                    HEC-1 Input Filename: 16196post-DE1
                    Description:          Casino Master Plan Alternative E Post-development Flow
                    Recurrence Interval:  2 year
                    Storm Duration:       24 hours
                    Date Compiled:        03/27/2017
                    Total Area at Point of Interest: 23.9

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     27Mar17  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME        0559  ENDING TIME
                      ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   29.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
```

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                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

             **************
             *            *
   10 KK     *    Basin   *
             *            *
             **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                              RUNOFF SUMMARY
                                                      FLOW IN CUBIC FEET PER SECOND
                                                   TIME IN HOURS,  AREA IN SQUARE MILES

                                          PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION         FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                              6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                          Basin            35.   12.18           5.          3.          2.        .04
1
                                                SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                    (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                        INTERPOLATED TO
                                                                                     COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO      VOLUME       DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                        PEAK

                                (MIN)     (CFS)      (MIN)     (IN)     (MIN)     (CFS)     (MIN)       (IN)

             Basin   MANE         1.00     35.24    731.00      1.71      1.00     35.24    731.00       1.71

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .4342E+01 OUTFLOW= .3406E+01 BASIN STORAGE= .3888E-02 PERCENT ERROR=  21.5
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*** NORMAL END OF HEC-1 ***
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1*****************************************                          ***************************************
 *                                       *                          *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                          *    U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                          *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                          *          609 SECOND STREET          *
 *                                       *                          *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27MAR17  TIME  11:53:26   *                          *           (916) 756-1104            *
 *                                       *                          *                                     *
 *****************************************                          ***************************************


                              X     X  XXXXXXX   XXXXX           X
                              X     X  X        X     X         XX
                              X     X  X        X                X
                              XXXXXXX  XXXX     X       XXXXX    X
                              X     X  X        X                X
                              X     X  X        X     X          X
                              X     X  XXXXXXX   XXXXX          XXX


            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                        HEC-1 INPUT                                                 PAGE  1

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              1          ID   HEC-1 Input Filename: 16196post-DE1
              2          ID   Description:          Casino Master Plan Alternative E Post-development Flow
              3          ID   Recurrence Interval:  10 year
              4          ID   Storm Duration:       24 hours
              5          ID   Date Compiled:        03/27/2017
              6          ID   Total Area at Point of Interest: 23.9
                         *
                         *
                         *
                         *
              7          IT       1 27Mar17    0000    1800
              8          IO       5       0       0
```

```
  9           IN       5
              *
              * Basin E
              * Alternative E - Anderson, Ca

 10           KK  Basin
 11           KO       0
 12           PB   3.364
 13           PI   0.004   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 14           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 15           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 16           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 17           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 18           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 19           PI   0.006   0.006   0.006   0.006   0.006   0.007   0.007   0.007   0.007   0.007
 20           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 21           PI   0.007   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.008
 22           PI   0.008   0.008   0.008   0.009   0.009   0.009   0.009   0.009   0.009   0.009
 23           PI   0.009   0.010   0.010   0.010   0.010   0.010   0.010   0.010   0.011   0.011
 24           PI   0.011   0.011   0.011   0.012   0.012   0.012   0.012   0.013   0.013   0.013
 25           PI   0.014   0.014   0.015   0.015   0.015   0.016   0.016   0.017   0.018   0.018
 26           PI   0.019   0.020   0.021   0.022   0.024   0.025   0.027   0.030   0.033   0.037
 27           PI   0.043   0.052   0.068   0.116   0.364   0.084   0.059   0.047   0.040   0.035
 28           PI   0.031   0.029   0.026   0.025   0.023   0.022   0.021   0.020   0.019   0.018
 29           PI   0.017   0.017   0.016   0.016   0.015   0.015   0.014   0.014   0.014   0.013
 30           PI   0.013   0.013   0.012   0.012   0.012   0.012   0.011   0.011   0.011   0.011
 31           PI   0.011   0.010   0.010   0.010   0.010   0.010   0.010   0.009   0.009   0.009
 32           PI   0.009   0.009   0.009   0.009   0.009   0.009   0.008   0.008   0.008   0.008
 33           PI   0.008   0.008   0.008   0.008   0.008   0.008   0.008   0.007   0.007   0.007
 34           PI   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007   0.007
 35           PI   0.007   0.007   0.007   0.007   0.006   0.006   0.006   0.006   0.006   0.006
 36           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
 37           PI   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.005   0.005
 38           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 39           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 40           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 41           PI   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
 42           BA  0.0373
 43           BF      -5    -0.1    1.05
 44           LS       0      84       0     .05      99       0
 45           UK     200   0.005   0.600      20
 46           UK     200   0.005   0.050      80
 47           RD     285  0.0050   0.030   0.005    TRAP     2.0    15.0
1                                        HEC-1 INPUT                                         PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           RD     900  0.0050   0.020   0.025    CIRC     1.5       0
 49           RD     900  0.0050   0.020   0.037    CIRC       2       0
 50           ZZ
```

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1*****************************************                    ****************************************
 *                                       *                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                    *          609 SECOND STREET           *
 *                                       *                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   27MAR17  TIME  11:53:26   *                    *           (916) 756-1104             *
 *                                       *                    *                                      *
 *****************************************                    ****************************************


                           HEC-1 Input Filename: 16196post-DE1
                           Description:          Casino Master Plan Alternative E Post-development Flow
                           Recurrence Interval:  10 year
                           Storm Duration:       24 hours
                           Date Compiled:        03/27/2017
                           Total Area at Point of Interest: 23.9

   8 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          1  MINUTES IN COMPUTATION INTERVAL
                       IDATE    27Mar17  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ       1800  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     28   17  ENDING DATE
                      NDTIME       0559  ENDING TIME
                      ICENT          19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE   29.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```
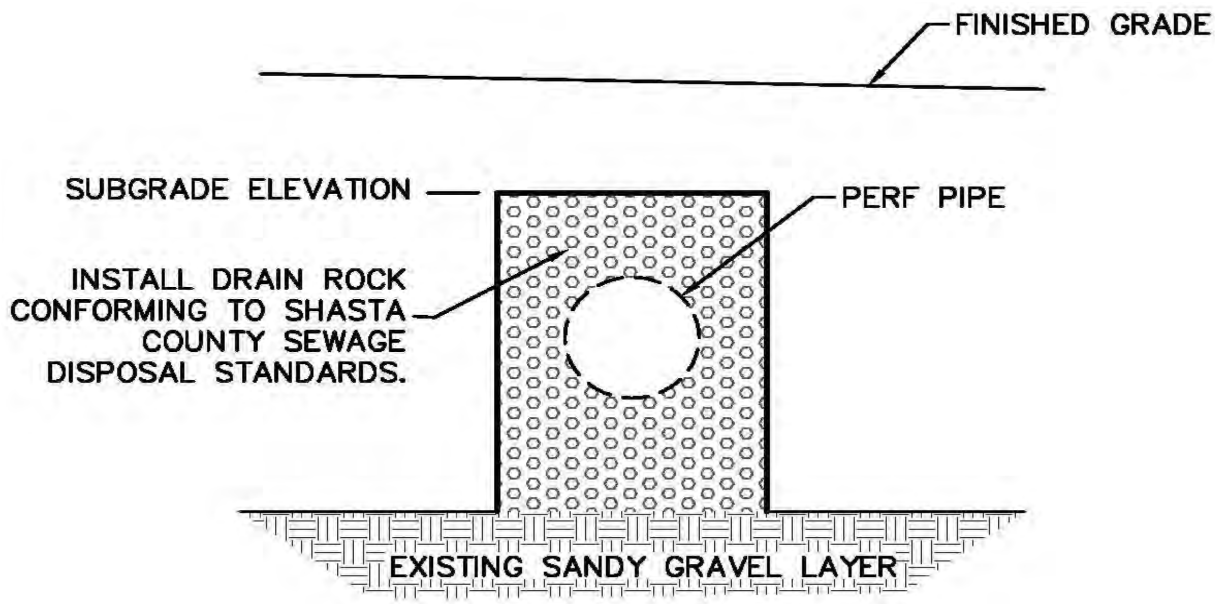

```
              **************
              *            *
   10 KK      *    Basin   *
              *            *
              **************

   11 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                                    RUNOFF SUMMARY
                                                            FLOW IN CUBIC FEET PER SECOND
                                                         TIME IN HOURS,  AREA IN SQUARE MILES

                                                 PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW     PEAK                                                AREA      STAGE     MAX STAGE
+                                                                  6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                           Basin         49.   12.17          7.          4.          3.        .04
1
                                                      SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                          (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                               INTERPOLATED TO
                                                                                            COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME       DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                          PEAK

                                 (MIN)     (CFS)      (MIN)      (IN)     (MIN)     (CFS)     (MIN)       (IN)

             Basin   MANE         1.00     48.79    730.00       2.07      1.00     48.79    730.00        2.07


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .5842E+01 OUTFLOW= .4122E+01 BASIN STORAGE= .3957E-02 PERCENT ERROR=  29.4



 *** NORMAL END OF HEC-1 ***
```

INFILTRATION TRENCH CALCULATIONS

DE#1

Determine the capacity of the proposed rock trench to convey flow to the existing sandy gravel layer below the surface.



Using Darcy's Law: Q = A*k*i where: A = cross-sectional area, including space occupied by porous material
k = hydraulic conductivity
i = hydraulic gradient = h/d = drop in head / distance drop occurs

assume: minimum h = d; therefore, i = 1.0

Table 11.1 (Soil Engineering, 4th Edition): k = 0.1 cm/s

k = (0.1 cm/s)*(0.03281 ft/cm) = 0.0033 ft/s

Calculate Q diverted to existing sandy gravel layer (Q_D)

A = 11700 sf
width of trench = 5 ft
length of trench = 2340 ft

Q = 38.4 cfs

The calculated 2-year peak flow for Alternative E is 35 cubic feet per second and the 10-year peak flow is 49 cubic feet per second. As shown in the above calculation the proposed infiltration trench is adequately sized to infiltrate the 2-year peak storm.

Appendix B

Grading and Earthwork Calculations

SHARRAH DUNLAP SAWYER INCORPORATED

Job No. 16.0196.000
Calc IS Checked Date 04/13/17
Job Name Casino Alternative A

Alternative 'A' - Redding Racnheria Casino Master Plan Preliminary Earthwork Calculations

Area	Cut (Yd^3)	Fill (Yd^3)	*Adj. Fill (Yd^3)	Adj. Net (Yd^3)	
Onsite Earthwork	56,000	82,000	94,300	38,300	FILL
Offsite Drainage	38,000	0	0	38,000	CUT
Total	94,000	82,000	94,300	**300**	**Short Material**

***Notes:**
1. The adjusted fill volumes are assuming a 15% shrinkage factor
2. The site was boken into two portions, the Onsite Earthwork consists of the buildings, parking areas, access road and trapezoidal channel east of the access road. The Offsite drainage include the trapezoidal channel and infiltration wet pond west of the access road.

SHARRAH DUNLAP SAWYER INCORPORATED

Page	1	Of	1		
Job No.	16.0196.000				
Calc	IS	Checked		Date	04/13/17
Job Name	Casino Alternative B				

Alternative 'B' - Redding Racnheria Casino Master Plan Preliminary Earthwork Calculations

Area	**Cut (Yd^3)**	**Fill (Yd^3)**	***Adj. Fill (Yd^3)**	**Adj. Net (Yd^3)**	
Onsite Earthwork	46,000	70,000	80,500	34,500	FILL
Offsite Drainage	34,000	0	0	34,000	CUT
Total	80,000	70,000	80,500	**500**	**Short Material**

***Notes:**

1. The adjusted fill volumes are assuming a 15% shrinkage factor
2. The site was boken into two portions, the Onsite Earthwork consists of the buildings, parking areas, access road and trapezoidal channel east of the access road. The Offsite drainage include the trapezoidal channel and infiltration wet pond west of the access road.

Alternative 'C' - Redding Racnheria Casino Master Plan Preliminary Earthwork Calculations

Area	Cut (Yd^3)	Fill (Yd^3)	*Adj. Fill (Yd^3)	Adj. Net (Yd^3)	
Onsite Earthwork	56,000	82,000	94,300	38,300	FILL
Offsite Drainage	38,000	0	0	38,000	CUT
Total	94,000	82,000	94,300	**300**	**Short Material**

***Notes:**

1. The adjusted fill volumes are assuming a 15% shrinkage factor
2. The site was boken into two portions, the Onsite Earthwork consists of the buildings, parking areas, access road and trapezoidal channel east of the access road. The Offsite drainage include the trapezoidal channel and infiltration wet pond west of the access road.

SHARRAH
DUNLAP
SAWYER
INCORPORATED

Job No. 16.0196.000
Calc IS Checked Date 04/13/17
Job Name Casino Alternative D

Alternative 'D' - Redding Racnheria Casino Master Plan Preliminary Earthwork Calculations

Area	Cut (Yd^3)	Fill (Yd^3)	*Adj. Fill (Yd^3)	Adj. Net (Yd^3)	
Onsite Earthwork	42,000	65,000	74,750	32,750	FILL
Offsite Drainage	33,000	0	0	33,000	CUT
Total	75,000	65,000	74,750	**250**	**Excess Material**

***Notes:**
1. The adjusted fill volumes are assuming a 15% shrinkage factor
2. The site was boken into two portions, the Onsite Earthwork consists of the buildings, parking areas, access road and trapezoidal channel east of the access road. The Offsite drainage include the trapezoidal channel and infiltration wet pond west of the access road.

Alternative 'E' - Redding Racnheria Casino Master Plan Preliminary Earthwork Calculations

Area	Cut (Yd^3)	Fill (Yd^3)	*Adj. Fill (Yd^3)	Adj. Net (Yd^3)	
Onsite Earthwork	18,000	120,000	138,000	120,000	FILL
Detention/Infiltration	120,000	0	0	120,000	CUT
Total	138,000	120,000	138,000	**0**	**Short Material**

***Notes:**

1. The adjusted fill volumes are assuming a 15% shrinkage factor
2. The site was boken into two portions, the Onsite Earthwork consists of the buildings, parking areas, access road and trapezoidal channel east of the access road. The Offsite drainage include the trapezoidal channel and infiltration wet pond west of the access road.

Appendix C

Retention / Infiltration Pond Sizing Calculations

SHARRAH DUNLAP SAWYER INCORPORATED

Job No. 16.0196.000
Calc IS Checked Date 03/27/17
Job Nar Casino - Wet Pond Sizing

Alternative A Pond Sizing

1-year runoff:	1.24	inches
2-year runoff:	1.43	inches
85 percentile storm:	1.34	inches
85% Volume =	320809	cubic feet
Pond Volume =	**641617**	**cubic feet**

Note: The pool volume of the Wet Pond shall be twice the volume of the 85 percentile storm (Per CASQA California Stormwater BMP Handbook)

Project Area: 66.2 acres

Alternative B Pond Sizing

1-year runoff:	1.00	inches
2-year runoff:	1.10	inches
85 percentile storm:	1.05	inches
85% Volume =	252321	cubic feet
Pond Volume =	**504643**	**cubic feet**

Note: The pool volume of the Wet Pond shall be twice the volume of the 85 percentile storm (Per CASQA California Stormwater BMP Handbook)

Project Area: 66.2 acres

Alternative C Pond Sizing

1-year runoff:	1.24	inches
2-year runoff:	1.43	inches
85 percentile storm:	1.34	inches
85% Volume =	320809	cubic feet
Pond Volume =	**641617**	**cubic feet**

Note: The pool volume of the Wet Pond shall be twice the volume of the 85 percentile storm (Per CASQA California Stormwater BMP Handbook)

Project Area: 66.2 acres

Alternative D Pond Sizing

1-year runoff:	0.92	inches
2-year runoff:	0.95	inches
85 percentile storm:	0.94	inches
85% Volume =	224686	cubic feet
Pond Volume =	**449372**	**cubic feet**

Note: The pool volume of the Wet Pond shall be twice the volume of the 85 percentile storm (Per CASQA California Stormwater BMP Handbook)

Project Area: 66.2 acres

Design Considerations

- Area Required
- Slope
- Water Availability
- Aesthetics
- Environmental Side-effects

Description

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling. The schematic diagram is of an on-line pond that includes detention for larger events, but this is not required in all areas of the state.

Targeted Constituents

☑	Sediment	■
☑	Nutrients	▲
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

California Experience

Caltrans constructed a wet pond in northern San Diego County (I-5 and La Costa Blvd.). Largest issues at this site were related to vector control, vegetation management, and concern that endangered species would become resident and hinder maintenance activities.

Advantages

- If properly designed, constructed and maintained, wet basins can provide substantial aesthetic/recreational value and wildlife and wetlands habitat.

- Ponds are often viewed as a public amenity when integrated into a park setting.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Due to the presence of the permanent wet pool, properly designed and maintained wet basins can provide significant water quality improvement across a relatively broad spectrum of constituents including dissolved nutrients.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Some concern about safety when constructed where there is public access.
- Mosquito and midge breeding is likely to occur in ponds.
- Cannot be placed on steep unstable slopes.
- Need for base flow or supplemental water if water level is to be maintained.
- Require a relatively large footprint
- Depending on volume and depth, pond designs may require approval from the State Division of Safety of Dams

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.
- Use a draw down time of 48 hours in most areas of California. Draw down times in excess of 48 hours may result in vector breeding, and should be used only after coordination with local vector control authorities. Draw down times of less than 48 hours should be limited to BMP drainage areas with coarse soils that readily settle and to watersheds where warming may be detrimental to downstream fisheries.
- Permanent pool volume equal to twice the water quality volume.
- Water depth not to exceed about 8 feet.
- Wetland vegetation occupying no more than 25% of surface area.
- Include energy dissipation in the inlet design and a sediment forebay to reduce resuspension of accumulated sediment and facilitate maintenance.
- A maintenance ramp should be included in the design to facilitate access to the forebay for maintenance activities and for vector surveillance and control.
- To facilitate vector surveillance and control activities, road access should be provided along at least one side of BMPs that are seven meters or less in width. Those BMPs that have shoreline-to-shoreline distances in excess of seven meters should have perimeter road access on both sides or be designed such that no parcel of water is greater than seven meters from the road.

Construction/Inspection Considerations

- In areas with porous soils an impermeable liner may be required to maintain an adequate permanent pool level.

- Outlet structures and piping should be installed with collars to prevent water from seeping through the fill and causing structural failure.

- Inspect facility after first large storm to determine whether the desired residence time has been achieved.

Performance

The observed pollutant removal of a wet pond is highly dependent on two factors: the volume of the permanent pool relative to the amount of runoff from the typical event in the area and the quality of the base flow that sustains the permanent pool. A recent study (Caltrans, 2002) has documented that if the permanent pool is much larger than the volume of runoff from an average event, then displacement of the permanent pool by the wet weather flow is the primary process. A statistical comparison of the wet pond discharge quality during dry and wet weather shows that they are not significantly different. Consequently, there is a relatively constant discharge quality during storms that is the same as the concentrations observed in the pond during ambient (dry weather) conditions. Consequently, for most constituents the performance of the pond is better characterized by the average effluent concentration, rather than the "percent reduction," which has been the conventional measure of performance. Since the effluent quality is essentially constant, the percent reduction observed is mainly a function of the influent concentrations observed at a particular site.

The dry and wet weather discharge quality is, therefore, related to the quality of the base flow that sustains the permanent pool and of the transformations that occur to those constituents during their residence in the basin. One could potentially expect a wide range of effluent concentrations at different locations even if the wet ponds were designed according to the same guidelines, if the quality of the base flow differed significantly. This may explain the wide range of concentration reductions reported in various studies.

Concentrations of nutrients in base flow may be substantially higher than in urban stormwater runoff. Even though these concentrations may be substantially reduced during the residence time of the base flow in the pond, when this water is displaced by wet weather flows, concentrations may still be quite elevated compared to the levels that promote eutrophication in surface water systems. Consequently comparing influent and effluent nutrient concentrations during wet weather can make the performance seem highly variable.

Relatively small perennial flows may often substantially exceed the wet weather flow treated. Consequently, one should also consider the load reduction observed under ambient conditions when assessing the potential benefit to the receiving water.

Siting Criteria

Wet ponds are a widely applicable stormwater management practice and can be used over a broad range of storm frequencies and sizes, drainage areas and land use types. Although they have limited applicability in highly urbanized settings and in arid climates, they have few other restrictions. Wet basins may be constructed on- or off-line and can be sited at feasible locations along established drainage ways with consistent base flow. An off-line design is preferred. Wet basins are often utilized in smaller sub-watersheds and are particularly appropriate in areas with residential land uses or other areas where high nutrient loads are considered to be potential problems (e.g., golf courses).

Ponds do not consume a large area (typically 2–3 percent of the contributing drainage area); however, these facilities are generally large. Other practices, such as filters or swales, may be "squeezed" into relatively unusable land, but ponds need a relatively large continuous area. Wet basins are typically used in drainage basins of more than ten acres and less than one square mile (Schueler et al., 1992). Emphasis can be placed in siting wet basins in areas where the pond can also function as an aesthetic amenity or in conjunction with other stormwater management functions.

Wet basin application is appropriate in the following settings: (1) where there is a need to achieve a reasonably high level of dissolved contaminant removal and/or sediment capture; (2) in small to medium-sized regional tributary areas with available open space and drainage areas greater than about 10 ha (25 ac.); (3) where base flow rates or other channel flow sources are relatively consistent year-round; (4) in residential settings where aesthetic and wildlife habitat benefits can be appreciated and maintenance activities are likely to be consistently undertaken.

Traditional wet extended detention ponds can be applied in most regions of the United States, with the exception of arid climates. In arid regions, it is difficult to justify the supplemental water needed to maintain a permanent pool because of the scarcity of water. Even in semi-arid Austin, Texas, one study found that 2.6 acre-feet per year of supplemental water was needed to maintain a permanent pool of only 0.29 acre-feet (Saunders and Gilroy, 1997). Seasonal wet ponds (i.e., ponds that maintain a permanent pool only during the wet season) may prove effective in areas with distinct wet and dry seasons; however, this configuration has not been extensively evaluated.

Wet ponds may pose a risk to cold water systems because of their potential for stream warming. When water remains in the permanent pool, it is heated by the sun. A study in Prince George's County, Maryland, found that stormwater wet ponds heat stormwater by about 9°F from the inlet to the outlet (Galli, 1990).

Additional Design Guidelines

Specific designs may vary considerably, depending on site constraints or preferences of the designer or community. There are several variations of the wet pond design, including constructed wetlands, and wet extended detention ponds. Some of these design alternatives are intended to make the practice adaptable to various sites and to account for regional constraints and opportunities. In conventional wet ponds, the open water area comprises 50% or more of the total surface area of the pond. The permanent pool should be no deeper than 2.5 m (8 feet) and should average 1.2 – 2 m (4-6 feet) deep. The greater depth of this configuration helps limit the extent of the vegetation to an aquatic bench around the perimeter of the pond with a nominal depth of about 1 foot and variable width. This shallow bench also protects the banks from erosion, enhances habitat and aesthetic values, and reduces the drowning hazard.

The wet extended detention pond combines the treatment concepts of the dry extended detention pond and the wet pond. In this design, the water quality volume is detained above the permanent pool and released over 24 hours. In addition to increasing the residence time, which improves pollutant removal, this design also attenuates peak runoff rates. Consequently, this design alternative is recommended.

Pretreatment incorporates design features that help to settle out coarse sediment particles. By removing these particles from runoff before they reach the large permanent pool, the maintenance burden of the pond is reduced. In ponds, pretreatment is achieved with a sediment forebay. A sediment forebay is a small pool (typically about 10 percent of the volume of the permanent pool). Coarse particles remain trapped in the forebay, and maintenance is performed on this smaller pool, eliminating the need to dredge the entire pond.

There are a variety of sizing criteria for determining the volume of the permanent pool, mostly related to the water quality volume (i.e., the volume of water treated for pollutant removal) or the average storm size in a particular area. In addition, several theoretical approaches to determination of permanent pool volume have been developed. However, there is little empirical evidence to support these designs. Consequently, a simplified method (i.e., permanent pool volume equal to twice the water quality volume) is recommended.

Other design features do not increase the volume of a pond, but can increase the amount of time stormwater remains in the device and eliminate short-circuiting. Ponds should always be designed with a length-to-width ratio of at least 1.5:1, where feasible. In addition, the design should incorporate features to lengthen the flow path through the pond, such as underwater berms designed to create a longer route through the pond. Combining these two measures helps ensure that the entire pond volume is used to treat stormwater. Wet ponds with greater amounts of vegetation often have channels through the vegetated areas and contain dead areas where stormwater is restricted from mixing with the entire permanent pool, which can lead to less pollutant removal. Consequently, a pond with open water comprising about 75% of the surface area is preferred.

Design features are also incorporated to ease maintenance of both the forebay and the main pool of ponds. Ponds should be designed with a maintenance access to the forebay to ease this relatively routine (every 5–7 year) maintenance activity. In addition, ponds should generally have a drain to draw down the pond for vegetation harvesting or the more infrequent dredging of the main cell of the pond.

Cold climates present many challenges to designers of wet ponds. The spring snowmelt may have a high pollutant load and a large volume to be treated. In addition, cold winters may cause freezing of the permanent pool or freezing at inlets and outlets. Finally, high salt concentrations in runoff resulting from road salting, and sediment loads from road sanding, may impact pond vegetation as well as reduce the storage and treatment capacity of the pond.

One option to deal with high pollutant loads and runoff volumes during the spring snowmelt is the use of a seasonally operated pond to capture snowmelt during the winter and retain the permanent pool during warmer seasons. In this option, proposed by Oberts (1994), the pond has two water quality outlets, both equipped with gate valves. In the summer, the lower outlet is closed. During the fall and throughout the winter, the lower outlet is opened to draw down the permanent pool. As the spring melt begins, the lower outlet is closed to provide detention for the melt event. The manipulation of this system requires some labor and vigilance; a careful maintenance agreement should be confirmed.

Several other modifications may help to improve the performance of ponds in cold climates. Designers should consider planting the pond with salt-tolerant vegetation if the facility receives road runoff. In order to counteract the effects of freezing on inlet and outlet structures, the use of inlet and outlet structures that are resistant to frost, including weirs and larger diameter pipes, may be useful. Designing structures on-line, with a continuous flow of water through the pond, will also help prevent freezing of these structures. Finally, since freezing of the permanent pool can reduce the effectiveness of pond systems, it is important to incorporate extended detention into the design to retain usable treatment area above the permanent pool when it is frozen.

Summary of Design Recommendations

(1) Facility Sizing – The basin should be sized to hold the permanent pool as well as the required water quality volume. The volume of the permanent pool should equal twice the water quality volume.

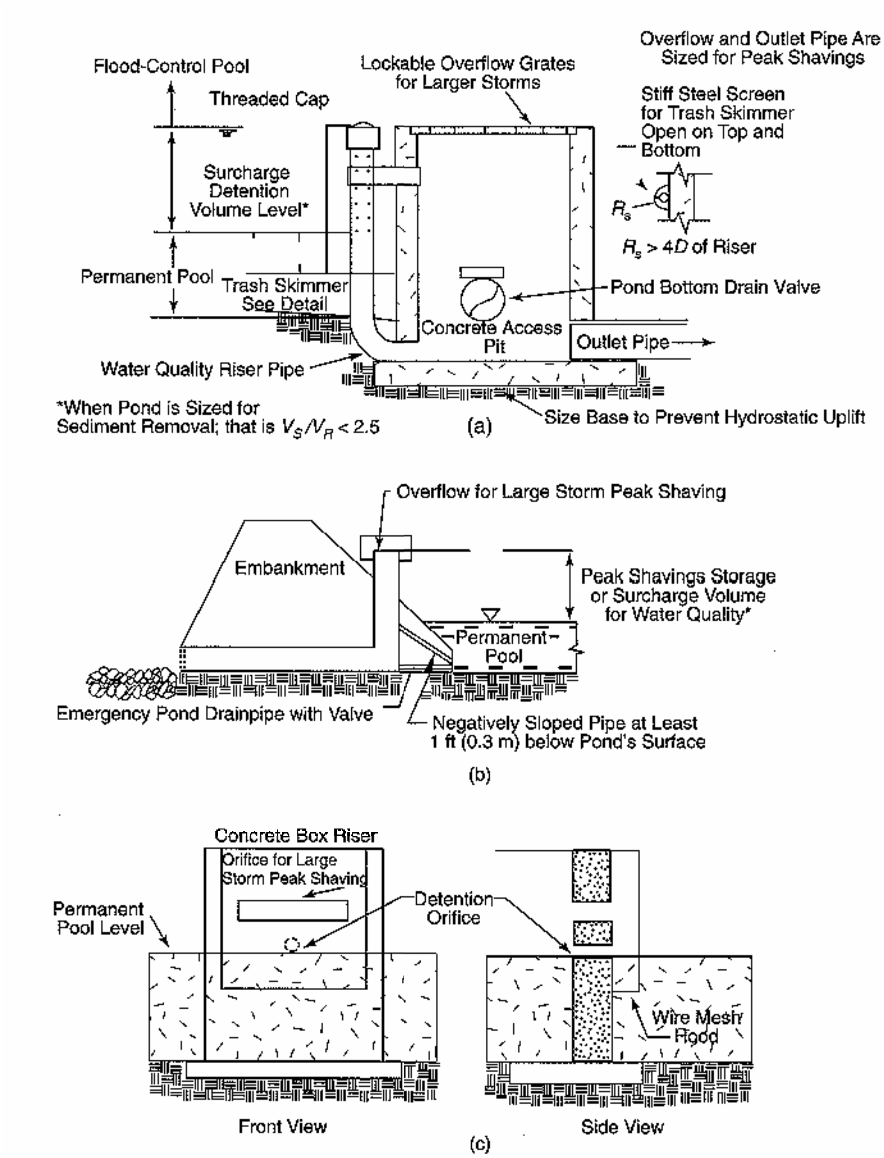
(2) Pond Configuration - The wet basin should be configured as a two stage facility with a sediment forebay and a main pool. The basins should be wedge-shaped, narrowest at the inlet and widest at the outlet. The minimum length to width ratio should be 1.5 where feasible. The perimeter of all permanent pool areas with depths of 4.0 feet or greater should be surrounded by an aquatic bench. This bench should extend inward 5-10 feet from the perimeter of the permanent pool and should be no more than 18 inches below normal depth. The area of the bench should not exceed about 25% of pond surface. The depth in the center of the basin should be 4 – 8 feet deep to prevent vegetation from encroaching on the pond open water surface.

(3) Pond Side Slopes - Side slopes of the basin should be 3:1 (H:V) or flatter for grass stabilized slopes. Slopes steeper than 3:1 should be stabilized with an appropriate slope stabilization practice.

(4) Sediment Forebay - A sediment forebay should be used to isolate gross sediments as they enter the facility and to simplify sediment removal. The sediment forebay should consist of a separate cell formed by an earthen berm, gabion, or loose riprap wall. The forebay should be sized to contain 15 to 25% of the permanent pool volume and should be at least 3 feet deep. Exit velocities from the forebay should not be erosive. Direct maintenance access should be provided to the forebay. The bottom of the forebay may be hardened (concrete) to make sediment removal easier. A fixed vertical sediment depth marker should be installed in the forebay to measure sediment accumulation.

(5) Outflow Structure - Figure 2 presents a schematic representation of suggested outflow structures. The outlet structure should be designed to drain the water quality volume over 24 hours with the orifice sized according to the equation presented in the Extended Detention Basin fact sheet. The facility should have a separate drain pipe with a manual valve that can completely or partially drain the pond for maintenance purposes. To allow for possible sediment accumulation, the submerged end of the pipe should be protected, and the drain pipe should be sized to drain the pond within 24 hours. The valve should be located at a point where it can be operated in a safe and convenient manner.

For on-line facilities, the principal and emergency spillways must be sized to provide 1.0 foot of freeboard during the 25-year event and to safely pass the 100-year flood. The embankment should be designed in accordance with all relevant specifications for small dams.



(6) Splitter Box - When the pond is designed as an off-line facility, a splitter structure is used to isolate the water quality volume. The splitter box, or other flow diverting approach, should be designed to convey the 25-year event while providing at least 1.0 foot of freeboard along pond side slopes.

(7) Vegetation - A plan should be prepared that indicates how aquatic and terrestrial areas will be vegetatively stabilized. Wetland vegetation elements should be placed along the aquatic bench or in the shallow portions of the permanent pool. The optimal elevation for planting of wetland vegetation is within 6 inches vertically of the normal pool elevation. A list of some wetland vegetation native to California is presented in Table 1.

Table 1 California Wetland Vegetation	
Botanical Name	**Common Name**
BACCHARIS SALICIFOLIA	MULE FAT
FRANKENIA GRANDIFOLIA	HEATH
SALIX GOODINGII	BLACK WILLOW
SALIX LASIOLEPIS	ARROYO WILLOW
SAMUCUS MEXICANUS	MEXICAN ELDERBERRY
HAPLOPAPPUS VENETUS	COAST GOLDENBRUSH
DISTICHIS SPICATA	SALT GRASS
LIMONIUM CALIFORNICUM	COASTAL STATICE
ATRIPLEX LENTIFORMIS	COASTAL QUAIL BUSH
BACCHARIS PILULARIS	CHAPARRAL BROOM
MIMULUS LONGIFLORUS	MONKEY FLOWER
SCIRPUS CALIFORNICUS	BULRUSH
SCIRPUS ROBUSTUS	BULRUSH
TYPHA LATIFOLIA	BROADLEAF CATTAIL
JUNCUS ACUTUS	RUSH

Maintenance

The amount of maintenance required for a wet pond is highly dependent on local regulatory agencies, particular health and vector control agencies. These agencies are often extremely concerned about the potential for mosquito breeding that may occur in the permanent pool. Even though mosquito fish (*Gambusia affinis*) were introduced into a wet pond constructed by Caltrans in the San Diego area, mosquito breeding was routinely observed during inspections. In addition, the vegetation at this site became sufficiently dense on the bench around the edge of the pool that mosquito fish were unable to enter this area to feed upon the mosquito larvae. The vegetation at this site was particularly vigorous because of the high nutrient concentrations in the perennial base flow (15.5 mg/L NO3-N) and the mild climate, which permitted growth year round. Consequently, the vector control agency required an annual harvest of vegetation to address this situation. This harvest can be very expensive.

On the other hand, routine harvesting may increase nutrient removal and prevent the export of these constituents from dead and dying plants falling in the water. A previous study (Faulkner and Richardson, 1991) documented dramatic reductions in nutrient removal after the first several years of operation and related it to the vegetation achieving a maximum density. That content then decreases through the growth season, as the total biomass increases. In effect, the total amount of nutrients/m2 of wetland remains essentially the same from June through September, when the plants start to put the P back into the rhizomes. Therefore harvesting should occur between June and September. Research also suggests that harvesting only the foliage is less effective, since a very small percentage of the removed nutrients is taken out with harvesting.

Since wet ponds are often selected for their aesthetic considerations as well as pollutant removal, they are often sited in areas of high visibility. Consequently, floating litter and debris are removed more frequently than would be required simply to support proper functioning of the pond and outlet. This is one of the primary maintenance activities performed at the Central Market Pond located in Austin, Texas. In this type of setting, vegetation management in the area surrounding the pond can also contribute substantially to the overall maintenance requirements.

One normally thinks of sediment removal as one of the typical activities performed at stormwater BMPs. This activity does not normally constitute one of the major activities on an annual basis. At the concentrations of TSS observed in urban runoff from stable watersheds, sediment removal may only be required every 20 years or so. Because this activity is performed so infrequently, accurate costs for this activity are lacking.

In addition to regular maintenance activities needed to maintain the function of wet ponds, some design features can be incorporated to ease the maintenance burden. In wet ponds, maintenance reduction features include techniques to reduce the amount of maintenance needed, as well as techniques to make regular maintenance activities easier.

One potential maintenance concern in wet ponds is clogging of the outlet. Ponds should be designed with a non-clogging outlet such as a reverse-slope pipe, or a weir outlet with a trash rack. A reverse-slope pipe draws from below the permanent pool extending in a reverse angle up to the riser and establishes the water elevation of the permanent pool. Because these outlets draw water from below the level of the permanent pool, they are less likely to be clogged by floating debris.

Typical maintenance activities and frequencies include:

- Schedule semiannual inspections for burrows, sediment accumulation, structural integrity of the outlet, and litter accumulation.

- Remove accumulated trash and debris in the basin at the middle and end of the wet season. The frequency of this activity may be altered to meet specific site conditions and aesthetic considerations.

- Where permitted by the Department of Fish and Game or other agency regulations, stock wet ponds/constructed wetlands regularly with mosquito fish (*Gambusia spp.*) to enhance natural mosquito and midge control.

- Introduce mosquito fish and maintain vegetation to assist their movements to control mosquitoes, as well as to provide access for vector inspectors. An annual vegetation harvest in summer appears to be optimum, in that it is after the bird breeding season, mosquito fish can provide the needed control until vegetation reaches late summer density, and there is time for re-growth for runoff treatment purposes before the wet season. In certain cases, more frequent plant harvesting may be required by local vector control agencies.

- Maintain emergent and perimeter shoreline vegetation as well as site and road access to facilitate vector surveillance and control activities.

- Remove accumulated sediment in the forebay and regrade about every 5-7 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Sediment removal may not be required in the main pool area for as long as 20 years.

Cost

Construction Cost

Wet ponds can be relatively inexpensive stormwater practices; however, the construction costs associated with these facilities vary considerably. Much of this variability can be attributed to the degree to which the existing topography will support a wet pond, the complexity and amount of concrete required for the outlet structure, and whether it is installed as part of new construction or implemented as a retrofit of existing storm drain system.

A recent study (Brown and Schueler, 1997) estimated the cost of a variety of stormwater management practices. The study resulted in the following cost equation, adjusting for inflation:

$$C = 24.5^{V0.705}$$

where:

C = Construction, design and permitting cost;

V = Volume in the pond to include the 10-year storm (ft^3).

Using this equation, typical construction costs are:

$45,700 for a 1 acre-foot facility

$232,000 for a 10 acre-foot facility

$1,170,000 for a 100 acre-foot facility

In contrast, Caltrans (2002) reported spending over $448,000 for a pond with a total permanent pool plus water quality volume of only 1036 m^3 (0.8 ac.-ft.), while the City of Austin spent $584,000 (including design) for a pond with a permanent pool volume of 3,100 m^3 (2.5 ac.-ft.). The large discrepancies between the costs of these actual facilities and the model developed by Brown and Schueler indicate that construction costs are highly site specific, depending on topography, soils, subsurface conditions, the local labor, rate and other considerations.

Maintenance Cost

For ponds, the annual cost of routine maintenance has typically been estimated at about 3 to 5 percent of the construction cost; however, the published literature is almost totally devoid of actual maintenance costs. Since ponds are long-lived facilities (typically longer than 20 years), major maintenance activities are unlikely to occur during a relatively short study.

Caltrans (2002) estimated annual maintenance costs of $17,000 based on three years of monitoring of a pond treating runoff from 1.7 ha. Almost all the activities are associated with the annual vegetation harvest for vector control. Total cost at this site falls within the 3-5% range reported above; however, the construction costs were much higher than those estimated by Brown and Schueler (1997). The City of Austin has been reimbursing a developer about $25,000/yr for wet pond maintenance at a site located at a very visible location. Maintenance costs are mainly the result of vegetation management and litter removal. On the other hand, King County estimates annual maintenance costs at about $3,000 per pond; however, this cost likely does not include annual extensive vegetation removal. Consequently, maintenance costs may vary considerably at sites in California depending on the aggressiveness of the vegetation management in that area and the frequency of litter removal.

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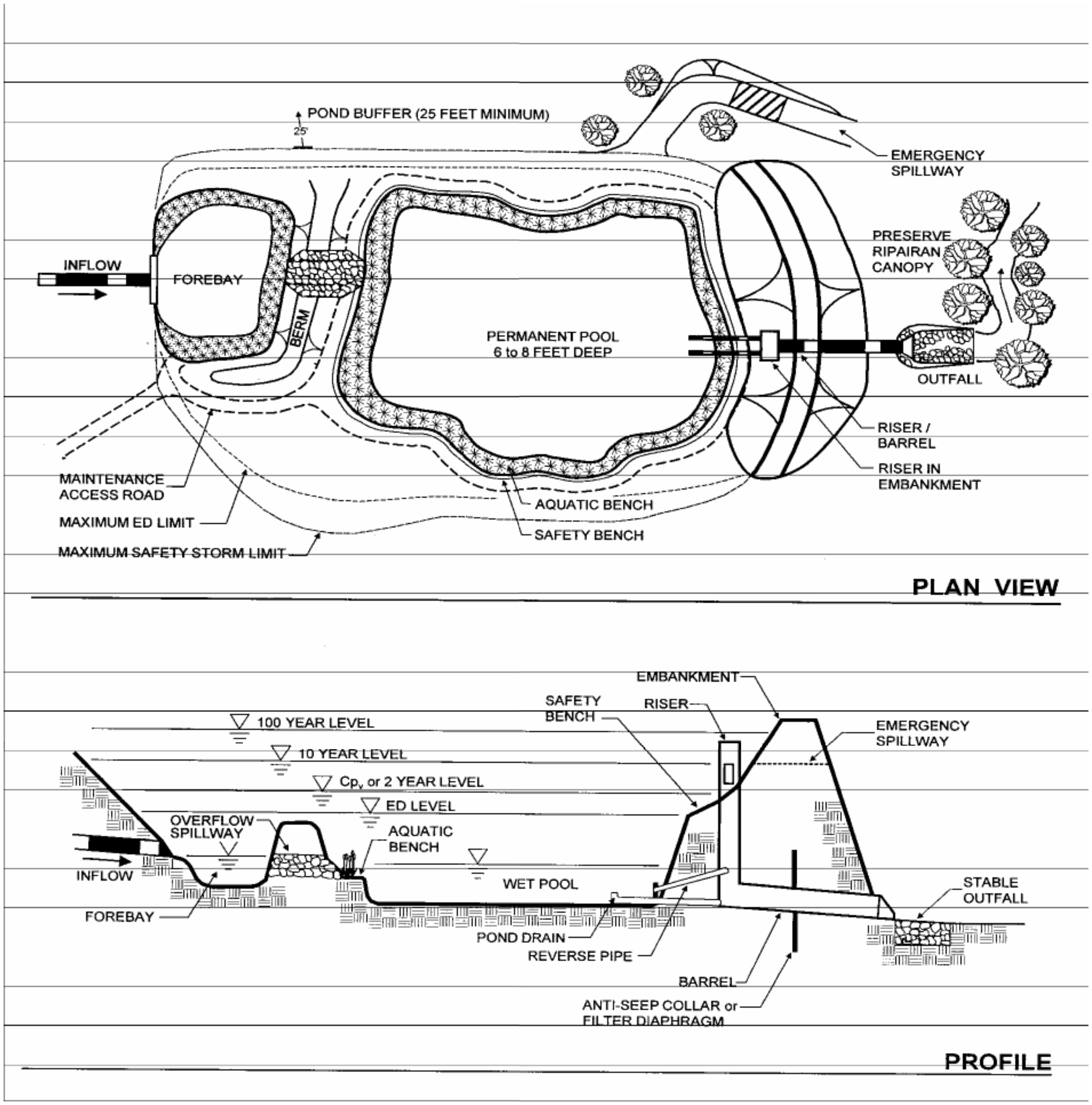

POND BUFFER (25 FEET MINIMUM)
25'
EMERGENCY SPILLWAY
INFLOW
FOREBAY
BERM
PRESERVE RIPAIRAN CANOPY
PERMANENT POOL 6 to 8 FEET DEEP
OUTFALL
RISER / BARREL
RISER IN EMBANKMENT
MAINTENANCE ACCESS ROAD
MAXIMUM ED LIMIT
AQUATIC BENCH
SAFETY BENCH
MAXIMUM SAFETY STORM LIMIT
PLAN VIEW
EMBANKMENT
SAFETY BENCH
RISER
100 YEAR LEVEL
10 YEAR LEVEL
Cp, or 2 YEAR LEVEL
ED LEVEL
EMERGENCY SPILLWAY
OVERFLOW SPILLWAY
AQUATIC BENCH
INFLOW
WET POOL
STABLE OUTFALL
FOREBAY
POND DRAIN
REVERSE PIPE
BARREL
ANTI-SEEP COLLAR or FILTER DIAPHRAGM
PROFILE

Appendix D

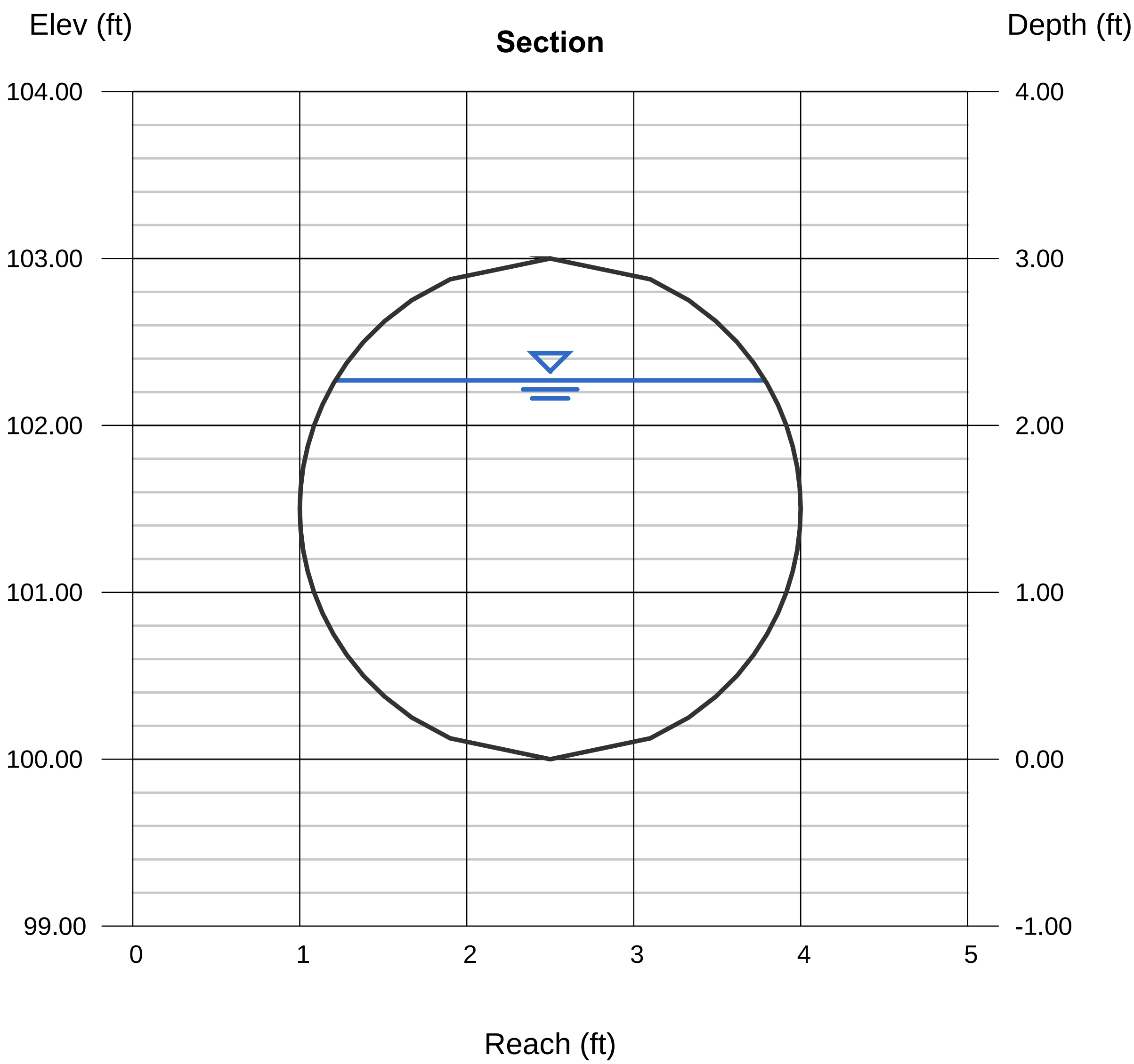
Drainage Structure Sizing

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Apr 7 2017

Alternative A: Drainage Area #1

Circular		**Highlighted**	
Diameter (ft)	= 3.00	Depth (ft)	= 2.27
		Q (cfs)	= 47.00
		Area (sqft)	= 5.74
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 8.19
Slope (%)	= 0.50	Wetted Perim (ft)	= 6.33
N-Value	= 0.012	Crit Depth, Yc (ft)	= 2.24
		Top Width (ft)	= 2.57
Calculations		EGL (ft)	= 3.31
Compute by:	Known Q		
Known Q (cfs)	= 47.00		

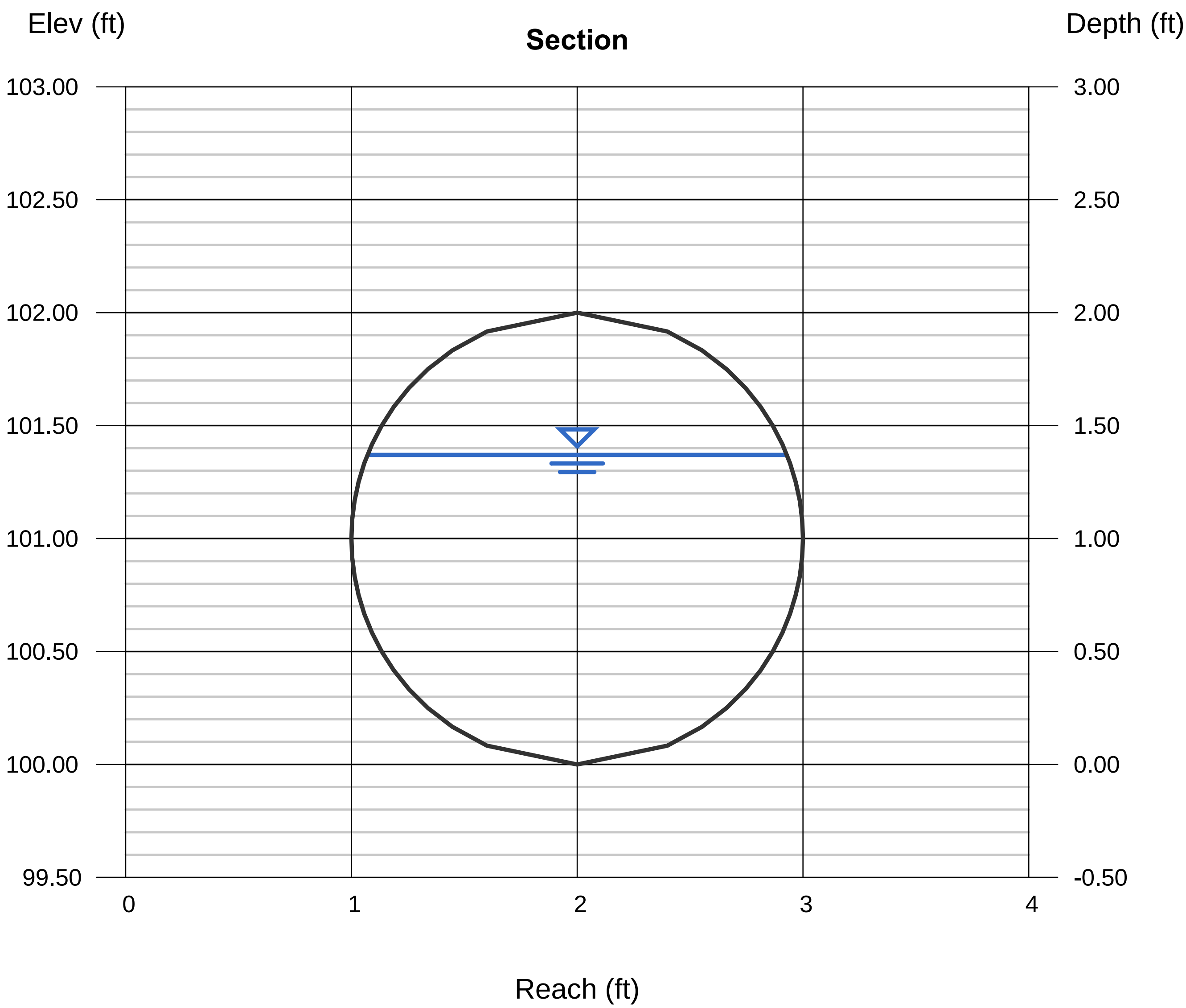


Channel Report

Alternative A: Drainage Areas #2 and #4

Circular	
Diameter (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.012
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 14.00

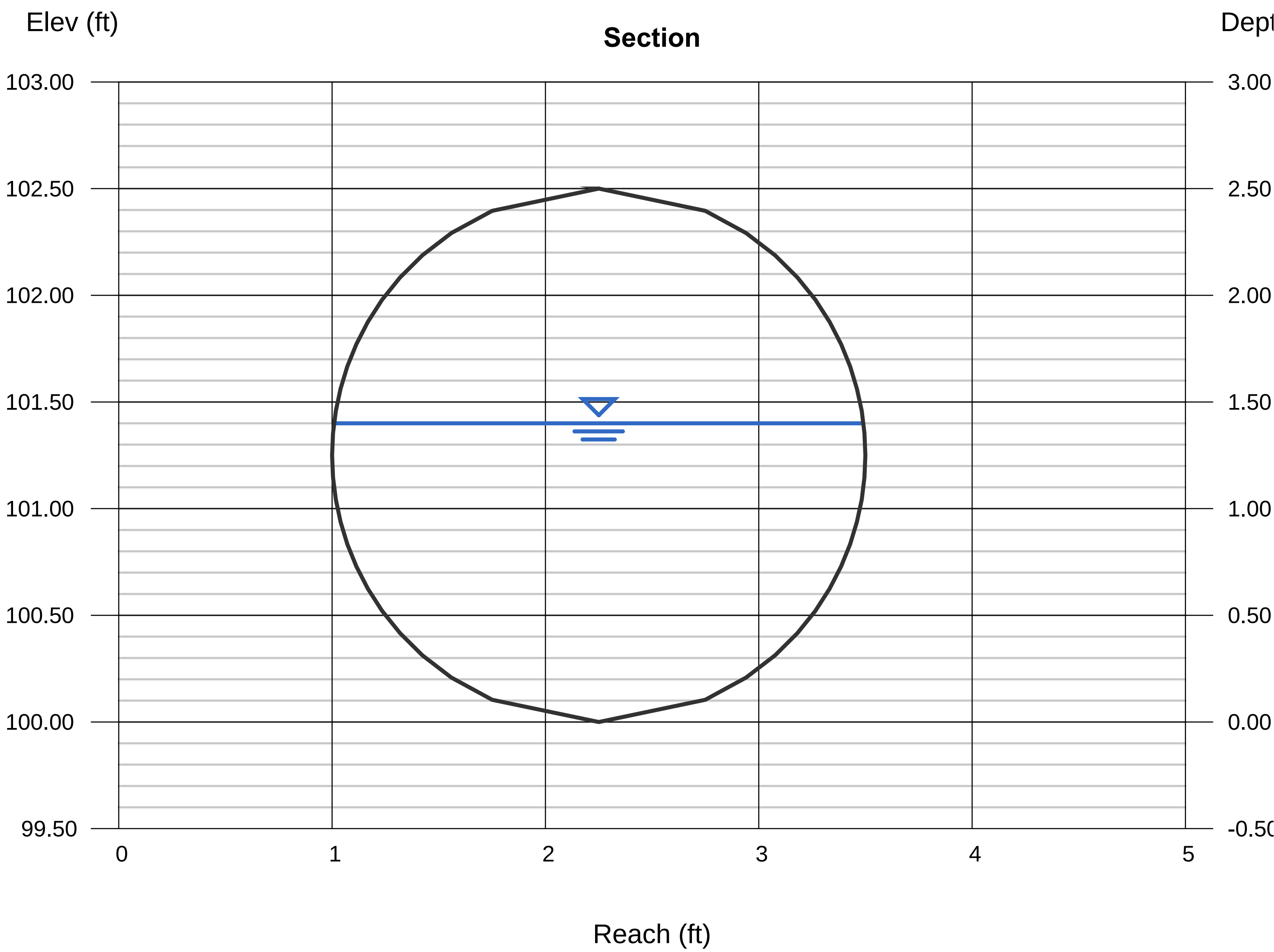
Highlighted	
Depth (ft)	= 1.37
Q (cfs)	= 14.00
Area (sqft)	= 2.29
Velocity (ft/s)	= 6.10
Wetted Perim (ft)	= 3.90
Crit Depth, Yc (ft)	= 1.35
Top Width (ft)	= 1.86
EGL (ft)	= 1.95



Channel Report

Alternative A: Drainage Area #3

Circular		**Highlighted**	
Diameter (ft)	= 2.50	Depth (ft)	= 1.40
		Q (cfs)	= 19.00
		Area (sqft)	= 2.84
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 6.69
Slope (%)	= 0.50	Wetted Perim (ft)	= 4.24
N-Value	= 0.012	Crit Depth, Yc (ft)	= 1.48
		Top Width (ft)	= 2.48
Calculations		EGL (ft)	= 2.10
Compute by:	Known Q		
Known Q (cfs)	= 19.00		



Channel Report

Alternative B: Drainage Area #1

Circular

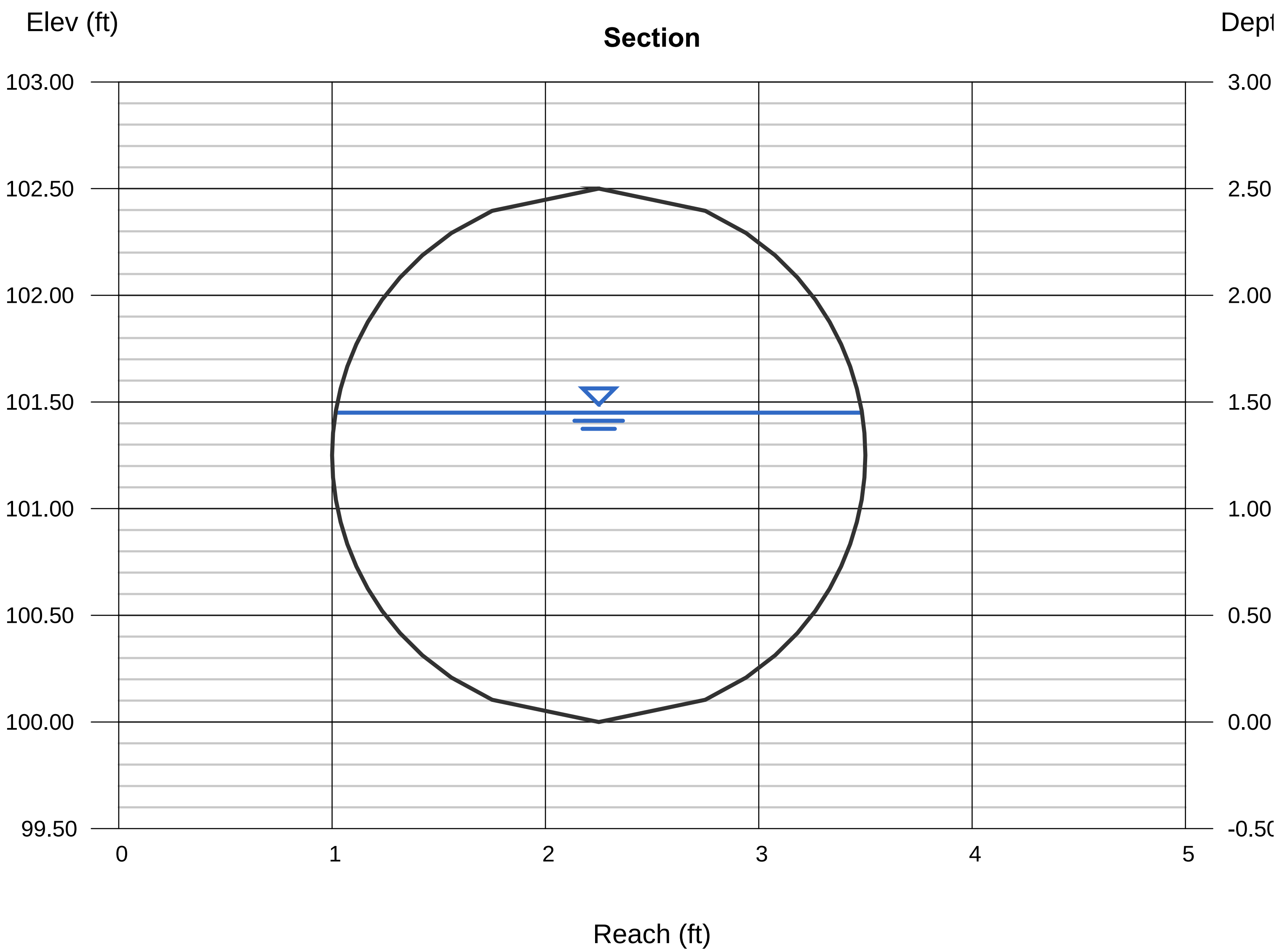
Diameter (ft)	= 2.50
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 20.00

Highlighted

Depth (ft)	= 1.45
Q (cfs)	= 20.00
Area (sqft)	= 2.96
Velocity (ft/s)	= 6.75
Wetted Perim (ft)	= 4.34
Crit Depth, Yc (ft)	= 1.52
Top Width (ft)	= 2.47
EGL (ft)	= 2.16

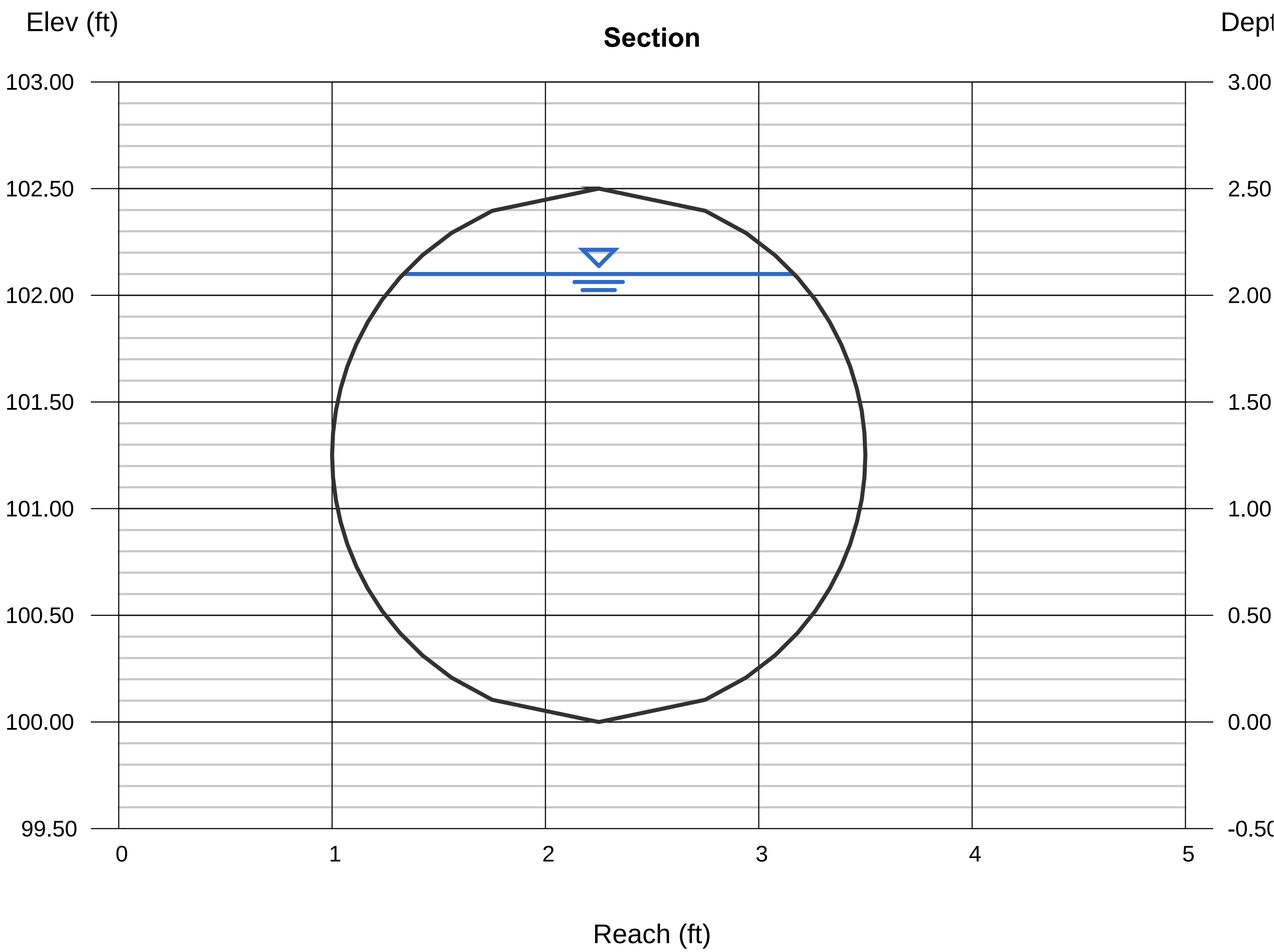


Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Apr 7 2017

Alternative D: Drainage Area #1

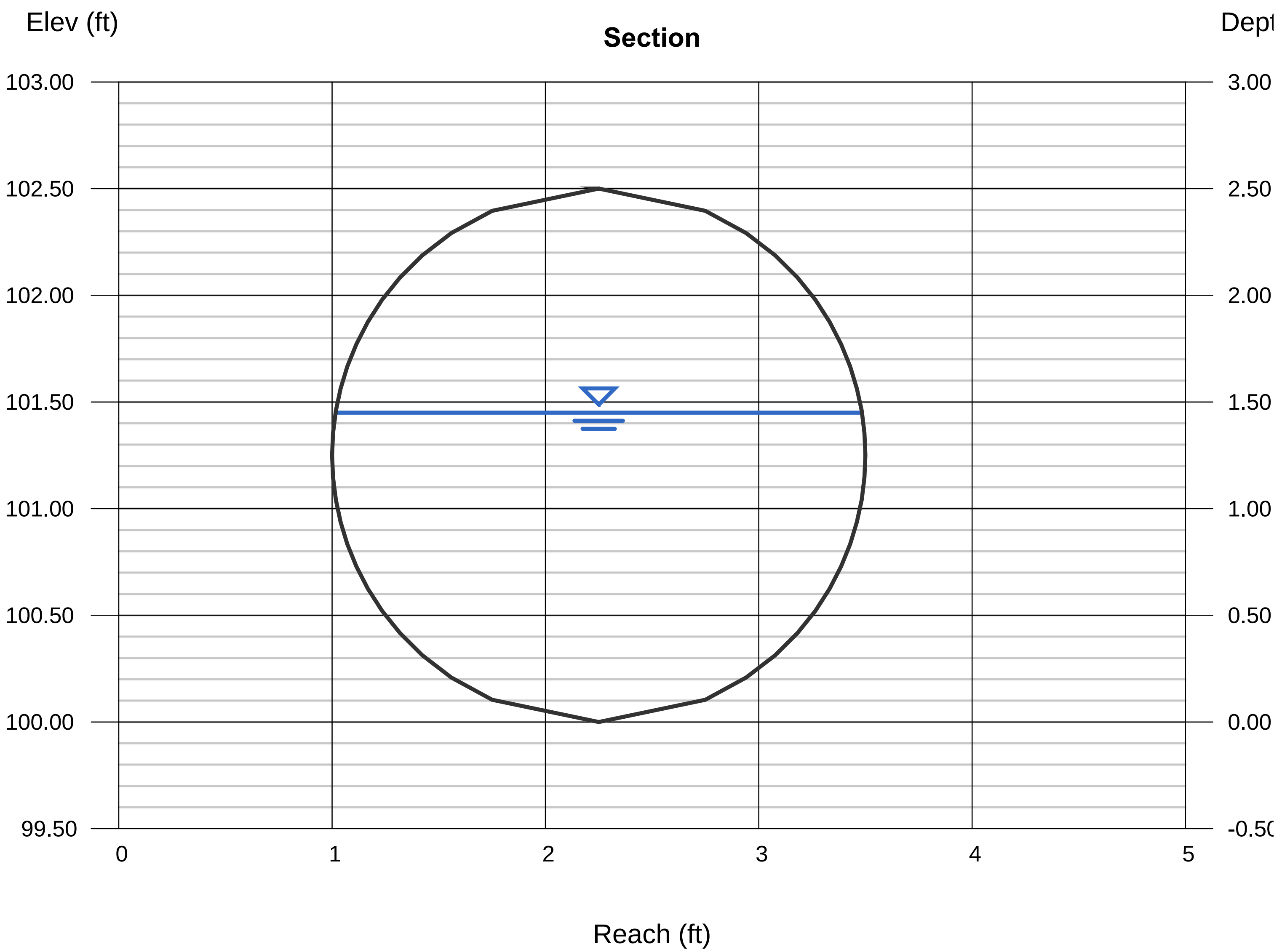
Circular		**Highlighted**	
Diameter (ft)	= 2.50	Depth (ft)	= 2.10
		Q (cfs)	= 32.00
		Area (sqft)	= 4.40
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 7.27
Slope (%)	= 0.50	Wetted Perim (ft)	= 5.80
N-Value	= 0.012	Crit Depth, Yc (ft)	= 1.93
		Top Width (ft)	= 1.83
Calculations		EGL (ft)	= 2.92
Compute by:	Known Q		
Known Q (cfs)	= 32.00		



Channel Report

Alternative D: Drainage Area #2

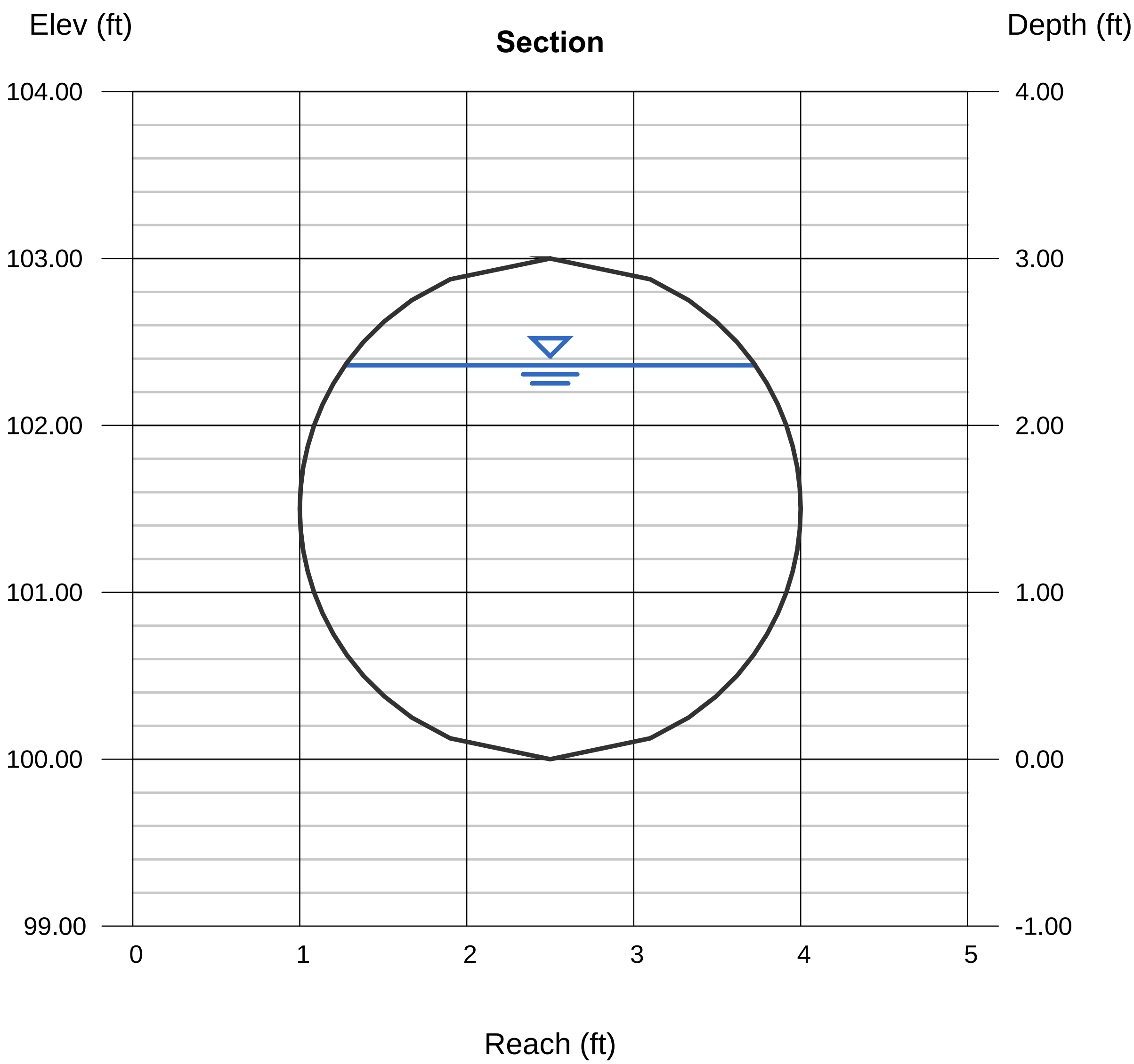
Circular			**Highlighted**	
Diameter (ft)	= 2.50		Depth (ft)	= 1.45
			Q (cfs)	= 20.00
			Area (sqft)	= 2.96
Invert Elev (ft)	= 100.00		Velocity (ft/s)	= 6.75
Slope (%)	= 0.50		Wetted Perim (ft)	= 4.34
N-Value	= 0.012		Crit Depth, Yc (ft)	= 1.52
			Top Width (ft)	= 2.47
Calculations			EGL (ft)	= 2.16
Compute by:	Known Q			
Known Q (cfs)	= 20.00			



Channel Report

Alternative E: Drainage Area #1

Circular		**Highlighted**	
Diameter (ft)	= 3.00	Depth (ft)	= 2.36
		Q (cfs)	= 49.00
		Area (sqft)	= 5.98
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 8.20
Slope (%)	= 0.50	Wetted Perim (ft)	= 6.56
N-Value	= 0.012	Crit Depth, Yc (ft)	= 2.28
		Top Width (ft)	= 2.45
Calculations		EGL (ft)	= 3.41
Compute by:	Known Q		
Known Q (cfs)	= 49.00		



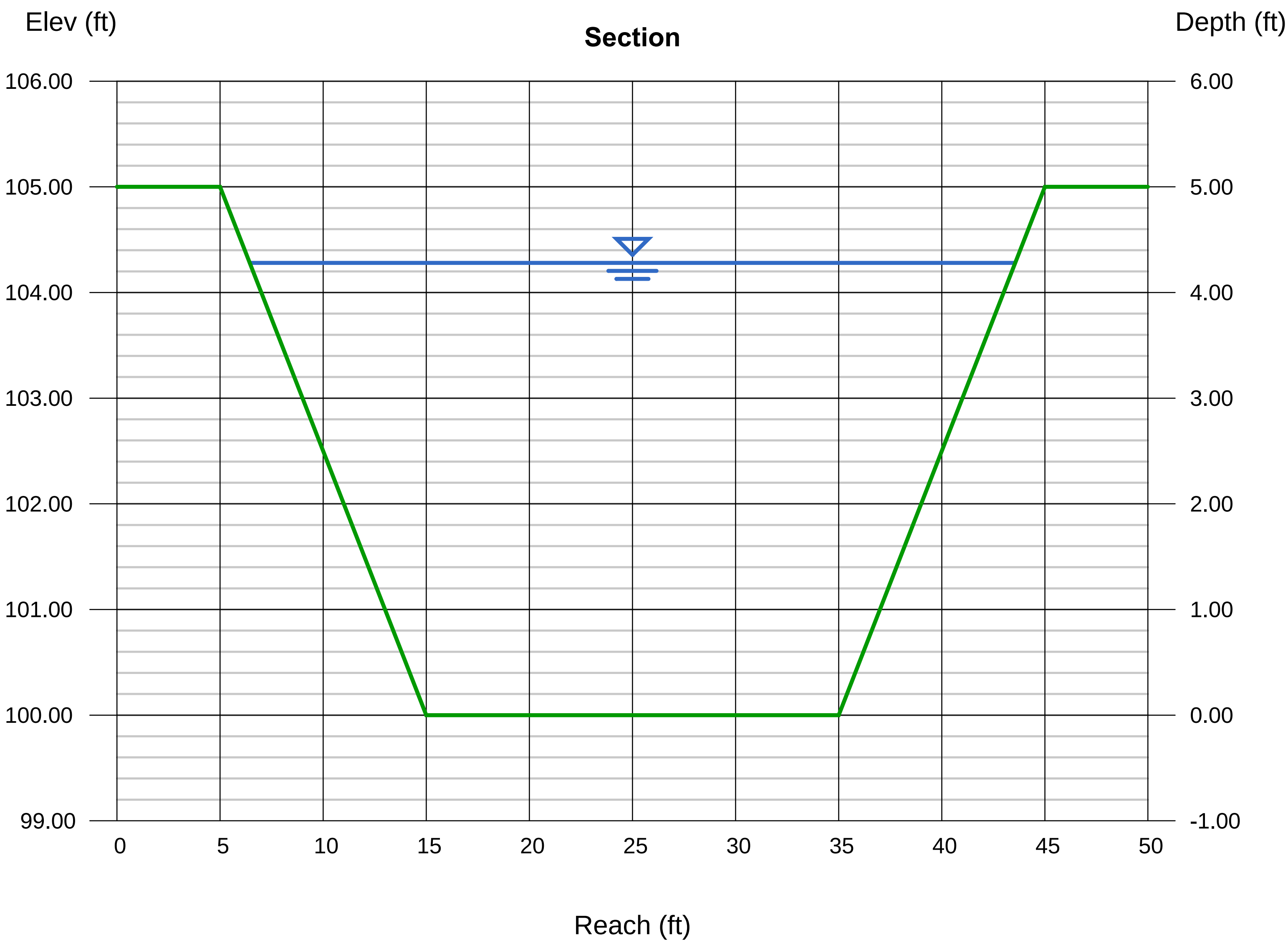
Channel Report

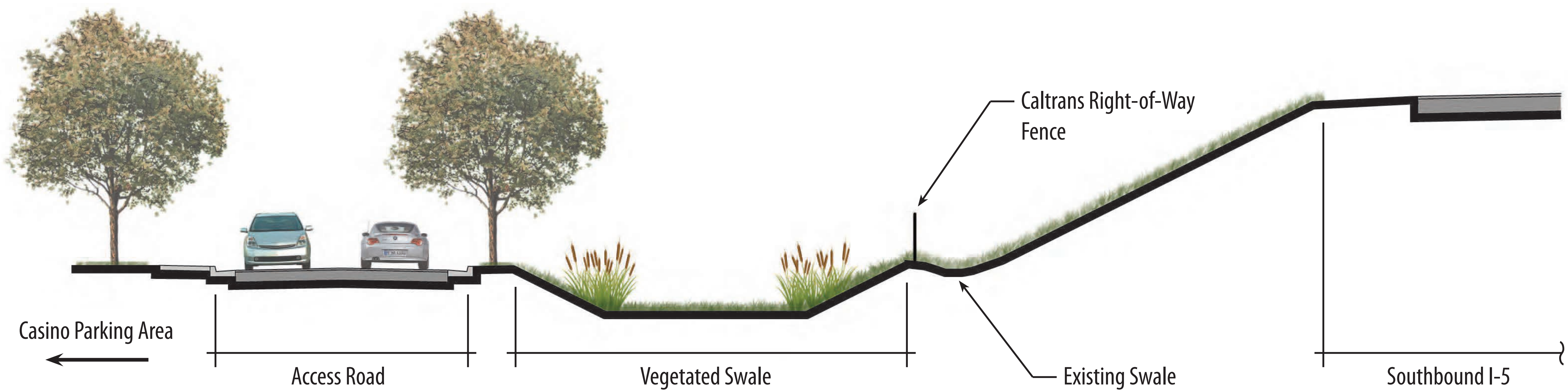
Proposed Earthen Infiltration Channel

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 20.00	Depth (ft)	= 4.28
Side Slopes (z:1)	= 2.00, 2.00	Q (cfs)	= 700.00
Total Depth (ft)	= 5.00	Area (sqft)	= 122.24
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 5.73
Slope (%)	= 0.40	Wetted Perim (ft)	= 39.14
N-Value	= 0.035	Crit Depth, Yc (ft)	= 3.03
		Top Width (ft)	= 37.12
		EGL (ft)	= 4.79

Calculations

Compute by:	Known Q
Known Q (cfs)	= 700.00




Caltrans Right-of-Way Fence
Casino Parking Area
Access Road
Vegetated Swale
Existing Swale
Southbound I-5

NOT TO SCALE

Design Considerations

- Tributary Area
- Area Required
- Slope
- Water Availability

Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems.

Targeted Constituents

☑	Sediment	▲
☑	Nutrients	●
☑	Trash	●
☑	Metals	▲
☑	Bacteria	●
☑	Oil and Grease	▲
☑	Organics	▲

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

California Experience

Caltrans constructed and monitored six vegetated swales in southern California. These swales were generally effective in reducing the volume and mass of pollutants in runoff. Even in the areas where the annual rainfall was only about 10 inches/yr, the vegetation did not require additional irrigation. One factor that strongly affected performance was the presence of large numbers of gophers at most of the sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- If properly designed, vegetated, and operated, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant collateral water quality benefits.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible.

Limitations

- Can be difficult to avoid channelization.
- May not be appropriate for industrial sites or locations where spills may occur
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.
- Swales are mores susceptible to failure if not properly maintained than other treatment BMPs.

Design and Sizing Guidelines

- Flow rate based design determined by local requirements or sized so that 85% of the annual runoff volume is discharged at less than the design rainfall intensity.
- Swale should be designed so that the water level does not exceed 2/3rds the height of the grass or 4 inches, which ever is less, at the design treatment rate.
- Longitudinal slopes should not exceed 2.5%
- Trapezoidal channels are normally recommended but other configurations, such as parabolic, can also provide substantial water quality improvement and may be easier to mow than designs with sharp breaks in slope.
- Swales constructed in cut are preferred, or in fill areas that are far enough from an adjacent slope to minimize the potential for gopher damage. Do not use side slopes constructed of fill, which are prone to structural damage by gophers and other burrowing animals.
- A diverse selection of low growing, plants that thrive under the specific site, climatic, and watering conditions should be specified. Vegetation whose growing season corresponds to the wet season are preferred. Drought tolerant vegetation should be considered especially for swales that are not part of a regularly irrigated landscaped area.
- The width of the swale should be determined using Manning's Equation using a value of 0.25 for Manning's n.

Construction/Inspection Considerations

- Include directions in the specifications for use of appropriate fertilizer and soil amendments based on soil properties determined through testing and compared to the needs of the vegetation requirements.

- Install swales at the time of the year when there is a reasonable chance of successful establishment without irrigation; however, it is recognized that rainfall in a given year may not be sufficient and temporary irrigation may be used.

- If sod tiles must be used, they should be placed so that there are no gaps between the tiles; stagger the ends of the tiles to prevent the formation of channels along the swale or strip.

- Use a roller on the sod to ensure that no air pockets form between the sod and the soil.

- Where seeds are used, erosion controls will be necessary to protect seeds for at least 75 days after the first rainfall of the season.

Performance

The literature suggests that vegetated swales represent a practical and potentially effective technique for controlling urban runoff quality. While limited quantitative performance data exists for vegetated swales, it is known that check dams, slight slopes, permeable soils, dense grass cover, increased contact time, and small storm events all contribute to successful pollutant removal by the swale system. Factors decreasing the effectiveness of swales include compacted soils, short runoff contact time, large storm events, frozen ground, short grass heights, steep slopes, and high runoff velocities and discharge rates.

Conventional vegetated swale designs have achieved mixed results in removing particulate pollutants. A study performed by the Nationwide Urban Runoff Program (NURP) monitored three grass swales in the Washington, D.C., area and found no significant improvement in urban runoff quality for the pollutants analyzed. However, the weak performance of these swales was attributed to the high flow velocities in the swales, soil compaction, steep slopes, and short grass height.

Another project in Durham, NC, monitored the performance of a carefully designed artificial swale that received runoff from a commercial parking lot. The project tracked 11 storms and concluded that particulate concentrations of heavy metals (Cu, Pb, Zn, and Cd) were reduced by approximately 50 percent. However, the swale proved largely ineffective for removing soluble nutrients.

The effectiveness of vegetated swales can be enhanced by adding check dams at approximately 17 meter (50 foot) increments along their length (See Figure 1). These dams maximize the retention time within the swale, decrease flow velocities, and promote particulate settling. Finally, the incorporation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.

Only 9 studies have been conducted on all grassed channels designed for water quality (Table 1). The data suggest relatively high removal rates for some pollutants, but negative removals for some bacteria, and fair performance for phosphorus.

Table 1 Grassed swale pollutant removal efficiency data							
Removal Efficiencies (% Removal)							
Study	**TSS**	**TP**	**TN**	**NO_3**	**Metals**	**Bacteria**	**Type**
Caltrans 2002	77	8	67	66	83-90	-33	dry swales
Goldberg 1993	67.8	4.5	-	31.4	42–62	-100	grassed channel
Seattle Metro and Washington Department of Ecology 1992	60	45	-	-25	2–16	-25	grassed channel
Seattle Metro and Washington Department of Ecology, 1992	83	29	-	-25	46–73	-25	grassed channel
Wang et al., 1981	80	-	-	-	70–80	-	dry swale
Dorman et al., 1989	98	18	-	45	37–81	-	dry swale
Harper, 1988	87	83	84	80	88–90	-	dry swale
Kercher et al., 1983	99	99	99	99	99	-	dry swale
Harper, 1988.	81	17	40	52	37–69	-	wet swale
Koon, 1995	67	39	-	9	-35 to 6	-	wet swale

While it is difficult to distinguish between different designs based on the small amount of available data, grassed channels generally have poorer removal rates than wet and dry swales, although some swales appear to export soluble phosphorus (Harper, 1988; Koon, 1995). It is not clear why swales export bacteria. One explanation is that bacteria thrive in the warm swale soils.

Siting Criteria

The suitability of a swale at a site will depend on land use, size of the area serviced, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the swale system (Schueler et al., 1992). In general, swales can be used to serve areas of less than 10 acres, with slopes no greater than 5 %. Use of natural topographic lows is encouraged and natural drainage courses should be regarded as significant local resources to be kept in use (Young et al., 1996).

Selection Criteria (NCTCOG, 1993)

- Comparable performance to wet basins
- Limited to treating a few acres
- Availability of water during dry periods to maintain vegetation
- Sufficient available land area

Research in the Austin area indicates that vegetated controls are effective at removing pollutants even when dormant. Therefore, irrigation is not required to maintain growth during dry periods, but may be necessary only to prevent the vegetation from dying.

The topography of the site should permit the design of a channel with appropriate slope and cross-sectional area. Site topography may also dictate a need for additional structural controls. Recommendations for longitudinal slopes range between 2 and 6 percent. Flatter slopes can be used, if sufficient to provide adequate conveyance. Steep slopes increase flow velocity, decrease detention time, and may require energy dissipating and grade check. Steep slopes also can be managed using a series of check dams to terrace the swale and reduce the slope to within acceptable limits. The use of check dams with swales also promotes infiltration.

Additional Design Guidelines

Most of the design guidelines adopted for swale design specify a minimum hydraulic residence time of 9 minutes. This criterion is based on the results of a single study conducted in Seattle, Washington (Seattle Metro and Washington Department of Ecology, 1992), and is not well supported. Analysis of the data collected in that study indicates that pollutant removal at a residence time of 5 minutes was not significantly different, although there is more variability in that data. Therefore, additional research in the design criteria for swales is needed. Substantial pollutant removal has also been observed for vegetated controls designed solely for conveyance (Barrett et al, 1998); consequently, some flexibility in the design is warranted.

Many design guidelines recommend that grass be frequently mowed to maintain dense coverage near the ground surface. Recent research (Colwell et al., 2000) has shown mowing frequency or grass height has little or no effect on pollutant removal.

Summary of Design Recommendations

1) The swale should have a length that provides a minimum hydraulic residence time of at least 10 minutes. The maximum bottom width should not exceed 10 feet unless a dividing berm is provided. The depth of flow should not exceed 2/3rds the height of the grass at the peak of the water quality design storm intensity. The channel slope should not exceed 2.5%.

2) A design grass height of 6 inches is recommended.

3) Regardless of the recommended detention time, the swale should be not less than 100 feet in length.

4) The width of the swale should be determined using Manning's Equation, at the peak of the design storm, using a Manning's n of 0.25.

5) The swale can be sized as both a treatment facility for the design storm and as a conveyance system to pass the peak hydraulic flows of the 100-year storm if it is located "on-line." The side slopes should be no steeper than 3:1 (H:V).

6) Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible. If flow is to be introduced through curb cuts, place pavement slightly above the elevation of the vegetated areas. Curb cuts should be at least 12 inches wide to prevent clogging.

7) Swales must be vegetated in order to provide adequate treatment of runoff. It is important to maximize water contact with vegetation and the soil surface. For general purposes, select fine, close-growing, water-resistant grasses. If possible, divert runoff (other than necessary irrigation) during the period of vegetation

establishment. Where runoff diversion is not possible, cover graded and seeded areas with suitable erosion control materials.

Maintenance

The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely. The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover.

Maintenance activities should include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Cuttings should be removed from the channel and disposed in a local composting facility. Accumulated sediment should also be removed manually to avoid concentrated flows in the swale. The application of fertilizers and pesticides should be minimal.

Another aspect of a good maintenance plan is repairing damaged areas within a channel. For example, if the channel develops ruts or holes, it should be repaired utilizing a suitable soil that is properly tamped and seeded. The grass cover should be thick; if it is not, reseed as necessary. Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Residuals (e.g., silt, grass cuttings) must be disposed in accordance with local or State requirements. Maintenance of grassed swales mostly involves maintenance of the grass or wetland plant cover. Typical maintenance activities are summarized below:

- Inspect swales at least twice annually for erosion, damage to vegetation, and sediment and debris accumulation preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the swale is ready for winter. However, additional inspection after periods of heavy runoff is desirable. The swale should be checked for debris and litter, and areas of sediment accumulation.

- Grass height and mowing frequency may not have a large impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

- Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.

- Sediment accumulating near culverts and in channels should be removed when it builds up to 75 mm (3 in.) at any spot, or covers vegetation.

- Regularly inspect swales for pools of standing water. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g. debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained.

Cost

Construction Cost

Little data is available to estimate the difference in cost between various swale designs. One study (SWRPC, 1991) estimated the construction cost of grassed channels at approximately \$0.25 per ft^2. This price does not include design costs or contingencies. Brown and Schueler (1997) estimate these costs at approximately 32 percent of construction costs for most stormwater management practices. For swales, however, these costs would probably be significantly higher since the construction costs are so low compared with other practices. A more realistic estimate would be a total cost of approximately \$0.50 per ft^2, which compares favorably with other stormwater management practices.

Table 2 Swale Cost Estimate (SEWRPC, 1991)

Component	Unit	Extent	Unit Cost			Total Cost		
			Low	Moderate	High	Low	Moderate	High
Mobilization / Demobilization-Light	Swale	1	$107	$274	$441	$107	$274	$441
Site Preparation								
Clearing[b]...............	Acre	0.5	$2,200	$3,800	$5,400	$1,100	$1,900	$2,700
Grubbing[c].............	Acre	0.25	$3,800	$5,200	$6,600	$950	$1,300	$1,650
General Excavation[d]...........	Yd^3	372	$2.10	$3.70	$5.30	$781	$1,376	$1,972
Level and Till[e]........	Yd^2	1,210	$0.20	$0.35	$0.50	$242	$424	$605
Sites Development								
Salvaged Topsoil Seed, and Mulch[f]..	Yd^2	1,210	$0.40	$1.00	$1.60	$484	$1,210	$1,936
Sod[g]......................	Yd^2	1,210	$1.20	$2.40	$3.60	$1,452	$2,904	$4,356
Subtotal	--	--	--	--	--	$5,116	$9,388	$13,660
Contingencies	Swale	1	25%	25%	25%	$1,279	$2,347	$3,415
Total	--	--	--	--	--	$6,395	$11,735	$17,075

Source: (SEWRPC, 1991)

Note: Mobilization/demobilization refers to the organization and planning involved in establishing a vegetative swale.

[a] Swale has a bottom width of 1.0 foot, a top width of 10 feet with 1:3 side slopes, and a 1,000-foot length.

[b] Area cleared = (top width + 10 feet) x swale length.

[c] Area grubbed = (top width x swale length).

[d] Volume excavated = (0.67 x top width x swale depth) x swale length (parabolic cross-section).

[e] Area tilled = $\left(\text{top width} + \frac{8(\text{swale depth}^2)}{3(\text{top width})}\right)$ x swale length (parabolic cross-section).

[f] Area seeded = area cleared x 0.5.

[g] Area sodded = area cleared x 0.5.

Table 3 Estimated Maintenance Costs (SEWRPC, 1991)

Component	Unit Cost	Swale Size (Depth and Top Width)		Comment
		1.5 Foot Depth, One-Foot Bottom Width, 10-Foot Top Width	3-Foot Depth, 3-Foot Bottom Width, 21-Foot Top Width	
Lawn Mowing	\$0.85 / 1,000 ft^2/ mowing	\$0.14 / linear foot	\$0.21 / linear foot	Lawn maintenance area=(top width + 10 feet) x length. Mow eight times per year
General Lawn Care	\$9.00 / 1,000 ft^2/ year	\$0.18 / linear foot	\$0.28 / linear foot	Lawn maintenance area = (top width + 10 feet) x length
Swale Debris and Litter Removal	\$0.10 / linear foot / year	\$0.10 / linear foot	\$0.10 / linear foot	–
Grass Reseeding with Mulch and Fertilizer	\$0.30 / yd^2	\$0.01 / linear foot	\$0.01 / linear foot	Area revegetated equals 1% of lawn maintenance area per year
Program Administration and Swale Inspection	\$0.15 / linear foot / year, plus \$25 / inspection	\$0.15 / linear foot	\$0.15 / linear foot	Inspect four times per year
Total	--	**\$0.58 / linear foot**	**\$ 0.75 / linear foot**	--

Maintenance Cost

Caltrans (2002) estimated the expected annual maintenance cost for a swale with a tributary area of approximately 2 ha at approximately $2,700. Since almost all maintenance consists of mowing, the cost is fundamentally a function of the mowing frequency. Unit costs developed by SEWRPC are shown in Table 3. In many cases vegetated channels would be used to convey runoff and would require periodic mowing as well, so there may be little additional cost for the water quality component. Since essentially all the activities are related to vegetation management, no special training is required for maintenance personnel.

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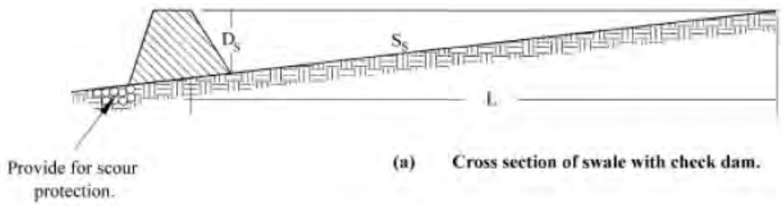
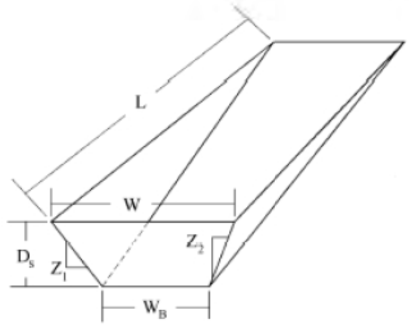


(a) Cross section of swale with check dam.



Notation:

L = Length of swale impoundment area per check dam (ft)

D_S = Depth of check dam (ft)

S_S = Bottom slpe of swale (ft/ft)

W = Top width of check dam (ft)

W_B = Bottom width of check dam (ft)

$Z_{1\&2}$ = Ratio of horizontal to vertical change in swale side slope (ft/ft)

(b) Dimensional view of swale impoundment area.

Appendix E – References

The following documents were utilized as primary reference documents in developing the Redding Rancheria Casino Master Plan, Grading and Drainage Study

California, State of, Department of Transportation. October 2000. *California Bank and Shore Rock Slope Protection Design, Practitioner's Guide and Field Evaluations of Riprap Methods, Third Edition-Internet.* Available at: http://www.dot.ca.gov/hq/oppd/hydrology/ca_riprap.pdf

California Stormwater Quality Association. January 2003. *Stormwater Best Management Practice Handbook, New Development and Redevelopment*

Central Valley Flood Protection Board. *Best Available Maps – Floodway Map*. Available at: http://cvfpb.ca.gov/profiles-maps/

FEMA. March 2011. *Flood Insurance Rate Map, Shasta County California and Incorporated Areas – Map Number 06089C1561G*

FEMA. March 2011. *Flood Insurance Rate Map, Shasta County California and Incorporated Areas – Map Number 06089C1563G*

FEMA. March 2011. *Flood Insurance Rate Map, Shasta County California and Incorporated Areas – Map Number 06089C1935G*

Redding, City of, Department of Public Works. October 1993. *Appendix C to City-Wide Master Storm Drain Study, Hydrology Manual*

Redding, City of. July 1994. *Redding City Council Policy Manual.* Available at: http://www.cityofredding.org/city-council/council-policy-manual

Redding, City of. August 2003. *Storm Water Quality Improvement Plan*. Available at: http://www.swrcb.ca.gov/stormwtr/docs/reddingcity/swmp.pdf

United States Department of Agriculture. *Web Soil Survey*. Available at: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

ATTACHMENT B

USFWS, CDFW, CNPS OFFICIAL SPECIES LISTS

USFWS IPaC Resource List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: July 18, 2018
Consultation Code: 08ESMF00-2017-SLI-2734
Event Code: 08ESMF00-2018-E-07999
Project Name: Redding

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2017-SLI-2734

Event Code: 08ESMF00-2018-E-07999

Project Name: Redding

Project Type: ** OTHER **

Project Description: Tribal fee-to-trust

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/40.52930951202774N122.3594509873035W

Counties: Shasta, CA

Endangered Species Act Species

There is a total of 8 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850 Habitat assessment guidelines: https://ecos.fws.gov/ipac/guideline/assessment/population/436/office/11420.pdf	Threatened

Crustaceans

NAME	STATUS
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
Slender Orcutt Grass *Orcuttia tenuis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1063	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

CDFW CNDDB Species List

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Enterprise (4012253))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Candidate Endangered	G2G3	S1S2	SSC
Agrostis hendersonii Henderson's bent grass	PMPOA040K0	None	None	G2Q	S2	3.2
Branchinecta lynchi vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
Cryptantha crinita silky cryptantha	PDBOR0A0Q0	None	None	G2	S2	1B.2
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T2	S2	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Great Valley Valley Oak Riparian Forest Great Valley Valley Oak Riparian Forest	CTT61430CA	None	None	G1	S1.1	
Great Valley Willow Scrub Great Valley Willow Scrub	CTT63410CA	None	None	G3	S3.2	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
Juncus leiospermus var. leiospermus Red Bluff dwarf rush	PMJUN011L2	None	None	G2T2	S2	1B.1
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G5	S3S4	
Lathyrus sulphureus var. argillaceus dubious pea	PDFAB25101	None	None	G5T1T2	S1S2	3
Legenere limosa legenere	PDCAM0C010	None	None	G2	S2	1B.1
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G4	S3S4	
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Margaritifera falcata western pearlshell	IMBIV27020	None	None	G4G5	S1S2	
Oncorhynchus mykiss irideus pop. 11 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
Oncorhynchus tshawytscha pop. 6 chinook salmon - Central Valley spring-run ESU	AFCHA0205A	Threatened	Threatened	G5	S1	
Oncorhynchus tshawytscha pop. 7 chinook salmon - Sacramento River winter-run ESU	AFCHA0205B	Endangered	Endangered	G5	S1	

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Orcuttia tenuis slender Orcutt grass	PMPOA4G050	Threatened	Endangered	G2	S2	1B.1
Rana boylii foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	G3	S3	SSC
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S2	
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC
Trilobopsis roperi Shasta chaparral	IMGASA2030	None	None	G1	S1	

Record Count: 25

CNPS Plant List

CNPS California Native Plant Society

Plant List

Inventory of Rare and Endangered Plants

6 matches found. *Click on scientific name for details*

Search Criteria

Found in Quad 4012253

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Blooming Period	CA Rare Plant Rank	State Listing Status	Federal Listing Status
Agrostis hendersonii	Henderson's bent grass	Apr-Jun	3.2		
Cryptantha crinita	silky cryptantha	Apr-May	1B.2		
Juncus leiospermus var. leiospermus	Red Bluff dwarf rush	Mar-Jun	1B.1		
Legenere limosa	legenere	Apr-Jun	1B.1		
Orcuttia tenuis	slender Orcutt grass	May-Sep(Oct)	1B.1	CE	FT
Sidalcea celata	Redding checkerbloom	Apr-Aug	3		

Suggested Citation

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 18 July 2018].

Search the Inventory

Simple Search

Advanced Search

Glossary

Information

About the Inventory

About the Rare Plant Program

CNPS Home Page

About CNPS

Join CNPS

Contributors

The Calflora Database

The California Lichen Society

California Natural Diversity Database

The Jepson Flora Project

The Consortium of California Herbaria

CalPhotos

Questions and Comments

rareplants@cnps.org

ATTACHMENT C

NSR BIOLOGICAL RESOURCES ASSESSMENT OF THE STRAWBERRY FIELDS STUDY AREA

STRAWBERRY FIELDS STUDY AREA

Biological Resources Assessment

November 7, 2007

Prepared for:
Redding Rancheria Tribe

Prepared by:
North State Resources, Inc.

NSR No. 50780

North State Resources, Inc.

STRAWBERRY FIELDS STUDY AREA

Biological Resources Assessment

November 7, 2007

Prepared for:
Redding Rancheria Tribe
Attn: Mr. Neal Malmsten
2000 Redding Rancheria Road
Redding, CA 96001

Prepared by:
North State Resources, Inc.
500 Orient Street, Suite 150
Chico, CA 95928
(530) 345-4552
(530) 345-4805 *fax*

NSR No. 50780

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Strawberry Fields Study Area
Biological Resources Assessment

1. INTRODUCTION

On behalf of the Redding Rancheria Tribe, North State Resources, Inc. (NSR) conducted a biological resources assessment of the approximately 225.86-acre Strawberry Fields Study Area, hereinafter referred to as the “study area.” The purpose of this assessment is to document the biological resources in the vicinity of the study area, including a general description of the terrestrial and aquatic habitats and identification of potentially occurring special-status plant and wildlife species. The results of plant and wildlife surveys within the study area are included in this biological resources assessment.

1.1 Study Area Location

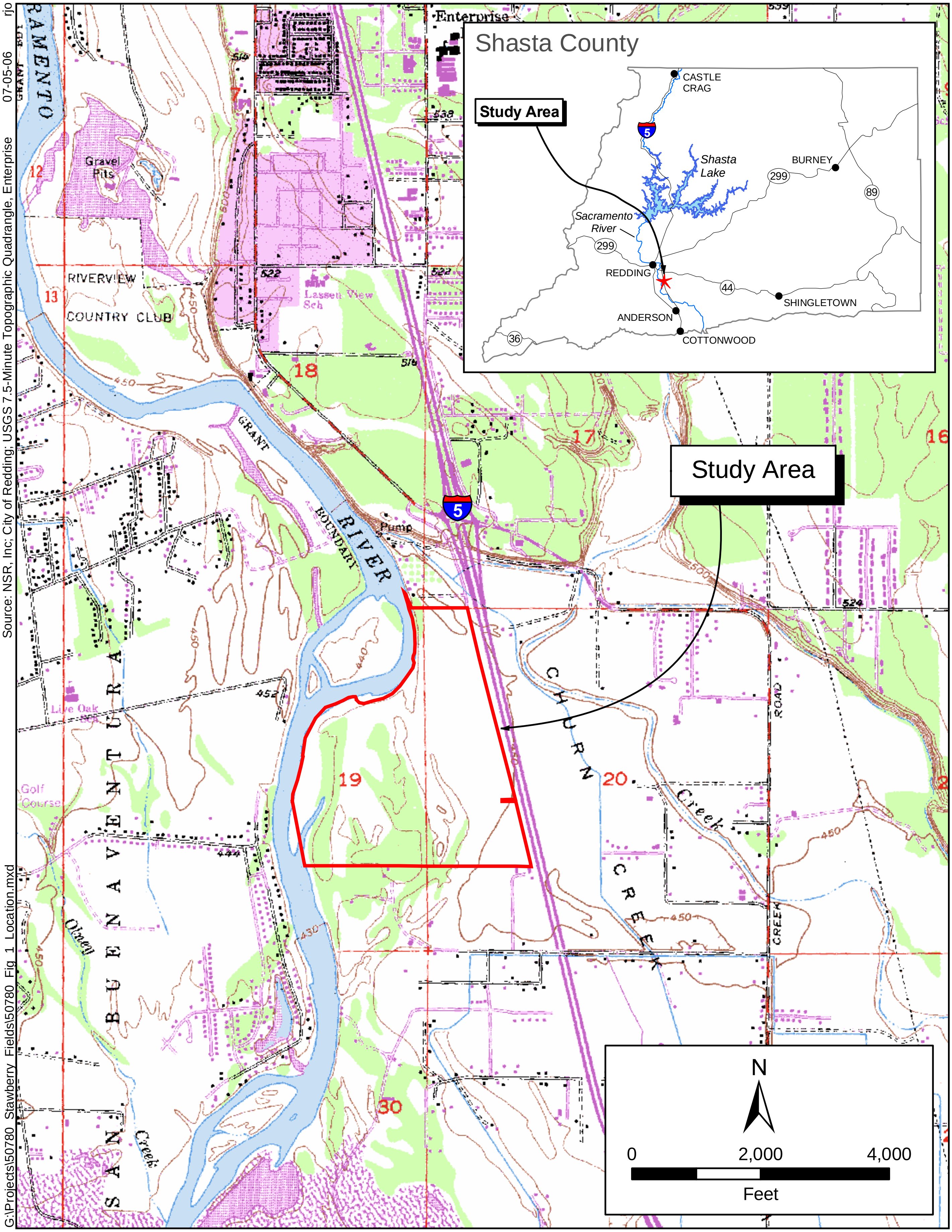
The study area is located south of the City of Redding in Shasta County, California and can be found within the *Enterprise*, *California* U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Township 31 North, Range 4 West, Sections 19 and 20). The central western and eastern boundaries of the study area are located at approximately 40º 31’ 67”N latitude by 122° 21’ 53”W longitude and 40º 31’ 67”N latitude by 122° 20’ 81”W longitude, respectively. A map of the study area is presented as Figure 1.

2. METHODS

2.1 Literature Review

For the purposes of this assessment, special-status plant species are defined as vascular plants that are: (1) listed as endangered or threatened under the federal Endangered Species Act (or formally proposed, or candidates, for listing); (2) listed as endangered or threatened under the California Endangered Species Act (or candidates for listing); and/or (3) listed as rare under the California Native Plant Protection Act. “Other” special-status plant species include those considered by the California Native Plant Society (CNPS) to be rare, threatened, or endangered in California and elsewhere (Lists 1B and 2).

Special-status fish and wildlife species include those that are: (1) designated as endangered or threatened by the state and/or federal governments (i.e., “listed species”) under the California Endangered Species Act and/or federal Endangered Species Act, respectively; (2) proposed for federal listing status as endangered or threatened; and/or (3) designated as candidates for state or federal listing status as endangered or threatened. “Other” special-status fish and wildlife species are identified by the California Department of Fish and Game (CDFG) as California Fully Protected Species or California Species of Special Concern. For potentially occurring special-status wildlife resources, emphasis is on resident or breeding species rather than on seasonally occurring species.



North State Resources, Inc.

Strawberry Fields Study Area

Figure 1
Study Area and Vicinity

Investigations into the occurrence and potential for occurrence of special-status plant and wildlife species in the study area included conducting: database searches; field reconnaissance and limited protocol-level surveys for special-status plant and wildlife species; and review of pertinent environmental documents and technical studies.

The *List of Endangered and Threatened Species That May Occur in, or be Affected by Projects in the Enterprise, California USGS quadrangle and Shasta County, California* (U.S. Fish and Wildlife Service 2007b) was reviewed for federally listed plant and wildlife species known to occur or suspected of occurring in the vicinity of the study area (Appendix A).

The California Natural Diversity Database (CNDDB) was reviewed for records of special-status plant and wildlife species in the *Enterprise, California* and eight surrounding USGS quadrangles (California Department of Fish and Game 2007a). The CNDDB is a database consisting of historical observations of special-status plant species, wildlife species, and special plant communities. It is limited to reported sightings and is not a comprehensive list of special-status plant and wildlife species that may occur in a particular area. A copy of the search results is included as Appendix B.

Another database search was performed from a query of the online *CNPS Inventory of Rare and Endangered Plants of California* (California Native Plant Society 2007). The query was conducted for documented special-status plant species occurrences in the *Enterprise, California* USGS quadrangle and the eight surrounding quadrangles. The results of this query are included as Appendix C.

Additionally, the following documents were reviewed: *Endangered and Threatened Animals of California* (California Department of Fish and Game 2006a), *Special Animals* (California Department of Fish and Game 2007b), *Endangered, Threatened, and Rare Plants of California* (California Department of Fish and Game 2006b), and *Special Vascular Plants, Bryophytes, and Lichens List* (California Department of Fish and Game 2006c).

2.2 Field Review/Surveys

Botany

A pre-field botanical review of the study area was conducted in general accordance with *Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities* (California Department of Fish and Game 2000) and *Botanical Survey Guidelines of the California Native Plant Society* (California Native Plant Society 2001a). Per botanical survey guidance, a target list of special-status plant species with the potential to occur within the study area was developed, in part, through a review of the previously mentioned environmental documents, technical studies, and databases. Local botanical expertise, herbarium database records, and regional floras were also used to develop a target list.

Prior to initiating field surveys, Mr. Colby J. Boggs, NSR botanist/plant ecologist, reviewed the habitat requirements and morphological features specific to each plant taxon on the target list. Protocol-level field surveys were conducted on April 25, May 3, May 9, and June 27, 2007. These dates coincide with the blooming/identifiable periods for all of the special-status plant species on the target list determined to have potential to occur within the study area. Field surveys were conducted

and all areas of the study area were viewed to the degree necessary to determine the presence/absence of special-status plant species and suitable habitat. All plant species detected within the study area were identified utilizing the nomenclature in *The Jepson Manual* (Hickman 1993).

Wildlife

Focused wildlife surveys were conducted for California red-legged frog (*Rana aurora draytonii*) and valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*). Ms. Ginger Bolen, NSR biologist conducted the California red-legged frog site assessment on August 17 and 20, and September 11, 2006, and May 7 and 10, 2007. Mr. Paul Kirk, NSR biologist conducted protocol-level VELB surveys on June 27, 28, and 29, and August 2, 2007.

2.2.1.1 ***California Red-Legged Frog Assessment***

A California Red-Legged frog site assessment was conducted using the guidelines set forth in *Revised Guidance on Site Assessments and Field Surveys for California Red-legged Frog* (U. S. Fish and Wildlife Service 2005). Information for the assessment was gathered through a combination of literature review, database searches, review of topographic mapping and aerial photography, and field visits to the site. The literature review identified the historic and current range of the California red-legged frog and provided information on specific habitat preferences of the species. The CNDDB records for Shasta County (California Department of Fish and Game 2007a) and the USFWS *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002) provided information regarding the known existing and historic populations of California red-legged frogs in the study area region.

A review of topographic mapping and aerial photography provided information regarding vegetation communities and land uses occurring near the study area. The study area and publicly accessible areas of the surrounding vicinity were characterized and evaluated for the presence of potentially suitable habitat for the California red-legged frog. A detailed California red-legged frog habitat assessment was prepared by NSR as a separate report (North State Resources 2007a).

2.2.1.2 ***Valley Longhorn Elderberry Beetle Survey***

Mr. Boggs, NSR botanist/plant ecologist conducted a reconnaissance level survey, noting the location of elderberry shrubs on an aerial map, as part of the botanical survey efforts in April and May 2007. Subsequently, Mr. Kirk, NSR biologist used the resulting aerial map to conduct the protocol-level VELB survey (U.S. Fish and Wildlife Service 1999) on June 27, June 28, and June 29, and August 2, 2007. The study area was surveyed on foot, and all areas were viewed to the degree necessary to locate all previously noted elderberry shrubs and to detect the presence of additional elderberry shrubs. Two elderberry shrubs in the southwest section of the study area were deeply embedded within Himalayan blackberry (*Rubus discolor*) brambles and were inaccessible for close inspection.

For each of the accessible elderberry shrubs, all stems measuring one inch or greater in diameter at ground level were counted, assessed for the presence of exit holes, and assigned to a size class (i.e., stems 1-3”, 3-5”, and >5”). For the few shrubs inaccessible for close inspection, binoculars were used to collect information to the greatest extent practicable. The vegetation community occurring in the immediate vicinity of all surveyed shrubs was recorded. The locations of all surveyed elderberry

shrubs were mapped using a Pathfinder Pro Global Positioning System (GPS) capable of sub-meter accuracy (NAD 27 projection). All spatial data were entered into a Geographic Information Systems (GIS) application and overlain onto a digital orthorectified aerial photograph.

3. RESULTS

3.1 General Setting

The study area is located on a level terrace with the general topography gently sloping west towards the Sacramento River. Elevations range from approximately 430 to 450 feet above mean sea level. The area has a Mediterranean climate with cool, wet winters and hot, dry summers. Average precipitation is approximately 25 to 35 inches per year and falls almost exclusively as rain between October and April. Mean January maximum temperature is 52° F and mean July maximum temperature is 95° F (Western Regional Climate Center 2006).

Vegetation and Associated Wildlife

The vegetation or habitat types present within the study area include riverine, annual grassland, valley oak woodland, and valley foothill riparian (Mayer and Laudenslayer 1988) as well as foothill pine (Sawyer and Keeler-Wolf 1995) as shown on Figure 2. Waters of the United States are present within these plant communities and are addressed briefly in Section 4. A description for each of these plant communities is provided below.

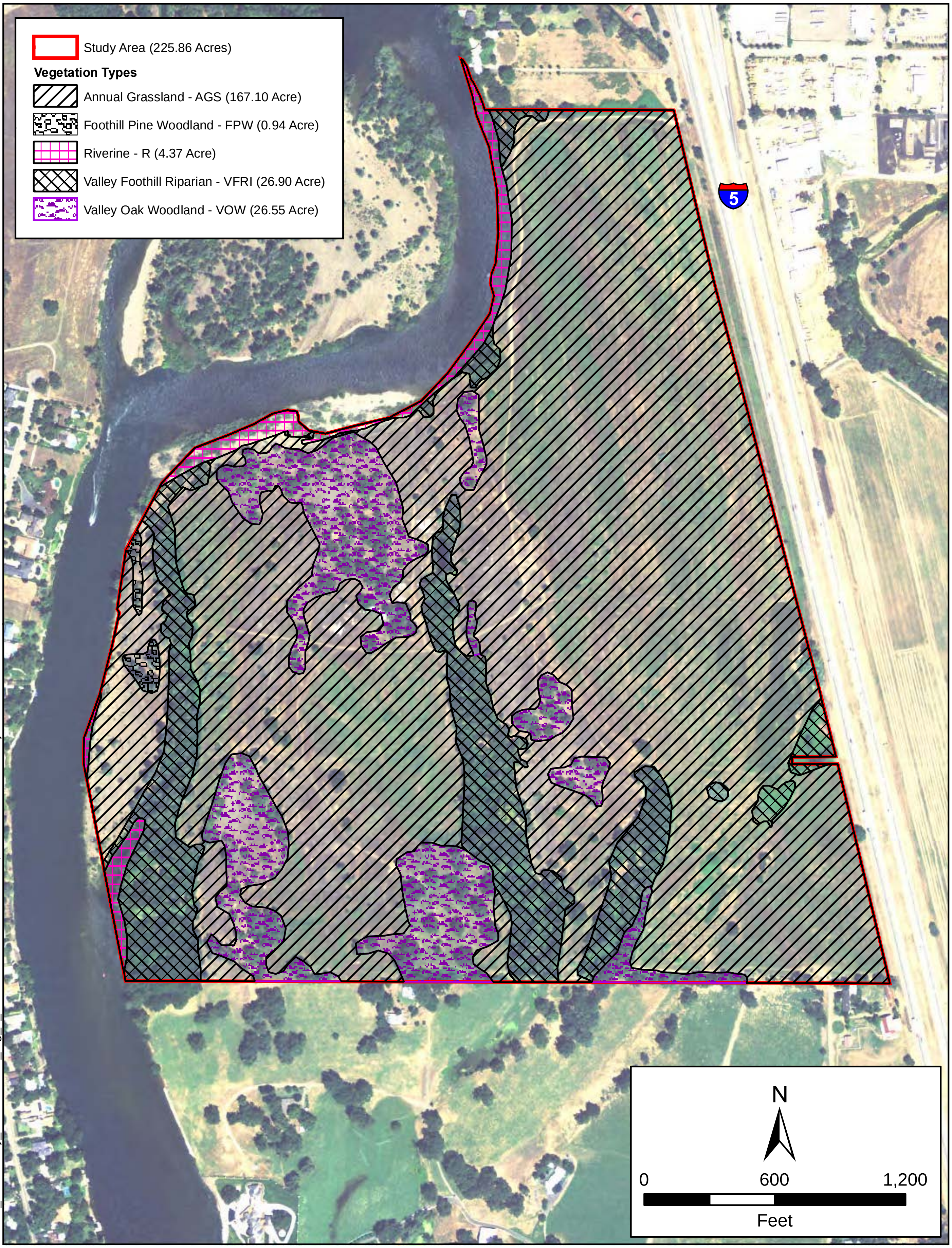
Riverine

Riverine habitat (4.37 acres) consists of the active channel and backwater area of the Sacramento River located along the western boundary of the study area. Riverine habitat is typically characterized by continually flowing water and boulder, cobble, gravel, and/or sand substrates. A dominant plant community within this habitat is absent due to the constant flow of water and movement of soil material (i.e., scour and deposition). However, seasonal fluctuations in water volume and velocity can allow the establishment of some vegetation along banks and on exposed gravel bars; most notably, primary successional species such as willows (*Salix* spp.).

Wildlife. The riverine habitat is suitable year-round for resident and anadromous fishes. Amphibians and reptiles expected to occur include the Pacific chorus frog (*Pseudacris regilla*), western toad (*Bufo boreas*), bullfrog (*Rana catesbeiana*), and northwestern pond turtle (*Clemmys marmorata marmorata*). In addition, birds such as the mallard (*Anas platyrhynchos*), great blue heron (*Ardea herodias*), osprey (*Pandion haliaetus*), and belted kingfisher (*Ceryle alcyon*) may forage here. Bats such as the little brown myotis (*Myotis lucifugus*), forage above this habitat during summer evenings.

Annual Grassland

Annual grassland habitat (167.10 acres) occurring within the study area is dominated by non-native annual grasses, and non-native annual and perennial herbaceous plants. This plant community occurs on all soil map units and the land type present on the site with minor differences in species composition based on location (e.g., greater abundance of native perennial species present on old gravel bar adjacent to the Sacramento River than on the terrace composed of moderately deep, sandy loam soil adjacent to I-5). Regardless of location, the dominant non-native grasses include European



50780_Strawberry_Fields\50780_Fig_2_WHR.mxd Source: NSR, Inc. 07-10-06 rjo

North State Resources, Inc.

Strawberry Fields Study Area

Figure 2
Vegetation Types

silver hairgrass (*Aira caryophyllea*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), medusahead (*Taeniatherum caput-medusae*) and rattail fescue (*Vulpia myuros*), and the dominant non-native herbaceous plants include black mustard (*Brassica nigra*), yellow star-thistle (*Centaurea solstitialis*), Spanish lotus (*Lotus purshianus*), and winter vetch (*Vicia villosa*). Native plant species include California poppy (*Eschscholzia californica*) and vinegar weed (*Trichostema lanceolatum*). Native plants occurring only on the gravel bar and on the Riverwash land type include showy milkweed (*Asclepias speciosa*), California brickellbush (*Brickellia californica*), yerba santa (*Eriodictyon californicum*), naked-stemmed buckwheat (*Eriogonum nudum*), Oregon false goldenaster (*Heterotheca oregana*), woolly-fruited lomatium (*Lomatium dasycarpum*), and silver bush lupine (*Lupinus albifrons*). Small stands of Himalayan blackberry (*Rubus discolor*) and narrowleaf willow (*Salix exigua*) as well as a few lone whiteleaf manzanita (*Arctostaphylos viscida*), foothill pine (*Pinus sabiniana*), valley oak (*Quercus lobata*), and blue elderberry (*Sambucus mexicana*) are found scattered throughout this habitat.

Wildlife. Annual grasslands are productive wildlife habitat. Grassland bird species, such as the mourning dove (*Zenaida macroura*), savannah sparrow (*Passerculus sandwichensis*), and white-crowned sparrow (*Zonotrichia leucophrys*) as well as rodents, including the California ground squirrel (*Spermophilus beecheyi)*, Botta's pocket gopher (*Thomomys bottae*), and deer mouse (*Peromyscus maniculatus*), forage on the seed crop this community provides. These species, in turn, attract predators such as the gopher snake (*Pituophis catenifer*), American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), and coyote (*Canis latrans*). Other common grassland species include the western meadowlark (*Sturnella neglecta*) and black-tailed hare (*Lepus californicus*). Reptile species expected to occur here include the western fence lizard (*Sceloporus occidentalis*), western skink (*Eumeces skiltonianus*), western rattlesnake (*Crotalus viridis*), and yellow-bellied racer (*Coluber constrictor mormon*).

Valley Oak Woodland

Valley oak woodland habitat (26.55 acres) occurring within the study area is dominated by valley oak. Other tree species occurring in this plant community include Oregon ash (*Fraxinus latifolia*), foothill pine (*Pinus sabiniana*), and interior live oak (*Quercus wislizenii*). Shrubs are sparse in this habitat but include California coffeeberry (*Rhamnus californica*), Himalayan blackberry, and poison-oak (*Toxicodendron diversilobum*). The valley oak woodland habitat is an ecological extension of the annual grassland plant community with the only significant difference being the presence of a tree canopy with an approximate foliar cover of 50-60%. The grasses and herbaceous plants occurring in this habitat are similar to those present in the annual grassland plant community. Grasses and herbaceous plants present in the valley oak woodland habitat include European silver hairgrass, slender oat (*Avena barbata*), black mustard, ripgut brome, soft chess, yellow star-thistle, California poppy, and rattail fescue. Plant species occurring only under the canopy of valley oak include goose grass (*Galium aparine*) and hare barley (*Hordeum murinum* ssp. *leporinum*).

Wildlife. The valley oak woodland provides food and cover for a variety birds including red-shouldered hawk (*Buteo lineatus*), California quail (*Callipepla californica*), acorn woodpecker (*Melanerpes formicivorus*), western scrub-jay (*Aphelocoma californica*), and great horned owl (*Bubo

virginianus). Other common animals include black-tailed deer (*Odocoileus hemionus*), opossum (*Didelphis virginianus*), California ground squirrel, and western fence lizard.

Valley Foothill Riparian

Valley foothill riparian habitat (26.90 acres) occurring within the study area is dominated by tree-of-heaven (*Ailanthus altissima*), California black walnut (*Juglans californica*), Fremont cottonwood (*Populus fremontii*), valley oak, and black locust (*Robinia pseudoacacia*). Other trees present in this plant community include white alder (*Alnus rhombifolia*), Oregon ash, mulberry (*Morus alba*), foothill pine, and interior live oak. Shrubs and vines form an understory layer in the valley foothill riparian habitat with an approximate foliar cover of 90-100% in some areas and includes oleander (*Nerium oleander*), California coffeeberry, Himalayan blackberry, narrowleaf willow, arroyo willow (*Salix lasiolepis*), blue elderberry, and California wild grape (*Vitis californica*). Accordingly, grasses and herbaceous plants occurring in this plant community exhibit low percent cover in the understory layer. However, these plants are present and include California pipevine (*Aristolochia californica*), mugwort (*Artemisia douglasiana*), Santa Barbara sedge (*Carex barbarae*), and goose grass.

Wildlife. Riparian communities are among the most important habitats for wildlife because of their high floristic and structural diversity, high biomass (and therefore high food abundance), and high water availability. In addition to providing breeding, foraging, and roosting habitat for a diverse array of animals, riparian communities provide movement corridors for some species, connecting a variety of habitats throughout a region.

The leaf litter, fallen tree branches, and logs associated with the riparian community in the study area provide cover for the western toad and Pacific chorus frog. The western fence lizard, western skink, and southern alligator lizard (*Elgaria multicarinata webbi*) are also expected to occur here, as are several snake species, including the western rattlesnake, yellow-bellied racer, and common kingsnake (*Lampropeltis getulus*).

The willows in the riparian community attract a number of bird species. Many of these species are year-round residents, breeding in the riparian community in the spring and summer and using it for cover and foraging habitat during the non-breeding season. Common species nesting and foraging, primarily in the riparian tree canopy, include the bushtit (*Psaltriparus minimus*), white-breasted nuthatch (*Sitta carolinensis*), and Nuttall's and downy woodpeckers (*Picoides nuttallii* and *Picoides pubescens*, respectively). Other resident species, such as the spotted towhee (*Pipilo maculatus*) and song sparrow (*Melospiza melodia*), nest and forage on or very close to the ground, usually in dense vegetation. Several species of raptors, including the Cooper's hawk (*Accipiter cooperii*) and western screech owl (*Otus kennicottii*), nest in riparian communities and remain there year-round.

In addition to the permanent residents, numerous species of neotropical migrants occur in this community from spring through fall, with many potentially breeding on the site, including the ash-throated flycatcher (*Myiarchus cinerascens*), olive-sided flycatcher (*Contopus cooperi*), western wood-pewee (*Contopus sordidulus*), warbling vireo (*Vireo gilvus*), Swainson's thrush (*Catharus ustulatus*) and black-headed grosbeak (*Pheucticus melanoleucus*).

A variety of mammals also occurs in riparian communities. Small mammals, such as the Botta's pocket gopher, and deer mouse, may burrow or find refuge in dense grass or brushy thickets. Mule

deer frequently use riparian habitats, and predators, such as the raccoon (*Procyon lotor*), long-tailed weasel (*Mustela frenata*) and coyote, are attracted to riparian areas by the abundance of prey and cover. In addition, the taller trees provide daytime roosts for nocturnal species such as the raccoon and Virginia opossum.

Foothill Pine Woodland

The foothill pine woodland plant community (0.94 acre) occurs on an old gravel bar adjacent to the Sacramento River in the western portion of the study area and is dominated by foothill pine. Other tree species occurring in this plant community include valley oak and interior live oak. Shrubs are sparse in this habitat but include whiteleaf manzanita, Himalayan blackberry, and poison-oak. The foothill pine woodland habitat is an ecological extension of the annual grassland plant community with the only significant difference being the presence of a tree canopy with an approximate foliar cover of 50-60%. The grasses and herbaceous plants occurring in this habitat are similar to those present in the annual grassland and valley oak woodland plant communities. Grasses and herbaceous plants present in the foothill pine woodland habitat include European silver hairgrass, California brickellbush, ripgut brome, soft chess, yellow star-thistle, naked-stemmed buckwheat, California poppy, and rattail fescue.

Wildlife. The foothill pine woodland community is small inclusion within the annual grassland on the gravel bar between the river and a strip of valley foothill woodland. The wildlife species expected in this community would be a subset of those found in the annual grassland and valley foothill woodland habitats.

Soils

The *Soil Survey of Shasta County Area, California* (U.S. Department of Agriculture and Soil Conservation Service 1974) identifies five soil map units and one land type within the study area:

- ***CcA – Churn loam, 0 to 3% slopes***. The Churn series consists of well-drained and moderately well-drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically light yellowish-brown, medium acid gravelly loam about nine inches thick. The subgroup taxonomy for the Churn series is *Ultic Haploxeralfs*. The Churn loam soil unit is well-drained and has moderately slow permeability. Runoff is slow, and the hazard of erosion is none to slight for this soil unit. The Churn loam soil map unit is classified as non-hydric with hydric inclusions in the form of cobbly alluvial lands associated with drainageways (USDA Soil Conservation Service 1992).

- ***CeA – Churn gravelly loam, 0 to 3% slopes.*** The Churn series consists of well-drained and moderately well-drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically light yellowish-brown, medium acid gravelly loam about nine inches thick. The subgroup taxonomy for the Churn series is *Ultic Haploxeralfs*. The Churn gravelly loam soil unit is well-drained and has moderately slow permeability. Runoff is slow, and the hazard of erosion is none to slight for this soil unit. The Churn gravelly loam soil map unit is classified as non-hydric with hydric inclusions in the form of cobbly alluvial lands associated with drainageways (USDA Soil Conservation Service 1992).

- ***RgA – Reiff fine sandy loam, 0 to 3% slopes.*** The Reiff series consists of well-drained and moderately well-drained soils that formed in recent alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically grayish-brown and brown, slightly acid fine sandy loam about 18 inches thick. The subgroup taxonomy for the Reiff series is *Typic Xerorthents*. The Reiff fine sandy loam soil unit is well-drained and has moderately rapid permeability. Runoff is very slow, and the hazard of erosion is none to slight for this soil unit. The Reiff fine sandy loam soil map unit is classified as non-hydric (USDA Soil Conservation Service 1992).

- ***Rw – Riverwash.*** The Riverwash land type is excessively drained and is associated with stream channels and adjacent areas subject to continuous or frequent flooding (U.S. Department of Agriculture and Soil Conservation Service 1974). Permeability is rapid, runoff is very slow, and the hazard of erosion is very high for this land type. Binomial subgroup taxonomy does not apply to land types. The Riverwash land type is classified as hydric and is associated with floodplain channels (USDA Soil Conservation Service 1992).

- ***TbA – Tehama loam, 0 to 3% slopes.*** The Tehama series consists of well-drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is pale brown, medium acid and slightly acid loam about 30 inches thick. The subgroup taxonomy for the Tehama series is *Typic Haploxeralfs*. The Tehama loam soil unit is well-drained and has slow permeability. Runoff is very slow, and the hazard of erosion is none to slight for this soil unit. The Tehama loam soil map unit is classified as non-hydric with hydric inclusions in the form of unnamed ponded features associated with depressions (USDA Soil Conservation Service 1992).

- ***TfA – Tujunga loamy sand, 0 to 3% slopes.*** The Tujunga series consists of somewhat excessively drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically pale brown, slightly acid loamy sand about 14 inches thick. The subgroup taxonomy for the Tujunga series is *Typic Xeropsamments*. The Tujunga loamy sand soil unit is somewhat excessively drained and has rapid permeability. Runoff is very slow, and the hazard of erosion is none to slight for this soil unit. The Tujunga loamy sand soil map unit is classified as non-hydric with hydric inclusions in the form of cobbly alluvial lands and riverwash associated with drainageways and floodplain channels, respectively (USDA Soil Conservation Service 1992).

Waters of the U.S.

NSR conducted a delineation of waters of the United States in accordance with U.S. Army Corps of Engineers (USACE) methodology and regulatory guidance letters within the study area on June 15, June 16, and June 21, 2006. A total of 4.419 acres of waters of the United States features were delineated within the study area that includes seasonal wetland (0.029 acre), riverine/perennial stream (4.366 acres), and intermittent stream (0.024 acre, 149 linear feet) habitat. A separate report was prepared by NSR on April 19, 2007 (North State Resources 2007b).

3.2 REGIONAL SPECIES OF CONCERN

Vegetation or habitat types found in the study area region potentially support special-status plant and wildlife species (Appendix D). Appendix D provides a general comparison of habitat requirements for each species and the general habitats present in the study area. Some of the special-status plants

and animals occurring near the study area are found in habitat types that are not present on-site, such as vernal pools. Therefore, these species are not considered in further detail as part of this assessment. For those species for which generally suitable habitat was determined to be present with the study area, the results of the reconnaissance-level survey were used to determine the likelihood of their presence on the site (Tables 1 and 2).

Special-Status Plant Species

Fourteen special-status vascular plant species were initially considered for analysis (Appendix D). Based upon geographic location, local botanical knowledge, and habitat parameters present within the study area, suitable habitat for four special-status plants was determined to occur in the study area (Table 1).

Table 1. Special-Status Plant Species Potentially Occurring in the Study Area

Common Name (*Scientific Name*)	Status[1] (FED/ST /CNPS)	General Habitat Description / Elevation Range	Typical Blooming Period	Comments
Fox sedge *Carex vulpinoidea*	--/--/2.2	Freshwater marshes and swamps, and riparian woodland / 98-3,937 feet	May-June	**Surveys negative, presumed absent.** Suitable habitat occurs within the seasonal wetland in the southwest portion of the study area.
Silky cryptantha *Cryptantha crinita*	--/--/1B.2	Gravelly streambeds within cismontane woodland, lower montane coniferous forest, riparian scrub, riparian woodland, and valley and foothill grassland / 278-984 feet	April-May	**Surveys negative, presumed absent.** Suitable habitat occurs within gravelly substrate present on gravel bars and old channels.
Red Bluff dwarf rush *Juncus leiospermus* var. *leiospermus*	--/--/1B.1	Meadows and seeps, vernal pools; vernally mesic areas within chaparral, cismontane woodland, and valley and foothill grassland / 115-3,346 feet	March-May	**Surveys negative, presumed absent.** Suitable habitat occurs within the ponded area in the northeast corner of the study area.
Ahart's paronychia *Paronychia ahartii*	--/--/1B.1	Cismontane woodland, valley and foothill grassland and vernal pools / 90-1,530 feet	March-June	**Surveys negative, presumed absent.** Suitable habitat occurs within valley oak woodland and foothill grassland on the study area.

Status Codes[1]:
FED = Federal
ST = State
Federal & State Codes:
E = Endangered; T = Threatened

CNPS = California Native Plant Society
CNPS Codes:
List 1B = Rare, Threatened or Endangered in CA and Elsewhere;
List 2 = Rare, Threatened or Endangered in CA, but more common elsewhere

Special-Status Wildlife Species

Sixty five (65) special-status wildlife species were initially considered for analysis (Appendix D). Based upon location and habitat parameters, twenty-nine (29) special-status wildlife species were identified as having the potential to occur in the study area. Table 2 presents a list of these species and their likelihood of occurrence. Special-status designation and general habitat requirements for each species are provided in the table. Conclusions presented in this table are based on the

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Comments
Federal or State Listed Species			
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Elderberry shrubs associated with riparian forests that occur along rivers and streams.	**Present.** Protocol level surveys detected VELB exit holes on numerous 12 elderberry shrubs.
Green sturgeon, southern DPS *Acipenser medirostris*	T/SC	Spawn in Sacramento and Feather rivers; juveniles are thought to rear mainly in the estuary. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock. Spawn in the mainstem Sacramento River when temperatures range between 46-60 °F.	**Present**. Known to occur in the Sacramento River throughout all accessible reaches upstream at least to Anderson-Cottonwood Irrigation District dam near Redding, California.
Steelhead, California Central Valley DPS *Oncorhynchus mykiss* Critical Habitat	T/--	Spawn and rear in freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**. Occur in the mainstem Sacramento River and tributary streams. Adults migrate upstream during the fall/winter and spawn from winter to early spring. Juveniles rear in natal areas for 1-2 years before migrating to the ocean. Suitable spawning and rearing habitat exists in the Sacramento River.
Central Valley spring-run ESU Chinook salmon *Oncorhynchus tshawytscha* Critical Habitat Essential Fish Habitat	T/T	Freshwater rivers and streams. (Sacramento River and its tributaries)	**Present.** Occur in the mainstem Sacramento River and its major perennial tributary streams. Adults migrate upstream during the spring and spawn from mid-August to mid-October. Suitable spawning and rearing habitat exists in the Sacramento River.
Sacramento River winter-run ESU Chinook salmon *Oncorhynchus tshawytscha* Critical Habitat Essential Fish Habitat	E/E	Freshwater rivers and streams. (Sacramento River and its tributaries)	**Present**. Occur in the mainstem Sacramento River. Adults migrate upstream during the winter and spawn from mid-April to August. Suitable spawning and rearing habitat exists in the Sacramento River.
California red-legged frog *Rana aurora draytonii*	T/SC	Require aquatic habitat for breeding, also uses a variety of other habitat types including riparian and upland areas. Adults utilize dense, shrubby or emergent vegetation associated with deep-water pools with fringes of cattails & dense stands of overhanging vegetation.	**Absent.** Protocol level surveys did not detect this species (North State Resources 2007a).

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Comments
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	C/--	Nesting habitat is cottonwood/willow riparian forest. Occurs only along the upper Sacramento Valley portion of the Sacramento River, the Feather River in Sutter Co., the south fork of the Kern River in Kern Co., and along the Santa Ana, Amargosa, and lower Colorado rivers	**Absent.** Presently there are no known breeding pairs along the Sacramento River north of Red Bluff, CA. The site does not have sufficiently dense riparian forest to support breeding.
Bald eagle *Haliaeetus leucocephalus*	T/E	Forages on live and dead fish and nests in large trees or snags. Requires large bodies of water, including ocean shorelines, lake margins, and large, open river courses for foraging, nesting, and wintering habitat.	**Present**. Incidental observations of eagles foraging over the site. No nests reported or observed on the site.
Bank swallow *Riparia riparia*	--/T	Colonial nester on vertical banks or cliffs with fine-textured soils near water.	**Present**. Bank swallows and colony of nests observed on cut-bank of Sacramento River.
Other Special-Status Species			
River lamprey *(Lampetra ayresii)*	--/SC	The biology of river lampreys has not been studied in California, general habitat and life history thought to be similar to Pacific lamprey.	**Present**. Occur in the mainstem Sacramento River and tributary streams.
Central Valley fall/late-fall run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Essential Fish Habitat	--/SC	Freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**. Occur in the mainstem Sacramento River and tributary streams. Adults migrate upstream during the fall and spawn from mid-October to February. Suitable spawning and rearing habitat exists in the Sacramento River.
Hardhead (*Mylopharodon conocephalus*)	--/SC	Quiet deep pools of large, warm, clear streams over rocks or sand.	**Present**. Occur in the mainstem Sacramento River and tributary streams.
Western spadefoot toad *Spea hammondii*	--/SC	Grasslands with temporary pools.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Northwestern pond turtle *Clemmys marmorata marmorata*	--/SC	Slow water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Require an upland oviposition site in the vicinity of the aquatic site	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Double-crested cormorant *Phalacrocorax auritus*	--/SC	Inland lakes; fresh, salt and estuarine waters.	**May be present as migrant**. Suitable breeding habitat does not occur on the site or surrounding area.

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Comments
Merlin *Falco columbarius*	--/SC	Frequents ocean shorelines, lake margins, and large, open river courses near tree stands for both nesting and wintering habitat. Does not breed in California.	**May be present as migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
Western burrowing owl *Athene cunicularia hypugaea*	--/SC	Open habitats, dry grasslands and ruderal habitats with ground squirrel burrows.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Sharp-shinned hawk *Accipiter striatus*	--/SC	Typically nests in dense conifer stands near water, winters in woodlands. Forages in many habitats in winter and migration.	**May be present as migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
Cooper's hawk *Accipiter cooperii*	--/SC	Nests in woodlands, forages in many habitats in winter and migration.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Ferruginous hawk *Buteo regalis*	--/SC	Forages in grasslands and occasionally in other open habitats during migration and winter.	**May be present as rare migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
Prairie falcon *Falco mexicanus*	--/SC	Occurs in open habitats such as grasslands, desert scrub, rangelands and croplands. Nests on open cliffs.	**May be present as rare migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
White-tailed kite *Elanus leucurus*	--/FP	Nests in lowlands with dense oak or riparian stands near open areas, forages over grassland, meadows, cropland and marshes.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Osprey *Pandion haliaetus*	--/SC	Ocean shorelines, lake margins and large, open river courses for both nesting and wintering habitat.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
California yellow warbler *Dendroica petechia brewsteri*	--/SC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Yellow-breasted chat *Icteria virens*	--/SC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Loggerhead shrike *Lanius ludovicianus*	--/SC	Prefers open habitats with scatters shrubs and trees throughout the Central Valley of California. Nests in shrubs and trees.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Ringtail *Bassariscus astutus*	--/FP	Riparian habitats and in brush stands of most forest and shrub habitats. Nests in rock recesses, hollow trees, logs, snags, abandoned burrows or woodrat nests.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Pallid bat *Antrozous pallidus*	--/SC	Forages over many habitats; roosts in buildings, large oaks or redwoods, rocky outcrops and rocky crevices in mines and caves, and under bridges. Roosts must protect from high temperatures	**May be present as forager**. Site does not contain suitable breeding roosts.

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Comments
Western mastiff bat *Eumops perotis*	--/SC	Roosts in cliff faces, rock outcrops, and buildings. Forages in open habitats. Needs vertical face to take flight.	**May be present as forager**. Site does not contain suitable breeding roosts.

[1]Status Codes:
Federal and State Codes: E = Endangered; T = Threatened; SC = Species of Special Concern: FP = Fully Protected

knowledge of local professional biologists and historic survey information. All special-status wildlife species potentially breeding in the study area are discussed in detail below. A list of all wildlife species observed is presented in Appendix E.

3.3 Detailed Evaluation of Special-Status Plant Species

No federal or state listed plant species have the potential to occur within the study area. There were four other special-status plant species determined to have the potential to occur in the study area: fox sedge (*Carex vulpinoidea*), silky cryptantha (*Cryptantha crinita*), Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*), and Ahart's paronychia (*Paronychia ahartii*). The status, habitat parameters, geographic distribution, and rationale for potential to occur on the site for each of these plant taxa is discussed below.

Fox sedge (*Carex vulpinoidea*). Federal Status: None; State Status: None; CNPS Status: List 2.2. This species is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be "Rare, Threatened or Endangered in California, but more common elsewhere."

Fox sedge is a tufted perennial in the sedge family (Cyperaceae). This species is known to occur in freshwater marshes and swamps and in riparian woodlands (California Native Plant Society 2001b). Fox sedge typically occurs at elevations between 98 and 3,937 feet above mean sea level and the blooming period is generally from May to June. Past experience specific to fox sedge in the Redding area has indicated that the optimal window of opportunity to observe this species occurs in late May.

Fox sedge is known to occur in the Inner North Coast Ranges, Cascade Range, and northern Sacramento Valley within Butte, Glenn, Shasta, Siskiyou, and Tehama counties (California Native Plant Society 2006; Tibor 2001). CNDDB records indicate that there is one occurrence of this species within five miles of the study area (California Department of Fish and Game 2007a).

Areas of potentially suitable habitat include the open water features located in the central and southern portions of the study area as well as the seasonal wetland in the southwest portion of the study area. These features have habitat and hydrology parameters, such as typical riparian plant species associates and duration of inundation and/or soil saturation, respectively, that qualify as sufficient to represent characteristic microhabitat attributes for fox sedge. Therefore, this species remained a target species for protocol-level botanical survey.

Silky Cryptantha (*Cryptantha crinita*). Federal Status: None; State Status: None; CNPS Status: List 1B. This species is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be "Rare, Threatened or Endangered in CA and Elsewhere."

Silky cryptantha is a small, annual in the borage family (Boraginaceae). This species is known to occur on sand and gravel deposits associated with intermittent and, occasionally, perennial streams (Nakamura and Nelson 2001) within cismontane woodland, lower montane coniferous forest, riparian scrub, riparian woodland, and valley and foothill grassland from elevations between 278 and 984 feet above mean sea level (Tibor 2001). Silky cryptantha typically occurs below 1,000 feet in elevation and the blooming period is generally from April to May (Nakamura and Nelson 2001). Past

experience specific to silky cryptantha in the Redding area has indicated that the optimal window of opportunity to observe this species in bloom occurs between late April and mid-May.

Silky cryptantha is restricted to the interior regions of northern California and is known to occur in the northern Sacramento Valley within Shasta and Tehama counties (Nakamura and Nelson 2001). CNDDB records indicate that there are three occurrences of this species within five miles of the study area (California Department of Fish and Game 2007a).

An area of potentially suitable habitat includes the gravel bar found along the Sacramento River along the western boundary of the site. Therefore, this species remained a target species for botanical survey efforts due to the presence of the gravel bar along the river, and attributes thereof, considered to have the potential to support populations of silky cryptantha.

Red Bluff Dwarf Rush (*Juncus leiospermus* var. *leiospermus*). Federal Status: None; State Status: None; CNPS Status: List 1B. This plant taxon is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be “Rare, Threatened or Endangered in CA and Elsewhere.”

Red Bluff dwarf rush is a small, reddish grass-like annual in the rush family (Juncaceae). This plant taxon is known to occur in a variety of seasonally moist habitats that include meadows and seeps, vernal pools, and vernally mesic areas within chaparral, cismontane woodland, and valley and foothill grassland from elevations between 115 and 3,350 feet above mean sea level . It is often found in small, sparsely vegetated micro-habitats (e.g., tire ruts, gopher mounds). Red Bluff dwarf rush typically occurs between 200 and 1,000 feet in elevation and the blooming period is typically from April to early June (Nakamura and Nelson 2001). Past experience specific to Red Bluff dwarf rush in the Redding area has indicated that the optimal window of opportunity to observe this plant taxon in bloom occurs between late April and mid-May.

Red Bluff dwarf rush is restricted to the interior regions of northern California and is known to occur in the northern Sacramento Valley and surrounding foothills of the Cascade Range within Butte, Shasta, and Tehama counties (California Native Plant Society 2001b; Nakamura and Nelson 2001). Disjunct populations of Red Bluff dwarf rush also occur in the northeast corner of Shasta County and southern Lassen County. CNDDB records indicate that there are twelve occurrences of this species within five miles of the study area (California Department of Fish and Game 2007a).

An area of potential habitat includes the ponded area in the northeast corner of the study area This area remains mesic due to seepage from the Anderson Cottonwood Irrigation District canal. An unpaved road in this mesic area contains relatively unvegetated zones which represent characteristic microhabitat attributes for Red Bluff dwarf rush. Therefore, this taxon remained a target taxon for botanical survey efforts due to the presence of seasonally ponded features, and attributes thereof, considered to have the potential to support populations of Red Bluff dwarf rush.

Ahart’s paronychia (*Paronychia ahartii*). Federal Status: None; State Status: None; CNPS Status: List 1B. This plant taxon is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be “Rare, Threatened or Endangered in CA and Elsewhere.”

Ahart's paronychia is a small, inconspicuous annual in the carnation family (Caryophyllaceae). This plant taxon grows in cismontane woodland, and valley and foothill grassland from elevations between 90 and 1,530 feet above mean sea level. It is endemic to California and is threatened by habitat loss. Regionally, it is found in slightly wet areas that are sparsely vegetated.

CNDDB records that regional occurrences of this species indicate that there are no occurrences of this species within five miles of the study area (California Department of Fish and Game 2007a).

3.4 Detailed Evaluation of Special-Status Wildlife Species

Federal or State Listed Wildlife Species

Valley Elderberry Longhorn Beetle (VELB) (*Desmocerus californicus dimorphus*). Federal Status: Threatened; State Status: None. The USFWS formally listed the VELB as *threatened* on August 8, 1980 (45 FR 52803 52807). Critical Habitat was also designated at this time (45 FR 52803 52807). Changed land use in the riverside habitats to which it is restricted is the primary threat to this beetle.

The VELB is an insect endemic to the foothills and Central Valley of California. It inhabits riparian and associated upland habitats where elderberry (*Sambucus* spp.), its host plant, grows. Specifically, its range extends throughout the Central Valley and adjacent foothills up to the 3,000 foot elevation level to the east and the Central Valley watershed to the west (U.S. Fish and Wildlife Service 1999). VELB habitat consists of riparian forests whose dominant plant species include cottonwood (*Populus* spp.), sycamore (*Platanus* spp.), valley oak (*Quercus lobata*.), and willow (*Salix* spp.), with an understory of elderberry shrubs (U.S. Fish and Wildlife Service 1991). Elderberry shrubs with a basal stem diameters larger than 1 inch are considered by the USFWS as suitable VELB habitat (U.S. Fish and Wildlife Service 1999).

The VELB life cycle is intimately connected to its habitat, elderberry shrubs. Following mating, the female lays her eggs in crevices in the elderberry bark. Upon hatching (after about 10 days), the larvae bore into the pith of the shrub and feed inside stems larger than 1 inch in diameter for 1 to 2 years until they mature. They emerge as adults during the spring via exit holes chewed through the bark. The adult beetles feed on the elderberry foliage until they mate, completing the cycle. Adults are active from March to June.

The study area has large areas of riparian forest containing elderberry shrubs and CNDDB records indicate an occurrence of VELB within five miles of the site.

Green Sturgeon, Southern DPS (*Acipenser medirostris*). Federal Status: Threatened; State Status: Species of Special Concern.

Relatively little is known about green sturgeon in the Sacramento River compared to its relative the white sturgeon (*Acipenser transmontanus*). Adult green sturgeon generally migrate into rivers between late-February and late-July. Spawning takes place in deep, fast water from March to July when water temperatures range from 46 °F to 60 °F. Juveniles may rear in the river for 1 to 3 years before migrating to the estuary, primarily during the summer and fall. Once in the estuary young sturgeon adopt an oceanic foraging habit, which may last from 3 to 13 years before returning for their first spawning season (Moyle 2002).

Green sturgeon use streams, rivers, and estuarine habitat as well as marine waters during their life cycle. Like the white sturgeon, green sturgeon prefer to spawn in lower to middle reaches of large rivers with swift currents and large cobble; no nest is built, adults broadcast spawn into the water column. The fertilized eggs sink and attach to the bottom to hatch. Research indicates that water flow is one of the key determinants of larval survival (Moyle 2002).

In the final determination to list the southern DPS as threatened under FESA, NMFS identified the reduction of available spawning habitat due to construction of barriers along the Sacramento and Feather rivers as being the principal threat to green sturgeon in the southern DPS (71 FR 17757). Other threats include, but are not limited to, insufficient flow rates, increased water temperature, water diversion, non-native species, poaching, pesticide and heavy metal contamination, and local fishing.

California Central Valley DPS Steelhead *(Onchorynchus mykiss)* Federal Status: Threatened; State Status: None.

Steelhead possess one of the most complex life history patterns of the Pacific salmonid species. Steelhead typically refers to the anadromous form of rainbow trout. Similar to other Pacific salmon, steelhead adults spawn in freshwater and spend a part of their life history at sea. However, unlike Chinook salmon, steelhead exhibit a variety of life history strategies during their freshwater rearing period and as adults may spawn more than once during their life. The typical life history pattern for steelhead is to rear in freshwater streams for two years followed by up to two or three years of residency in the marine environment. However, juvenile steelhead may rear in freshwater from one to four years (Busby et al. 1997; Moyle 2002).

Steelhead populations inhabiting the upper Sacramento River basin belong to the Central Valley steelhead DPS as defined by Good et al. (1997). These steelhead populations generally exhibit a life history pattern typical of a fall/winter run. This species historically has provided a popular sport fishery throughout the Sacramento River and its tributaries; however, at present naturally-produced steelhead remain at relatively low levels throughout their range in the Central Valley (Hallock 1989; McEwan 2001).

Steelhead adults may enter the Sacramento River and its tributaries from August through March, but peak migration generally occurs from October through February. Spawning begins in late December and can extend into early-April. Steelhead spawn in gravel and small cobble substrates usually associated with riffle and run habitat types. The upper mainstem Sacramento River is known to provide suitable spawning and juvenile rearing habitat for steelhead. The Sacramento River in the vicinity of the project may be used by steelhead during all life stages, including spawning and egg incubation.

Critical habitat designations for listed anadromous salmonids published in September 2005 (70 FR 52488) were finalized as part of the recent status reviews and are restricted to the species' anadromous range, which is coextensive with the steelhead-only DPS delineations described in that notice (71 FR 834). Designated critical habitat for Central Valley steelhead DPS includes all river reaches accessible to steelhead in the Sacramento and San Joaquin rivers and their tributaries, which includes the Sacramento River adjacent to the action area.

Central Valley Spring-run Chinook Salmon ESU *(Onchorynchus tshawytscha* Federal Status: Threatened; State Status: Threatened.

Spring-run Chinook salmon migrate upstream during the spring beginning in March, hold over in deep pools of the mainstem river and its large perennial tributaries, where fish can access cold headwaters, during the summer months, and spawn from mid-August through mid-October. Most of the spring run in the Sacramento River Basin ascend and spawn in the principal tributary streams (Mill, Deer, Clear, and Butte creeks, and the Feather River). Egg incubation occurs from mid-August through mid-January. Spring-run in the Sacramento River exhibit an ocean-type life history, emigrating as fry, sub-yearlings, and yearlings. Based on observations at Red Bluff Diversion Dam, spring-run emigration from the upper Sacramento River typically occurs from November through April (Vogel and Marine 1991; (Johnson, Weigand, and Fisher 1992)). Although some spring-run salmon may spawn in the Sacramento River between Red Bluff and Keswick Dam, it is thought that most have hybridized with fall-run salmon due to overlapping spawning periods, lack of spatial separation, and redd superimposition (California Department of Fish and Game 1998).

Central Valley spring-run ESU Chinook salmon populations in the Sacramento River and its tributaries have remained relatively depressed; however, some modest increases have occurred in their principal spawning tributaries such as Deer, Mill, and Butte Creeks (California Department of Fish and Game 2004). Spring-run Chinook salmon spawning in the mainstem Sacramento River and nearby tributaries such as Clear Creek and Battle Creek remain relatively depressed (California Department of Fish and Game 2004).

Designated critical habitat for Central Valley spring-run Chinook salmon includes the San Francisco Bay-Delta estuary, mainstem Sacramento River upstream to Keswick Dam and most of the Sacramento Valley's perennial tributaries with established spring salmon runs, including the Feather River and Feather River Hatchery. Designated critical habitat for Central Valley spring-run Chinook salmon includes all river reaches accessible to the species in the Sacramento and San Joaquin Rivers and their tributaries in California, which includes the Sacramento River adjacent to the property.

Sacramento River Winter-run Chinook Salmon ESU *(Onchorynchus tshawytscha)*. Federal Status: Endangered; State Status: Endangered.

Historically, winter-run Chinook salmon spawned in the cold spring-fed headwaters of the upper Sacramento, Pit, McCloud, and Calaveras rivers (U.S. Fish and Wildlife Service 1995). Following construction of Shasta Dam, deep water releases during the summer months provided suitable cold water conditions for winter-run Chinook salmon spawning and rearing downstream of the dam. In response to these conditions, which increased total coldwater spawning habitat available to the winter run, the population increased. In 1969, the winter run exceeded 100,000 salmon; however, during the early 1990's, run size estimates have ranged from about 1,400 fish to as low as about 200 fish in some years. The Sacramento River winter-run Chinook salmon population has exhibited a continuing recovery from the extremely low adult returns observed in the early 1990's. Recent spawning populations range from about 7,000 to 8,000 (California Department of Fish and Game 2004); however, these levels remain well below draft recovery goals established for this run (National Marine Fisheries Service 2004).

Winter-run Chinook salmon begin their migration up the Sacramento River in December and may spawn from mid-April through mid-August with a peak in spawning occurring from late May through June (Vogel and Marine 1991; Moyle 2002). Winter-run Chinook salmon spawning and juvenile rearing areas include the river reach adjacent to the project site (D. Killam, CDFG, unpublished data).

The egg incubation period extends from mid-April through mid-September. Juvenile winter-run Chinook salmon are known to rear in suitable habitats of the upper Sacramento River, including that adjacent to the project site.

The critical habitat designation includes the Sacramento-San Joaquin Delta and the Sacramento River, within all accessible reaches, including that reach adjacent to the action area. Constituent elements of anadromous salmonid critical habitat is considered to include seasonal timing and volume of stream flows sufficient to allow the fish to migrate, reproduce and rear; suitable streambed and bank conditions to support spawning, incubation, and larval development; suitable water quantity and quality and floodplain connectivity to form and maintain physical habitat to support juvenile development, growth, and mobility; natural cover such as shade, submerged and overhanging vegetation and large wood, log jams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; and finally, freshwater migration corridors free of obstruction with water quantities and quality and natural cover that support juvenile and adult fish migration and survival (69 FR 71880).

California Red-legged Frog (*Rana aurora draytonii).* Federal Status: Threatened; State Status: Species of Special Concern. The California red-legged frog inhabits quiet pools of streams, marshes, and ponds. All life history stages are most likely to be encountered in and around breeding sites, which include coastal lagoons, marshes, springs, permanent and semi permanent natural ponds, and ponded and backwater portions of streams, as well as artificial impoundments such as stock ponds, irrigation ponds, and siltation ponds. This species breeds from March to July; females lay 750 to 4000 eggs in clusters, attached to vegetation 7 to 15 cm (2 to 6 in) below the water surface. Juveniles can occur in slow moving, shallow riffle zones in creeks or along the margins of ponds. Eggs are typically deposited in permanent pools, attached to emergent vegetation (Zeiner, Laudenslayer, and Mayer 1989)

The historic range of the California red-legged frog extended along the coast from the vicinity of Point Reyes National Seashore, Marin County, and inland from the vicinity of Redding, Shasta County, southward to northwestern Baja California, Mexico. The species has lost approximately 70 percent of its former range; California red-legged frogs are locally abundant in the San Francisco Bay area and the central coast, but only isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse ranges (50 CFR Part 17 14626).

NSR staff conducted a USFWS protocol-level site assessment for California red-legged frog, and produced a separate detailed report (North State Resources 2007a). NSR staff did not observe any California red-legged frogs during the USFWS protocol-level surveys, but did conclude that the seasonal pond in the central region of the site provides suitable breeding habitat. The nearest known records of California red-legged frog are from Thomes Creek and Sunflower Gulch on Red Bank Creek, approximately 33 miles south southwest of the project site.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*). Federal Status: Candidate; State Status: Endangered. The western yellow-billed cuckoo is a federal candidate for listing. It is generally considered a neotropical migrant that arrives in California to begin breeding in June.

In northern California it prefers riparian forests, containing willow (*Salix* spp.) and Fremont cottonwood (*Populus fremontii*) (Laymon 1998). It is also found in orchards adjacent to river bottoms. The western yellow-billed cuckoo feeds primarily on large insects but also occasionally takes small frogs, lizards, eggs, and young birds. The species is known to be an interspecific brood parasite, laying eggs in the nests of at least 11 other bird species (Hughes 1999). Major declines among western populations in twentieth century due to habitat loss and fragmentation, local extinctions, and low colonization rates; now extremely rare in most areas . There are approximately 30 pairs breeding in California. The nearest known breeding pairs are approximately 30 miles south of the project site along the Sacramento River (Laymon 1998).

Bald Eagle (*Haliaeetus leucocephalus*). Federal status: Delisted (previously endangered); State status: Endangered. The bald eagle is a large soaring bird; in North America, it is second in size only to the California condor (*Gymnogyps californianus*). Most of the annual food requirements of a bald eagle is derived from or obtained around aquatic habitats. The food most often consumed consists of fish, water birds, and small to medium-sized mammals. Because of the dietary association, nesting territories are usually found near water.

Perches are used primarily during the day for resting, preening, and hunting, and may include human-made structures such as power poles. Roosting areas contain a night communal roosting tree that is easily accessible to the large birds and tall enough to provide safety from threats from the ground. Bald eagle nests and roosts are usually found where human activity is infrequent or muted. In California, breeding pairs are found mostly in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties (U.S. Fish and Wildlife Service 2007a).

The USFWS delisted the bald eagle in 2007, and attributes the recovery of the species to reduction in use of organochlorine pesticides and habitat conservation (U.S. Fish and Wildlife Service 2007a). NSR staff have have incidentally observed bald eagles foraging over the project site, but have not observed them nesting on the project site.

Bank Swallow (*Riparia riparia*). Federal status: None; State status: Threatened. Bank swallows are found primarily in riparian and other lowland habitats in the Central Valley, typically between April and September. They nest colonially and inhabit isolated places where fine-textured or sandy, vertical bluffs or riverbanks are available in which to dig burrows. Bank swallows forage over open riparian areas, brushland, grassland, and cropland.

The species' range in California is estimated to be have been reduced by 50 percent since 1900 (Zeiner et al. 1990a). Now, only 110 to 120 colonies remain within the state. Perhaps 75 percent of the current breeding population in California occurs along the banks of the Sacramento and Feather rivers in the northern Central Valley in areas where the rivers still meander in a mostly natural state. About 50 to 60 colonies remain along the middle Sacramento River, and 15 to 25 colonies occur along the lower Feather River. Other colonies persist along the central coast from Monterey to San

Mateo counties and in northeastern California in Shasta, Siskiyou, Lassen, Plumas, and Modoc counties (Zeiner et al. 1990a).

Other Special-Status Wildlife Species

River Lamprey *(Lampetra ayresii)* Federal Status: None; State Status: Species of Special Concern. River lamprey are anadromous; like salmon they are born in freshwater streams, migrate to the ocean, and return to fresh water as mature adults to spawn. Also like the salmon, lampreys do not feed during their spawning migration. Mating pairs of lamprey construct a nest by digging together using rapid vibrations of their tails and by moving stones using their suction mouths. They enter streams from July to October; spawning takes place the following spring when water temperatures are between 50° and 62.6°F. They ascend rivers by alternately swimming upstream in brief spurts and resting by sucking and holding on to rocks. Spawning takes place in low-gradient reaches of streams with gravel and sandy bottoms. Adults die within 4 days of spawning, after depositing from 10,000 to 100,000 very small-sized eggs in their nest. The young hatch in 2 to 3 weeks and swim to areas of low-velocity water where sediments are soft and rich in dead plant materials. They quickly burrow into the muddy bottom, where they filter the mud and water, eating microscopic plants (mostly diatoms) and animals.

Juvenile lamprey will stay burrowed in the mud for 3 to 6 years, moving only rarely to new areas. After a 2-month metamorphosis, triggered by unknown factors, they metamorphose into an adult morphology averaging 4.5 inches long. Newly metamorphosed lampreys migrate downstream during winter and spring high flow events. Adult river lampreys are thought to spend from 2 to 12 months in the estuary or ocean before returning to the rivers to spawn. River lamprey are known to occur in the Sacramento River (Moyle 2002).

Central Valley Fall/Late-fall Run Chinook Salmon ESU (Oncorhynchus tshawytscha) Federal Status: None; State Status: Species of Special Concern. The Central Valley fall/late-fall run ESU Chinook salmon comprises the largest present day population of Chinook salmon in the Central Valley. Fall-run Chinook salmon begin to enter the Sacramento River in July and the run builds through the late summer and fall months peaking by late-September and October (Vogel and Marine 1991). Spawning occurs throughout the upper Sacramento River and in a majority of its tributaries from mid-October through December (Vogel and Marine 1991; Moyle 2002). Spawning densities of fall run salmon are very high in the Sacramento River from near Red Bluff to Keswick Dam (D. Killam, CDFG, personal communication). Juvenile fall-run Chinook salmon rear throughout the Sacramento River and its tributaries. Juvenile fall run fry may emigrate to the estuary from shortly after they hatch through the spring and summer months following their birth.

The late-fall run component of this Chinook salmon ESU enters the Sacramento-San Joaquin estuary and ascends Central Valley streams after the fall run, usually from late-October through March (Vogel and Marine 1991). Spawning begins in January and is usually complete by late-April. Late-fall run spawning densities are greatest in the upper Sacramento River from Red Bluff to Keswick Dam. Both fall and late-fall run salmon use the spawning habitat of the mainstem river adjacent to the study area (CDFG, unpublished data). Juvenile late-fall run salmon rear in the upper Sacramento

River from late-April through the following winter before emigrating to the estuary (Vogel and Marine 1991; Moyle 2002).

Large numbers of the fall run and late-fall run salmon are spawned and reared by state and federal fish hatcheries in California's Central Valley. The number of hatchery-produced fish may greatly exceed the number naturally produced fall/late-fall run Chinook salmon in some Central Valley streams which has led to concern over the viability of certain tributary populations. These runs support valuable and popular ocean and river commercial and sport fisheries.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a federal fisheries management plan (FMP). EFH refers to those waters and substrates necessary for the spawning, breeding, feeding, or growth to maturity. Central Valley spring-run ESU Chinook salmon, Central Valley fall/late-fall run ESU Chinook salmon, and Sacramento River winter-run ESU Chinook salmon are all managed under a FMP and are therefore subject to protection under MSA.

The Sacramento River is designated by the National Marine Fisheries Service (NMFS) to contain EFH for Chinook salmon, as defined by the Magnuson-Stevens Fisheries Conservation and Management Act of 1994, as amended. EFH refers to those waters and substrates necessary for spawning, breeding, feeding, or growth to maturity. Freshwater EFH for salmon consists of four major components: spawning and incubation habitat; juvenile rearing habitat; juvenile migration corridors; and adult migration corridors and adult holding habitat (Pacific Fishery Management Council 2003).

The Sacramento River adjacent to the project site provides all four major components of freshwater EFH for salmon. Adult Chinook salmon migrate to and are known to spawn within all suitable habitats adjacent to the project site. Fry and juveniles are known to occur in suitable rearing habitats nearly year round. Medium to large cobbles and boulders dominate the river bottom in these habitats, providing suitable cover and refuge for rearing salmonids.

Hardhead *(Mylopharodon conocephalus)* Federal Status: None; State Status: Species of Special Concern. Hardhead were identified as a California Species of Special Concern in 1995 (Moyle et al. 1995). Hardhead are listed as a Class 3 species of special concern. Class 3 species are those fish species occupying much of their native range, but that were formerly more widespread or abundant within that range. Included in this classification are taxa with very restricted distributions (e.g., Eagle Lake tui chub). The populations of such species need to be assessed periodically (i.e., every 5 years) and included in long-term plans for protected waterways.

Hardhead are large cyprinids that closely resemble Sacramento pikeminnow and are widely distributed in low- to mid-elevation streams in the Sacramento–San Joaquin drainage. Hardhead typically inhabit undisturbed areas of larger low- to mid-elevation streams, although they are also found in the mainstem Sacramento River at low elevations and in its tributaries to about 4,921 feet . They prefer clear, deep pools and runs with slow velocities and occur in streams where summer temperatures reach in excess of 68°F (Moyle 2002).

Historically, hardhead have been regarded as widespread and abundant in central California and are still widely distributed in foothill streams. The specific risk to hardhead is their increasingly isolated populations, making them vulnerable to localized extinctions. Hardhead also tend to be absent from streams where introduced species dominate (Mayden, Rainboth, and Buth 1991; Moyle and Daniels 1982), and from streams that have been severely altered by human activity (Baltz and Moyle 1993).

Western Spadefoot Toad (*Spea hammondi*). Federal status: None; State Status: Species of Special Concern. Historically, the western spadefoot toad ranged from Redding to northwestern Baja, California. It has been extirpated from many locations within this range. Since 1990, there have been sightings in Alameda, Butte, Calaveras, Fresno, Kern, Kings, Los Angeles, Madera, Merced, Monterey, Orange, Placer, Riverside, Sacramento, San Benito, San Diego, San Joaquin, San Luis Obispo, Santa Barbara, Stanislaus, Tulare, Ventura, and Yolo counties (U.S. Fish and Wildlife Service 2007c).

The western spadefoot toad occurs primarily in grassland locations, but occasional populations also occur in valley-foothill hardwood woodlands. Some populations persist for a few years in orchard-vineyard habitats (Zeiner, Laudenslayer, and Mayer 1989). The species is found at elevations below 3,000 feet but can occur up to 4,500 feet. Western spadefoot toads breed in temporary pools from January to May. Water temperatures in these pools must be between 48ºF and 86ºF. Eggs are deposited on plant stems or on pieces of detritus in temporary rain pools or, less frequently, in pools in ephemeral stream courses (U.S. Fish and Wildlife Service 2007c).

Western spadefoot toads are extremely sensitive to low frequency noises and vibrations. These disturbances cause western spadefoot toads to break dormancy and emerge from their burrows (Dimmitt and Ruibal 1980).

Northwestern Pond Turtle (*Clemmys marmorata marmorata*). Federal Status: None; State Status: Species of Special Concern. The northwestern pond turtle is found in the quiet waters of ponds, marshes, creeks, and irrigation ditches. This species requires basking sites such as partially submerged logs, rocks, mats of floating vegetation, or open mud banks. They frequently bask on logs or other objects out of the water when water temperatures are low and air temperatures are greater than water temperatures. When air temperatures become too warm, western pond turtles water bask by lying in the warmer surface water layer with their heads out of the water. Hibernation in colder areas is passed underwater in bottom mud (Zeiner, Laudenslayer, and Mayer 1989). Mating typically occurs in late April or early May, but may occur year-round. Nests are located in an upland location that may be a considerable distance from the aquatic site (up to ¼ mile) (California Department of Fish and Game 1994). Hatchling turtles are thought to emerge from the nest and move to the aquatic site in the spring. Today, the northwestern pond turtle occurs in 90% of its historic range in the Central Valley and west of the Sierra Nevada mountains, but in greatly reduced numbers (Jennings and Hayes 1994). It occurs from the Oregon border south to the American Basin in the Central Valley, where it intergrades with southwestern pond turtle.

Western Burrowing Owl (*Athene cunicularia hypugaea*). Federal status: None; State status: Species of Special Concern. The western burrowing owl inhabits open, dry grasslands and deserts, as well as open stages of pinyon-juniper and ponderosa pine. The nesting season is between February 1 and August 31. Western burrowing owls typically nest in abandoned rodent burrows, particularly

those of California ground squirrels, which they modify each year. Burrowing owls forage in open grassland areas adjacent to nest sites. The species has also been documented in open areas near human habitation, especially airports and golf courses. The Central Valley and surrounding foothill regions of California provide year-round habitat for the western burrowing owl.

The study area has the general habitat requirements for the burrowing owl, but NSR staff did not note rodent activity and burrows during the site visits. There are no recorded CNDDB occurrences of the western burrowing owl within a 5-mile radius of the study area (California Department of Fish and Game 2007a).

Cooper's Hawk (*Accipiter cooperii*). Federal status: None; State status: Species of Special Concern. Cooper's hawks prefer landscapes where wooded areas occur in patches and groves facilitating the ambush hunting tactics employed by this species. The species preys upon medium-sized birds (e.g., jays, doves, and quail) and occasionally takes small mammals and reptiles. Breeding pairs in California prefer nest sites within dense stands of live oak woodland or riparian areas, and prey heavily on young birds during the nesting season. Cooper's hawks are breeding residents throughout most of the wooded areas in California, but populations have declined in recent decades (Zeiner et al. 1990a).

Cooper's hawks have the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

White-tailed Kite (*Elanus leucurus*). Federal Status: None; State Status: Fully Protected Species. The white-tailed kite can be found in association with the herbaceous and open stages of a variety of habitat types, including open grasslands, meadows, emergent wetlands, and agricultural lands. Nests are constructed near the top of dense oaks, willows, or other tree stands located adjacent to foraging areas. The species forages in undisturbed, open grasslands, meadows, farmlands and emergent wetlands. White-tailed kite are seldom observed more than 0.5 mi (0.8 km) from an active nest during the breeding season (Zeiner et al. 1990a). The white-tailed kite is found year-round in both the coastal zones and lowlands of the Central Valley in California.

White-tailed kites have the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

Osprey (*Pandion haliaetus*). Federal Status: None; State Status: Species of Special Concern. In California, osprey are common summer residents and breeders but are less common in winter. Osprey breed primarily in scattered locations throughout northern California from the Cascade Ranges south to Lake Tahoe, and along the coast south to Marin County. They nest and roost on exposed treetops, towers, pilings, or similar structures near lakes, reservoirs, rivers, estuaries, and the open sea coast. They forage over fish-bearing bodies of water. Current threats to the species include degradation of aquatic environments such as rivers and lakes and loss of nesting structures such as trees to timber harvest and other activities (Zeiner et al. 1990a).

Osprey have the potential to nest within the study area in the riparian area along the Sacramento River. There are two CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

California Yellow Warbler (*Dendroica petechia brewsteri*). Federal Status: None; State Status: Species of Special Concern. The yellow warbler is a long-distance migrant, usually arriving in California in April and leaving by October. The species breeds from mid-April to early August, building an open cup nest in a tree or shrub. Foraging patterns typically involve gleaning and hovering for insects and spiders. The yellow warbler occurs as a summer resident in northern California. It is usually found in dense riparian deciduous habitats with cottonwoods, willows, alders, and other small trees and shrubs typical of open-canopy riparian woodlands.

Yellow warblers have the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

Yellow-breasted Chat (Ictera virens); Federal Status: None; State Status; Species of Special Concern. The yellow-breasted chat is a neotropical migrant that occurs in riparian or marsh habitats throughout California. They are found in dense, brushy thickets near water and in the thick understory of riparian woodlands. Forage patterns usually involve gleaning insects, spiders, and berries from the foliage of shrubs and low trees. Nests are often low to the ground in dense shrubs along streams. They occur as summer breeding residents in the Sacramento River Valley and its tributaries (Zeiner et al. 1990a).

Yellow-breated chat has the potential to nest within the study area in the riparian forest along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

Loggerhead Shrike (*Lanius ludovicianus*). Federal Status: None; State Status: Species of Special Concern. The loggerhead shrike prefers open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches located in open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper, juniper, desert riparian, and Joshua tree habitats. Loggerhead shrikes skewer their prey to thorns or barbs on barbed-wire fences. The purpose of this trait may be to help kill the prey or to cache the food for latter consumption. Loggerhead shrikes are found in lowlands and foothills throughout California (Zeiner et al. 1990a).

Loggerhead shrike has the potential to nest within the study area within the valley oak woodland. NSR staff did not observe this species or any nests during site visits.

Ringtail (*Bassiriscus astutus*). Federal Status: None; Federal Status: Fully Protected Species. The ringtail occurs in various riparian habitats in and brush stands of most forest and shrub habitats. Nocturnal, and primarily carnivorous, ringtails mainly eat small mammals but also feed on birds, reptiles, insects, and fruit. They forage on the ground, among rocks, and in trees; usually near water.

Hollow trees and logs, cavities in rocky areas, and other recesses are used for cover. The ringtail is widely distributed in California (Zeiner et al. 1990b).

Ringtail has the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species during site visits.

3.5 Field Review/Surveys

During the field reconnaissance and protocol-level surveys, the study area was inspected to identify plant and wildlife special-status species and/or potential habitat for these species in the study area. Lists of all plant and wildlife species observed are presented in Appendix E.

Botany

No special-status vascular plant species were detected as a result of botanical survey efforts. A list of all plant species observed is presented in Appendix E.

Wildlife

3.5.1.1 ***NSR staff California Red-Legged Frog Assessment***

NSR staff conducted a USFWS protocol-level site assessment for California red-legged frog, and produced a separate detailed report (North State Resources 2007a). NSR staff did not observe any California red-legged frogs during the USFWS protocol-level surveys, but did conclude that the seasonal pond in the central region of the site provides suitable breeding habitat.

3.5.1.2 ***Valley Elderberry Longhorn Beetle Surveys***

Sixty two (62) elderberry shrubs with stems measuring 1-inch or greater in diameter at ground level were detected during the surveys. Nearly all of the recorded elderberry shrubs are located within the valley foothill riparian and valley oak woodland habitat types in the southwest and south central section of the study area (Figure 3 in map pocket). Several of the elderberry shrubs are within the 100-foot buffer zone just south of the boundary at the southwest corner of the study area. Two of the 62 elderberry shrubs were deeply embedded within Himalayan blackberry brambles and were inaccessible for close inspection. Field survey data for the 62 elderberry shrubs are presented in a table in Appendix F.

Exit holes characteristic of VELB (e.g. exit hole oval to circular, approximately ¼ inch in diameter, and without beveled edges; exit hole on stem greater than one inch in diameter and within six feet from ground) were detected on 13 of the 60 elderberry shrubs that were accessible for close inspection. These 13 elderberry shrubs are located within valley foothill riparian and valley oak woodland habitats in the southwest and south central section of the study area (Figure 3 in map pocket). All of the 36 observed VELB exit holes are within six feet above ground level and located in live stems greater than 1-inch in diameter. There were both new exit holes, characterized by sharp hole edges and light colored wood, and older exit holes, characterized by the gradual sealing of the hole due to cambial growth (See photographs in Appendix G).

3.5.1.3 ***Incidental Special-Status Wildlife Observations***

NSR staff made incidental field observations of 30 wildlife species including one special-status species; bank swallow (Appendix E). NSR botanist/plant ecologist, Mr. Boggs and NSR biologist, Ms. Bolen observed a colony of bank swallows nesting in the cut-bank of the Sacramento River within the northern portion of the study area (Figure 3 in map pocket).

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APPENDIX A

U.S. Fish and Wildlife Service Species List

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

April 26, 2007

Document Number: 070426124401

Michael Gorman
North State Resources, Inc.
500 Orient St. Suite 150
Chico, CA 95928

Subject: Species List for Strawberry Fields Property

Dear: Mr.

We are sending this official species list in response to your April 26, 2007 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 25, 2007.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found at www.fws.gov/sacramento/es/branches.htm.

Endangered Species Division

TAKE PRIDE IN AMERICA

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 070426124401

Database Last Updated: March 5, 2007

Quad Lists

Listed Species

Invertebrates

Branchinecta conservatio
- *Conservancy fairy shrimp (E)*

Branchinecta lynchi
- *Critical habitat, vernal pool fairy shrimp (X)*
- *vernal pool fairy shrimp (T)*

Desmocerus californicus dimorphus
- *valley elderberry longhorn beetle (T)*

Lepidurus packardi
- *Critical habitat, vernal pool tadpole shrimp (X)*
- *vernal pool tadpole shrimp (E)*

Pacifastacus fortis
- *Shasta crayfish (E)*

Fish

Acipenser medirostris
- *green sturgeon (T) (NMFS)*

Hypomesus transpacificus
- *delta smelt (T)*

Oncorhynchus mykiss
- *Central Valley steelhead (T) (NMFS)*
- *Critical habitat, Central Valley steelhead (X) (NMFS)*

Oncorhynchus tshawytscha
- *Central Valley spring-run chinook salmon (T) (NMFS)*
- *Critical Habitat, Central Valley spring-run chinook (X) (NMFS)*
- *Critical habitat, winter-run chinook salmon (X) (NMFS)*
- *winter-run chinook salmon, Sacramento River (E) (NMFS)*

Amphibians

Rana aurora draytonii
- *California red-legged frog (T)*

Birds

Haliaeetus leucocephalus
- *bald eagle (T)*

Strix occidentalis caurina
- *northern spotted owl (T)*

Plants

Orcuttia tenuis
- *Critical habitat, slender Orcutt grass (X)*
- *slender Orcutt grass (T)*

Candidate Species

Fish

Oncorhynchus tshawytscha

Central Valley fall/late fall-run chinook salmon (C) (NMFS)
Critical habitat, Central Valley fall/late fall-run chinook (C) (NMFS)

Birds

Coccyzus americanus occidentalis

Western yellow-billed cuckoo (C)

Quads Containing Listed, Proposed or Candidate Species:

BALLS FERRY (628B)

COTTONWOOD (629A)

OLINDA (629B)

BELLA VISTA (646B)

PALO CEDRO (646C)

PROJECT CITY (647A)

SHASTA DAM (647B)

REDDING (647C)

ENTERPRISE (647D)

County Lists

Shasta County

Listed Species

Invertebrates

Branchinecta lynchi

Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardi

Critical habitat, vernal pool tadpole shrimp (X)
vernal pool tadpole shrimp (E)

Pacifastacus fortis

Shasta crayfish (E)

Fish

Hypomesus transpacificus

delta smelt (T)

Oncorhynchus mykiss

Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha

Central Valley spring-run chinook salmon (T) (NMFS)
Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)

winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii

California red-legged frog (T)

Birds

Haliaeetus leucocephalus

bald eagle (T)

Strix occidentalis caurina

Critical habitat, northern spotted owl (X)

northern spotted owl (T)

Plants

Orcuttia tenuis

Critical habitat, slender Orcutt grass (X)

slender Orcutt grass (T)

Tuctoria greenei

Critical habitat, Greene's tuctoria (=Orcutt grass) (X)

Greene's tuctoria (=Orcutt grass) (E)

Candidate Species

Fish

Oncorhynchus tshawytscha

Central Valley fall/late fall-run chinook salmon (C) (NMFS)

Critical habitat, Central Valley fall/late fall-run chinook (C) (NMFS)

Birds

Coccyzus americanus occidentalis

Western yellow-billed cuckoo (C)

Mammals

Martes pennanti

fisher (C)

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.

(C) *Candidate* - Candidate to become a proposed species.

(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.

(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our critical habitat page for maps.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 25, 2007.

APPENDIX B

CNDDB Query Results

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
1	***Agelaius tricolor*** tricolored blackbird	ABPBXB0020			G2G3	S2	SC
2	***Agrostis hendersonii*** Henderson's bent grass	PMPOA040K0			G1Q	S1.1	3.2
3	***Anthicus antiochensis*** Antioch Dunes anthicid beetle	IICOL49020			G1	S1	
4	***Anthicus sacramento*** Sacramento anthicid beetle	IICOL49010			G1	S1	
5	***Antrozous pallidus*** pallid bat	AMACC10010			G5	S3	SC
6	***Branchinecta lynchi*** vernal pool fairy shrimp	ICBRA03030	Threatened		G3	S2S3	
7	***Carex scoparia*** pointed broom sedge	PMCYP03C90			G5	S2S3	2.2
8	***Carex vulpinoidea*** fox sedge	PMCYP03EN0			G5	S2.2	2.2
9	***Castilleja rubicundula ssp. rubicundula*** pink creamsacs	PDSCR0D482			G5T2	S2.2	1B.2
10	***Clarkia borealis ssp. borealis*** northern clarkia	PDONA05062			G3T2	S2.3	1B.3
11	***Cryptantha crinita*** silky cryptantha	PDBOR0A0Q0			G1	S1.1	1B.2
12	***Desmocerus californicus dimorphus*** valley elderberry longhorn beetle	IICOL48011	Threatened		G3T2	S2	
13	***Emys (=Clemmys) marmorata marmorata*** northwestern pond turtle	ARAAD02031			G3G4T3	S3	SC
14	***Euderma maculatum*** spotted bat	AMACC07010			G4	S2S3	SC
15	***Fluminicola seminalis*** Nugget Pebblesnail	IMGASG3110			G2	S1S2	
16	***Gratiola heterosepala*** Boggs Lake hedge-hyssop	PDSCR0R060		Endangered	G3	S3.1	1B.2
17	***Great Valley Cottonwood Riparian Forest***	CTT61410CA			G2	S2.1	
18	***Great Valley Mixed Riparian Forest***	CTT61420CA			G2	S2.2	
19	***Great Valley Valley Oak Riparian Forest***	CTT61430CA			G1	S1.1	
20	***Great Valley Willow Scrub***	CTT63410CA			G3	S3.2	
21	***Haliaeetus leucocephalus*** bald eagle	ABNKC10010	Threatened	Endangered	G5	S2	
22	***Hydromantes shastae*** Shasta salamander	AAAAD09030		Threatened	G1G2	S1S2	
23	***Juncus leiospermus var. leiospermus*** Red Bluff dwarf rush	PMJUN011L2			G2T2	S2.2	1B.1
24	***Lanx patelloides*** Kneecap Lanx	IMGASL7030			G1	S1	
25	***Legenere limosa*** legenere	PDCAM0C010			G2	S2.2	1B.1
26	***Lepidurus packardi*** vernal pool tadpole shrimp	ICBRA10010	Endangered		G3	S2S3	

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
27	***Limnanthes floccosa ssp. bellingeriana*** Bellinger's meadowfoam	PDLIM02041			G4T2	S1.1	1B.2
28	***Linderiella occidentalis*** California linderiella	ICBRA06010			G3	S2S3	
29	***Martes pennanti (pacifica) DPS*** Pacific fisher	AMAJF01021	Candidate		G5	S2S3	SC
30	***Monadenia troglodytes troglodytes*** Shasta sideband (snail)	IMGASC7090			G1G2	S1S2	
31	***Neviusia cliftonii*** Shasta snow-wreath	PDROS14020			G2	S2.2	1B.2
32	***Oncorhynchus tshawytscha spring-run*** spring-run chinook salmon	AFCHA0205A	Threatened	Threatened	G5T1Q	S1	
33	***Oncorhynchus tshawytscha winter run*** chinook salmon winter run	AFCHA0205B	Endangered	Endangered	G5T1Q	S1	
34	***Orcuttia tenuis*** slender orcutt grass	PMPOA4G050	Threatened	Endangered	G3	S3.1	1B.1
35	***Pandion haliaetus*** osprey	ABNKC01010			G5	S3	SC
36	***Paronychia ahartii*** Ahart's paronychia	PDCAR0L0V0			G2	S2.1	1B.1
37	***Riparia riparia*** bank swallow	ABPAU08010		Threatened	G5	S2S3	
38	***Trilobopsis roperi*** Shasta Chaparral	IMGASA2030			G1	S1	
39	***Viburnum ellipticum*** oval-leaved viburnum	PDCPR07080			G5	S2.3	2.3

APPENDIX C

CNPS Query Results

CNPS Inventory of Rare and Endangered Plants

Status: Plant Press Manager window with 15 items - Thu, Apr. 26, 2007 12:43 c

Reformat list as: Standard List - with Plant Press controls

ECOLOGICAL REPORT

scientific	family	life form	blooming	communities	elevation	CNPS
Agrostis hendersonii	Poaceae	annual herb	Apr-May	•Valley and foothill grassland (VFGrs) (mesic) •Vernal pools (VnPls)	70 - 305 meters	List 3.2
Anomobryum julaceum	Bryaceae	moss	•Broadleafed upland forest (BUFrs) •Lower montane coniferous forest (LCFrs) •North Coast coniferous forest (NCFrs)/damp rock and soil on outcrops, usually on roadcuts	100 - 1000 meters	List 2.2	
Carex scoparia	Cyperaceae	perennial herb	May	•Great Basin scrub (GBScr)(mesic)	130 - 1000 meters	List 2.2
Carex vulpinoidea	Cyperaceae	perennial herb	May-Jun	•Marshes and swamps (MshSw)(freshwater) •Riparian woodland (RpWld)	30 - 1200 meters	List 2.2
Castilleja rubicundula ssp. rubicundula	Scrophulariaceae	annual herb	Apr-Jun	•Chaparral (Chprl) (openings) •Cismontane woodland (CmWld) •Meadows and seeps (Medws) •Valley and foothill grassland (VFGrs)/serpentinite	20 - 900 meters	List 1B.2
Clarkia borealis ssp. borealis	Onagraceae	annual	Jun-Sep	•Chaparral (Chprl) •Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs)	400 - 1340 meters	List 1B.3
Cryptantha crinita	Boraginaceae	annual herb	Apr-May	•Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs) •Riparian forest (RpFrs) •Riparian woodland (RpWld) •Valley and foothill grassland (VFGrs)/gravelly streambeds	85 - 1215 meters	List 1B.2
				•Marshes and swamps		

Gratiola heterosepala	Scrophulariaceae	annual herb	Apr-Aug	(MshSw)(lake margins) •Vernal pools (VnPls)/clay	10 - 2375 meters	List 1B.2
Juncus leiospermus var. leiospermus	Juncaceae	annual herb	Mar-May	•Chaparral (Chprl) •Cismontane woodland (CmWld) •Meadows and seeps (Medws) •Valley and foothill grassland (VFGrs) •Vernal pools (VnPls)/vernally mesic	35 - 1020 meters	List 1B.1
Lathyrus sulphureus var. argillaceus	Fabaceae	perennial herb	Apr	•Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs) •Upper montane coniferous forest (UCFrs)	150 - 305 meters	List 3
Legenere limosa	Campanulaceae	annual herb	Apr-Jun	•Vernal pools (VnPls)	1 - 880 meters	List 1B.1
Neviusia cliftonii	Rosaceae	perennial deciduous shrub	Apr-Jun	•Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs) •Riparian woodland (RpWld)/ often streamsides; sometimes carbonate, volcanic, or metavolcanic	300 - 500 meters	List 1B.2
Orcuttia tenuis	Poaceae	annual herb	May-Sep(Oct) Months in parentheses are uncommon.	•Vernal pools (VnPls)	35 - 1760 meters	List 1B.1
Paronychia ahartii	Caryophyllaceae	annual herb	Mar-Jun	•Cismontane woodland (CmWld) •Valley and foothill grassland (VFGrs) •Vernal pools (VnPls)	30 - 510 meters	List 1B.1
Viburnum ellipticum	Caprifoliaceae	perennial deciduous shrub	May-Jun	•Chaparral (Chprl) •Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs)	215 - 1400 meters	List 2.3

APPENDIX D

Special-Status Species Considered for Analysis

Summary of Special-Status Species Review – Plants

Common Name *Scientific Name*	Status[1] (Fed/State/CNPS)	General Habitat Description/Elevation	Blooming Period	General Habitat Within Study Area (Present/ Absent)
Federal or State Listed Species				
Boggs Lake hedge-hyssop *Gratiola heterosepala*	--/E/1B.2	Clay soils within marshes and swamps (lake margins), vernal pools / 30-7,792 feet	April-August	**Absent.**
Slender Orcutt grass *Orcuttia tenuis*	T/E/1B.1	Vernal pools / 114-5,774 feet	May-October	**Absent**
Greene's tuctoria *Tuctoria greenei*	E/R/1B.1	Vernal pools / 98-3510 feet.	May-July	**Absent**
Other Special-Status Species				
Slender silver-moss *Anomobryum julaceum*	--/--/2.2	Damp rock and soil on outcrops within broadleafed upland forest, lower montane coniferous forest, North coast coniferous forest with; usually on roadcuts / 300-3,000 feet	Moss	**Absent**
Pointed broom sedge *Carex scoparia*	--/--/2.2	Mesic areas within Great Basin scrub / 426 – 3280 feet	May	**Absent**
Fox sedge *Carex vulpinoidea*	--/--/2.2	Freshwater marshes and swamps, and riparian woodland / 98-3,937 feet	May-June	**Present**
Pink creamsacs *Castilleja rubicundula* ssp. *rubicundula*	--/--/1B	Serpentinite soils within chaparral openings, cismontane woodland, meadows, seeps and valley and foothill grassland / 60-2,700 feet	April-June	**Absent.**
Northern clarkia *Clarkia borealis* ssp. *borealis*	--/--/1B.3	Chaparral, cismontane woodland, and lower montane coniferous forest / 1,312-4,396 feet	June-September	**Absent**
Silky cryptantha *Cryptantha crinita*	--/--/1B.2	Gravelly streambeds within cismontane woodland, lower montane coniferous forest, riparian scrub, riparian woodland, and valley and foothill grassland / 278-984 feet	April-May	**Present.** Gravelly substrate present on gravel bars and old channels.
Red Bluff dwarf rush *Juncus leiospermus* var. *leiospermus*	--/--/1B.1	Meadows and seeps, vernal pools; Vernally mesic areas within chaparral, cismontane woodland, and valley and foothill grassland / 115-3,346 feet	March-May	**Present.** Foothill grassland present.
Legenere *Legenere limosa*	--/--/1B.1	Vernal pools / 3-2,887 feet	April-June	**Absent**
Shasta snow wreath *Neviusia cliftonii*	--/--/1B.2	Often on streamsides within lower montane coniferous forest and riparian woodland / 984-1,640 feet	April-May	**Absent**
Ahart's nailwort *Paronychia ahartii*	--/--/1B.1	Cismontane woodland, valley and foothill grassland and vernal pools / 90-1,530 feet	March-June	**Present.** Valley oak woodland and foothill grassland present.
Oval-leaved viburnum *Viburnum ellipticum*	--/--/2.3	Chaparral, cismontane woodland, and lower montane coniferous forest / 705-4,593 feet	May-June	**Absent**

Summary of Special-Status Species Review – Wildlife

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Federal or State Listed Species				
Invertebrates				
Conservancy fairy shrimp *Branchinecta lynchi*	T/--	Vernal pool crustaceans live in vernal pools, swales, and ephemeral freshwater habitats. None are known to occur in riverine waters or marine waters.	Absent	Although seasonal wetlands occur in the study area, the site does not occur in a natural vernal pool setting and occurrences of listed vernal pool species do not occur near the study area.
Vernal pool fairy shrimp *Branchinecta conservatio*	E/--	Vernal pool crustaceans live in vernal pools, swales, and ephemeral freshwater habitats. None are known to occur in riverine waters or marine waters.	Absent	Although seasonal wetlands occur in the study area, the site does not occur in a natural vernal pool setting and occurrences of listed vernal pool species do not occur near the study area.
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Elderberry shrubs associated with riparian forests that occur along rivers and streams.	**Present**	Elderberry shrubs occur in the study area.
Vernal pool tadpole shrimp *Lepidurus packardi*	E/--	Vernal pool crustaceans live in vernal pools, swales, and ephemeral freshwater habitats. None are known to occur in riverine waters or marine waters.	Absent	Although seasonal wetlands occur in the study area, the site does not occur in a natural vernal pool landscape and occurrences of listed vernal pool species do not occur near the study area.
Shasta crayfish *Pacifastacus fortis*	E/--	Pit River, Fall River and Hat Creek drainages in Shasta County	Absent	Watersheds in which the species occur do not occur in the study area. Thus, this species is eliminated from further consideration.
Fish				
Green sturgeon, southern DPS (*Acipenser medirostris*)	T/SC	Spawn in Sacramento and Feather rivers; juveniles are thought to rear mainly in the estuary.	**Present**	Suitable habitat occurs in the Sacramento River.
Delta smelt (*Hypomesus transpacificus*)	T/T	Estuarine systems in the Sacramento-San Joaquin Delta.	Absent	Suitable habitat not present.
Steelhead, California Central Valley DPS (*Oncorhynchus mykiss*) Critical Habitat	T/--	Spawn and rear in freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**	Suitable spawning, rearing, and migration habitat occurs in the Sacramento River.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Central Valley spring-run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Critical Habitat	T/T	Freshwater rivers and streams. (Sacramento River and its tributaries)	**Present**	Suitable spawning, rearing, and migration habitat occurs in the Sacramento River.
Sacramento River winter-run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Critical Habitat	E/E	Freshwater river and streams. (Sacramento River and its tributaries)	**Present**	Suitable spawning, rearing, and migration habitat occurs in the Sacramento River.
Amphibians				
Shasta salamander *Hydromantes shastae*	--/T	Moist limestone fissures and caves, in volcanic and other rock outcroppings, and under woody debris in mixed pine-hardwood stands.	Absent	Limestone outcrops do not occur within the study area. Thus, this species is eliminated from further consideration.
California red-legged frog *Rana aurora draytonii*	T/SC	Require aquatic habitat for breeding, also uses a variety of other habitat types including riparian and upland areas. Adults utilize dense, shrubby or emergent vegetation associated with deep-water pools with fringes of cattails & dense stands of overhanging vegetation.	**Present**	One perennial pond occurs in the study area.
Birds				
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	C/E	Nesting habitat is cottonwood/willow riparian forest. Occurs only along the upper Sacramento Valley portion of the Sacramento River, the Feather River in Sutter Co., the south fork of the Kern River in Kern Co., and along the Santa Ana, Amargosa, and lower Colorado rivers	**Present**	Extensive cottonwood/willow riparian forest habitat occurs in the study area.
Willow flycatcher *Empidonax traillii*	--/E	Rare summer resident in wet meadow and montane riparian habitats at 2,000 to 8,000 feet elevation. No longer known to nest in Sacramento Valley but migrates through the north state region in spring and fall.	Absent	Suitable habitat not present.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
American peregrine falcon *Falco peregrinus anatum*	D/E, FP	Forages in many habitats; requires cliffs for nesting.	Absent	Suitable habitat not present.
Greater sandhill crane *Grus canadensis tabida*	--/T, FP	Wetlands required for breeding; forage in nearby pastures, fields, and meadows.	Absent	Suitable habitat not present.
Bald eagle *Haliaeetus leucocephalus*	T/E	Forages on live and dead fish and nests in large trees or snags. Requires large bodies of water, including ocean shorelines, lake margins, and large, open river courses for foraging, nesting, and wintering habitat.	**Present**	The Sacramento River runs along the western edge of the property and provides suitable foraging habitat.
Bank swallow *Riparia riparia*	--/T	Colonial nester on vertical banks or cliffs with fine-textured soils near water.	**Present**	Vertical banks are present along the Sacramento River along the northwestern boundary of the site.
Northern spotted owl *Strix occidentalis caurina* Critical habitat	T/--	In northern California, resides in large stands of old growth, multi-layered mixed conifer, redwood, and Douglas-fir habitats	Absent	Dense, mixed conifer forest is not present.
Mammals				
California wolverine *Gulo gulo luteus*	--/T, FP	A variety of habitats within the elevations of 1,600 and 14,200 ft. Most commonly inhabits open terrain above timberline.	Absent	Suitable habitat not present.
Pacific fisher *Martes pennanti pacifica*	C/SC	Dens and forages in intermediate to large stands of old-growth forests or mixed stands of old-growth and mature trees with greater than 50% canopy closure. May use riparian corridors for movement.	Absent	Suitable habitat not present.
Sierra Nevada red fox *Vulpes vulpes nector*	--/T	Red fir and lodgepole pine forests in the sub-alpine zone and alpine fell-fields of the Sierra Nevada.	Absent	Suitable habitat not present.
Other Special-Status Species				
Fish				
River lamprey *(Lampetra ayresii)*	--/SC	The biology of river lampreys has not been studied in California, general habitat and life history thought to be similar to Pacific lamprey.	**Present**	Suitable habitat occurs in the Sacramento River.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Central Valley fall/late-fall run ESU Chinook salmon (*Oncorhynchus tshawytscha*)	SC/SC	Freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**	Suitable habitat occurs in the Sacramento River.
Hardhead (*Mylopharodon conocephalus*)	--/SC	Quiet deep pools of large, warm, clear streams over rocks or sand.	**Present**	Suitable habitat occurs in the Sacramento River.
Pit roach *Lavinia symmetricus mitrulus*	--/SC	Small, warm, intermittent streams in the upper Pit River and its tributaries and tributaries to Goose Lake.	Absent	Study area outside the upper Pit River watershed.
McCloud River redband trout *Oncorhynchus mykiss ssp.*	--/SC	McCloud River and its tributaries, Swamp Creek and Trout Creek.	Absent	Study area is outside the McCloud River watershed.
Sacramento splittail *Pogonichthys macrolepidotus*	--/SC	Shallow, dead-end sloughs with submerged vegetation.	Absent	Native, non-game species; historically occurred near Redding, however, range is not thought to presently extend above Red Bluff.
Longfin smelt *Spirinchus thaleichthys*	--/SC	Sloughs of Suisun Bay and Delta.	Absent	Suitable habitat not present.
Amphibians				
Tailed frog *Ascaphus truei*	--/SC	Clear, rocky, swift, cool perennial streams in densely forested habitats.	Absent	Suitable habitat not present.
Foothill yellow-legged frog *Rana boylii*	--/SC	Rocky streams in a variety of habitats. Found in coast ranges.	Absent	Suitable habitat not present.
Cascades frog *Rana cascadae*	--/SC	Open coniferous forests along the sunny, rocky banks of ponds, lakes, streams, and meadow potholes. From 2,600 to 9,000 feet in elevation in Cascades and Trinity Mountains.	Absent	Suitable habitat not present.
Western spadefoot toad *Spea hammondii*	--/SC	Grasslands with temporary pools.	**Present**	One intermittent pool is located within a grassland in the northeast section of the site.
Reptiles				
Northwestern pond turtle *Clemmys marmorata marmorata*	--/SC	Slow water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Require an upland oviposition site in the vicinity of the aquatic site	**Present**	One perennial pond occurs on the project site.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Birds				
Long-billed curlew *Numenius americanus*	--/SC	Large coastal estuaries, upland herbaceous areas, and croplands. Breeds in wet meadow habitat.	Absent	Suitable habitat not present.
Double-crested cormorant *Phalacrocorax auritus*	--/SC	Inland lakes; fresh, salt and estuarine waters.	**Present**	Suitable nesting habitat not present on site due to level of human disturbance. May occur as a forager.
White-faced ibis *Plegadis chihi*	--/SC	A rare visitor to the Central Valley, this species nests and forages in freshwater marshes.	Absent	Suitable habitat not present.
California spotted owl *Strix occidentalis occidentalis*	--/SC	Dense, multi-layered mixed conifer, redwood, and Douglas-fir habitats with large overstory trees.	Absent	Conifer forest not present in study area.
Merlin *Falco columbarius*	--/SC	Frequents ocean shorelines, lake margins, and large, open river courses near tree stands for both nesting and wintering habitat. Does not breed in California.	**Present**	Woodlands provide suitable habitat.
Long-eared owl *Asio otus*	--/SC	Dense riparian and live oak thickets near meadow edges, and nearby woodland and forest habitats; also found in dense conifer stands at higher elevations.	Absent	Dense vegetation and meadows do not occur within the study area.
Western burrowing owl *Athene cunicularia hypugaea*	--/SC	Open habitats, dry grasslands and ruderal habitats with ground squirrel burrows.	**Present**	Suitable habitat present, however, there are no known occurrences in the area.
Golden eagle *Aquila chrysaetos*	--/SC/FP	Breeds on cliffs or in large trees or electrical towers, forages in open areas.	Absent	Open habitats and cliffs do not occur in the study area. Thus, this species is eliminated from further consideration
Sharp-shinned hawk *Accipiter striatus*	--/SC	Typically nests in dense conifer stands near water, winters in woodlands. Forages in many habitats in winter and migration.	**Present**	Unlikely to nest in area but may occur as a winter migrant.
Cooper's hawk *Accipiter cooperii*	--/SC	Nests in woodlands, forages in many habitats in winter and migration.	**Present**	Suitable nesting and foraging habitat is present in the project.
Northern goshawk *Accipiter gentilis*	--/SC	Breeds in dense, mature conifer and deciduous forests, interspersed with meadows, other openings and riparian areas; nesting habitat includes north-facing slopes near water.	Absent	Dense coniferous forests do not occur in the study area.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Ferruginous hawk *Buteo regalis*	--/SC	Forages in grasslands and occasionally in other open habitats during migration and winter.	**Present**	May be rare as migrant.
Northern harrier *Circus cyaneus*	--/SC	Forages in marshes, grasslands, and ruderal habitats; nests in extensive marshes and wet fields or grasslands.	Absent	Open grasslands or marshlands do not occur in the study area. Thus, this species is eliminated from further consideration
Prairie falcon *Falco mexicanus*	--/SC	Occurs in open habitats such as grasslands, desert scrub, rangelands and croplands. Nests on open cliffs.	**Present**	May be rare as migrant.
White-tailed kite *Elanus leucurus*	--/FP	Nests in lowlands with dense oak or riparian stands near open areas, forages over grassland, meadows, cropland and marshes.	**Present**	Woodlands and riparian forest provided suitable habitat.
Osprey *Pandion haliaetus*	--/SC	Ocean shorelines, lake margins and large, open river courses for both nesting and wintering habitat.	**Present**	Riparian habitat or large bodies of water occur in and near the study area
Black swift *Cypseloides niger*	--/SC	Nests in moist crevice or cave or sea cliffs above the surf, or on cliffs behind, or adjacent to, waterfalls in deep canyons; forages widely over many habitats.	Absent	Cliffs, deep canyons not present in Project vicinity. Thus, this species is eliminated from further consideration
Vaux's swift *Chaetura vauxi*	--/SC	Prefers redwood and Douglas-fir habitats, nests in hollow trees and snags or, occasionally, in chimneys; forages aerially.	Absent	Neither redwood nor Douglas-fir habitat is present. Thus, this species is eliminated from further consideration
Purple martin *Progne subis*	--/SC	Breeding habitat includes old-growth, multi-layered, open forest and woodland with snags; forages over riparian areas, forest, and woodlands	Absent	Multi-layered old growth does not occur in the study area. Thus, this species is eliminated from further consideration
Tricolored blackbird *Agelaius tricolor*	--/SC	Breeds near fresh water in dense emergent vegetation. Forages in grassland and cropland.	Absent	Dense emergent vegetation does not occur in the wetlands occuring in the study area. Foraging habitat is not available. Thus, this species is eliminated from further consideration.
California yellow warbler *Dendroica petechia brewsteri*	--/SC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	**Present**	Riparian habitat occurs in and near the study area.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Yellow-breasted chat *Icteria virens*	--/SC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	**Present**	Riparian habitat occurs in and near the study area.
Bell's Sage Sparrow *Amphispiza belli belli*	--/SC	Nests in shrublands, preferably coastal scrub but is tolerant to a variety of shrublands. Irregular in its northern range of the western Shasta and Trinity Counties	Absent	Mixed chaparral occurs in the study area. Study area located near northernmost range of species
Loggerhead shrike *Lanius ludovicianus*	--/SC	Prefers open habitats with scatters shrubs and trees throughout the Central Valley of California. Nests in shrubs and trees.	**Present**	Open shrub/tree habitat occurs in the study area
Mammals				
Ringtail *Bassariscus astutus*	--/FP	Riparian habitats and in brush stands of most forest and shrub habitats. Nests in rock recesses, hollow trees, logs, snags, abandoned burrows or woodrat nests.	**Present**	Riparian habitat occurs in and near the study area.
Sierra Nevada snowshoe hare *Lepus americanus tahoensis*	--/SC	Boreal zones, typically inhabiting riparian communities with thickets of deciduous trees and shrubs above 4,800 ft. They also inhabit thickets of young conifers and chaparral.	Absent	Study area is below the required elevation for suitable habitat.
Townsend's western big-eared bat *Corynorhinus townsendii*	--/SC	Roosts in colonies in caves, mines, tunnels, or buildings in mesic habitats. The species forages along habitat edges, gleaning insects from bushes and trees. Habitat must include appropriate roosting, maternity and hibernacula sites free from disturbance by humans.	Absent	Roosting habitat is not present.
Pallid bat *Antrozous pallidus*	--/SC	Forages over many habitats; roosts in buildings, large oaks or redwoods, rocky outcrops and rocky crevices in mines and caves, and under bridges. Roosts must protect from high temperatures	**Present**	Roosting habitat does not occur within the study area; however suitable foraging habitat occurs in the study area.
Spotted bat *Euderma maculatum*	--/SC	Ponderosa pine region of the western highlands. Prefers cracks/crevices of high cliffs and canyons for roosting.	Absent	Ponderosa pine habitat not present and the project is located out of the current range of this species. Thus, this species is eliminated from further consideration

Scientific Name	**Status[1] (Fed/State)**	**General Habitat Description**	**General Habitat[1] (Present/ Absent)**	**Rationale**
Western mastiff bat *Eumops perotis*	--/SC	Roosts in cliff faces, rock outcrops, and buildings. Forages in open habitats. Needs vertical face to take flight.	**Present**	Roosting habitat does not occur within the study area; however suitable foraging habitat occurs in the study area.
American badger *Taxidea taxus*	--/SC	Herbaceous, shrub, and open stages of most habitats with dry, friable soils.	Absent	Suitable habitat does not occur within the study area.

[1]**Status and Habitat Codes:** Absent means general habitat is not present and no further work needed. Present means general habitat is present and species may be present.
Federal and State Codes: E = Endangered; T = Threatened; C = Candidate; Species of Special Concern (State); D = Delisted (status to be monitored for 5 years); FP = California Fully Protected Species. CNPS Codes: List 1B = Rare, Threatened or Endangered in CA and Elsewhere; List 2 = Rare, Threatened or Endangered in CA, but more common elsewhere.

APPENDIX E

Plant and Wildlife Species Observed

Plant Species Observed on the Strawberry Fields Study Area

Observers: Colby Boggs and Paul Kirk

Dates: April 25, May 3, May 9, and June 27, 2007

Annual Grassland		
Scientific name	**Common name**	**Family**
Aira caryophyllea	Silver European hairgrass	Poaceae
Amsinckia menziesii var. *intermedia*	Common fiddleneck	Boraginaceae
Brassica nigra	Black mustard	Brassicaceae
Brickellia californica	California brickellbush	Asteraceae
Bromus diandrus	Ripgut brome	Poaceae
Bromus hordeaceus	Soft brome	Poaceae
Bromus madritensis ssp. *rubens*	Red brome	Poaceae
Capsella bursa-pastoris	Shepherd's purse	Brassicaceae
Castilleja attenuata	Valley tassels	Scrophulariaceae
Centaurea solstitialis	Yellow star-thistle	Asteraceae
Cerastium glomeratum	Sticky mouse-eared chickweed	Caryophyllaceae
Chamomilla suaveolens	Pineapple weed	Asteraceae
Cichorium intybus	Chicory	Asteraceae
Cirsium vulgare	Bull thistle	Asteraceae
Convolvulus arvensis	Bindweed	Convolvulaceae
Cryptantha flaccida	Flaccid cryptantha	Boraginaceae
Cynodon dactylon	Bermuda grass	Poaceae
Cyperus eragrostis	Tall flatsedge	Cyperaceae
Dipsacus fullonum	Wild teasel	Dipsacaceae
Elymus elymoides	Squirreltail	Poaceae
Eriodictyon californicum	Yerba santa	Hydrophyllaceae
Eriogonum luteolum	Golden buckwheat	Polygonaceae
Eriogonum nudum	Naked eriogonum	Polygonaceae
Eriogonum sphaerocephalum	Round-headed buckwheat	Polygonaceae
Eriogonum vimineum	Wicker buckwheat	Polygonaceae
Eriophyllum lanatum	Woolly sunflower	Asteraceae
Erodium botrys	Long-beaked stork's bill	Geraniaceae
Erodium cicutarium	Red-stemmed filaree	Geraniaceae
Eschscholzia californica	California poppy	Papaveraceae
Filago californica	California herba impia	Asteraceae
Fraxinus latifolia	Oregon ash	Oleaceae
Grindelia camporum	Great valley gumweed	Asteraceae
Heterotheca oregona	Oregon goldenaster	Asteraceae
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley	Poaceae
Hordeum murinum ssp. *leporinum*	Foxtail barley	Poaceae
Hypochaeris glabra	Smooth cat's-ear	Asteraceae
Juncus effusus	Common bog rush	Juncaceae
Keckiella breviflora	Gaping keckiella	Scrophulariaceae
Leontodon taraxacoides	Hawkbit	Asteraceae
Lolium multiflorum	Italian ryegrass	Poaceae
Lomatium dasycarpum	Woolly-fruited lomatium	Apiaceae
Lotus humistratus	Short-podded lotus	Fabaceae

Annual Grassland (cont.)		
Scientific name	**Common name**	**Family**
Lupinus albifrons	Silver bush lupine	Fabaceae
Lupinus bicolor	Miniature lupine	Fabaceae
Mentzelia laevicaulis	Smooth-stem blazing star	Loasaceae
Petrorhagia dubia	Grass pink	Caryophyllaceae
Plagiobothrys fulvus	Fulvous popcorn flower	Boraginaceae
Plantago erecta	Erect plantain	Plantaginaceae
Raphanus raphanistrum	Jointed charlock	Brassicaceae
Rubus discolor	Himalayan blackberry	Rosaceae
Sagina apetala	Dwarf pearlwort	Caryophyllaceae
Salix exigua	Narrow-leaved willow	Salicaceae
Senecio vulgaris	Old man of spring	Asteraceae
Silybum marianum	Milk thistle	Asteraceae
Sonchus oleraceus	Common sow thistle	Asteraceae
Sorghum halepense	Johnson grass	Poaceae
Spergularia rubra	Ruby sandspurry	Caryophyllaceae
Symphytum officinale	Comfrey	Boraginaceae
Taraxacum officinale	Common dandelion	Asteraceae
Trifolium dubium	Shamrock	Fabaceae
Trifolium hirtum	Rose clover	Fabaceae
Trifolium microcephalum	Small-head field clover	Fabaceae
Trifolium repens	White clover	Fabaceae
Veronica peregrina ssp. *xalapensis*	Purslane speedwell	Scrophulariaceae
Vicia villosa	Winter vetch	Fabaceae
Vulpia myuros	Rattail fescue	Poaceae

Valley Foothill Riparian		
Acacia dealbata	Silver wattle	Fabaceae
Agrostis exarata	Spike bentgrass	Poaceae
Ailanthus altissima	Tree-of-heaven	Simaroubaceae
Alnus rhombifolia	White alder	Betulaceae
Aristolochia californica	Pipevine	Aristolochiaceae
Artemisia douglasiana	Mugwort	Asteraceae
Asparagus officinalis ssp. *officinalis*	Asparagus	Liliaceae
Barbarea orthoceras	Winter cress	Brassicaceae
Brassica nigra	Black mustard	Brassicaceae
Brickellia californica	California brickellbush	Asteraceae
Briza minor	Small quaking grass	Poaceae
Bromus diandrus	Ripgut brome	Poaceae
Bromus hordeaceus	Soft brome	Poaceae
Carduus pycnocephalus	Italian plumeless thistle	Asteraceae
Carex integra	Smooth-beaked sedge	Cyperaceae
Carex nudata	Torrent sedge	Cyperaceae
Cercis occidentalis	Western redbud	Fabaceae
Cyperus eragrostis	Tall flatsedge	Cyperaceae
Datura wrightii	Toluaca	Solanaceae
Dipsacus fullonum	Wild teasel	Dipsacaceae
Echinochloa crus-galli	Barnyard grass	Poaceae
Elymus elymoides	Squirreltail	Poaceae
Epilobium brachycarpum	Tall annual willowherb	Onagraceae

Valley Foothill Riparian (cont.)

Scientific name	**Common name**	**Family**
Equisetum laevigatum	Smooth scouring rush	Equisetaceae
Eriogonum vimineum	Wicker buckwheat	Polygonaceae
Festuca rubra	Red fescue	Poaceae
Ficus carica	Common fig	Moraceae
Fraxinus latifolia	Oregon ash	Oleaceae
Galium aparine	Goose grass	Rubiaceae
Geranium molle	Dove's foot geranium	Geraniaceae
Gnaphalium californicum	California everlasting	Asteraceae
Hordeum murinum	Barley	Poaceae
Iris pseudacorus	Water iris	Iridaceae
Juglans californica	California black walnut	Juglandaceae
Juncus effusus	Common bog rush	Juncaceae
Juncus saximontanus	Rocky mountain rush	Juncaceae
Lactuca serriola	Prickly lettuce	Asteraceae
Leontodon taraxacoides	Hawkbit	Asteraceae
Lolium multiflorum	Italian ryegrass	Poaceae
Melilotus alba	White sweetclover	Fabaceae
Morus alba	Mulberry	Moraceae
Paspalum dilatatum	Dallis grass	Poaceae
Phytolacca americana	Pokeweed	Phytolaccaceae
Pinus ponderosa	Ponderosa pine	Pinaceae
Pinus sabiniana	Gray pine	Pinaceae
Plantago lanceolata	English plantain	Plantaginaceae
Plectritis ciliosa	Long-spurred plectritis	Valerianaceae
Polygonum lapathifolium	Willow weed	Polygonaceae
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Salicaceae
Quercus lobata	Valley oak	Fagaceae
Quercus wislizenii	Interior live oak	Fagaceae
Rhamnus californica	California coffeeberry	Rhamnaceae
Robinia pseudoacacia	Black locust	Fabaceae
Rubus discolor	Himalayan blackberry	Rosaceae
Rumex acetosella	Common sheep sorrel	Polygonaceae
Salix exigua	Narrow-leaved willow	Salicaceae
Salix gooddingii	Goodding's black willow	Salicaceae
Salix lasiolepis	Arroyo willow	Salicaceae
Sambucus mexicana	Blue elderberry	Caprifoliaceae
Saponaria officinalis	Bouncing bet	Caryophyllaceae
Setaria pumila	Yellow bristle grass	Poaceae
Silybum marianum	Milk thistle	Asteraceae
Sonchus oleraceus	Common sow thistle	Asteraceae
Stellaria media	Common chickweed	Caryophyllaceae
Torilis arvensis	Field hedge-parsley	Apiaceae
Toxicodendron diversilobum	Poison oak	Anacardiaceae
Ulmus minor	Smoothleaf elm	Ulmaceae
Verbascum thapsus	Woolly mullein	Scrophulariaceae
Vicia villosa	Winter vetch	Fabaceae
Vitis californica	California wild grape	Vitaceae
Vulpia myuros	Rattail fescue	Poaceae

Foothill Pine		
Scientific name	**Common name**	**Family**
Ailanthus altissima	Tree-of-heaven	Simaroubaceae
Anthoxanthum aristatum	Annual vernal grass	Poaceae
Arctostaphylos manzanita	Big leaved manzanita	Ericaceae
Avena barbata	Slender wild-oat	Poaceae
Brickellia californica	California brickellbush	Asteraceae
Briza minor	Small quaking grass	Poaceae
Eriodictyon californicum	Yerba santa	Hydrophyllaceae
Gilia capitata	Blue field-gilia	Polemoniaceae
Heterotheca oregona	Oregon goldenaster	Asteraceae
Juglans californica	California black walnut	Juglandaceae
Lepidium virginicum	Wild pepper-grass	Brassicaceae
Linaria genistifolia ssp. *dalmatica*	Dalmatian toad-flax	Scrophulariaceae
Lupinus albifrons	Silver bush lupine	Fabaceae
Petrorhagia dubia	Grass pink	Caryophyllaceae
Pinus sabiniana	Gray pine	Pinaceae
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Salicaceae
Quercus wislizenii	Interior live oak	Fagaceae
Raphanus raphanistrum	Jointed charlock	Brassicaceae
Salix gooddingii	Goodding's black willow	Salicaceae
Spartium junceum	Gorse	Fabaceae
Verbascum blattaria	Moth mullein	Scrophulariaceae

Valley Oak Woodland		
Camissonia contorta	Contorted sun-cup	Onagraceae
Chenopodium ambrosioides	Mexican tea	Chenopodiaceae
Cryptantha flaccida	Flaccid cryptantha	Boraginaceae
Heterotheca grandiflora	Telegraph weed	Asteraceae
Marrubium vulgare	Horehound	Lamiaceae
Morus alba	Mulberry	Moraceae
Orobanche fasciculata	Clustered broom-rape	Orobanchaceae
Phacelia heterophylla ssp. *virgata*	Virgate phacelia	Hydrophyllaceae
Rhamnus tomentella	Hoary coffeeberry	Rhamnaceae
Vitis californica	California wild grape	Vitaceae

Intermittent Pool and Pond		
Digitaria sanguinalis	Crabgrass	Poaceae
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley	Poaceae
Juncus bufonius	Toad rush	Juncaceae
Lemna minor	Common duckweed	Lemnaceae
Lolium multiflorum	Italian ryegrass	Poaceae
Lotus corniculatus	Birdfoot trefoil	Fabaceae
Poa annua	Annual blue grass	Poaceae
Polygonum arenastrum	Common knotweed	Polygonaceae
Veronica peregrina ssp. *xalapensis*	Purslane speedwell	Scrophulariaceae

Wildlife Species Observed on the Strawberry Fields Study Area

Observer: Colby Boggs, Ginger Bolen, and Heather Kelly
Dates: April 25, May 3, May 9, May 10, June 27, and November 2, 2007

Common name	***Scientific name***
Pacific chorus frog	*Pseudacris regilla*
bullfrog	*Rana catesbeiana*
alligator lizard	*Elgaria* sp.
fence lizard	*Sceloporus occidentalis*
mallard duck	*Anas platyrhynchos*
scrub jay	*Aphelocoma californica*
great egret	*Ardea alba*
Canada goose	*Branta canadensis*
red-tailed hawk	*Buteo jamaicensis*
California quail	*Callipepla californica*
turkey vulture	*Cathartes aura*
killdeer	*Charadrius vociferus*
red-shafted flicker	*Colaptes auratus*
acorn woodpecker	*Melanerpes formicivorus*
song sparrow	*Melospiza melodia*
downy woodpecker	*Picoides pubescens*
spotted towhee	*Pipilo maculatus*
western tanager	*Piranga ludoviciana*
blue-gray gnatcatcher	*Polioptila caerulea*
bushtits	*Psaltriparus minimus*
bank swallow	*Riparia riparia*
black phoebe	*Sayornis nigricans*
red breasted nuthatch (migrant)	*Sitta canadensis*
American robin	*Turdus migratorius*
western kingbird	*Tyrannus verticalis*
mourning dove	*Zenaida macroura*
coyote	*Canis latrans*
black-tailed jack rabbit	*Lepus californicus*
mule deer	*Odocoileus hemionus*
grey squirrel	*Sciurus griseus*

APPENDIX F

Summary Table of VELB Survey Data

Summary Table of VELB Survey Data from the Strawberry Fields Study Area.

Observer: Paul Kirk

Survey Dates: June 27, June 28, June 29, and August 2, 2007

Elderberry Shrub Number	# Exit Holes	Stems 1-3”	Stems 3-5”	Stems >5”	Approximate Shrub Ht. (ft)	Riparian Location?	Associated Habitat
1	0	0	0	1	12	No	Annual grassland
2	0	0	8	3	18	Yes	Valley foothill riparian
3	0	6	9	8	18	Yes	Valley foothill riparian
4	4	2	4	11	20	No	Valley oak woodland
5	1	0	4	3	15	No	Valley oak woodland
6	0	0	1	1	20	No	Valley oak woodland
7	0	0	0	1	25	No	Valley oak woodland
8	0	0	0	1	15	No	Valley oak woodland
9	0	0	0	2	46	Yes	Valley foothill riparian
10	0	0	1	3	18	Yes	Valley foothill riparian
11	0	3	2	0	18	Yes	Valley foothill riparian
12	0	1	0	0	12	Yes	Valley foothill riparian
13	NS[1]	≥ 1	NS[1]	NS[1]	18	Yes	Valley foothill riparian
14	NS[1]	≥ 1	NS[1]	NS[1]	18	Yes	Valley foothill riparian
15	0	0	0	1	20	No	Valley oak woodland
16	0	2	0	2	15	No	Valley oak woodland
17	0	2	1	2	12	No	Valley oak woodland
18	0	0	0	2	12	No	Valley oak woodland
19	0	4	5	2	18	No	Valley oak woodland
20	1	1	1	3	20	No	Valley oak woodland
21	0	4	0	2	15	No	Valley oak woodland
22	0	4	2	4	18	Yes	Valley foothill riparian
23	0	6	6	1	18	Yes	Valley foothill riparian
24	0	6	4	2	15	Yes	Valley foothill riparian
25	0	4	6	2	18	Yes	Valley foothill riparian
26	0	0	0	2	18	No	Valley oak woodland
27	0	0	1	0	15	No	Valley oak woodland
28	3	1	1	3	18	No	Valley oak woodland
29	3	0	0	8	16	No	Valley oak woodland
30	0	1	2	9	18	Yes	Valley foothill riparian
31	0	3	3	0	12	Yes	Valley foothill riparian

Elderberry Shrub Number	# Exit Holes	Stems 1-3"	Stems 3-5"	Stems >5"	Approximate Shrub Ht. (ft)	Riparian Location?	Associated Habitat
32	0	1	0	0	10	Yes	Valley foothill riparian
33	2	0	2	0	12	Yes	Valley foothill riparian
34	0	1	0	0	8	Yes	Valley foothill riparian
35	0	2	0	0	8	Yes	Valley foothill riparian
36	0	7	5	1	15	Yes	Valley foothill riparian
37	7	3	1	3	18	Yes	Valley foothill riparian
38	0	3	1	3	14	Yes	Valley foothill riparian
40[2]	0	1	0	2	15	Yes	Valley foothill riparian
41	0	1	0	0	10	Yes	Valley foothill riparian
42	0	1	1	0	15	Yes	Valley foothill riparian
43	3	4	1	0	12	Yes	Valley foothill riparian
44	0	0	1	0	12	Yes	Valley foothill riparian
45	0	1	0	0	8	Yes	Valley foothill riparian
47[2]	0	1	5	6	18	Yes	Valley foothill riparian
48	0	1	0	0	12	No	Annual grassland
49	0	14	4	3	16	No	Riverine
50	0	6	2	1	12	No	Riverine
51	0	3	1	0	15	No	Annual grassland
52	0	3	0	1	18	Yes	Valley foothill riparian
53	0	0	1	2	15	Yes	Valley foothill riparian
54	0	1	1	1	20	Yes	Valley foothill riparian
55	6	1	3	9	20	Yes	Valley foothill riparian
56	1	1	1	1	12	Yes	Valley foothill riparian
57	0	1	0	1	16	Yes	Valley foothill riparian
58	0	0	1	0	14	Yes	Valley foothill riparian
59	0	0	2	2	16	No	Valley oak woodland
60	1	0	0	4	16	No	Valley oak woodland
62	0	1	0	0	9	Yes	Valley foothill riparian
61	1	1	1	2	20	No	Valley oak woodland
63	0	4	1	2	12	Yes	Valley foothill riparian
64	3	1	2	5	15	Yes	Valley foothill riparian

[1] These shrubs are overgrown with Himalayan blackberry and were not surveyed (NS) for exit holes. Stem count and shrub height were estimated using binoculars.
[2] Break in sequence due to duplicate GPS recording.

APPENDIX G

Representative Photographs of VELB Exit Holes

Representative Photographs of VELB Exit Holes Observed at the Strawberry Fields Study Area

Photographs taken on June 29 and August 2, 2007

Photograph 1. Old VELB exit hole on elderberry stem (shrub #37). This shrub had seven exit holes on three different stems.

Photograph 2. Recent VELB exit hole with clean edges on elderberry stem (shrub # 55).

STRAWBERRY FIELDS STUDY AREA
BIOLOGICAL RESOURCES ASSESSMENT
PREPARED BY NORTH STATE RESOURCES

STRAWBERRY FIELDS STUDY AREA

Biological Resources Assessment

November 7, 2007

Prepared for:
Redding Rancheria Tribe

Prepared by:
North State Resources, Inc.

NSR No. 50780

North State Resources, Inc.

STRAWBERRY FIELDS STUDY AREA

Biological Resources Assessment

November 7, 2007

Prepared for:
Redding Rancheria Tribe
Attn: Mr. Neal Malmsten
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Redding, CA 96001

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NSR No. 50780

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Biological Resources Assessment

1. INTRODUCTION

On behalf of the Redding Rancheria Tribe, North State Resources, Inc. (NSR) conducted a biological resources assessment of the approximately 225.86-acre Strawberry Fields Study Area, hereinafter referred to as the "study area." The purpose of this assessment is to document the biological resources in the vicinity of the study area, including a general description of the terrestrial and aquatic habitats and identification of potentially occurring special-status plant and wildlife species. The results of plant and wildlife surveys within the study area are included in this biological resources assessment.

1.1 STUDY AREA LOCATION

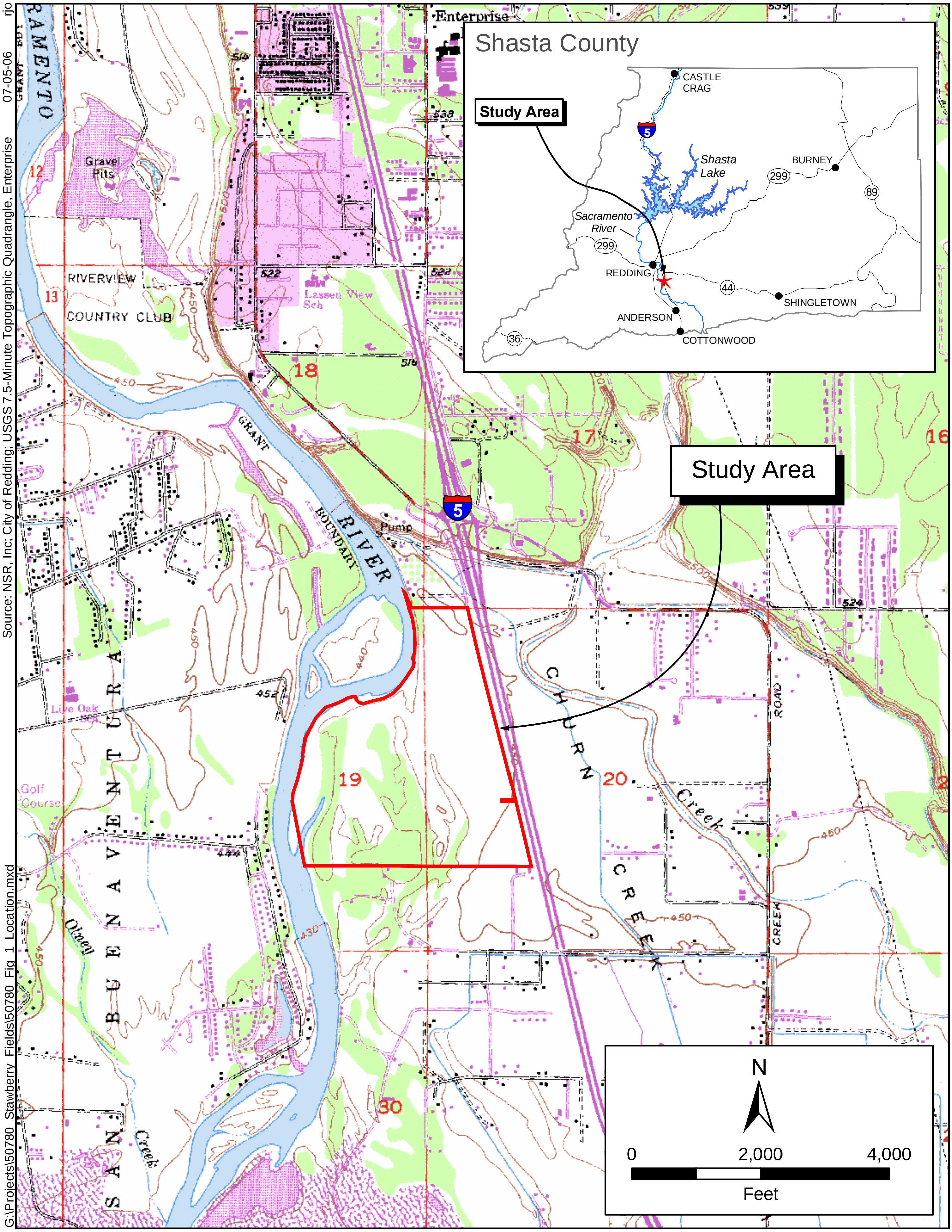
The study area is located south of the City of Redding in Shasta County, California and can be found within the *Enterprise*, *California* U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Township 31 North, Range 4 West, Sections 19 and 20). The central western and eastern boundaries of the study area are located at approximately 40º 31' 67"N latitude by 122° 21' 53"W longitude and 40º 31' 67"N latitude by 122° 20' 81"W longitude, respectively. A map of the study area is presented as Figure 1.

2. METHODS

2.1 LITERATURE REVIEW

For the purposes of this assessment, special-status plant species are defined as vascular plants that are: (1) listed as endangered or threatened under the federal Endangered Species Act (or formally proposed, or candidates, for listing); (2) listed as endangered or threatened under the California Endangered Species Act (or candidates for listing); and/or (3) listed as rare under the California Native Plant Protection Act. "Other" special-status plant species include those considered by the California Native Plant Society (CNPS) to be rare, threatened, or endangered in California and elsewhere (Lists 1B and 2).

Special-status fish and wildlife species include those that are: (1) designated as endangered or threatened by the state and/or federal governments (i.e., "listed species") under the California Endangered Species Act and/or federal Endangered Species Act, respectively; (2) proposed for federal listing status as endangered or threatened; and/or (3) designated as candidates for state or federal listing status as endangered or threatened. "Other" special-status fish and wildlife species are identified by the California Department of Fish and Game (CDFG) as California Fully Protected Species or California Species of Special Concern. For potentially occurring special-status wildlife resources, emphasis is on resident or breeding species rather than on seasonally occurring species.



North State Resources, Inc.

Strawberry Fields Study Area

Figure 1
Study Area and Vicinity

Investigations into the occurrence and potential for occurrence of special-status plant and wildlife species in the study area included conducting: database searches; field reconnaissance and limited protocol-level surveys for special-status plant and wildlife species; and review of pertinent environmental documents and technical studies.

The *List of Endangered and Threatened Species That May Occur in, or be Affected by Projects in the Enterprise, California USGS quadrangle and Shasta County, California* (U.S. Fish and Wildlife Service 2007b) was reviewed for federally listed plant and wildlife species known to occur or suspected of occurring in the vicinity of the study area (Appendix A).

The California Natural Diversity Database (CNDDB) was reviewed for records of special-status plant and wildlife species in the *Enterprise, California* and eight surrounding USGS quadrangles (California Department of Fish and Game 2007a). The CNDDB is a database consisting of historical observations of special-status plant species, wildlife species, and special plant communities. It is limited to reported sightings and is not a comprehensive list of special-status plant and wildlife species that may occur in a particular area. A copy of the search results is included as Appendix B.

Another database search was performed from a query of the online *CNPS Inventory of Rare and Endangered Plants of California* (California Native Plant Society 2007). The query was conducted for documented special-status plant species occurrences in the *Enterprise, California* USGS quadrangle and the eight surrounding quadrangles. The results of this query are included as Appendix C.

Additionally, the following documents were reviewed: *Endangered and Threatened Animals of California* (California Department of Fish and Game 2006a), *Special Animals* (California Department of Fish and Game 2007b), *Endangered, Threatened, and Rare Plants of California* (California Department of Fish and Game 2006b), and *Special Vascular Plants, Bryophytes, and Lichens List* (California Department of Fish and Game 2006c).

2.2 FIELD REVIEW/SURVEYS

Botany

A pre-field botanical review of the study area was conducted in general accordance with *Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities* (California Department of Fish and Game 2000) and *Botanical Survey Guidelines of the California Native Plant Society* (California Native Plant Society 2001a). Per botanical survey guidance, a target list of special-status plant species with the potential to occur within the study area was developed, in part, through a review of the previously mentioned environmental documents, technical studies, and databases. Local botanical expertise, herbarium database records, and regional floras were also used to develop a target list.

Prior to initiating field surveys, Mr. Colby J. Boggs, NSR botanist/plant ecologist, reviewed the habitat requirements and morphological features specific to each plant taxon on the target list. Protocol-level field surveys were conducted on April 25, May 3, May 9, and June 27, 2007. These dates coincide with the blooming/identifiable periods for all of the special-status plant species on the target list determined to have potential to occur within the study area. Field surveys were conducted

and all areas of the study area were viewed to the degree necessary to determine the presence/absence of special-status plant species and suitable habitat. All plant species detected within the study area were identified utilizing the nomenclature in *The Jepson Manual* (Hickman 1993).

Wildlife

Focused wildlife surveys were conducted for California red-legged frog (*Rana aurora draytonii*) and valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*). Ms. Ginger Bolen, NSR biologist conducted the California red-legged frog site assessment on August 17 and 20, and September 11, 2006, and May 7 and 10, 2007. Mr. Paul Kirk, NSR biologist conducted protocol-level VELB surveys on June 27, 28, and 29, and August 2, 2007.

2.2.1.1 ***California Red-Legged Frog Assessment***

A California Red-Legged frog site assessment was conducted using the guidelines set forth in *Revised Guidance on Site Assessments and Field Surveys for California Red-legged Frog* (U. S. Fish and Wildlife Service 2005). Information for the assessment was gathered through a combination of literature review, database searches, review of topographic mapping and aerial photography, and field visits to the site. The literature review identified the historic and current range of the California red-legged frog and provided information on specific habitat preferences of the species. The CNDDB records for Shasta County (California Department of Fish and Game 2007a) and the USFWS *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002) provided information regarding the known existing and historic populations of California red-legged frogs in the study area region.

A review of topographic mapping and aerial photography provided information regarding vegetation communities and land uses occurring near the study area. The study area and publicly accessible areas of the surrounding vicinity were characterized and evaluated for the presence of potentially suitable habitat for the California red-legged frog. A detailed California red-legged frog habitat assessment was prepared by NSR as a separate report (North State Resources 2007a).

2.2.1.2 ***Valley Longhorn Elderberry Beetle Survey***

Mr. Boggs, NSR botanist/plant ecologist conducted a reconnaissance level survey, noting the location of elderberry shrubs on an aerial map, as part of the botanical survey efforts in April and May 2007. Subsequently, Mr. Kirk, NSR biologist used the resulting aerial map to conduct the protocol-level VELB survey (U.S. Fish and Wildlife Service 1999) on June 27, June 28, and June 29, and August 2, 2007. The study area was surveyed on foot, and all areas were viewed to the degree necessary to locate all previously noted elderberry shrubs and to detect the presence of additional elderberry shrubs. Two elderberry shrubs in the southwest section of the study area were deeply embedded within Himalayan blackberry (*Rubus discolor*) brambles and were inaccessible for close inspection.

For each of the accessible elderberry shrubs, all stems measuring one inch or greater in diameter at ground level were counted, assessed for the presence of exit holes, and assigned to a size class (i.e., stems 1-3", 3-5", and >5"). For the few shrubs inaccessible for close inspection, binoculars were used to collect information to the greatest extent practicable. The vegetation community occurring in the immediate vicinity of all surveyed shrubs was recorded. The locations of all surveyed elderberry

shrubs were mapped using a Pathfinder Pro Global Positioning System (GPS) capable of sub-meter accuracy (NAD 27 projection). All spatial data were entered into a Geographic Information Systems (GIS) application and overlain onto a digital orthorectified aerial photograph.

3. RESULTS

3.1 General Setting

The study area is located on a level terrace with the general topography gently sloping west towards the Sacramento River. Elevations range from approximately 430 to 450 feet above mean sea level. The area has a Mediterranean climate with cool, wet winters and hot, dry summers. Average precipitation is approximately 25 to 35 inches per year and falls almost exclusively as rain between October and April. Mean January maximum temperature is 52° F and mean July maximum temperature is 95° F (Western Regional Climate Center 2006).

Vegetation and Associated Wildlife

The vegetation or habitat types present within the study area include riverine, annual grassland, valley oak woodland, and valley foothill riparian (Mayer and Laudenslayer 1988) as well as foothill pine (Sawyer and Keeler-Wolf 1995) as shown on Figure 2. Waters of the United States are present within these plant communities and are addressed briefly in Section 4. A description for each of these plant communities is provided below.

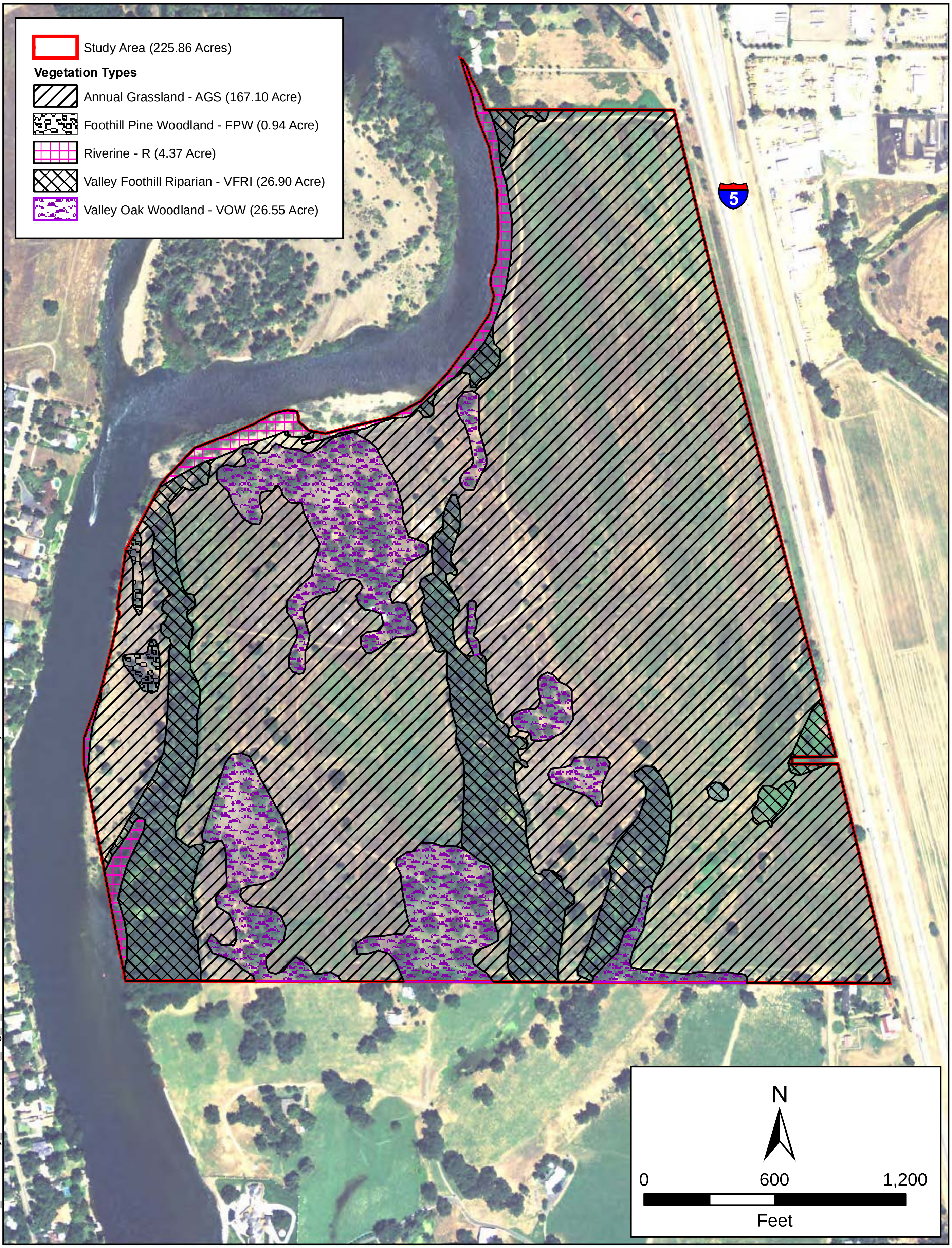
Riverine

Riverine habitat (4.37 acres) consists of the active channel and backwater area of the Sacramento River located along the western boundary of the study area. Riverine habitat is typically characterized by continually flowing water and boulder, cobble, gravel, and/or sand substrates. A dominant plant community within this habitat is absent due to the constant flow of water and movement of soil material (i.e., scour and deposition). However, seasonal fluctuations in water volume and velocity can allow the establishment of some vegetation along banks and on exposed gravel bars; most notably, primary successional species such as willows (*Salix* spp.).

Wildlife. The riverine habitat is suitable year-round for resident and anadromous fishes. Amphibians and reptiles expected to occur include the Pacific chorus frog (*Pseudacris regilla*), western toad (*Bufo boreas*), bullfrog (*Rana catesbeiana*), and northwestern pond turtle (*Clemmys marmorata marmorata*). In addition, birds such as the mallard (*Anas platyrhynchos*), great blue heron (*Ardea herodias*), osprey (*Pandion haliaetus*), and belted kingfisher (*Ceryle alcyon*) may forage here. Bats such as the little brown myotis (*Myotis lucifugus*), forage above this habitat during summer evenings.

Annual Grassland

Annual grassland habitat (167.10 acres) occurring within the study area is dominated by non-native annual grasses, and non-native annual and perennial herbaceous plants. This plant community occurs on all soil map units and the land type present on the site with minor differences in species composition based on location (e.g., greater abundance of native perennial species present on old gravel bar adjacent to the Sacramento River than on the terrace composed of moderately deep, sandy loam soil adjacent to I-5). Regardless of location, the dominant non-native grasses include European



50780_Strawberry_Fields\50780_Fig_2_WHR.mxd Source: NSR, Inc. 07-10-06 rjo

North State Resources, Inc.

Strawberry Fields Study Area

Figure 2
Vegetation Types

silver hairgrass (*Aira caryophyllea*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), medusahead (*Taeniatherum caput-medusae*) and rattail fescue (*Vulpia myuros*), and the dominant non-native herbaceous plants include black mustard (*Brassica nigra*), yellow star-thistle (*Centaurea solstitialis*), Spanish lotus (*Lotus purshianus*), and winter vetch (*Vicia villosa*). Native plant species include California poppy (*Eschscholzia californica*) and vinegar weed (*Trichostema lanceolatum*). Native plants occurring only on the gravel bar and on the Riverwash land type include showy milkweed (*Asclepias speciosa*), California brickellbush (*Brickellia californica*), yerba santa (*Eriodictyon californicum*), naked-stemmed buckwheat (*Eriogonum nudum*), Oregon false goldenaster (*Heterotheca oregana*), woolly-fruited lomatium (*Lomatium dasycarpum*), and silver bush lupine (*Lupinus albifrons*). Small stands of Himalayan blackberry (*Rubus discolor*) and narrowleaf willow (*Salix exigua*) as well as a few lone whiteleaf manzanita (*Arctostaphylos viscida*), foothill pine (*Pinus sabiniana*), valley oak (*Quercus lobata*), and blue elderberry (*Sambucus mexicana*) are found scattered throughout this habitat.

Wildlife. Annual grasslands are productive wildlife habitat. Grassland bird species, such as the mourning dove (*Zenaida macroura*), savannah sparrow (*Passerculus sandwichensis*), and white-crowned sparrow (*Zonotrichia leucophrys*) as well as rodents, including the California ground squirrel (*Spermophilus beecheyi)*, Botta’s pocket gopher (*Thomomys bottae*), and deer mouse (*Peromyscus maniculatus*), forage on the seed crop this community provides. These species, in turn, attract predators such as the gopher snake (*Pituophis catenifer*), American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), and coyote (*Canis latrans*). Other common grassland species include the western meadowlark (*Sturnella neglecta*) and black-tailed hare (*Lepus californicus*). Reptile species expected to occur here include the western fence lizard (*Sceloporus occidentalis*), western skink (*Eumeces skiltonianus*), western rattlesnake (*Crotalus viridis*), and yellow-bellied racer (*Coluber constrictor mormon*).

Valley Oak Woodland

Valley oak woodland habitat (26.55 acres) occurring within the study area is dominated by valley oak. Other tree species occurring in this plant community include Oregon ash (*Fraxinus latifolia*), foothill pine (*Pinus sabiniana*), and interior live oak (*Quercus wislizenii*). Shrubs are sparse in this habitat but include California coffeeberry (*Rhamnus californica*), Himalayan blackberry, and poison-oak (*Toxicodendron diversilobum*). The valley oak woodland habitat is an ecological extension of the annual grassland plant community with the only significant difference being the presence of a tree canopy with an approximate foliar cover of 50-60%. The grasses and herbaceous plants occurring in this habitat are similar to those present in the annual grassland plant community. Grasses and herbaceous plants present in the valley oak woodland habitat include European silver hairgrass, slender oat (*Avena barbata*), black mustard, ripgut brome, soft chess, yellow star-thistle, California poppy, and rattail fescue. Plant species occurring only under the canopy of valley oak include goose grass (*Galium aparine*) and hare barley (*Hordeum murinum* ssp. *leporinum*).

Wildlife. The valley oak woodland provides food and cover for a variety birds including red-shouldered hawk (*Buteo lineatus*), California quail (*Callipepla californica*), acorn woodpecker (*Melanerpes formicivorus*), western scrub-jay (*Aphelocoma californica*), and great horned owl (*Bubo*

virginianus). Other common animals include black-tailed deer (*Odocoileus hemionus*), opossum (*Didelphis virginianus*), California ground squirrel, and western fence lizard.

<u>Valley Foothill Riparian</u>

Valley foothill riparian habitat (26.90 acres) occurring within the study area is dominated by tree-of-heaven (*Ailanthus altissima*), California black walnut (*Juglans californica*), Fremont cottonwood (*Populus fremontii*), valley oak, and black locust (*Robinia pseudoacacia*). Other trees present in this plant community include white alder (*Alnus rhombifolia*), Oregon ash, mulberry (*Morus alba*), foothill pine, and interior live oak. Shrubs and vines form an understory layer in the valley foothill riparian habitat with an approximate foliar cover of 90-100% in some areas and includes oleander (*Nerium oleander*), California coffeeberry, Himalayan blackberry, narrowleaf willow, arroyo willow (*Salix lasiolepis*), blue elderberry, and California wild grape (*Vitis californica*). Accordingly, grasses and herbaceous plants occurring in this plant community exhibit low percent cover in the understory layer. However, these plants are present and include California pipevine (*Aristolochia californica*), mugwort (*Artemisia douglasiana*), Santa Barbara sedge (*Carex barbarae*), and goose grass.

Wildlife. Riparian communities are among the most important habitats for wildlife because of their high floristic and structural diversity, high biomass (and therefore high food abundance), and high water availability. In addition to providing breeding, foraging, and roosting habitat for a diverse array of animals, riparian communities provide movement corridors for some species, connecting a variety of habitats throughout a region.

The leaf litter, fallen tree branches, and logs associated with the riparian community in the study area provide cover for the western toad and Pacific chorus frog. The western fence lizard, western skink, and southern alligator lizard (*Elgaria multicarinata webbi*) are also expected to occur here, as are several snake species, including the western rattlesnake, yellow-bellied racer, and common kingsnake (*Lampropeltis getulus*).

The willows in the riparian community attract a number of bird species. Many of these species are year-round residents, breeding in the riparian community in the spring and summer and using it for cover and foraging habitat during the non-breeding season. Common species nesting and foraging, primarily in the riparian tree canopy, include the bushtit (*Psaltriparus minimus*), white-breasted nuthatch (*Sitta carolinensis*), and Nuttall's and downy woodpeckers (*Picoides nuttallii* and *Picoides pubescens*, respectively). Other resident species, such as the spotted towhee (*Pipilo maculatus*) and song sparrow (*Melospiza melodia*), nest and forage on or very close to the ground, usually in dense vegetation. Several species of raptors, including the Cooper's hawk (*Accipiter cooperii*) and western screech owl (*Otus kennicottii*), nest in riparian communities and remain there year-round.

In addition to the permanent residents, numerous species of neotropical migrants occur in this community from spring through fall, with many potentially breeding on the site, including the ash-throated flycatcher (*Myiarchus cinerascens*), olive-sided flycatcher (*Contopus cooperi*), western wood-pewee (*Contopus sordidulus*), warbling vireo (*Vireo gilvus*), Swainson's thrush (*Catharus ustulatus*) and black-headed grosbeak (*Pheucticus melanoleucus*).

A variety of mammals also occurs in riparian communities. Small mammals, such as the Botta's pocket gopher, and deer mouse, may burrow or find refuge in dense grass or brushy thickets. Mule

deer frequently use riparian habitats, and predators, such as the raccoon (*Procyon lotor*), long-tailed weasel (*Mustela frenata*) and coyote, are attracted to riparian areas by the abundance of prey and cover. In addition, the taller trees provide daytime roosts for nocturnal species such as the raccoon and Virginia opossum.

Foothill Pine Woodland

The foothill pine woodland plant community (0.94 acre) occurs on an old gravel bar adjacent to the Sacramento River in the western portion of the study area and is dominated by foothill pine. Other tree species occurring in this plant community include valley oak and interior live oak. Shrubs are sparse in this habitat but include whiteleaf manzanita, Himalayan blackberry, and poison-oak. The foothill pine woodland habitat is an ecological extension of the annual grassland plant community with the only significant difference being the presence of a tree canopy with an approximate foliar cover of 50-60%. The grasses and herbaceous plants occurring in this habitat are similar to those present in the annual grassland and valley oak woodland plant communities. Grasses and herbaceous plants present in the foothill pine woodland habitat include European silver hairgrass, California brickellbush, ripgut brome, soft chess, yellow star-thistle, naked-stemmed buckwheat, California poppy, and rattail fescue.

Wildlife. The foothill pine woodland community is small inclusion within the annual grassland on the gravel bar between the river and a strip of valley foothill woodland. The wildlife species expected in this community would be a subset of those found in the annual grassland and valley foothill woodland habitats.

Soils

The *Soil Survey of Shasta County Area, California* (U.S. Department of Agriculture and Soil Conservation Service 1974) identifies five soil map units and one land type within the study area:

- ***CcA – Churn loam, 0 to 3% slopes***. The Churn series consists of well-drained and moderately well-drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically light yellowish-brown, medium acid gravelly loam about nine inches thick. The subgroup taxonomy for the Churn series is *Ultic Haploxeralfs*. The Churn loam soil unit is well-drained and has moderately slow permeability. Runoff is slow, and the hazard of erosion is none to slight for this soil unit. The Churn loam soil map unit is classified as non-hydric with hydric inclusions in the form of cobbly alluvial lands associated with drainageways (USDA Soil Conservation Service 1992).

- ***CeA – Churn gravelly loam, 0 to 3% slopes.*** The Churn series consists of well-drained and moderately well-drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically light yellowish-brown, medium acid gravelly loam about nine inches thick. The subgroup taxonomy for the Churn series is *Ultic Haploxeralfs*. The Churn gravelly loam soil unit is well-drained and has moderately slow permeability. Runoff is slow, and the hazard of erosion is none to slight for this soil unit. The Churn gravelly loam soil map unit is classified as non-hydric with hydric inclusions in the form of cobbly alluvial lands associated with drainageways (USDA Soil Conservation Service 1992).

- ***RgA – Reiff fine sandy loam, 0 to 3% slopes.*** The Reiff series consists of well-drained and moderately well-drained soils that formed in recent alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically grayish-brown and brown, slightly acid fine sandy loam about 18 inches thick. The subgroup taxonomy for the Reiff series is *Typic Xerorthents*. The Reiff fine sandy loam soil unit is well-drained and has moderately rapid permeability. Runoff is very slow, and the hazard of erosion is none to slight for this soil unit. The Reiff fine sandy loam soil map unit is classified as non-hydric (USDA Soil Conservation Service 1992).

- ***Rw – Riverwash.*** The Riverwash land type is excessively drained and is associated with stream channels and adjacent areas subject to continuous or frequent flooding (U.S. Department of Agriculture and Soil Conservation Service 1974). Permeability is rapid, runoff is very slow, and the hazard of erosion is very high for this land type. Binomial subgroup taxonomy does not apply to land types. The Riverwash land type is classified as hydric and is associated with floodplain channels (USDA Soil Conservation Service 1992).

- ***TbA – Tehama loam, 0 to 3% slopes.*** The Tehama series consists of well-drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is pale brown, medium acid and slightly acid loam about 30 inches thick. The subgroup taxonomy for the Tehama series is *Typic Haploxeralfs*. The Tehama loam soil unit is well-drained and has slow permeability. Runoff is very slow, and the hazard of erosion is none to slight for this soil unit. The Tehama loam soil map unit is classified as non-hydric with hydric inclusions in the form of unnamed ponded features associated with depressions (USDA Soil Conservation Service 1992).

- ***TfA – Tujunga loamy sand, 0 to 3% slopes.*** The Tujunga series consists of somewhat excessively drained soils that formed in alluvium derived from mixed sources (U.S. Department of Agriculture and Soil Conservation Service 1974). The surface layer in a representative profile is typically pale brown, slightly acid loamy sand about 14 inches thick. The subgroup taxonomy for the Tujunga series is *Typic Xeropsamments*. The Tujunga loamy sand soil unit is somewhat excessively drained and has rapid permeability. Runoff is very slow, and the hazard of erosion is none to slight for this soil unit. The Tujunga loamy sand soil map unit is classified as non-hydric with hydric inclusions in the form of cobbly alluvial lands and riverwash associated with drainageways and floodplain channels, respectively (USDA Soil Conservation Service 1992).

Waters of the U.S.

NSR conducted a delineation of waters of the United States in accordance with U.S. Army Corps of Engineers (USACE) methodology and regulatory guidance letters within the study area on June 15, June 16, and June 21, 2006. A total of 4.419 acres of waters of the United States features were delineated within the study area that includes seasonal wetland (0.029 acre), riverine/perennial stream (4.366 acres), and intermittent stream (0.024 acre, 149 linear feet) habitat. A separate report was prepared by NSR on April 19, 2007 (North State Resources 2007b).

3.2 Regional Species of Concern

Vegetation or habitat types found in the study area region potentially support special-status plant and wildlife species (Appendix D). Appendix D provides a general comparison of habitat requirements for each species and the general habitats present in the study area. Some of the special-status plants

and animals occurring near the study area are found in habitat types that are not present on-site, such as vernal pools. Therefore, these species are not considered in further detail as part of this assessment. For those species for which generally suitable habitat was determined to be present with the study area, the results of the reconnaissance-level survey were used to determine the likelihood of their presence on the site (Tables 1 and 2).

Special-Status Plant Species

Fourteen special-status vascular plant species were initially considered for analysis (Appendix D). Based upon geographic location, local botanical knowledge, and habitat parameters present within the study area, suitable habitat for four special-status plants was determined to occur in the study area (Table 1).

Table 1. Special-Status Plant Species Potentially Occurring in the Study Area

Common Name (*Scientific Name*)	Status[1] (FED/ST /CNPS)	General Habitat Description / Elevation Range	Typical Blooming Period	Comments
Fox sedge *Carex vulpinoidea*	--/--/2.2	Freshwater marshes and swamps, and riparian woodland / 98-3,937 feet	May-June	**Surveys negative, presumed absent.** Suitable habitat occurs within the seasonal wetland in the southwest portion of the study area.
Silky cryptantha *Cryptantha crinita*	--/--/1B.2	Gravelly streambeds within cismontane woodland, lower montane coniferous forest, riparian scrub, riparian woodland, and valley and foothill grassland / 278-984 feet	April-May	**Surveys negative, presumed absent.** Suitable habitat occurs within gravelly substrate present on gravel bars and old channels.
Red Bluff dwarf rush *Juncus leiospermus* var. *leiospermus*	--/--/1B.1	Meadows and seeps, vernal pools; vernally mesic areas within chaparral, cismontane woodland, and valley and foothill grassland / 115-3,346 feet	March-May	**Surveys negative, presumed absent.** Suitable habitat occurs within the ponded area in the northeast corner of the study area.
Ahart's paronychia *Paronychia ahartii*	--/--/1B.1	Cismontane woodland, valley and foothill grassland and vernal pools / 90-1,530 feet	March-June	**Surveys negative, presumed absent.** Suitable habitat occurs within valley oak woodland and foothill grassland on the study area.

Status Codes[1]:
FED = Federal
ST = State
Federal & State Codes:
E = Endangered; T = Threatened

CNPS = California Native Plant Society
CNPS Codes:
List 1B = Rare, Threatened or Endangered in CA and Elsewhere;
List 2 = Rare, Threatened or Endangered in CA, but more common elsewhere

Special-Status Wildlife Species

Sixty five (65) special-status wildlife species were initially considered for analysis (Appendix D). Based upon location and habitat parameters, twenty-nine (29) special-status wildlife species were identified as having the potential to occur in the study area. Table 2 presents a list of these species and their likelihood of occurrence. Special-status designation and general habitat requirements for each species are provided in the table. Conclusions presented in this table are based on the

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	**Status[1] (Fed/State)**	**General Habitat Description**	**Comments**
Federal or State Listed Species			
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Elderberry shrubs associated with riparian forests that occur along rivers and streams.	**Present.** Protocol level surveys detected VELB exit holes on numerous 12 elderberry shrubs.
Green sturgeon, southern DPS *Acipenser medirostris*	T/SC	Spawn in Sacramento and Feather rivers; juveniles are thought to rear mainly in the estuary. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock. Spawn in the mainstem Sacramento River when temperatures range between 46-60 °F.	**Present**. Known to occur in the Sacramento River throughout all accessible reaches upstream at least to Anderson-Cottonwood Irrigation District dam near Redding, California.
Steelhead, California Central Valley DPS *Oncorhynchus mykiss* Critical Habitat	T/--	Spawn and rear in freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**. Occur in the mainstem Sacramento River and tributary streams. Adults migrate upstream during the fall/winter and spawn from winter to early spring. Juveniles rear in natal areas for 1-2 years before migrating to the ocean. Suitable spawning and rearing habitat exists in the Sacramento River.
Central Valley spring-run ESU Chinook salmon *Oncorhynchus tshawytscha* Critical Habitat Essential Fish Habitat	T/T	Freshwater rivers and streams. (Sacramento River and its tributaries)	**Present.** Occur in the mainstem Sacramento River and its major perennial tributary streams. Adults migrate upstream during the spring and spawn from mid-August to mid-October. Suitable spawning and rearing habitat exists in the Sacramento River.
Sacramento River winter-run ESU Chinook salmon *Oncorhynchus tshawytscha* Critical Habitat Essential Fish Habitat	E/E	Freshwater rivers and streams. (Sacramento River and its tributaries)	**Present**. Occur in the mainstem Sacramento River. Adults migrate upstream during the winter and spawn from mid-April to August. Suitable spawning and rearing habitat exists in the Sacramento River.
California red-legged frog *Rana aurora draytonii*	T/SC	Require aquatic habitat for breeding, also uses a variety of other habitat types including riparian and upland areas. Adults utilize dense, shrubby or emergent vegetation associated with deep-water pools with fringes of cattails & dense stands of overhanging vegetation.	**Absent.** Protocol level surveys did not detect this species (North State Resources 2007a).

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Comments
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	C/--	Nesting habitat is cottonwood/willow riparian forest. Occurs only along the upper Sacramento Valley portion of the Sacramento River, the Feather River in Sutter Co., the south fork of the Kern River in Kern Co., and along the Santa Ana, Amargosa, and lower Colorado rivers	**Absent.** Presently there are no known breeding pairs along the Sacramento River north of Red Bluff, CA. The site does not have sufficiently dense riparian forest to support breeding.
Bald eagle *Haliaeetus leucocephalus*	T/E	Forages on live and dead fish and nests in large trees or snags. Requires large bodies of water, including ocean shorelines, lake margins, and large, open river courses for foraging, nesting, and wintering habitat.	**Present**. Incidental observations of eagles foraging over the site. No nests reported or observed on the site.
Bank swallow *Riparia riparia*	--/T	Colonial nester on vertical banks or cliffs with fine-textured soils near water.	**Present**. Bank swallows and colony of nests observed on cut-bank of Sacramento River.
Other Special-Status Species			
River lamprey *(Lampetra ayresii)*	--/SC	The biology of river lampreys has not been studied in California, general habitat and life history thought to be similar to Pacific lamprey.	**Present**. Occur in the mainstem Sacramento River and tributary streams.
Central Valley fall/late-fall run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Essential Fish Habitat	--/SC	Freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**. Occur in the mainstem Sacramento River and tributary streams. Adults migrate upstream during the fall and spawn from mid-October to February. Suitable spawning and rearing habitat exists in the Sacramento River.
Hardhead (*Mylopharodon conocephalus*)	--/SC	Quiet deep pools of large, warm, clear streams over rocks or sand.	**Present**. Occur in the mainstem Sacramento River and tributary streams.
Western spadefoot toad *Spea hammondii*	--/SC	Grasslands with temporary pools.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Northwestern pond turtle *Clemmys marmorata marmorata*	--/SC	Slow water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Require an upland oviposition site in the vicinity of the aquatic site	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Double-crested cormorant *Phalacrocorax auritus*	--/SC	Inland lakes; fresh, salt and estuarine waters.	**May be present as migrant**. Suitable breeding habitat does not occur on the site or surrounding area.

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	**Status[1] (Fed/State)**	**General Habitat Description**	**Comments**
Merlin *Falco columbarius*	--/SC	Frequents ocean shorelines, lake margins, and large, open river courses near tree stands for both nesting and wintering habitat. Does not breed in California.	**May be present as migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
Western burrowing owl *Athene cunicularia hypugaea*	--/SC	Open habitats, dry grasslands and ruderal habitats with ground squirrel burrows.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Sharp-shinned hawk *Accipiter striatus*	--/SC	Typically nests in dense conifer stands near water, winters in woodlands. Forages in many habitats in winter and migration.	**May be present as migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
Cooper's hawk *Accipiter cooperii*	--/SC	Nests in woodlands, forages in many habitats in winter and migration.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Ferruginous hawk *Buteo regalis*	--/SC	Forages in grasslands and occasionally in other open habitats during migration and winter.	**May be present as rare migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
Prairie falcon *Falco mexicanus*	--/SC	Occurs in open habitats such as grasslands, desert scrub, rangelands and croplands. Nests on open cliffs.	**May be present as rare migrant**. Suitable breeding habitat does not occur on the site or surrounding area.
White-tailed kite *Elanus leucurus*	--/FP	Nests in lowlands with dense oak or riparian stands near open areas, forages over grassland, meadows, cropland and marshes.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Osprey *Pandion haliaetus*	--/SC	Ocean shorelines, lake margins and large, open river courses for both nesting and wintering habitat.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
California yellow warbler *Dendroica petechia brewsteri*	--/SC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Yellow-breasted chat *Icteria virens*	--/SC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Loggerhead shrike *Lanius ludovicianus*	--/SC	Prefers open habitats with scatters shrubs and trees throughout the Central Valley of California. Nests in shrubs and trees.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Ringtail *Bassariscus astutus*	--/FP	Riparian habitats and in brush stands of most forest and shrub habitats. Nests in rock recesses, hollow trees, logs, snags, abandoned burrows or woodrat nests.	**May be present**. Suitable breeding and foraging habitat occurs in the study area.
Pallid bat *Antrozous pallidus*	--/SC	Forages over many habitats; roosts in buildings, large oaks or redwoods, rocky outcrops and rocky crevices in mines and caves, and under bridges. Roosts must protect from high temperatures	**May be present as forager**. Site does not contain suitable breeding roosts.

Table 2. Special-Status Wildlife Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Comments
Western mastiff bat *Eumops perotis*	--/SC	Roosts in cliff faces, rock outcrops, and buildings. Forages in open habitats. Needs vertical face to take flight.	**May be present as forager**. Site does not contain suitable breeding roosts.

[1]Status Codes:

Federal and State Codes: E = Endangered; T = Threatened; SC = Species of Special Concern: FP = Fully Protected

knowledge of local professional biologists and historic survey information. All special-status wildlife species potentially breeding in the study area are discussed in detail below. A list of all wildlife species observed is presented in Appendix E.

3.3 Detailed Evaluation of Special-Status Plant Species

No federal or state listed plant species have the potential to occur within the study area. There were four other special-status plant species determined to have the potential to occur in the study area: fox sedge (*Carex vulpinoidea*), silky cryptantha (*Cryptantha crinita*), Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*), and Ahart's paronychia (*Paronychia ahartii*). The status, habitat parameters, geographic distribution, and rationale for potential to occur on the site for each of these plant taxa is discussed below.

Fox sedge (*Carex vulpinoidea*). Federal Status: None; State Status: None; CNPS Status: List 2.2. This species is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be "Rare, Threatened or Endangered in California, but more common elsewhere."

Fox sedge is a tufted perennial in the sedge family (Cyperaceae). This species is known to occur in freshwater marshes and swamps and in riparian woodlands (California Native Plant Society 2001b). Fox sedge typically occurs at elevations between 98 and 3,937 feet above mean sea level and the blooming period is generally from May to June. Past experience specific to fox sedge in the Redding area has indicated that the optimal window of opportunity to observe this species occurs in late May.

Fox sedge is known to occur in the Inner North Coast Ranges, Cascade Range, and northern Sacramento Valley within Butte, Glenn, Shasta, Siskiyou, and Tehama counties (California Native Plant Society 2006; Tibor 2001). CNDDB records indicate that there is one occurrence of this species within five miles of the study area (California Department of Fish and Game 2007a).

Areas of potentially suitable habitat include the open water features located in the central and southern portions of the study area as well as the seasonal wetland in the southwest portion of the study area. These features have habitat and hydrology parameters, such as typical riparian plant species associates and duration of inundation and/or soil saturation, respectively, that qualify as sufficient to represent characteristic microhabitat attributes for fox sedge. Therefore, this species remained a target species for protocol-level botanical survey.

Silky Cryptantha (*Cryptantha crinita*). Federal Status: None; State Status: None; CNPS Status: List 1B. This species is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be "Rare, Threatened or Endangered in CA and Elsewhere."

Silky cryptantha is a small, annual in the borage family (Boraginaceae). This species is known to occur on sand and gravel deposits associated with intermittent and, occasionally, perennial streams (Nakamura and Nelson 2001) within cismontane woodland, lower montane coniferous forest, riparian scrub, riparian woodland, and valley and foothill grassland from elevations between 278 and 984 feet above mean sea level (Tibor 2001). Silky cryptantha typically occurs below 1,000 feet in elevation and the blooming period is generally from April to May (Nakamura and Nelson 2001). Past

experience specific to silky cryptantha in the Redding area has indicated that the optimal window of opportunity to observe this species in bloom occurs between late April and mid-May.

Silky cryptantha is restricted to the interior regions of northern California and is known to occur in the northern Sacramento Valley within Shasta and Tehama counties (Nakamura and Nelson 2001). CNDDB records indicate that there are three occurrences of this species within five miles of the study area (California Department of Fish and Game 2007a).

An area of potentially suitable habitat includes the gravel bar found along the Sacramento River along the western boundary of the site. Therefore, this species remained a target species for botanical survey efforts due to the presence of the gravel bar along the river, and attributes thereof, considered to have the potential to support populations of silky cryptantha.

Red Bluff Dwarf Rush (*Juncus leiospermus* var. *leiospermus*). Federal Status: None; State Status: None; CNPS Status: List 1B. This plant taxon is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be "Rare, Threatened or Endangered in CA and Elsewhere."

Red Bluff dwarf rush is a small, reddish grass-like annual in the rush family (Juncaceae). This plant taxon is known to occur in a variety of seasonally moist habitats that include meadows and seeps, vernal pools, and vernally mesic areas within chaparral, cismontane woodland, and valley and foothill grassland from elevations between 115 and 3,350 feet above mean sea level . It is often found in small, sparsely vegetated micro-habitats (e.g., tire ruts, gopher mounds). Red Bluff dwarf rush typically occurs between 200 and 1,000 feet in elevation and the blooming period is typically from April to early June (Nakamura and Nelson 2001). Past experience specific to Red Bluff dwarf rush in the Redding area has indicated that the optimal window of opportunity to observe this plant taxon in bloom occurs between late April and mid-May.

Red Bluff dwarf rush is restricted to the interior regions of northern California and is known to occur in the northern Sacramento Valley and surrounding foothills of the Cascade Range within Butte, Shasta, and Tehama counties (California Native Plant Society 2001b; Nakamura and Nelson 2001). Disjunct populations of Red Bluff dwarf rush also occur in the northeast corner of Shasta County and southern Lassen County. CNDDB records indicate that there are twelve occurrences of this species within five miles of the study area (California Department of Fish and Game 2007a).

An area of potential habitat includes the ponded area in the northeast corner of the study area This area remains mesic due to seepage from the Anderson Cottonwood Irrigation District canal. An unpaved road in this mesic area contains relatively unvegetated zones which represent characteristic microhabitat attributes for Red Bluff dwarf rush. Therefore, this taxon remained a target taxon for botanical survey efforts due to the presence of seasonally ponded features, and attributes thereof, considered to have the potential to support populations of Red Bluff dwarf rush.

Ahart's paronychia (*Paronychia ahartii*). Federal Status: None; State Status: None; CNPS Status: List 1B. This plant taxon is not listed under the Federal Endangered Species Act, California Endangered Species Act, or California Native Plant Protection Act. It is considered by CNPS to be "Rare, Threatened or Endangered in CA and Elsewhere."

Ahart's paronychia is a small, inconspicuous annual in the carnation family (Caryophyllaceae). This plant taxon grows in cismontane woodland, and valley and foothill grassland from elevations between 90 and 1,530 feet above mean sea level. It is endemic to California and is threatened by habitat loss. Regionally, it is found in slightly wet areas that are sparsely vegetated.

CNDDB records that regional occurrences of this species indicate that there are no occurrences of this species within five miles of the study area (California Department of Fish and Game 2007a).

3.4 Detailed Evaluation of Special-Status Wildlife Species

Federal or State Listed Wildlife Species

Valley Elderberry Longhorn Beetle (VELB) (*Desmocerus californicus dimorphus*). Federal Status: Threatened; State Status: None. The USFWS formally listed the VELB as *threatened* on August 8, 1980 (45 FR 52803 52807). Critical Habitat was also designated at this time (45 FR 52803 52807). Changed land use in the riverside habitats to which it is restricted is the primary threat to this beetle.

The VELB is an insect endemic to the foothills and Central Valley of California. It inhabits riparian and associated upland habitats where elderberry (*Sambucus* spp.), its host plant, grows. Specifically, its range extends throughout the Central Valley and adjacent foothills up to the 3,000 foot elevation level to the east and the Central Valley watershed to the west (U.S. Fish and Wildlife Service 1999). VELB habitat consists of riparian forests whose dominant plant species include cottonwood (*Populus* spp.), sycamore (*Platanus* spp.), valley oak (*Quercus lobata*.), and willow (*Salix* spp.), with an understory of elderberry shrubs (U.S. Fish and Wildlife Service 1991). Elderberry shrubs with a basal stem diameters larger than 1 inch are considered by the USFWS as suitable VELB habitat (U.S. Fish and Wildlife Service 1999).

The VELB life cycle is intimately connected to its habitat, elderberry shrubs. Following mating, the female lays her eggs in crevices in the elderberry bark. Upon hatching (after about 10 days), the larvae bore into the pith of the shrub and feed inside stems larger than 1 inch in diameter for 1 to 2 years until they mature. They emerge as adults during the spring via exit holes chewed through the bark. The adult beetles feed on the elderberry foliage until they mate, completing the cycle. Adults are active from March to June.

The study area has large areas of riparian forest containing elderberry shrubs and CNDDB records indicate an occurrence of VELB within five miles of the site.

Green Sturgeon, Southern DPS (*Acipenser medirostris*). Federal Status: Threatened; State Status: Species of Special Concern.

Relatively little is known about green sturgeon in the Sacramento River compared to its relative the white sturgeon (*Acipenser transmontanus*). Adult green sturgeon generally migrate into rivers between late-February and late-July. Spawning takes place in deep, fast water from March to July when water temperatures range from 46 °F to 60 °F. Juveniles may rear in the river for 1 to 3 years before migrating to the estuary, primarily during the summer and fall. Once in the estuary young sturgeon adopt an oceanic foraging habit, which may last from 3 to 13 years before returning for their first spawning season (Moyle 2002).

Green sturgeon use streams, rivers, and estuarine habitat as well as marine waters during their life cycle. Like the white sturgeon, green sturgeon prefer to spawn in lower to middle reaches of large rivers with swift currents and large cobble; no nest is built, adults broadcast spawn into the water column. The fertilized eggs sink and attach to the bottom to hatch. Research indicates that water flow is one of the key determinants of larval survival (Moyle 2002).

In the final determination to list the southern DPS as threatened under FESA, NMFS identified the reduction of available spawning habitat due to construction of barriers along the Sacramento and Feather rivers as being the principal threat to green sturgeon in the southern DPS (71 FR 17757). Other threats include, but are not limited to, insufficient flow rates, increased water temperature, water diversion, non-native species, poaching, pesticide and heavy metal contamination, and local fishing.

California Central Valley DPS Steelhead *(Onchorynchus mykiss)* Federal Status: Threatened; State Status: None.

Steelhead possess one of the most complex life history patterns of the Pacific salmonid species. Steelhead typically refers to the anadromous form of rainbow trout. Similar to other Pacific salmon, steelhead adults spawn in freshwater and spend a part of their life history at sea. However, unlike Chinook salmon, steelhead exhibit a variety of life history strategies during their freshwater rearing period and as adults may spawn more than once during their life. The typical life history pattern for steelhead is to rear in freshwater streams for two years followed by up to two or three years of residency in the marine environment. However, juvenile steelhead may rear in freshwater from one to four years (Busby et al. 1997; Moyle 2002).

Steelhead populations inhabiting the upper Sacramento River basin belong to the Central Valley steelhead DPS as defined by Good et al. (1997). These steelhead populations generally exhibit a life history pattern typical of a fall/winter run. This species historically has provided a popular sport fishery throughout the Sacramento River and its tributaries; however, at present naturally-produced steelhead remain at relatively low levels throughout their range in the Central Valley (Hallock 1989; McEwan 2001).

Steelhead adults may enter the Sacramento River and its tributaries from August through March, but peak migration generally occurs from October through February. Spawning begins in late December and can extend into early-April. Steelhead spawn in gravel and small cobble substrates usually associated with riffle and run habitat types. The upper mainstem Sacramento River is known to provide suitable spawning and juvenile rearing habitat for steelhead. The Sacramento River in the vicinity of the project may be used by steelhead during all life stages, including spawning and egg incubation.

Critical habitat designations for listed anadromous salmonids published in September 2005 (70 FR 52488) were finalized as part of the recent status reviews and are restricted to the species' anadromous range, which is coextensive with the steelhead-only DPS delineations described in that notice (71 FR 834). Designated critical habitat for Central Valley steelhead DPS includes all river reaches accessible to steelhead in the Sacramento and San Joaquin rivers and their tributaries, which includes the Sacramento River adjacent to the action area.

Central Valley Spring-run Chinook Salmon ESU *(Onchorynchus tshawytscha* Federal Status: Threatened; State Status: Threatened.

Spring-run Chinook salmon migrate upstream during the spring beginning in March, hold over in deep pools of the mainstem river and its large perennial tributaries, where fish can access cold headwaters, during the summer months, and spawn from mid-August through mid-October. Most of the spring run in the Sacramento River Basin ascend and spawn in the principal tributary streams (Mill, Deer, Clear, and Butte creeks, and the Feather River). Egg incubation occurs from mid-August through mid-January. Spring-run in the Sacramento River exhibit an ocean-type life history, emigrating as fry, sub-yearlings, and yearlings. Based on observations at Red Bluff Diversion Dam, spring-run emigration from the upper Sacramento River typically occurs from November through April (Vogel and Marine 1991; (Johnson, Weigand, and Fisher 1992)). Although some spring-run salmon may spawn in the Sacramento River between Red Bluff and Keswick Dam, it is thought that most have hybridized with fall-run salmon due to overlapping spawning periods, lack of spatial separation, and redd superimposition (California Department of Fish and Game 1998).

Central Valley spring-run ESU Chinook salmon populations in the Sacramento River and its tributaries have remained relatively depressed; however, some modest increases have occurred in their principal spawning tributaries such as Deer, Mill, and Butte Creeks (California Department of Fish and Game 2004). Spring-run Chinook salmon spawning in the mainstem Sacramento River and nearby tributaries such as Clear Creek and Battle Creek remain relatively depressed (California Department of Fish and Game 2004).

Designated critical habitat for Central Valley spring-run Chinook salmon includes the San Francisco Bay-Delta estuary, mainstem Sacramento River upstream to Keswick Dam and most of the Sacramento Valley’s perennial tributaries with established spring salmon runs, including the Feather River and Feather River Hatchery. Designated critical habitat for Central Valley spring-run Chinook salmon includes all river reaches accessible to the species in the Sacramento and San Joaquin Rivers and their tributaries in California, which includes the Sacramento River adjacent to the property.

Sacramento River Winter-run Chinook Salmon ESU *(Onchorynchus tshawytscha)*. Federal Status: Endangered; State Status: Endangered.

Historically, winter-run Chinook salmon spawned in the cold spring-fed headwaters of the upper Sacramento, Pit, McCloud, and Calaveras rivers (U.S. Fish and Wildlife Service 1995). Following construction of Shasta Dam, deep water releases during the summer months provided suitable cold water conditions for winter-run Chinook salmon spawning and rearing downstream of the dam. In response to these conditions, which increased total coldwater spawning habitat available to the winter run, the population increased. In 1969, the winter run exceeded 100,000 salmon; however, during the early 1990’s, run size estimates have ranged from about 1,400 fish to as low as about 200 fish in some years. The Sacramento River winter-run Chinook salmon population has exhibited a continuing recovery from the extremely low adult returns observed in the early 1990’s. Recent spawning populations range from about 7,000 to 8,000 (California Department of Fish and Game 2004); however, these levels remain well below draft recovery goals established for this run (National Marine Fisheries Service 2004).

Winter-run Chinook salmon begin their migration up the Sacramento River in December and may spawn from mid-April through mid-August with a peak in spawning occurring from late May through June (Vogel and Marine 1991; Moyle 2002). Winter-run Chinook salmon spawning and juvenile rearing areas include the river reach adjacent to the project site (D. Killam, CDFG, unpublished data).

The egg incubation period extends from mid-April through mid-September. Juvenile winter-run Chinook salmon are known to rear in suitable habitats of the upper Sacramento River, including that adjacent to the project site.

The critical habitat designation includes the Sacramento-San Joaquin Delta and the Sacramento River, within all accessible reaches, including that reach adjacent to the action area. Constituent elements of anadromous salmonid critical habitat is considered to include seasonal timing and volume of stream flows sufficient to allow the fish to migrate, reproduce and rear; suitable streambed and bank conditions to support spawning, incubation, and larval development; suitable water quantity and quality and floodplain connectivity to form and maintain physical habitat to support juvenile development, growth, and mobility; natural cover such as shade, submerged and overhanging vegetation and large wood, log jams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; and finally, freshwater migration corridors free of obstruction with water quantities and quality and natural cover that support juvenile and adult fish migration and survival (69 FR 71880).

California Red-legged Frog (*Rana aurora draytonii*). Federal Status: Threatened; State Status: Species of Special Concern. The California red-legged frog inhabits quiet pools of streams, marshes, and ponds. All life history stages are most likely to be encountered in and around breeding sites, which include coastal lagoons, marshes, springs, permanent and semi permanent natural ponds, and ponded and backwater portions of streams, as well as artificial impoundments such as stock ponds, irrigation ponds, and siltation ponds. This species breeds from March to July; females lay 750 to 4000 eggs in clusters, attached to vegetation 7 to 15 cm (2 to 6 in) below the water surface. Juveniles can occur in slow moving, shallow riffle zones in creeks or along the margins of ponds. Eggs are typically deposited in permanent pools, attached to emergent vegetation (Zeiner, Laudenslayer, and Mayer 1989)

The historic range of the California red-legged frog extended along the coast from the vicinity of Point Reyes National Seashore, Marin County, and inland from the vicinity of Redding, Shasta County, southward to northwestern Baja California, Mexico. The species has lost approximately 70 percent of its former range; California red-legged frogs are locally abundant in the San Francisco Bay area and the central coast, but only isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse ranges (50 CFR Part 17 14626).

NSR staff conducted a USFWS protocol-level site assessment for California red-legged frog, and produced a separate detailed report (North State Resources 2007a). NSR staff did not observe any California red-legged frogs during the USFWS protocol-level surveys, but did conclude that the seasonal pond in the central region of the site provides suitable breeding habitat. The nearest known records of California red-legged frog are from Thomes Creek and Sunflower Gulch on Red Bank Creek, approximately 33 miles south southwest of the project site.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*). Federal Status: Candidate; State Status: Endangered. The western yellow-billed cuckoo is a federal candidate for listing. It is generally considered a neotropical migrant that arrives in California to begin breeding in June.

In northern California it prefers riparian forests, containing willow (*Salix* spp.) and Fremont cottonwood (*Populus fremontii*) (Laymon 1998). It is also found in orchards adjacent to river bottoms. The western yellow-billed cuckoo feeds primarily on large insects but also occasionally takes small frogs, lizards, eggs, and young birds. The species is known to be an interspecific brood parasite, laying eggs in the nests of at least 11 other bird species (Hughes 1999). Major declines among western populations in twentieth century due to habitat loss and fragmentation, local extinctions, and low colonization rates; now extremely rare in most areas . There are approximately 30 pairs breeding in California. The nearest known breeding pairs are approximately 30 miles south of the project site along the Sacramento River (Laymon 1998).

Bald Eagle (*Haliaeetus leucocephalus*). Federal status: Delisted (previously endangered); State status: Endangered. The bald eagle is a large soaring bird; in North America, it is second in size only to the California condor (*Gymnogyps californianus*). Most of the annual food requirements of a bald eagle is derived from or obtained around aquatic habitats. The food most often consumed consists of fish, water birds, and small to medium-sized mammals. Because of the dietary association, nesting territories are usually found near water.

Perches are used primarily during the day for resting, preening, and hunting, and may include human-made structures such as power poles. Roosting areas contain a night communal roosting tree that is easily accessible to the large birds and tall enough to provide safety from threats from the ground. Bald eagle nests and roosts are usually found where human activity is infrequent or muted. In California, breeding pairs are found mostly in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties (U.S. Fish and Wildlife Service 2007a).

The USFWS delisted the bald eagle in 2007, and attributes the recovery of the species to reduction in use of organochlorine pesticides and habitat conservation (U.S. Fish and Wildlife Service 2007a). NSR staff have have incidentally observed bald eagles foraging over the project site, but have not observed them nesting on the project site.

Bank Swallow (*Riparia riparia*). Federal status: None; State status: Threatened. Bank swallows are found primarily in riparian and other lowland habitats in the Central Valley, typically between April and September. They nest colonially and inhabit isolated places where fine-textured or sandy, vertical bluffs or riverbanks are available in which to dig burrows. Bank swallows forage over open riparian areas, brushland, grassland, and cropland.

The species' range in California is estimated to be have been reduced by 50 percent since 1900 (Zeiner et al. 1990a). Now, only 110 to 120 colonies remain within the state. Perhaps 75 percent of the current breeding population in California occurs along the banks of the Sacramento and Feather rivers in the northern Central Valley in areas where the rivers still meander in a mostly natural state. About 50 to 60 colonies remain along the middle Sacramento River, and 15 to 25 colonies occur along the lower Feather River. Other colonies persist along the central coast from Monterey to San

Mateo counties and in northeastern California in Shasta, Siskiyou, Lassen, Plumas, and Modoc counties (Zeiner et al. 1990a).

Other Special-Status Wildlife Species

River Lamprey *(Lampetra ayresii)* Federal Status: None; State Status: Species of Special Concern. River lamprey are anadromous; like salmon they are born in freshwater streams, migrate to the ocean, and return to fresh water as mature adults to spawn. Also like the salmon, lampreys do not feed during their spawning migration. Mating pairs of lamprey construct a nest by digging together using rapid vibrations of their tails and by moving stones using their suction mouths. They enter streams from July to October; spawning takes place the following spring when water temperatures are between 50° and 62.6°F. They ascend rivers by alternately swimming upstream in brief spurts and resting by sucking and holding on to rocks. Spawning takes place in low-gradient reaches of streams with gravel and sandy bottoms. Adults die within 4 days of spawning, after depositing from 10,000 to 100,000 very small-sized eggs in their nest. The young hatch in 2 to 3 weeks and swim to areas of low-velocity water where sediments are soft and rich in dead plant materials. They quickly burrow into the muddy bottom, where they filter the mud and water, eating microscopic plants (mostly diatoms) and animals.

Juvenile lamprey will stay burrowed in the mud for 3 to 6 years, moving only rarely to new areas. After a 2-month metamorphosis, triggered by unknown factors, they metamorphose into an adult morphology averaging 4.5 inches long. Newly metamorphosed lampreys migrate downstream during winter and spring high flow events. Adult river lampreys are thought to spend from 2 to 12 months in the estuary or ocean before returning to the rivers to spawn. River lamprey are known to occur in the Sacramento River (Moyle 2002).

Central Valley Fall/Late-fall Run Chinook Salmon ESU (Oncorhynchus tshawytscha) Federal Status: None; State Status: Species of Special Concern. The Central Valley fall/late-fall run ESU Chinook salmon comprises the largest present day population of Chinook salmon in the Central Valley. Fall-run Chinook salmon begin to enter the Sacramento River in July and the run builds through the late summer and fall months peaking by late-September and October (Vogel and Marine 1991). Spawning occurs throughout the upper Sacramento River and in a majority of its tributaries from mid-October through December (Vogel and Marine 1991; Moyle 2002). Spawning densities of fall run salmon are very high in the Sacramento River from near Red Bluff to Keswick Dam (D. Killam, CDFG, personal communication). Juvenile fall-run Chinook salmon rear throughout the Sacramento River and its tributaries. Juvenile fall run fry may emigrate to the estuary from shortly after they hatch through the spring and summer months following their birth.

The late-fall run component of this Chinook salmon ESU enters the Sacramento-San Joaquin estuary and ascends Central Valley streams after the fall run, usually from late-October through March (Vogel and Marine 1991). Spawning begins in January and is usually complete by late-April. Late-fall run spawning densities are greatest in the upper Sacramento River from Red Bluff to Keswick Dam. Both fall and late-fall run salmon use the spawning habitat of the mainstem river adjacent to the study area (CDFG, unpublished data). Juvenile late-fall run salmon rear in the upper Sacramento

River from late-April through the following winter before emigrating to the estuary (Vogel and Marine 1991; Moyle 2002).

Large numbers of the fall run and late-fall run salmon are spawned and reared by state and federal fish hatcheries in California's Central Valley. The number of hatchery-produced fish may greatly exceed the number naturally produced fall/late-fall run Chinook salmon in some Central Valley streams which has led to concern over the viability of certain tributary populations. These runs support valuable and popular ocean and river commercial and sport fisheries.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a federal fisheries management plan (FMP). EFH refers to those waters and substrates necessary for the spawning, breeding, feeding, or growth to maturity. Central Valley spring-run ESU Chinook salmon, Central Valley fall/late-fall run ESU Chinook salmon, and Sacramento River winter-run ESU Chinook salmon are all managed under a FMP and are therefore subject to protection under MSA.

The Sacramento River is designated by the National Marine Fisheries Service (NMFS) to contain EFH for Chinook salmon, as defined by the Magnuson-Stevens Fisheries Conservation and Management Act of 1994, as amended. EFH refers to those waters and substrates necessary for spawning, breeding, feeding, or growth to maturity. Freshwater EFH for salmon consists of four major components: spawning and incubation habitat; juvenile rearing habitat; juvenile migration corridors; and adult migration corridors and adult holding habitat (Pacific Fishery Management Council 2003).

The Sacramento River adjacent to the project site provides all four major components of freshwater EFH for salmon. Adult Chinook salmon migrate to and are known to spawn within all suitable habitats adjacent to the project site. Fry and juveniles are known to occur in suitable rearing habitats nearly year round. Medium to large cobbles and boulders dominate the river bottom in these habitats, providing suitable cover and refuge for rearing salmonids.

Hardhead *(Mylopharodon conocephalus)* Federal Status: None; State Status: Species of Special Concern. Hardhead were identified as a California Species of Special Concern in 1995 (Moyle et al. 1995). Hardhead are listed as a Class 3 species of special concern. Class 3 species are those fish species occupying much of their native range, but that were formerly more widespread or abundant within that range. Included in this classification are taxa with very restricted distributions (e.g., Eagle Lake tui chub). The populations of such species need to be assessed periodically (i.e., every 5 years) and included in long-term plans for protected waterways.

Hardhead are large cyprinids that closely resemble Sacramento pikeminnow and are widely distributed in low- to mid-elevation streams in the Sacramento–San Joaquin drainage. Hardhead typically inhabit undisturbed areas of larger low- to mid-elevation streams, although they are also found in the mainstem Sacramento River at low elevations and in its tributaries to about 4,921 feet . They prefer clear, deep pools and runs with slow velocities and occur in streams where summer temperatures reach in excess of 68ºF (Moyle 2002).

Historically, hardhead have been regarded as widespread and abundant in central California and are still widely distributed in foothill streams. The specific risk to hardhead is their increasingly isolated populations, making them vulnerable to localized extinctions. Hardhead also tend to be absent from streams where introduced species dominate (Mayden, Rainboth, and Buth 1991; Moyle and Daniels 1982), and from streams that have been severely altered by human activity (Baltz and Moyle 1993).

Western Spadefoot Toad (*Spea hammondi*). Federal status: None; State Status: Species of Special Concern. Historically, the western spadefoot toad ranged from Redding to northwestern Baja, California. It has been extirpated from many locations within this range. Since 1990, there have been sightings in Alameda, Butte, Calaveras, Fresno, Kern, Kings, Los Angeles, Madera, Merced, Monterey, Orange, Placer, Riverside, Sacramento, San Benito, San Diego, San Joaquin, San Luis Obispo, Santa Barbara, Stanislaus, Tulare, Ventura, and Yolo counties (U.S. Fish and Wildlife Service 2007c).

The western spadefoot toad occurs primarily in grassland locations, but occasional populations also occur in valley-foothill hardwood woodlands. Some populations persist for a few years in orchard-vineyard habitats (Zeiner, Laudenslayer, and Mayer 1989). The species is found at elevations below 3,000 feet but can occur up to 4,500 feet. Western spadefoot toads breed in temporary pools from January to May. Water temperatures in these pools must be between 48ºF and 86ºF. Eggs are deposited on plant stems or on pieces of detritus in temporary rain pools or, less frequently, in pools in ephemeral stream courses (U.S. Fish and Wildlife Service 2007c).

Western spadefoot toads are extremely sensitive to low frequency noises and vibrations. These disturbances cause western spadefoot toads to break dormancy and emerge from their burrows (Dimmitt and Ruibal 1980).

Northwestern Pond Turtle (*Clemmys marmorata marmorata*). Federal Status: None; State Status: Species of Special Concern. The northwestern pond turtle is found in the quiet waters of ponds, marshes, creeks, and irrigation ditches. This species requires basking sites such as partially submerged logs, rocks, mats of floating vegetation, or open mud banks. They frequently bask on logs or other objects out of the water when water temperatures are low and air temperatures are greater than water temperatures. When air temperatures become too warm, western pond turtles water bask by lying in the warmer surface water layer with their heads out of the water. Hibernation in colder areas is passed underwater in bottom mud (Zeiner, Laudenslayer, and Mayer 1989). Mating typically occurs in late April or early May, but may occur year-round. Nests are located in an upland location that may be a considerable distance from the aquatic site (up to ¼ mile) (California Department of Fish and Game 1994). Hatchling turtles are thought to emerge from the nest and move to the aquatic site in the spring. Today, the northwestern pond turtle occurs in 90% of its historic range in the Central Valley and west of the Sierra Nevada mountains, but in greatly reduced numbers (Jennings and Hayes 1994). It occurs from the Oregon border south to the American Basin in the Central Valley, where it intergrades with southwestern pond turtle.

Western Burrowing Owl (*Athene cunicularia hypugaea*). Federal status: None; State status: Species of Special Concern. The western burrowing owl inhabits open, dry grasslands and deserts, as well as open stages of pinyon-juniper and ponderosa pine. The nesting season is between February 1 and August 31. Western burrowing owls typically nest in abandoned rodent burrows, particularly

those of California ground squirrels, which they modify each year. Burrowing owls forage in open grassland areas adjacent to nest sites. The species has also been documented in open areas near human habitation, especially airports and golf courses. The Central Valley and surrounding foothill regions of California provide year-round habitat for the western burrowing owl.

The study area has the general habitat requirements for the burrowing owl, but NSR staff did not note rodent activity and burrows during the site visits. There are no recorded CNDDB occurrences of the western burrowing owl within a 5-mile radius of the study area (California Department of Fish and Game 2007a).

Cooper's Hawk (*Accipiter cooperii*). Federal status: None; State status: Species of Special Concern. Cooper's hawks prefer landscapes where wooded areas occur in patches and groves facilitating the ambush hunting tactics employed by this species. The species preys upon medium-sized birds (e.g., jays, doves, and quail) and occasionally takes small mammals and reptiles. Breeding pairs in California prefer nest sites within dense stands of live oak woodland or riparian areas, and prey heavily on young birds during the nesting season. Cooper's hawks are breeding residents throughout most of the wooded areas in California, but populations have declined in recent decades (Zeiner et al. 1990a).

Cooper's hawks have the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

White-tailed Kite (*Elanus leucurus*). Federal Status: None; State Status: Fully Protected Species. The white-tailed kite can be found in association with the herbaceous and open stages of a variety of habitat types, including open grasslands, meadows, emergent wetlands, and agricultural lands. Nests are constructed near the top of dense oaks, willows, or other tree stands located adjacent to foraging areas. The species forages in undisturbed, open grasslands, meadows, farmlands and emergent wetlands. White-tailed kite are seldom observed more than 0.5 mi (0.8 km) from an active nest during the breeding season (Zeiner et al. 1990a). The white-tailed kite is found year-round in both the coastal zones and lowlands of the Central Valley in California.

White-tailed kites have the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

Osprey (*Pandion haliaetus*). Federal Status: None; State Status: Species of Special Concern. In California, osprey are common summer residents and breeders but are less common in winter. Osprey breed primarily in scattered locations throughout northern California from the Cascade Ranges south to Lake Tahoe, and along the coast south to Marin County. They nest and roost on exposed treetops, towers, pilings, or similar structures near lakes, reservoirs, rivers, estuaries, and the open sea coast. They forage over fish-bearing bodies of water. Current threats to the species include degradation of aquatic environments such as rivers and lakes and loss of nesting structures such as trees to timber harvest and other activities (Zeiner et al. 1990a).

Osprey have the potential to nest within the study area in the riparian area along the Sacramento River. There are two CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

California Yellow Warbler (*Dendroica petechia brewsteri*). Federal Status: None; State Status: Species of Special Concern. The yellow warbler is a long-distance migrant, usually arriving in California in April and leaving by October. The species breeds from mid-April to early August, building an open cup nest in a tree or shrub. Foraging patterns typically involve gleaning and hovering for insects and spiders. The yellow warbler occurs as a summer resident in northern California. It is usually found in dense riparian deciduous habitats with cottonwoods, willows, alders, and other small trees and shrubs typical of open-canopy riparian woodlands.

Yellow warblers have the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

Yellow-breasted Chat (Ictera virens); Federal Status: None; State Status; Species of Special Concern. The yellow-breasted chat is a neotropical migrant that occurs in riparian or marsh habitats throughout California. They are found in dense, brushy thickets near water and in the thick understory of riparian woodlands. Forage patterns usually involve gleaning insects, spiders, and berries from the foliage of shrubs and low trees. Nests are often low to the ground in dense shrubs along streams. They occur as summer breeding residents in the Sacramento River Valley and its tributaries (Zeiner et al. 1990a).

Yellow-breated chat has the potential to nest within the study area in the riparian forest along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species or any nests during site visits.

Loggerhead Shrike (*Lanius ludovicianus*). Federal Status: None; State Status: Species of Special Concern. The loggerhead shrike prefers open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches located in open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper, juniper, desert riparian, and Joshua tree habitats. Loggerhead shrikes skewer their prey to thorns or barbs on barbed-wire fences. The purpose of this trait may be to help kill the prey or to cache the food for latter consumption. Loggerhead shrikes are found in lowlands and foothills throughout California (Zeiner et al. 1990a).

Loggerhead shrike has the potential to nest within the study area within the valley oak woodland. NSR staff did not observe this species or any nests during site visits.

Ringtail (*Bassiriscus astutus*). Federal Status: None; Federal Status: Fully Protected Species. The ringtail occurs in various riparian habitats in and brush stands of most forest and shrub habitats. Nocturnal, and primarily carnivorous, ringtails mainly eat small mammals but also feed on birds, reptiles, insects, and fruit. They forage on the ground, among rocks, and in trees; usually near water.

Hollow trees and logs, cavities in rocky areas, and other recesses are used for cover. The ringtail is widely distributed in California (Zeiner et al. 1990b).

Ringtail has the potential to nest within the study area in the riparian area along the Sacramento River. There are no recorded CNDDB occurrences of this species within a 5-mile radius of the study area (California Department of Fish and Game 2007a). NSR staff did not observe this species during site visits.

3.5 Field Review/Surveys

During the field reconnaissance and protocol-level surveys, the study area was inspected to identify plant and wildlife special-status species and/or potential habitat for these species in the study area. Lists of all plant and wildlife species observed are presented in Appendix E.

Botany

No special-status vascular plant species were detected as a result of botanical survey efforts. A list of all plant species observed is presented in Appendix E.

Wildlife

3.5.1.1 ***NSR staff California Red-Legged Frog Assessment***

NSR staff conducted a USFWS protocol-level site assessment for California red-legged frog, and produced a separate detailed report (North State Resources 2007a). NSR staff did not observe any California red-legged frogs during the USFWS protocol-level surveys, but did conclude that the seasonal pond in the central region of the site provides suitable breeding habitat.

3.5.1.2 ***Valley Elderberry Longhorn Beetle Surveys***

Sixty two (62) elderberry shrubs with stems measuring 1-inch or greater in diameter at ground level were detected during the surveys. Nearly all of the recorded elderberry shrubs are located within the valley foothill riparian and valley oak woodland habitat types in the southwest and south central section of the study area (Figure 3 in map pocket). Several of the elderberry shrubs are within the 100-foot buffer zone just south of the boundary at the southwest corner of the study area. Two of the 62 elderberry shrubs were deeply embedded within Himalayan blackberry brambles and were inaccessible for close inspection. Field survey data for the 62 elderberry shrubs are presented in a table in Appendix F.

Exit holes characteristic of VELB (e.g. exit hole oval to circular, approximately ¼ inch in diameter, and without beveled edges; exit hole on stem greater than one inch in diameter and within six feet from ground) were detected on 13 of the 60 elderberry shrubs that were accessible for close inspection. These 13 elderberry shrubs are located within valley foothill riparian and valley oak woodland habitats in the southwest and south central section of the study area (Figure 3 in map pocket). All of the 36 observed VELB exit holes are within six feet above ground level and located in live stems greater than 1-inch in diameter. There were both new exit holes, characterized by sharp hole edges and light colored wood, and older exit holes, characterized by the gradual sealing of the hole due to cambial growth (See photographs in Appendix G).

3.5.1.3 ***Incidental Special-Status Wildlife Observations***

NSR staff made incidental field observations of 30 wildlife species including one special-status species; bank swallow (Appendix E). NSR botanist/plant ecologist, Mr. Boggs and NSR biologist, Ms. Bolen observed a colony of bank swallows nesting in the cut-bank of the Sacramento River within the northern portion of the study area (Figure 3 in map pocket).

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APPENDIX A

U.S. Fish and Wildlife Service Species List

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

April 26, 2007

Document Number: 070426124401

Michael Gorman
North State Resources, Inc.
500 Orient St. Suite 150
Chico, CA 95928

Subject: Species List for Strawberry Fields Property

Dear: Mr.

We are sending this official species list in response to your April 26, 2007 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 25, 2007.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found at www.fws.gov/sacramento/es/branches.htm.

Endangered Species Division

TAKE PRIDE IN AMERICA

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 070426124401

Database Last Updated: March 5, 2007

Quad Lists

Listed Species

Invertebrates

Branchinecta conservatio

Conservancy fairy shrimp (E)

Branchinecta lynchi

Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardi

Critical habitat, vernal pool tadpole shrimp (X)
vernal pool tadpole shrimp (E)

Pacifastacus fortis

Shasta crayfish (E)

Fish

Acipenser medirostris

green sturgeon (T) (NMFS)

Hypomesus transpacificus

delta smelt (T)

Oncorhynchus mykiss

Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha

Central Valley spring-run chinook salmon (T) (NMFS)
Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii

California red-legged frog (T)

Birds

Haliaeetus leucocephalus

bald eagle (T)

Strix occidentalis caurina

northern spotted owl (T)

Plants

Orcuttia tenuis

Critical habitat, slender Orcutt grass (X)
slender Orcutt grass (T)

Candidate Species

Fish

Oncorhynchus tshawytscha

Central Valley fall/late fall-run chinook salmon (C) (NMFS)
Critical habitat, Central Valley fall/late fall-run chinook (C) (NMFS)

Birds

Coccyzus americanus occidentalis

Western yellow-billed cuckoo (C)

Quads Containing Listed, Proposed or Candidate Species:

BALLS FERRY (628B)

COTTONWOOD (629A)

OLINDA (629B)

BELLA VISTA (646B)

PALO CEDRO (646C)

PROJECT CITY (647A)

SHASTA DAM (647B)

REDDING (647C)

ENTERPRISE (647D)

County Lists

Shasta County

Listed Species

Invertebrates

Branchinecta lynchi

Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardi

Critical habitat, vernal pool tadpole shrimp (X)
vernal pool tadpole shrimp (E)

Pacifastacus fortis

Shasta crayfish (E)

Fish

Hypomesus transpacificus

delta smelt (T)

Oncorhynchus mykiss

Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha

Central Valley spring-run chinook salmon (T) (NMFS)
Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)

winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii

California red-legged frog (T)

Birds

Haliaeetus leucocephalus

bald eagle (T)

Strix occidentalis caurina

Critical habitat, northern spotted owl (X)

northern spotted owl (T)

Plants

Orcuttia tenuis

Critical habitat, slender Orcutt grass (X)

slender Orcutt grass (T)

Tuctoria greenei

Critical habitat, Greene's tuctoria (=Orcutt grass) (X)

Greene's tuctoria (=Orcutt grass) (E)

Candidate Species

Fish

Oncorhynchus tshawytscha

Central Valley fall/late fall-run chinook salmon (C) (NMFS)

Critical habitat, Central Valley fall/late fall-run chinook (C) (NMFS)

Birds

Coccyzus americanus occidentalis

Western yellow-billed cuckoo (C)

Mammals

Martes pennanti

fisher (C)

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.

(C) *Candidate* - Candidate to become a proposed species.

(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.

(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our critical habitat page for maps.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 25, 2007.

APPENDIX B

CNDDB Query Results

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
1	***Agelaius tricolor*** tricolored blackbird	ABPBXB0020			G2G3	S2	SC
2	***Agrostis hendersonii*** Henderson's bent grass	PMPOA040K0			G1Q	S1.1	3.2
3	***Anthicus antiochensis*** Antioch Dunes anthicid beetle	IICOL49020			G1	S1	
4	***Anthicus sacramento*** Sacramento anthicid beetle	IICOL49010			G1	S1	
5	***Antrozous pallidus*** pallid bat	AMACC10010			G5	S3	SC
6	***Branchinecta lynchi*** vernal pool fairy shrimp	ICBRA03030	Threatened		G3	S2S3	
7	***Carex scoparia*** pointed broom sedge	PMCYP03C90			G5	S2S3	2.2
8	***Carex vulpinoidea*** fox sedge	PMCYP03EN0			G5	S2.2	2.2
9	***Castilleja rubicundula ssp. rubicundula*** pink creamsacs	PDSCR0D482			G5T2	S2.2	1B.2
10	***Clarkia borealis ssp. borealis*** northern clarkia	PDONA05062			G3T2	S2.3	1B.3
11	***Cryptantha crinita*** silky cryptantha	PDBOR0A0Q0			G1	S1.1	1B.2
12	***Desmocerus californicus dimorphus*** valley elderberry longhorn beetle	IICOL48011	Threatened		G3T2	S2	
13	***Emys (=Clemmys) marmorata marmorata*** northwestern pond turtle	ARAAD02031			G3G4T3	S3	SC
14	***Euderma maculatum*** spotted bat	AMACC07010			G4	S2S3	SC
15	***Fluminicola seminalis*** Nugget Pebblesnail	IMGASG3110			G2	S1S2	
16	***Gratiola heterosepala*** Boggs Lake hedge-hyssop	PDSCR0R060		Endangered	G3	S3.1	1B.2
17	***Great Valley Cottonwood Riparian Forest***	CTT61410CA			G2	S2.1	
18	***Great Valley Mixed Riparian Forest***	CTT61420CA			G2	S2.2	
19	***Great Valley Valley Oak Riparian Forest***	CTT61430CA			G1	S1.1	
20	***Great Valley Willow Scrub***	CTT63410CA			G3	S3.2	
21	***Haliaeetus leucocephalus*** bald eagle	ABNKC10010	Threatened	Endangered	G5	S2	
22	***Hydromantes shastae*** Shasta salamander	AAAAD09030		Threatened	G1G2	S1S2	
23	***Juncus leiospermus var. leiospermus*** Red Bluff dwarf rush	PMJUN011L2			G2T2	S2.2	1B.1
24	***Lanx patelloides*** Kneecap Lanx	IMGASL7030			G1	S1	
25	***Legenere limosa*** legenere	PDCAM0C010			G2	S2.2	1B.1
26	***Lepidurus packardi*** vernal pool tadpole shrimp	ICBRA10010	Endangered		G3	S2S3	

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
27	***Limnanthes floccosa ssp. bellingeriana*** Bellinger's meadowfoam	PDLIM02041			G4T2	S1.1	1B.2
28	***Linderiella occidentalis*** California linderiella	ICBRA06010			G3	S2S3	
29	***Martes pennanti (pacifica) DPS*** Pacific fisher	AMAJF01021	Candidate		G5	S2S3	SC
30	***Monadenia troglodytes troglodytes*** Shasta sideband (snail)	IMGASC7090			G1G2	S1S2	
31	***Neviusia cliftonii*** Shasta snow-wreath	PDROS14020			G2	S2.2	1B.2
32	***Oncorhynchus tshawytscha spring-run*** spring-run chinook salmon	AFCHA0205A	Threatened	Threatened	G5T1Q	S1	
33	***Oncorhynchus tshawytscha winter run*** chinook salmon winter run	AFCHA0205B	Endangered	Endangered	G5T1Q	S1	
34	***Orcuttia tenuis*** slender orcutt grass	PMPOA4G050	Threatened	Endangered	G3	S3.1	1B.1
35	***Pandion haliaetus*** osprey	ABNKC01010			G5	S3	SC
36	***Paronychia ahartii*** Ahart's paronychia	PDCAR0L0V0			G2	S2.1	1B.1
37	***Riparia riparia*** bank swallow	ABPAU08010		Threatened	G5	S2S3	
38	***Trilobopsis roperi*** Shasta Chaparral	IMGASA2030			G1	S1	
39	***Viburnum ellipticum*** oval-leaved viburnum	PDCPR07080			G5	S2.3	2.3

APPENDIX C

CNPS Query Results

CNPS Inventory of Rare and Endangered Plants

Status: Plant Press Manager window with 15 items - Thu, Apr. 26, 2007 12:43 c

Reformat list as: Standard List - with Plant Press controls

ECOLOGICAL REPORT

scientific	family	life form	blooming	communities	elevation	CNPS
Agrostis hendersonii	Poaceae	annual herb	Apr-May	•Valley and foothill grassland (VFGrs) (mesic) •Vernal pools (VnPls)	70 - 305 meters	List 3.2
Anomobryum julaceum	Bryaceae	moss	•Broadleafed upland forest (BUFrs) •Lower montane coniferous forest (LCFrs) •North Coast coniferous forest (NCFrs)/damp rock and soil on outcrops, usually on roadcuts	100 - 1000 meters	List 2.2	
Carex scoparia	Cyperaceae	perennial herb	May	•Great Basin scrub (GBScr)(mesic)	130 - 1000 meters	List 2.2
Carex vulpinoidea	Cyperaceae	perennial herb	May-Jun	•Marshes and swamps (MshSw)(freshwater) •Riparian woodland (RpWld)	30 - 1200 meters	List 2.2
Castilleja rubicundula ssp. rubicundula	Scrophulariaceae	annual herb	Apr-Jun	•Chaparral (Chprl) (openings) •Cismontane woodland (CmWld) •Meadows and seeps (Medws) •Valley and foothill grassland (VFGrs)/serpentinite	20 - 900 meters	List 1B.2
Clarkia borealis ssp. borealis	Onagraceae	annual	Jun-Sep	•Chaparral (Chprl) •Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs)	400 - 1340 meters	List 1B.3
Cryptantha crinita	Boraginaceae	annual herb	Apr-May	•Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs) •Riparian forest (RpFrs) •Riparian woodland (RpWld) •Valley and foothill grassland (VFGrs)/gravelly streambeds	85 - 1215 meters	List 1B.2
				•Marshes and swamps		

Gratiola heterosepala	Scrophulariaceae	annual herb	Apr-Aug	(MshSw)(lake margins) •Vernal pools (VnPls)/clay	10 - 2375 meters	List 1B.2
Juncus leiospermus var. leiospermus	Juncaceae	annual herb	Mar-May	•Chaparral (Chprl) •Cismontane woodland (CmWld) •Meadows and seeps (Medws) •Valley and foothill grassland (VFGrs) •Vernal pools (VnPls)/vernally mesic	35 - 1020 meters	List 1B.1
Lathyrus sulphureus var. argillaceus	Fabaceae	perennial herb	Apr	•Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs) •Upper montane coniferous forest (UCFrs)	150 - 305 meters	List 3
Legenere limosa	Campanulaceae	annual herb	Apr-Jun	•Vernal pools (VnPls)	1 - 880 meters	List 1B.1
Neviusia cliftonii	Rosaceae	perennial deciduous shrub	Apr-Jun	•Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs) •Riparian woodland (RpWld)/ often streamsides; sometimes carbonate, volcanic, or metavolcanic	300 - 500 meters	List 1B.2
Orcuttia tenuis	Poaceae	annual herb	May-Sep(Oct) Months in parentheses are uncommon.	•Vernal pools (VnPls)	35 - 1760 meters	List 1B.1
Paronychia ahartii	Caryophyllaceae	annual herb	Mar-Jun	•Cismontane woodland (CmWld) •Valley and foothill grassland (VFGrs) •Vernal pools (VnPls)	30 - 510 meters	List 1B.1
Viburnum ellipticum	Caprifoliaceae	perennial deciduous shrub	May-Jun	•Chaparral (Chprl) •Cismontane woodland (CmWld) •Lower montane coniferous forest (LCFrs)	215 - 1400 meters	List 2.3

APPENDIX D

Special-Status Species Considered for Analysis

Summary of Special-Status Species Review – Plants

Common Name *Scientific Name*	Status[1] (Fed/State/CNPS)	General Habitat Description/Elevation	Blooming Period	General Habitat Within Study Area (Present/ Absent)
Federal or State Listed Species				
Boggs Lake hedge-hyssop *Gratiola heterosepala*	--/E/1B.2	Clay soils within marshes and swamps (lake margins), vernal pools / 30-7,792 feet	April-August	**Absent.**
Slender Orcutt grass *Orcuttia tenuis*	T/E/1B.1	Vernal pools / 114-5,774 feet	May-October	**Absent**
Greene's tuctoria *Tuctoria greenei*	E/R/1B.1	Vernal pools / 98-3510 feet.	May-July	**Absent**
Other Special-Status Species				
Slender silver-moss *Anomobryum julaceum*	--/--/2.2	Damp rock and soil on outcrops within broadleafed upland forest, lower montane coniferous forest, North coast coniferous forest with; usually on roadcuts / 300-3,000 feet	Moss	**Absent**
Pointed broom sedge *Carex scoparia*	--/--/2.2	Mesic areas within Great Basin scrub / 426 – 3280 feet	May	**Absent**
Fox sedge *Carex vulpinoidea*	--/--/2.2	Freshwater marshes and swamps, and riparian woodland / 98-3,937 feet	May-June	**Present**
Pink creamsacs *Castilleja rubicundula* ssp. *rubicundula*	--/--/1B	Serpentinite soils within chaparral openings, cismontane woodland, meadows, seeps and valley and foothill grassland / 60-2,700 feet	April-June	**Absent.**
Northern clarkia *Clarkia borealis* ssp. *borealis*	--/--/1B.3	Chaparral, cismontane woodland, and lower montane coniferous forest / 1,312-4,396 feet	June-September	**Absent**
Silky cryptantha *Cryptantha crinita*	--/--/1B.2	Gravelly streambeds within cismontane woodland, lower montane coniferous forest, riparian scrub, riparian woodland, and valley and foothill grassland / 278-984 feet	April-May	**Present.** Gravelly substrate present on gravel bars and old channels.
Red Bluff dwarf rush *Juncus leiospermus* var. *leiospermus*	--/--/1B.1	Meadows and seeps, vernal pools; Vernally mesic areas within chaparral, cismontane woodland, and valley and foothill grassland / 115-3,346 feet	March-May	**Present.** Foothill grassland present.
Legenere *Legenere limosa*	--/--/1B.1	Vernal pools / 3-2,887 feet	April-June	**Absent**
Shasta snow wreath *Neviusia cliftonii*	--/--/1B.2	Often on streamsides within lower montane coniferous forest and riparian woodland / 984-1,640 feet	April-May	**Absent**
Ahart's nailwort *Paronychia ahartii*	--/--/1B.1	Cismontane woodland, valley and foothill grassland and vernal pools / 90-1,530 feet	March-June	**Present.** Valley oak woodland and foothill grassland present.
Oval-leaved viburnum *Viburnum ellipticum*	--/--/2.3	Chaparral, cismontane woodland, and lower montane coniferous forest / 705-4,593 feet	May-June	**Absent**

Summary of Special-Status Species Review – Wildlife

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Federal or State Listed Species				
Invertebrates				
Conservancy fairy shrimp *Branchinecta lynchi*	T/--	Vernal pool crustaceans live in vernal pools, swales, and ephemeral freshwater habitats. None are known to occur in riverine waters or marine waters.	Absent	Although seasonal wetlands occur in the study area, the site does not occur in a natural vernal pool setting and occurrences of listed vernal pool species do not occur near the study area.
Vernal pool fairy shrimp *Branchinecta conservatio*	E/--	Vernal pool crustaceans live in vernal pools, swales, and ephemeral freshwater habitats. None are known to occur in riverine waters or marine waters.	Absent	Although seasonal wetlands occur in the study area, the site does not occur in a natural vernal pool setting and occurrences of listed vernal pool species do not occur near the study area.
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Elderberry shrubs associated with riparian forests that occur along rivers and streams.	**Present**	Elderberry shrubs occur in the study area.
Vernal pool tadpole shrimp *Lepidurus packardi*	E/--	Vernal pool crustaceans live in vernal pools, swales, and ephemeral freshwater habitats. None are known to occur in riverine waters or marine waters.	Absent	Although seasonal wetlands occur in the study area, the site does not occur in a natural vernal pool landscape and occurrences of listed vernal pool species do not occur near the study area.
Shasta crayfish *Pacifastacus fortis*	E/--	Pit River, Fall River and Hat Creek drainages in Shasta County	Absent	Watersheds in which the species occur do not occur in the study area. Thus, this species is eliminated from further consideration.
Fish				
Green sturgeon, southern DPS (*Acipenser medirostris*)	T/SC	Spawn in Sacramento and Feather rivers; juveniles are thought to rear mainly in the estuary.	**Present**	Suitable habitat occurs in the Sacramento River.
Delta smelt (*Hypomesus transpacificus*)	T/T	Estuarine systems in the Sacramento-San Joaquin Delta.	Absent	Suitable habitat not present.
Steelhead, California Central Valley DPS (*Oncorhynchus mykiss*) Critical Habitat	T/--	Spawn and rear in freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**	Suitable spawning, rearing, and migration habitat occurs in the Sacramento River.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Central Valley spring-run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Critical Habitat	T/T	Freshwater rivers and streams. (Sacramento River and its tributaries)	**Present**	Suitable spawning, rearing, and migration habitat occurs in the Sacramento River.
Sacramento River winter-run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Critical Habitat	E/E	Freshwater river and streams. (Sacramento River and its tributaries)	**Present**	Suitable spawning, rearing, and migration habitat occurs in the Sacramento River.
Amphibians				
Shasta salamander *Hydromantes shastae*	--/T	Moist limestone fissures and caves, in volcanic and other rock outcroppings, and under woody debris in mixed pine-hardwood stands.	Absent	Limestone outcrops do not occur within the study area. Thus, this species is eliminated from further consideration.
California red-legged frog *Rana aurora draytonii*	T/SC	Require aquatic habitat for breeding, also uses a variety of other habitat types including riparian and upland areas. Adults utilize dense, shrubby or emergent vegetation associated with deep-water pools with fringes of cattails & dense stands of overhanging vegetation.	**Present**	One perennial pond occurs in the study area.
Birds				
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	C/E	Nesting habitat is cottonwood/willow riparian forest. Occurs only along the upper Sacramento Valley portion of the Sacramento River, the Feather River in Sutter Co., the south fork of the Kern River in Kern Co., and along the Santa Ana, Amargosa, and lower Colorado rivers	**Present**	Extensive cottonwood/willow riparian forest habitat occurs in the study area.
Willow flycatcher *Empidonax traillii*	--/E	Rare summer resident in wet meadow and montane riparian habitats at 2,000 to 8,000 feet elevation. No longer known to nest in Sacramento Valley but migrates through the north state region in spring and fall.	Absent	Suitable habitat not present.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
American peregrine falcon *Falco peregrinus anatum*	D/E, FP	Forages in many habitats; requires cliffs for nesting.	Absent	Suitable habitat not present.
Greater sandhill crane *Grus canadensis tabida*	--/T, FP	Wetlands required for breeding; forage in nearby pastures, fields, and meadows.	Absent	Suitable habitat not present.
Bald eagle *Haliaeetus leucocephalus*	T/E	Forages on live and dead fish and nests in large trees or snags. Requires large bodies of water, including ocean shorelines, lake margins, and large, open river courses for foraging, nesting, and wintering habitat.	**Present**	The Sacramento River runs along the western edge of the property and provides suitable foraging habitat.
Bank swallow *Riparia riparia*	--/T	Colonial nester on vertical banks or cliffs with fine-textured soils near water.	**Present**	Vertical banks are present along the Sacramento River along the northwestern boundary of the site.
Northern spotted owl *Strix occidentalis caurina* Critical habitat	T/--	In northern California, resides in large stands of old growth, multi-layered mixed conifer, redwood, and Douglas-fir habitats	Absent	Dense, mixed conifer forest is not present.
Mammals				
California wolverine *Gulo gulo luteus*	--/T, FP	A variety of habitats within the elevations of 1,600 and 14,200 ft. Most commonly inhabits open terrain above timberline.	Absent	Suitable habitat not present.
Pacific fisher *Martes pennanti pacifica*	C/SC	Dens and forages in intermediate to large stands of old-growth forests or mixed stands of old-growth and mature trees with greater than 50% canopy closure. May use riparian corridors for movement.	Absent	Suitable habitat not present.
Sierra Nevada red fox *Vulpes vulpes nector*	--/T	Red fir and lodgepole pine forests in the sub-alpine zone and alpine fell-fields of the Sierra Nevada.	Absent	Suitable habitat not present.
Other Special-Status Species				
Fish				
River lamprey *(Lampetra ayresii)*	--/SC	The biology of river lampreys has not been studied in California, general habitat and life history thought to be similar to Pacific lamprey.	**Present**	Suitable habitat occurs in the Sacramento River.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Central Valley fall/late-fall run ESU Chinook salmon (*Oncorhynchus tshawytscha*)	SC/SC	Freshwater rivers and streams. (Sacramento and San Joaquin rivers and their tributaries)	**Present**	Suitable habitat occurs in the Sacramento River.
Hardhead (*Mylopharodon conocephalus*)	--/SC	Quiet deep pools of large, warm, clear streams over rocks or sand.	**Present**	Suitable habitat occurs in the Sacramento River.
Pit roach *Lavinia symmetricus mitrulus*	--/SC	Small, warm, intermittent streams in the upper Pit River and its tributaries and tributaries to Goose Lake.	Absent	Study area outside the upper Pit River watershed.
McCloud River redband trout *Oncorhynchus mykiss ssp.*	--/SC	McCloud River and its tributaries, Swamp Creek and Trout Creek.	Absent	Study area is outside the McCloud River watershed.
Sacramento splittail *Pogonichthys macrolepidotus*	--/SC	Shallow, dead-end sloughs with submerged vegetation.	Absent	Native, non-game species; historically occurred near Redding, however, range is not thought to presently extend above Red Bluff.
Longfin smelt *Spirinchus thaleichthys*	--/SC	Sloughs of Suisun Bay and Delta.	Absent	Suitable habitat not present.
Amphibians				
Tailed frog *Ascaphus truei*	--/SC	Clear, rocky, swift, cool perennial streams in densely forested habitats.	Absent	Suitable habitat not present.
Foothill yellow-legged frog *Rana boylii*	--/SC	Rocky streams in a variety of habitats. Found in coast ranges.	Absent	Suitable habitat not present.
Cascades frog *Rana cascadae*	--/SC	Open coniferous forests along the sunny, rocky banks of ponds, lakes, streams, and meadow potholes. From 2,600 to 9,000 feet in elevation in Cascades and Trinity Mountains.	Absent	Suitable habitat not present.
Western spadefoot toad *Spea hammondii*	--/SC	Grasslands with temporary pools.	**Present**	One intermittent pool is located within a grassland in the northeast section of the site.
Reptiles				
Northwestern pond turtle *Clemmys marmorata marmorata*	--/SC	Slow water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Require an upland oviposition site in the vicinity of the aquatic site	**Present**	One perennial pond occurs on the project site.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Birds				
Long-billed curlew *Numenius americanus*	--/SC	Large coastal estuaries, upland herbaceous areas, and croplands. Breeds in wet meadow habitat.	Absent	Suitable habitat not present.
Double-crested cormorant *Phalacrocorax auritus*	--/SC	Inland lakes; fresh, salt and estuarine waters.	**Present**	Suitable nesting habitat not present on site due to level of human disturbance. May occur as a forager.
White-faced ibis *Plegadis chihi*	--/SC	A rare visitor to the Central Valley, this species nests and forages in freshwater marshes.	Absent	Suitable habitat not present.
California spotted owl *Strix occidentalis occidentalis*	--/SC	Dense, multi-layered mixed conifer, redwood, and Douglas-fir habitats with large overstory trees.	Absent	Conifer forest not present in study area.
Merlin *Falco columbarius*	--/SC	Frequents ocean shorelines, lake margins, and large, open river courses near tree stands for both nesting and wintering habitat. Does not breed in California.	**Present**	Woodlands provide suitable habitat.
Long-eared owl *Asio otus*	--/SC	Dense riparian and live oak thickets near meadow edges, and nearby woodland and forest habitats; also found in dense conifer stands at higher elevations.	Absent	Dense vegetation and meadows do not occur within the study area.
Western burrowing owl *Athene cunicularia hypugaea*	--/SC	Open habitats, dry grasslands and ruderal habitats with ground squirrel burrows.	**Present**	Suitable habitat present, however, there are no known occurrences in the area.
Golden eagle *Aquila chrysaetos*	--/SC/FP	Breeds on cliffs or in large trees or electrical towers, forages in open areas.	Absent	Open habitats and cliffs do not occur in the study area. Thus, this species is eliminated from further consideration
Sharp-shinned hawk *Accipiter striatus*	--/SC	Typically nests in dense conifer stands near water, winters in woodlands. Forages in many habitats in winter and migration.	**Present**	Unlikely to nest in area but may occur as a winter migrant.
Cooper's hawk *Accipiter cooperii*	--/SC	Nests in woodlands, forages in many habitats in winter and migration.	**Present**	Suitable nesting and foraging habitat is present in the project.
Northern goshawk *Accipiter gentilis*	--/SC	Breeds in dense, mature conifer and deciduous forests, interspersed with meadows, other openings and riparian areas; nesting habitat includes north-facing slopes near water.	Absent	Dense coniferous forests do not occur in the study area.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Ferruginous hawk *Buteo regalis*	--/SC	Forages in grasslands and occasionally in other open habitats during migration and winter.	**Present**	May be rare as migrant.
Northern harrier *Circus cyaneus*	--/SC	Forages in marshes, grasslands, and ruderal habitats; nests in extensive marshes and wet fields or grasslands.	Absent	Open grasslands or marshlands do not occur in the study area. Thus, this species is eliminated from further consideration
Prairie falcon *Falco mexicanus*	--/SC	Occurs in open habitats such as grasslands, desert scrub, rangelands and croplands. Nests on open cliffs.	**Present**	May be rare as migrant.
White-tailed kite *Elanus leucurus*	--/FP	Nests in lowlands with dense oak or riparian stands near open areas, forages over grassland, meadows, cropland and marshes.	**Present**	Woodlands and riparian forest provided suitable habitat.
Osprey *Pandion haliaetus*	--/SC	Ocean shorelines, lake margins and large, open river courses for both nesting and wintering habitat.	**Present**	Riparian habitat or large bodies of water occur in and near the study area
Black swift *Cypseloides niger*	--/SC	Nests in moist crevice or cave or sea cliffs above the surf, or on cliffs behind, or adjacent to, waterfalls in deep canyons; forages widely over many habitats.	Absent	Cliffs, deep canyons not present in Project vicinity. Thus, this species is eliminated from further consideration
Vaux's swift *Chaetura vauxi*	--/SC	Prefers redwood and Douglas-fir habitats, nests in hollow trees and snags or, occasionally, in chimneys; forages aerially.	Absent	Neither redwood nor Douglas-fir habitat is present. Thus, this species is eliminated from further consideration
Purple martin *Progne subis*	--/SC	Breeding habitat includes old-growth, multi-layered, open forest and woodland with snags; forages over riparian areas, forest, and woodlands	Absent	Multi-layered old growth does not occur in the study area. Thus, this species is eliminated from further consideration
Tricolored blackbird *Agelaius tricolor*	--/SC	Breeds near fresh water in dense emergent vegetation. Forages in grassland and cropland.	Absent	Dense emergent vegetation does not occur in the wetlands occuring in the study area. Foraging habitat is not available. Thus, this species is eliminated from further consideration.
California yellow warbler *Dendroica petechia brewsteri*	--/SC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	**Present**	Riparian habitat occurs in and near the study area.

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Yellow-breasted chat *Icteria virens*	--/SC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	**Present**	Riparian habitat occurs in and near the study area.
Bell's Sage Sparrow *Amphispiza belli belli*	--/SC	Nests in shrublands, preferably coastal scrub but is tolerant to a variety of shrublands. Irregular in its northern range of the western Shasta and Trinity Counties	Absent	Mixed chaparral occurs in the study area. Study area located near northernmost range of species
Loggerhead shrike *Lanius ludovicianus*	--/SC	Prefers open habitats with scatters shrubs and trees throughout the Central Valley of California. Nests in shrubs and trees.	**Present**	Open shrub/tree habitat occurs in the study area
Mammals				
Ringtail *Bassariscus astutus*	--/FP	Riparian habitats and in brush stands of most forest and shrub habitats. Nests in rock recesses, hollow trees, logs, snags, abandoned burrows or woodrat nests.	**Present**	Riparian habitat occurs in and near the study area.
Sierra Nevada snowshoe hare *Lepus americanus tahoensis*	--/SC	Boreal zones, typically inhabiting riparian communities with thickets of deciduous trees and shrubs above 4,800 ft. They also inhabit thickets of young conifers and chaparral.	Absent	Study area is below the required elevation for suitable habitat.
Townsend's western big-eared bat *Corynorhinus townsendii*	--/SC	Roosts in colonies in caves, mines, tunnels, or buildings in mesic habitats. The species forages along habitat edges, gleaning insects from bushes and trees. Habitat must include appropriate roosting, maternity and hibernacula sites free from disturbance by humans.	Absent	Roosting habitat is not present.
Pallid bat *Antrozous pallidus*	--/SC	Forages over many habitats; roosts in buildings, large oaks or redwoods, rocky outcrops and rocky crevices in mines and caves, and under bridges. Roosts must protect from high temperatures	**Present**	Roosting habitat does not occur within the study area; however suitable foraging habitat occurs in the study area.
Spotted bat *Euderma maculatum*	--/SC	Ponderosa pine region of the western highlands. Prefers cracks/crevices of high cliffs and canyons for roosting.	Absent	Ponderosa pine habitat not present and the project is located out of the current range of this species. Thus, this species is eliminated from further consideration

Scientific Name	Status[1] (Fed/State)	General Habitat Description	General Habitat[1] (Present/ Absent)	Rationale
Western mastiff bat *Eumops perotis*	--/SC	Roosts in cliff faces, rock outcrops, and buildings. Forages in open habitats. Needs vertical face to take flight.	**Present**	Roosting habitat does not occur within the study area; however suitable foraging habitat occurs in the study area.
American badger *Taxidea taxus*	--/SC	Herbaceous, shrub, and open stages of most habitats with dry, friable soils.	Absent	Suitable habitat does not occur within the study area.

[1]**Status and Habitat Codes:** Absent means general habitat is not present and no further work needed. Present means general habitat is present and species may be present.
Federal and State Codes: E = Endangered; T = Threatened; C = Candidate; Species of Special Concern (State); D = Delisted (status to be monitored for 5 years); FP = California Fully Protected Species. CNPS Codes: List 1B = Rare, Threatened or Endangered in CA and Elsewhere; List 2 = Rare, Threatened or Endangered in CA, but more common elsewhere.

APPENDIX E

Plant and Wildlife Species Observed

Plant Species Observed on the Strawberry Fields Study Area

Observers: Colby Boggs and Paul Kirk

Dates: April 25, May 3, May 9, and June 27, 2007

Annual Grassland		
Scientific name	**Common name**	**Family**
Aira caryophyllea	Silver European hairgrass	Poaceae
Amsinckia menziesii var. *intermedia*	Common fiddleneck	Boraginaceae
Brassica nigra	Black mustard	Brassicaceae
Brickellia californica	California brickellbush	Asteraceae
Bromus diandrus	Ripgut brome	Poaceae
Bromus hordeaceus	Soft brome	Poaceae
Bromus madritensis ssp. *rubens*	Red brome	Poaceae
Capsella bursa-pastoris	Shepherd's purse	Brassicaceae
Castilleja attenuata	Valley tassels	Scrophulariaceae
Centaurea solstitialis	Yellow star-thistle	Asteraceae
Cerastium glomeratum	Sticky mouse-eared chickweed	Caryophyllaceae
Chamomilla suaveolens	Pineapple weed	Asteraceae
Cichorium intybus	Chicory	Asteraceae
Cirsium vulgare	Bull thistle	Asteraceae
Convolvulus arvensis	Bindweed	Convolvulaceae
Cryptantha flaccida	Flaccid cryptantha	Boraginaceae
Cynodon dactylon	Bermuda grass	Poaceae
Cyperus eragrostis	Tall flatsedge	Cyperaceae
Dipsacus fullonum	Wild teasel	Dipsacaceae
Elymus elymoides	Squirreltail	Poaceae
Eriodictyon californicum	Yerba santa	Hydrophyllaceae
Eriogonum luteolum	Golden buckwheat	Polygonaceae
Eriogonum nudum	Naked eriogonum	Polygonaceae
Eriogonum sphaerocephalum	Round-headed buckwheat	Polygonaceae
Eriogonum vimineum	Wicker buckwheat	Polygonaceae
Eriophyllum lanatum	Woolly sunflower	Asteraceae
Erodium botrys	Long-beaked stork's bill	Geraniaceae
Erodium cicutarium	Red-stemmed filaree	Geraniaceae
Eschscholzia californica	California poppy	Papaveraceae
Filago californica	California herba impia	Asteraceae
Fraxinus latifolia	Oregon ash	Oleaceae
Grindelia camporum	Great valley gumweed	Asteraceae
Heterotheca oregona	Oregon goldenaster	Asteraceae
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley	Poaceae
Hordeum murinum ssp. *leporinum*	Foxtail barley	Poaceae
Hypochaeris glabra	Smooth cat's-ear	Asteraceae
Juncus effusus	Common bog rush	Juncaceae
Keckiella breviflora	Gaping keckiella	Scrophulariaceae
Leontodon taraxacoides	Hawkbit	Asteraceae
Lolium multiflorum	Italian ryegrass	Poaceae
Lomatium dasycarpum	Woolly-fruited lomatium	Apiaceae
Lotus humistratus	Short-podded lotus	Fabaceae

Annual Grassland (cont.)		
Scientific name	**Common name**	**Family**
Lupinus albifrons	Silver bush lupine	Fabaceae
Lupinus bicolor	Miniature lupine	Fabaceae
Mentzelia laevicaulis	Smooth-stem blazing star	Loasaceae
Petrorhagia dubia	Grass pink	Caryophyllaceae
Plagiobothrys fulvus	Fulvous popcorn flower	Boraginaceae
Plantago erecta	Erect plantain	Plantaginaceae
Raphanus raphanistrum	Jointed charlock	Brassicaceae
Rubus discolor	Himalayan blackberry	Rosaceae
Sagina apetala	Dwarf pearlwort	Caryophyllaceae
Salix exigua	Narrow-leaved willow	Salicaceae
Senecio vulgaris	Old man of spring	Asteraceae
Silybum marianum	Milk thistle	Asteraceae
Sonchus oleraceus	Common sow thistle	Asteraceae
Sorghum halepense	Johnson grass	Poaceae
Spergularia rubra	Ruby sandspurry	Caryophyllaceae
Symphytum officinale	Comfrey	Boraginaceae
Taraxacum officinale	Common dandelion	Asteraceae
Trifolium dubium	Shamrock	Fabaceae
Trifolium hirtum	Rose clover	Fabaceae
Trifolium microcephalum	Small-head field clover	Fabaceae
Trifolium repens	White clover	Fabaceae
Veronica peregrina ssp. *xalapensis*	Purslane speedwell	Scrophulariaceae
Vicia villosa	Winter vetch	Fabaceae
Vulpia myuros	Rattail fescue	Poaceae

Valley Foothill Riparian		
Acacia dealbata	Silver wattle	Fabaceae
Agrostis exarata	Spike bentgrass	Poaceae
Ailanthus altissima	Tree-of-heaven	Simaroubaceae
Alnus rhombifolia	White alder	Betulaceae
Aristolochia californica	Pipevine	Aristolochiaceae
Artemisia douglasiana	Mugwort	Asteraceae
Asparagus officinalis ssp. *officinalis*	Asparagus	Liliaceae
Barbarea orthoceras	Winter cress	Brassicaceae
Brassica nigra	Black mustard	Brassicaceae
Brickellia californica	California brickellbush	Asteraceae
Briza minor	Small quaking grass	Poaceae
Bromus diandrus	Ripgut brome	Poaceae
Bromus hordeaceus	Soft brome	Poaceae
Carduus pycnocephalus	Italian plumeless thistle	Asteraceae
Carex integra	Smooth-beaked sedge	Cyperaceae
Carex nudata	Torrent sedge	Cyperaceae
Cercis occidentalis	Western redbud	Fabaceae
Cyperus eragrostis	Tall flatsedge	Cyperaceae
Datura wrightii	Toluaca	Solanaceae
Dipsacus fullonum	Wild teasel	Dipsacaceae
Echinochloa crus-galli	Barnyard grass	Poaceae
Elymus elymoides	Squirreltail	Poaceae
Epilobium brachycarpum	Tall annual willowherb	Onagraceae

Valley Foothill Riparian (cont.)		
Scientific name	**Common name**	**Family**
Equisetum laevigatum	Smooth scouring rush	Equisetaceae
Eriogonum vimineum	Wicker buckwheat	Polygonaceae
Festuca rubra	Red fescue	Poaceae
Ficus carica	Common fig	Moraceae
Fraxinus latifolia	Oregon ash	Oleaceae
Galium aparine	Goose grass	Rubiaceae
Geranium molle	Dove's foot geranium	Geraniaceae
Gnaphalium californicum	California everlasting	Asteraceae
Hordeum murinum	Barley	Poaceae
Iris pseudacorus	Water iris	Iridaceae
Juglans californica	California black walnut	Juglandaceae
Juncus effusus	Common bog rush	Juncaceae
Juncus saximontanus	Rocky mountain rush	Juncaceae
Lactuca serriola	Prickly lettuce	Asteraceae
Leontodon taraxacoides	Hawkbit	Asteraceae
Lolium multiflorum	Italian ryegrass	Poaceae
Melilotus alba	White sweetclover	Fabaceae
Morus alba	Mulberry	Moraceae
Paspalum dilatatum	Dallis grass	Poaceae
Phytolacca americana	Pokeweed	Phytolaccaceae
Pinus ponderosa	Ponderosa pine	Pinaceae
Pinus sabiniana	Gray pine	Pinaceae
Plantago lanceolata	English plantain	Plantaginaceae
Plectritis ciliosa	Long-spurred plectritis	Valerianaceae
Polygonum lapathifolium	Willow weed	Polygonaceae
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Salicaceae
Quercus lobata	Valley oak	Fagaceae
Quercus wislizenii	Interior live oak	Fagaceae
Rhamnus californica	California coffeeberry	Rhamnaceae
Robinia pseudoacacia	Black locust	Fabaceae
Rubus discolor	Himalayan blackberry	Rosaceae
Rumex acetosella	Common sheep sorrel	Polygonaceae
Salix exigua	Narrow-leaved willow	Salicaceae
Salix gooddingii	Goodding's black willow	Salicaceae
Salix lasiolepis	Arroyo willow	Salicaceae
Sambucus mexicana	Blue elderberry	Caprifoliaceae
Saponaria officinalis	Bouncing bet	Caryophyllaceae
Setaria pumila	Yellow bristle grass	Poaceae
Silybum marianum	Milk thistle	Asteraceae
Sonchus oleraceus	Common sow thistle	Asteraceae
Stellaria media	Common chickweed	Caryophyllaceae
Torilis arvensis	Field hedge-parsley	Apiaceae
Toxicodendron diversilobum	Poison oak	Anacardiaceae
Ulmus minor	Smoothleaf elm	Ulmaceae
Verbascum thapsus	Woolly mullein	Scrophulariaceae
Vicia villosa	Winter vetch	Fabaceae
Vitis californica	California wild grape	Vitaceae
Vulpia myuros	Rattail fescue	Poaceae

Foothill Pine		
Scientific name	**Common name**	**Family**
Ailanthus altissima	Tree-of-heaven	Simaroubaceae
Anthoxanthum aristatum	Annual vernal grass	Poaceae
Arctostaphylos manzanita	Big leaved manzanita	Ericaceae
Avena barbata	Slender wild-oat	Poaceae
Brickellia californica	California brickellbush	Asteraceae
Briza minor	Small quaking grass	Poaceae
Eriodictyon californicum	Yerba santa	Hydrophyllaceae
Gilia capitata	Blue field-gilia	Polemoniaceae
Heterotheca oregona	Oregon goldenaster	Asteraceae
Juglans californica	California black walnut	Juglandaceae
Lepidium virginicum	Wild pepper-grass	Brassicaceae
Linaria genistifolia ssp. *dalmatica*	Dalmatian toad-flax	Scrophulariaceae
Lupinus albifrons	Silver bush lupine	Fabaceae
Petrorhagia dubia	Grass pink	Caryophyllaceae
Pinus sabiniana	Gray pine	Pinaceae
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Salicaceae
Quercus wislizenii	Interior live oak	Fagaceae
Raphanus raphanistrum	Jointed charlock	Brassicaceae
Salix gooddingii	Goodding's black willow	Salicaceae
Spartium junceum	Gorse	Fabaceae
Verbascum blattaria	Moth mullein	Scrophulariaceae

Valley Oak Woodland		
Camissonia contorta	Contorted sun-cup	Onagraceae
Chenopodium ambrosioides	Mexican tea	Chenopodiaceae
Cryptantha flaccida	Flaccid cryptantha	Boraginaceae
Heterotheca grandiflora	Telegraph weed	Asteraceae
Marrubium vulgare	Horehound	Lamiaceae
Morus alba	Mulberry	Moraceae
Orobanche fasciculata	Clustered broom-rape	Orobanchaceae
Phacelia heterophylla ssp. *virgata*	Virgate phacelia	Hydrophyllaceae
Rhamnus tomentella	Hoary coffeeberry	Rhamnaceae
Vitis californica	California wild grape	Vitaceae

Intermittent Pool and Pond		
Digitaria sanguinalis	Crabgrass	Poaceae
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley	Poaceae
Juncus bufonius	Toad rush	Juncaceae
Lemna minor	Common duckweed	Lemnaceae
Lolium multiflorum	Italian ryegrass	Poaceae
Lotus corniculatus	Birdfoot trefoil	Fabaceae
Poa annua	Annual blue grass	Poaceae
Polygonum arenastrum	Common knotweed	Polygonaceae
Veronica peregrina ssp. *xalapensis*	Purslane speedwell	Scrophulariaceae

Wildlife Species Observed on the Strawberry Fields Study Area

Observer: Colby Boggs, Ginger Bolen, and Heather Kelly
Dates: April 25, May 3, May 9, May 10, June 27, and November 2, 2007

Common name	***Scientific name***
Pacific chorus frog	*Pseudacris regilla*
bullfrog	*Rana catesbeiana*
alligator lizard	*Elgaria* sp.
fence lizard	*Sceloporus occidentalis*
mallard duck	*Anas platyrhynchos*
scrub jay	*Aphelocoma californica*
great egret	*Ardea alba*
Canada goose	*Branta canadensis*
red-tailed hawk	*Buteo jamaicensis*
California quail	*Callipepla californica*
turkey vulture	*Cathartes aura*
killdeer	*Charadrius vociferus*
red-shafted flicker	*Colaptes auratus*
acorn woodpecker	*Melanerpes formicivorus*
song sparrow	*Melospiza melodia*
downy woodpecker	*Picoides pubescens*
spotted towhee	*Pipilo maculatus*
western tanager	*Piranga ludoviciana*
blue-gray gnatcatcher	*Polioptila caerulea*
bushtits	*Psaltriparus minimus*
bank swallow	*Riparia riparia*
black phoebe	*Sayornis nigricans*
red breasted nuthatch (migrant)	*Sitta canadensis*
American robin	*Turdus migratorius*
western kingbird	*Tyrannus verticalis*
mourning dove	*Zenaida macroura*
coyote	*Canis latrans*
black-tailed jack rabbit	*Lepus californicus*
mule deer	*Odocoileus hemionus*
grey squirrel	*Sciurus griseus*

APPENDIX F

Summary Table of VELB Survey Data

Summary Table of VELB Survey Data from the Strawberry Fields Study Area.

Observer: Paul Kirk
Survey Dates: June 27, June 28, June 29, and August 2, 2007

Elderberry Shrub Number	# Exit Holes	Stems 1-3”	Stems 3-5”	Stems >5”	Approximate Shrub Ht. (ft)	Riparian Location?	Associated Habitat
1	0	0	0	1	12	No	Annual grassland
2	0	0	8	3	18	Yes	Valley foothill riparian
3	0	6	9	8	18	Yes	Valley foothill riparian
4	4	2	4	11	20	No	Valley oak woodland
5	1	0	4	3	15	No	Valley oak woodland
6	0	0	1	1	20	No	Valley oak woodland
7	0	0	0	1	25	No	Valley oak woodland
8	0	0	0	1	15	No	Valley oak woodland
9	0	0	0	2	46	Yes	Valley foothill riparian
10	0	0	1	3	18	Yes	Valley foothill riparian
11	0	3	2	0	18	Yes	Valley foothill riparian
12	0	1	0	0	12	Yes	Valley foothill riparian
13	NS[1]	≥ 1	NS[1]	NS[1]	18	Yes	Valley foothill riparian
14	NS[1]	≥ 1	NS[1]	NS[1]	18	Yes	Valley foothill riparian
15	0	0	0	1	20	No	Valley oak woodland
16	0	2	0	2	15	No	Valley oak woodland
17	0	2	1	2	12	No	Valley oak woodland
18	0	0	0	2	12	No	Valley oak woodland
19	0	4	5	2	18	No	Valley oak woodland
20	1	1	1	3	20	No	Valley oak woodland
21	0	4	0	2	15	No	Valley oak woodland
22	0	4	2	4	18	Yes	Valley foothill riparian
23	0	6	6	1	18	Yes	Valley foothill riparian
24	0	6	4	2	15	Yes	Valley foothill riparian
25	0	4	6	2	18	Yes	Valley foothill riparian
26	0	0	0	2	18	No	Valley oak woodland
27	0	0	1	0	15	No	Valley oak woodland
28	3	1	1	3	18	No	Valley oak woodland
29	3	0	0	8	16	No	Valley oak woodland
30	0	1	2	9	18	Yes	Valley foothill riparian
31	0	3	3	0	12	Yes	Valley foothill riparian

Elderberry Shrub Number	# Exit Holes	Stems 1-3”	Stems 3-5”	Stems >5”	Approximate Shrub Ht. (ft)	Riparian Location?	Associated Habitat
32	0	1	0	0	10	Yes	Valley foothill riparian
33	2	0	2	0	12	Yes	Valley foothill riparian
34	0	1	0	0	8	Yes	Valley foothill riparian
35	0	2	0	0	8	Yes	Valley foothill riparian
36	0	7	5	1	15	Yes	Valley foothill riparian
37	7	3	1	3	18	Yes	Valley foothill riparian
38	0	3	1	3	14	Yes	Valley foothill riparian
40[2]	0	1	0	2	15	Yes	Valley foothill riparian
41	0	1	0	0	10	Yes	Valley foothill riparian
42	0	1	1	0	15	Yes	Valley foothill riparian
43	3	4	1	0	12	Yes	Valley foothill riparian
44	0	0	1	0	12	Yes	Valley foothill riparian
45	0	1	0	0	8	Yes	Valley foothill riparian
47[2]	0	1	5	6	18	Yes	Valley foothill riparian
48	0	1	0	0	12	No	Annual grassland
49	0	14	4	3	16	No	Riverine
50	0	6	2	1	12	No	Riverine
51	0	3	1	0	15	No	Annual grassland
52	0	3	0	1	18	Yes	Valley foothill riparian
53	0	0	1	2	15	Yes	Valley foothill riparian
54	0	1	1	1	20	Yes	Valley foothill riparian
55	6	1	3	9	20	Yes	Valley foothill riparian
56	1	1	1	1	12	Yes	Valley foothill riparian
57	0	1	0	1	16	Yes	Valley foothill riparian
58	0	0	1	0	14	Yes	Valley foothill riparian
59	0	0	2	2	16	No	Valley oak woodland
60	1	0	0	4	16	No	Valley oak woodland
62	0	1	0	0	9	Yes	Valley foothill riparian
61	1	1	1	2	20	No	Valley oak woodland
63	0	4	1	2	12	Yes	Valley foothill riparian
64	3	1	2	5	15	Yes	Valley foothill riparian

[1] These shrubs are overgrown with Himalayan blackberry and were not surveyed (NS) for exit holes. Stem count and shrub height were estimated using binoculars.

[2] Break in sequence due to duplicate GPS recording.

APPENDIX G

Representative Photographs of VELB Exit Holes

Representative Photographs of VELB Exit Holes Observed at the Strawberry Fields Study Area

Photographs taken on June 29 and August 2, 2007

Photograph 1. Old VELB exit hole on elderberry stem (shrub #37). This shrub had seven exit holes on three different stems.

Photograph 2. Recent VELB exit hole with clean edges on elderberry stem (shrub # 55).

USACE PRELIMINARY JURISDICTIONAL DETERMINATION

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

March 20, 2017

Regulatory Division (SPK-2007-00821)

Redding Rancheria Tribe
Attn: Ms. Tracy Edwards
2000 Redding Rancheria Road
Redding, California 96001

Dear Ms. Edwards:

We are responding to your September 6, 2016, request for a preliminary jurisdictional determination (JD) for the Strawberry Fields site. The approximately 236.3-acre project site is located on the Sacramento River, Section 17, Township 31 North, Range 4 West, Mount Diablo Meridian, Latitude 40.52799°, Longitude -122.35348°, Redding, Shasta County, California.

Based on available information, we concur with your aquatic resources delineation for the site as depicted on the enclosed September 26, 2016, *Waters of the U.S.* drawings prepared by Analytical Environmental Services (enclosure 1). The approximately 5.63 acres of wetlands, and 2.17 acres of other waters of the United States present within the survey area, are potential jurisdictional aquatic resources regulated under Section 404 of the Clean Water Act and Sections 9 and 10 of the Rivers and Harbors Act.

At your request, we have completed a preliminary JD for the site. Enclosed find a copy of the *Preliminary Jurisdictional Determination Form* (enclosure 2). Please sign and return the completed form to this office, at the address listed below, within 30 days of the date of this letter. If you do not return the signed form within 30 days, we will presume concurrence and finalize the preliminary jurisdictional determination.

You may request an approved JD for this site at any time prior to starting work within waters, including after a permit decision is made.

We recommend you provide a copy of this letter and notice to all other affected parties, including any individual who has an identifiable and substantial legal interest in the property.

This preliminary jurisdictional determination has been conducted to identify the potential limits of wetlands and other aquatic resources at the project site which may be subject to U.S. Army Corps of Engineers jurisdiction under Section 404 of the Clean

Water Act and Section 9 and 10 of the Rivers and Harbors Act. A *Notification of Appeal Process and Request for Appeal Form* is enclosed to notify you of your options with this determination (enclosure 3).

We appreciate feedback, especially about interactions with our staff and processes. Please refer to identification number SPK-2007-00821 in any correspondence concerning this project. If you have any questions, please contact Matthew Roberts at 310 Hemsted Drive, Suite 310, Redding CA, 96002, by telephone at 530-223-9538, or by email at *Matthew.J.Roberts@usace.army.mil.* For program information or to complete our Customer Survey, visit our website at *www.spk.usace.army.mil/Missions/Regulatory.aspx*.

Sincerely,

Matthew P. Kelley
Chief, Redding Regulatory
Regulatory Division

Enclosures

cc: (w/o encls)
Mr. Nicholas Bonzey, Analytical Environmental Solutions, *Nbonzey@analyticalcorp.com*
Ms. Dannas Berchtold, Central Valley Regional Water Quality Control Board, *Dannas.Berchtold@waterboards.ca.gov*

PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: January 20, 2017

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Redding Rancheria Tribe;

Ms. Tracy Edwards, 2000 Redding Rancheria Road, Redding, California 96001

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: SPK-2007-00821

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)

State: California County: Shasta

Center coordinates of site (lat/long in degree decimal format):

Lat.: 40.52799 Long.: -122.35348

Universal Transverse Mercator: 10 T 554759.54 E 4486562.39 N

Name of nearest waterbody: Sacramento River

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:

☒ Field Determination. Date(s): December 13, 2016; March 13, 2017

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

Site number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
IS-1	40.52582	-122.359	0.02	Non-wetland	404
NOW-1	40.52459	-122.353	0.4	Wetland	404
NOW-2	40.52911	-122.354	0.17	Wetland	404
NSW-1	40.53441	-122.351	0.01	Wetland	404

R-1	40.52671	-122.36	1.64	Non-Wetland	10
R-2	40.52509	-122.36	0.51	Non-Wetland	10
Riparian	40.53157	-122.354	5.02	Wetland	10
SW-1	40.52591	-122.359	0.03	Wetland	404

1) The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.
2) In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there *"may be"* waters of the U.S. and/or that there *"may be"* navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for PJD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

- [X] Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
  Map: *Waters of the U.S.* sheets 1-4
- [X] Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - [X] Office concurs with data sheets/delineation report.
  - [ ] Office does not concur with data sheets/delineation report. Rationale: _______.
- [ ] Data sheets prepared by the Corps: ________.
- [ ] Corps navigable waters' study: ____________.
- [ ] U.S. Geological Survey Hydrologic Atlas: ________.
  - [ ] USGS NHD data.
  - [ ] USGS 8 and 12 digit HUC maps.
- [X] U.S. Geological Survey map(s). Cite scale & quad name: 1:24K; CA-ENTERPRISE.
- [ ] Natural Resources Conservation Service Soil Survey. Citation: __________.
- [ ] National wetlands inventory map(s). Cite name: ________.
- [ ] State/local wetland inventory map(s): ____________.
- [ ] FEMA/FIRM maps: ________________.
- [ ] 100-year Floodplain Elevation is: ____. (National Geodetic Vertical Datum of 1929)
- [ ] Photographs: [ ] Aerial (Name & Date): ______.
  or [ ] Other (Name & Date): ______.
- [ ] Previous determination(s). File no. and date of response letter: __________.
- [ ] Other information (please specify): ______________.

<u>IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.</u>

ROBERTS.MATTHEW.JAMES.1248429514 Digitally signed by ROBERTS.MATTHEW.JAMES.1248429514	
Signature and date of Regulatory staff member completing PJD	Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)[1]

[1] Districts may establish timeframes for requestor to return signed PJD forms. If the requestor does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Redding Rancheria Tribe, Attn: Ms. Tracy Edwards		File No.: SPK-2007-00821	Date: March 20, 2017
Attached is:			See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)		A
	PROFFERED PERMIT (Standard Permit or Letter of permission)		B
	PERMIT DENIAL		C
	APPROVED JURISDICTIONAL DETERMINATION		D
X	PRELIMINARY JURISDICTIONAL DETERMINATION		E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at *http://www.usace.army.mil/cecw/pages/reg_materials.aspx* or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer (address on reverse). This form must be received by the division engineer within 60 days of the date of this notice.

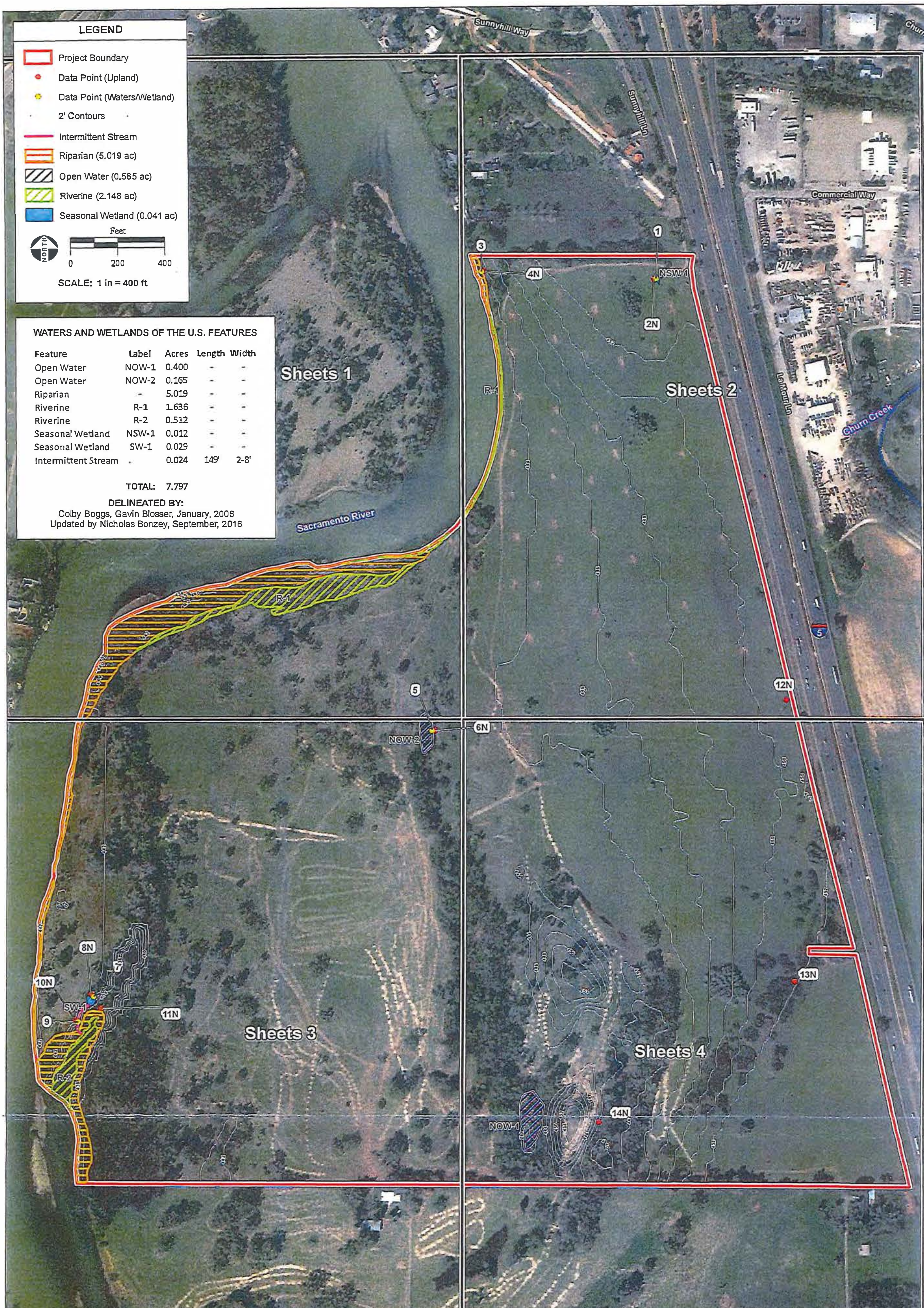
C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer (address on reverse). This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer (address on reverse). This form must be received by the division engineer within 60 days of the date of this notice.

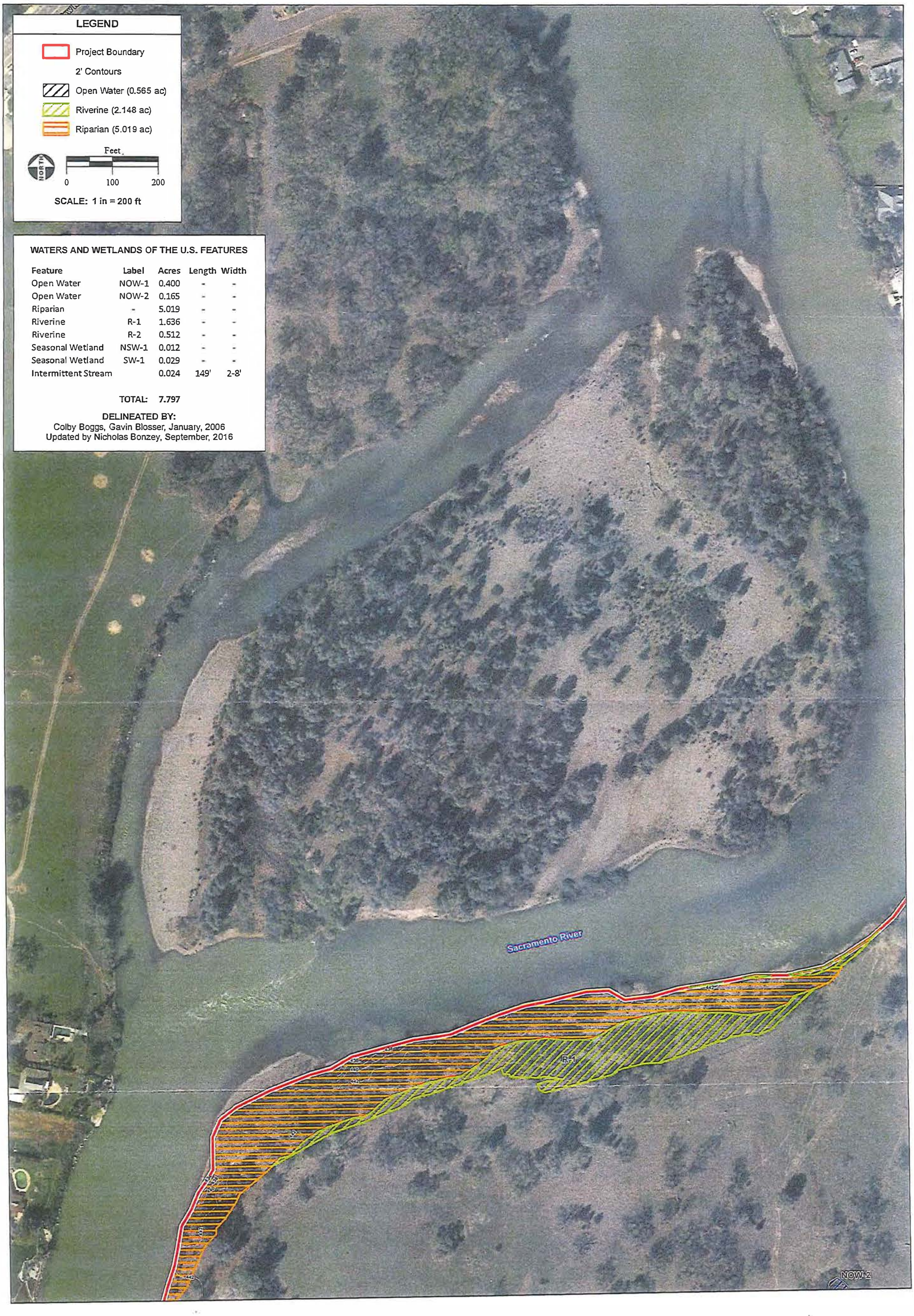
E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT		
REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)		
ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.		
POINT OF CONTACT FOR QUESTIONS OR INFORMATION:		
If you have questions regarding this decision and/or the appeal process you may contact: Matthew J. Roberts Project Manager Regulatory Division U.S. Army Corps of Engineers 310 Hemsted Drive, Suite 310 Redding CA, 96002 Phone: 530-223-9538, FAX 916-557-7803 Email: Matthew.J.Roberts@usace.army.mil	If you only have questions regarding the appeal process you may also contact: Thomas J. Cavanaugh Administrative Appeal Review Officer U.S. Army Corps of Engineers South Pacific Division 1455 Market Street, 2052B San Francisco, California 94103-1399 Phone: 415-503-6574, FAX 415-503-6646) Email: Thomas.J.Cavanaugh@usace.army.mil	
RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.		
Signature of appellant or agent.	Date:	Telephone number:



SOURCE:USDA aerial photograph, 7/26/2014; North State Resources, 1/21/2006; AES, 1/26/2017

Waters of the U.S.



SOURCE: USDA aerial photograph, 7/26/2014; North State Resources, 1/21/2006; AES, 1/27/2017

Redding Rancheria Fee-to-Trust EIS / 214584

Sheet

Waters of

Feature	Label	Acres	Length	Width
Open Water	NOW-1	0.400	-	-
Open Water	NOW-2	0.165	-	-
Riparian	-	5.019	-	-
Riverine	R-1	1.636	-	-
Riverine	R-2	0.512	-	-
Seasonal Wetland	NSW-1	0.012	-	-
Seasonal Wetland	SW-1	0.029	-	-
Intermittent Stream		0.024	149'	2-8'
	TOTAL:	7.797		

SOURCE:USDA aerial photograph, 7/26/2014; North State Resources, 1/21/2006; AES, 1/27/2017

Sheet 2

Waters of tl

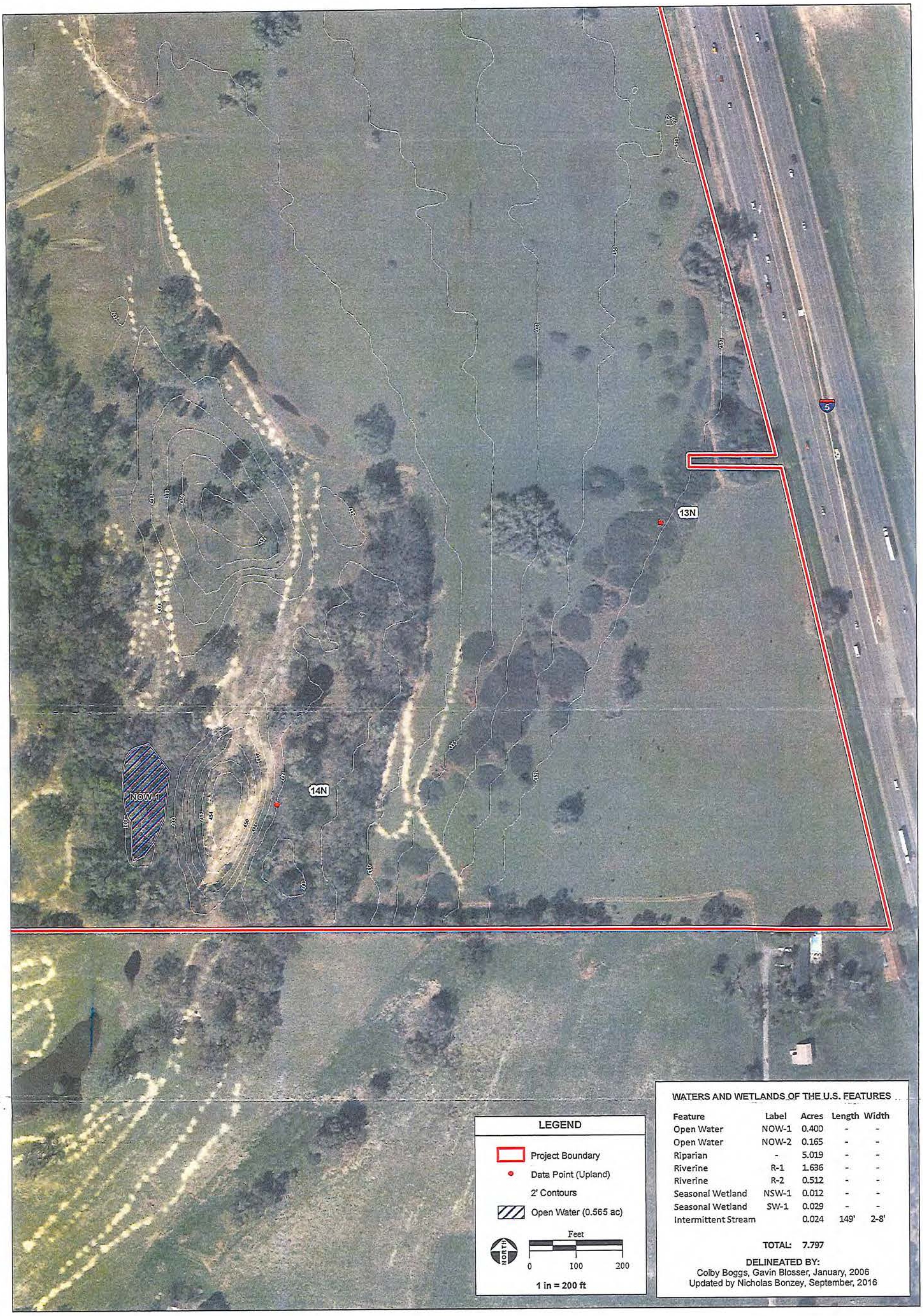
WATERS AND WETLANDS OF THE U.S. FEATURES

Feature	Label	Acres	Length	Width
Open Water	NOW-1	0.400	-	-
Open Water	NOW-2	0.165	-	-
Riparian	-	5.019	-	-
Riverine	R-1	1.636	-	-
Riverine	R-2	0.512	-	-
Seasonal Wetland	NSW-1	0.012	-	-
Seasonal Wetland	SW-1	0.029	-	-
Intermittent Stream		0.024	149'	2-8'
	TOTAL:	7.797		

DELINEATED BY:
Colby Boggs, Gavin Blosser, January, 2006
Updated by Nicholas Bonzey, September, 2016

SOURCE: USDA aerial photograph, 7/26/2014; North State Resources, 1/21/2006; AES, 1/27/2017

Sheet 3
Waters of the U.S.



WATERS AND WETLANDS OF THE U.S. FEATURES

Feature	Label	Acres	Length	Width
Open Water	NOW-1	0.400	-	-
Open Water	NOW-2	0.165	-	-
Riparian	-	5.019	-	-
Riverine	R-1	1.636	-	-
Riverine	R-2	0.512	-	-
Seasonal Wetland	NSW-1	0.012	-	-
Seasonal Wetland	SW-1	0.029	-	-
Intermittent Stream		0.024	149'	2-8'
	TOTAL:	7.797		

DELINEATED BY:
Colby Boggs, Gavin Blosser, January, 2006
Updated by Nicholas Bonzey, September, 2016

SOURCE:USDA aerial photograph, 7/26/2014; North State Resources, 1/21/2006; AES, 1/27/2017

Sheet 4
Waters of the U.S.

SPECIAL-STATUS SPECIES SEARCHES

STRAWBERRY FIELDS SITE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: July 18, 2018
Consultation Code: 08ESMF00-2017-SLI-2734
Event Code: 08ESMF00-2018-E-07999
Project Name: Redding

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2017-SLI-2734

Event Code: 08ESMF00-2018-E-07999

Project Name: Redding

Project Type: ** OTHER **

Project Description: Tribal fee-to-trust

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/40.52930951202774N122.3594509873035W

Counties: Shasta, CA

Endangered Species Act Species

There is a total of 8 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850 Habitat assessment guidelines: https://ecos.fws.gov/ipac/guideline/assessment/population/436/office/11420.pdf	Threatened

Crustaceans

NAME	STATUS
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
Slender Orcutt Grass *Orcuttia tenuis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1063	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

CNPS California Native Plant Society

Plant List

Inventory of Rare and Endangered Plants

6 matches found. *Click on scientific name for details*

Search Criteria

Found in Quad 4012253

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Blooming Period	CA Rare Plant Rank	State Listing Status	Federal Listing Status
Agrostis hendersonii	Henderson's bent grass	Apr-Jun	3.2		
Cryptantha crinita	silky cryptantha	Apr-May	1B.2		
Juncus leiospermus var. leiospermus	Red Bluff dwarf rush	Mar-Jun	1B.1		
Legenere limosa	legenere	Apr-Jun	1B.1		
Orcuttia tenuis	slender Orcutt grass	May-Sep(Oct)	1B.1	CE	FT
Sidalcea celata	Redding checkerbloom	Apr-Aug	3		

Suggested Citation

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 18 July 2018].

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Contributors

The Calflora Database
The California Lichen Society
California Natural Diversity Database
The Jepson Flora Project
The Consortium of California Herbaria
CalPhotos

Questions and Comments

rareplants@cnps.org

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Enterprise (4012253))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Candidate Endangered	G2G3	S1S2	SSC
Agrostis hendersonii Henderson's bent grass	PMPOA040K0	None	None	G2Q	S2	3.2
Branchinecta lynchi vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
Cryptantha crinita silky cryptantha	PDBOR0A0Q0	None	None	G2	S2	1B.2
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T2	S2	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Great Valley Valley Oak Riparian Forest Great Valley Valley Oak Riparian Forest	CTT61430CA	None	None	G1	S1.1	
Great Valley Willow Scrub Great Valley Willow Scrub	CTT63410CA	None	None	G3	S3.2	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
Juncus leiospermus var. leiospermus Red Bluff dwarf rush	PMJUN011L2	None	None	G2T2	S2	1B.1
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G5	S3S4	
Lathyrus sulphureus var. argillaceus dubious pea	PDFAB25101	None	None	G5T1T2	S1S2	3
Legenere limosa legenere	PDCAM0C010	None	None	G2	S2	1B.1
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G4	S3S4	
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Margaritifera falcata western pearlshell	IMBIV27020	None	None	G4G5	S1S2	
Oncorhynchus mykiss irideus pop. 11 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
Oncorhynchus tshawytscha pop. 6 chinook salmon - Central Valley spring-run ESU	AFCHA0205A	Threatened	Threatened	G5	S1	
Oncorhynchus tshawytscha pop. 7 chinook salmon - Sacramento River winter-run ESU	AFCHA0205B	Endangered	Endangered	G5	S1	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Orcuttia tenuis slender Orcutt grass	PMPOA4G050	Threatened	Endangered	G2	S2	1B.1
Rana boylii foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	G3	S3	SSC
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S2	
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC
Trilobopsis roperi Shasta chaparral	IMGASA2030	None	None	G1	S1	

Record Count: 25

ANDERSON SITE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: July 18, 2018
Consultation Code: 08ESMF00-2018-SLI-2762
Event Code: 08ESMF00-2018-E-08032
Project Name: Anderson Site

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2018-SLI-2762

Event Code: 08ESMF00-2018-E-08032

Project Name: Anderson Site

Project Type: DEVELOPMENT

Project Description: Development

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/40.456851635445446N122.29880482840184W

Counties: Shasta, CA

Endangered Species Act Species

There is a total of 7 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850 Habitat assessment guidelines: https://ecos.fws.gov/ipac/guideline/assessment/population/436/office/11420.pdf	Threatened

Crustaceans

NAME	STATUS
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
Slender Orcutt Grass *Orcuttia tenuis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1063	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

CNPS California Native Plant Society

Plant List

Inventory of Rare and Endangered Plants

3 matches found. *Click on scientific name for details*

Search Criteria

Found in Quad 4012243

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Family	Blooming Period	CA Rare Plant Rank	State Listing Status	Federal Listing Status
Cryptantha crinita	silky cryptantha	Boraginaceae	Apr-May	1B.2		
Juncus leiospermus var. leiospermus	Red Bluff dwarf rush	Juncaceae	Mar-Jun	1B.1		
Orcuttia tenuis	slender Orcutt grass	Poaceae	May-Sep (Oct)	1B.1	CE	FT

Suggested Citation

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 18 July 2018].

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The Calflora Database
The California Lichen Society
California Natural Diversity Database
The Jepson Flora Project
The Consortium of California Herbaria
CalPhotos

Questions and Comments

rareplants@cnps.org

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Cottonwood (4012243))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Candidate Endangered	G2G3	S1S2	SSC
Branchinecta lynchi vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
Cryptantha crinita silky cryptantha	PDBOR0A0Q0	None	None	G2	S2	1B.2
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T2	S2	
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Great Valley Valley Oak Riparian Forest Great Valley Valley Oak Riparian Forest	CTT61430CA	None	None	G1	S1.1	
Great Valley Willow Scrub Great Valley Willow Scrub	CTT63410CA	None	None	G3	S3.2	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
Juncus leiospermus var. leiospermus Red Bluff dwarf rush	PMJUN011L2	None	None	G2T2	S2	1B.1
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G5	S3S4	
Lasiurus blossevillii western red bat	AMACC05060	None	None	G5	S3	SSC
Lasiurus cinereus hoary bat	AMACC05030	None	None	G5	S4	
Legenere limosa legenere	PDCAM0C010	None	None	G2	S2	1B.1
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G4	S3S4	
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Myotis yumanensis Yuma myotis	AMACC01020	None	None	G5	S4	
Oncorhynchus mykiss irideus pop. 11 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
Oncorhynchus tshawytscha pop. 7 chinook salmon - Sacramento River winter-run ESU	AFCHA0205B	Endangered	Endangered	G5	S1	
Orcuttia tenuis slender Orcutt grass	PMPOA4G050	Threatened	Endangered	G2	S2	1B.1
Pandion haliaetus osprey	ABNKC01010	None	None	G5	S4	WL

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S2	
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC

Record Count: 22

WIN-RIVER CASINO SITE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: July 18, 2018
Consultation Code: 08ESMF00-2018-SLI-2757
Event Code: 08ESMF00-2018-E-08019
Project Name: Win River

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2018-SLI-2757

Event Code: 08ESMF00-2018-E-08019

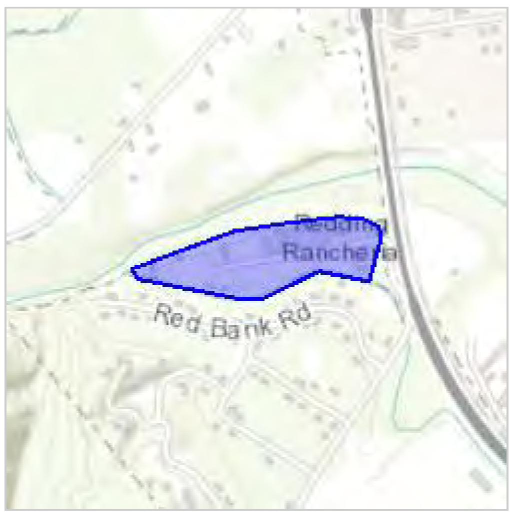
Project Name: Win River

Project Type: DEVELOPMENT

Project Description: Casino

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/40.506728638692394N122.38429731452516W



Counties: Shasta, CA

Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850 Habitat assessment guidelines: https://ecos.fws.gov/ipac/guideline/assessment/population/436/office/11420.pdf	Threatened

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

CNPS *California Native Plant Society*

Plant List

Inventory of Rare and Endangered Plants

2 matches found. *Click on scientific name for details*

Search Criteria

Found in Quad 4012254

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Family	Blooming Period	CA Rare Plant Rank	State Listing Status	Federal Listing Status
Brodiaea matsonii	Sulphur Creek brodiaea	Themidaceae	May-Jun	1B.1		
Lathyrus sulphureus var. argillaceus	dubious pea	Fabaceae	Apr-May	3		

Suggested Citation

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 18 July 2018].

Search the Inventory

Simple Search
Advanced Search
Glossary

Information

About the Inventory
About the Rare Plant Program
CNPS Home Page
About CNPS
Join CNPS

Contributors

The Calflora Database
The California Lichen Society
California Natural Diversity Database
The Jepson Flora Project
The Consortium of California Herbaria
CalPhotos

Questions and Comments

rareplants@cnps.org

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Redding (4012254))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Candidate Endangered	G2G3	S1S2	SSC
Ardea alba great egret	ABNGA04040	None	None	G5	S4	
Brodiaea matsonii Sulphur Creek brodiaea	PMLIL0C0H0	None	None	G1	S1	1B.1
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G3G4	S2	SSC
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Helminthoglypta hertleini Oregon shoulderband	IMGASC2280	None	None	G1	S1S2	
Lanx patelloides kneecap lanx	IMGASL7030	None	None	G2	S2	
Lathyrus sulphureus var. argillaceus dubious pea	PDFAB25101	None	None	G5T1T2	S1S2	3
Margaritifera falcata western pearlshell	IMBIV27020	None	None	G4G5	S1S2	
Oncorhynchus mykiss irideus pop. 11 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
Oncorhynchus tshawytscha pop. 6 chinook salmon - Central Valley spring-run ESU	AFCHA0205A	Threatened	Threatened	G5	S1	
Oncorhynchus tshawytscha pop. 7 chinook salmon - Sacramento River winter-run ESU	AFCHA0205B	Endangered	Endangered	G5	S1	
Rana boylii foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	G3	S3	SSC
Trilobopsis roperi Shasta chaparral	IMGASA2030	None	None	G1	S1	

Record Count: 15

SPECIES OBSERVED

ANALYTICAL ENVIRONMENTAL SERVICES

SPECIES OBSERVED ON THE STRAWBERRY FIELDS SITE

PREPARED FOR:	Redding Rancheria Tribe
FROM:	Mark Ashenfelter; Senior Biologist; John Hale; Botanist
PROJECT:	Redding Rancheria Casino Project
SUBJECT:	Species Observed on the Strawberry Fields Site
DATE:	May 2016

OBSERVED WILDLIFE SPECIES	
SCIENTIFIC NAME	**COMMON NAME**
Branta canadensis	Canada goose
Anas platyrhynchos	Mallard duck
Aphelocoma californica	Scrub jay
Buteo jamaicensis	Red-tailed hawk
Callipepla californica	California quail
Charadrius vociferus	Killdeer
Cathartes aura	Turkey vulture
Tyrannus verticalis	Western kingbird
Melanerpes formicivorus	Acorn woodpecker
Sayornis nigricans	Black phoebe
Psaltriparus minimus	Bushtits
Zenaida macroura	Mourning dove
Polioptila caerulea	Blue-gray gnatcatcher
Ardea herodias	Great blue heron
Baeolophus inornatus	Oak titmouse
Lepus californicus	Black tailed jack rabbit
Odocoileus hemionus	Mule deer
Sciurus griseus	Grey squirrel
Ursus americanus	Signs of black bear

OBSERVED VASCULAR PLANT SPECIES	
SCIENTIFIC NAME	**COMMON NAME**
Collomia grandiflora	Large-flowered collomia
Croton setigerus	Turkey-mullein
Gnaphalium palustre	Western marsh cudweed
Lythrum hyssopifolia	Hyssop loosestrife
Nerium oleander	Oleander
Opuntia ficus-indica	Indian fig
Plagiobothrys stipitatus var. *micranthus*	Small-flowered stalked popcorn-flower
Verbena hastata	Blue vervain