FINAL ENVIRONMENTAL IMPACT STATEMENT

REDDING RANCHERIA
FEE-TO-TRUST AND CASINO PROJECT

VOLUME II - APPENDICES

FEBRUARY 2024

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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APPENDICES

LIST OF APPENDICES

APPENDIX L

PRO FORMA ADVISORS RESPONSE TO PUBLIC COMMENTS

Pro Forma
Advisors LLC

memo

To: **AES**

From: **Lance Harris - Pro Forma Advisors**

Date: **January 17, 2023**

re: **Summary of Socioeconomic Responses for Redding Rancheria Draft EIS**

cc:

Introduction

The following responses to public comments address the Redding Rancheria Strawberry Fields Economic Analysis for the Draft Environmental Impact Statement (DEIS), which was completed in June of 2017. Consistent with all economic analysis, the conclusions are based on data when the study was prepared. Any structural changes to the economic and long-term growth projections could change conclusions drawn in the study and the responses to the questions addressed herein.

Redding A-4.1

The City of Redding (Redding) had two key comments specific to the Socioeconomic analysis within the DEIS. First, Redding noted that "although the report identifies a potentially negative economic impact to existing sporting goods stores in Redding, it does not identify how the impact will be mitigated." On page 45 of Appendix A of the DEIS it is noted that Redding had an estimated retail surplus (suggesting that it exports sales to people living outside the region) for sporting good store sales. The proposed large-format retail store sizing suggests annual store sales of around $50.2 million could be achieved, which is potentially larger than the estimated sales volume of all existing sporting stores in Redding. Given these dynamics, while the proposed large-scale format outdoor sporting goods retailer could take away some of the existing sales in Redding (estimated to be approximately 24 percent), the vast majority of its projected sales would require the capture of sales from outside the region and the net effect would be an increase in total retail sales (estimated at approximately 29 percent).

Second, Redding noted that the "DEIS fails to provide any analysis of how the two new entertainment venues will impact the Civic Auditorium." The new entertainment venue would increase WIn-River's capacity by 800 seats. The entertainment content for both the Redding Civic Auditorium and Cascade Theater were analyzed. It was determined that most of the entertainment at these venues (these included symphony, performing arts, community events, holiday shows, etc.) would not be hosted by the proposed new development. As stated on Page 48 of Appendix A of the DEIS, given "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."

Both these questions fall within the larger question of impacts to local businesses as a result of a new casino development (also commonly referred to as “substitution effects”). The existing competition and relative impact as it relates to business substitution are discussed in the Competition section (pages 28 to 48) of Appendix A of the DEIS. In the analysis, these potential business related impacts were analyzed and found to have no significant impact for competitive gaming, hotel, retail, and event related facilities in the region.

Shasta A-6.03

Shasta County (County) asked specific questions regarding the potential increase in costs for law enforcement. It was noted in additional comments that the number of calls for service (CFS) has increased since the time of our report included as Draft EIS Appendix A. CFS data was requested from the Shasta County Sheriff’s Office (SCSO) for the 2019/2020 fiscal year. Based on their information, there were 319 CFS to the Win River Casino during the requested timeframe. In contrast, during calendar year 2017 through mid-year 2018, the Tribe reported an adjusted 120 CFS on an annual basis. The CFS originated from the Casino includes responses to crime, disturbances, trespass, or health emergencies. **Table 1** presents a comparison of CFS data from the Tribe’s Surveillance Department and SCSO.

1.Redding Rancheria Calls for Service Data

Source: Tribe, County Sheriff's Department

	Tribe’s Surveillance Department	Shasta County Sheriff Office
Calls for Service		
Start Date	1/1/2017	7/1/2019
End Date	6/30/2018	6/30/2020
Days	545	365
Calls for Service	171	319
Calls for Service per Days	0.31	0.87
Annual Calls for Service (Estimate, Rounded)	120	320

Note: A written document was provided by the Tribe to Pro Forma Advisors that detailed the SCSO patrol contacts, requests for assistance from the SCSO, and CFS during the time frame specified.

Primary law enforcement services for the Strawberry Fields Site and the existing Win-River Casino are provided by the SCSO, which is allied with the Redding Police Department. Under one development option, it is anticipated that the Tribe will enter into an agreement for law enforcement services with SCSO. SCSO would have the authority to enforce all non-gaming state criminal laws on the proposed trust lands pursuant to Public Law 280. The Tribe would employ security personnel to patrol the facilities to reduce and prevent criminal and civil incidents. Additionally, surveillance equipment would be installed in the casino and parking areas and tribal security personnel would work cooperatively with the local law enforcement agencies to provide general law enforcement services to the Strawberry Fields Site. It is not anticipated that law enforcement services from the Redding will be required.

In a second development option, the Tribe would fund the construction and operation of a Public Safety Building on the Strawberry Fields Site. The Public Safety Building would be comprised of a police substation and fire and emergency services. The facility would be approximately 10,500 square feet, and would be located near the southeast corner of the Strawberry Fields Site. For the Anderson Site, it is anticipated that the Tribe would enter into an agreement for law enforcement services with the Anderson Police Department.

First, **Table 2** presents a comparison of CFS data for the County and Anderson and the assumed split between Fire/EMT and Police CFS for the Project. This information is used to allocate police and fire department costs given the ratio of crime related and health/fire related CFS is unknown from data provided by the Tribe's Surveillance Department.

2. Annual Calls for Service (Police and Fire/EMT, 2019)

Source: City of Anderson, City of Redding

	Shasta County	City of Anderson	Project Estimate
Calls for Service			
Fire/EMT	3,268	2,799	
Police	42,148	13,382	
Total	45,416	16,181	
Calls for Service (Percent by Type)			
Fire/EMT	**7%**	**17%**	**10%**
Police	**93%**	**83%**	**90%**
Total	100%	100%	100%

Note:Specific CFS breakdown was not provided by the Tribe's Surveillance Department.

Second, given that the assumed level of CFS has changed from 120 to 320 per year an adjustment was made to the CFS data presented in our report included as Draft EIS Appendix A. The following table provides the revised CFS estimate by alternative. Besides the increase in base casino CFS, an additional adjustment was made to the hotel CFS estimate. Based on our gaming model, approximately 13 percent of the overnight hotel customers will not be comped and thus could be considered a traditional non-casino or business/leisure guest. The estimated CFS was reduced by a planning factor of 85 percent in order to not double count CFS originating from the casino and hotel as the majority of the market overlaps. No adjustment was made to the previously reported retail related CFS estimates.

3. Revised Calls for Service Estimate by Project Alternative

Source: Pro Forma Advisors

	Annual CFS	**Casino Visitation Increase** (Percent)	Casino	**Hotel** (15 Percent)	**Retail** (100 Percent)	Total CFS
Project Alternative A	320	29%	92	6	71	**169**
Project Alternative B	320	29%	92	6	0	**98**
Project Alternative C	320	20%	63	6	71	**140**
Project Alternative D	320	0%	0	2	54	**56**
Project Alternative E	320	21%	66	6	65	**137**
Project Alternative F	320	5%	16	0	0	**16**

Third, in order to estimate the Project's impact to law enforcement, a proportional cost approach is used to calculate expenditures that are expected to increase on a consistent basis with new development and the associated CFS. **Table 4** presents all the public safety related departments that could experience operation cost increases with net new CFS in the County. **Table 5** provides the estimated cost per CFS for police related expenditures in the County and Anderson Police Department. To be consistent with available data, the 2019 data is adjusted by 18 percent to account for inflation. Finally, **Table 6** extrapolates the cost by Project Alternative for the impacted jurisdictions.

4. Public Safety Related Expenditure in Shasta County

Source: Shasta County, Pro Forma Advisors

	2019-2020 Actuals
203 - Conflict Public Defense (Fund 0060)	$2,298,052
207 - Public Defender (Fund 0060)	$3,597,370
208 - Grand Jury (Fund 0060)	$74,077
227 - District Attorney (Fund 0195)	$8,288,070
235 - Sheriff (Fund 0195)	$17,136,804
236 - Boading Safety (Fund 0195)	$764,394
237 - Sheriff Civil Unit (Fund 0060)	$553,367
246 - Detention Annex (Fund 0195)	$469,211
256 - Victim Witness Assisance (Fund 0060)	$1,464,730
260 - Jail (fund 0195)	$17,706,685
262 - Juvenile Rehab Facility (Fund 0195)	$5,233,876
263 - Probation (Fund 0195)	$11,551,539
288 - Central Dispatch (Fund 0195)	$1,516,637
Total	$70,654,812

5. Police and Public Safety Cost per CFS Calculation (2019)

Source: CA DOF, Shasta County, Pro Forma Advisors

	Shasta County Sheriff's Office	Anderson Police Department	Notes
Department Costs (2019-2020 Actuals)	$70,654,812	$6,019,723	*SCSO includes Budget Units 203, 207, 208, 227, 235, 236, 237, 246, 256, 260, 262, 263, and 288, which all relate to costs associated with police and public safety expenditures (please see Table 3). Anderson includes all Police Department expenditures.*
Calls for Service	42,148	13,310	*SCSO calls for service data for Fiscal Year 2019-2020. Anderson 2020 calls for service data used for Fiscal Year 2019-2020.*
Cost per Police Calls for Service	$1,676	$452	Department costs divided by Calls for Service
Adjusted 2022 Cost per Police Calls for Service	**$1,978**	**$534**	*Adjusted 2022 cost reflects an 18 percent increase to account for inflation between January 2019 and October 2022.*

6. Police and Public Safety Costs by Project Alternative (2022)

Source: Pro Forma Advisors

	Affected Department	CFS	Cost per Police CFS	Total Net New Cost (Rounded)
Project Alternative A	SCSO	152	$1,978	**$300,700**
Project Alternative B	SCSO	88	$1,978	**$174,100**
Project Alternative C	SCSO	126	$1,978	**$249,200**
Project Alternative D	SCSO	50	$1,978	**$98,900**
Project Alternative E	Anderson Police Department	123	$534	**$65,700**
Project Alternative F	SCSO	14	$1,978	**$27,700**

Shasta A-6.04

The Strawberry Fields Site and the existing Win-River Casino are served by the Shasta County Fire Department (SCFD). SCFD, the Redding Fire Department (RFD), and California Department of Fire and Forestry (CAL FIRE) maintain a mutual/automatic aid agreement. It is anticipated that the Tribe will either enter into an agreement with SCFD and/or RFD for the provision of fire and emergency response services or fund the construction and operation of a Public Safety Building on the Strawberry Fields Site (as discussed above). The Anderson Fire Department (AFD) currently provides fire protection and emergency medical services to the Anderson Site. It is anticipated that the Tribe would enter into an agreement for fire protection and emergency medical services with AFD. A similar methodology was used to estimate fire costs by Project Alternative and impacted jurisdiction based on induced CFS of the Project. **Table 7** presents the estimate for the fire costs per CFS. **Table 8** presents a range of fire/EMT cost estimates based on the assumed level of induced CFS by Project Alternative and potential municipal service provider.

7. Fire/EMT Cost per CFS Calculation

Source: Shasta County, City of Redding, City of Anderson, Pro Forma Advisors

	Shasta County Fire Department (SCFD)	**Redding Fire Department** (RFD)	**Anderson Fire Department** (AFD)	**Notes**
Department Costs (2019-2020 Actuals)	$3,860,363	$21,776,193	$1,844,064	
Calls for Service	3,268	14,355	2,799	
Cost per Fire/EMT Calls for Service	$1,181	$1,517	$659	Department costs divided by Calls for Service
Adjusted 2022 Cost per Fire/EMT Calls for Service	**$1,394**	**$1,790**	**$777**	

Note: (1) Department costs divided by total calls for service equals cost per fire calls for service. (2) Adjusted 2022 cost reflects an 18 percent increase to account for inflation between January 2019 and October 2022.

8. Fire/EMT Costs by Project Alternative (2022)

Source: Pro Forma Advisors

			Cost per CFS by Potential Service Provider			**Total Net New Cost** (Rounded)		
	Affected Department	**CFS**	**SCFD**	**RFD**	**AFD**	**SCFD**	**RFD**	**AFD**
Project Alternative A	SCFD or RFD	17	$1,394	$1,790	$777	**$23,700**	**$30,400**	**NA**
Project Alternative B	SCFD or RFD	10	$1,394	$1,790	$777	**$13,900**	**$17,900**	**NA**
Project Alternative C	SCFD or RFD	14	$1,394	$1,790	$777	**$19,500**	**$25,100**	**NA**
Project Alternative D	SCFD or RFD	6	$1,394	$1,790	$777	**$8,400**	**$10,700**	**NA**
Project Alternative E	AFD	14	$1,394	$1,790	$777	**NA**	**NA**	**$10,900**
Project Alternative F	SCFD or RFD	2	$1,394	$1,790	$777	**$2,800**	**$3,600**	**NA**

Note: Costs associated with each alternative are based on estimated costs associated with potential fire/EMT service providers. These costs are unique to each municipality depending on the agreement. These costs are only applicable for those alternatives if no Public Safety building is developed at the Strawberry Hills Site. The inclusion of a Public Safety Building operated by the Tribe would effectively eliminate fire and EMT costs estimated herein.

Shasta A-6.9

The County asked a question regarding the anticipated fiscal impacts associated with the loss of property tax. They note that "the Strawberry Fields site currently generates approximately $41,000 in annual property tax revenue; Shasta County's share of this revenue is approximately $4,300." The County further explains that if the site is placed into trust, property tax revenue will no longer be generated to the County. While no specific analysis was completed to isolate the net fiscal impacts (inclusive of both revenues and expenditures), the general fiscal benefit was quantified in the analysis above and beyond the noted loss to the County. However, to put the comment in context, according to the Office of Shasta County Assessor-Recorder's Annual Report the total assessed value of land in the County was $18.6 billion (inclusive of land, improvements, and personal property in 2018). For illustrative purposes, the County budget reported that property taxes generated approximately $16 million in revenue. The loss of $4,300 in property tax would represent a loss of approximately 0.03 percent of the total property tax revenue in the County. The contemporary property tax revenue potentially impacted by the proposed project is presented below in **Table 9**. The tax revenue flowing to Redding and Anderson was estimated using the latest Annual Comprehensive Financial Report data (Fiscal Year ending June 30, 2021).

9. Property Tax Loss Estimate (Fiscal Year 2022-2023)

Source: Shasta County Tax Collector; Individual Cities

	Assessed Value	**Property Tax** (Rounded)	**Implied Property Tax Rate**
Assumed Property Tax Allocation by City			
City of Redding (FY 2020-2021)	$897,678,835	$2,211,000	0.25%
City of Anderson (FY2020-2021)	$9,884,531,000	$22,809,000	0.23%
Shasta County			
Strawberry Field Site	$4,220,039	**$44,500**	1.05%
Anderson Site	$3,059,487	**$32,700**	1.07%
City of Redding			
Strawberry Field Site	$4,220,039	**$10,400**	0.25%
City of Anderson			
Anderson Site	$3,059,487	**$7,100**	0.23%

Note: Strawberry Fields Site includes Assessor's Parcel Number (APN): 055-010-011, 055-010-012, 055-010-014, 055-010-015, 055-020-001, 055-020-004, and 055-020-005. Anderson Site includes APN: 201-720-004, 201-720-013, 201-720-014, 201-730-001. Implied property tax rate at the city level reflects estimated proportion of property tax collected by each city based on the 2020/21 fiscal year citywide property tax revenue to assess value ratio.

A second comment was made in regards to the loss of transient occupancy tax (TOT) collected in association with hotel revenue. However, the TOT revenue from the new development would not apply in this analysis as there is no hotel currently providing those tax revenues to the County. As such, there would be no net loss in revenue. All TOT revenue flows to the County's General Fund.

The general question surrounding the potential fiscal impacts of the Project Alternatives were raised by others responding with comments to the DEIS. Using the IMPLAN impact model all the alternatives were analyzed and produced varying amounts of positive indirect and induced fiscal revenues to the Federal, State, and local tax jurisdictions. These estimated impacts were all based on net revenues and jobs created by the Project alternatives and would be above and beyond any existing positive fiscal impacts currently created by the existing casino facility (please see Appendix A of the DEIS pages 62 - 84 for additional information). A summary of the revised direct fiscal impacts are presented in **Table 10**, which do not include these indirect and induced fiscal revenue, are provided below adjusted to current 2022 dollars.

10. Direct Fiscal Costs by Summary by Alternative

Source: Pro Forma Advisors

	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Notes
City of Redding							
Police Costs	NA	NA	NA	NA	NA	NA	
Fire/EMT Costs	$30,400	$17,900	$25,100	$10,700	NA	$3,600	Table 8
Loss of Property Tax	$10,400	$10,400	$10,400	$10,400	NA	NA	Table 9
City of Anderson							
Police Costs	NA	NA	NA	NA	$65,700	NA	Table 6
Fire/EMT Costs	NA	NA	NA	NA	$10,900	NA	Table 8
Loss of Property Tax	NA	NA	NA	NA	$7,100	NA	Table 9
Shasta County							
Police Costs	$300,700	$174,100	$249,200	$99,800	NA	$27,700	Table 6
Fire/EMT Costs	$23,700	$13,900	$19,500	$8,400	NA	$2,800	Table 8
Loss of Property Tax	$44,500	$44,500	$44,500	$44,500	$32,700	NA	Table 9

Note: Costs associated with each alternative are based on estimated costs associated with each development and public safety alternative. These costs are unique to each municipality depending on the agreement. These costs are only applicable for those alternatives if no Public Safety building is developed at the Strawberry Hills Site. The inclusion of a Public Safety Building operated by the Tribe would effectively eliminate police, fire, and EMT costs estimated herein in the applicable alternatives.

Shasta A-6.10

The Shasta County Housing Authority is concerned that the proposed development will have an impact on the available housing stock in the County. Citing the Carr Fire and Camp Fire, which occurred subsequent to the preparation of the DEIS, they note that the loss of housing (loss of approximately 1,100 units) has had a significant impact on the housing stock by shrinking the number of homes available to rent and purchase in the County. On page 19 of Appendix A of the DEIS the projected housing demand was provided between 2010 and 2030. This housing projection in combination of the projected net new housing demand created by the project alternatives suggest that the amount of housing is sufficient to meet the anticipated demand. In regards to long-term forecasts, short-term economic conditions or events such as the fires have less impact as it assumed that there will not be a structure change to the population, employment, and housing forecast. However, for illustrative purposes, the housing impact by development alternative is revised by the Shasta County Housing Authority's estimate and presented below in **Table 11**.

11. Impact on County Housing

Source: Pro Forma Advisors; Shasta County Housing Authority

Development	**2016 Housing Estimate**	**2030 Housing Estimate**	**Projected Housing Change**	**Revised Total due to Housing Loss from Fire** (Projected Change less 1,100 units)	**Induced Housing Growth** (Outside County)	**Growth as Percent of Projected Change**
Alternative A	78,379	87,729	9,347	8,247	**79**	1.0%
Alternative B	78,379	87,729	9,347	8,247	**42**	0.5%
Alternative C	78,379	87,729	9,347	8,247	**66**	0.8%
Alternative D	78,379	87,729	9,347	8,247	**38**	0.5%
Alternative E	78,379	87,729	9,347	8,247	**67**	0.8%
Alternative F	78,379	87,729	9,347	8,247	**5**	0.1%

Notes: Bold numbers reflect previously reported estimates for growth by jurisdiction. Please see Redding Rancheria Strawberry Fields Economic Analysis page 64 for Alternative A; Page 68 for Alternative B; Page 72 for Scenario C; Page 76 for Scenario D; Page 80 for Scenario E; and Page 84 for Scenario F.

As a second part of this comment the County notes that "the Draft EIS fails to consider the impacts of the proposed development to the Shasta County Health and Human Services Agency, who anticipates the need to implement education, prevention, and treatment programs addressing problem gambling and gambling addiction and related impacts" similar to those in effect at the existing Win-River Casino. Without knowing the extent of the existing net impact on the Shasta County Health and Human Services Agency it is difficult to isolate the specific social impact.

In general, the question of impacts related to the social costs of gaming (inclusive of issues surrounding problem gaming, mental health, drug and alcohol issues, human trafficking, prostitution, homelessness, and increases in related crime) are presented on Pages 21 - 25 of Appendix A of the DEIS. This portion of the analysis provides a literature review of a number of comprehensive studies. In summary, from an economic perspective, accounting for the monetary impact of the social costs created by casino gambling is difficult. This is due to 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.

Three distinct social costs arising from problem gambling typically include:

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 cost borne by the individual is a private expense of that individual engaging in the 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. The costs borne by family/friends and society 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, 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 a 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. As such, the conclusion that gaming is the reason for an increase in mental health issues, alcohol or drug abuse, homelessness, etc., can not be proven.

While most people gamble responsibly for recreation, those who gamble excessively are what is commonly referred to as either a pathological or problem gambler. However, statistics from national studies do not provide a clear correlation between the amount of gaming activity and the percent of the population identified as having a gambling disorder. As in this instance, the gaming already exists in the County and the comments suggest that an increase in gaming activity has a positive correlation with an increase in social costs. In 2012 it was estimated that the State of California ranked first in US gaming revenues, while at the same time had an estimated 1.9 percent of the State’s population believed to have a gambling disorder. This percent of problem gamblers ranked below the national average and well below other states that had significantly lower gaming revenues. Using population estimates from the analysis, it is estimated that over a ten year time period the number of problem gamblers in Shasta County will increase by less than 200 people regardless of the new casino operation as it is more a function of susceptible population versus growth in overall gaming revenue.

Other comments suggest that the effect of problem gaming not only manifests in the need for additional health and human services, but also an increase in crime. This comment is addressed in comment response A-6.03.

Shasta A-6.11

Finally, the County noted that the Tribe's Chief Executive Officer indicated that homeless populations continue to set up illegal campsites adjacent to the Rancheria, on tribal and non-tribally owned lands alike, and adversely impact the Tribe's current gaming operation. The County noted that the DEIS did not address the project might shift or alter homeless in the County. Based on the research, similar to what was previously discussed in comment A-6.10, there is not a clear nexus between gambling and homelessness. Similarly, the impacts of shifting homeless population with new development would be temporary and not unique to the proposed Project but all new development in the County.

Paskenta T-6.1

The Counsel for the Paskenta Band of Komlaki Indians (Paskenta) prepared a comprehensive comment letter. On Page 1, the first of several comments regarding the financial analysis occurs. Global Market Advisors (GMA) comments relate to the impact on Rolling Hills Casino Resort (Rolling Hills) EBITDA. The purpose of Appendix A of the DEIS is to quantify socio-economic impacts. With respect to competitive impacts, the focus is to identify major resulting impacts such as store closures.

Direct competitive impacts are identified, but do not require mitigation as businesses have natural impacts from competition. For example, GMA’s Rolling assessment assumes planned improvements at Rolling Hills such as a casino expansion and F&B expansion, which could have an impact on all regional competitors but do not require mitigation.

With respect the the Questioner’s assessment of EBITDA impact, the projected revenue impact is approximately 5.8%. Based on the GMA’s implied operating margin, this would result in approximately 7.4% drop in Rolling Hills EBITDA. This level of impact typically can be managed and is not expected to severely impact operations at Rolling Hills nor result in in closure of the facility.

It is not possible to comment specifically on GMA's assessment of the substitution related impact because it has included additional casinos in the market model (e.g. Hard Rock Hotel & Casino, the Wilton Rancheria Elk Grove Casino is not including in the Rolling Hills impact model but is included included in the Economic Return Evaluation report). The report does not identify the impact it attributes to the Project Alternatives verses the new casino or other market changes.

However, the GMA suggests that overall market GGR would only grow 0.8% despite the Alternative Developments, the Rolling Hills Expansion, and the opening of a greenfield facility (Hard Rock). Based on gaming to income ratios, Pro Forma Advisors has assessed that the northern California market is not completely saturated (i.e. this is only found where there are practically no limits on gaming facilities and positions such as Nevada). Traditional gravity models fundamentally predict "probabilities," but do not inherently project market scale changes. As such, many applications of gravity models to existing (and not fully saturated) markets underestimates market growth and overestimates cannibalization. We believe this is the case in GMA's substitution estimates.

Paskenta T-6.12

In regards for the need for the viability and need for Modified Alternative F please see comment T-16.16, which incorporates the majority of the substantive comments on this topic area.

Paskenta T-6.13

In regards for the need to generate additional government revenue please see comment T-16.16, which incorporates the majority of the substantive comments on this topic area.

Paskenta T-6.16

Paskenta note the following as it relates to the socioeconomic analysis; "Even if Redding had a genuine need for more government revenues and per capita payouts to its tribal members than it is is already realizing from the Win-River Resort Casino, the DEIS alternative is defective because (1) It Wrongly Concludes that Alternatives A, B, and C are Economically Viable, (2) It Fails to Examine a Modified Alternative F, which would be more economically viable than Alternatives A, B,C or the Current Alternative F, (3) It Fails to Consider Three Additional Alternatives

In regards to comment number one above, Paskenta reaches the conclusion based on a Global Market Advisors (GMA) study that notes that "the DEIS financial return assessment of Alternatives A, B, and C is flawed by relying entirely upon incremental revenue projections. This approach fails to address financing costs, operating and ongoing maintenance and capital expenses for the Alternatives and thus does not include an estimate of return on investment or actual projected cash flows available to Redding Rancheria for each Alternative."

Beginning on Page 49 of Appendix A of the DEIS, the revenue analysis of the alternatives are presented in support of the economic impact analysis. This is a required input to accepted economic impact analysis modeling. As part of EIS Economic Analysis' revenue projections, Pro Forma Advisors created internal financial projections that included operating costs, capital reserves, and cash flow.

The comment conflates economic feasibility (a positive IRR) with the ability to fund a project. The two are related, but independent assessments. For example, a project with a high projected IRR with a high cost of capital or challenges with debt financing due may not be fundable. Conversely, a lower IRR project could be funded internally or through debt capacity based on existing cash flows or pledges on assets.

The Tribe currently has existing track record of operations and positive cash flow which would continue through the opening of the Project. This situation is preferred by financial institutions making funding easier than a Greenfield development. The internal rate of return (IRR) of the investment and increased cash flow Alternatives A, B, and C were higher than the Tribe's likely cost of capital, making them fundable and feasible.

It is important to note that in regards to comment number two, the cited "Modified Alternative F" was not a scenario under study. Furthermore its posits a number of questionable assumptions and conclusions. First, the design of Alternative F, as evaluated in Appendix A of the DEIS, was developed by a qualified architect with expertise in casino design. The design considered issues related to the specific buildings, right of ways, and other construction constraints. It is incorrect to assume that GMA are more qualified to assess these design related issues, which they seem to conclude by noting that "the flaws of Alternative F are self-evident to anyone familiar with casino resort design."

Second, in concluding that the "Modified Alternative F" would be more economically viable Paskenta's consultant has projected incremental revenue of over $17 million, which is approximately 22% higher than Win-River Resort Casino's 2017 GMA estimated gross revenue. As the "Modified Alternative F" revenue is not impacted by a more accessible location, expansion of on-site hotel inventory, or larger and higher quality setting, the estimated increase is based solely on an increase of 200 slots and changes to the F&B program, and some interior design improvements.

In a significant number of similar analysis performed by Pro Forma Advisors, these incremental on-site improvements provide a modest additional performance of the casino, which has been estimated in our analysis. The IRR of the incremental cash flows is a modest.

Finally, in support of Modified Alternative F's economic viability, GMA does not include impacts to existing operations during construction, which would be significant in any Alternative F. GMA also uses a highly preferential assumed interest rate (6.5% vs. 10%) to calculate an after financing cash flow, with a key assumption that Alternatives A, B, and C are "greenfield or brownfield developments". This is an incorrect assumption as the Win-River Casino would continue to generate cash flow in all scenarios and would be less impacted by a new facility verses a major upgrade on the revenue generating facility.

In regards to comment number three above, as the Tribe consider the current Alternative F as a viable option, the impacts of Paskenta's proposed three alternatives are not materially different than the impacts identified in the current Alternative F.

Paskenta T-6.17

In regards for the need for the viability and need for Modified Alternative F please see comment T-16.16.

Paskenta T-6.18

In regards for the need for the viability and need for modified alternative please see comment T-16.16.

GMA T-6.97

In regards to the question regarding EBITDA, please see comment T-16.1.

GMA T-6.99

In regards to the question regarding EBITDA, please see comment T-16.1.

GMA T-6.100

In regards for the need for the viability and need for Modified Alternative F please see comment T-16.16.

Littier I-68.6

Please see comment A-4.1 in response to the question regarding the competitive effects of business "substitution."

Littier I-68.7

Please see comment A-6.10 in response to the question regarding the potential social impacts of the Project including issues surrounding human trafficking, prostitution, and other issues of criminal behavior.

Coulter I-71.3

Please see comment A-6.10 in response to the question regarding the potential increase in crime.

Coulter I-71.4

Please see comment A-6.10 in response to the question regarding the potential increase in homelessness and other social issues.

Coulter I-71.5

Mr. Coulter's comments specific to the Socioeconomic analysis within the DEIS generally revolved around issues associated with the potential loss in property value. This issue is analyzed on Page 27 of Appendix A of the DEIS. As noted in the socioeconomic analysis we do not anticipate a negative impact on housing values for the following reasons. Although "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," since "the Project and Project Alternatives locations are near the Interstate 5 freeway and other commercial areas" where potential negative externalities already exist, "these existing 'negative' externalities make it difficult to isolate the potential incremental impact of future casino operations." Furthermore, other studies suggest that a casino can have a positive impact on commercial property values when it is introduced into a new commercial area. The combination of this along with the larger point that any negative externalities created by the casino are theoretically priced into the larger market area suggest that there is no evidence that a new casino will have a cumulative negative impact on property values in the region.

Coulter I-71.7

Please see comment A-6.9 in response to the question regarding the potential fiscal impacts of the Project.

Littier I-79.2

Please see comment A-4.1 in response to the question regarding the competitive effects of business "substitution."

Clack I-80.1

Please see comment A-6.10 in response to the question regarding the potential increase in crime.

Wenham I-86.1

Please see comments T-16.1 and T6-16 in response to the question regarding the feasibility of gaming expansion and comment A-6.9 in response to the question regarding the potential fiscal impacts of the Project.

Lynch I-90.12

Please see comments T-16.1 and T6-16 in response to the economic viability of alternative site locations.

Lynch I-90.23

Please see comment T-16.1 in response to the casino related substitution.

Lynch I-90.24

In regards to Mr. Lynch's statement about the statement "diverse spending patterns," the intent of the section is to demonstrate that although there is an anticipated immediate impact to the casino market overtime as the market grows the ability to recapture lost gaming revenue strengthens. Please see comment T-16.1 in response to the casino related substitution.

Lynch I-90.25

Please see comment A-6.10 in response to the question regarding the potential increase in alcohol, drug use and other social issues.

Lynch I-90.26

Please see comment A-6.10 in response to the question regarding the potential increase in crime. In addition, the studies provided in the DEIS were illustrative and not included nor referenced in Economic Analysis. The studies included in Appendix A provide a literature review of several comprehensive non-partisan studies, including reports issued by the State of California. A key point of clarification in the referenced "Gambling in the Golden State: 1998 Forward" is that the focus linking crime and casinos were for communities where casinos were not previously present. As a result, this information is less illustrative as the purpose of the economic analysis is to determine the net impact above the current Win River Casino facility.

Lynch I-90.27

Please see comment A-6.10 in response to the question regarding the potential increase in crime.

Lynch I-90.37

Please see comments T6-1 and T-6.16 in response to the question regarding the feasibility of gaming expansion.

Lynch I-90.38

Please see comments T6-1 and T-6.16 in response to the question regarding the feasibility of gaming expansion.

Carter I-93.11

In regards to Mr. Carter's comments, the socioeconomic analysis analyzes the net impact of the alternatives in comparison to the existing conditions. The relative impact over current conditions creates the condition of a significant impact. As such, documenting the entire socioeconomic conditions in the market is not warranted.

Livingston I-99.7

Please see comment A-4.1 in response to the question regarding the competitive effects of business "substitution."

Livingston I-99.10

Please see comment A-4.1 in response to the question regarding the competitive effects of the amphitheater. It should also be noted that the amphitheater has been removed from the development program.

Mannion I-103.3

Please see comments I-71.5 in response for the question regarding potential loss of property value, A-4.1 in response to the question regarding the competitive effects of business "substitution" and A-6.9 in response to the question regarding the fiscal impacts associated with the Project.

Evans F-1.7

Please see comment A-4.1 in response to the question regarding the competitive effects of business "substitution."

Evans F-1.8

In regards to Mr. Evans' comments, a more direct question is required to respond to the assertion that the "project should not proceed without a genuine assessment of impacts to the local economy beyond short term jobs." The analysis provides a detailed analysis of issues beyond this comment. We would refer Mr. Evans to the Impact section that discusses the ongoing benefits of the Project Alternatives starting on page 53 of Appendix A of the DEIS.

Post Analysis Trends

Our responses did not contemplate COVID-19, which was declared a pandemic by the World Health Organization in March 2020. The recovery from the COVID-19 pandemic has been uneven, with some industries experiencing little to no hardships and other extreme duress. In the United States, a national recession occurred for two months in April and May of 2020.

As it relates to the gaming industry, the National Indian Gaming Commission (NIGC) released fiscal year 2021 (FY 2021)[1] gross gaming revenue (GGR) numbers totaling $39 billion, which represents an increase of 40 percent over FY 2020 and a 13 percent increase compared to FY 2019. The FY 2021 revenues are calculated from the independently audited financial statements of 510 gaming operations owned by 243 federally recognized tribes in 29 states. As such, the gaming industry has recovered from the COVID-19 pandemic and no macro structural changes have occurred since the time of the study.

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[1] The NIGA fiscal year runs from October 1 to September 30th.

As of August 2022, the United States has recovered most jobs lost during the pandemic. In California unemployment has decreased to approximately four percent, which is comparable to year end 2019 pre-pandemic unemployment rates. At this time, Pro Forma Advisors is also unaware to any updates to long-term regional growth projections that would fundamentally alter the findings in the analysis.

APPENDIX M

UPDATED WASTEWATER MANAGEMENT & DRINKING WATER FEASIBILITY STUDY

REDDING RANCHERIA CASINO

Wastewater Management and Drinking Water

FEASIBILITY STUDY

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Coleman Project #: ANES16-002

Revised January 26, 2024
February 7, 2020

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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. Primary Site, Alternatives A, B, C, and D: 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. Alternate Site, Alternative E: 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. Expansion of Existing Casino, Alternative F: 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 A-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. Table A-2 in Appendix A summarizes the estimated weekend peak flows and average day flows, by building use, for each Alternative from the wastewater flow projections worksheets.

Table 1 below is a summary of the projected wastewater flows.

Table 1: 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. Therefore, water demand is calculated by adding 5% to the estimated wastewater flow projections found in Appendix A, Table A-

2 to create the estimated average day, maximum day (weekend), and peak hour water demands for each Alternative as summarized in Table 2 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.

Table 2: 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	100,700	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 A-3 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.

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 A-3 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.

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 multiplied by the new 10,000-sqft addition. A 5% reduction was applied to the water demand to estimate the wastewater flows. Table 3 below summarizes the projections associated with Alternative F.

Table 3: 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

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

2.4 Recycled Water Reuse

Based on experience, comparison to similar casinos used as references (refer to 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 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, Shasta County's 2018 Local Agency Management Program (LAMP) for Onsite Wastewater Treatment Systems (OWTS) 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 Subsurface Disposal

Wastewater subsurface disposal options which would be subject to regulations include mound systems, and other types of injection wells such as conventional leach fields and engineered (special designed) leach fields. The subsurface disposal types being considered under this project are classified as Class V injection wells. Subsurface disposal on trust land will either be *Authorized By Rule* or *Permitted by EPA Region 9.* Both approval methods are summarized below.

Authorized by rule means that an injection well may be operated without a permit as long as the owners or operators:

- Submit inventory information to their permitting authority and verify that they are authorized (allowed) to inject. The permitting authority will review the information to be sure that the well will not endanger an underground source of drinking water (USDW).
- Operate the wells in a way that does not endanger USDWs. The permitting authority will explain any specific requirements.
- Properly close their Class V well when it is no longer being used. The well should be closed in a way that prevents movement of any contaminated fluids into USDWs. Rainfall intensities

After reviewing an owner or operator's inventory information, the permitting authority may determine that an individual permit is necessary to prevent USDW contamination.

Permitted By R9 means if the owner wants to operate or plans to construct one or more injection wells, it is required to register those features, also known as injection wells, with the Underground Injection Control program. This requirement applies to deep and shallow subsurface disposal systems as defined in 40 CFR part 144. Compliance with the federal Underground Injection Control (UIC) regulations includes fulfilling two basic requirements: (1) - register injection well(s) and (2) - do not use injection wells in a manner that will contaminate underground sources of drinking water.

For reference only, a few key disposal criteria have been summarized below from the previous version of the Shasta County Sewage Disposal Standards, dated from 2012. The current version of the Shasta County Sewage Disposal Standards does not include as much detailed design criteria however calculations made for this analysis remain fully compliant with the current County Standard.

“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 4 below lists typical textbook ranges for the composition of untreated domestic wastewater.

Table 4: 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

In order to provide the Casino with the greatest flexibility, produce high quality effluent, and minimize the wastewater treatment plant (WWTP) footprint, a membrane bioreactor (MBR) treatment is the recommended onsite treatment option. 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.

Effluent from the proposed MBR treatment facility will be conveyed through a leach line dispersal system located outside the 100-year flood plain (refer to Appendix C, Exhibit 7). According to Shasta County's LAMP for OWTS, the required horizontal setback distance between a leach field and perennial stream is 100-feet and "to be measured from the 10-year flood line or top of bank or other evident high water-line or the expected 10-year flood line." Given this Shasta County standard requiring a setback from the 10-year flood line, the proposed leach field design offers a large factor of safety in the event the Sacramento River floods, as the proposed leach field is located outside the 100-year flood line.

The majority of the Redding site can be classified as "Reiff fine sandy loam," "Riverwash," and "Tujunga loamy sand" and the majority of the Anderson site as "Wet alluvial land" and "Reiff loam," according to SCS Soils Maps and Surveys, NRCS Custom Soil Resource Report, and City GIS maps.

Site specific geotechnical exploration and testing was completed at the site of Alternatives A-D by Blackburn Consulting (refer to Appendix D). Percolation tests were performed in several locations across the proposed leach field area and were used to determine the average hydraulic loading rate. The tests were performed using the method described in Shasta County *Onsite Wastewater Treatment System Technical Guidance Manual*. The percolation tests conclude that only two of the fifteen test locations fall outside the standard range for "usable disposal material" according to the UIC Program (refer to Appendix B, Table B-3). Furthermore, Shasta County's LAMP for OWTS specifies a minimum depth to groundwater based on percolation rates.

Based on Blackburn's test pit logs, the average depth to groundwater is more than 12 feet, which complies with Shasta County Standards for the required minimum depth to groundwater of 5 feet, (refer to Shasta County *Onsite Wastewater Treatment System Technical Guidance Manual, TSM SECTION E. LEACH LINE WASTEWATER DISPERSAL SYSTEMS (OWTS Policy 9.5).* The sizing of the proposed leach field area accounts for Blackburn's site exploration results and is designed to comply with Shasta County standards for leach field design (refer to Appendix B, Table B-2 and Appendix C, Exhibit 7).

For the proposed leach field for Alternative E, a hydraulic loading of 0.45 gpd/ft^2 was assumed for preliminary 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.

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's LAMP for OWTS is the design criteria used for this feasibility level study state in part that subsurface disposal systems "shall not include land subject to flooding." Floodplain considerations for the two sites include the following:

Redding (Primary Site)

- The complete site under consideration is approximately 232-acres.
- 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.
- Approximately 111 acres is outside the 100-year floodplain (Zone X).
- The remaining 6.2 acres lie in Flood Zone AE.
- Appendix C, 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 C, 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 C, 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. 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 0.5 MGD from the Casino site.

Except for West Side Interceptor Phase III, 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 C, Exhibit 4). Dave Durette, City Engineer at the City of Anderson, reported that 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 subsurface 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 2, the new water supply source needs to provide a flow between 56 and 219 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 system 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.

Groundwater Well

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 C, 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).

Based on well completion reports from local wells, the depth to groundwater aquifers ranges from approximately 20-to 300-feet below ground surface. It is assumed that a well drilled 300- to 600-feet should produce enough water quantity and quality. A well drawing from a deeper confined aquifer should not affect the shallower local residential wells or Sacramento River recharge due to the confining layers which act as a barriers between the upper and lower water bearing strata.

Each of the sites are within the Anderson and Enterprise Subbasins and under the jurisdiction of the Enterprise Anderson Groundwater Sustainability Agency (EAGSA). As such, if these sites are taken into trust, they will no longer be within the jurisdiction of the EAGSA and will not be subject to the groundwater management plan that will be released in 2022.

Although supplying water to the site may have the potential to affect other users in the Anderson and Enterprise Subbasins, the Subbasins are both under medium priority, and are not classified as critical. Given the information from the City of Redding Urban Water Management Plan, the impact should not be significant, as there appears to be sufficient capacity for further development. Further research will need to be completed during detailed site design.

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 5 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 5.

Table 5: 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)	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

In a letter to the Bureau of Indian Affairs on May 22, 2019 the City has stated that the City of Redding's water supply has the ability to provide water to the Strawberry Fields Site. Although this option is feasible, the connection to City water in any case is dependent on the discretion of the City of Redding City Council. In 2015, which was the second year in which the state was under an emergency drought declaration by the Governor, the average daily demand was approximately 18.9 MGD, with the peak demand being 41.6 MGD. The Foothills water treatment plant has the capacity to provide 44 MGD to the City. With the peak demand for these Alternatives being approximately 0.55 MGD, the City appears to have sufficient capacity in drought years, as well as non-drought years.

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, Appendix C). 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 C, 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 rainwater 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 an MBR (refer to Appendix C, 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 generally includes both filtration and disinfection. An 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 A-4).

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. Table 6 below shows typical effluent constituent levels that may be expected from typical MBR treatment.

Table 6: MBR Effluent Constituent Levels

Parameters	Typical Values
BOD_5	<2.0 mg/L
TSS	<2.0 mg/L
Ammonia (NH_3)	<1.0 mg/L
Total Nitrogen (TN)	<10.0 mg/L
Phosphorus (TP)	<1.0 mg/L
Turbidity	<0.10 NTU
Fecal Coliform	<2.2 CFU/100mL
SDI	<3

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, and controls. 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 an 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 an MBR is not typically required for subsurface disposal.

5.1.5 Solids Handling and Disposal

Biosolids handling is typically a 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 constraints at the Casino site.

5.1.6 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 subsurface disposal of the wastewater effluent as shown in Appendix C, Exhibit 7.

<u>Anderson (Alternative E)</u>

Subsurface disposal is not possible due to the lack of suitable land. As Table B-2 in Appendix B indicates, 53 acres would be required to accommodate the required subsurface disposal design but there are only 8 acres available for subsurface disposal on the Alternative E site.

5.1.7 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.

5.1.8 Recycled Water Reuse

Since 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 A-4 of 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

Following treatment in the MBR, effluent will be suitable for sub-surface disposal via leach field. 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 7: Available Land for Disposal – Alternative A as Worst Case

Alternative	Land Parcel Size	Casino Development Area	Flood Plain Area <u>Not</u> Including Development Area	Land Available for Subsurface Disposal
A	232	(47)	(115)	48

Units: acres

5.2.1 Leach Field Disposal

Blackburn Consulting performed percolation tests in several locations across the proposed leach field area for Alternatives A-D. Using Shasta County's LAMP for OWTS as the design criteria, the results conclude that there are only a few locations unsuitable for wastewater disposal by leach field (refer to Appendix C, Exhibit 7). The percolation data from Blackburn's testing was used to calculate the average hydraulic loading rate and required leach field area for the Redding site.

For the proposed leach field for Alternative E, a hydraulic loading of 0.45 gallons per day per square feet (gpd/ft^2) was assumed for sizing.

<u>Conventional Leach Fields</u>

A conventional leach field can be sized using a design flow and hydraulic loading rate. A summary of the criteria used to solve for the required land area is shown below:

- Peak flow
- Redding Site Average Hydraulic Loading rate = 0.76 gpd/ft^2
- Anderson Site Hydraulic Loading rate = 0.45 gpd/ft^2
- 100% Replacement Area
- No storage required, assume year-round disposal
- Subsurface disposal allowed during rain events

Redding (Strawberry Fields Site / Primary Site, Alternatives A-D). The effective hydraulic loading rate, in gallons per day per square feet (gpd/ft^2), was determined at each percolation test location using the application rates from Shasta County's LAMP for OWTS, which correlates percolation rates (MPI) and hydraulic loading rates (gpd/ft^2). An average hydraulic loading rate was calculated across the Blackburn testing sites with percolation rates ranging between 5 and 60 minutes per inch (MPI). Using the design flow and the average hydraulic loading rate, the total required leach field land area for each Alternative was calculated (refer to Appendix B, Table B-3 and Table B-4).

Conventional leach field land requirements were calculated and summarized below in Table 8 (refer to Appendix B, Table B-2). The land requirements were calculated by dividing the average 24-hour volume of wastewater by the absorption capacity of the soil. Using Shasta County design criteria, calculation results include a 100% replacement area and 20% contingency due to reuse. As shown in Table 8, Alternative A is the most land intensive disposal option, requiring approximately 33 acres. The Redding site currently has 48 acres of available leach field area, which is more than enough for Alternatives A-D, refer to Appendix C, Exhibit 7.

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 8: Calculated Leach Field Land Requirements (Subsurface Disposal) – Alternative Summaries

	Alt A	Alt B	Alt C	Alt D	Alt E
Subsurface Disposal Land Area incl. 100% Replacement [a]	27	22	26	10	44
Reclaim Treated Wastewater: Subsurface Disposal Area [b]	33	27	32	12	53

Units: acres

[a] *20% contingency added to avoid over saturation of the soil and to handle high peak flows*

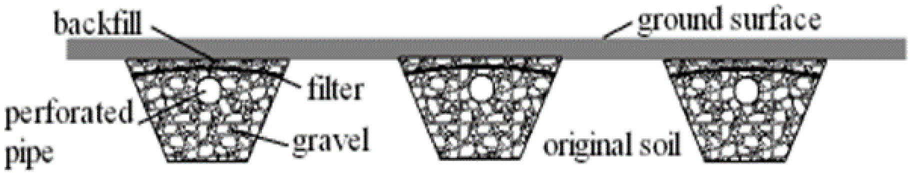
[b] *20% reduction used due to reuse*

Anderson (Alternative E). 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 subsurface 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.

Using MBR, the advantage 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.

5.3 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 (refer to Appendix C, 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.

5.3.1 Alternatives A-D

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.

According to the City of Redding 2012 Wastewater Utility Master Plan, Sunnyhill Lift Station has an approximate peak wet weather flow of 17.21 MGD. The projected flows into the Sunnyhill Lift Station in 2020 and 2030 are 10.76 MGD and 10.78 MGD, respectively. The peak flow from the Casino site is projected to be 0.501 MGD. Given the small change in the projected flows, and the small flow, in comparison, going to the Sunnyhill Lift Station, 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 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. 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 an additional 42-inch sewer pipe in parallel with the existing interceptor. This expansion will provide a total interceptor capacity of 32.5 MGD, based on the Westside Sewer Interceptor Project Development Report. 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. Table 9 shows the percentage of Casino flow to the West Side Interceptor Capacity for each Alternative.

Table 9: Percentage of Casino Flow to West Side Interceptor Capacity

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Projected Peak Flow (GPD)	500,750	415,000	476,750	173,250	485,250	122,500
% of Project Flow to WSI Capacity	1.54%	1.28%	1.47%	0.53%	1.49%	0.38%

The Westside Interceptor Phase III project was initially programmed to be designed in 2015-16 and constructed in 2016-2018.The City has changed their schedule and is currently working to get the environmental portion of the design complete. The City has identified artifacts and archeological sites that may require additional study and have delayed the project. The City anticipates having the interceptor go to construction in 2023. With this schedule, the Westside interceptor improvements may not be complete before the proposed Casino is open.

Based on the City of Redding's Capital Improvement Plan 2017-2018 to 2022-2023, the project cost is $7,543,080. It is understood that the City of Redding and the Casino would negotiate an acceptable connection fee to tie into the City's pipe.

In the interim, the Casino site may 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, shown in Table 1, is 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 2023 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 2023, the on-site storage should not be needed.

The Clear Creek WWTP currently treats about 9 MGD of wastewater. The 2012 Master Plan outlines that the capacity of Clear Creek WWTP peak wet weather flow was expanded to approximately 40 MGD. The maximum wet weather flow shown in the Master Plan is about 35 MGD. With the peak flow of the Casino being 0.501 MGD, the existing WWTP is confirmed to have sufficient current capacity to treat the peak flow generated by the primary site.

5.3.2 Alternative E

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 be 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 Anderson Water Pollution Control Plant (WPCP) currently treats 1.28 MGD ADWF, and has capacity to treat 2.0 MGD ADWF, 6.0 MGD MDF, and 8.0 MGD PWWF when 2.0 MGD is diverted to the emergency storage pond. The addition of the Alternate Site's flows pushes projected ADWF to 1.5 MGD, or 75% of design flow.

The City intends to commence planning and design of plant expansion when ADWF reaches 75% of capacity so that capacity improvement upgrades can be implemented within five years. Plant expansion would require upgrading several treatment components in the plant:

- Upgrade filter pumps 1 & 2 from 15 hp to 20 hp to increase the capacity flow approximately 0.6 MGD
- New pressure filter
- Add a fifth filter pump to ensure redundancy
- Replace contact chamber completely or possibly just partially with UV

Upgrading these parameters would increase plant capacity to:

- 2.5 MGD ADWF

- 7.0 MGD MDF
- 9.0 MGD PWWF

The City has noted a recent sizeable increase in ADWF, possibly due to I&I flows from growth and the Anderson-Cottonwood Irrigation District. Addressing I&I issues throughout the system could potentially decrease the WPCP ADWF by 0.6 MGD, eliminating the need for plant expansion.

5.3.3 Alternative F

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 C, 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.

Groundwater

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).

According to well completion reports from local wells in surrounding areas, the depth to groundwater aquifers ranges from approximately 20-to 300-feet below ground surface. 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. It is likely that only one well will be required to supply the Casino. Its location is expected to be on the north end of the project site but will ultimately depend on the results of test well drilling which should be accomplished during detailed design of the site. A well drawing from a deeper confined aquifer is not expected to impact the shallower local residential wells or Sacramento River recharge. 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.

Additionally, projected Casino demands were compared to recorded USGS Sacramento River flow data at Hydrologic Unit 18020154, located just above Redding, CA. Projected peak hour demands from the Casino are less than 0.02% of the minimum recorded annual Sacramento River flow and less than 0.01% of average annual River flow. Therefore, well demand will not affect the river’s recharge.

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 C, 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 are 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.

The total capacity of the system is 44 MGD (per City of Redding), where the current use is approximately 18.9 MGD. In the event of a drought year, with the addition of approximately 221,319 gpd (247.99 AFY), the current City water supply or treatment capacity will not be exceeded if the site is tied into the existing City system.

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. Subsurface wastewater disposal is recommended.
E. Recommend effluent be recycled to reduce wastewater disposal requirements.
F. Advantages: (1) autonomy from the City; (2) recycled water may be used for toilets, landscape irrigation, and fire suppression (refer to Appendix A, Table A-4); (3) No connection fee or on-going monthly billings; and (4) can accommodate future expansion.
G. 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. Subsurface disposal not possible, even using specially designed leach fields, there is simply not enough land area
B. 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. Work with the City to upgrade the WPCP to accommodate flows.
E. 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 when compared with on-site alternatives; and (4) no lift station required.

F. 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

Table A-1: Total Building and Amenity Area

Table A-2: Estimated Wastewater Flows by Building Use

Table A-3: Metered Water Usage (Demands) of the Existing Redding Racheria Casino from the City of Redding

Table A-4: Recycled Water Uses Allowed in California (2013)

Table A-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 A-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 A-3: 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 A-4: 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.

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[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

Table B-1 Worksheets: Estimated Wastewater Flow Projections - Alternatives A-E

Table B-2: Leach Field Disposal Land Requirement - Alternatives A-E

Table B-3: Blackburn Percolation Test Results - Alternatives A-D

Table B-4: Application Rates from Shasta County's Local Agency Management Program for Onsite Wastewater Treatment Systems

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
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
Redding Effective Application Rate (gpd/ft^2) =		**0.76**		Anderson Effective Application Rate (gpd/ft^2) =	**0.45**
Absorption Area Needed (ft2)	262,321	217,662	249,748	90,758	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	525	435	499	182	863
	11-foot separation between pipes (8-foot separation from trench edge to edge)				
Land area (ft^2) =	577,106	478,857	549,446	199,668	948,933
100% Replacement	577,106	478,857	549,446	199,668	948,933
Total Area required (ft^2)	**1,154,212**	**957,714**	**1,098,893**	**399,336**	**1,897,867**
Total Area (acres) w/ 100% Replacement	27	22	26	10	44
20% Efficiency Add. (acres)	**33**	**27**	**32**	**12**	**53**

WASTEWATER RECYCLE - Subsurface Land Area Calculations

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.

Reduced Sewer Flow	160,240	132,960	152,560	55,440	155,280
Absorption Area Needed (ft^2)	209,857	174,130	199,799	72,606	345,067
# of 100' trenches	420	349	400	146	691
Land area (ft^2) =	462,000	383,900	440,000	160,600	760,100
100% Replacement	462,000	383,900	440,000	160,600	760,100
Total Area required (ft^2)	**924,000**	**767,800**	**880,000**	**321,200**	**1,520,200**
Total Area (acres) w/ 100% Replacement	22	18	21	8	35
20% Efficiency Add. (acres)	**27**	**22**	**26**	**10**	**42**

Redding Rancheria Casino
Blackburn Percolation Test Results

Location	Improvement	Test Date	Reading Interval*	Calculated Infiltration Rate (min/inch)		Effective Application Rate (gal/day/ft^2)
B19-01	Leach Field	11/6/2019	Every 10mins for 60mins	5.21	⇒	1.116
B19-02	Leach Field	11/6/2019	Every 30mins for 240mins	10.87	⇒	0.788
B19-03	Leach Field	11/6/2019	Every 10mins for 60mins	6.94	⇒	0.800
B19-04	Leach Field	11/6/2019	Every 10mins for 60mins	3.62	⇒	1.200
B19-05	Leach Field	11/6/2019	Every 30mins for 240mins	10.87	⇒	0.788
B19-06	Leach Field	11/7/2019	Every 30mins for 240mins	13.89	⇒	0.745
B19-07	Leach Field	11/7/2019	Every 30mins for 240mins	14.71	⇒	0.733
B19-08	Leach Field	11/7/2019	Every 10mins for 60mins	6.41	⇒	0.800
B19-09	Leach Field	11/7/2019	Every 10mins for 60mins	6.41	⇒	0.800
B19-10	Leach Field	11/7/2019	Every 30mins for 240mins	27.78	⇒	0.558
B19-11	Leach Field	11/7/2019	Every 30mins for 240mins	35.71	⇒	0.470
B19-12	Leach Field	11/7/2019	Every 30mins for 240mins	27.78	⇒	0.558
B19-13	Storage Pond	11/6/2019	Every 10mins for 60mins	5.56	⇒	0.976
B19-14	Storage Pond	11/6/2019	Every 10mins for 60mins	10.42	⇒	0.794
B19-15	Storage Pond	11/6/2019	Every 10mins for 60mins	2.53	⇒	1.200
					AVG	0.764
					MAX	1.116
					MIN	0.470

Redding Rancheria Casino
Application Rates from Shasta County's Local Agency Management Program for Onsite Wastewater Treatment Systems

Percolation Rate (MPI)	Application Rate (gpd/ft^2)	Percolation Rate (MPI)	Application Rate (gpd/ft^2)	Percolation Rate (MPI)	Application Rate (gpd/ft^2)
1	1.2	31	0.522	61	0.197
2	1.2	32	0.511	62	0.194
3	1.2	33	0.5	63	0.19
4	1.2	34	0.489	64	0.187
5	1.2	35	0.478	65	0.184
6	0.8	36	0.467	66	0.18
7	0.8	37	0.456	67	0.177
8	0.8	38	0.445	68	0.174
9	0.8	39	0.434	69	0.17
10	0.8	40	0.422	70	0.167
11	0.786	41	0.411	71	0.164
12	0.771	42	0.4	72	0.16
13	0.757	43	0.289	73	0.157
14	0.743	44	0.378	74	0.154
15	0.729	45	0.367	75	0.15
16	0.714	46	0.356	76	0.147
17	0.7	47	0.345	77	0.144
18	0.686	48	0.334	78	0.14
19	0.671	49	0.323	79	0.137
20	0.657	50	0.311	80	0.133
21	0.643	51	0.3	81	0.13
22	0.629	52	0.289	82	0.127
23	0.614	53	0.278	83	0.123
24	0.6	54	0.267	84	0.12
25	0.589	55	0.256	85	0.117
26	0.578	56	0.245	86	0.113
27	0.567	57	0.234	87	0.11
28	0.556	58	0.223	88	0.107
29	0.545	59	0.212	89	0.103
30	0.533	60	0.2	90-120	0.1

This table is from Shasta County's 2018 Local Agency Management Program for Onsite Wastewater Treatment Systems, Page 113 – Table 2

Appendix C

Exhibits 1: Alternative Site Locations Area Map

Exhibit 2A: Redding Primary Site Floodplain Map

Exhibit 2B: Anderson Alternate Site Floodplain Map

Exhibit 3: City of Redding Existing Water and Sewer Utilities Near Casino Site

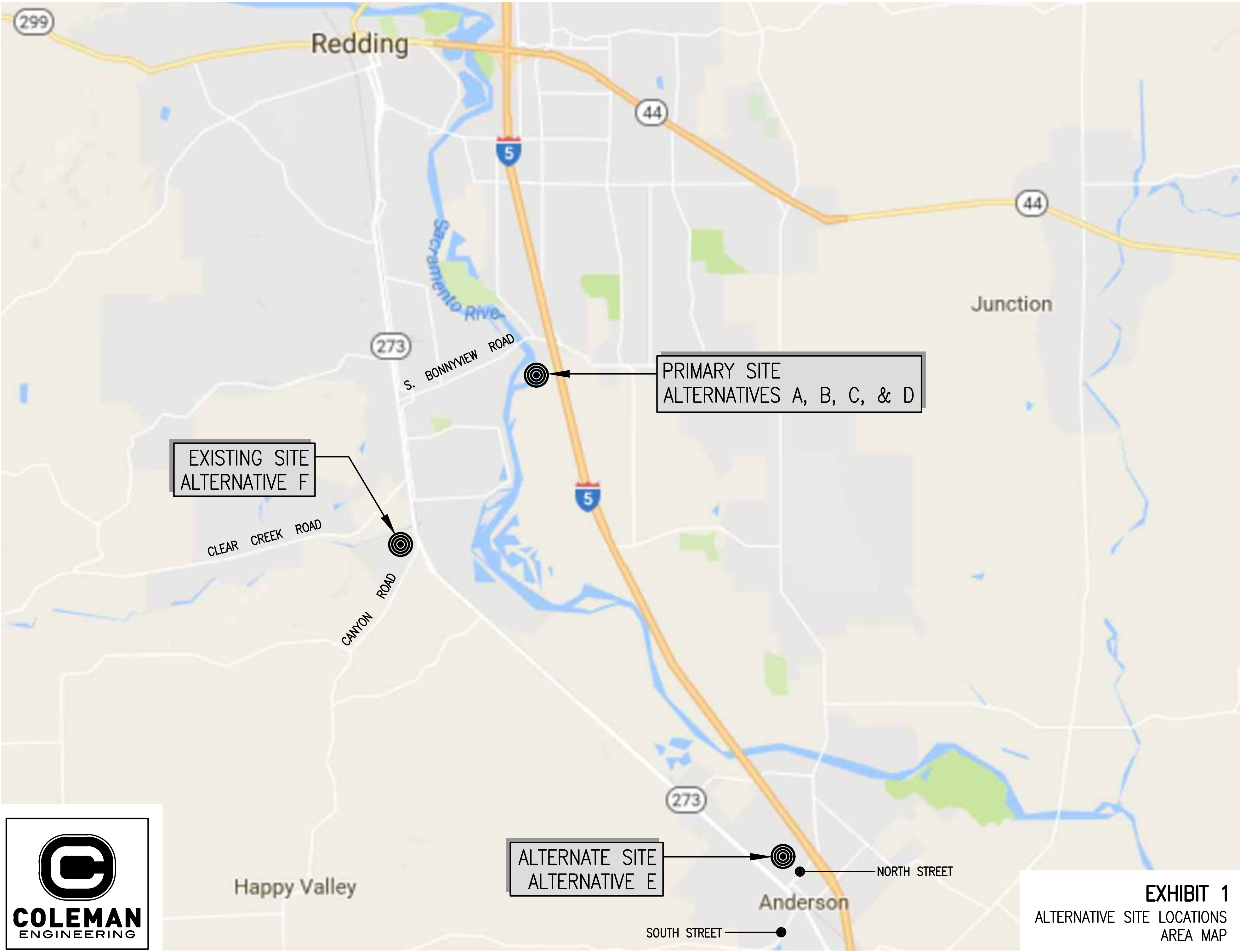
Exhibit 4: City of Anderson Existing Water and Sewer Utilities Near Casino Site

Exhibit 5: City of Redding Municipal Well Locations

Exhibit 6: Wastewater Management MBR Process Flow Diagram

Exhibit 7: Wastewater Disposal Land Requirement

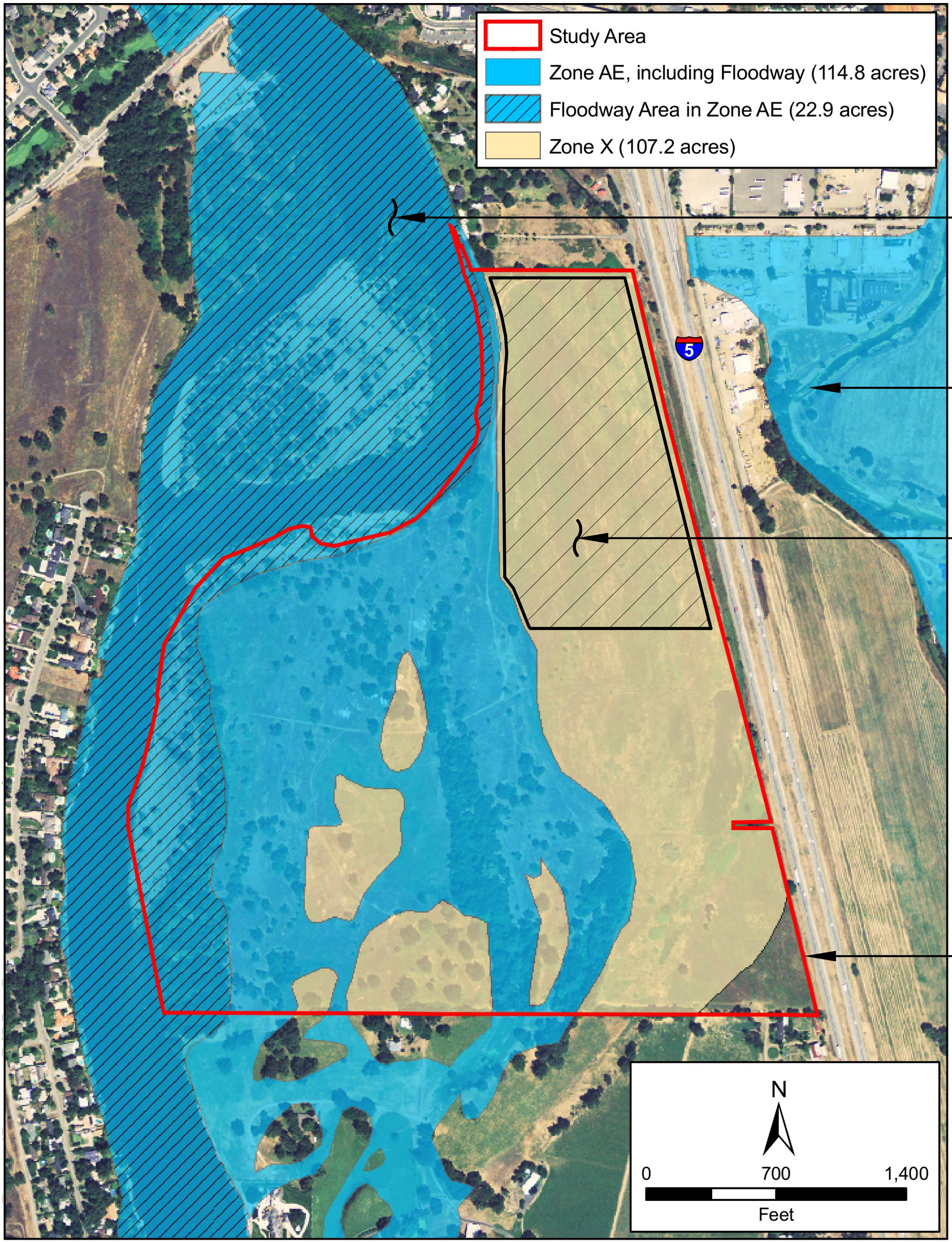
Exhibit 8: Drinking Water Process Flow Diagram



COLEMAN
ENGINEERING

EXHIBIT 1

ALTERNATIVE SITE LOCATIONS
AREA MAP



SACRAMENTO RIVER

CHURN CREEK

ALTERNATIVE A DEVELOPMENT FOOTPRINT APPROXIMATELY 47 ACRES

TOTAL PROPERTY BOUNDARY AREA APPROXIMATELY 232 ACRES

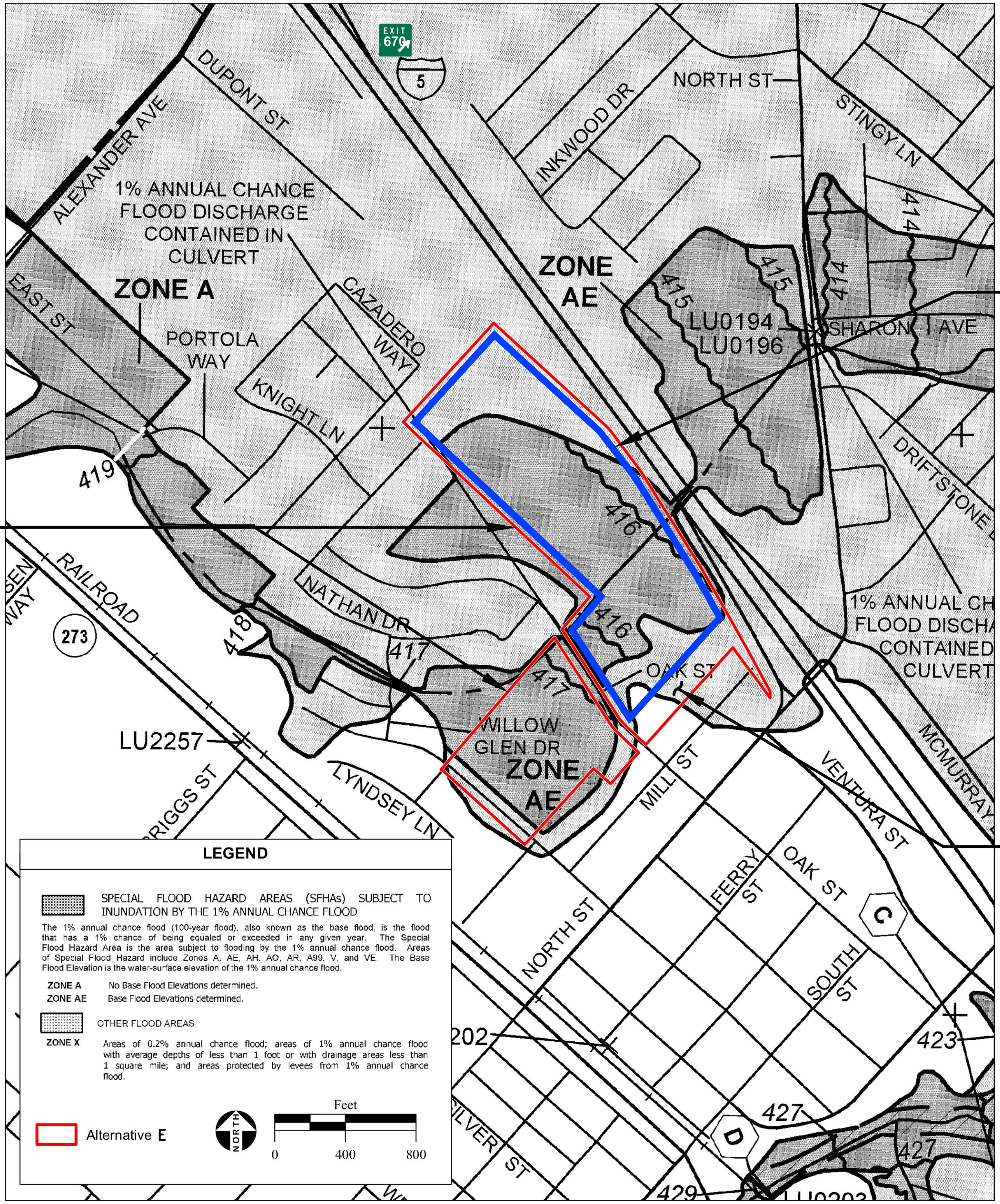
ORIGINAL FIGURE FROM THE DRAFT TECHNICAL MEMORANDUM, FIGURE 2 – OCTOBER 20, 2008 MR. PAUL KIRK

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

LEGEND

▨ SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.

▨ OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

🟥 Alternative E

NORTH

Feet
0 400 800

COLEMAN ENGINEERING

EXHIBIT 2B

ANDERSON ALTERNATE SITE
FLOODPLAIN MAP

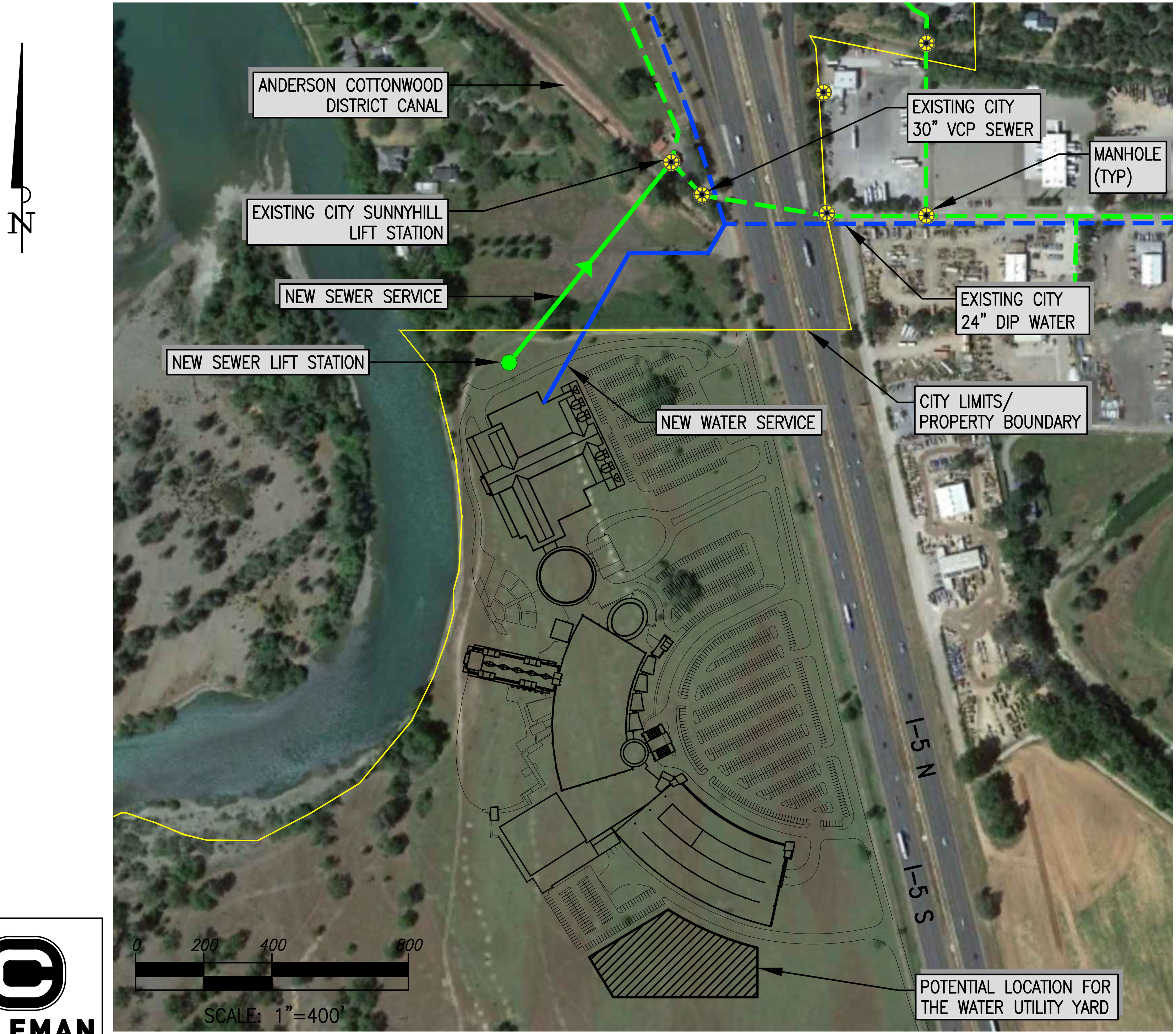


IMAGE FROM CITY OF REDDING GIS (WEBSITE)

EXISTING UTILITY ▬ ▬ ▬

PROPOSED UTILITY ▬▬▬

COLEMAN ENGINEERING

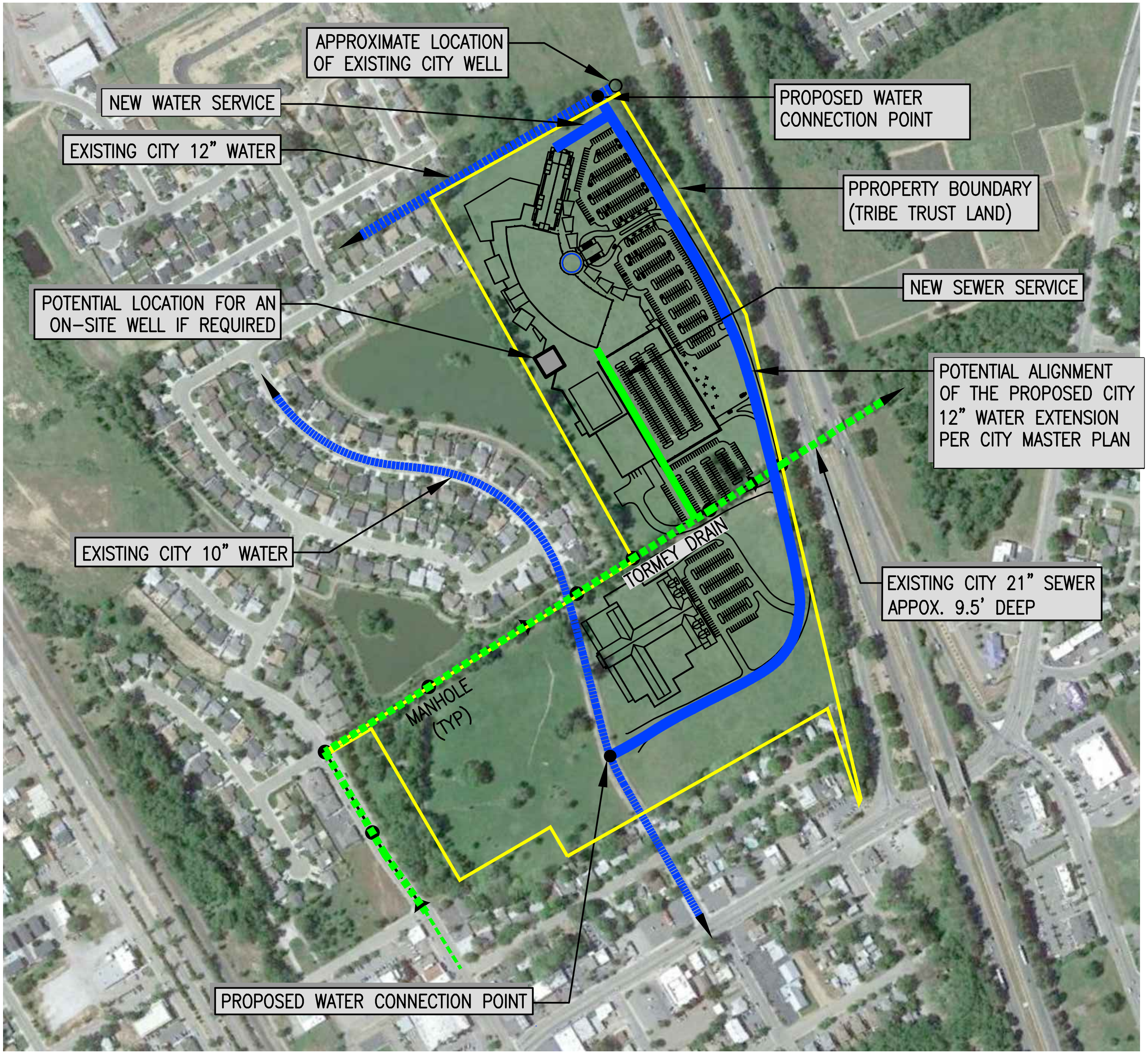
EXHIBIT 3

CITY OF REDDING

EXISTING WATER AND SEWER UTILITIES NEAR CASINO SITE

N

NOT TO SCALE



EXISTING UTILITY ▪▪▪▪▪▪▪▪▪▪

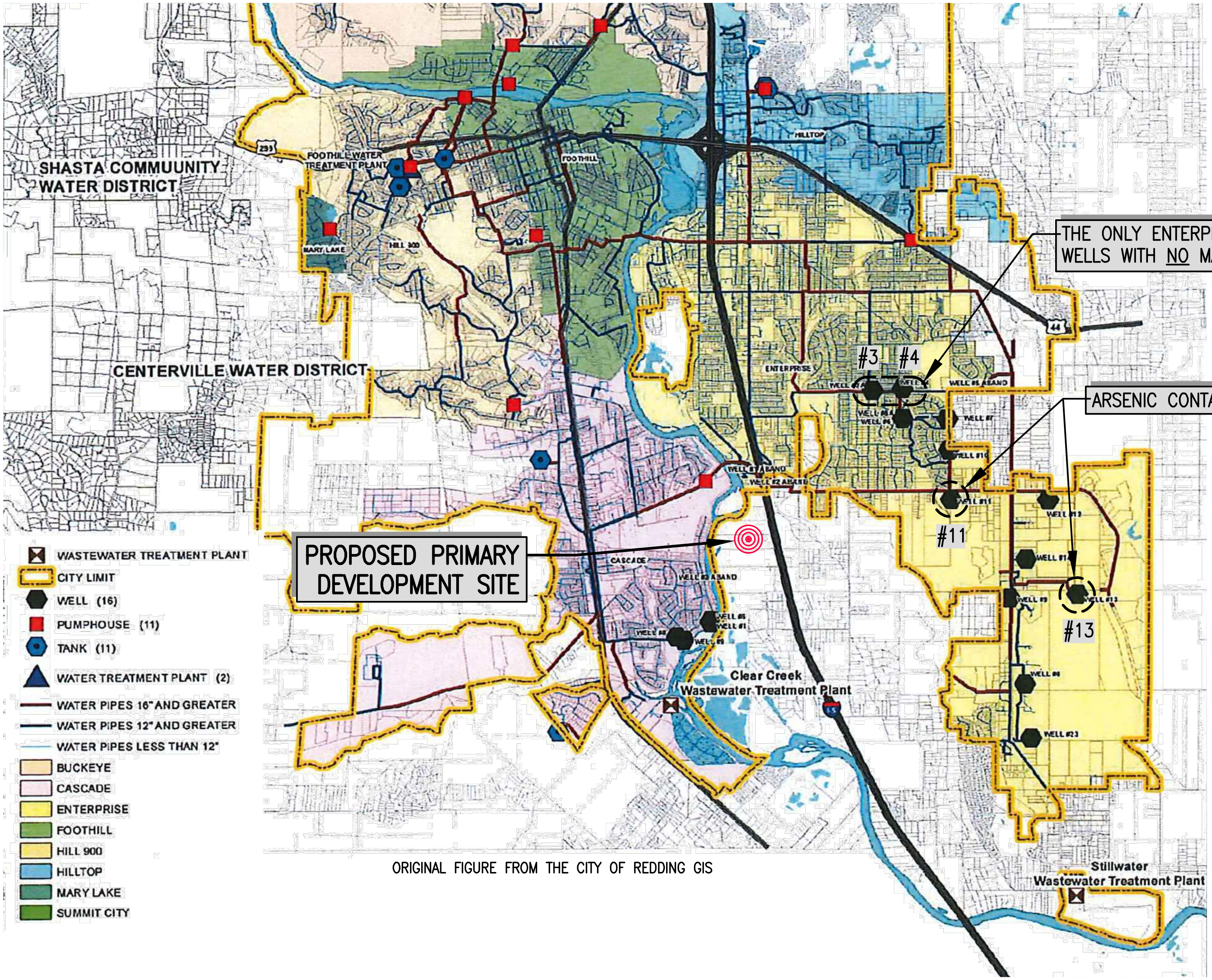
PROPOSED UTILITY ▬▬▬▬

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

COLEMAN
ENGINEERING

EXHIBIT 4

CITY OF ANDERSON
EXISTING WATER AND SEWER UTILITIES NEAR CASINO SITE



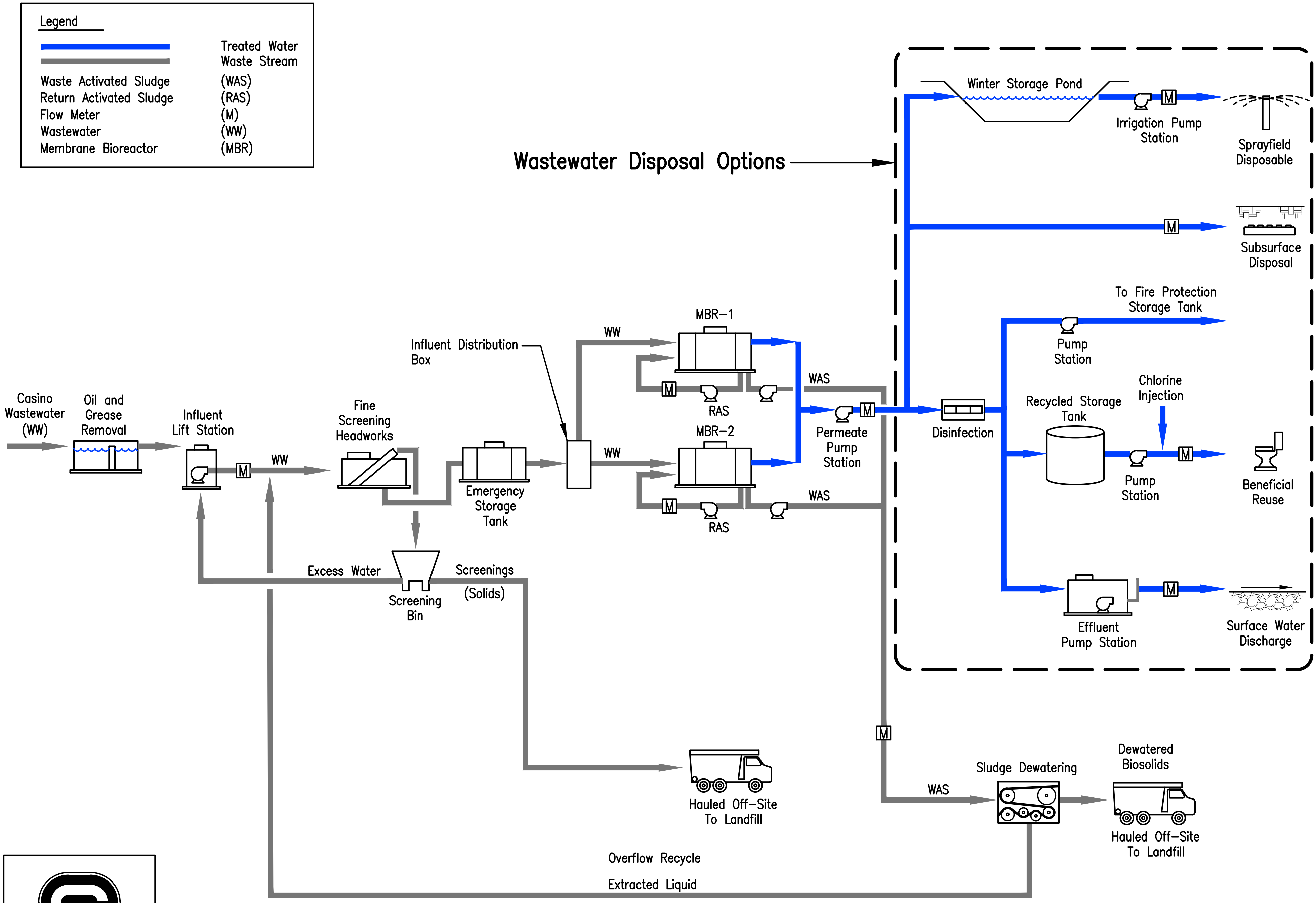
ORIGINAL FIGURE FROM THE CITY OF REDDING GIS

COLEMAN
ENGINEERING

EXHIBIT 5

CITY OF REDDING

MUNICIPAL WELL LOCATIONS



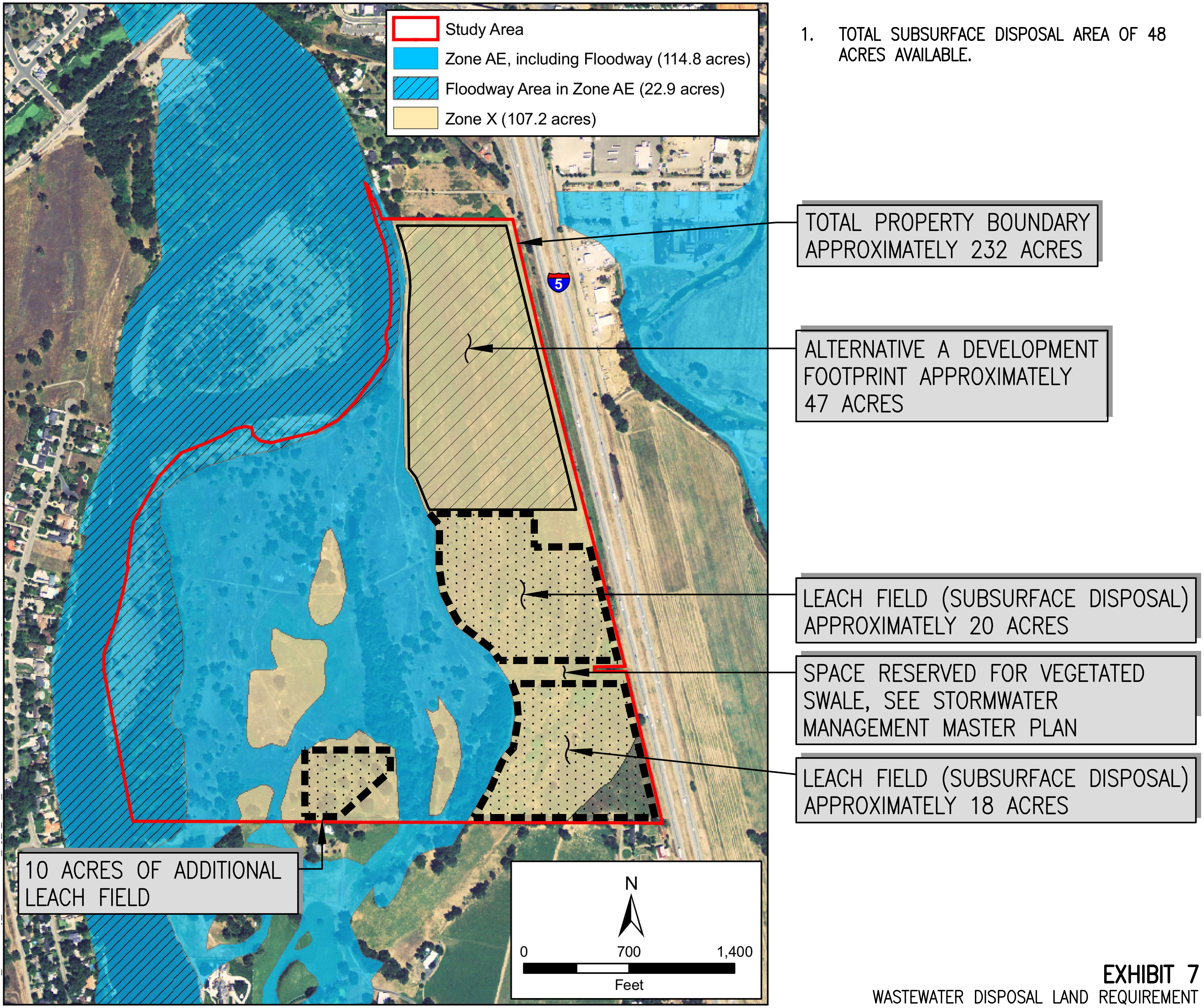
COLEMAN
ENGINEERING

EXHIBIT 6

WASTEWATER MANAGEMENT
MBR PROCESS FLOW DIAGRAM

NOTES:

1. TOTAL SUBSURFACE DISPOSAL AREA OF 48 ACRES AVAILABLE.



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

EXHIBIT 7

WASTEWATER DISPOSAL LAND REQUIREMENT

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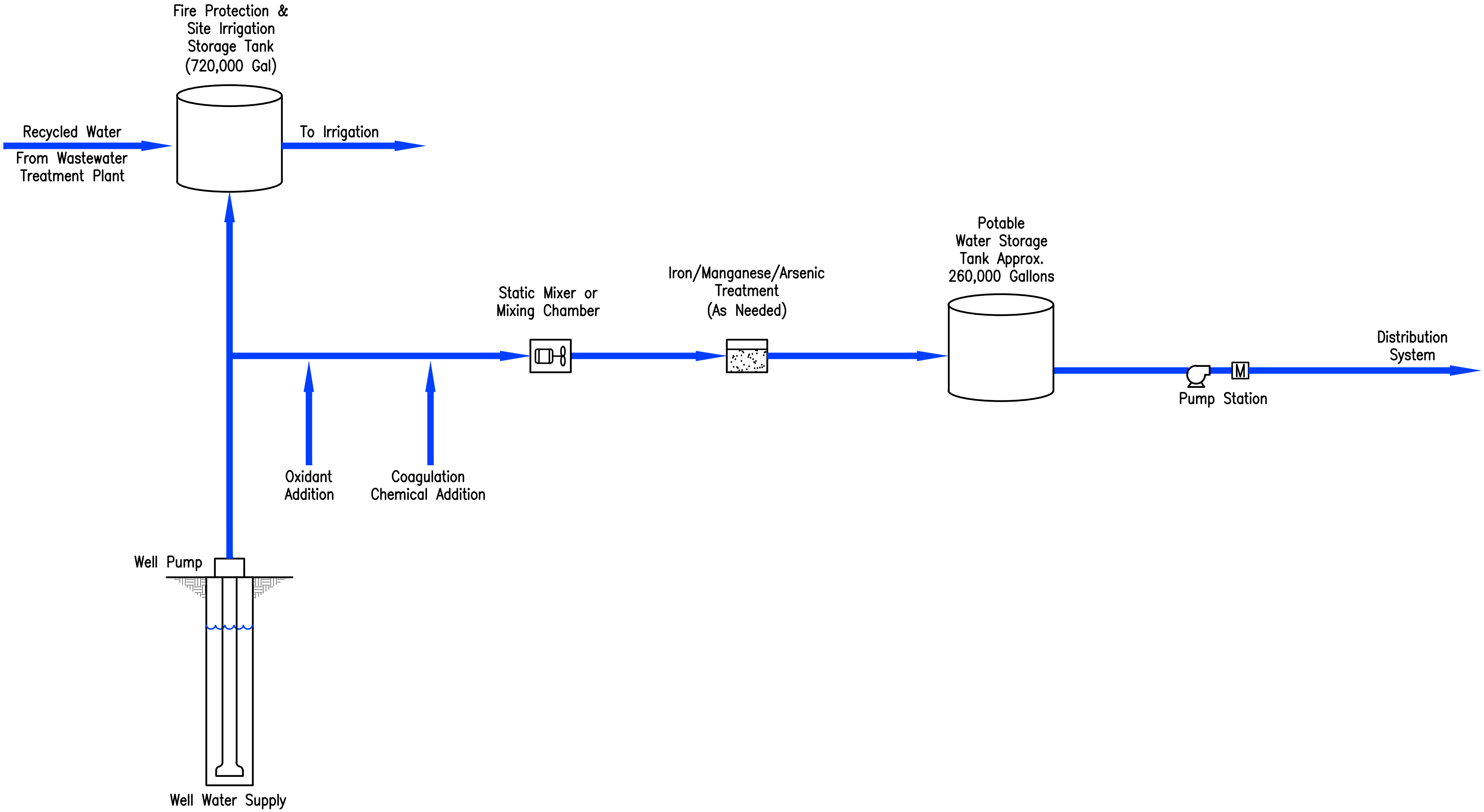

COLEMAN
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EXHIBIT 8

DRINKING WATER
PROCESS FLOW DIAGRAM

Appendix D

Geotechnical Report, Redding Rancheria Casino by Blackburn Consulting

GEOTECHNICAL REPORT
Redding Rancheria Casino

Redding, California

December 2019

Prepared for:

Coleman Engineering
1358 Blue Oaks Boulevard, Suite 200
Roseville, CA 95678

Prepared by:

blackburn consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603

Auburn Office:
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Geotechnical ▪ Geo-Environmental ▪ Construction Services ▪ Forensics

Blackburn File No. 3720.X
December 20, 2019

Coleman Engineering
Mr. Chad Coleman, P.E.
1358 Blue Oaks Boulevard, Suite 200
Roseville, CA 95678

Subject: **GEOTECHNICAL REPORT**
Redding Rancheria Casino
Redding, CA

Dear Mr. Coleman,

Blackburn Consulting (Blackburn) is pleased to submit this Geotechnical Report for the Redding Rancheria Casino Project (Project) in Redding, CA. Blackburn prepared this report in accordance with our September 19, 2019 Agreement.

In this report, we summarize the site geotechnical conditions, the results of our percolation tests, and geotechnical recommendations. We attach logs of our exploratory test pits, percolation test results, and laboratory test results.

Thank you for the opportunity to support your project. Please call if you have questions or require additional information.

Sincerely,

BLACKBURN CONSULTING

ROBERT C. PICKARD
No. 2508

Reviewed by:

THOMAS W. BLACKBURN
No. 2311

Rob Pickard, P.G., C.E.G.
Senior Engineering Geologist

Thomas W. Blackburn, P.E., G.E.
Senior Principal

Table of Contents

1 INTRODUCTION

1.1 Purpose

Blackburn Consulting (Blackburn) prepared this geotechnical report to evaluate a wastewater disposal system (on-site leach field and wastewater storage pond) at the proposed Redding Rancheria Casino in Redding, CA. This report describes surface and subsurface conditions and geotechnical design recommendations for the proposed wastewater disposal system.

Blackburn prepared this report for Coleman Engineering and the project design team to use during design and construction. Do not use or rely upon this report for different locations or improvements without Blackburn's written consent.

1.2 Scope of Services

To prepare this report, Blackburn:

- Reviewed available geologic/geotechnical information for the site.
- Discussed on-site wastewater treatment system site evaluation with Mr. Chad Coleman, PE (Coleman Engineering)
- Reviewed preliminary plans (October 20, 2008) and scope of services (August 30, 2019) prepared by Coleman Engineering
- Reviewed Shasta County requirements for septic tank and leach line design, construction, and installation.
- Observed the site subsurface conditions in 10 test pits excavated on October 21-22, 2019.
- Performed fifteen percolation tests within the proposed leach field and proposed storage pond on November 5-7, 2019.
- Performed laboratory tests on soil samples obtained from the exploratory test pits.
- Performed engineering analysis to develop our conclusions and recommendations.

1.3 Site Description

The proposed project is located between the Sacramento River and Interstate 5 on the south side of Redding, CA. Figure 1 – Vicinity Map shows the general site location.

The site is relatively level at an elevation ranging from approximately 443 to 456 feet and currently covered by grass and scattered trees.

1.4 Project Description

The construction of on-site wastewater treatment facilities will include:

- Approximately 46 acres for leach field.
- An approximately 15 acre, above ground, lined, winter storage pond (or a possible additional leach field area).

Figure 2 shows the planned leach field and storage pond.

2 GEOLOGIC CONDITIONS

2.1 General Site Geology

Published mapping[1] shows the site is underlain by Holocene alluvial deposits.

United States Department of Agriculture (USDA) online soil maps (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx) indicate the site is underlain by:

- Silty sand and clayey sand with lesser areas of lean clay, silt, and clayey gravel in the area of the leach field.
- Poorly graded sands and silty sands in the area of the proposed storage pond area.

3 SUBSURFACE CONDITIONS

3.1 Exploration Program

Test Pits

Blackburn retained Kelly Construction Company (Kelly) to excavate 10 test pits (TP-1 to TP-10) on October 21 and 22, 2019 to evaluate the subsurface conditions within the proposed leach field and storage pond areas. Kelly excavated the test pits to depths ranging from 10 to 15 feet below existing ground surface (bgs) using a John Deere 85G backhoe, equipped with a 2-foot wide bucket. Blackburn's project engineer, Mr. Luke Morrell, logged the test pits and obtained soil samples at various intervals for evaluation and laboratory testing. Kelly backfilled test pits with excavated soils. Mr. Morrell transported samples to our West Sacramento laboratory for testing and further classification. Figure 2 shows the test pit locations.

Percolation Borings

Blackburn's subcontractor, Ultra Fencing (Ultra), drilled 15 borings (B19-01 to B19-15) to a depth of 3 feet bgs on November 5, 2019 for percolation tests. Ultra drilled the borings using a Bobcat equipped with an 8-inch (outside diameter, O.D.) hollow stem auger. A post hole digger was used clean out loose material from the holes. Mr. Morrell, observed and logged the holes and collected representative samples. We chose the location of the percolation tests based on the planned leach field locations and the subsurface conditions encountered in our test pits. Section 5 discusses the percolation test method.

Figure 2 shows the percolation tests locations.

---

[1] Fraticelli, L,A, Albers, J.P., Irwin, W.P., Blake, M.C., Jr., and Wentworth, C.M., 2012, Digital geologic map of the Redding 1° x 2° quadrangle, Shasta, Tehama, Humboldt, and Trinity Counties, California: U.S. Geological Survey Open-File Report 2012-1228, scale 1:250,000

3.2 Soil Conditions

We observed the general soil conditions below. Refer to the test pit logs (Appendix A) and percolation logs and test results (Appendix B) for more specific subsurface conditions in each test pit/boring. Figure 2 identifies the soil layers encountered in the upper 5 feet in our test pits and borings.

Table 1: Soil Profile and Depth to Groundwater

Test Pit	Location	Soil Profile	Depth to Groundwater
TP-1	Leach Field	0-8.5 ft; dense* silty sand 8.5-11 ft; dense* poorly graded sand with gravel 11-13.5 ft; dense* poorly graded gravel with sand	12 ft
TP-2	Leach Field	0-10 ft; medium dense, silty sand 10-11.5 ft; dense* poorly graded sand with gravel	10.5 ft
TP-3	Leach Field	0-5.5 ft; dense* silty sand 5.5-8 ft; dense* poorly graded sand with gravel 8-12 ft; very dense* poorly graded gravel with sand	10 ft
TP-4	Leach Field	0-11.5 ft; dense* silty sand	8.5 ft
TP-5	Leach Field	0-6 ft; hard sandy lean clay 6-12 ft; very dense* clayey sand 12-14.5 ft; very dense* poorly graded sand with gravel	14.5 ft
TP-6	Leach Field	0-11 ft; hard sandy lean clay 11-15 ft; very dense* clayey sand	Not Encountered
TP-7	Leach Field	0-8 ft; medium dense* silty sand 8-10 ft; medium dense* poorly graded sand with gravel	10 ft
TP-8	Storage Pond	0-11 ft; medium dense* silty sand 11-14 ft; dense* poorly graded sand with gravel	13.5 ft
TP-9	Storage Pond	0-7 ft; dense* silty sand 7-14.5 ft; dense* clayey sand	14 ft
TP-10	Storage Pond	0-7 ft; dense* silty sand 7-14.5 ft; dense* clayey sand	Not Encountered

*Estimated soil consistency

3.3 Groundwater

We encountered groundwater in our test pit excavations at depths of approximately 8.5 to 14.5 feet bgs. Table 1 summarizes the groundwater levels in our test pits. The nearby Sacramento River generally controls site groundwater levels. Seasonally groundwater levels may be higher or lower than those recorded based on river levels, well pumping, and irrigation.

We did not encounter groundwater in our percolation test holes.

4 LABORATORY TESTS

We performed the following laboratory tests on representative soil samples from the exploratory test pits and percolation holes:

- Sieve Analysis for soil classification
- Remolded direct shear test to evaluate soil strength
- Modified proctor to determine maximum dry density of soils

Appendix C presents the laboratory test results.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 FIELD PERCOLATION TESTS

Blackburn performed percolation tests using the method described in *Shasta County Onsite Wastewater Treatment System Technical Guidance Manual.* Please refer to the manual for complete instructions. The method states:

- Excavate percolation holes to a depth of 36” in area of proposed disposal site. (Blackburn drilled an 8-inch diameter hole)
- After removing any loose material, place up to 2” of coarse sand or fine gravel into bottom of hole
- Pre-soak the percolation hole with clear water to at least 12” over the gravel. Add water as needed to keep water in the hole for at least 4 hours.
- Determine the percolation rate 24 hours after first adding water to the hole. In sandy soil, the percolation test may be conducted after water from one filling of the hole has seeped away.
- For testing, add water to bring the depth of water to 6” over the gravel. Measure the drop in water level at 30 minute intervals for 4 hours for clay or clayey soils, refilling to 6” over the gravel as necessary. Measure the drop in water level at 10 minute intervals for 1 hour for sandy soils.

Table 2 presents the percolation test results. Field test logs are included in Appendix B.

Table 2: Percolation Test Results*					
Percolation Test Number	**Improvement**	**Soil Classification**	**Test Date**	**Reading Interval**	**Calculated Infiltration Rate (Minutes/Inch)**
B19-01	Leach Field	GP	11/6/2019	Every 10mins for 60mins	5.21
B19-02	Leach Field	SM	11/6/2019	Every 30mins for 240mins	10.87
B19-03	Leach Field	SM	11/6/2019	Every 10mins for 60mins	6.94
B19-04	Leach Field	SM	11/6/2019	Every 10mins for 60mins	3.62
B19-05	Leach Field	SM	11/6/2019	Every 30mins for 240mins	10.87
B19-06	Leach Field	SM	11/7/2019	Every 30mins for 240mins	13.89
B19-07	Leach Field	SM	11/7/2019	Every 30mins for 240mins	14.71
B19-08	Leach Field	SM	11/7/2019	Every 10mins for 60mins	6.41
B19-09	Leach Field	SM	11/7/2019	Every 10mins for 60mins	6.41
B19-10	Leach Field	SC/CL	11/7/2019	Every 30mins for 240mins	27.78
B19-11	Leach Field	SC/CL	11/7/2019	Every 30mins for 240mins	35.71
B19-12	Leach Field	SC/CL	11/7/2019	Every 30mins for 240mins	27.78
B19-13	Storage Pond	SM	11/6/2019	Every 10mins for 60mins	5.56
B19-14	Storage Pond	SM	11/6/2019	Every 10mins for 60mins	10.42
B19-15	Storage Pond	SM	11/6/2019	Every 10mins for 60mins	2.53

* Blackburn performed percolation testing in each hole using the method described in *Shasta County Onsite Wastewater Treatment System Technical Guidance Manual.* Please refer to the manual for complete instructions.

Use the above percolation rates to design the system in accordance with Shasta County's Onsite Wastewater Treatment System Technical Guidance Manual and Septic Tank and Leach Line Design, Construction, and Installation Guidelines. Retain Blackburn to observe soil conditions exposed at the base of the excavations to confirm they are representative for the design infiltration rate.

5.2 STORAGE POND

The proposed storage pond area is primarily underlain by silty sands. The sands have a high infiltration rate (2.53 to 10.42 minutes/inch). Expect significant infiltration through the bottom and sidewalls/embankments of any pond constructed on and with the on-site native soils. The designer should consider lining the pond to minimize infiltration loss.

Excavated soils are suitable for embankment construction. Based on remolded direct shear tests of the silty sands we expect lined embankments constructed from on-site soils will be stable at slope angles of 3h:1v on both sides. Blackburn should perform further analysis and recommendations for:

- Embankment stability based on proposed slopes and geometries.
- Ground preparation.
- Embankment fill.
- Inlet/Outlet pipe installation.

5.3 CONSTRUCTION CONSIDERATIONS

Soils should be excavatable using typical excavation equipment. Some caving of trenches within the silty sand may occur.

On a preliminary basis, we generally anticipate that temporary excavation sloping and shoring for Type C soil requirements (Federal Register, 29 CFR, Part 1926, Subpart P; Occupational Safety and Health Standards – Excavations) will be adequate.

All excavations must be sloped, shored, and/or shielded in accordance with current Cal/OSHA requirements. The contractor is responsible for site safety, final excavation and shoring design (including OSHA soil type determinations) and construction, based on actual excavation conditions encountered during construction. The contractor is also responsible for the protection of existing facilities and improvements. The impact of construction traffic vibrations, actual soil conditions exposed in the open excavations, seepage and/or groundwater conditions, surcharges adjacent to excavations, proximity of excavations to existing structures, and other factors that may promote excavation wall instability or cause excavation related damage to existing facilities and improvements must be evaluated at the time of construction and excavation sloping/shoring methods adjusted accordingly.

We encountered some thin layers in our test pits that exhibited medium dry strength. These layers may have decreased percolation rates. Blackburn should review excavations for leach lines to evaluate the thickness and extent of these zones.

6 RISK MANAGEMENT

Our experience and that of our profession clearly indicates that the risks of costly design, construction, and maintenance problems can be significantly lowered by retaining the geotechnical engineer of record to provide services during design and construction. For this project, retain Blackburn to:

- Review and provide comments on the civil plans and specifications prior to construction.
- Monitor construction to check and document our report assumptions. At a minimum, Blackburn should observe leach line excavations and monitor grading and compaction, foundation excavations for embankment construction.
- Update this report if design changes occur, 2 years or more lapses between this report and construction, and/or site conditions have changed.

If we are not retained to perform the above applicable services, we are not responsible for any other party's interpretation of our report, and subsequent addendums, letters, and discussions.

7 LIMITATIONS

Blackburn performed services in accordance with generally accepted geotechnical engineering principles and practices currently used in this area. Where referenced, we used ASTM or Caltrans standards as a general (not strict) *guideline* only. We do not warranty our services.

This report is based on the current site conditions. We assumed the soil and groundwater conditions encountered in our borings are representative of the subsurface conditions across the site. Actual conditions between these locations could be different.

Our scope did not include evaluation of on-site hazardous material, flood potential, aerial photograph review, or biological pollutants. Please contact Blackburn if you would like an evaluation of one or more of these potential issues.

Appendix A presents our exploratory test pit logs. The lines designating the interface between soil types are approximate. The transition between soil types may be abrupt or gradual. Our recommendations are based on the final logs, which represent our interpretation of the field logs, laboratory test results, and general knowledge of the site and geological conditions.

Modern design and construction is complex, with many regulatory sources/restrictions, involved parties, construction alternatives, etc. It is common to experience changes and delays. The owner should set aside a reasonable contingency fund based on complexities and cost estimates to cover changes and delays.

Refer to Appendix D (Important Information about This Geotechnical Engineering Report, Geoprofessional Business Association, 2016) for additional limitations regarding this report.

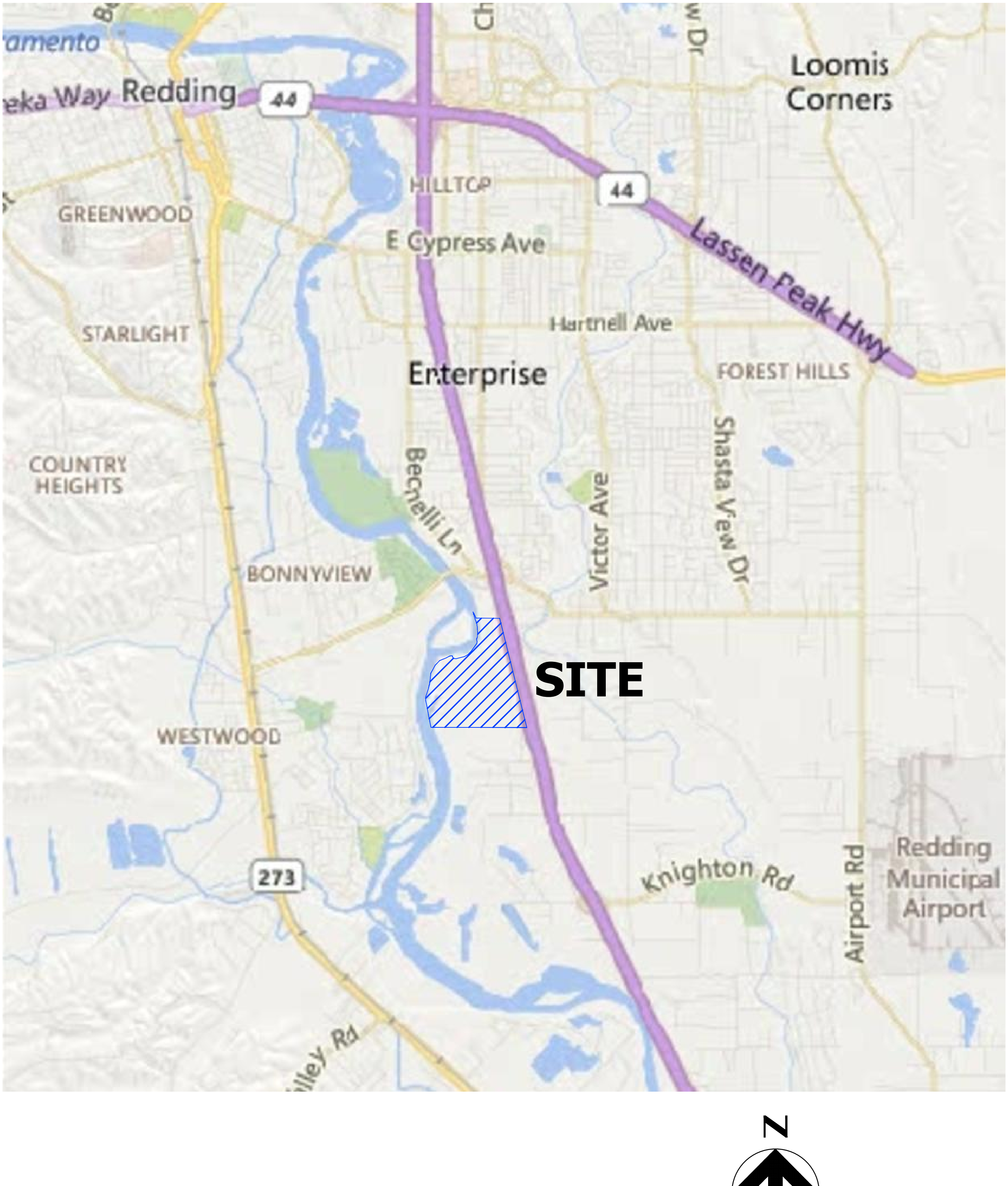
GEOTECHNICAL REPORT
Redding Rancheria Casino

Redding, California

December 2019

FIGURES

Vicinity Map
Site Plan



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CONSULTING

VICINITY MAP

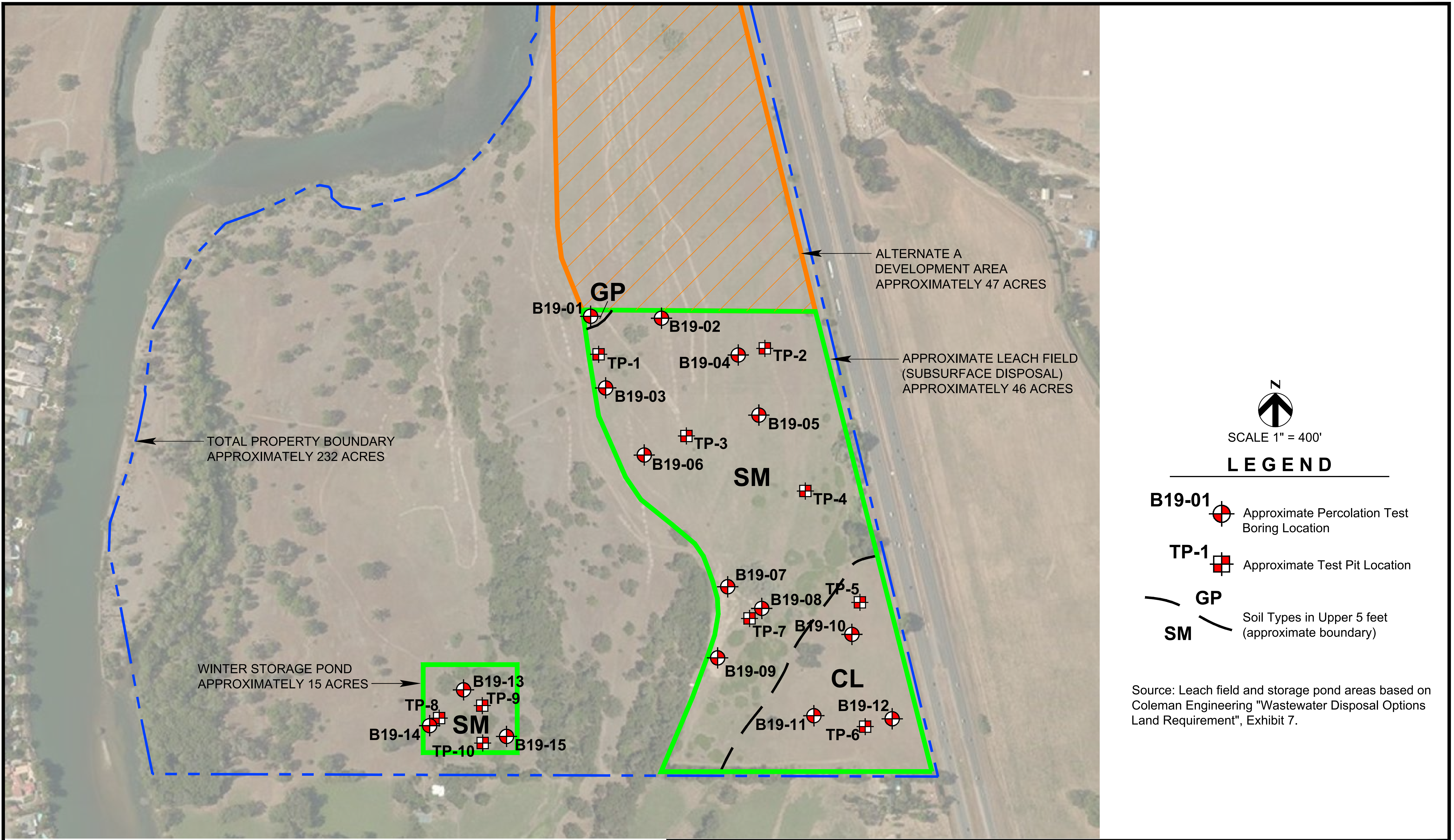
Redding Rancheria
Redding, California

File No. 3720.x

December 2019

Figure 1

12/17/2019 3720.x Fig1 Redding Rancheria.dwg



Source: Leach field and storage pond areas based on Coleman Engineering "Wastewater Disposal Options Land Requirement", Exhibit 7.

BLACKBURN CONSULTING

SITE MAP

Redding Rancheria
Redding, California

File No. 3720.x

December 2019

Figure 2

12/18/2019 3720.x Fig2 Redding Rancheria.dwg

GEOTECHNICAL REPORT
Redding Rancheria Casino

Redding, California

December 2019

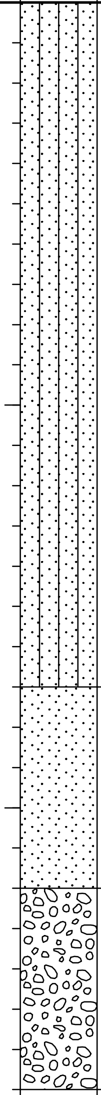
APPENDIX A

Test Pit Legend
Test Pit Logs

LOG OF TEST PIT TP-1

Date Excavated: 10-22-19 Logged by: LDM Depth to Water (ft): 12

Equipment: John Deere 85G, 24" Bucket Surface Elevation (ft): Water Reading Date: 10/22/2019



DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	SAMPLE NUMBER	POCKET PEN. (tsf)	DRY DENSITY (pcf)	MOISTURE (%)	FINES (%)	LIQUID LIMIT	PLASTICITY INDEX
		SILTY SAND (SM); (dense); strong brown; dry; very fine SAND; 20-30% fines								
1										
2										
3		Moist								
4				Bulk A						
5										
6										
7										
8		Some COBBLES, GRAVEL, BOULDERS								
9		Poorly Graded SAND with GRAVEL (SP); (dense); dark brown; moist; little COBBLES								
10		Some moderate cementation		Bulk B						
11		Poorly Graded GRAVEL with SAND (GP); (dense); grayish brown; moist; little COBBLES ▽								
12		Wet		Bulk C						
13										
14		Backfill with spoils Bulk A 0-8.5 ft Bulk B 8.5-11ft Bulk C 11-13.5 ft Groundwater encountered @ 12 ft bgs								
15										
16										
17										

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11521 Blocker Dr, Suite 110
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Redding Rancheria Casino

3720.X

LOG OF TEST PIT TP-2

Date Excavated: 10-21-19
Logged by: LDM
Depth to Water (ft): 10.5
Equipment: John Deere 85G, 24" Bucket
Surface Elevation (ft):
Water Reading Date: 10/21/2019

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	SAMPLE NUMBER	POCKET PEN. (tsf)	DRY DENSITY (pcf)	MOISTURE (%)	FINES (%)	LIQUID LIMIT	PLASTICITY INDEX
1 2 3 4 5 6 7 8 9		SILTY SAND (SM); (medium dense); strong brown; dry; 5-10% fines; very fine SAND; no to low dry strength with some medium dry strength seams Moist; fine SAND		Bulk A						
10 11		Poorly Graded SAND with GRAVEL (SP); (dense); grayish brown; wet; few 3-5" COBBLES ∇		Bulk B						
12 13 14		Backfill with spoils Bulk A 0-10 ft Bulk B 10-11.5 ft Groundwater encountered @ 10.5 ft bgs								

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Redding Rancheria Casino

3720.X

LOG OF TEST PIT TP-3

Date Excavated: 10-21-19
Logged by: LDM
Depth to Water (ft): 10
Equipment: John Deere 85G, 24" Bucket
Surface Elevation (ft):
Water Reading Date: 10/21/2019

DEPTH (feet)	MATERIAL DESCRIPTION	SAMPLE	SAMPLE NUMBER	POCKET PEN. (tsf)	DRY DENSITY (pcf)	MOISTURE (%)	FINES (%)	LIQUID LIMIT	PLASTICITY INDEX
	SILTY SAND (SM); (dense); strong brown; moist; 10-15% fines; very fine SAND; no to low dry strength with some medium dry strength seams								
1									
2									
3			Bulk A						
4									
5									
6	Poorly Graded SAND with GRAVEL (SP); (dense); strong brown; moist; medium to coarse GRAVEL; approximately 3-6" COBBLES								
7			Bulk B						
8									
9	Poorly Graded GRAVEL with SAND (GP); (very dense); grayish brown; wet; medium to coarse GRAVEL; COBBLES; trace BOULDERS								
10	∇		Bulk C						
11	Some COBBLES; BOULDERS								
12	Backfill with spoils Bulk A 0-5.5 ft Bulk B 5.5-8 ft Bulk C 8-12 ft Groundwater encountered @ 10 ft bgs								
13									
14									

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Redding Rancheria Casino

3720.X

LOG OF TEST PIT TP-4

Date Excavated: 10-21-19
Logged by: LDM
Depth to Water (ft): 8.5
Equipment: John Deere 85G, 24" Bucket
Surface Elevation (ft):
Water Reading Date: 10/21/2019

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	SAMPLE NUMBER	POCKET PEN. (tsf)	DRY DENSITY (pcf)	MOISTURE (%)	FINES (%)	LIQUID LIMIT	PLASTICITY INDEX
		SILTY SAND (SM); (dense); strong brown; moist; fine SAND; no to low dry strength with some medium dry strength seams								
1										
2										
3										
4				Bulk A						
5		Very moist								
6										
7										
8		Some COBBLES; GRAVEL; few 12-14" BOULDERS; wet ▽								
9										
10				Bulk B						
11										
12		Backfill with spoils Bulk A 0-8 ft Bulk B 8-11.5 ft Groundwater encountered @ 8.5 ft bgs								
13										
14										

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Redding Rancheria Casino

3720.X

LOG OF TEST PIT TP-5

Date Excavated: 10-21-19 Logged by: LDM Depth to Water (ft): 14.5

Equipment: John Deere 85G, 24" Bucket Surface Elevation (ft): Water Reading Date: 10/21/2019

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	SAMPLE NUMBER	POCKET PEN. (tsf)	DRY DENSITY (pcf)	MOISTURE (%)	FINES (%)	LIQUID LIMIT	PLASTICITY INDEX
		SANDY Lean CLAY (CL); hard; dark yellowish brown; dry; fine SAND			4.5+					
1										
2										
3		Moist		Bulk A						
4										
5										
6		CLAYEY SAND (SC); (very dense); dark yellowish brown; moist; fine SAND; 30-40% fines								
7										
8		Few 3-6" COBBLES								
9				Bulk B						
10										
11										
12		Poorly GRADED SAND with GRAVEL (SP); (very dense); strong brown; moist; some fines; some COBBLES								
13				Bulk C						
14		▽								
15		Backfill with spoils Bulk A 0-6 ft Bulk B 6-12 ft Bulk C 12-14.5 ft Groundwater encountered @ 14.5 ft bgs								
16										
17										

LOG OF TEST PIT TP-6

Date Excavated: 10-21-19 Logged by: LDM Depth to Water (ft): Not encountered

Equipment: John Deere 85G, 24" Bucket Surface Elevation (ft): Water Reading Date: 10/21/2019

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	SAMPLE NUMBER	POCKET PEN. (tsf)	DRY DENSITY (pcf)	MOISTURE (%)	FINES (%)	LIQUID LIMIT	PLASTICITY INDEX
	▨	SANDY Lean CLAY (CL); hard; strong brown; dry; 20% very fine SAND								
1	▨				4.5+					
2	▨									
3	▨			Bulk A						
4	▨									
5	▨	Moist								
6	▨	Increasing SAND content								
7	▨									
8	▨			Bulk B						
9	▨									
10	▨									
11	▨	CLAYEY SAND (SC); (very dense); dark yellowish brown to grayish brown; moist; very fine SAND; some strong cementation								
12	▨									
13	▨			Bulk C						
14	▨	Few COBBLES; very moist								
15		Backfill with spoils Bulk A 0-6 ft Bulk B 6-11 ft Bulk C 11-15 ft No groundwater encountered								
16										
17										

LOG OF TEST PIT TP-7

Date Excavated: 10-21-19
Logged by: LDM
Depth to Water (ft): 9
Equipment: John Deere 85G, 24" Bucket
Surface Elevation (ft):
Water Reading Date: 10/21/2019

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	SAMPLE NUMBER	POCKET PEN. (tsf)	DRY DENSITY (pcf)	MOISTURE (%)	FINES (%)	LIQUID LIMIT	PLASTICITY INDEX
		Poorly Graded SAND (SP); (medium dense); dark yellowish brown; dry; very fine SAND								
1										
2										
3										
4				Bulk A						
5										
6		Moist								
7		Fine to medium SAND; yellowish brown and black								
8		Poorly Graded SAND with GRAVEL (SP); (medium dense); grayish black; wet; 15% fine GRAVEL								
9		▽		Bulk B						
10		Backfill with spoils Bulk A 0-8 ft Bulk B 8-10 ft Groundwater encountered @ 10 ft bgs								
11										
12										
13										
14										

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Auburn, CA 95603
Phone: (530) 887-1494 Fax: (530) 887-1495

Redding Rancheria Casino

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LOG OF TEST PIT TP-8

Date Excavated: 10-22-19
Logged by: LDM
Depth to Water (ft): 13.5
Equipment: John Deere 85G, 24" Bucket
Surface Elevation (ft):
Water Reading Date: 10/22/2019

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	SAMPLE NUMBER	POCKET PEN. (tsf)	DRY DENSITY (pcf)	MOISTURE (%)	FINES (%)	LIQUID LIMIT	PLASTICITY INDEX
		SILTY SAND (SM); (medium dense); strong brown; dry; fine SAND						24		
1										
2				Bulk A						
3		Moist								
4										
5		Increasing fine content								
6										
7										
8				Bulk B						
9										
10										
11		Poorly Graded SAND with GRAVEL (SP); (dense); dark brown; moist; 3-9" COBBLES								
12				Bulk C						
13		∇								
14		14" BOULDER; wet								
		Backfill with spoils Bulk A 0-5 ft Bulk B 5-11 ft Bulk C 11-14 ft Groundwater encountered @ 13.5 ft bgs								
15										
16										
17										

LOG OF TEST PIT TP-9

Date Excavated: 10-22-19
Logged by: LDM
Depth to Water (ft): 14
Equipment: John Deere 85G, 24" Bucket
Surface Elevation (ft):
Water Reading Date: 10/22/2019

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	SAMPLE NUMBER	POCKET PEN. (tsf)	DRY DENSITY (pcf)	MOISTURE (%)	FINES (%)	LIQUID LIMIT	PLASTICITY INDEX
		SILTY SAND (SM); (dense); strong brown; dry; fine SAND						22		
1										
2										
3		Moist		Bulk A						
4										
5										
6										
7		CLAYEY SAND (SC); (dense); dark brown; moist; very fine SAND; 20-30% fines								
8				Bulk B						
9		Some roots								
10		Increasing SAND content								
11										
12				Bulk C						
13		Fine to medium SAND								
14		▽ GRAVEL; COBBLES								
15		Backfill with spoils Bulk A 0-7 ft Bulk B 7-10 ft Bulk C 10-14.5 ft Groundwater encountered @ 14 ft bgs								
16										
17										

TEST PIT LOG (1/PAGE) LIBRARY_NEW TEMPLATE.GPJ AUBURN THE LIBRARY_2016.GLB 12/20/19

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Redding Rancheria Casino

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LOG OF TEST PIT TP-10

Date Excavated: 10-22-19
Logged by: LDM
Depth to Water (ft): Not encountered

Equipment: John Deere 85G, 24" Bucket
Surface Elevation (ft):
Water Reading Date: 10/22/2019

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	SAMPLE NUMBER	POCKET PEN. (tsf)	DRY DENSITY (pcf)	MOISTURE (%)	FINES (%)	LIQUID LIMIT	PLASTICITY INDEX
		SILTY SAND (SM); (dense); strong brown; dry; very fine SAND; 5-10% fines						26		
1										
2										
3				Bulk A						
4		Moist								
5										
6										
7		CLAYEY SAND (SC); (dense); dark brown; dry; fine SAND; 20-30% fines								
8										
9		Some roots		Bulk B						
10										
11		Increasing fines content								
12		12-14" BOULDER		Bulk C						
13										
14										
15		Backfill with spoils Bulk A 0-7 ft Bulk B 7-11 ft Bulk C 11-14.3 ft No groundwater encountered								
16										
17										

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Redding Rancheria Casino

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UNIFIED SOIL CLASSIFICATION (ASTM D 2487)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS <5% FINES	$Cu \geq 4$ AND $1 \leq Cc \leq 3$	GW	WELL-GRADED GRAVEL
			$Cu < 4$ AND/OR $1 > Cc > 3$	GP	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR MH	GM	SILTY GRAVEL
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL
	SANDS <50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN SANDS <5% FINES	$Cu \geq 6$ AND $1 \leq Cc \leq 3$	SW	WELL-GRADED SAND
			$Cu < 6$ AND/OR $1 > Cc > 3$	SP	POORLY-GRADED SAND
		SANDS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR MH	SM	SILTY SAND
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT <50	INORGANIC	PI>7 AND PLOTS ON OR ABOVE "A" LINE	CL	LEAN CLAY
			PI>4 AND PLOTS BELOW "A" LINE	ML	SILT
		ORGANIC	LL (oven dried)<0.75/LL (not dried)	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT >50	INORGANIC	PI PLOTS ON OR ABOVE "A" LINE	CH	FAT CLAY
			PI PLOTS BELOW "A" LINE	MH	ELASTIC SILT
		ORGANIC	LL (oven dried)<0.75/LL (not dried)	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK COLOR, ORGANIC ODOR		PT	PEAT

NOTE: $Cu=D_{60}/D_{10}$

$Cc=(D_{30})^2/ D_{10} xD_{60}$

BLOW COUNT

The number of blows of a 140-lb. hammer falling 30-inches required to drive the sampler the last 12-inches of an 18-inch drive. The notation 50/4 indicates 4-inches of penetration achieved in 50 blows.

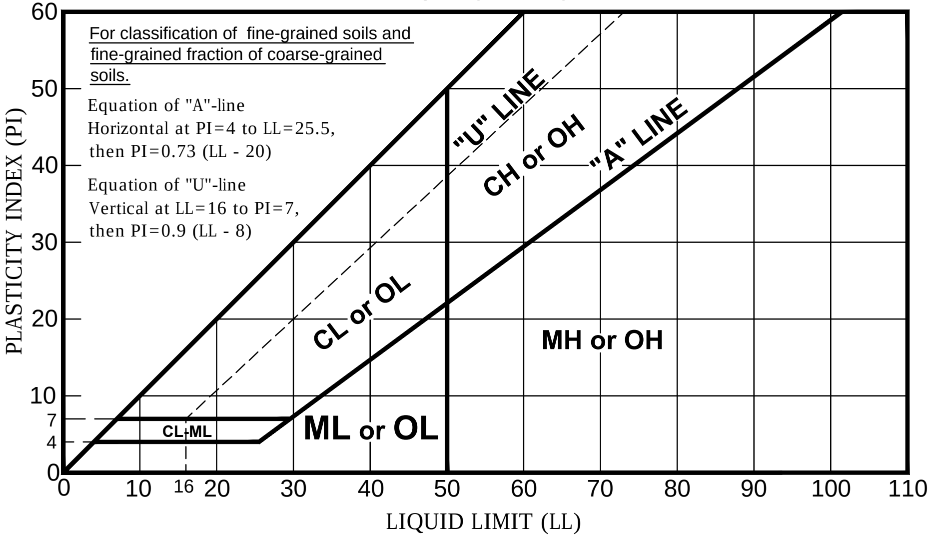
SAMPLE TYPES

▯	Auger or backhoe cuttings	⧓	Modified California
■	Shelby tube	‖	Rock core
⊠	Standard Penetration (SPT)		

ADDITIONAL TESTS

C	- Consolidation
CP	- Compaction Curve
CR	- Corrosivity Testing
CU	- Consolidated Undrained Triaxial
DS	- Direct Shear
EI	- Expansion Index
P	- Permeability
PA	- Partical Size Analysis
PI	- Plasticity Index
PP	- Pocket Penetrometer
R	- R-Value
SE	- Sand Equivalent
SG	- Specific Gravity
SL	- Shrinkage Limit
SW	- Swell Potential
TV	- Pocket Torvane Shear Test
UC	- Unconfined Compression
UU	- Unconsolidated Undrained Triaxial

PLASTICITY CHART



GROUND WATER LEVELS

▼ Later water level after drilling

▽ Water level at time of drilling

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BORING LOG / TEST PIT
LEGEND AND SOIL DESCRIPTIONS

GEOTECHNICAL REPORT
Redding Rancheria Casino

Redding, California

December 2019

APPENDIX B

Percolation Logs and Test Results

SHASTA COUNTY DEPARTMENT OF RESOURCE MANAGEMENT
ENVIRONMENTAL HEALTH DIVISION

Land Use Percolation Test

Parcel/Lot #__________

Date: 11/6/19

operty Owner: Redding Rancheria Casino

Weather: Sunny/Warm

Location: 5186 Bechelli Ln, Redding, CA

Performed by: LDM

	Number of Fillings	Time of Measurement	Water Level From Surface	Drop In Water Level	Comments & Observations
Hole No: B19-01	2/1	0	1.82'	0	
Depth: 3' / 2.65'		10	2.11	0.29'	
Diameter or size: 8in 1.4'	Water	20/20	2.31/1.90	0.19'	Hole collapsing
Pre-soak start time: 8:30AM		30	2.10	0.20	
Soaked overnight? y		40	2.26	0.16	
Location:		50	2.39	0.07	
Remarks: GP w/SAND; tree; brwn; dry		60	2.55	0.16'	
Results: 5.21 minutes/inch					
Hole No: B19-02	3/1	0	1.90'	0	
Depth: 3' /2.7'		30	2.26	0.36'	
Diameter or size: 8in 0.95'	Water	1hr/1	2.58/2.07	0.32'	
Pre-soak start time: 9:00		1.5	2.32	0.25'	
Soaked overnight?	water	2/2	2.56/2.17	0.24	**Comments & Observations**
Location:		2.5	2.46	0.29	
Remarks: [redacted] SM	water	3/3	2.65/1.98	0.15	
		3.5	2.30	0.32	
Results: 10.87 minutes/inch		4	2.53	0.23	
Hole No: B19-03	1/1	0	2.04'	0	
Depth: 3' / 2.85'		10	2.30	.26'	
Diameter or size: 8in 0.95'		20	2.51	0.21	
Pre-soak start time: 9:15		30	2.63	0.12	
Soaked overnight? y	Water	40/40	2.73/2.35	0.10	
Location:		50	2.46	0.09	
Remarks: [redacted] SM		60	2.58	0.12'	
Results: 6.94 minutes/inch					

I hereby certify under penalty of perjury that these data are true and correct, and that correct test procedures have been followed.

SHASTA COUNTY DEPARTMENT OF RESOURCE MANAGEMENT
ENVIRONMENTAL HEALTH DIVISION

Land Use Percolation Test

Parcel/Lot #__________

Date: 11/6/19

Property Owner: Redding Rancheria Casino

Weather: Sunny/Warm

Location: 5186 Bechelli Ln, Redding, CA

Performed by: LDM

	Number of Fillings	Time of Measurement	Water Level From Surface	Drop In Water Level	Comments & Observations
Hole No: B19-04	3.25/1	0	2.16'	0'	
Depth: 3'		10	2.35	0.19'	
Diameter or size: 8" 0.9'		20	2.52	0.17	
Pre-soak start time: 12:50	water	30/30	2.69/2.08	0.17	
Soaked overnight? y		40	2.32	0.24	
Location:		50	2.57	0.25	
Remarks: ~~[illegible]~~ SM		60	2.80	0.23'	
Results: 3.62 minutes/inch					
Hole No: B19-05	3.25/1	0	2.27	0	
Depth: 3.1'		30	2.60	0.33'	
Diameter or size: 8"	water	1.0/1	2.80/2.22	0.20'	
Pre-soak start time: 12:35		1.5	2.51	0.29'	
Soaked overnight? y	water	2/2	2.72/2.12	0.21'	Comments & Observations
Location:		2.5	2.36	0.24'	
Remarks: ~~[illegible]~~ SM	water	3/3	2.63/2.14	0.27'	
		3.5	2.39	0.25'	
Results: 10.87 minutes/inch		4	2.62	0.23'	
Hole No: B19-					
Depth: 3'					
Diameter or size: 8"					
Pre-soak start time:					
Soaked overnight?					
Location:					
Remarks:					
Results: minutes/inch					

I hereby certify under penalty of perjury that these data are true and correct, and that correct test procedures have been followed.

____

SHASTA COUNTY DEPARTMENT OF RESOURCE MANAGEMENT
ENVIRONMENTAL HEALTH DIVISION

Land Use Percolation Test

Parcel/Lot #

Date: 11/7/19

Property Owner: Redding Rancheria Casino

Weather: Sunny/Warm

Location: 5186 Bechelli Ln, Redding, CA

Performed by: LDM

	Number of Fillings	Time of Measurement	Water Level From Surface	Drop In Water Level	Comments & Observations
Hole No: B19-06	3	0	2.22'	0	
Depth: ~~8in~~ 3.1'/3'		30	2.58	0.36'	
Diameter or size: 8in 0.9'	water	60/60	2.76/2.23	0.18'	
Pre-soak start time: 9:40		1.5hr	2.47	0.24'	
Soaked overnight? y		2	2.68	0.21'	
Location:		2.5	2.77	0.09	
Remarks: [redacted] SM	water	3/3	2.91/2.16	0.14	
		3.5	2.40	0.24	
Results: 13.89 minutes/inch		4	2.58	0.18'	
Hole No: B19-07	3	0	2.53	0	
Depth: 3'/3'	water	30/30	2.83/2.42	0.30	
Diameter or size: 8in 0.9'		1hr	2.69	0.27	
Pre-soak start time: 10:00	water	1.5/1.5	2.89/2.44	0.20	
Soaked overnight? y		2	2.68	0.24	**Comments & Observations**
Location:	water	2.5/2.5	2.87/2.19	0.19	
Remarks: [redacted] SM		3	2.47	0.28	
		3.5	2.67	0.20	
Results: 14.71 minutes/inch		4	2.84	0.17	
Hole No: B19-08	2	0	2.17	0	
Depth: 3'/2.8'		10	2.39	0.22	
Diameter or size: 8in 0.9'	water	20/20	2.57/2.10	0.18	
Pre-soak start time: 10:20		30	2.30	0.20	
Soaked overnight? y	water	40/40	2.44/2.20	0.14	
Location:		50	2.42	0.22	
Remarks: [redacted] SM		60	2.55	0.13	
Results: 6.41 minutes/inch					

I hereby certify under penalty of perjury that these data are true and correct, and that correct test procedures have been followed.

SHASTA COUNTY DEPARTMENT OF RESOURCE MANAGEMENT
ENVIRONMENTAL HEALTH DIVISION

Land Use Percolation Test

Parcel/Lot #__________

Date: 1/7/19

operty Owner: Redding Rancheria Casino

Weather: Sunny/Warm

Location: 5186 Bechelli Ln, Redding, CA

Performed by: LDM

	Number of Fillings	Time of Measurement	Water Level From Surface	Drop In Water Level	Comments & Observations
Hole No: B19-09	3/1	0	2.29'	0'	
Depth: 3' /3'	water	30 / 10	2.96/2.86	0.67'	
Diameter or size: 8" 0.9'		60	2.88	0.52'	
Pre-soak start time: 10:40		0	2.38	0	
Soaked overnight? y		10	2.58	0.20	
Location:		20	2.72	0.14	
Remarks: 5M	water	30/30	2.87/2.23	0.15'	
		40	2.43	0.20	
Results: 6.41		50	2.58	0.15	
minutes/inch		60	2.71	0.13'	
Hole No: B19-					
Depth: 3'					
Diameter or size: 8"					
Pre-soak start time:					Comments & Observations
Soaked overnight?					
Location:					
Remarks:					
Results: minutes/inch					
Hole No: B19-					
Depth: 3'					
Diameter or size: 8"					
Pre-soak start time:					
Soaked overnight?					
Location:					
Remarks:					
Results: minutes/inch					

I hereby certify under penalty of perjury that these data are true and correct, and that correct test procedures have been followed.

SHASTA COUNTY DEPARTMENT OF RESOURCE MANAGEMENT
ENVIRONMENTAL HEALTH DIVISION

Land Use Percolation Test

Parcel/Lot #____________

Date: 11/7

uperty Owner: Redding Rancheria Casino

Weather: Sunny/Warm

Location: 5186 Bechelli Ln, Redding, CA

Performed by: LDM

	Number of Fillings	**Time of Measurement**	**Water Level From Surface**	**Drop In Water Level**	**Comments & Observations**
Hole No: B19-10	2.5/1	0	2.21'	0	
Depth: 3' 3.1'/3'		30	2.48	0.27'	
Diameter or size: 8" 0.9'		1hr	2.58	0.10'	
Pre-soak start time: 12:15		1.5	2.69	0.11	
Soaked overnight? y	water	2/2	2.78/2.30	0.09	
Location:		2.5	2.42	0.06	
Remarks: SC/CL		3	2.53	0.09	
		3.5	2.65	0.12	
Results:		4	2.74	0.09	
minutes/inch					
Hole No: B19-11	2.5/1	0	2.35	0'	
Depth: 3' 3.1 /2.95'		30	2.50	0.15'	
Diameter or size: 8" 0.95'		60	2.60	0.10	
Pre-soak start time: 11:50		1.5hr	2.70	0.10	
Soaked overnight? y	water	2hr/2	2.78/2.60	0.08	**Comments & Observations**
Location:		2.5	2.66	0.06	
Remarks: SC/CL		3	2.74	0.08	
		3.5	2.81	0.07	
Results: minutes/inch		4	2.88	0.07	
Hole No: B19-12		0	2.21'	0	
Depth: 3' 3.1'/3'		30	2.48	0.27'	
Diameter or size: 8" 0.9'		1hr	2.58	0.10'	
Pre-soak start time: 12.07		1.5	2.69	0.09	
Soaked overnight? y		2/2	2.78/2.34	0.09	
Location:		2.5	2.42	0.06	
Remarks: SC/CL		3	2.53	0.11	
		3.5	2.65	0.12	
Results: minutes/inch		4	2.74	0.09'	

I hereby certify under penalty of perjury that these data are true and correct, and that correct test procedures have been followed.

____

Rev 7/2018

SHASTA COUNTY DEPARTMENT OF RESOURCE MANAGEMENT
ENVIRONMENTAL HEALTH DIVISION

Land Use Percolation Test

Parcel/Lot #

Date: 11/6/19

operty Owner: Redding Rancheria Casino

Weather: Sunny/Warm

Location: 5186 Bechelli Ln, Redding, CA

Performed by: LDM

	Number of Fillings	Time of Measurement	Water Level From Surface	Drop In Water Level	Comments & Observations
Hole No: B19-13	1/1	0	2.12'	0	
Depth: 3'		10	2.41	0.29'	
Diameter or size: 0.9'	water	20/20	2.61/2.10	0.20	
Pre-soak start time: 11:15		30	2.49	0.21	
Soaked overnight? y	water	40/40	2.66/2.36	0.17	
Location: 11/6/19		50	2.56	0.20	
Remarks: SM Loose		60	2.71	0.15	
Results: 5.56 minutes/inch					
Hole No: B19-14	1/1	0	2.03'	0	
Depth: 3' / 3'		10	2.28	0.25'	
Diameter or size: 1'		20	2.44	0.16	
Pre-soak start time: 11:30		30	2.57	0.13	**Comments & Observations**
Soaked overnight? y		40	2.67	0.10	
Location: 11/6		50	2.76	0.09	
Remarks: SM		60	2.84	0.08	
Results: 10.42 minutes/inch					
Hole No: B19-15	1/1	0	2.32'	0	Hole collapsing
Depth: 3' /2.9'	water	10/15	2.65/2.07'	0.33'	
Diameter or size: 1'		15/20	2.15/2.47	0.40'	
Pre-soak start time: 10:55	water	30/30	2.73/2.12	0.30	
Soaked overnight? y	water	40/45	2.51/2.68	0.39'	
Location: 11/6		45	2.14	—	
Remarks: SM Loose		50	2.34	0.37	
		60	2.67	0.33'	
Results: 2.53 minutes/inch					

I hereby certify under penalty of perjury that these data are true and correct, and that correct test procedures have been followed.

Rev 7/2018

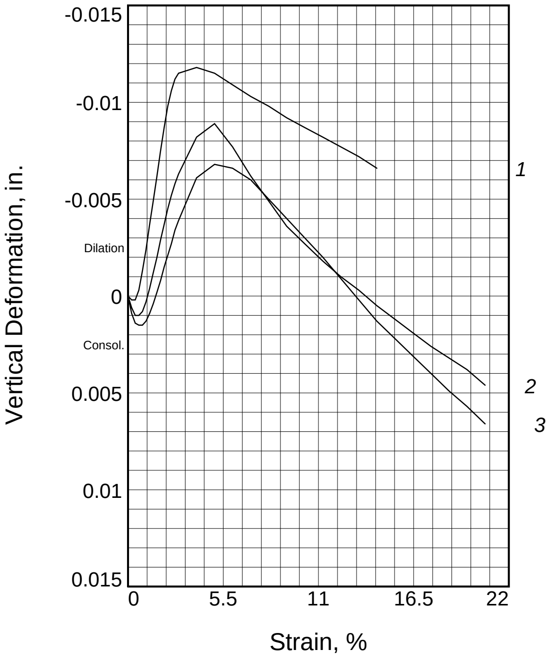
GEOTECHNICAL REPORT
Redding Rancheria Casino

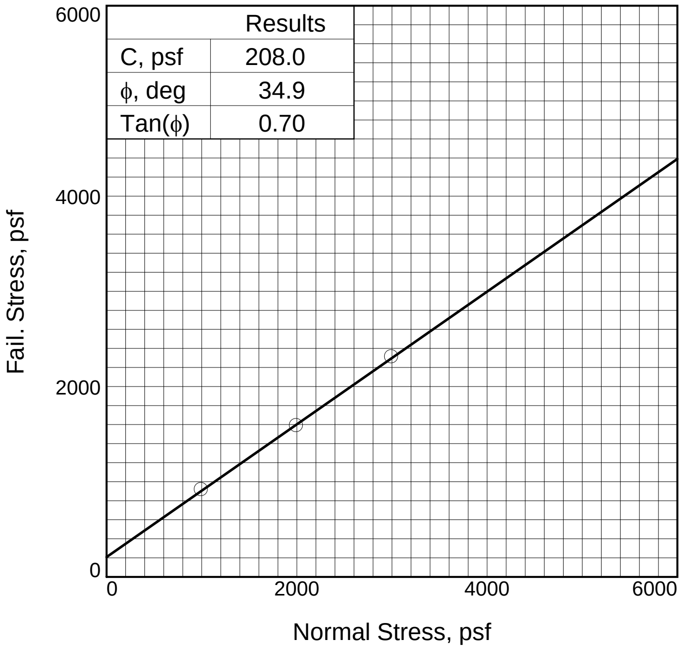
Redding, California

December 2019

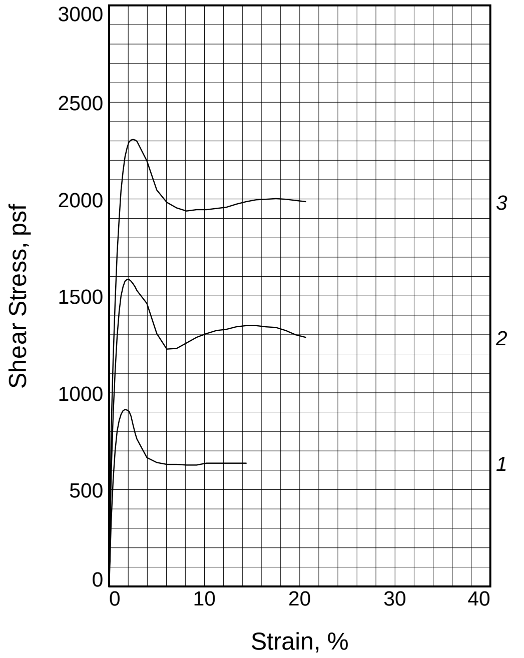
APPENDIX C

Laboratory Test Results





Results	
C, psf	208.0
ϕ, deg	34.9
Tan(ϕ)	0.70



	Sample No.	1	2	3
Initial	Water Content, %	17.0	17.0	17.0
	Dry Density, pcf	99.6	98.3	99.8
	Saturation, %	66.4	64.3	66.7
	Void Ratio	0.6915	0.7142	0.6884
	Diameter, in.	2.400	2.400	2.400
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	24.8	24.5	23.4
	Dry Density, pcf	100.4	100.4	103.3
	Saturation, %	98.6	97.4	100.0
	Void Ratio	0.6791	0.6785	0.6317
	Diameter, in.	2.400	2.400	2.400
	Height, in.	0.993	0.979	0.966
	Normal Stress, psf	1000.0	2000.0	3000.0
	Fail. Stress, psf	913.5	1585.2	2307.7
	Strain, %	1.7	2.1	2.5
	Ult. Stress, psf			
	Strain, %			
	Strain rate, in./min.	0.005	0.005	0.005

Sample Type: 2.4" Remold

Description: SILTY SAND, yellowish brown

Assumed Specific Gravity= 2.7

Remarks:

Figure ________

Client: Coleman Engineering

Project: Redding Rancheria

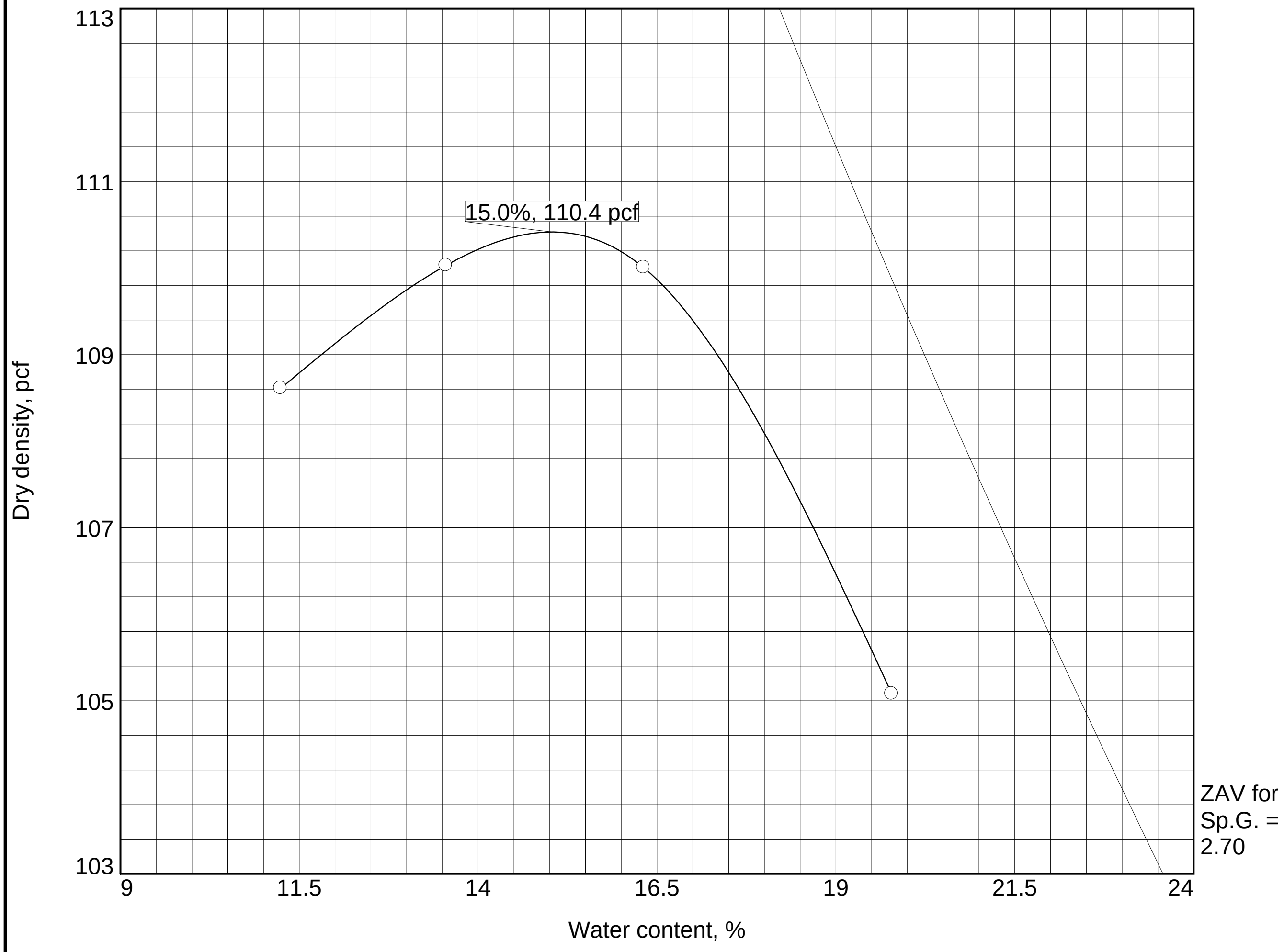
Source of Sample: TP-9 **Depth:** 0-7'

Sample Number: Bulk A

Proj. No.: 3720.X **Date Sampled:**

DIRECT SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified, manual rammer, wet prep method

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
0-7'	SM			2.7			0	22

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 110.4 pcf Optimum moisture = 15.0 %	SILTY SAND, yellowish brown

Project No. 3720.X **Client:** Coleman Engineering
Project: Redding Rancheria

○**Source of Sample:** TP-9 **Sample Number:** Bulk A

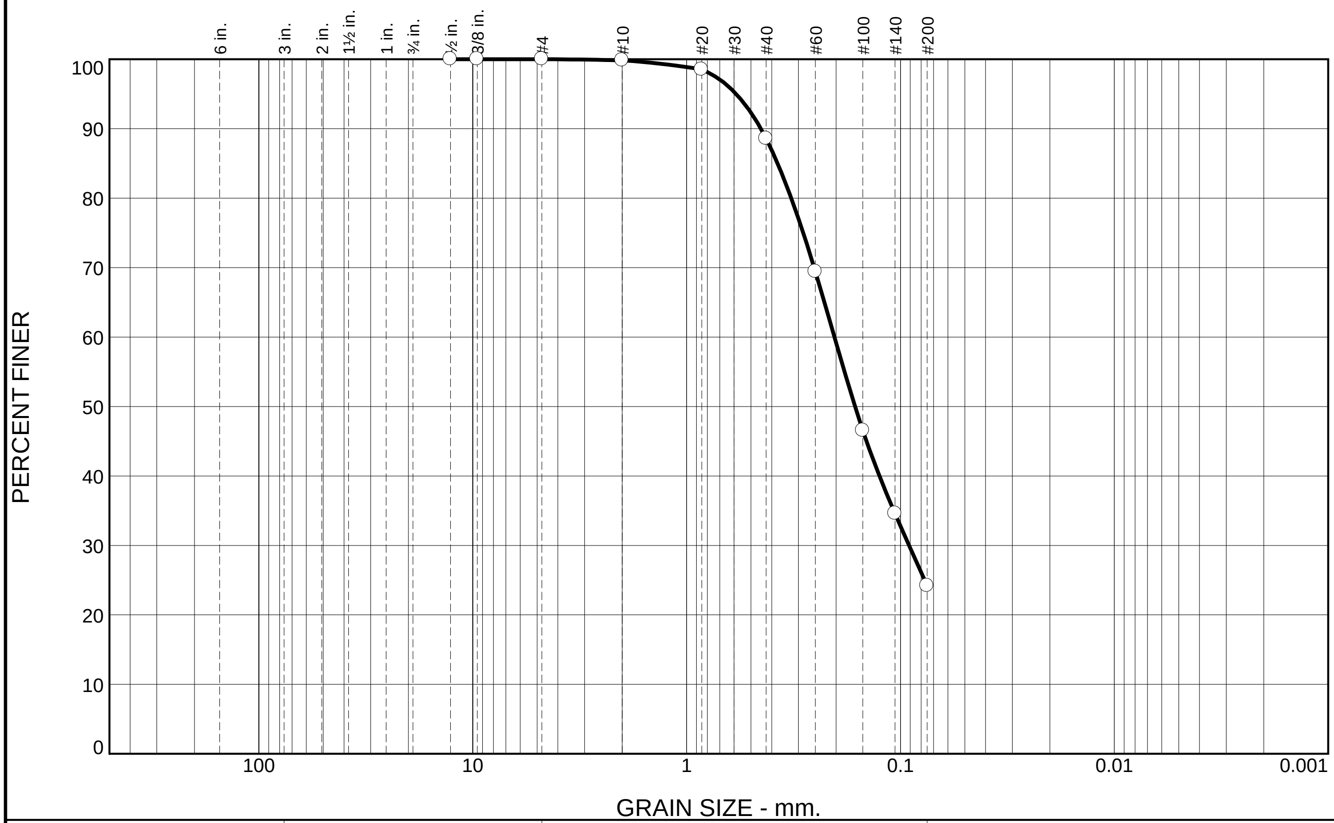
Remarks:

Blackburn Consulting

W. Sacramento, CA

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	11	65	24	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100		
3/8"	100		
#4	100		
#10	100		
#20	99		
#40	89		
#60	69		
#100	47		
#140	35		
#200	24		

* (no specification provided)

Material Description

SILTY SAND, yellowish brown

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4497 D_{85}= 0.3754 D_{60}= 0.2036
D_{50}= 0.1631 D_{30}= 0.0912 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: TP-8 **Depth:** 0-5'
Sample Number: Bulk A **Date:**

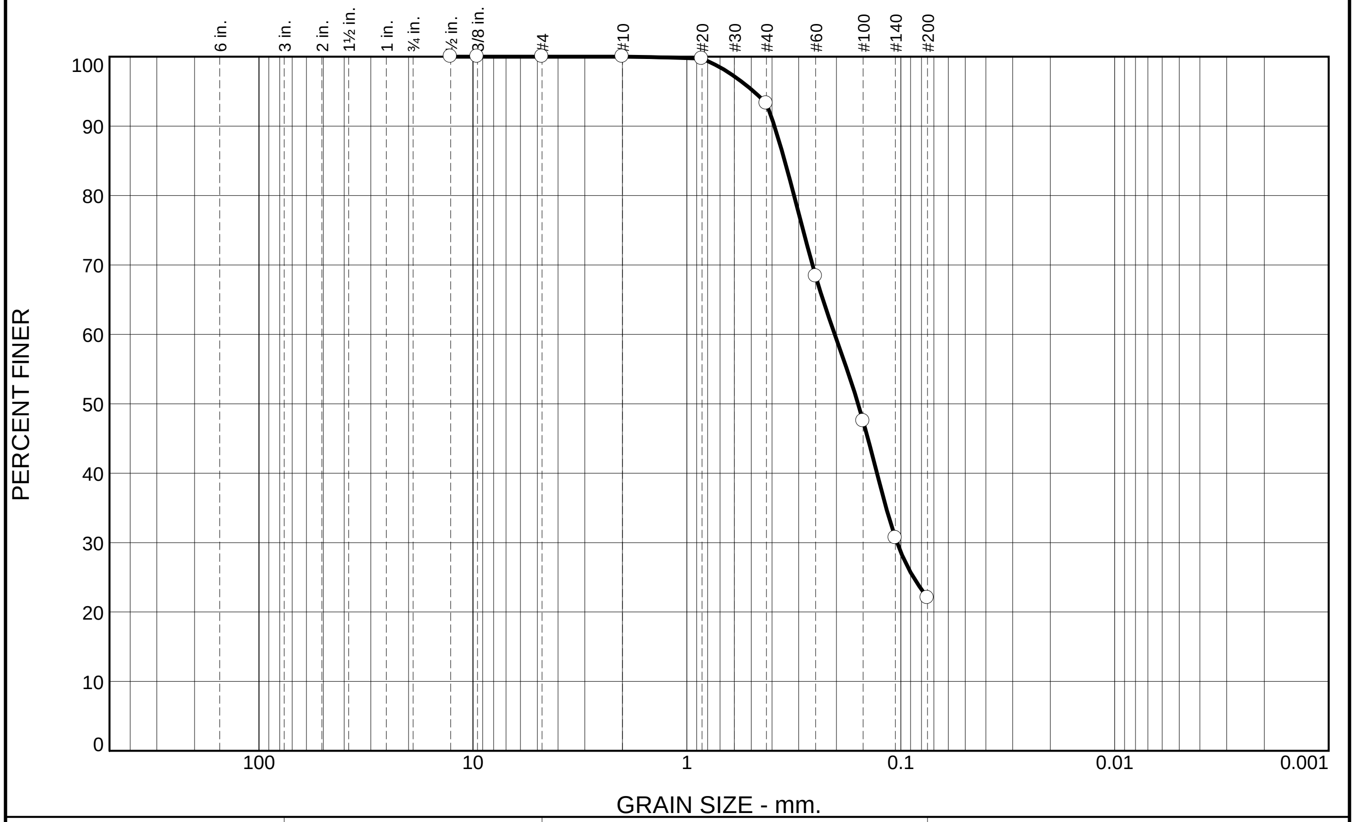
Blackburn Consulting

W. Sacramento, CA

Client: Coleman Engineering
Project: Redding Rancheria

Project No: 3720.X **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	7	71	22	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100		
3/8"	100		
#4	100		
#10	100		
#20	100		
#40	93		
#60	68		
#100	48		
#140	31		
#200	22		

* (no specification provided)

Material Description

SILTY SAND, yellowish brown

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3895 D_{85}= 0.3488 D_{60}= 0.2037
D_{50}= 0.1584 D_{30}= 0.1041 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

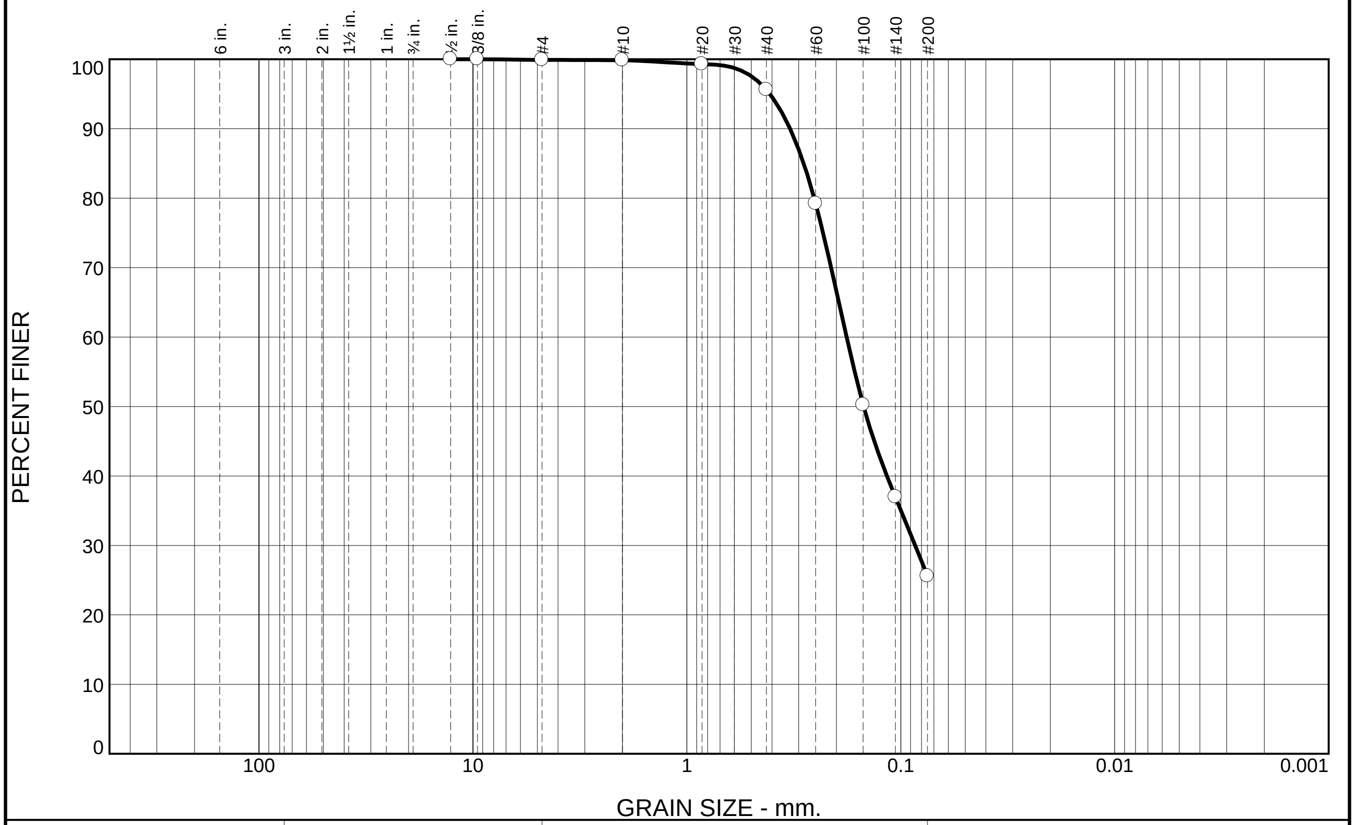
Source of Sample: TP-9 **Depth:** 0-7'
Sample Number: Bulk A **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: Coleman Engineering
Project: Redding Rancheria
Project No: 3720.X **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	4	70	26	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100		
3/8"	100		
#4	100		
#10	100		
#20	99		
#40	96		
#60	79		
#100	50		
#140	37		
#200	26		

* (no specification provided)

Material Description

SILTY SAND, dark yellowish brown

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3294 D_{85}= 0.2846 D_{60}= 0.1792

D_{50}= 0.1493 D_{30}= 0.0858 D_{15}=

D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: TP-10 **Depth:** 0-7'
Sample Number: Bulk A **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: Coleman Engineering
Project: Redding Rancheria

Project No: 3720.X **Figure**

GEOTECHNICAL REPORT
Redding Rancheria Casino

Redding, California

December 2019

APPENDIX D

IMPORTANT INFORMATION ABOUT
THIS GEOTECHNICAL ENGINEERING REPORT,
GEO-PROFESSIONAL BUSINESS ASSOCIATION, 2016

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL
BUSINESS
ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

APPENDIX N

UPDATED MASTER PLAN GRADING AND DRAINAGE STUDY

REDDING RANCHERIA CASINO MASTER PLAN

GRADING AND DRAINAGE STUDY

PREPARATION DATE:
OCTOBER, 2021

PREPARED FOR:
REDDING RANCHERIA
2000 REDDING RANCHERIA ROAD
REDDING, CA 96001

PREPARED BY:
SHARRAH DUNLAP SAWYER, INC.
6590 LOCKHEED DRIVE
REDDING, CA 96002

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SECTION 2 Existing Site Conditions

SECTION 3 Grading and Drainage

SECTION 4 Hydrology and Hydraulics – Proposed Site

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SECTION 6 Stormwater Quality

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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 would address project grading, drainage, and stormwater management for the Proposed Project and the project alternatives.

1.2 Project Description

The Redding Rancheria has applied 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 would 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 would 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 would 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 would include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south would 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 would 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 would include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south would 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 would 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 would include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south would 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 would 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 would include a road connection to the southern end of Bechelli Lane (see Figure 5), and a potential access from the south would 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 would 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 would include a road connection to Oak Street as shown on Figure E1.

Section 2 – Existing Site Conditions

2.1 Proposed Project Site – Alternatives A through 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 northeast corner of the project to a low point of roughly 430 feet above mean sea level near the Sacramento River on the southwest 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.

Most 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. Most of the soil located in the lower areas near the river in the southwest portion of the project is river wash 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, most of the Proposed Project site is located within one of two different flood zones from the Sacramento River to the west. Most of the lowlands portion of the site is in a special flood hazard area within the 100-year floodplain 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 floodplain 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 floodplain 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 floodplain 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 floodplain line or is located west of the FEMA 100-year floodplain 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 floodplain 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 would remain undeveloped and be used for a material borrow area and stormwater infiltration and storage.

Soil 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, most of the Alternative Project site is located within the special flood hazard area within the 100-year floodplain which means that these areas are subject to inundation during the 100-year event. The FEMA 100-year floodplain from the Tormey Drain is shown on Figure E4.

Section 3 – Grading and Drainage

3.1 Proposed Project Access

The proposed project would 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 would require significant improvements to the intersection of South Bonnyview Road and Bechelli Lane including road widening and construction of a three-lane roundabout at the intersection. The intersection would require numerous retaining walls to accommodate the roundabout footprint and sidewalk extension.

Widening Bechelli 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 would 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 would be constructed south to Smith Road. At the intersection of Smith Road, a Shasta County Standard Road Connection would be constructed. These improvements would require minimal grading beyond the typical roadway infrastructure (street improvements, pedestrian facilities, drainage and other utility infrastructure, etc.). The road would be designed to follow the existing terrain where possible and minimize the roadway grading footprint and impact. It is anticipated that the access road would extend approximately 3,500 feet south to Smith Road and the grading footprint would 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 would be the same and there is no import or export of material required. The proposed finished floor elevations for each of the buildings were established based upon the FEMA 100-year water surface elevation and the adjacent top of bank elevation of the Sacramento River west of the development. The finished floor elevations are at least 3.5 feet above the adjacent 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. All access routes from the building sites to the existing public roads would be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot would be approximately 1-foot above the FEMA 100-year floodplain elevation. The proposed project would 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 while remaining above the 100-year flood elevation.

A 20-foot (bottom width) by 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 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 that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale would pass through a large box culvert under the access road and to a 60,000 square foot vegetated stormwater infiltration area as shown on Figure A4.

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

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 proposed finished floor elevations for each of the buildings were established based upon the FEMA 100-year water surface elevation and the adjacent top of bank elevation of the Sacramento River west of the development. The finished floor elevations are at least 3.5 feet above the adjacent 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. All access routes from the building sites to the existing public roads would be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot would be approximately 1-foot above the FEMA 100-year floodplain elevation. The proposed project would 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 while remaining above the 100-year flood elevation.

A 20-foot (bottom width) by 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 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 that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale would pass through a large box culvert under the access road and to a 60,000 square foot vegetated stormwater infiltration area as shown on Figure B4.

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

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 proposed finished floor elevations for each of the buildings were established based upon the FEMA 100-year water surface elevation and the adjacent top of bank elevation of the Sacramento River west of the development. The proposed finished floor elevations are at least 3.5 feet above the adjacent 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. All access routes from the building sites to the existing public roads would be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot would be approximately 1-foot above the FEMA 100-year floodplain elevation. The proposed project would 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 while remaining above the 100-year flood elevation.

A 20-foot (bottom width) by 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 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 that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale would pass through a large box culvert under the access road and to a 60,000 square foot vegetated stormwater infiltration area as shown on Figure C4.

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

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 proposed finished floor elevations for each of the buildings were established based upon the FEMA 100-year water surface elevation and the adjacent top of bank elevation of the Sacramento River west of the development. The proposed finished floor elevations are at least 6 feet above the adjacent 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. All access routes from the building sites to the existing public roads would be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot would be approximately 1-foot above the FEMA 100-year floodplain elevation. The proposed project would 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 while remaining above the 100-year flood elevation.

A 20-foot (bottom width) by 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 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 that potentially could come westerly from Churn Creek during extreme rain events as described in Sections 2.1 and 4.1. The vegetated swale would pass through a large box culvert under the access road and to a 60,000 square foot vegetated stormwater infiltration area as shown on Figure D4.

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

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 northeast through the middle of the project. The proposed finished floor elevations are approximately 3 feet above the FEMA 100-year water surface elevation of the Tormey Drain.

The parking lots would be 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. Two large stormwater retention ponds would 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. This would create new flood storage volume below 416 feet (the 100-year flood elevation) to directly replace the existing flood storage volume that would be eliminated as a result of the proposed project grading.

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 would be designed in such a way that the grading would be a balanced earthwork operation, meaning the cut and fill quantities would be the same and there is no import or export of material required. There would be no fill placed in the FEMA 100-year floodplain. There would 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" would 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 would be elevated above the FEMA 100-year floodplain. The lowest finish grade elevation within the southern parking lot would 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 would 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. Soil 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.

This lack of observed overtopping of I-5 during known extreme flooding of Churn Creek might be explained by a more detailed look at the local topography as depicted on the City of Redding Interactive Map found at https://gispub.cityofredding.org/reddingmap/ . The hydraulic capacity of the Churn Creek channel is limited by a low point higher than 458 feet (NGVD29) and lower than 460 feet on the westerly bank at Lamour Lane about 450 east of I-5 approximately 1,400 feet south of Commercial Way where the Anderson Cottonwood Irrigation District canal is immediately adjacent to Churn Creek. The easterly bank of Churn Creek at this location is higher than 458 feet and lower than 460 feet. Excess floodwater overflows the Churn Creek channel at this point and flows southerly while extending westerly toward I-5 when it overwhelms the irrigation canal. The lowest elevation of the traveled way of I-5 in this area is higher than 456 feet and lower than 458 feet. However, the nearby elevation of the agricultural field between Churn Creek and I-5 is no higher than 456 feet and sloping southerly to Smith Road. The lowest elevation of Smith Road east of I-5 is 454 feet, and the traveled way of I-5 is at about 455 feet in this area.

It is more likely that the bulk of the estimated 700 cfs spill-over flows south to Smith Road and beyond – well away from the proposed project. When this happens there will be considerable storage routing in the large agricultural field and increased westerly flow through an unknown number of relatively small culvert pipes under I-5 between Commercial Way and Smith Road. This storage and diversion will cause the overflow at Smith Road to be less than the channel overflow at Lamour lane and will likely result in no overflow of I-5 at the proposed project.

4.1.1 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.

4.2 Methodology

Hydrology Calculations were prepared using engineering industry standard methodology as prescribed by the City of Redding Construction Standards. Hydrology for drainage basins smaller than 10 acres is calculated using the rational method. Rainfall intensities utilized for all hydrology analyses are derived from the analysis of local precipitation records as provided by the City Engineer (see Appendix A). Hydrology for basins larger than 10 acres is calculated using HEC-1 interface tools provided by the City Engineering Division.

Per the City of Redding Construction Standards, a recurrence interval (storm frequency) of 10 years is used to design the on-site storm drainage inlets and piping system as no individual inlet or pipe serves an area greater than 40 acres. The piping system is designed to pass the 10-year peak flow without surcharging (filling the pipes).

In order to ensure that post-developed flows leaving the site do not exceed the existing condition, 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 Darcy Equation (Q=Aki) was used to estimate the amount of infiltration that would be achieved in the proposed storm drain conveyance and infiltration system. The storm drainage pipe would be perforated, and the trenches containing the pipes would be extended down into the underlying sandy cobbles and backfilled with drain rock in order to maximize infiltration of the stormwater. The proposed large interception channel terminating in an infiltration area will ensure that all the on-site stormwater will be infiltrated into the sandy cobbles underlying the site.

The City of Redding Hydrology method and rainfall was used for on-site design of Alternative E in the City of Anderson because the City of Anderson has adopted the City of Redding standards and the rainfall data is based on the rain gauge at the nearby Redding Municipal Airport.

4.3 Resilience

FEMA, in its guidance document “Further Advice on Executive Order 11988 – Floodplain Management” stated that “in light of increasing flood damages occurring outside of the designated 100-year floodplain, it may be appropriate to consider using a higher flood standard for proposed activities which are funded, either directly or indirectly, by the federal government”. While this project is not funded by the federal government, the advice is valid for protecting assets associated with government actions.

Others have stated, without empirical evidence, that floods and droughts are likely to become more common and more intense as regional and seasonal precipitation patterns change and rainfall becomes more concentrated into heavy events, with longer, hotter dry periods between. This is a qualitative statement with no quantitative data upon which to base an alternative design.

The best available quantitative information regarding probable flooding of the Sacramento River is provided by FEMA in the form of the Flood Insurance Rate Map (FIRM). The Strawberry Fields location is somewhat unusual because the 10-year water surface elevation (WSEL) and the 100-year WSEL are identical. This is so because flow in the adjoining stretch of river up to and including the 100-year recurrence interval is entirely controlled by the Shasta Dam and Reservoir. This stretch of the river is well-studied and the observed WSEL’s associated with maximum regulatory releases for Shasta Dam, which have occurred several times in the eight decades that the dam has been in place, correlate closely with the WSEL’s depicted on the FIRM.

The FIRM depicts a WSEL of 451 feet near the southern limit of the proposed development (Figure A3) where the lowest nearby proposed structure, the flood resistant parking structure, is at elevation 454.5 feet. The nearest other structure (not flood resistant) at elevation 455 feet is 4-feet higher than the regulatory flood and 3-feet above the regulatory limit for new buildings. The FIRM depicts a WSEL of 452.5 feet near the northern limit of the proposed development. The nearby structure at 458 feet is 5.5-feet higher than the regulatory flood and 4.5-feet above the regulatory limit for new buildings.

Future FEMA FIRMs could raise the regulatory flood elevation be as much as 3-feet, if the best available science supports that, without rendering any proposed on-site buildings obsolete. Referring to FEMA's Flood Insurance Study for the City of Redding: Detailed cross-section AI near the southern limit of the proposed project shows an 8.5-foot increase in WSEL between the 10-year/100-year flow of 79,000 cfs and the 500-year flow of 318,000 cfs. Linear interpolation suggests that the regulatory 100-year flow rate could more than double – to 163,000 cfs – without rendering any proposed on-site buildings obsolete.

Floodwater will also approach the site from the east as a result of flooding on Churn Creek. Churn Creek flooding is not regulated and is less predictable than the Sacramento River. As discussed in detail in Section 4.1 anywhere from 700 cfs to considerably less will drain on to the Strawberry Fields site. The bank-full capacity of the proposed 5-feet deep interceptor channel is 936 cfs – 34% greater than the 700 cfs that flood studies by others suggest might flow over I-5. The proposed Alternatives A-D would be reasonably resilient to unquantified potential increases in regulatory flooding from off-site sources.

The rainfall data that is used in this analysis of proposed on-site storm drainage features is based on probabilistic analysis (by others) of historically recorded rainfall data. Peak flow resulting from the established 10-year recurrence interval rainfall intensity and duration is used to design the on-site piping system. The piping system is designed to be less than completely full under the designated condition. The 10-year design peak flow rate will certainly be exceeded at some point during the life of the project.

The on-site grading and storm drainage piping systems are design such that the 100-year runoff will be captured by the system, the pipes will flow full surcharging junction structures and placing additional hydraulic head on the infiltration system. Increased head results in increased flow into the underlying sand and cobbles. The infiltration system is designed to infiltrate up to 242 cfs which is 39% greater than the calculated maximum post developed 100-year flow rate of 174 cfs. Future storm intensity could increase by over 35% and it is still unlikely that stormwater runoff from the developed site will reach the Sacramento River.

The lowest proposed buildings for Alternative E, the Oak Street site, is 419-feet. The regulatory flood elevation is 416-feet. Future FEMA FIRMs could raise the regulatory flood elevation be as much as 2-feet, if the best available science supports that, without rendering any proposed on-site buildings obsolete. The Tormey Drain takes drainage from a large area of agricultural and foothill land north and west of the project site. Hydrologic analysis of this watershed is based on estimates of upstream land characteristics and rainfall probability vs. empirical observations of water surface elevations and known and controlled releases from Shasta Dam at the Strawberry Fields site. The downstream hydraulic performance of Tormey Drain is largely dependent on maintenance of several miles of constructed earth channel. For these reasons Alternative E is judged to be less resilient to potential future flood risks than Alternatives A-D.

4.4 Results of On-Site 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 would be captured by onsite inlets and conveyed by a series of perforated storm-drain pipe and drain-rock infiltration trenches to the sandy gravel layer below or to the proposed vegetated swale along the frontage road at the eastern boundary of the project

In order to convey the potential overflow from Churn Creek, though it may be much lower than the 700 cfs contemplated in the previous flood studies, a vegetated swale would be constructed between the proposed frontage road and Interstate 5. This proposed vegetated swale would be approximately 20-feet wide at the bottom and 5-feet deep. The hydraulic calculations for the proposed vegetated swale are in Appendix D. It would have a longitudinal slope of 0.4 percent to encourage infiltration to the sandy gravelly layer below. The vegetated swale would convey the onsite runoff, and when necessary, the potential overflow from Churn Creek, from the project to a proposed terminal infiltration area on site.

The highest proposed post-development peak flow rate is for Alternatives A & C is 174 cfs prior to infiltration. Deducting the existing condition 100-year peak flow rate of 19 cfs leaves 155 cfs to be infiltrated in the pipe trenches and vegetated swale. The pipe trenches, vegetated swale, and infiltration area would be capable of infiltrating 242 cfs. Infiltration calculations can be found in Appendix C.

4.4.1 Alternative A – Proposed Project

With development of the proposed project, the site would 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 would 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 would drain the runoff from the proposed north parking lot, entry, and Big Box Retail. A series of inlets and storm drain pipe would collect and convey the runoff to the proposed infiltration channel. The storm drain pipe would range from 15 to 36 inches in size.

<u>Drainage Area #2</u> is approximately 4 acres in size and would drain the runoff from approximately half of the east side of the proposed casino. A series of inlets and storm drain pipe would collect and convey the runoff to the proposed infiltration channel. The storm drain pipe would be a maximum of 24 inches in size.

<u>Drainage Area #3</u> is approximately 6 acres in size and would drain the runoff from the remainder of the east side of the casino. A series of inlets and storm drain pipe would collect and convey the runoff to the proposed infiltration channel. The storm drain pipe would range from 15 to 30 inches in size.

<u>Drainage Area #4</u> is approximately 4 acres in size and would drain the runoff from the proposed south parking lot. A series of inlets and perforated storm drain pipe would collect and convey the runoff to the Sacramento River. The perforated storm drain pipe would be a maximum of 24 inches in size and would be placed within a drain rock infiltration trench three feet wide. This infiltration trench would 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 would 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 would 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 could 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.

4.4.2 Alternative B – No Big Box Retail

With development of the proposed project, the site would 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 would 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 would drain the runoff from the proposed north parking lot and entry. A series of inlets and storm drain pipe would collect and convey the runoff to the proposed infiltration channel. The storm drain pipe would 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 can 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.

4.4.3 Alternative C – Reduced Intensity Alternative

Hydrologically and hydraulically speaking, Alternative C is the same as Alternative A.

4.4.4 Alternative D – Non-Gaming Alternative

With development of the proposed project, the site would 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 would 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 would drain the runoff from the proposed north parking lot and Big Box Retail. A series of inlets and storm drain pipe would collect and convey the runoff to the proposed infiltration channel. The storm drain pipe would range from 15 to 30 inches in size.

Drainage Area #2 is approximately 6 acres in size and would drain the runoff from the proposed hotel and south parking lot. A series of inlets and storm drain pipe would collect and convey the runoff to the proposed infiltration channel. The storm drain pipe would 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 could 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.

4.5 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 would 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 would be no increase in flows downstream. This would 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 would 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 regarding 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 would not negatively impact Stormwater quality or quantity.

All 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 would be conveyed by constructing a large vegetated swale along the project's easterly boundary that would allow the estimated 600-700 cfs to bypass the proposed development and be conveyed to the Sacramento River. The development would 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 would not impede the potential Interstate 5 overflow. Any future watershed development upstream of the proposed development would 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 would be constructed as part of this project and ground elevations would not be increased within the FEMA 100-year floodplain. Therefore, there would be no loss of existing floodplain storage volume.

There would 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 would 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 would 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 would 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) would be conveyed by the proposed on-site system. A series of inlets and perforated storm drain pipe would collect and convey the runoff to the proposed retention pond. The perforated storm drain pipe would be a maximum of 36 inches in size and would be placed within a drain rock infiltration trench five feet wide. This infiltration trench would 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 would be filled. This would require filing a Letter of Map Revision - Fill with FEMA. This storage would be relocated to the southeast portion of the site on both sides of Oak Street. The bottom of the proposed retention pond would be set at the flowline of the Tormey Drain (elevation 410) and the top of the pond would be at the ground elevation of 416 feet. The proposed pond depicted would 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 would be designed in such a way that the grading would be a balanced earthwork operation, meaning the cut and fill quantities would be the same and there is no import or export of material required. The grading design of the alternative site would 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 would be mitigated by an equal volume of cut (detention/ infiltration basins) within the FEMA 100-year floodplain. This would 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 would be no increase in flows downstream. This would 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 would 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 would 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 would not negatively impact Stormwater quality or quantity.

There would 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 rainwater, 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 would 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 would 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 then be reused.

All the alternatives would 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 would be built as opposed to solid wall underground storm drain systems. Perforated pipe would be installed in a drain rock backfilled trench which would 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 would absorb into the ground which simulates the pre-development natural absorption and purification condition that existed prior to development. These infiltration trenches would 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 and 60,000 square foot infiltration area provide filtration through proposed vegetation and infiltration for stormwater runoff.

6.1.4 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

6.1.5 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.

The project is proposing construction of a 60,000 square foot wet pond near the southern limits of the project at the end of the large vegetated swale. It is anticipated that the water surface elevation of the proposed wet pond will fluctuate with the water level in the adjacent section of the river and groundwater in the area.

6.1.6 Green Roofs

When used in appropriate climates, green roofs can significantly reduce the amount of rainwater 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 (Revised November 2019)

The eastern streambank of the Sacramento River (westerly project boundary) consists of a nearly vertical loam bank varying from about 4 feet high at the south to about 8 feet along much of the project frontage. The loam is underlain and supported by sandy gravelly cobble with scattered boulders at approximately 2 horizontal to 1 vertical slope. Riparian oak trees are well established on the northern 200-feet of the project site, and scattered willows are growing near the ordinary waterline.

The photos below illustrate erosion in the loam bank resulting from maximum regulatory (10-year and 100-year recurrence interval) flows from Shasta and Keswick Dams in 2017. The near-vertical loamy upper segment of the bank is habitat for Bank Swallows (Riparia riparia). The presence of the willows at the ordinary waterline after the long-duration high flow in February and Early March of 2017 indicates that the river channel slope below the willows is fairly stable.

Comparison of the waterline depicted by B.E. Reiser on the map recorded at LS27PG15 dated 2/22/1961 to the lidar topography currently used for the City of Redding Interactive Map shows that the waterline may have shifted up to forty-five feet east in approximately 57 years, for an average of 0.8 feet per year in the area roughly 450-feet south of the northern boundary of the project site. Comparison of Reiser's meander line to the top of bank as surveyed in 2017 yields a similar result. The bank does not appear to have moved since 1961 at the northern well-vegetated boundary of the project site. The existing top of bank is still west of Reiser's meander line about 1,000 feet south of the north project boundary indicating relative stability there as well.

Sacramento River eastern bank (Facing north) March 10, 2017

Sacramento River eastern bank (Facing north) March 10, 2017

Sacramento River eastern bank (Facing north) March 10, 2017

6.2.1 Streambank Stabilization Recommendations

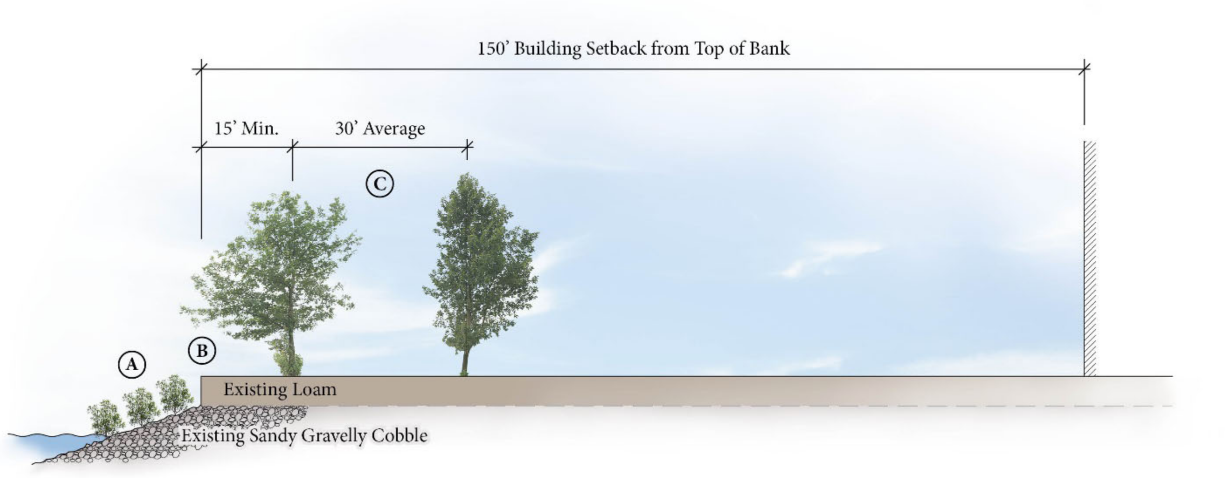
The near-vertical loamy upper segment of the bank is habitat for Bank Swallows (Riparia riparia). Therefore, the proposed streambank stabilization method includes setting the proposed buildings back 150 feet from the existing bank, prohibiting disturbance to Bank Swallows during the breeding season (April 1 – August 31), preserving the dynamic riparian processes at the existing nearly vertical loam bank, replacing the existing agricultural pasture by re-establishing native trees with an herbaceous understory in the setback area, and bio-technical stabilization of the cobbly portion of the riverbank. The bio-technical stabilization technique implemented shall be in accordance with the "Approaches to the Design of Biotechnical Streambank Stabilization" document prepared by the Indiana Department of Transportation and Purdue University or current industry Best Management Practices.

Bio-technical stabilization of the cobbly portion of the riverbank would involve establishing willows from the ordinary high-water line to the toe of the nearly vertical loam bank extending approximately 1,000-feet downstream from the northern project boundary. Willow cuttings (preferably taken from the on-site willows) would be placed by the live stake method at not more than 3-feet on center spacing over the area to be vegetated without disturbing the loam bank.

The loam mantel would be stabilized by planting native streamside trees such as oak, cottonwood and sycamore in the zone between fifteen feet and fifty feet east of the top of bank at an average spacing of thirty feet without disturbing the Bank Swallow nesting habitat. Over time the roots of the trees would mechanically stabilize the loam and help to drain the bank and reduce the occurrence of bank saturation by way of water uptake in the trees. The trees and herbaceous understory would provide cover and enhanced foraging opportunities for the bank swallows.

The bio-technical stabilization plants would be monitored annually and replaced as necessary for a period of five years.

The bio-technically stabilized bank would reduce erosion in the splash zone but would not increase the flow energy because the channel roughness coefficient and geometry would 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 willows on cobbly bank range from 0.035-0.055 in the overbank area. See Figure 6.1 below.



Ⓐ Live stakes of local native willows at 3' on center from water line to toe of nearly vertical loam bank

Ⓑ Do not disturb nearly vertical loam bank

Ⓒ Native riparian trees to be planted 15' minimum from top of bank at 30' average spacing

Figure 6.1: Proposed Streambank Stabilization

Figures

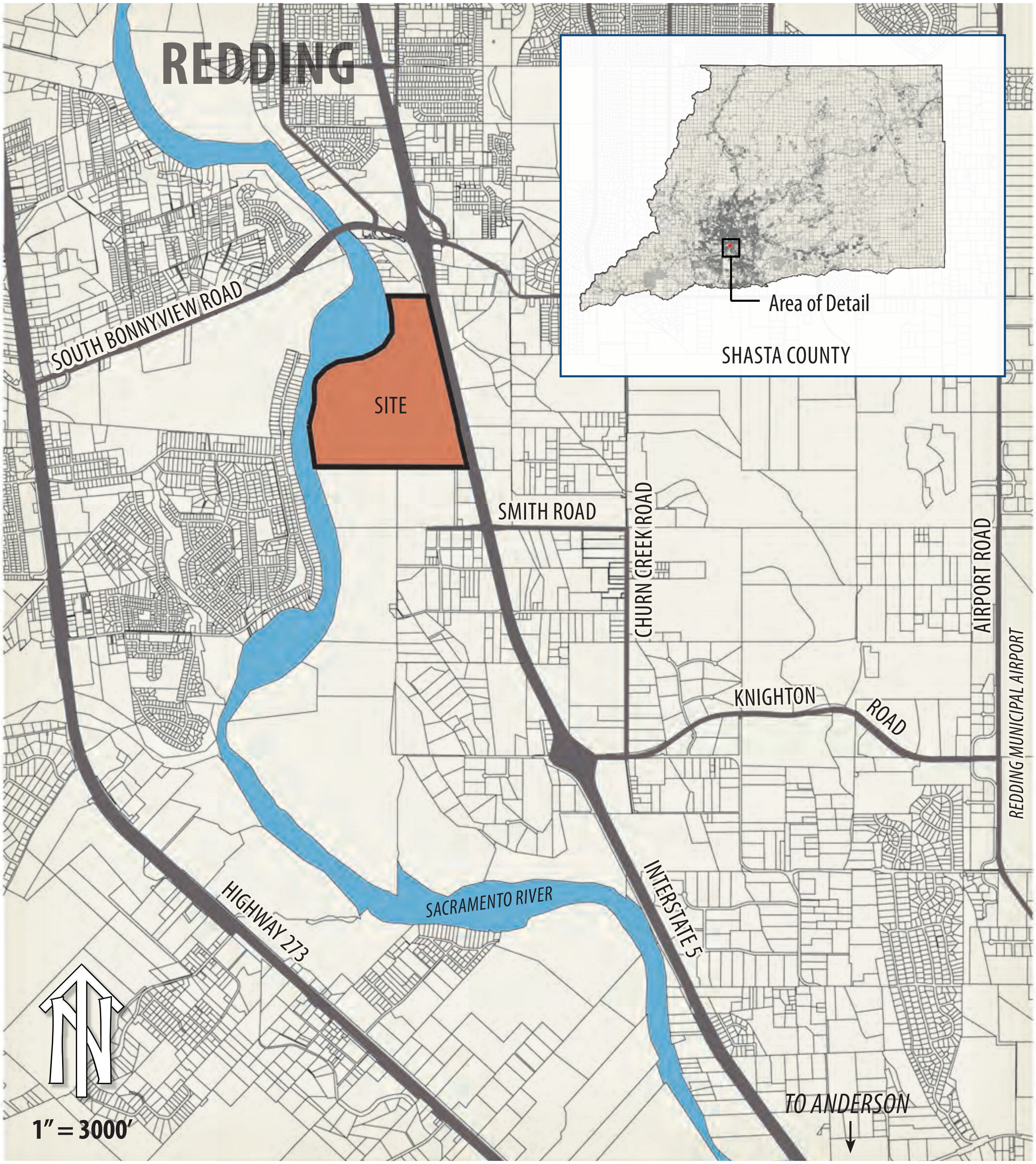


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FIGURE 1
PROPOSED PROJECT - ALT 'A', 'B', 'C', & 'D'
LOCATION MAP

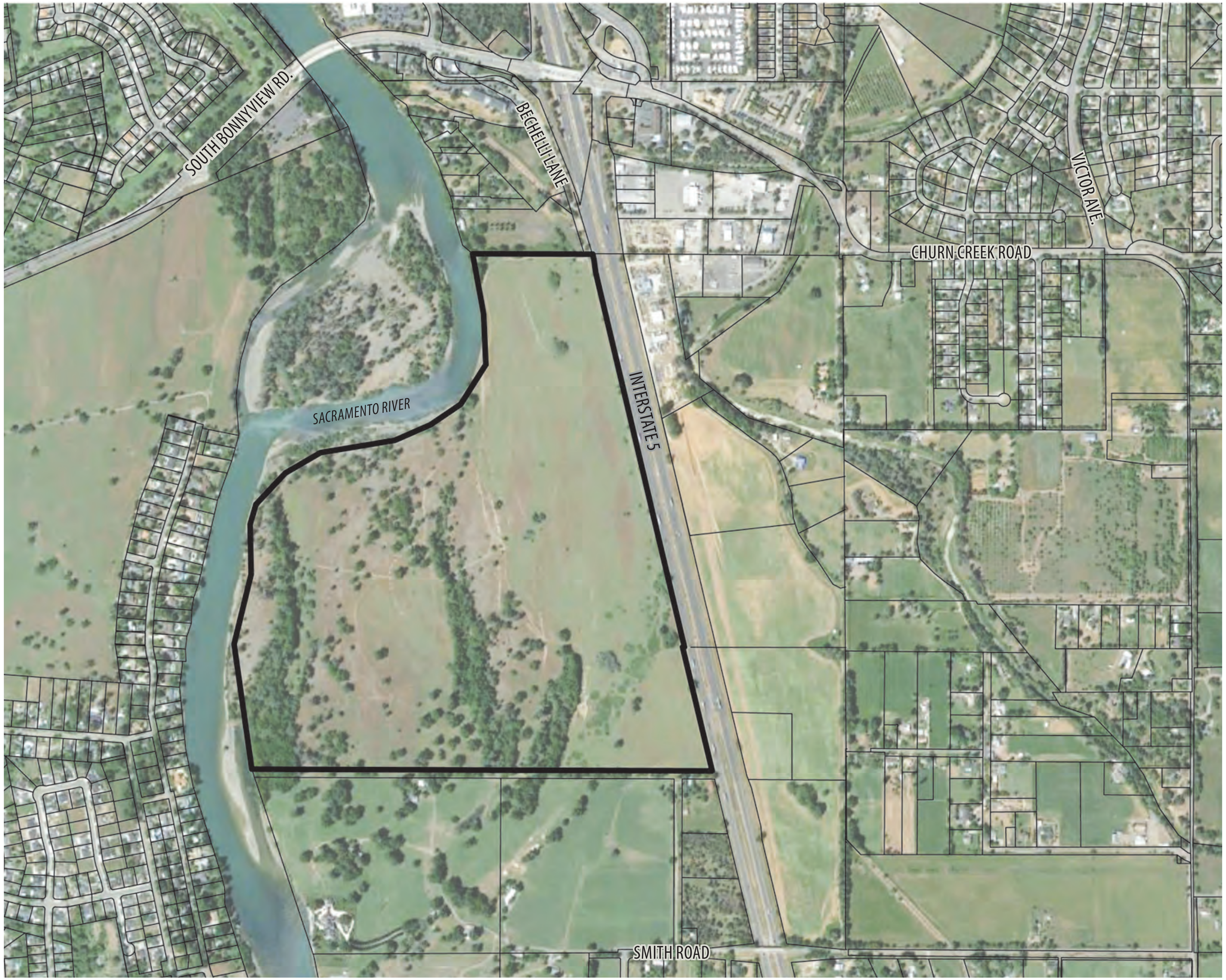

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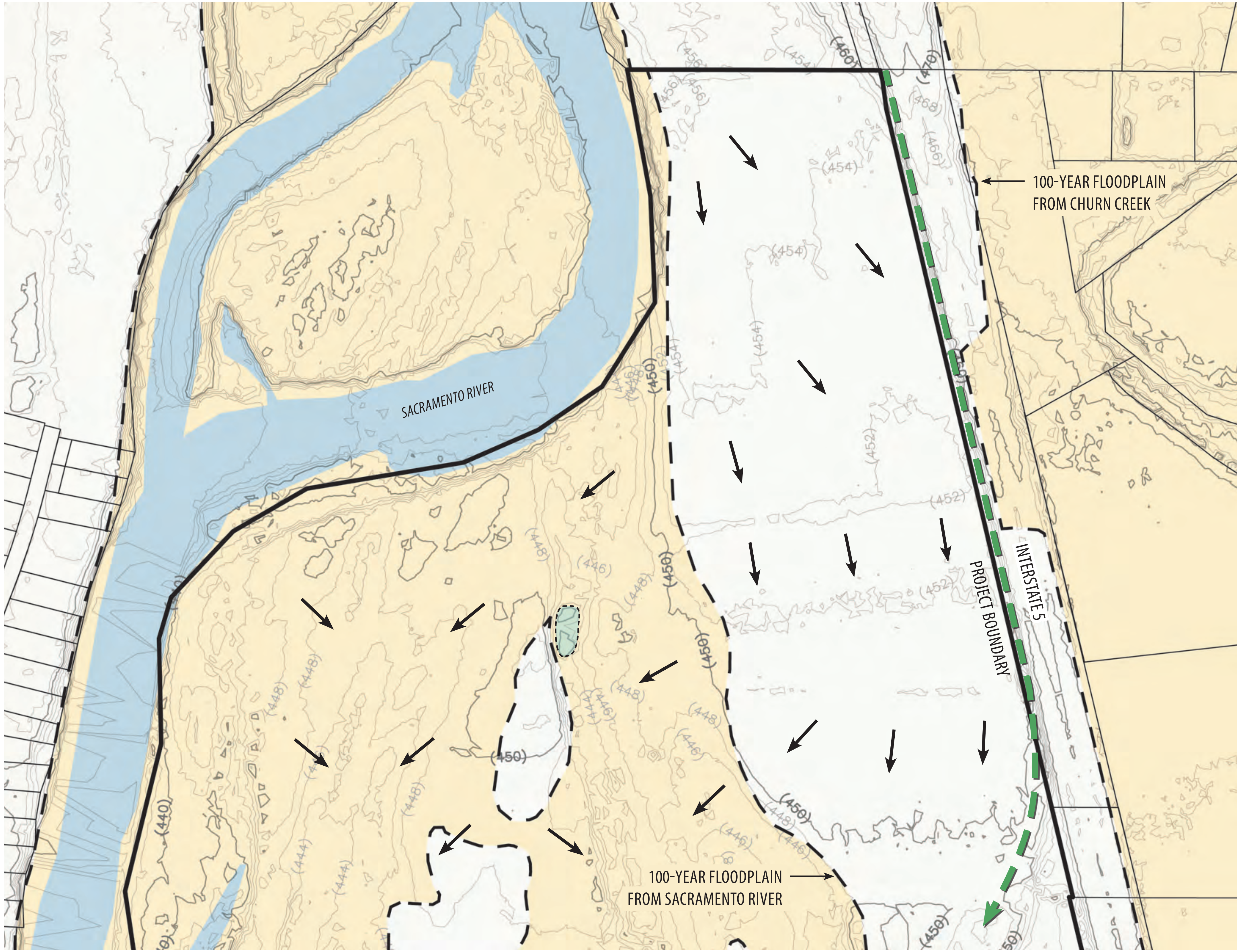
FIGURE 2
PROPOSED PROJECT
ENLARGED LOCATION MAP WITH AERIAL



LEGEND

⬚	100-YEAR FLOODPLAIN
▭	SACRAMENTO RIVER
▬ ▬	EXISTING DRAINAGE SWALE
→	FLOW DIRECTION
⬯	EXISTING POND

1" = 400'

FIGURE 3
**PROPOSED PROJECT
EXISTING TOPOGRAPHY**

FIGURE 4
PROPOSED PROJECT
AERIAL AND TOPOGRAPHY

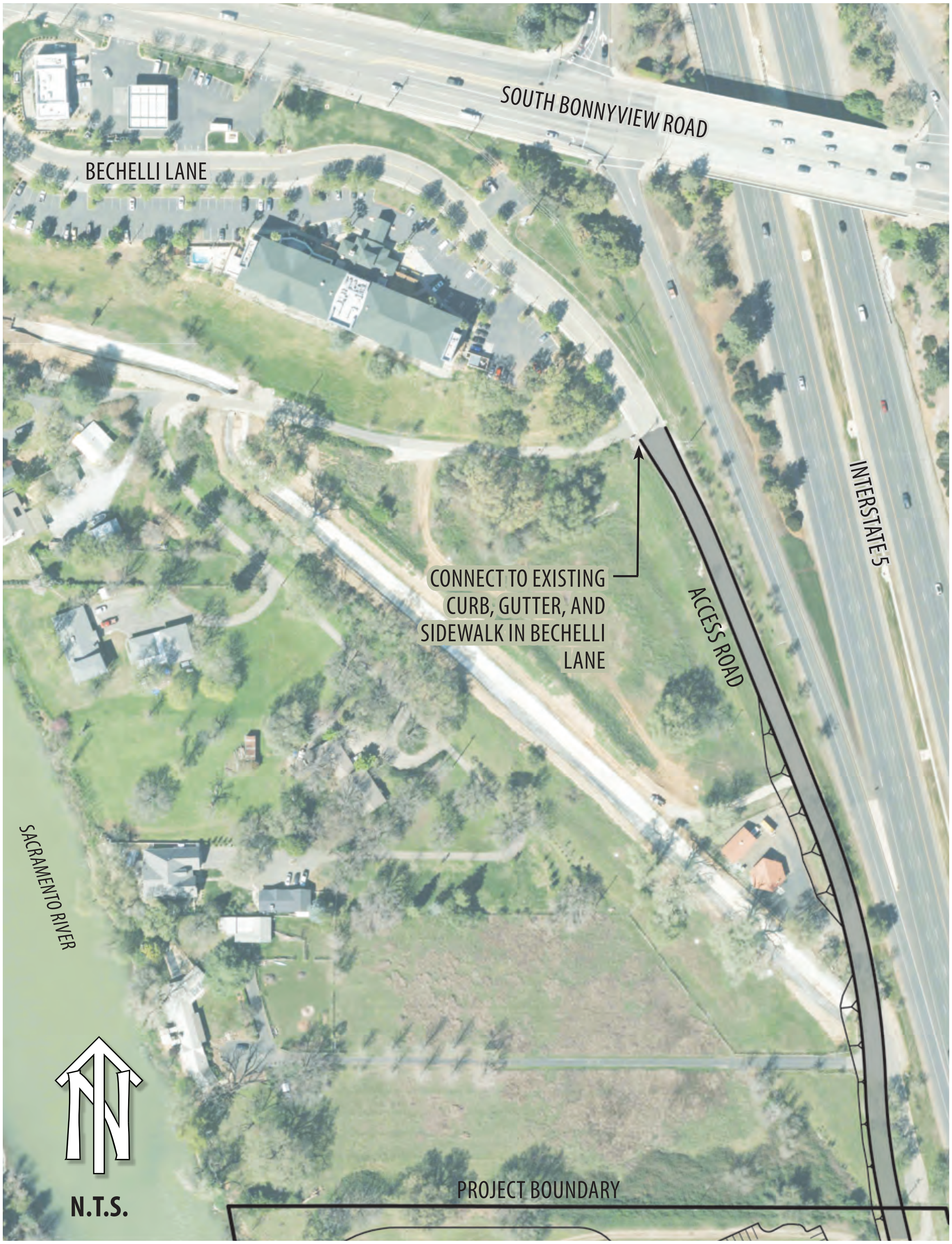


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FIGURE 5
PROPOSED PROJECT
NORTH ROAD CONNECTION

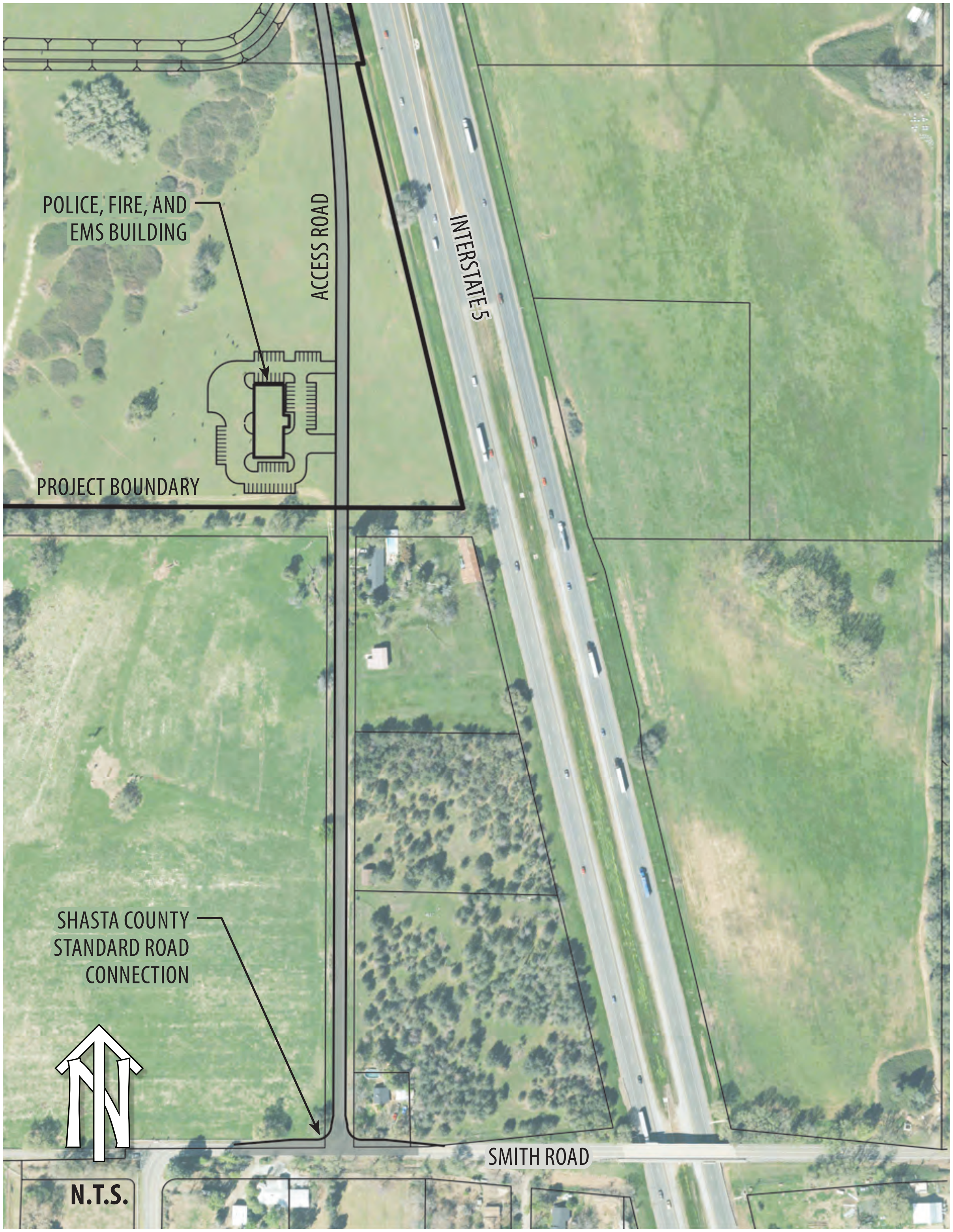

FIGURE 6
PROPOSED PROJECT
SOUTH ROAD CONNECTION

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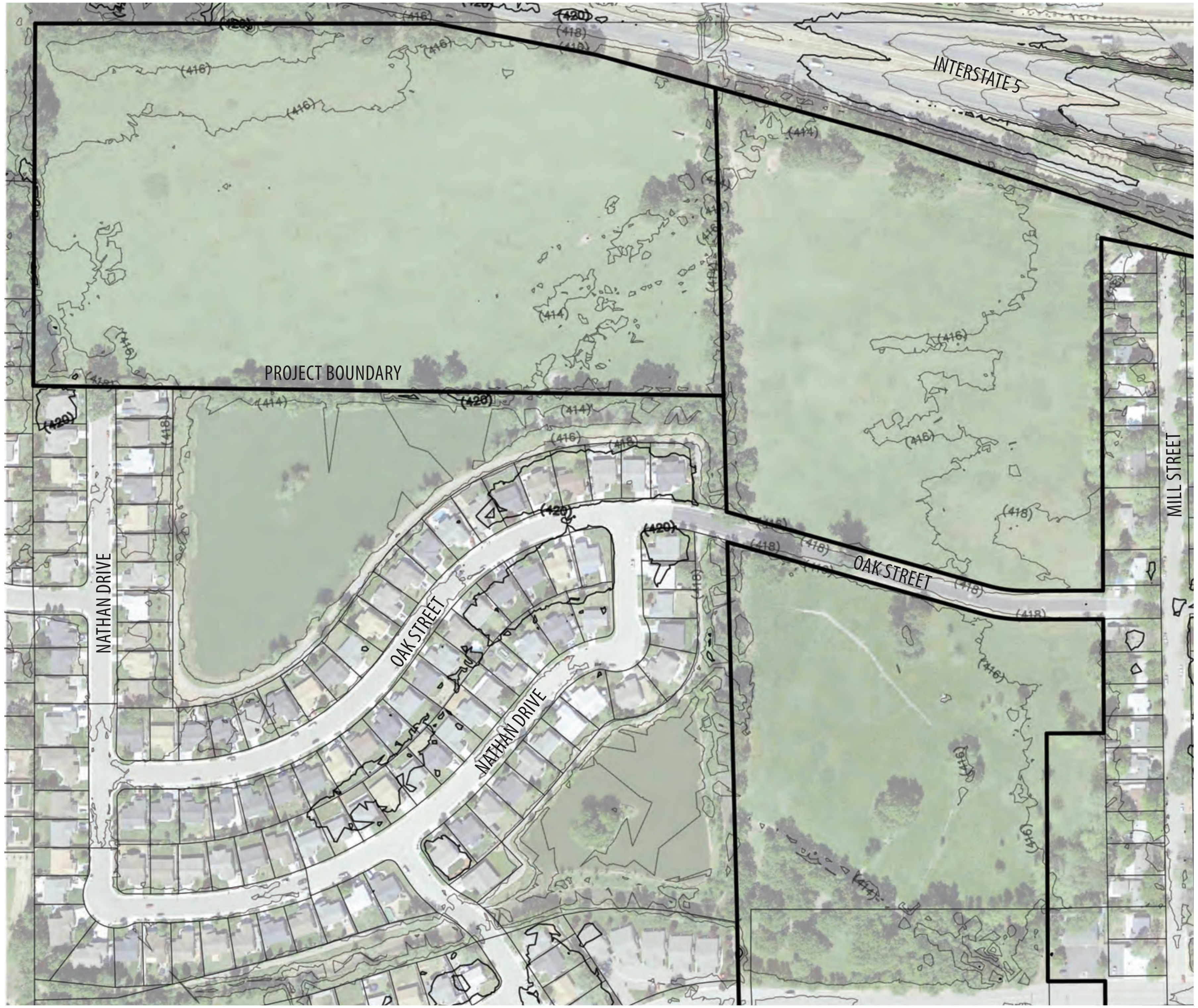
FIGURE 7
PROPOSED PROJECT - ALT 'E'
LOCATION MAP

FIGURE 8
ALT SITE
EXISTING TOPOGRAPHY



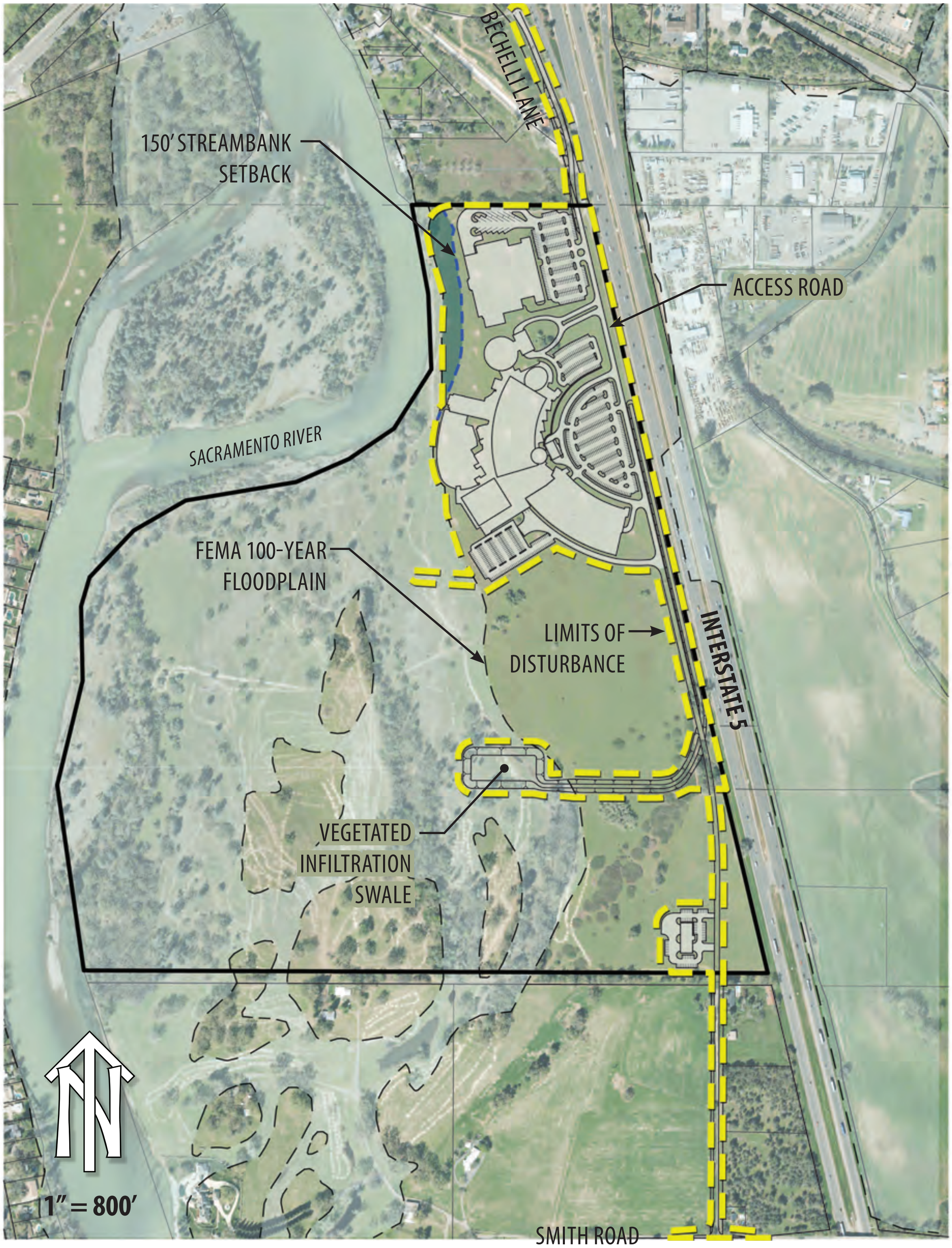
1" = 300'

FIGURE 9
ALT SITE
AERIAL AND TOPOGRAPHY

Figures – Alternative A

REDDING RANCHERIA CASINO MASTER PLAN

OCTOBER 2021



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🟩 Area of disturbance within 150' streambank setback (limited to landscape and streambank stabilization - no structures.)

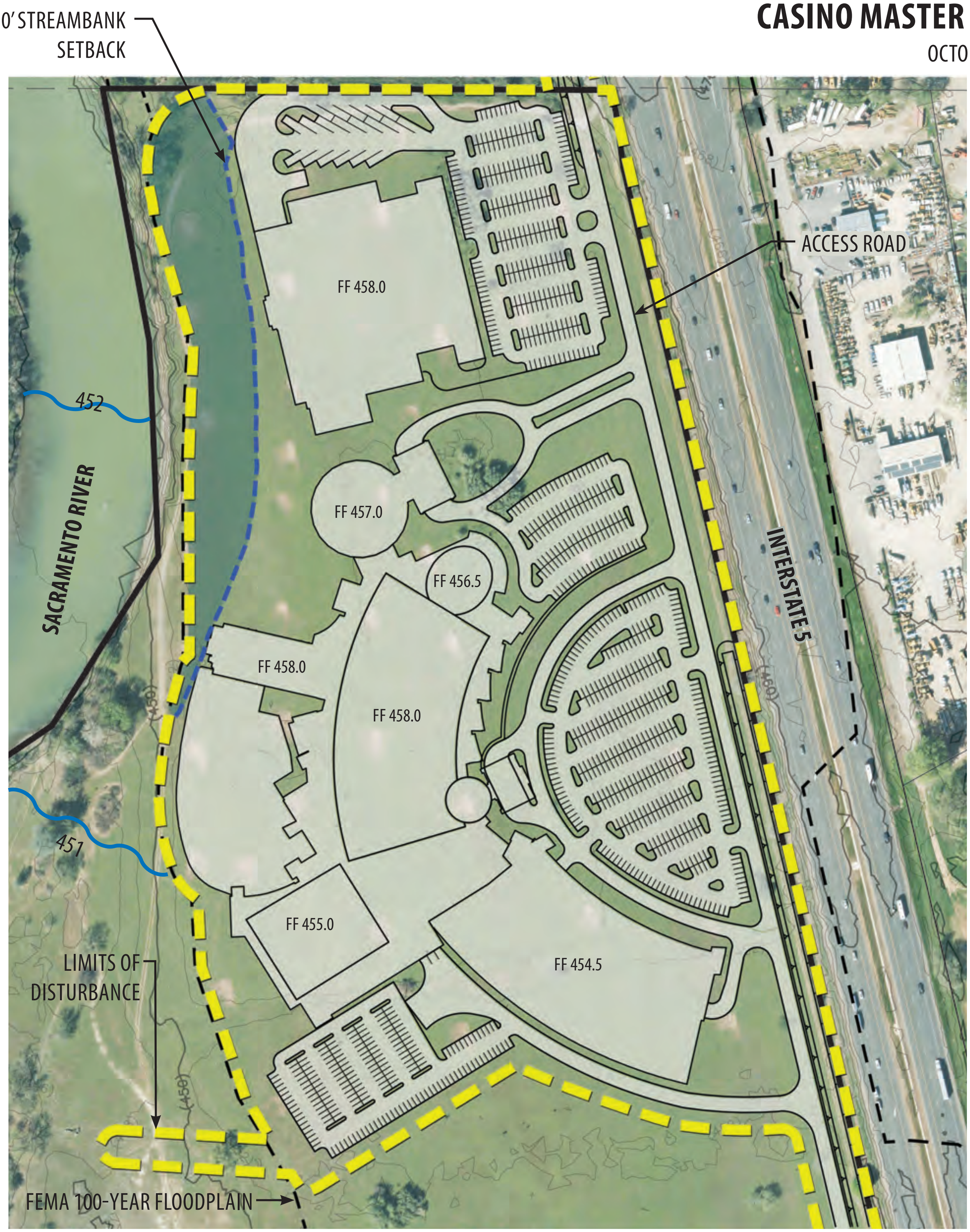
FIGURE A1

PROPOSED PROJECT - ALT 'A'

OVERALL DISTURBANCE LIMITS

REDDING RANCHERIA CASINO MASTER PLAN

OCTOBER 2021



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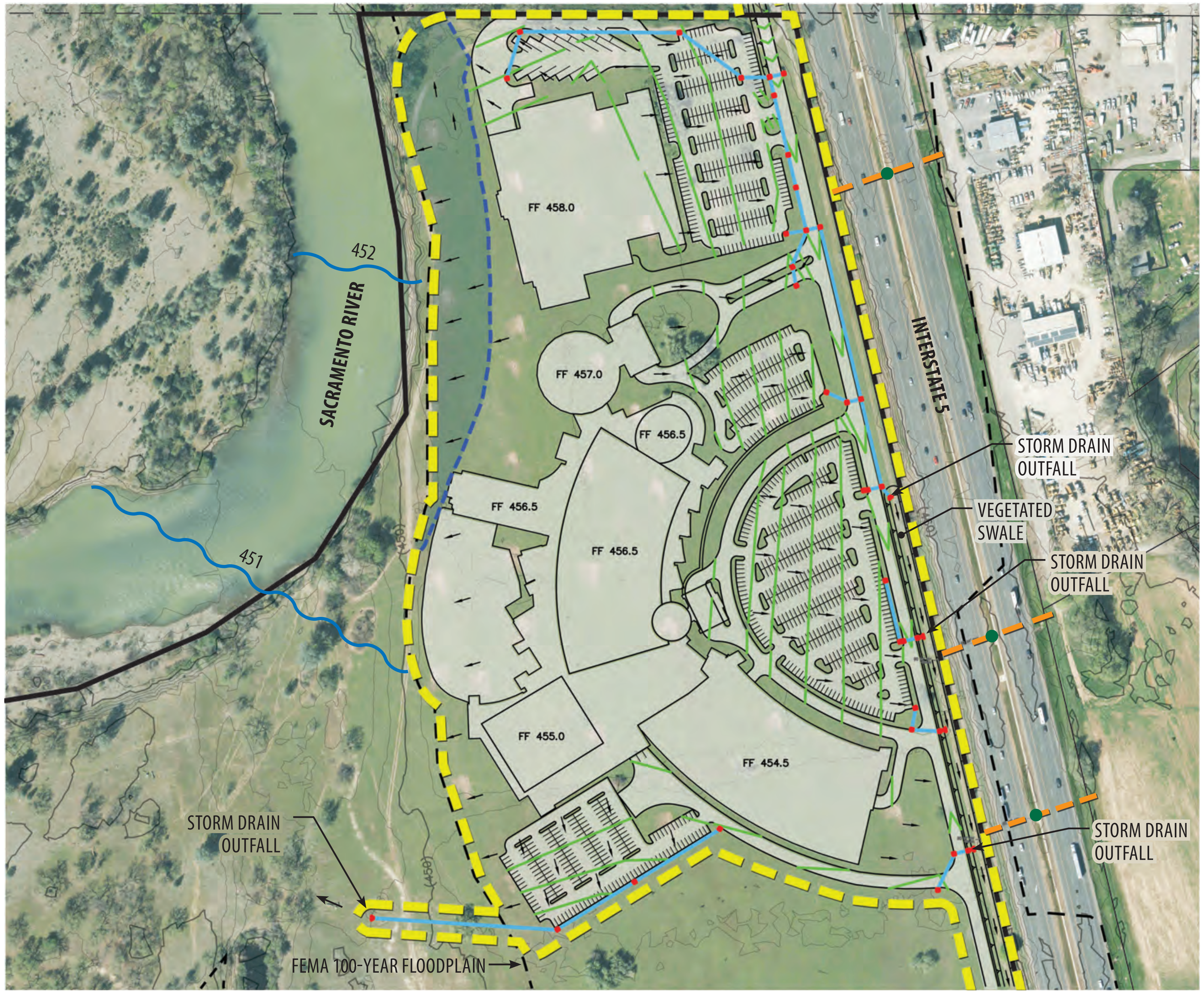
🟩 Area of disturbance within 150' streambank setback (limited to landscape and streambank stabilization - no structures.)

FIGURE A2

PROPOSED PROJECT - ALT 'A'

ONSITE DISTURBANCE LIMITS



LEGEND

───	FINISH GRADE CONTOUR
───	NEW STORM DRAIN
- - -	150' STREAMBANK SETBACK
- - -	EXISTING STORM DRAIN
●	DRAINAGE STRUCTURE
●	EXISTING DRAINAGE STRUCTURE
452 〰	FEMA 100 YEAR FLOOD ELEVATION
▨	FLOW DIRECTION
🟩	AREA OF DISTURBANCE WITHIN 150' STREAMBANK SETBACK *(limited to landscape and streambank stabilization - no structures.)*

N

NOT TO SCALE

FIGURE A3
PROPOSED PROJECT - ALT 'A'
ONSITE GRADING

REDDING RANCHERIA
CASINO MASTER PLAN

OCTOBER 2021

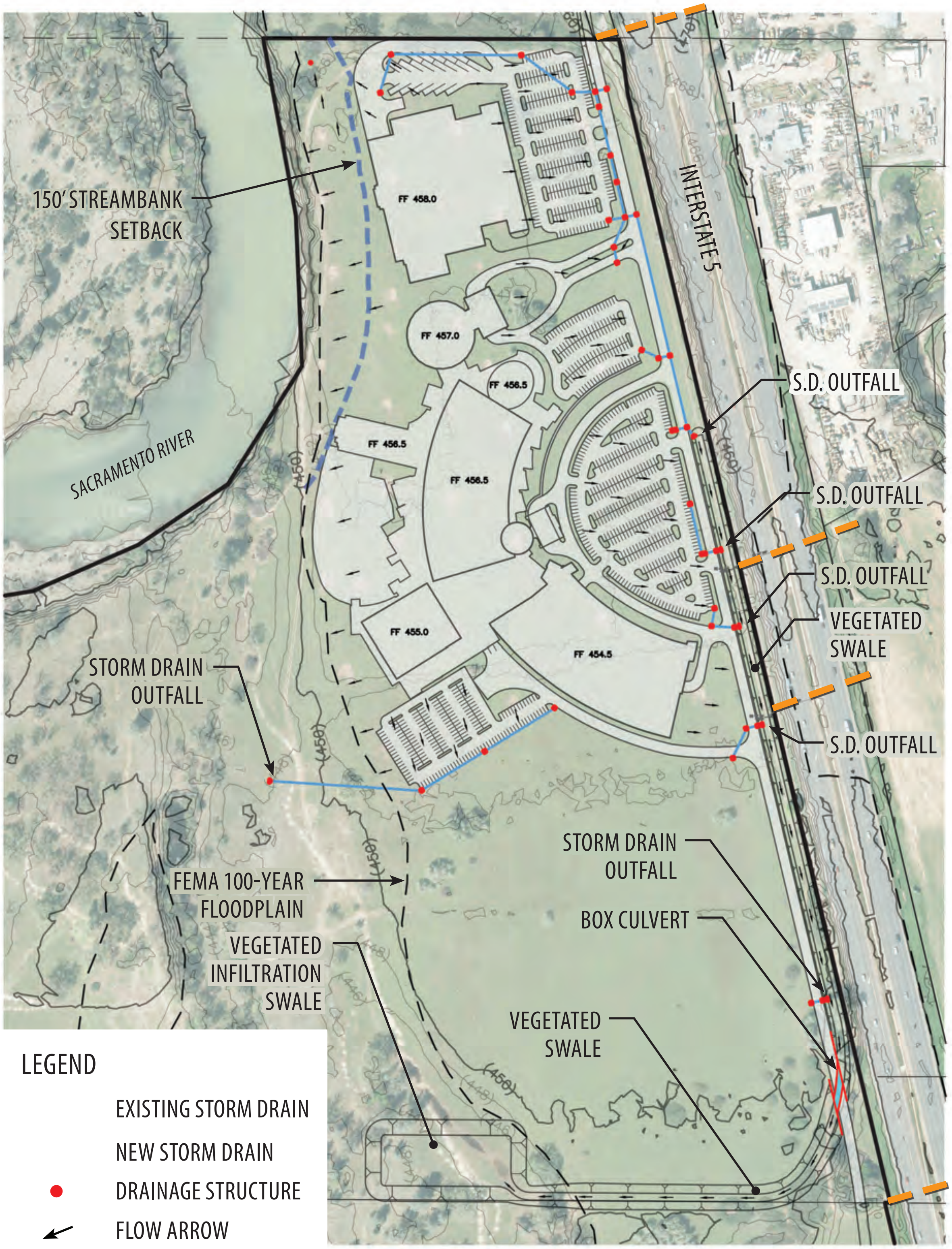


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FIGURE A4
PROPOSED PROJECT - ALT 'A'
OVERALL GRADING

REDDING RANCHERIA
CASINO MASTER PLAN

OCTOBER 2021

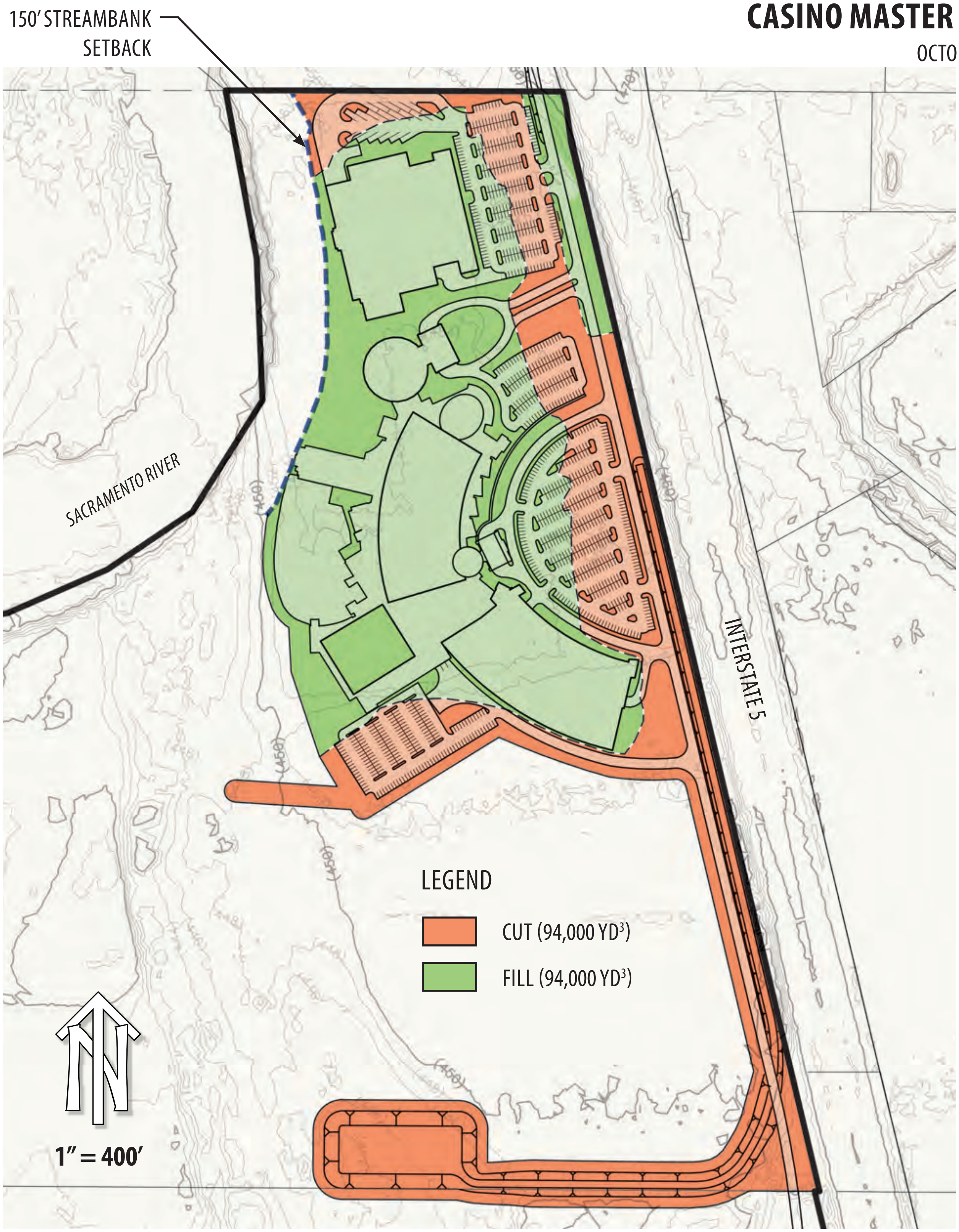

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FIGURE A5
PROPOSED PROJECT - ALT 'A'
CUT FILL DIAGRAM

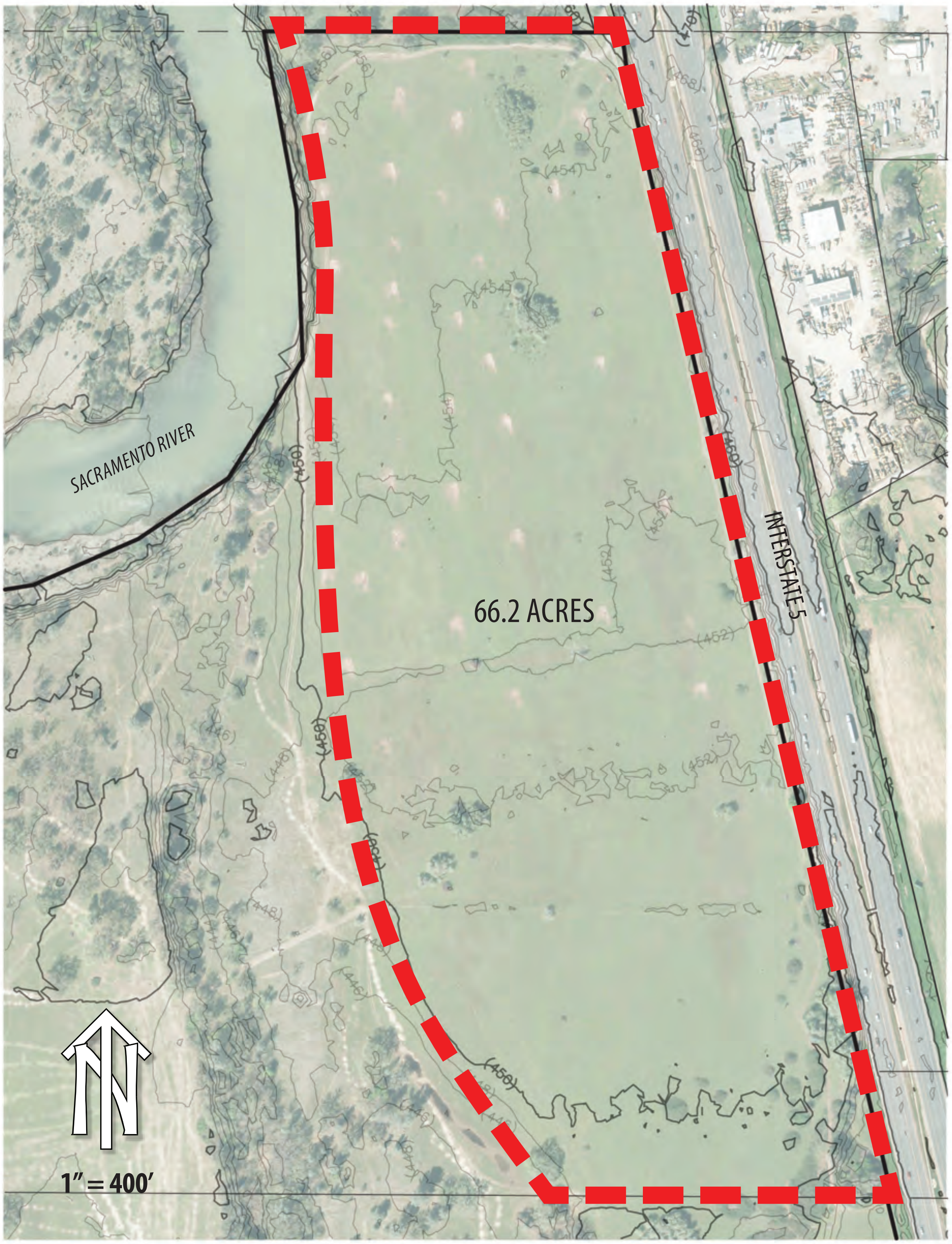

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FIGURE A6

OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'A'

EXISTING CONDITION

REDDING RANCHERIA
CASINO MASTER PLAN
OCTOBER 2021

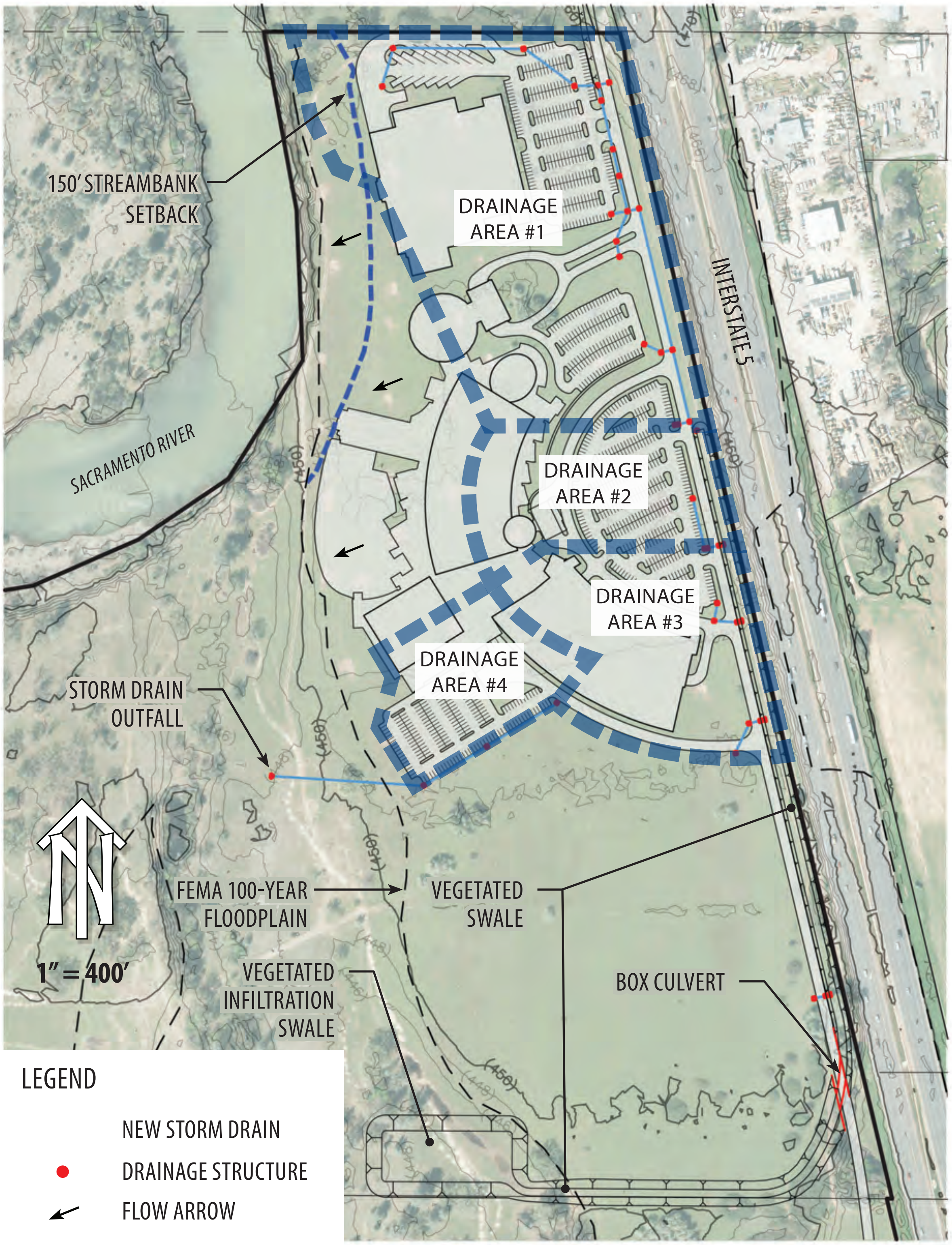

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FIGURE A7
PROPOSED PROJECT - ALT 'A'
STORMWATER MANAGEMENT

Figures – Alternative B

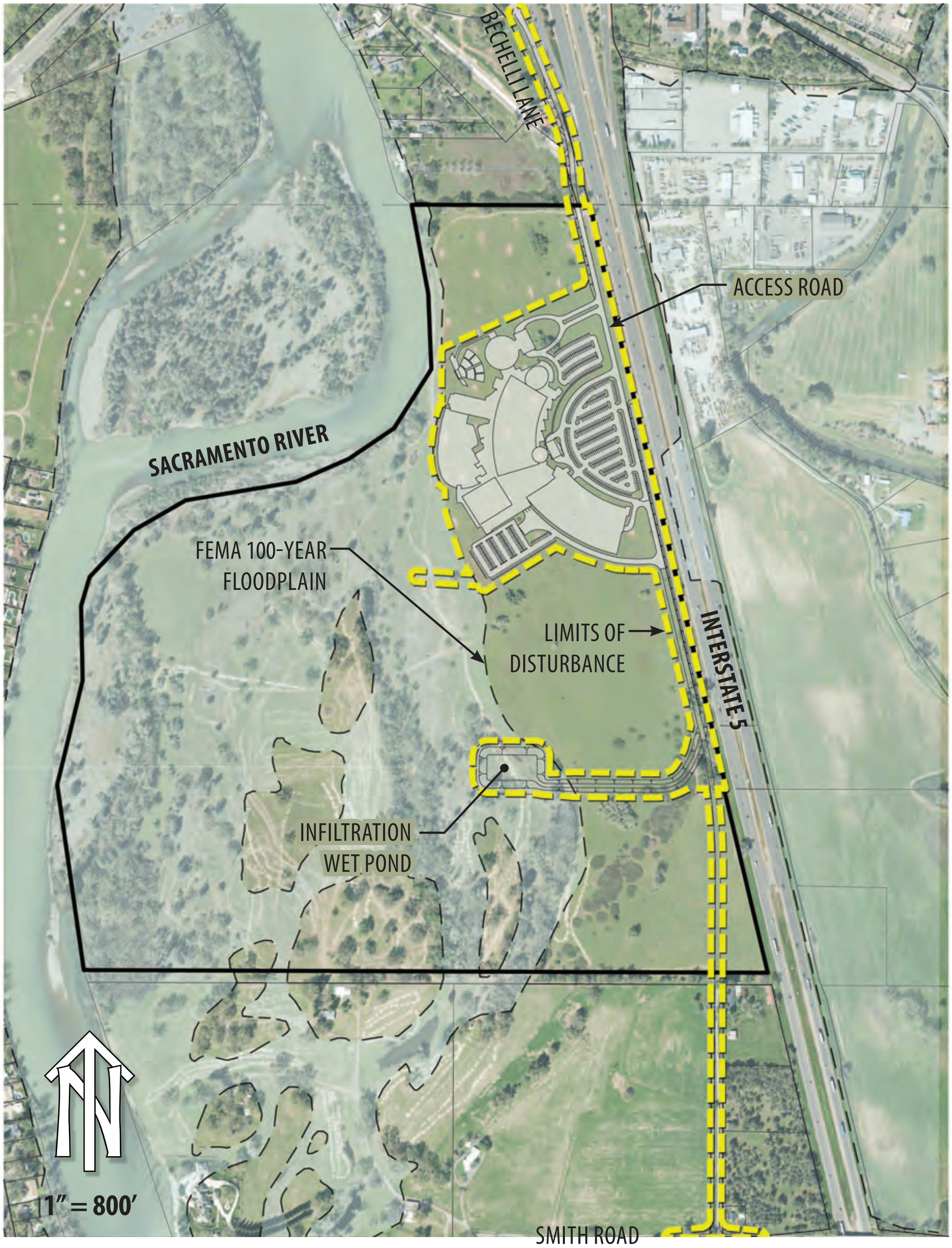

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FIGURE B1
PROPOSED PROJECT - ALT 'B'
OVERALL DISTURBANCE LIMITS

REDDING RANCHERIA
CASINO MASTER PLAN

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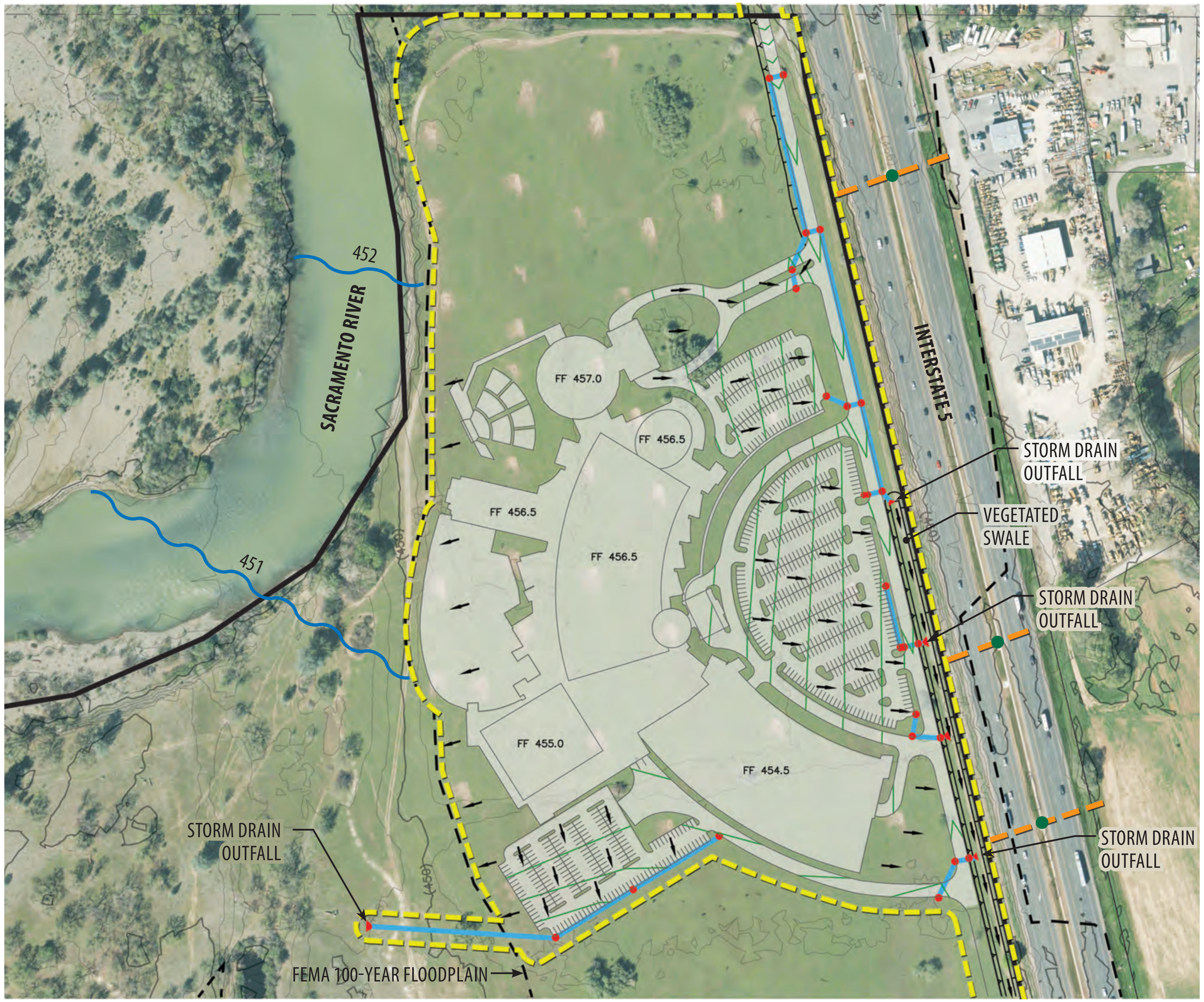
FIGURE B2
PROPOSED PROJECT - ALT 'B'
ONSITE DISTURBANCE LIMITS

REDDING RANCHERIA
CASINO MASTER PLAN



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

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FIGURE B3
PROPOSED PROJECT - ALT 'B'
ONSITE GRADING

REDDING RANCHERIA
CASINO MASTER PLAN

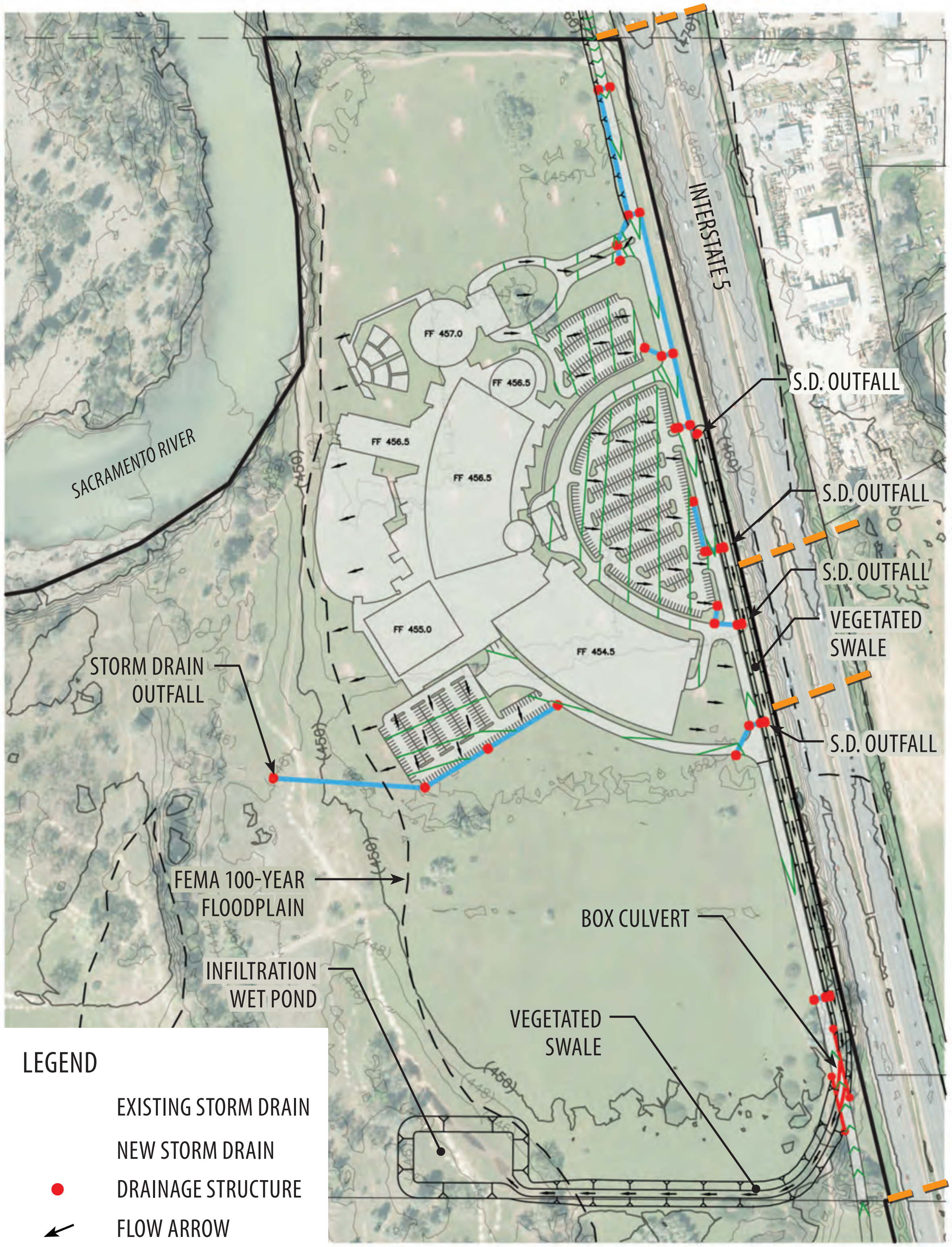

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FIGURE B4
PROPOSED PROJECT - ALT 'B'
OVERALL GRADING

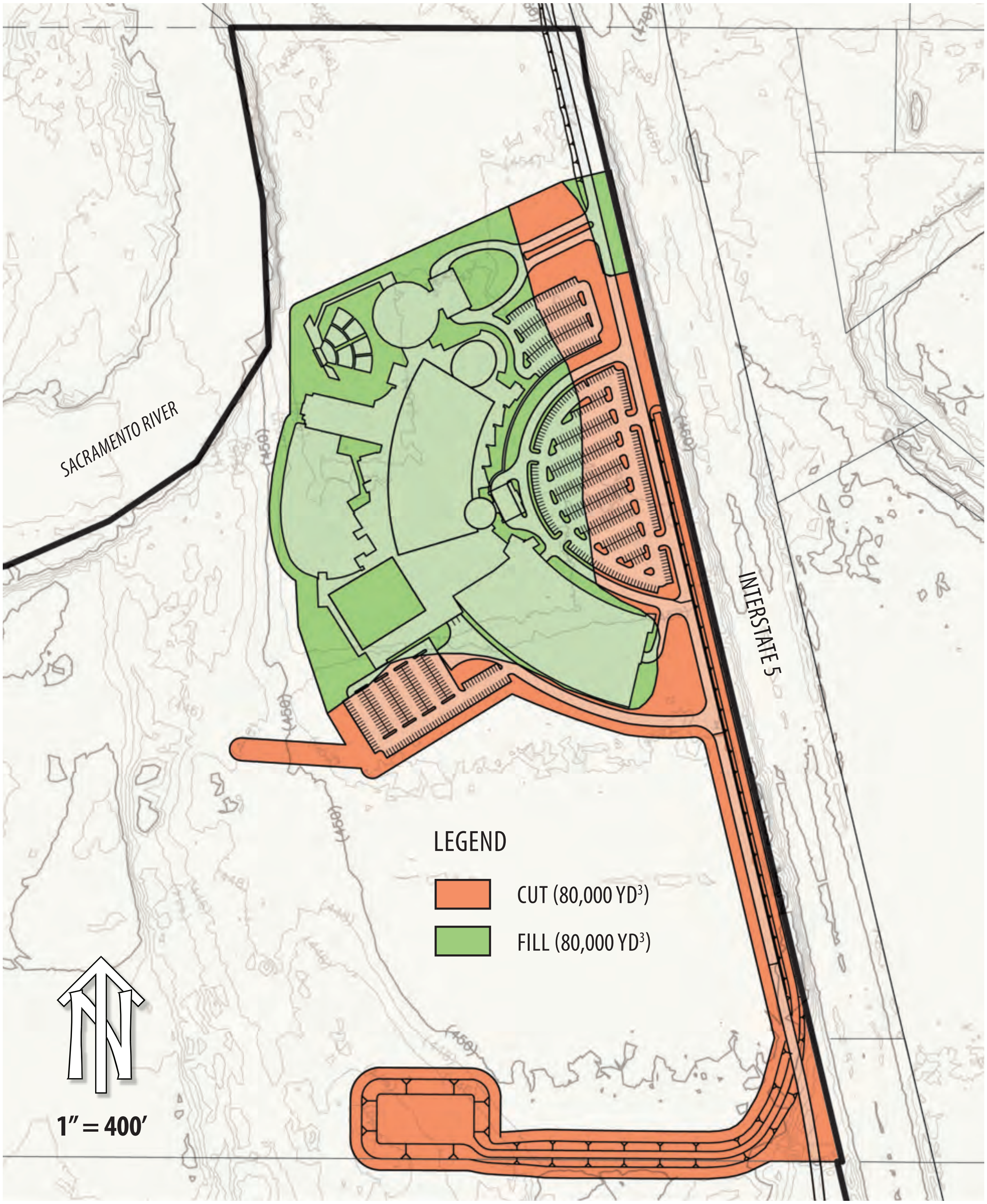

FIGURE B5
PROPOSED PROJECT - ALT 'B'
CUT FILL DIAGRAM

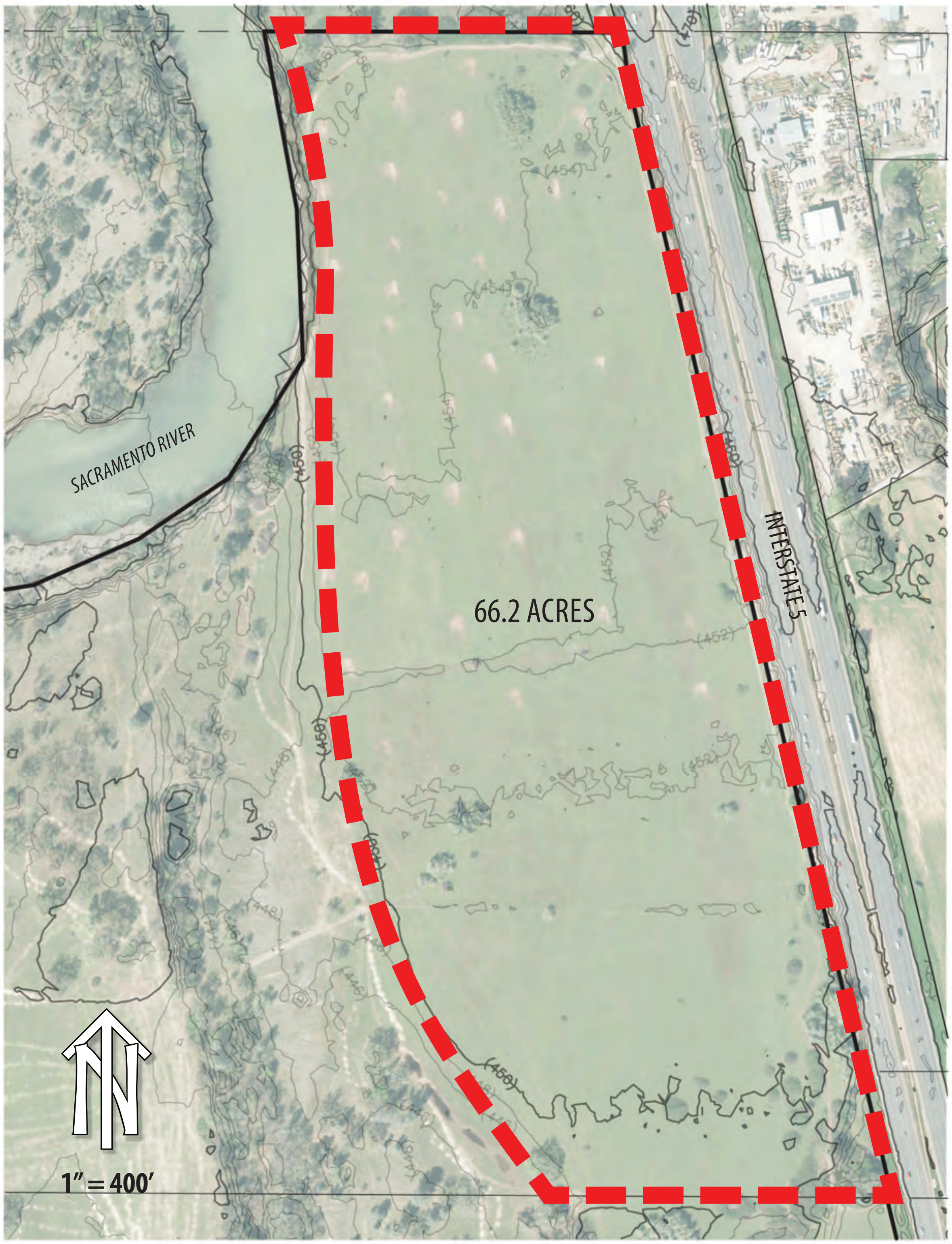

FIGURE B6

OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'B'

EXISTING CONDITION

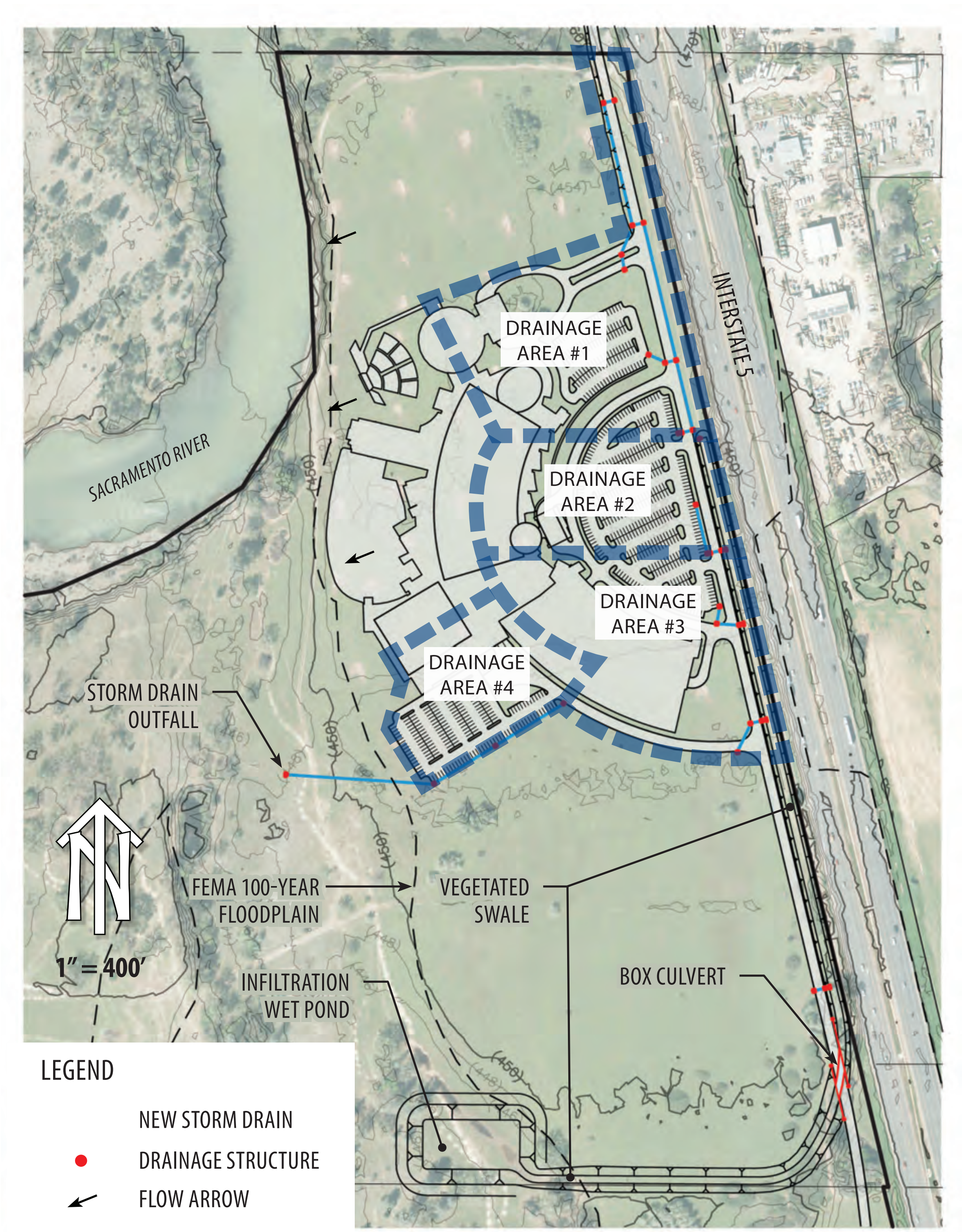

FIGURE B7
PROPOSED PROJECT - ALT 'B'
STORMWATER MANAGEMENT

Figures – Alternative C

REDDING RANCHERIA
CASINO MASTER PLAN

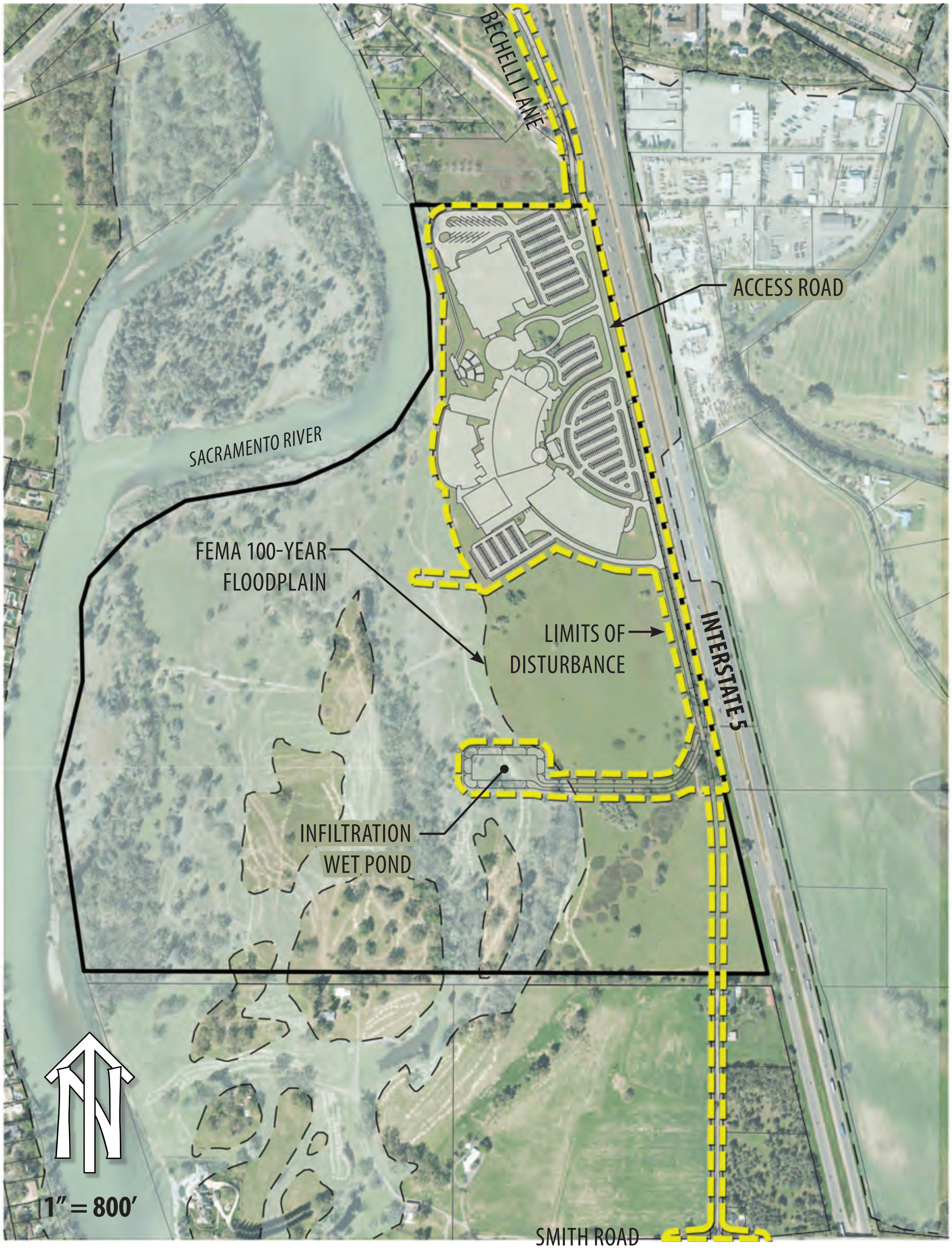

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FIGURE C1
PROPOSED PROJECT - ALT 'C'
OVERALL DISTURBANCE LIMITS

REDDING RANCHERIA CASINO MASTER PLAN

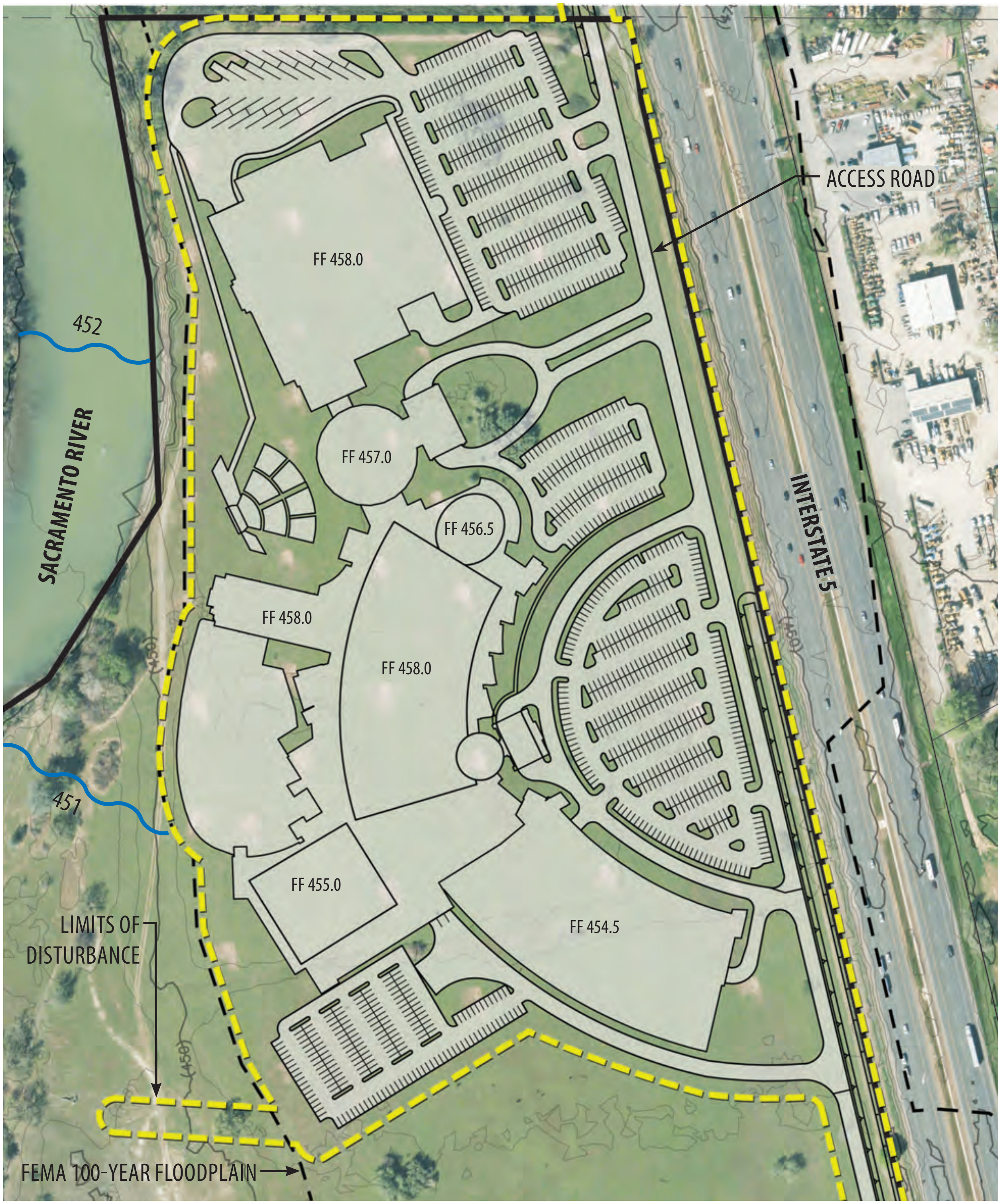

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FIGURE C2

PROPOSED PROJECT - ALT 'C'

ONSITE DISTURBANCE LIMITS

REDDING RANCHERIA
CASINO MASTER PLAN

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FIGURE C3
PROPOSED PROJECT - ALT 'C'
ONSITE GRADING

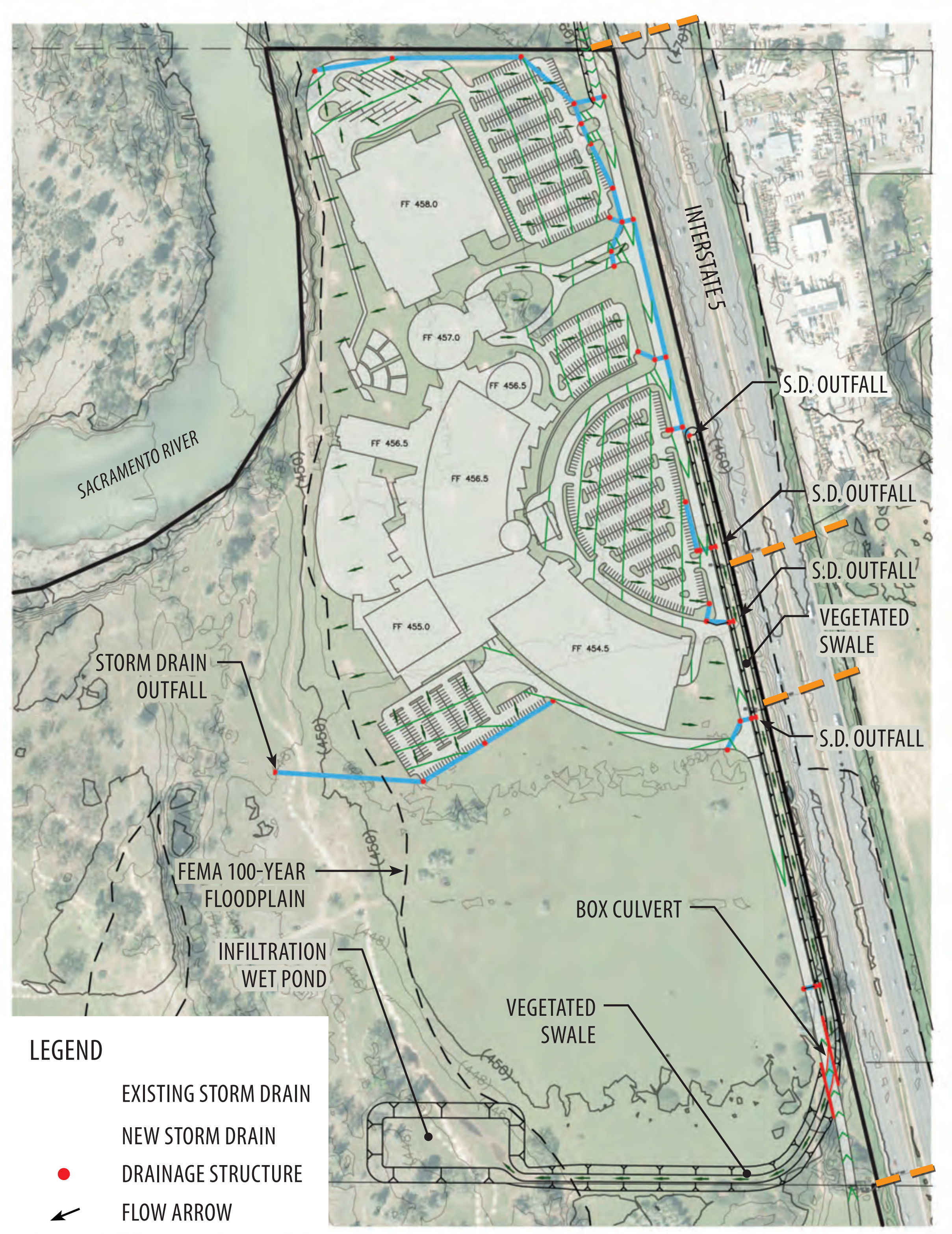

FIGURE C4
PROPOSED PROJECT - ALT 'C'
OVERALL GRADING

REDDING RANCHERIA
CASINO MASTER PLAN

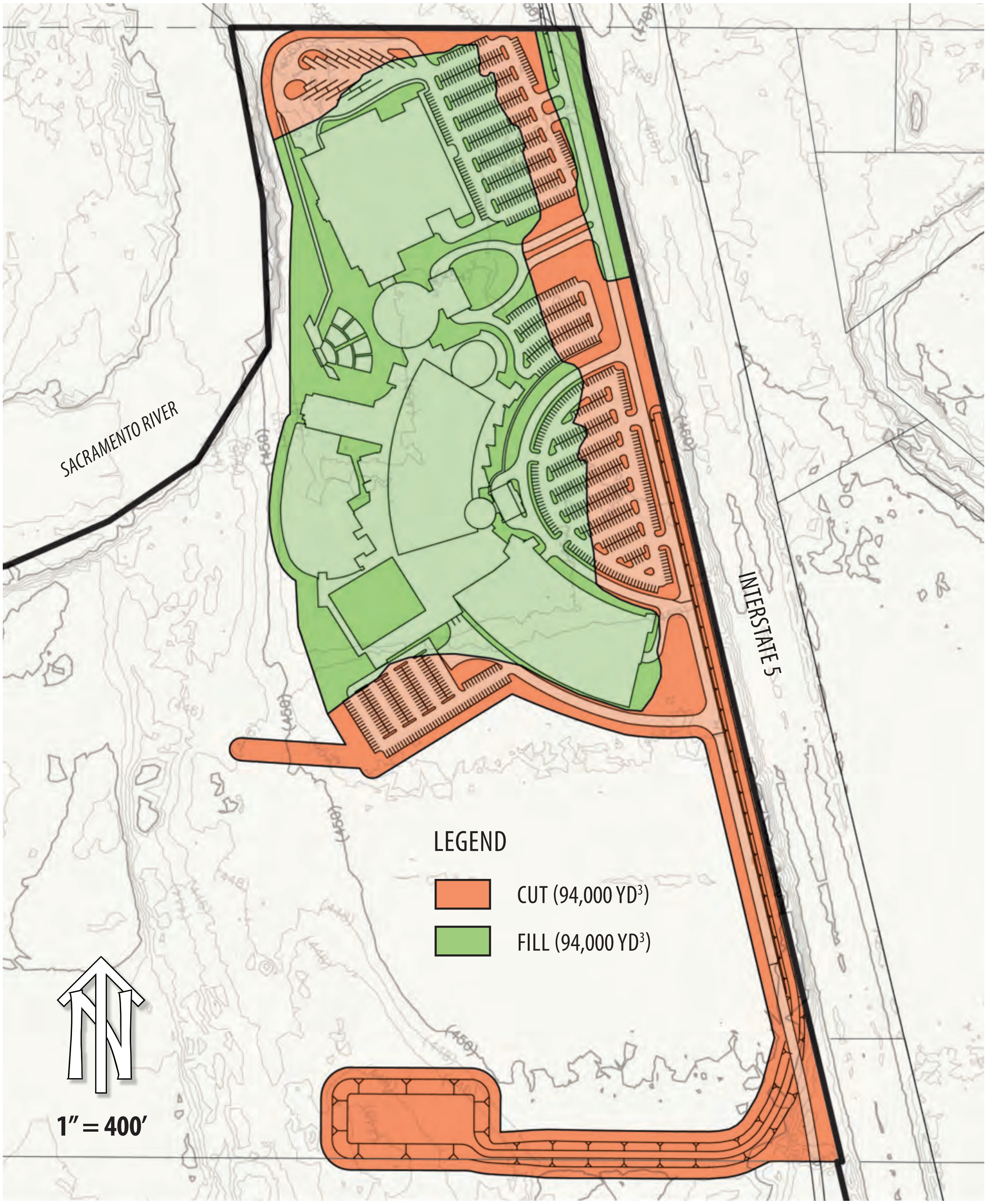

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FIGURE C5
PROPOSED PROJECT - ALT 'C'
CUT FILL DIAGRAM

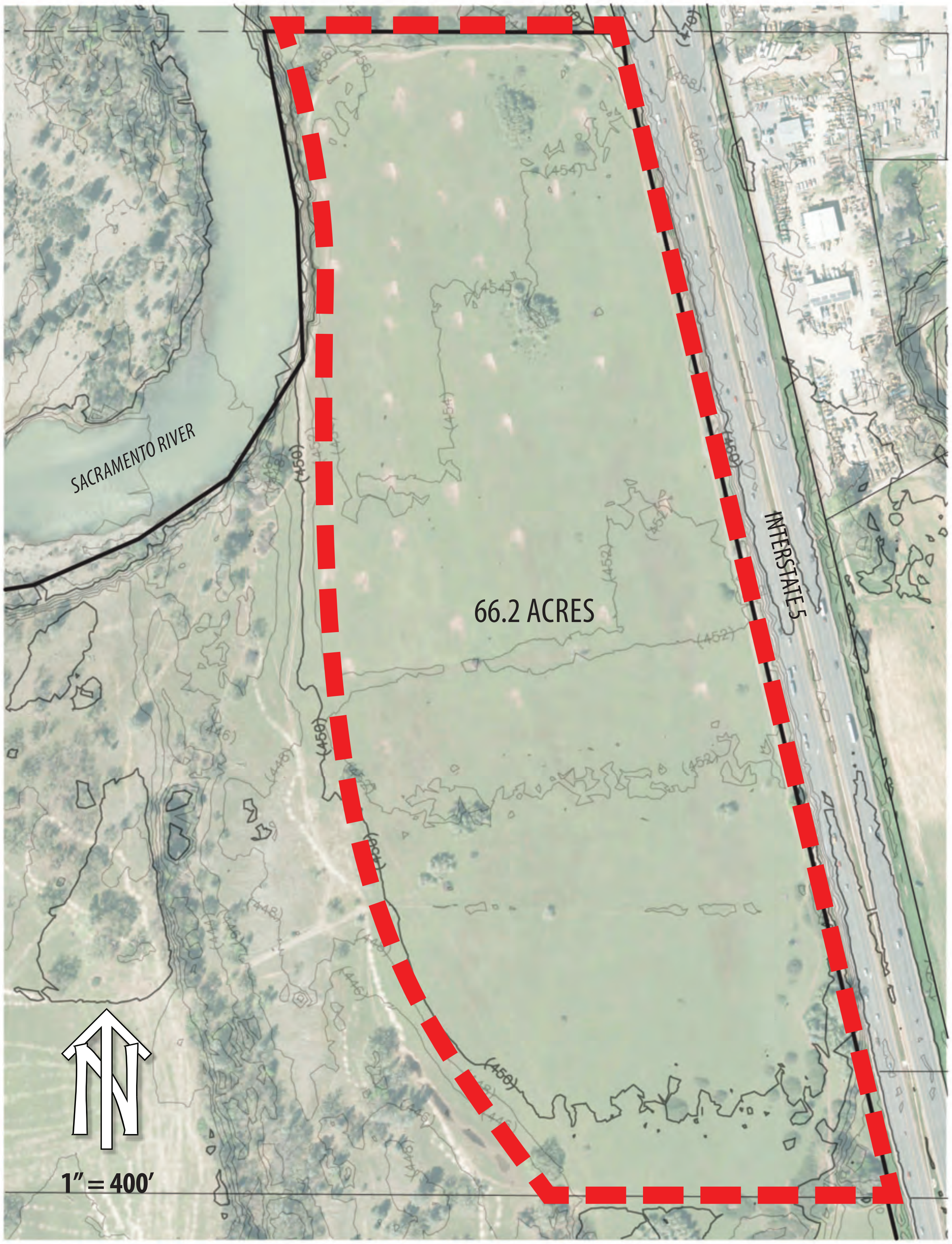


FIGURE C6
OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'C'
EXISTING CONDITION

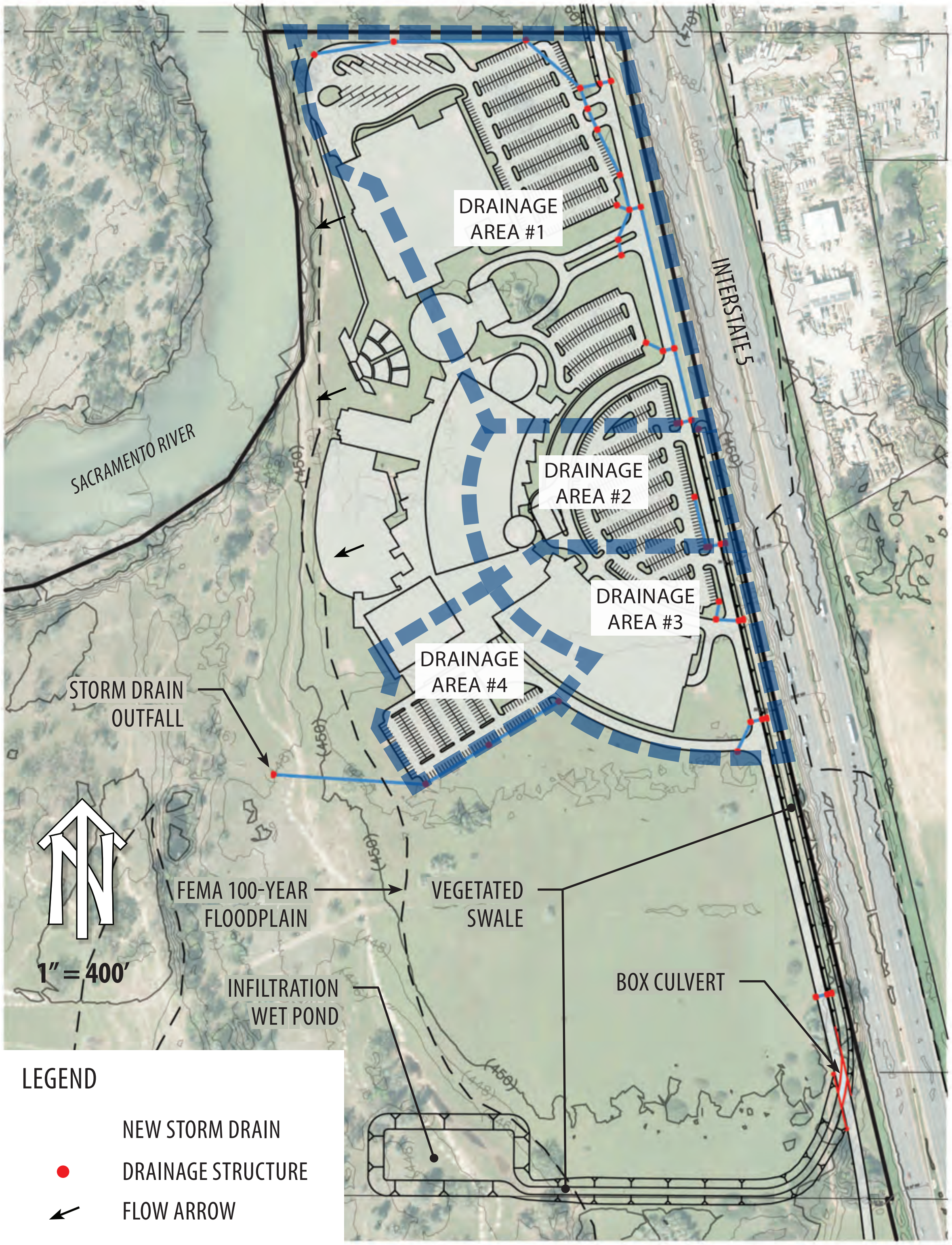
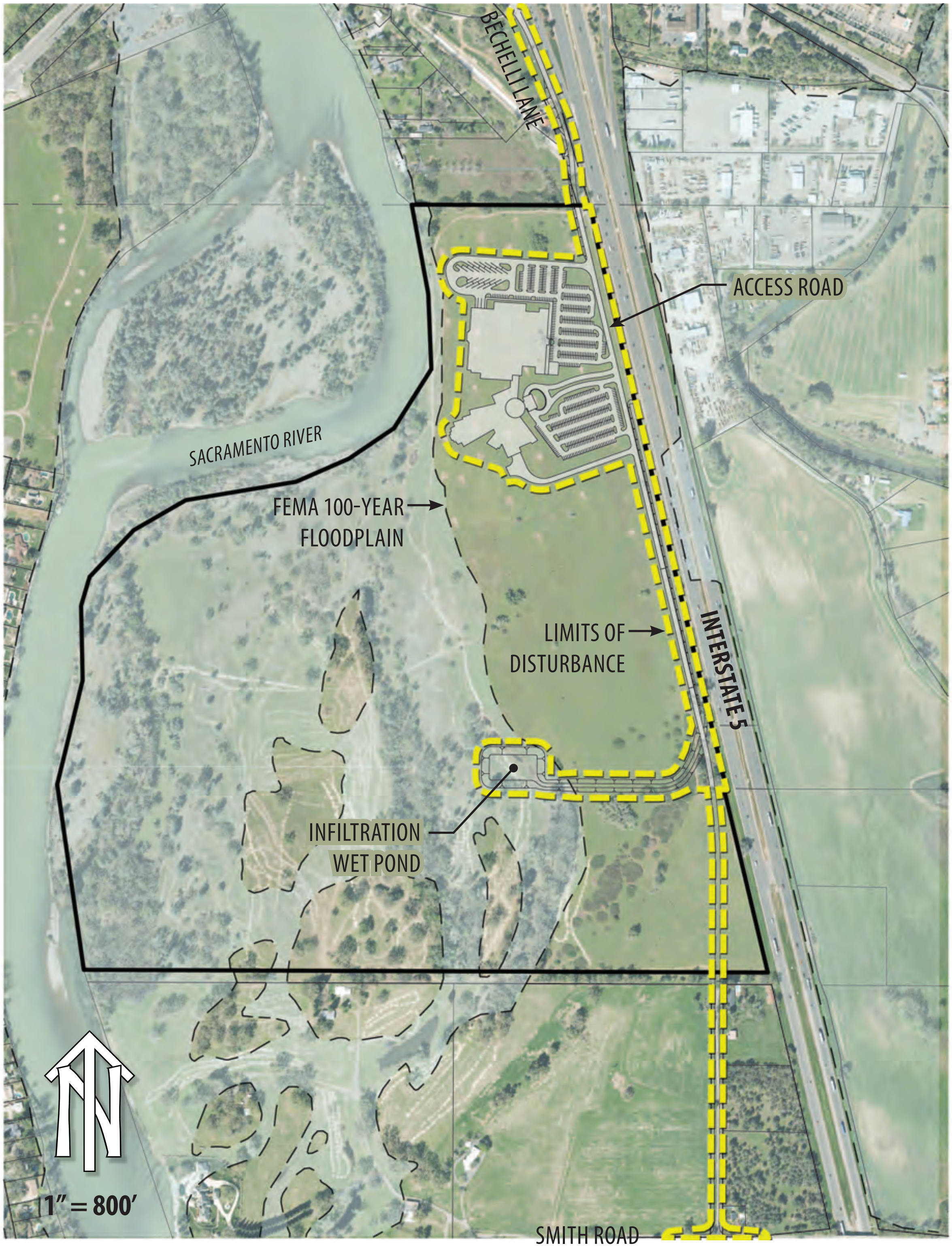


FIGURE C7
PROPOSED PROJECT - ALT 'C'
STORMWATER MANAGEMENT

Figures – Alternative D

REDDING RANCHERIA
CASINO MASTER PLAN



SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE D1
PROPOSED PROJECT - ALT 'D'
OVERALL DISTURBANCE LIMITS

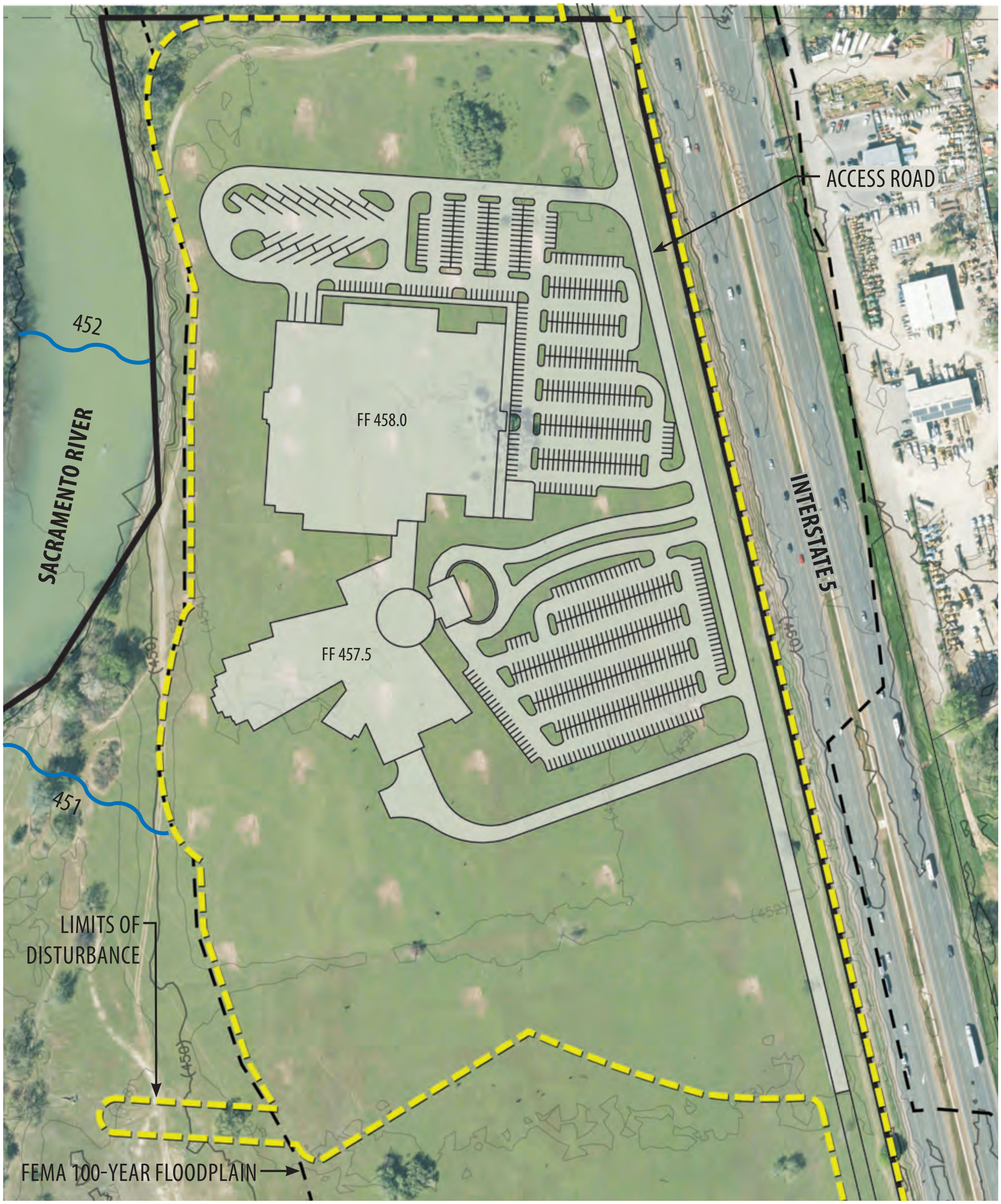


FIGURE D2
PROPOSED PROJECT - ALT 'D'
ONSITE DISTURBANCE LIMITS

FIGURE D3
PROPOSED PROJECT - ALT 'D'
ONSITE GRADING

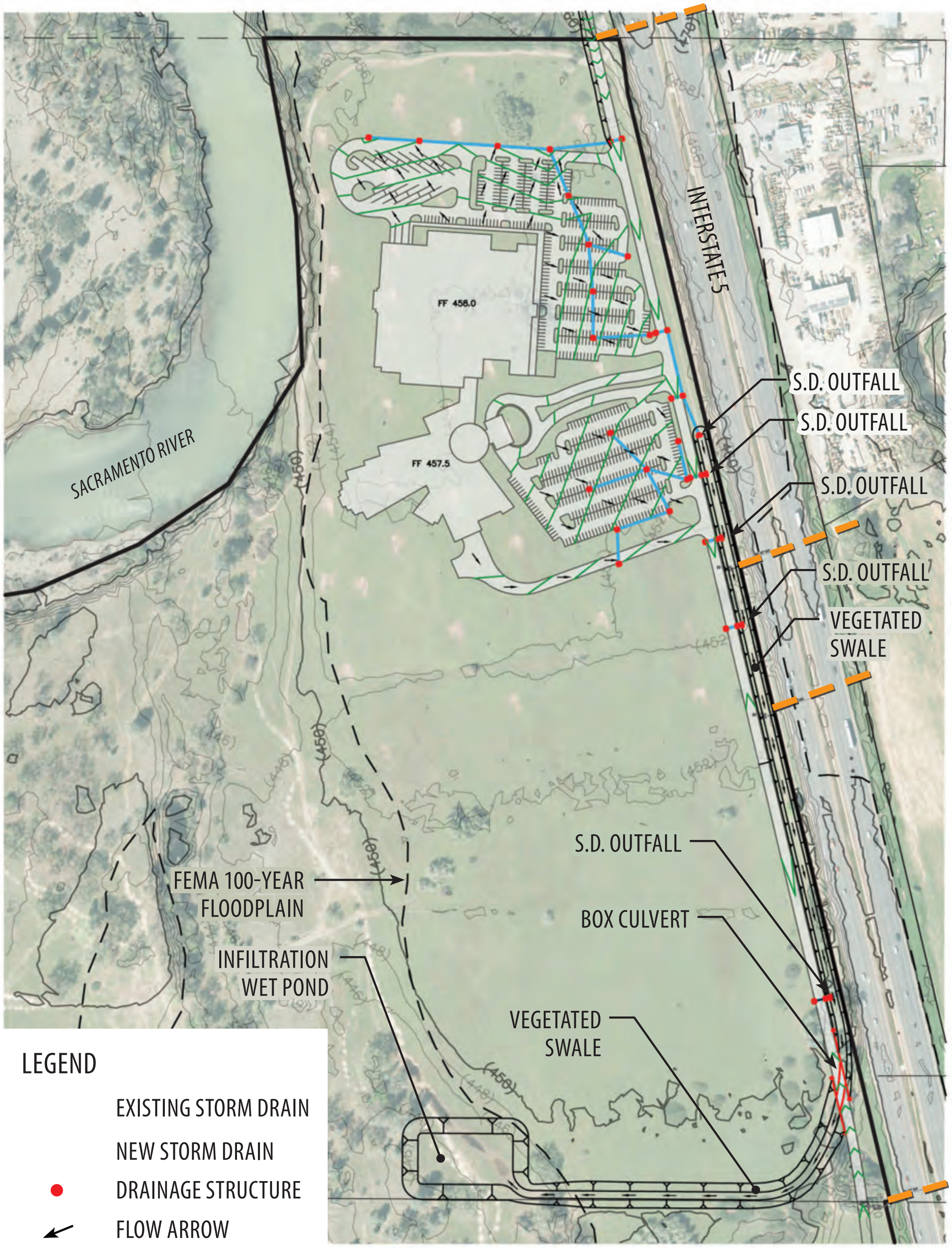


FIGURE D4
PROPOSED PROJECT - ALT 'D'
OVERALL GRADING

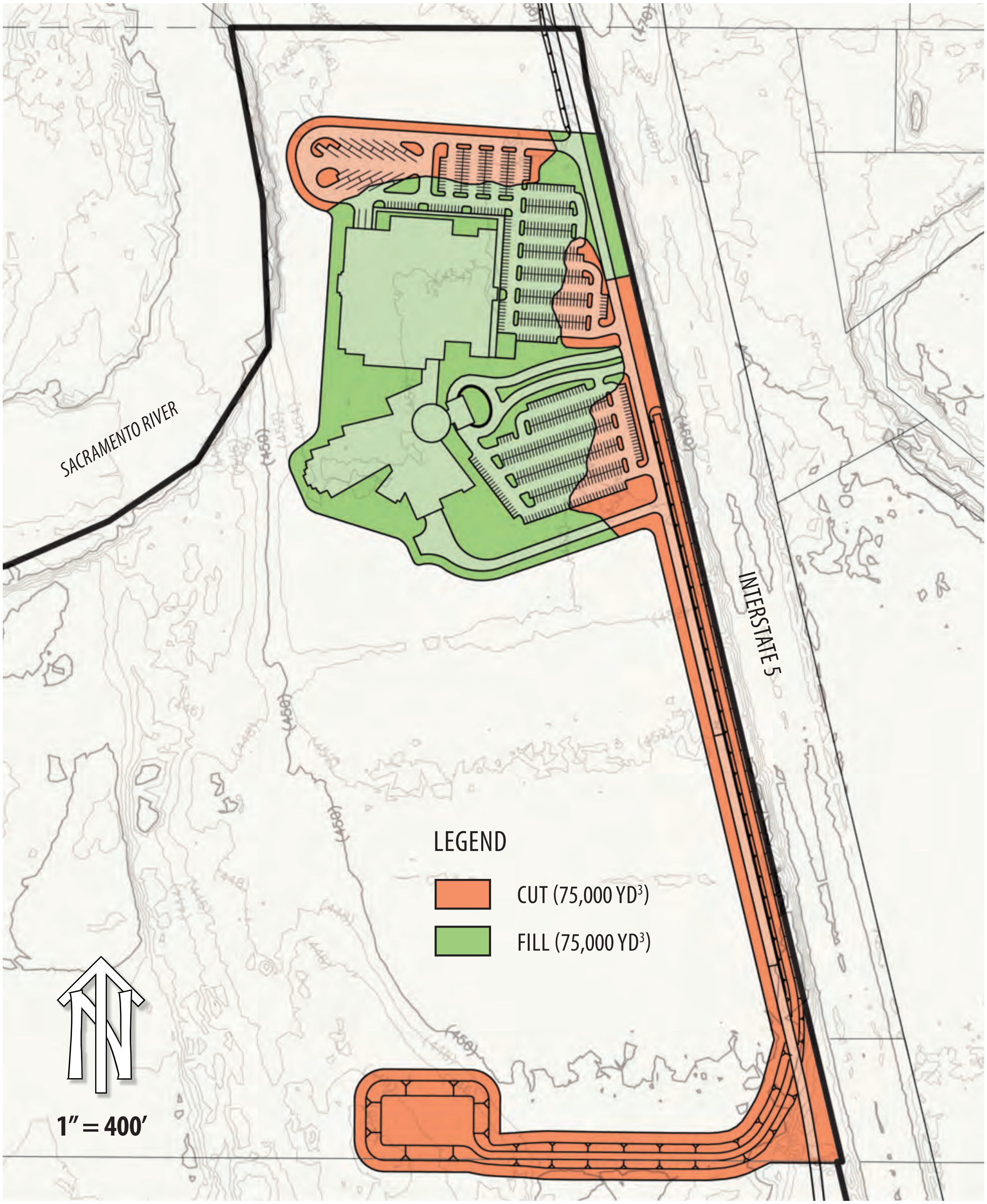


FIGURE D5
PROPOSED PROJECT - ALT 'D'
CUT FILL DIAGRAM

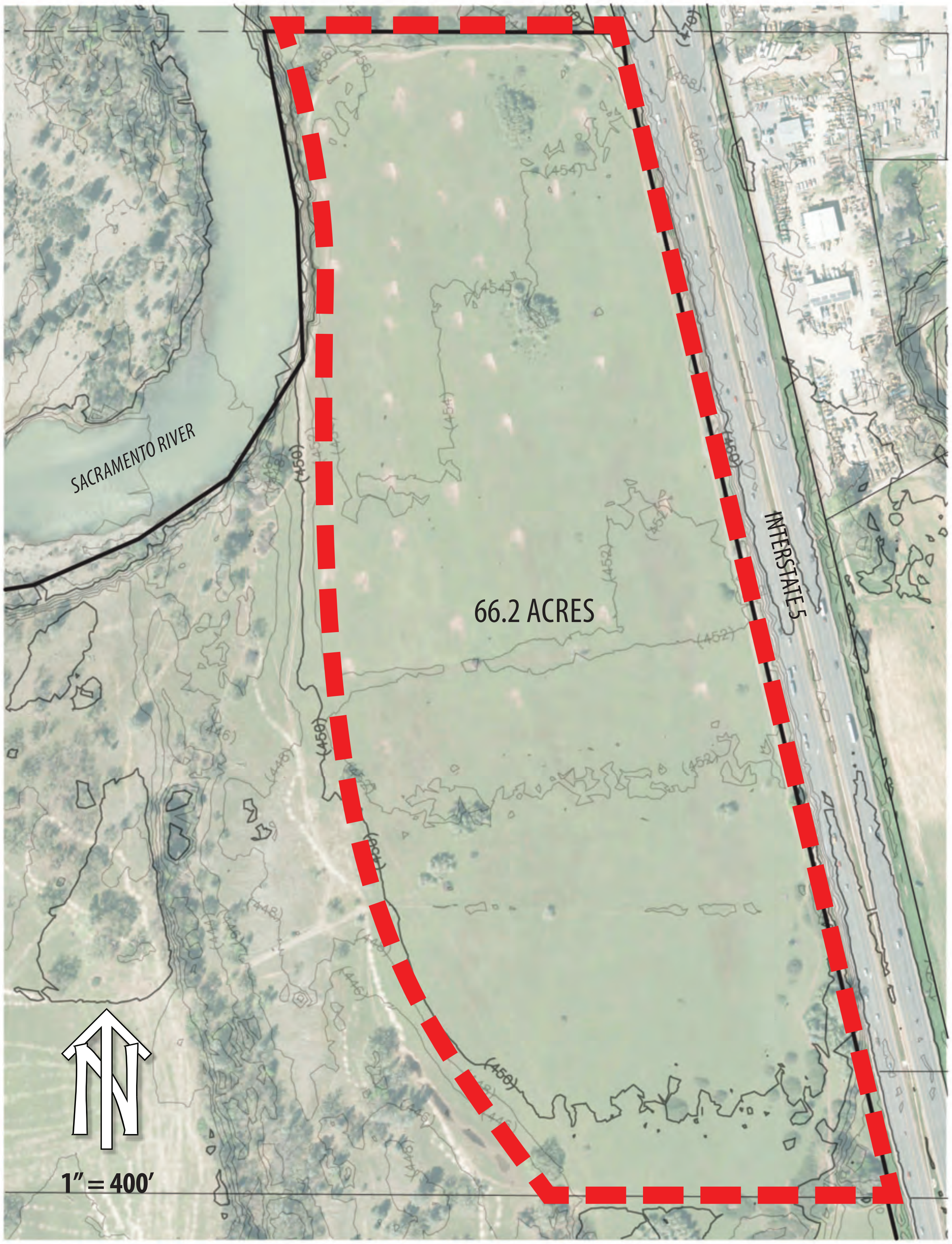
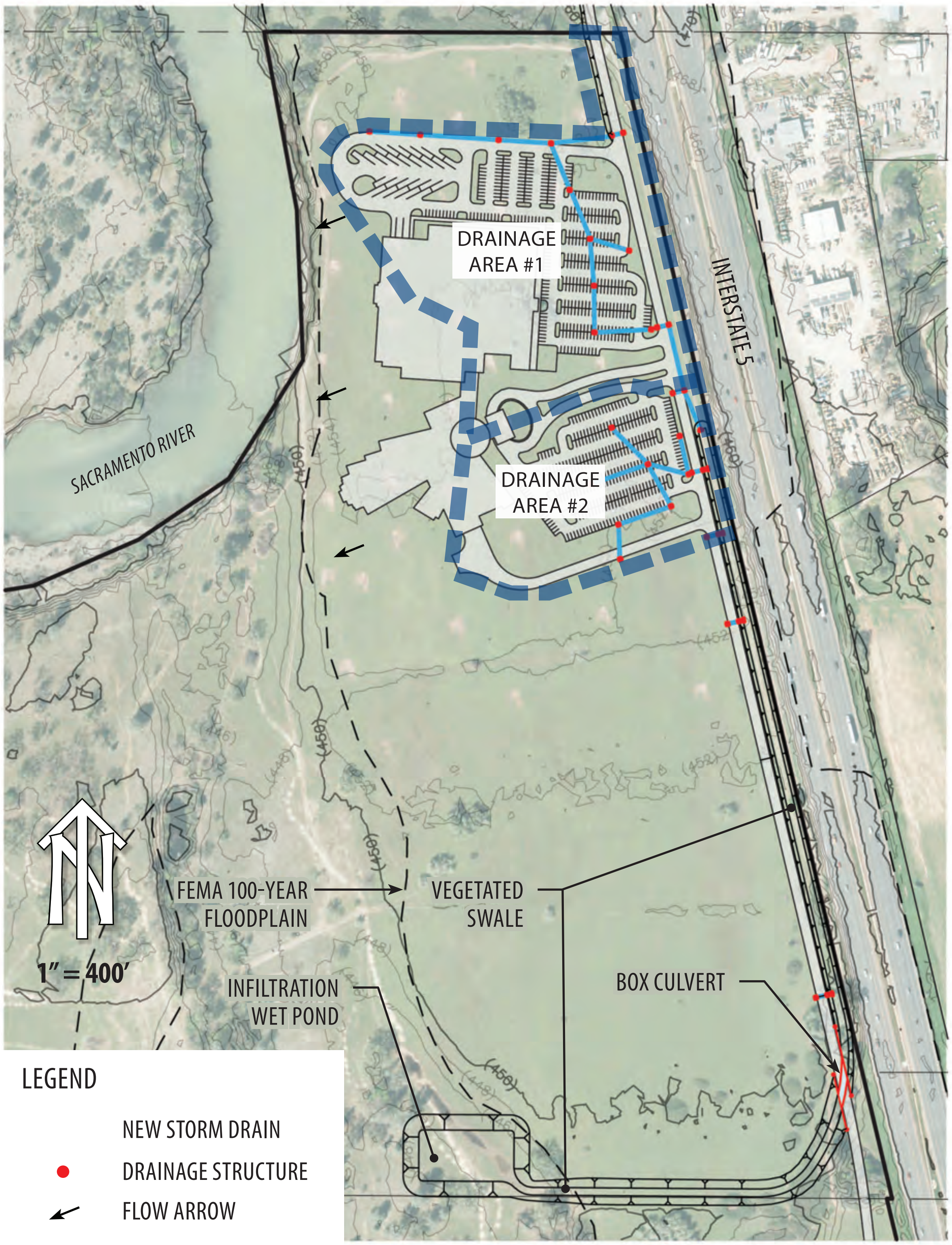


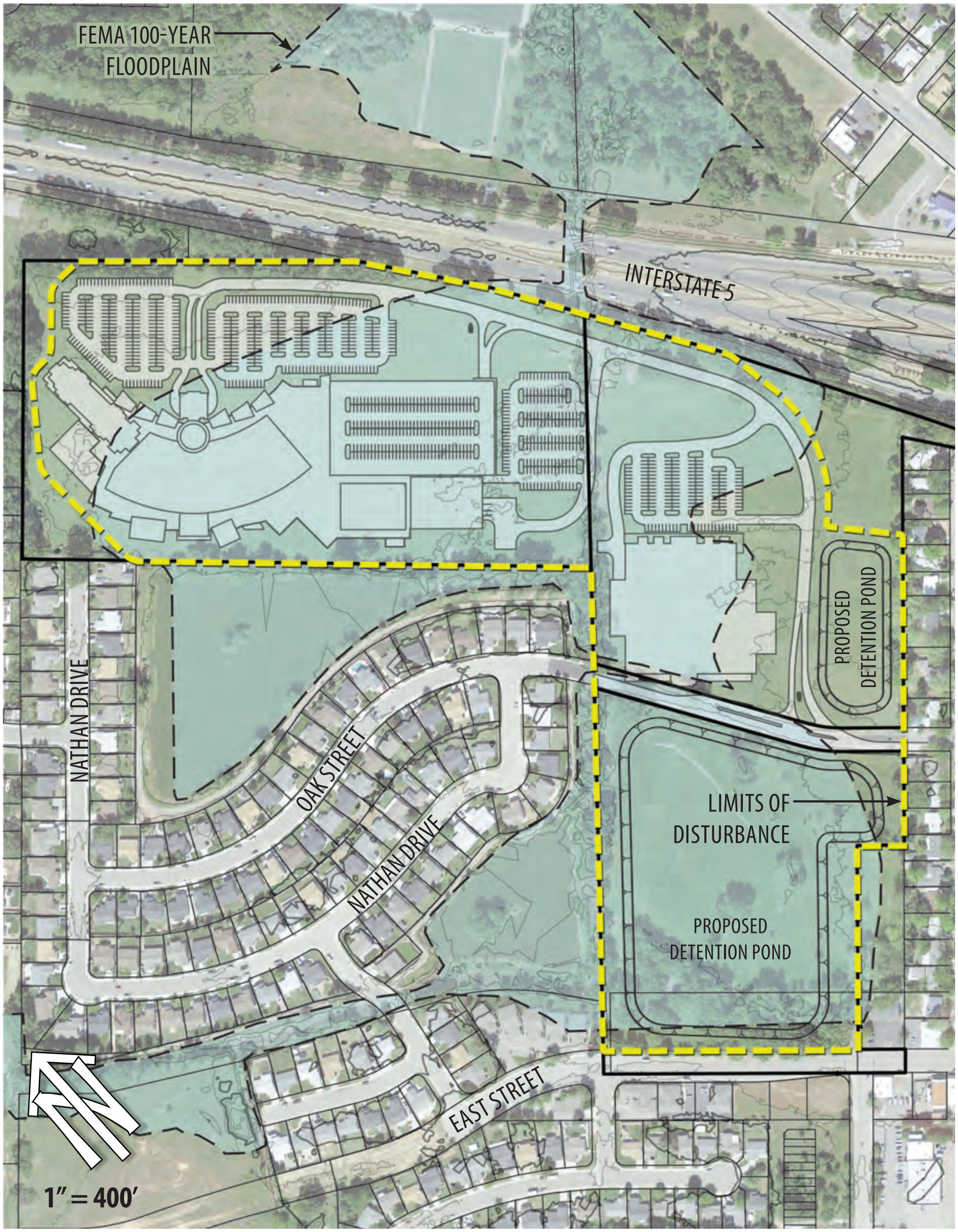
FIGURE D6
OVERALL DEVELOPABLE SITE DRAINAGE AREA- ALT 'D'
EXISTING CONDITION



SHARRAH
DUNLAP
SAWYER
INCORPORATED

FIGURE D7
PROPOSED PROJECT - ALT 'D'
STORMWATER MANAGEMENT

Figures – Alternative E



SHARRAH DUNLAP SAWYER INCORPORATED

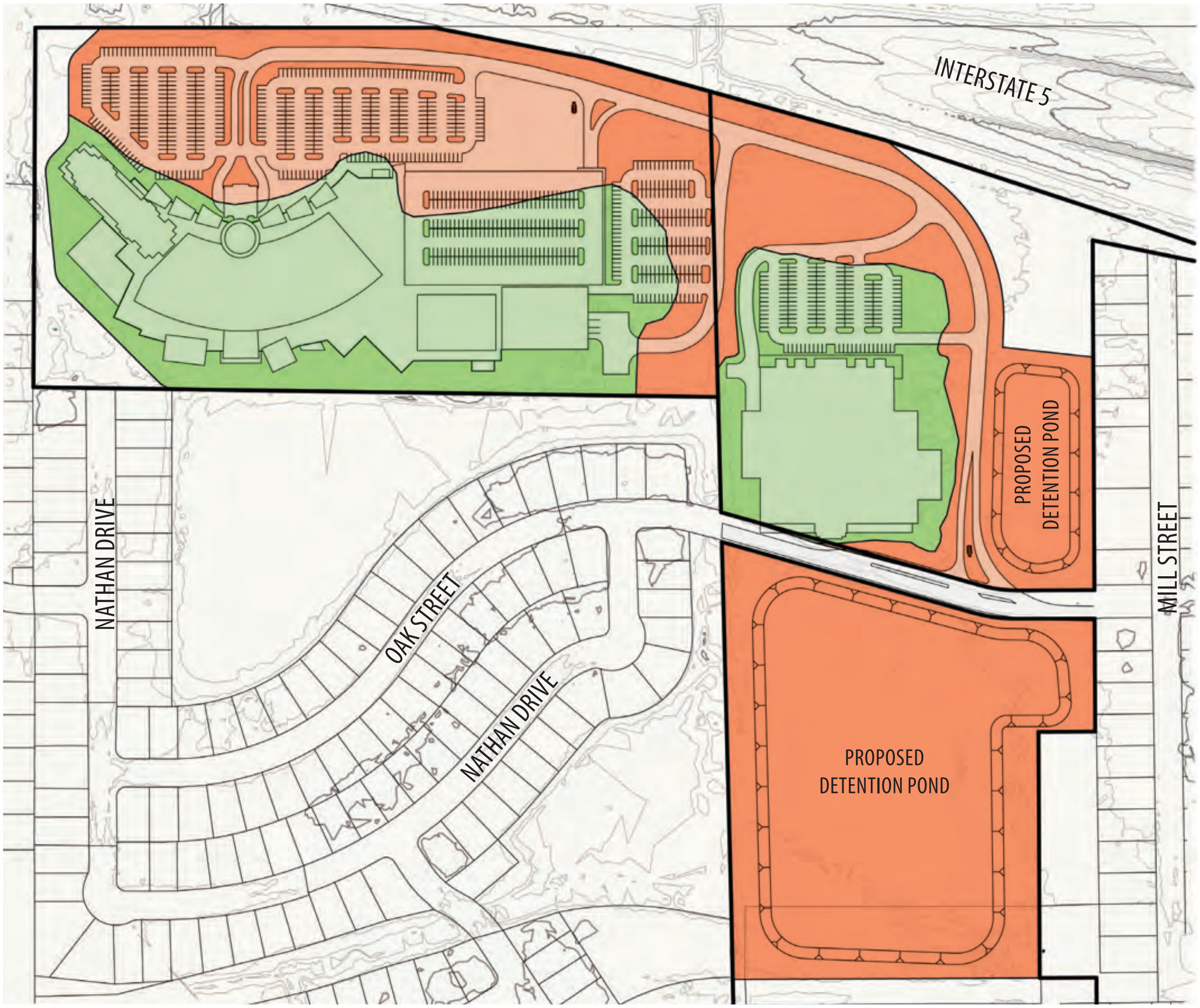
FIGURE E1
PROPOSED PROJECT - ALT 'E'
OVERALL DISTURBANCE LIMITS

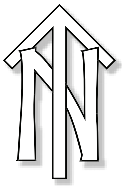
REDDING RANCHERIA
CASINO MASTER PLAN

SHARRAH
DUNLAP
SAWYER
INCORPORATED

FIGURE E2
PROPOSED PROJECT - ALT 'E'
ONSITE GRADING

REDDING RANCHERIA
CASINO MASTER PLAN





1" = 150'

LEGEND

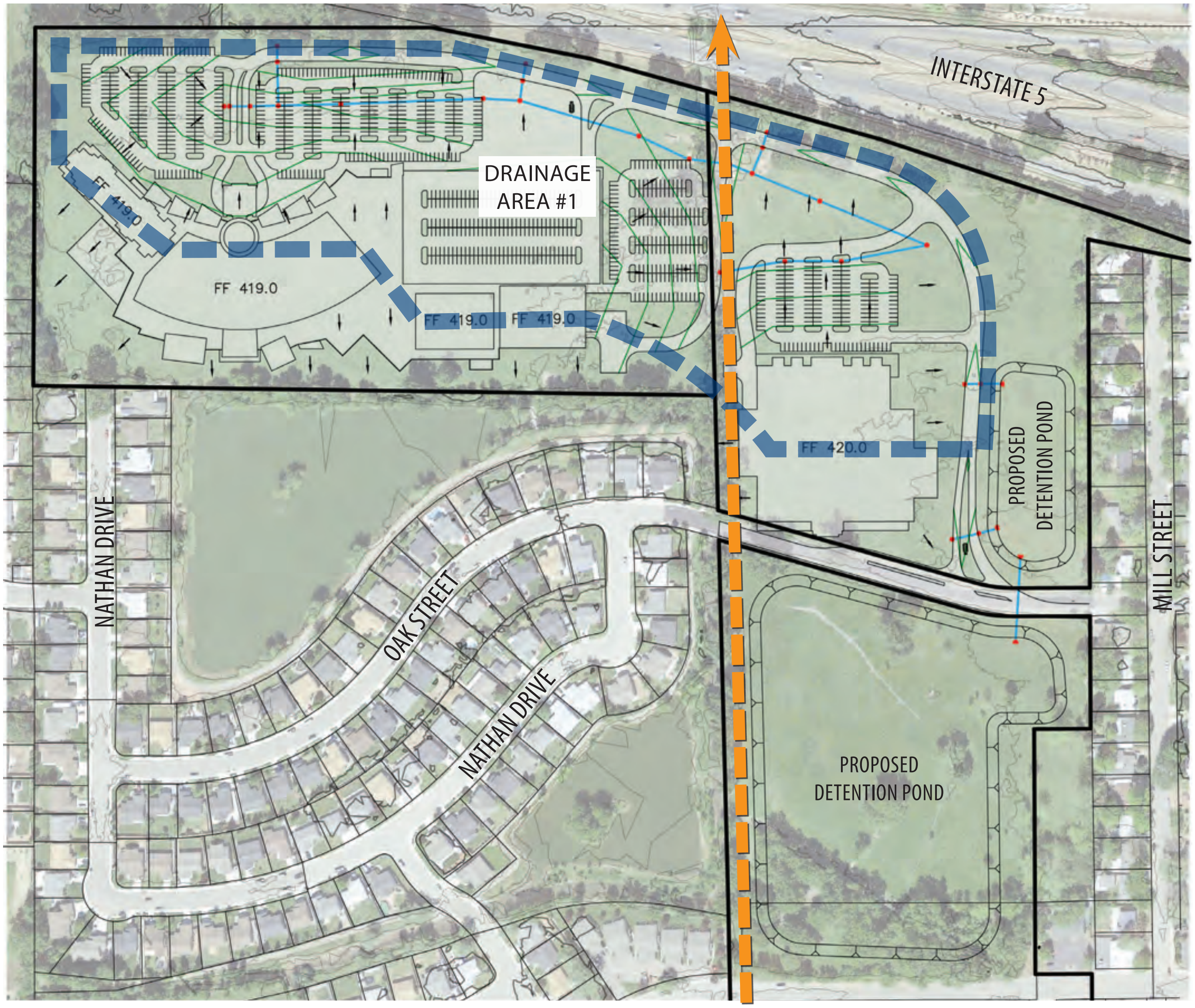
🟥 CUT (138,000 YD³)

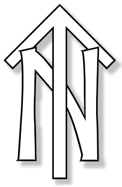
🟩 FILL (138,000 YD³)

SHARRAH DUNLAP SAWYER INCORPORATED

FIGURE E3
PROPOSED PROJECT - ALT 'E'
CUT FILL DIAGRAM

REDDING RANCHERIA
CASINO MASTER PLAN





1" = 150'

LEGEND

━ NEW STORM DRAIN

● DRAINAGE STRUCTURE

↙ FLOW ARROW

⇦ TORMEY DRAIN

SHARRAH
DUNLAP
SAWYER
INCORPORATED

FIGURE E4
PROPOSED PROJECT - ALT 'E'
STORMWATER MANAGEMENT

Appendix A

Hydrology and Hydraulic Calculations

CITY OF REDDING
APPENDIX C
CITY-WIDE MASTER STORM DRAIN STUDY
HYDROLOGY MANUAL

1. INTRODUCTION

The Redding Preprocessor (RPRE) is a computer program that was developed to provide a standardized and easy to use tool for creating HEC-1 input files. HEC-1 is a rainfall/runoff computer program developed by the U.S. Army Corps of Engineers' Hydrology Engineering Center in Davis, California. This program calculates the potential runoff from an area based on a set of parameters that describe the area and the rainfall. The required parameters for input into HEC-1 include precipitation, area, percent impervious, soil types, land use, and a subbasin unit hydrograph. It is important that all persons doing HEC-1 modeling in the City of Redding use consistent methodologies for data and input file development so that the results of the models will be directly comparable and acceptable to the City. The adoption of RPRE for use in developing HEC-1 input files is a big step toward the required consistency.

RPRE is designed to provide an easy to use method for entering data into the proper HEC-1 format as well as consistent design precipitation events and unit hydrographs. This manual is intended to give engineers and hydrologists the information they need to incorporate RPRE into their HEC-1 modeling work in the City.

The preprocessor was based on menu software from Softway, Inc. (ref. 16) and the 1990 HEC-1 User Manual (ref. 18). This report provides documentation for this preprocessor, which is only applicable to the Redding area. A similar preprocessor and methodology is used in Salt Lake City and West Valley, Utah; and Sacramento City, Sacramento County and El Dorado County, California.

2. PRECIPITATION

2.1 Storm Characteristics

Redding usually experiences flood producing rainfall during the late October through early April wet season. This rainfall is from storms that have originated in the subtropical Pacific Ocean and traveled from the southwest or west via upper air currents. Storm durations of over an hour are the result of widespread precipitation from frontal systems or from convergence uplift of moist air masses (general rainstorm). These general storm precipitation durations have an orographic component, that is, precipitation increases with elevation. Storm durations of one hour or less, associated with severe thunderstorms or thunderstorm mergers (local storms), produce the greatest precipitation intensities. These shorter intense events typically exhibit no significant change in precipitation relative to elevation; however, they can occur embedded within general storms of longer duration. Local thunderstorms or cloudbursts have also occurred, although rarely, in the May through September period.

2.2 Design Storms

Precipitation is applied to a drainage area to obtain a design runoff hydrograph. The variability of precipitation depth and the temporal and areal distribution occurring in nature require that a statistical approach, a design storm, be used to represent this precipitation. Design storms are a distribution of rainfall depths or intensities over a time increment for a given storm duration and frequency. The following are elements of a design storm:

1. Precipitation depth: the amount of precipitation occurring during a specified storm duration. The depths of rainfall are statistical depths obtained by studying historical precipitation data to find the maximum depth for each duration for a particular frequency. Precipitation depth is usually expressed in inches.

2. Duration: the specified length of storm time under study. Duration of a design storm event should be at least four times the reaction time of the basin. The reaction time is the time required for the flow peak to reach the point of interest, such as a structure, outlet or spillway. Duration may be expressed in any time unit such as minutes, hours, or days.

3. Frequency: the frequency of occurrence of events with the specified precipitation depth and duration. This is expressed in terms of the return period. In order to provide a reasonable level of flood protection, the statistical concept of return period or recurrence interval is utilized which aids in assigning a probabilistic meaning to a precipitation event.

2.3 Depth-Duration-Frequency Analysis

Given a long history of maximum rainfall intensities for varying duration, a reasonable statistical interpretation can be made of the data to determine estimates of maximum rainfall intensities or depths as a function of storm duration and of return frequency. The design storms for Redding were based on the statistics derived from depth-duration-frequency (DDF) analyses for Redding and Shasta Dam, shown in Table C-1 and C-2. Basic data for this analysis were obtained from the California Department of Water Resources (ref. 2).

TABLE C-1
DEPTH-DURATION-FREQUENCY DATA FOR REDDING 5 SSE

Duration	10-year	25-year	100-year
5 min	0.44	0.55	0.79
10 min	0.59	0.74	1.03
15 min	0.70	0.87	1.21
30 min	0.94	1.16	1.60
1 hr	1.26	1.55	2.10
2 hr	1.70	2.06	2.76
3 hr	2.02	2.43	3.24
6 hr	2.72	3.24	4.26
12 hr	3.65	4.32	5.61
1 day	4.91	5.76	7.38
2 days	6.59	7.67	9.71
3 days	7.84	9.08	11.40
5 days	9.75	11.21	13.95
10 days	13.10	14.94	18.35

TABLE C-2
DEPTH-DURATION-FREQUENCY DATA FOR SHASTA DAM

Duration	10-year	25-year	100-year
5 min	0.49	0.61	0.86
10 min	0.68	0.85	1.18
15 min	0.83	1.03	1.42
30 min	1.17	1.43	1.95
1 hr	1.64	1.99	2.67
2 hr	2.30	2.76	3.65
3 hr	2.81	3.35	4.39
6 hr	3.95	4.66	6.02
12 hr	5.54	6.48	8.24
1 day	7.79	9.00	11.29
2 days	10.94	12.52	15.47
3 days	13.34	15.19	18.60
5 days	17.14	19.36	23.45
10 days	24.07	26.92	32.13

2.4 Elevation Adjustments

A linear interpolation and extrapolation relationship was determined for the DDF Data for Redding 5 SSE at elevation 425 ft. MSL and Shasta Dam at elevation 1075 ft. MSL. Elevation adjustments produced patterns similar to the Shasta County mean annual precipitation map (ref. 3). The adjusted depth for a given duration and recurrence interval is calculated from:

$$D_b = R_d + \left(\frac{S_d - R_d}{650}\right) * (E_b - 425)$$

where:

D_b = Subbasin DDF Value
R_d = Redding 5SSE DDF Value (Table C-1)
S_d = Shasta Dam DDF Value (Table C-2)
E_b = Subbasin Elevation (ft)

2.5 Areal Reduction Factors (ARF)

Point precipitation gage statistics are only representative of areas of a few hundred acres. The distance for significant correlation between point gage measurements is characteristically a few miles for short duration precipitation (less than one hour) and up to a few hundred miles for long duration precipitation. Relationships for correcting point gage intensity to mean areal intensity have been developed from analysis of storm precipitation from closely space gage networks in Illinois, Arizona and Southern California (ref. 8, 27, 29).

Multiplying factors have been determined for converting point-gage data to areal data. These factors for durations greater than one hour are based on NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume XI-California, published by the National Weather Service (ref. 12). These ARFs have not changed since the publication of Technical Paper 40 in 1961 (ref. 8). The factors for durations of one hour are based on NWS Hydro 40 (ref. 27). These reduction factors, which convert point precipitation to average areal precipitation, are shown in Table C-3.

The maximum peak discharge at any given concentration point will normally be computed by entering the total drainage area in the preprocessor. For most studies, a single downstream concentration point will give adequate peak discharge definition for all the concentration points upstream in the model. As the size of the drainage area increases, other concentration points may be necessary. Generally, a computer run with ARF=1.0 (enter one square mile in preprocessor) is used for all drainage areas less than approximately five square miles. For larger areas, the model should be run for a few selected areas, and peak flows interpolated by comparing the drainage area for intermediate points. The largest drainage area in this study is 40 square miles at the mouth of Churn Creek.

2.6 Precipitation Temporal Distribution

Time distribution of rainfall within storms is important in estimating flood hydrographs. Distributions vary with storm type (orthographic, convective), intensity and duration. There is no typical distribution that is applicable to all situations. A balanced symmetrical distribution was chosen to represent the design storm for Redding. A symmetrical precipitation distribution is constructed such that the depths specified for the greatest intensities occur during the central part of the storm. The design storm pattern consists of incremental precipitation depths nested within the storm duration in an alternating pattern with the maximum value in the center and the second highest value to the right of center. For example, the 5-minute depth is subtracted from the 10-minute depth and the 10-minute depth is subtracted from the 15-minute depth. The storm pattern is formed by arranging the 5-minute incremental depths such that the maximum 5-minute depth is contained within the maximum 10-minute depth and the maximum 10-minute depth is contained within the maximum 15-minute depth and so forth. With this nested pattern the critical storm depth for all durations less than the total duration of the storm are nested within the storm.. Time increments of 5-minutes are recommended for the calculation of precipitation for design storms in Redding and are used by RPRE.

2.7 Constructing a design storm

Once the frequency and duration of the storm along with the elevation and area of the drainage basin are determined, the design storm can be constructed. Listed below are the steps in creating a design storm.

1. Determine the average elevation of the drainage area above the point of interest or the average elevation for an individual subbasin.

2. Apply the area multiplier (Table C-3) to the elevation adjusted precipitation data.

3. Calculate the incremental depths for the desired time increment, by subtracting the precipitation for each duration from the next longest duration and dividing it into 5-minute increments.

4. Distribute the precipitation values with the maximum depth as the central value and alternate succeeding lower values to the right and then left of the central maximum depth.

TABLE C-3
AREAL REDUCTION FACTORS (ARF)

Total Area (miles)	Duration					
	1-hr	2-hr	3-hr	6-hr	12-hr	24hr
1	1.00	1.00	1.00	1.00	1.00	1.00
2	0.98	0.99	0.99	0.99	1.00	1.00
3	0.98	0.98	0.99	0.99	0.99	1.00
4	0.97	0.98	0.98	0.99	0.99	0.99
5	0.97	0.97	0.98	0.99	0.99	0.99
6	0.96	0.97	0.98	0.98	0.99	0.99
7	0.96	0.97	0.98	0.98	0.99	0.99
8	0.96	0.96	0.97	0.98	0.99	0.99
9	0.95	0.96	0.97	0.98	0.98	0.99
10	0.95	0.96	0.97	0.98	0.98	0.99
15	0.92	0.94	0.96	0.97	0.98	0.98
20	0.90	0.93	0.95	0.96	0.97	0.97
25	0.87	0.91	0.93	0.95	0.96	0.96
30	0.85	0.90	0.92	0.94	0.96	0.96
35	0.84	0.88	0.91	0.93	0.95	0.96
40	0.82	0.87	0.90	0.93	0.94	0.95
45	0.81	0.86	0.89	0.92	0.94	0.95
50	0.80	0.85	0.89	0.91	0.93	0.95
60	0.78	0.84	0.87	0.91	0.93	0.95
70	0.77	0.83	0.86	0.90	0.92	0.94
80	0.75	0.82	0.86	0.89	0.91	0.94
90	0.74	0.31	0.85	0.89	0.91	0.94
100	0.73	0.80	0.84	0.88	0.91	0.93

Design storms are created by RPRE. The preprocessor will adjust the precipitation for the elevation of each basin. It will also adjust the precipitation for the entire drainage basin area. The preprocessor can generate design storms for the 10-, 25-, and 100- years and recurrence intervals for optional durations of 6-, 12-, and 24-hours.

STORM DRAIN IMPROVEMENTS SUBMITTED FOR REVIEW AND APPROVAL SHALL BE IN CONFORMANCE WITH THE FOLLOWING STANDARDS:

1. ALL SUBMITTALS SHALL BE IN DUPLICATE.

2. TOPOGRAPHIC MAPS SHALL HAVE CONTOUR INTERVALS (MAXIMUM INTERVAL 5 FEET), ADEQUATE TO DEFINE BOUNDARIES AND SLOPE OF DRAINAGE BASIN.

3. EACH DRAINAGE BASIN TO BE IDENTIFIED AND CORRELATED TO CALCULATIONS FOR THAT BASIN.

4. ALL DATA AND CALCULATIONS SHALL BE COMPLETE AND SHALL HAVE REASONABLE CLARITY.

5. DIVERSIONS OF ALL TYPES SHALL BE IN STRICT ACCORDANCE WITH APPLICABLE LAWS. TRANS–BASIN DIVERSIONS SHALL NOT BE ALLOWED WITHOUT THE FOLLOWING:
   A. COMPLETE ANALYSIS OF THE RECEIVING BASIN WATERSHED TO SHOW THAT NO INCREASES IN PEAK FLOWS OCCUR AT ANY LOCATION DOWNSTREAM IN THE 10–, 25–, AND 100–YEAR RETURN PERIOD DESIGN STORM EVENTS.
   B. ALTERNATIVES ANALYSIS DEMONSTRATING TO THE SATISFACTION OF THE CITY ENGINEER THAT NO REASONABLE ALTERNATIVE IS AVAILABLE.
   C. A RECORDED RELEASE OF LIABILITY INDEMNIFYING THE CITY OF REDDING AGAINST ANY AND ALL FUTURE FLOODING CLAIMS THAT IDENTIFY THE PROJECT AS A POTENTIAL CAUSE OF FLOODING, INCLUDING LEGAL DEFENSE COSTS.

6. PLACEMENT OF FILLS OF ANY MAGNITUDE ACROSS AN EXISTING DRAINAGE COURSE SHALL INCORPORATE A MEANS BY WHICH 100–YEAR FLOWS NOT HANDLED BY THE DESIGN DRAINAGE SYSTEM CAN FLOW OVERLAND VIA ESSENTIALLY THE SAME COURSE AS PRIOR TO PLACING THE FILL ACROSS THE DRAINAGE COURSE. ANALYSIS OF OVERLAND RELEASE ROUTES SHALL DEMONSTRATE THAT ADJACENT STRUCTURE FLOOR ELEVATIONS HAVE AT LEAST 1.0 FOOT OF ELEVATION ABOVE THE EXPECTED ADJACENT 100–YEAR WATER SURFACE.

7. ENGINEERING CALCULATIONS SHALL BE SUBMITTED VERIFYING THAT APPROPRIATE MEASURES HAVE BEEN ADDRESSED, ENSURING THAT EXIT VELOCITIES ARE NON–ERODING.

8. HYDROLOGY FOR DRAINAGE BASINS SMALLER THAN 10 ACRES SHALL BE CALCULATED USING THE RATIONAL METHOD. RAINFALL INTENSITIES UTILIZED FOR ALL HYDROLOGY ANALYSIS SHALL BE DERIVED FROM THE ANALYSIS OF LOCAL PRECIPITATION RECORDS AS PROVIDED BY THE CITY ENGINEER.

9. HYDROLOGY FOR DRAINAGE BASINS LARGER THAN 10 ACRES SHALL BE CALCULATED USING HEC–1 COMPUTER ANALYSIS. ALL ANALYSIS SHALL EMPLOY THE CITY OF REDDING HEC–1 INTERFACE TOOLS AVAILABLE FROM THE CITY ENGINEERING DIVISION.

10. RECURRENCE INTERVAL (STORM FREQUENCY)

    A. A 10– YEAR FREQUENCY FOR AREAS LESS THAN FORTY ACRES AND WHERE THE PROPOSED DRAINAGE STRUCTURE WILL NOT BE PLACED IN A NATURAL OR CONSTRUCTED SUMP. CULVERTS UNDER MODERATE FILLS TO PASS A TEN–YEAR STORM WITHOUT STATIC HEAD, AND UNDER HIGH FILLS TO PASS A 25–YEAR STORM WITH HEAD; HOWEVER, **NO DAMAGE DUE TO PONDING IS TO OCCUR.**

    B. A 25–YEAR FREQUENCY FOR AREAS LARGER THAN 40 ACRES AND LESS THAN 160 ACRES. CULVERTS UNDER MODERATE FILLS ON COLLECTOR AND LOCAL STREETS ARE TO PASS A 25–YEAR STORM WITHOUT STATIC HEAD, AND UNDER HIGH FILLS TO PASS A 100–YEAR STORM WITH HEAD; HOWEVER, **NO DAMAGE DUE TO PONDING IS TO OCCUR.**

    C. A 100–YEAR FREQUENCY FOR AREAS LARGER THAN 160 ACRES, OR WHERE CULVERTS ARE TO BE PLACED UNDER HIGH FILLS; WHERE A SUMP CONDITION EXISTS AND DAMAGE WOULD RESULT DUE TO PONDING AND WHERE MAJOR STREETS OR A FREEWAY ARE TO BE CROSSED. CULVERTS TO PASS 100–YEAR STORM WITH HEAD; HOWEVER, **NO DAMAGE DUE TO PONDING IS TO OCCUR.**

11. ALL NEWLY CONSTRUCTED OR MODIFIED STORM DRAIN INLETS SHALL BE LABELED PER CITY OF REDDING CONSTRUCTION STANDARD 202.00.

12. REGULATORY AGENCY PERMITS SHALL BE OBTAINED OR CONSULTATION WITH REGULATORY AGENCIES SHALL OCCUR, AS, REQUIRED, PRIOR TO SUBMITTING PLANS FOR APPROVAL.

DWG DATE: 9/89		SCALE: NTS	CITY OF REDDING • PUBLIC WORKS DEPARTMENT • ENGINEERING DIVISION	
4 3	7/13 4/06	REVISE NOTES ADD NOTE	APPROVED BY 10/9/13 CITY ENGINEER	**DRAINAGE CRITERIA**
MARK	DATE	REVISION		

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             *
 *                                       *                                                           *                                     *
 *****************************************                                                           ***************************************



                                                  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

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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
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   9          IN       5
              *
              * BA
              * Casino Master Plan Alternates A-D

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  11          KO       0
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  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      -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  10:47:16   *                                                     *           (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 ***
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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)   *                                                   *   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          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
```

```
             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)   *                                                      *    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             *
 *                                       *                                                      *                                     *
 *****************************************                                                      ***************************************


                                           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
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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  10:58:57   *                                                    *            (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

                                       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     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                    PEAK                                     PEAK

                                (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 ***
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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  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
```

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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  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     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                      PEAK                                     PEAK

                                  (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
```

```
           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
```

Post-development 10-year Storm Event
Alternative A Drainage Area #2

```
 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


             **************
             *            *
   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
```

Post-development 2-year Storm Event
Alternative A Drainage Area #3

```
 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


             **************
             *            *
   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
```

```
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 ***
```

Post-development 2-year Storm Event
Alternative B 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   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
```

Post-development 2-year Storm Event
Alternative B Drainage Area #1

```
         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


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

Post-development 2-year Storm Event
Alternative B Drainage Area #1

```
             **************
             *            *
   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
```

Post-development 10-year Storm Event
Alternative B Drainage Area #1

```
 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

             **************
             *            *
   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

Post-development 2-year Storm Event
Alternate D

```
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)   *                                                  *    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


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

Post-development 10-year Storm Event
Alternate D: Drainage Area #1

```
            **************
            *            *
   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


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

Post-development 2-year Storm Event
Alternate D: Drainage Area #2

```
             **************
             *            *
   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
```

Post-development 10-year Storm Event
Alternate D: Drainage Area #2

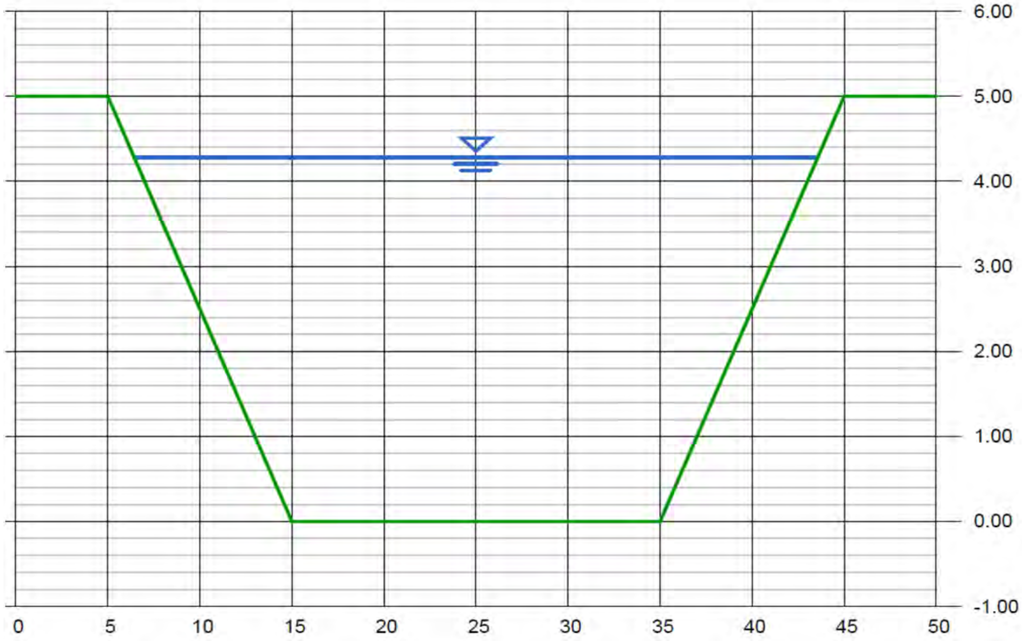
```
1*****************************************                                                         ***************************************
 *                                       *                                                         *                                     *
 *   FLOOD HYDROGRAPH 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   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
```

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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  11:09:29  *                                                   *           (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


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

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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         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 ***
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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             *
 *                                       *                                                   *                                      *
 *****************************************                                                   ****************************************




                                                 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 ***
```

Post-development 2-year Storm Event
Alternative E: 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   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
```

Post-development 2-year Storm Event
Alternative E: Drainage Area #1

```
                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
```

```
*** 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  11:53:26   *                                                   *           (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
```

Post-development 10-year Storm Event
Alternative E: 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   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


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

Post-development 10-year Storm Event
Alternative E: Drainage Area #1

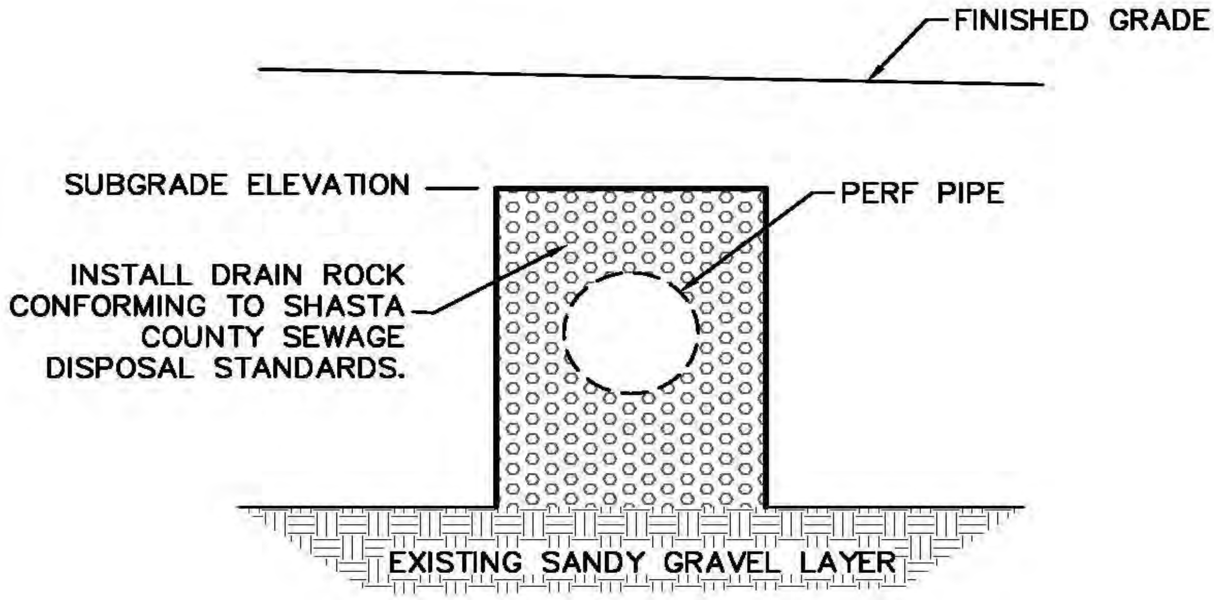
```
             **************
             *            *
   10 KK     *    Basin   *
             *            *
             **************

   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 ***
```

Casino Master Plan
Job#16.0196.000
Calc'd By: K. Reagan, P.E.
Sharrah Dunlap Sawyer, Inc.
Date:March 2017

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

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INCORPORATED

Page	1	Of	1		
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.

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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.

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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.

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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.

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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.

Appendix C

Retention / Infiltration Pond Sizing Calculations

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Page 1 Of 1
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

Wet Ponds TC-20

Design Considerations

- Area Required
- Slope
- Water Availability
- Aesthetics
- Environmental Side-effects

Targeted Constituents

☑	Sediment	■
☑	Nutrients	▲
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend ***(Removal Effectiveness)***

● Low

■ High

▲ Medium

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.

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.

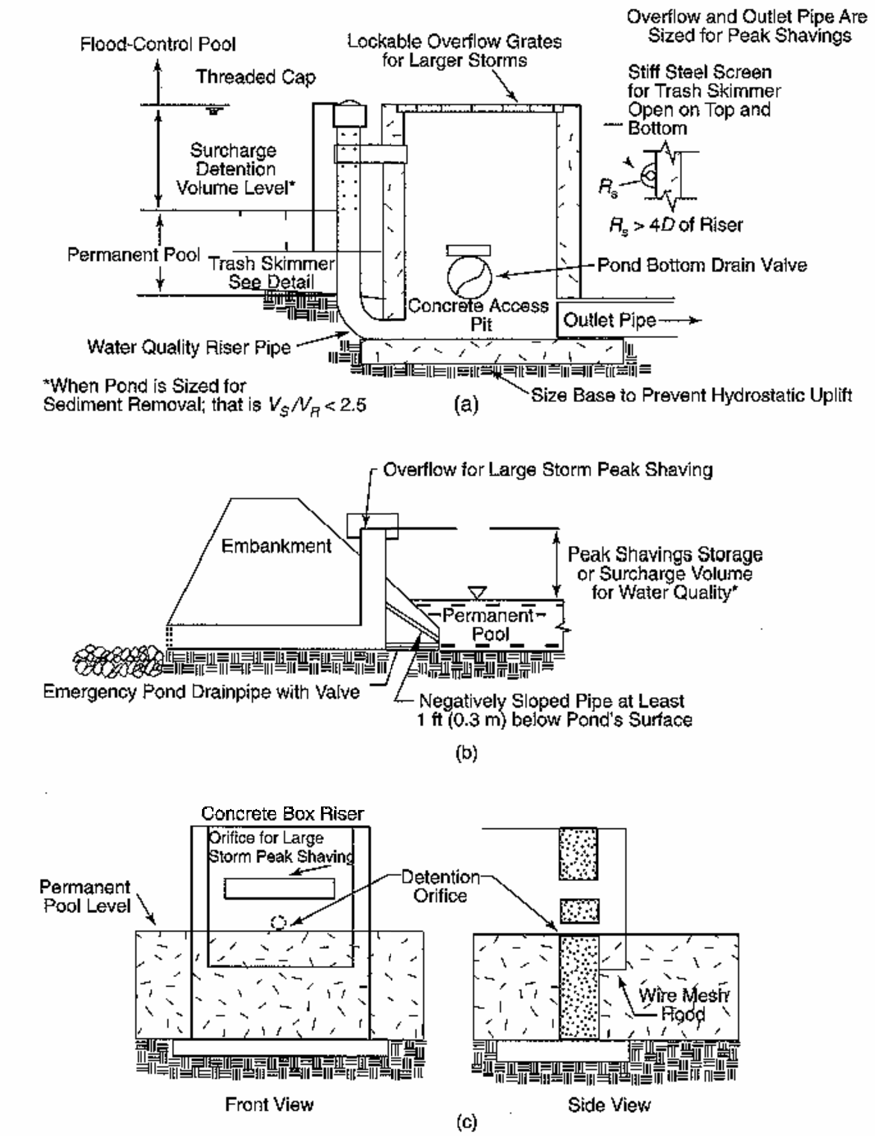
(2) Pond Configuration - The wet basin should be configured as a two stage facility with a sediment forebay and a main pool. The basins should be wedge-shaped, narrowest at the inlet and widest at the outlet. The minimum length to width ratio should be 1.5 where feasible. The perimeter of all permanent 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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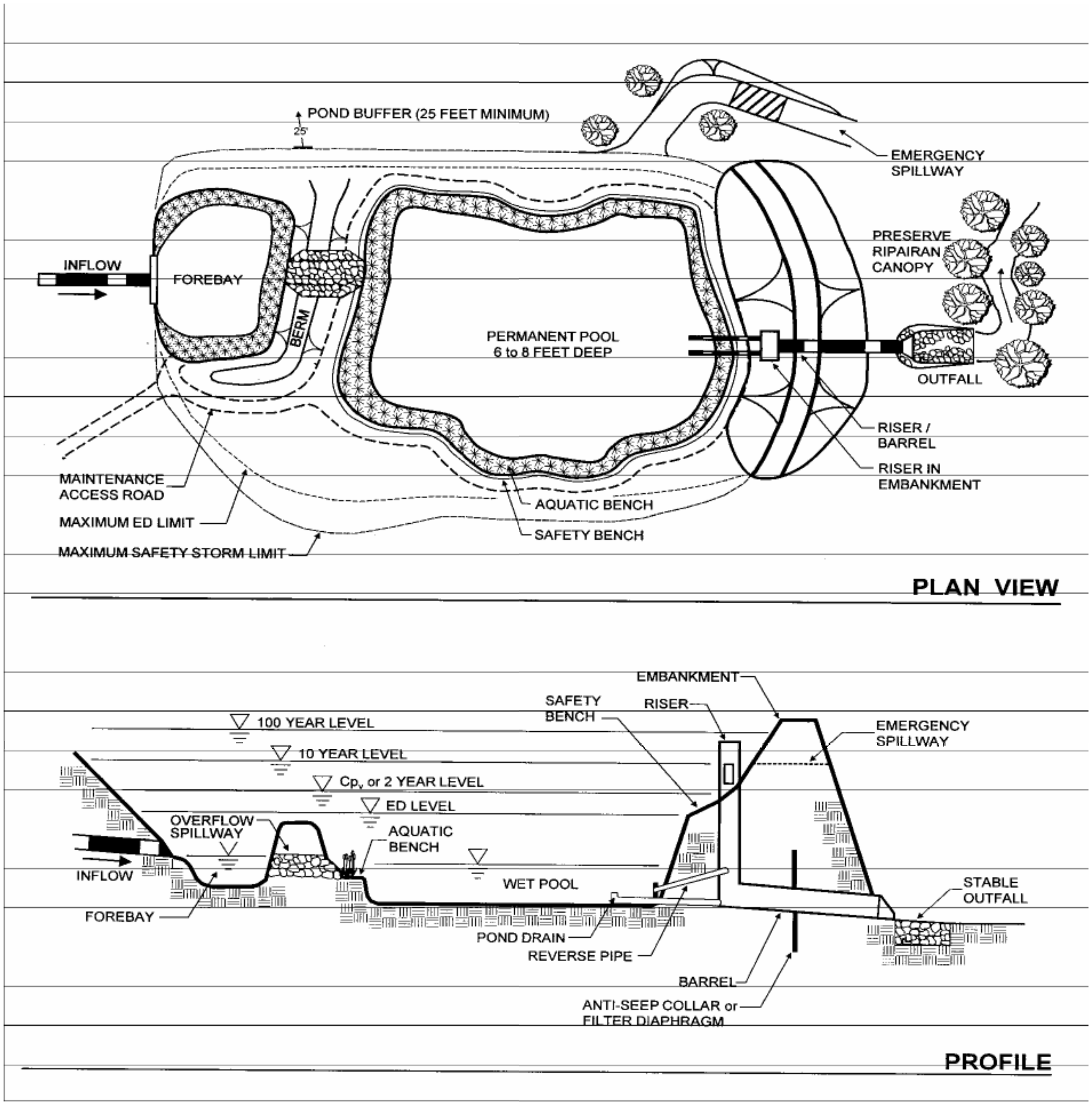

POND BUFFER (25 FEET MINIMUM)
25'
EMERGENCY SPILLWAY
PRESERVE RIPAIRAN CANOPY
INFLOW
FOREBAY
BERM
PERMANENT POOL 6 to 8 FEET DEEP
OUTFALL
RISER / BARREL
RISER IN EMBANKMENT
MAINTENANCE ACCESS ROAD
MAXIMUM ED LIMIT
MAXIMUM SAFETY STORM LIMIT
AQUATIC BENCH
SAFETY BENCH
PLAN VIEW
EMBANKMENT
SAFETY BENCH
RISER
100 YEAR LEVEL
10 YEAR LEVEL
Cp_v 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

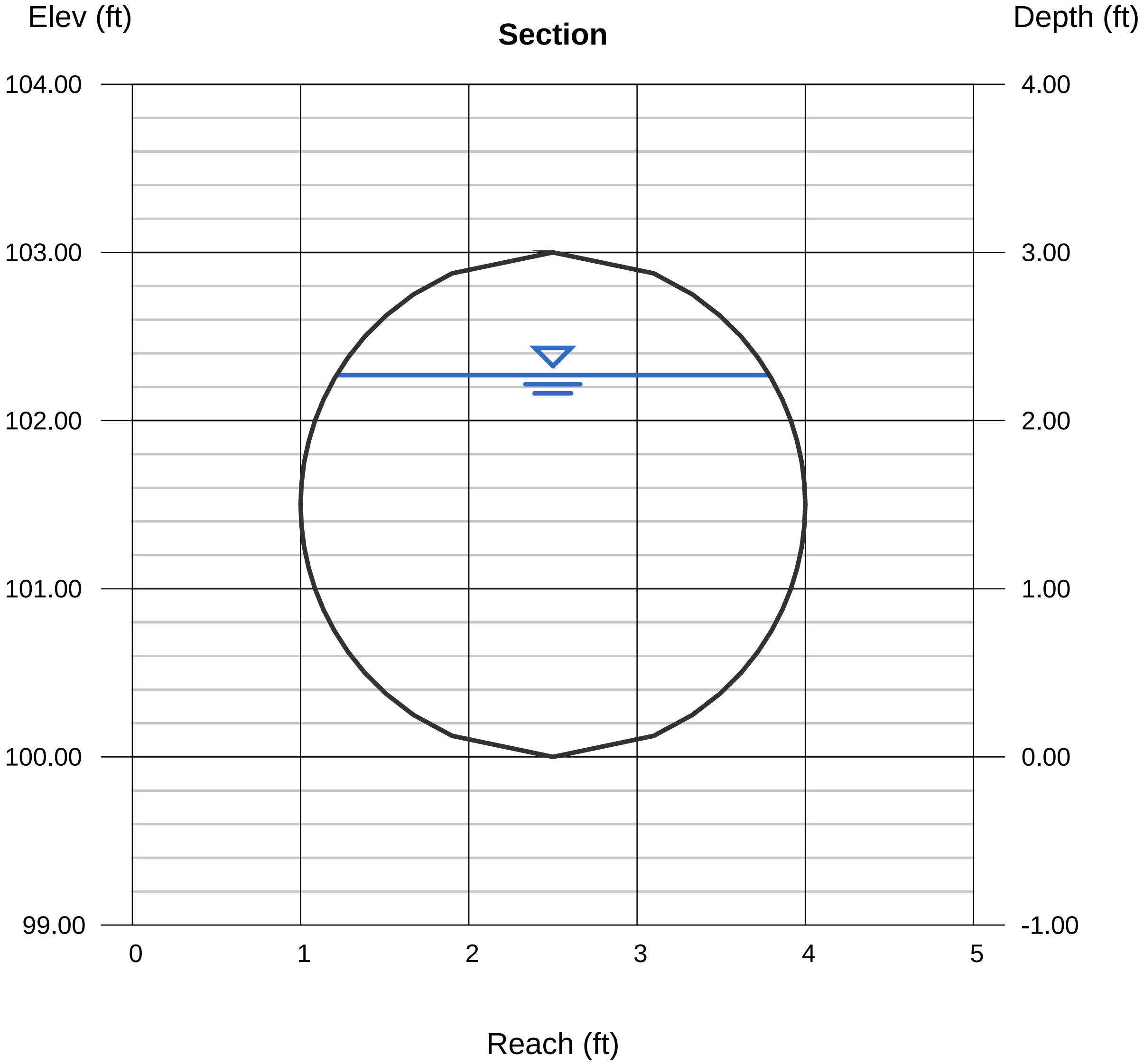
Alternative A: Drainage Area #1

Circular
Diameter (ft) = 3.00

Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.012

Calculations
Compute by: Known Q
Known Q (cfs) = 47.00

Highlighted
Depth (ft) = 2.27
Q (cfs) = 47.00
Area (sqft) = 5.74
Velocity (ft/s) = 8.19
Wetted Perim (ft) = 6.33
Crit Depth, Yc (ft) = 2.24
Top Width (ft) = 2.57
EGL (ft) = 3.31



Channel Report

Alternative A: Drainage Areas #2 and #4

Circular

Diameter (ft) = 2.00

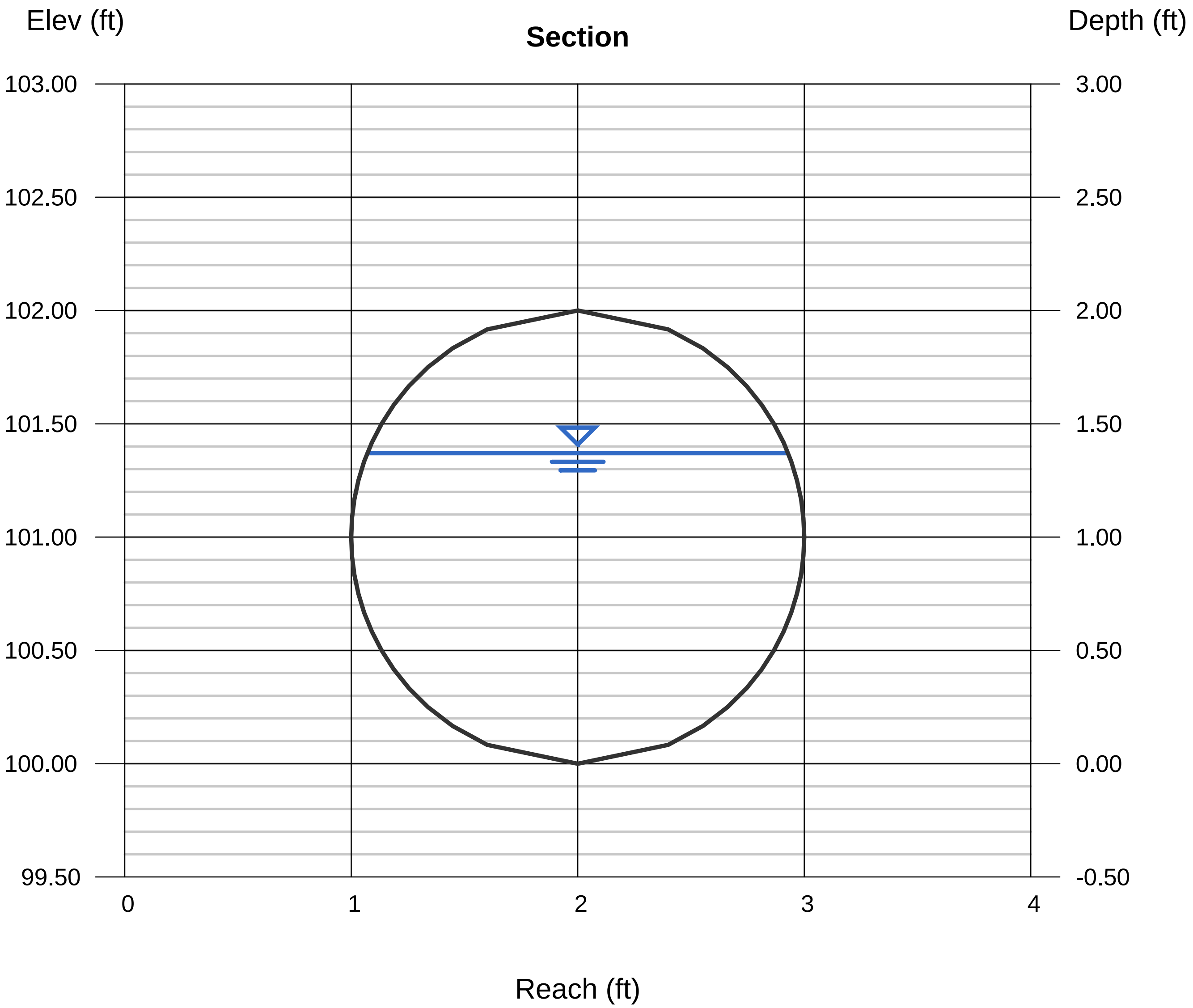
Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.012

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

Diameter (ft) = 2.50

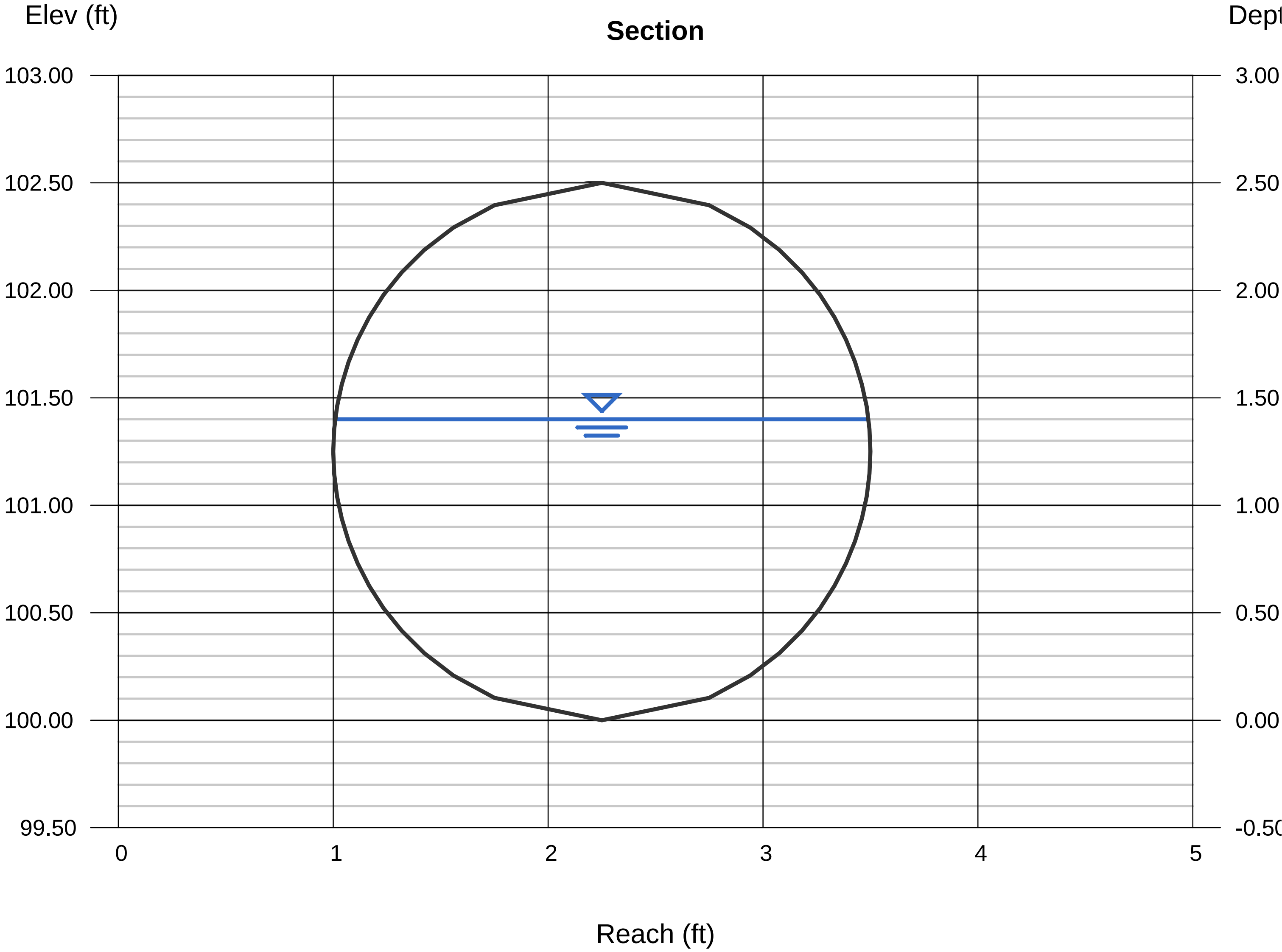
Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.012

Calculations

Compute by: Known Q
Known Q (cfs) = 19.00

Highlighted

Depth (ft) = 1.40
Q (cfs) = 19.00
Area (sqft) = 2.84
Velocity (ft/s) = 6.69
Wetted Perim (ft) = 4.24
Crit Depth, Yc (ft) = 1.48
Top Width (ft) = 2.48
EGL (ft) = 2.10



Channel Report

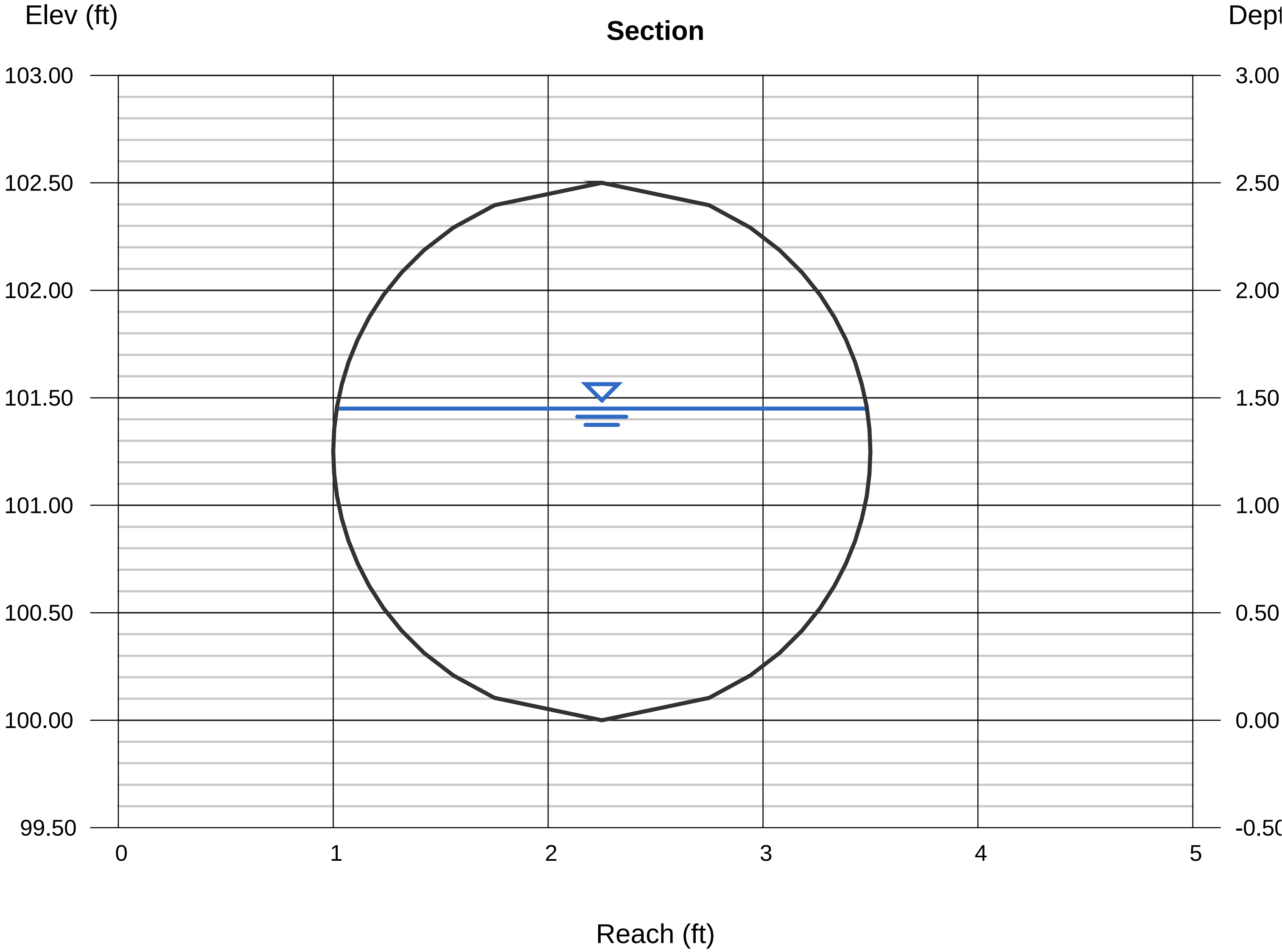
Alternative B: Drainage Area #1

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

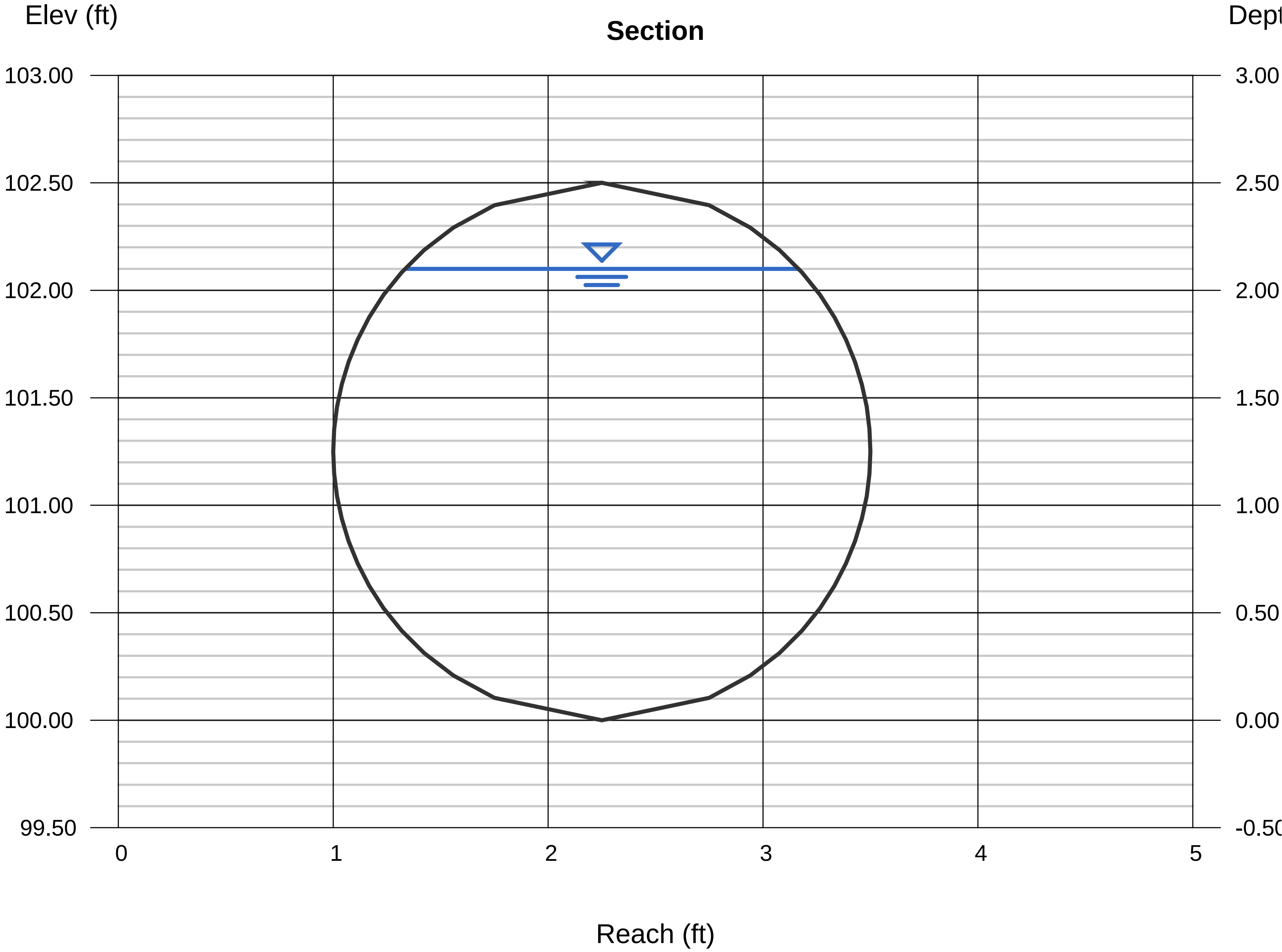
Alternative D: Drainage Area #1

Circular
Diameter (ft) = 2.50

Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.012

Calculations
Compute by: Known Q
Known Q (cfs) = 32.00

Highlighted
Depth (ft) = 2.10
Q (cfs) = 32.00
Area (sqft) = 4.40
Velocity (ft/s) = 7.27
Wetted Perim (ft) = 5.80
Crit Depth, Yc (ft) = 1.93
Top Width (ft) = 1.83
EGL (ft) = 2.92



Channel Report

Alternative D: Drainage Area #2

Circular

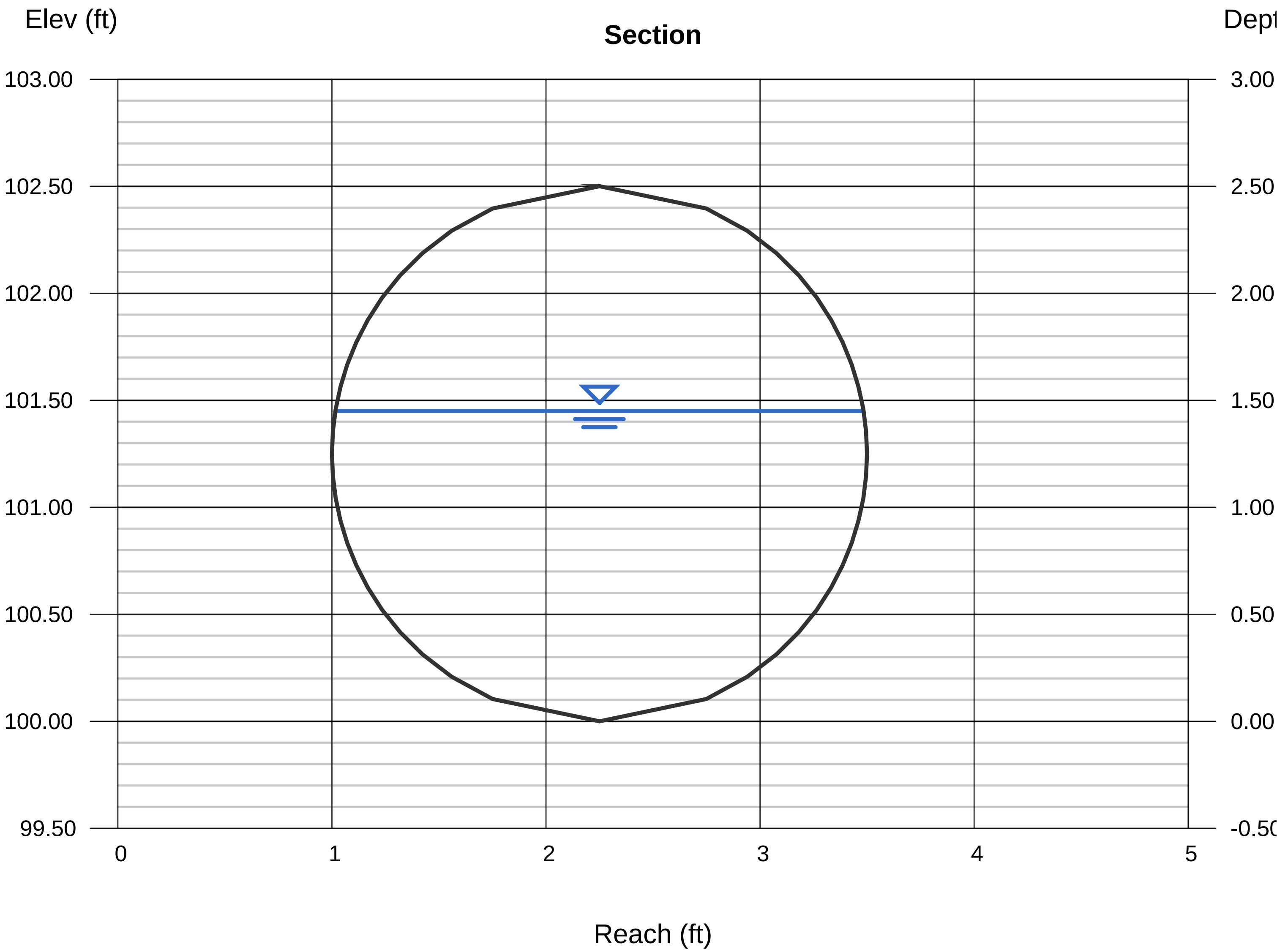
Diameter (ft)	= 2.50
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 20.00

Highlighted

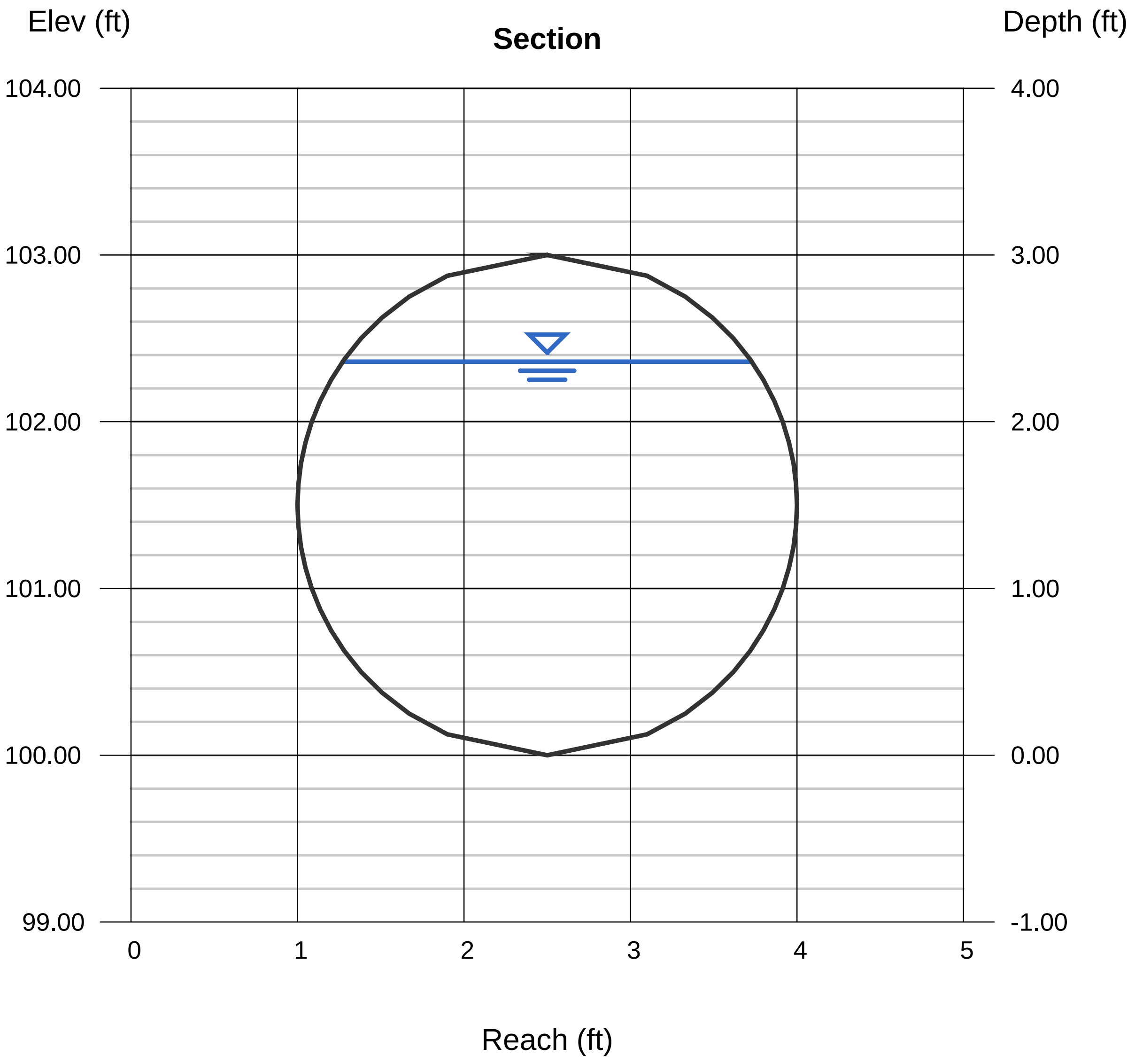
Depth (ft)	= 1.45
Q (cfs)	= 20.00
Area (sqft)	= 2.96
Velocity (ft/s)	= 6.75
Wetted Perim (ft)	= 4.34
Crit Depth, Yc (ft)	= 1.52
Top Width (ft)	= 2.47
EGL (ft)	= 2.16



Channel Report

Alternative E: Drainage Area #1

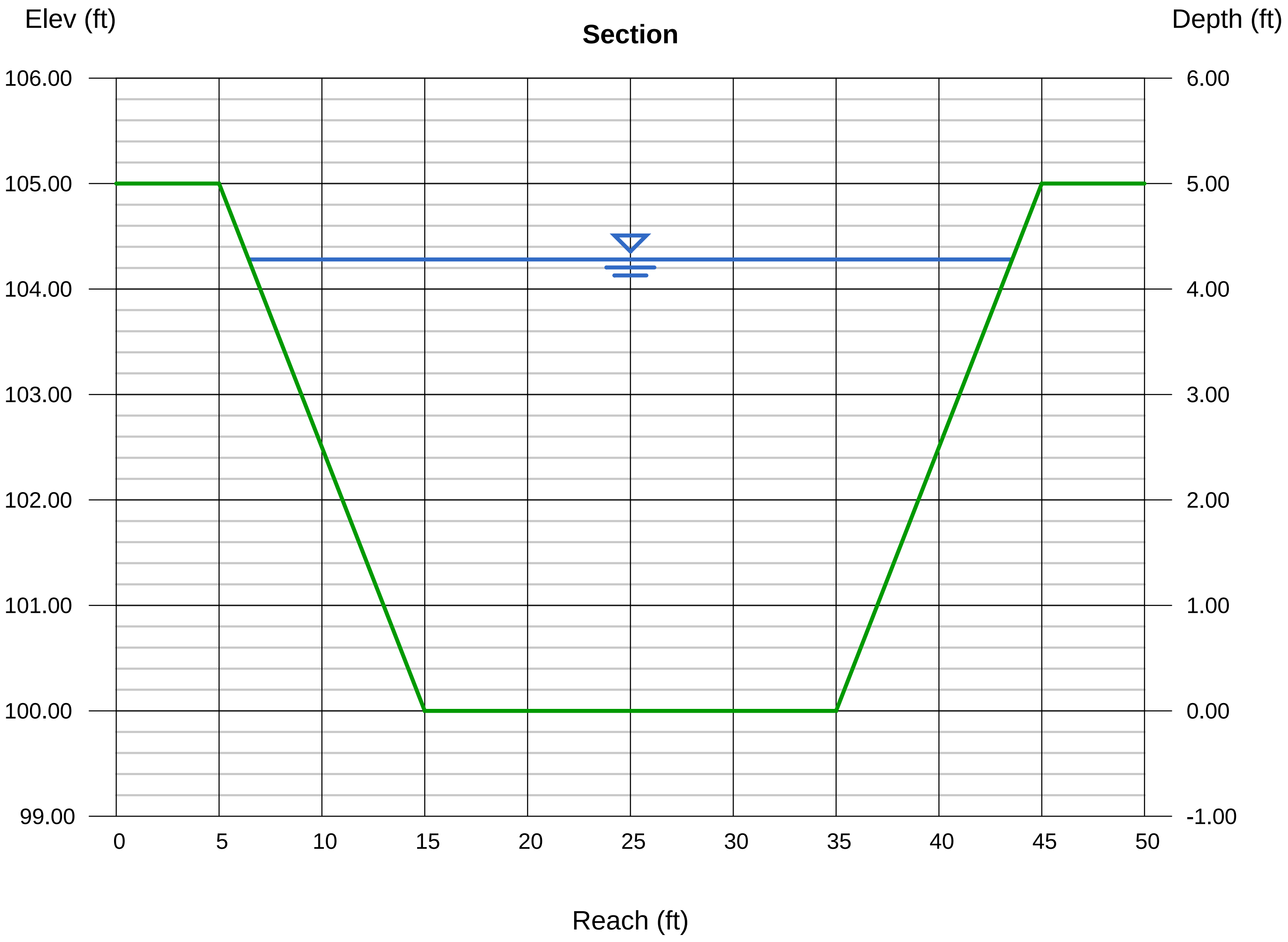
Circular		**Highlighted**	
Diameter (ft)	= 3.00	Depth (ft)	= 2.36
		Q (cfs)	= 49.00
		Area (sqft)	= 5.98
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 8.20
Slope (%)	= 0.50	Wetted Perim (ft)	= 6.56
N-Value	= 0.012	Crit Depth, Yc (ft)	= 2.28
		Top Width (ft)	= 2.45
Calculations		EGL (ft)	= 3.41
Compute by:	Known Q		
Known Q (cfs)	= 49.00		

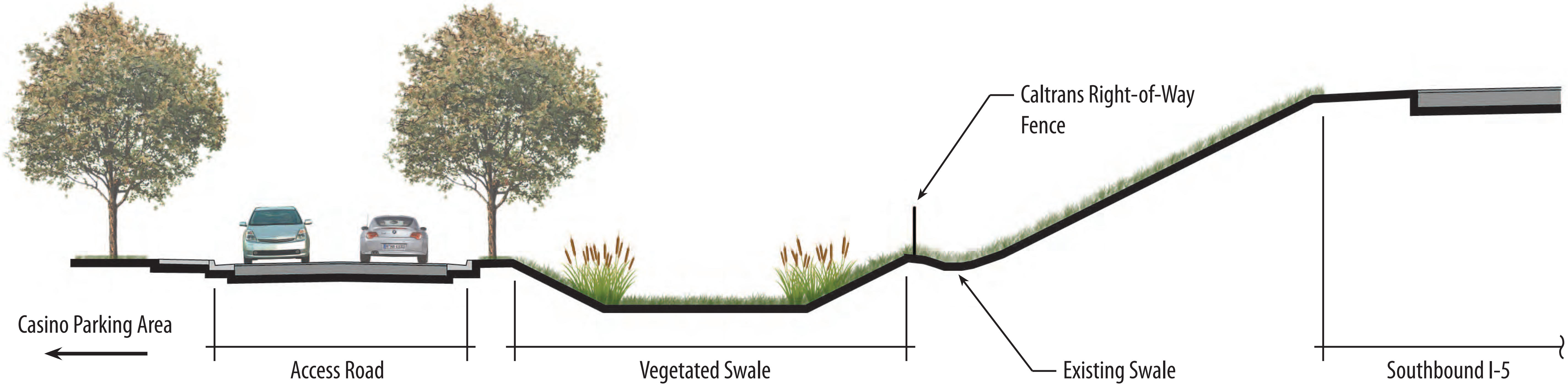


Channel Report

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
Calculations		EGL (ft)	= 4.79
Compute by:	Known Q		
Known Q (cfs)	= 700.00		





NOT TO SCALE

SHARRAH
DUNLAP
SAWYER
INCORPORATED

**VEGETATED SWALE
SECTION EXHIBIT**

Vegetated Swale TC-30

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.

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

- 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 = (top width + $\frac{8(\text{swale depth}^2)}{3(\text{top width})}$ 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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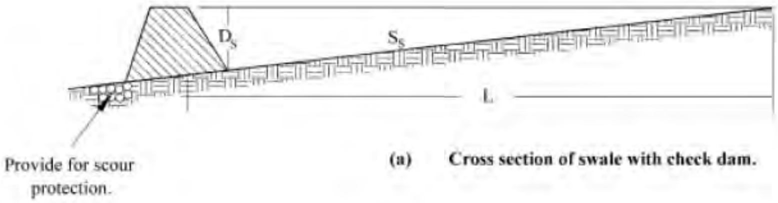
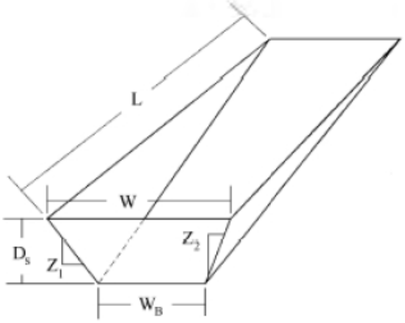


(a) Cross section of swale with check dam.



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

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APPENDIX O

ADDITIONAL BIOLOGICAL RESOURCES DOCUMENTS

LIST OF APPENDICES

APPENDIX O-1

NATIONAL MARINE FISHERIES SERVICE CONCURRENCE LETTER

Pro Recd
5-10-19

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

Refer to NMFS: WCRO-2019-00253

May 7, 2019

Reg Dir ad
Dep RD Trust
Dep RD IS
Route Decems Chad B.
Response Required
Due Date
Memo Ltr
Fax

Chad Broussard
Environmental Protection Specialist
Pacific Regional Office
Bureau of Indian Affairs
2800 Cottage Way
Sacramento, California 95825

Re: Endangered Species Act Section 7(a)(2) Concurrence Letter and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Redding Rancheria Tribe Fee-to-Trust and Casino Project

Dear Mr. Broussard:

On March 25, 2019, NOAA's National Marine Fisheries Service (NMFS) received your request for a written concurrence that the Bureau of Indian Affair's (BIA) Redding Rancheria Tribe Fee-to-Trust and Casino Project is not likely to adversely affect species listed as threatened or endangered or critical habitats designated under the Endangered Species Act (ESA). This response to your request was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402, and agency guidance for preparation of letters of concurrence.

NMFS also reviewed the proposed action for potential effects on essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), including conservation measures and any determination you made regarding the potential effects of the action. This review was pursuant to section 305(b) of the MSA, implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. In this case, NMFS concluded the action would not adversely affect EFH. Thus, consultation under the MSA is not required for this action.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The concurrence letter will be available online through NMFS' Public Consultation Tracking System. A complete record of this consultation is on file with the California Central Valley Office in Sacramento, California.

Proposed Action and Action Area

The action area borders the City of Redding in southern Shasta County, California (40.528777° N, 122.353488° W). The site is within the Enterprise USGS topographic quadrangle (quad). 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, Interstate 5 (I-5) to the east, and private property to the south. The action area is adjacent to approximately one linear mile of the Sacramento River. Further, the action area includes approximately 2.15 acres of riverine habitat. The riverine habitat includes a backwater of the Sacramento River and floodplain habitat. Approximately 325 linear feet of Sacramento River backwater and approximately 950 linear feet of floodplain occur on the site. Listed fish species that may occur in the Sacramento River are listed in Table 1.

Table 1. ESA Listing History.

Species	Scientific Name	Original Final Listing Status	Current Final Listing Status	Critical Habitat Designated in Proposed Action Area
Sacramento River winter-run Chinook salmon ESU	*Oncorhynchus tshawytscha*	1/4/1994 59 FR 440 Endangered	6/28/2005 70 FR 37160 Endangered	6/16/1993 58 FR 33212
Central Valley spring-run Chinook salmon ESU	*Oncorhynchus tshawytscha*	9/16/1999 64 FR 50394 Threatened	6/28/2005 70 FR 37160 Threatened	9/2/2005 70 FR 52488
California Central Valley steelhead DPS	*Oncorhynchus mykiss*	3/19/1998 63 FR 13347 Threatened	1/5/2006 71 FR 834 Threatened	9/2/2005 70 FR 52488
Southern DPS of North American green sturgeon	*Acipenser medirostris*	4/7/2006 71 FR 17757 Threatened	4/7/2006 71 FR 17757 Threatened	10/9/2009 74 FR 52300

The proposed project consists of the acquisition of a site along the Sacramento River in Shasta County into Federal trust for gaming purposes. The Redding Rancheria Tribe then proposes to develop the site with a casino, hotel, and related facilities. The project includes the transfer of the approximately 232-acre Strawberry Fields Site to Federal trust status for the benefit of the Redding Rancheria Tribe. Development of the acquired trust property will include 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 include water, sewer, and stormwater infrastructure. The existing Win-River Casino will be closed and redeveloped into tribal services and housing. Improvement of off-site access roads to access the site from either the north or the north and south would occur. Stabilization of the eastern bank of the Sacramento River is proposed, using the windrow rock slope protection (RSP) method. The bank stabilization will occur along the western edge of the action area and will extend approximately 1,000 feet south along the eastern Sacramento River bank starting from the northern project site boundary. Bank stabilization activities will take approximately four weeks or less. Work will be conducted in summer or early fall when the river is at its lowest level.

The windrow RSP method 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 will be further covered with a minimum of 18 inches of native loam.

The Strawberry Fields site is relatively flat and generally drains southwesterly from I-5 towards the Sacramento River. The development area is outside of the 100-year floodplain and the designated floodway of the Sacramento River. During storm events smaller than a 100-year event, approximately 600-700 cubic feet per second will flow through the site from east of I-5. The flow comes from Churn Creek, spills over I-5, and is conveyed overland to the Sacramento River. Surface parking lots will be constructed with a west-to-east slope toward storm drain inlets, which will 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. The filters will clean the stormwater during low flows and will have no standing water. A 40-foot wide, 5-foot deep vegetated swale is proposed to run north to south between the access road within the site and I-5. The 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 coming westerly from Churn Creek during extreme rain events. The vegetated swale will pass south of the proposed development through a box culvert under the access road and to a 65,000 cubic-foot water quality retention pond. The proposed water quality retention pond has been sized in accordance with the California Stormwater Quality Association California Stormwater Best Management Practice Handbook for New Development and Redevelopment and 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.

Water supply and wastewater treatment will either be provided through connections to the City of Redding's water supply and wastewater treatment services or developed on site. If the applicant opts for the on-site water supply, water will be provided through the installation of groundwater wells on the Strawberry Fields Site. Recycled water from on-site wastewater treatment will be reused for indoor non-potable uses, such as toilet flushing, and for landscape irrigation. The proposed groundwater wells will be drilled to a depth between 300 and 600 feet, which is anticipated to produce water of sufficient quality and quantity. If the applicant opts for on-site wastewater treatment, an on-site wastewater treatment plant (WWTP) will be built south of the new casino and hotel. The WWTP will be sized to treat the peak flows resulting from the proposed project. The WWTP will include a biological reactor and microfiltration process. Recycled water from the WWTP will meet the equivalent of State standards governing the use of recycled water as described in Title 22 of the California Code of Regulations. A recycled water storage tank will be constructed to hold one to two days of peak treated water reuse demand. On-site leach fields will 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 will be located in the southeast area of the Strawberry Fields Site, entirely outside of the floodplain of the Sacramento River. The size of the leach field will 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.

Interrelated and interdependent actions from this project include off-site utility and infrastructure improvements and off-site traffic improvements. Water and wastewater pipelines will be required if the applicant opts for off-site water supply and wastewater treatment. Connecting to the municipal water supply infrastructure will require the construction of approximately 777 linear feet of pipeline from the site to the 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 will 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. The project will also require utility service connections with Redding Electric Utility for electricity and PG&E for natural gas service. The electrical connection will be made with existing overhead 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 will require grading, excavation, trenching, laying of pipe, and placement of backfill material to construct the connection to existing water, wastewater, electricity, and natural gas utilities. The proposed utility improvements will extend through non-native annual grassland, dominated by ruderal species. Indirect effects to water quality will be avoided through implementation of best management practices (BMPs). Off-site traffic improvements will be required due to this project. Traffic mitigation improvements are recommended at six intersections: 1) South Bonnyview Road and Bechelli Lane, 2) South Bonnyview Road and I-5 Southbound Ramps, 3) South Bonnyview Road and I-5 Northbound Ramps, 4) South Bonnyview Road and Churn Creek Road, 5) Churn Creek Road and Victor Avenue, 6) Churn Creek Road and Rancho Road. Off-site traffic improvements will require obtaining approvals and permits from the City of Redding, Caltrans, and/or Shasta County and will require additional environmental review prior to approval. Off-site traffic improvements are not likely to impact listed fish species or fish habitat.

Action Agency's Effects Determination

BIA determined that the actions of this project are not likely to adversely affect listed fish species based on available information for the action area including the inclusion of project avoidance and minimization measures. Critical habitat for all four listed species occurs within the proposed action area for the listed species. BIA determined that critical habitat will not be adversely affected by the proposed action. BIA determined that essential fish habitat will not be impacted by the proposed action.

Consultation History

- On March 25, 2019, NMFS' WCR CCVO received a consultation initiation request letter and application package for the Redding Rancheria Tribe Fee-to-Trust and Casino Project from BIA.

- On April 15, 2019, NMFS requested additional information for this project regarding the bank stabilization portion of the project.

- On April 15, 2019, NMFS received additional information for this project.

- On April 18, 2019, NMFS requested clarification as to which steelhead DPS BIA's determination was for.

- On April 29, 2019, NMFS received clarification that BIA intended to consult on CCV steelhead.

- On April 29, 2019, NMFS initiated informal consultation.

Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

The effects of the proposed action are reasonably likely to include increased sedimentation and turbidity and introduction of hazardous chemicals or other deleterious materials into waterways in and adjacent to the action area.

Disturbance to soils and the river bank within the project limits due to construction effects and bank stabilization may temporarily mobilize sediment and increase turbidity in the Sacramento River. Any increase in sedimentation and turbidity resulting from project activities will be minimal and temporary and will occur when listed fish presence is likely to be low. BMPs to minimize the potential for sedimentation into the river will be employed. Therefore the potential for adverse effects to listed species and their associated critical habitat due to sedimentation and turbidity is insignificant.

Construction activities and a change to the action area's stormwater runoff could potentially impair water quality should hazardous chemicals or other deleterious materials enter the Sacramento River. Hazardous chemicals or other deleterious materials could potentially affect listed fish species by causing physiological stress, reducing biodiversity, interfering with fish passage, and causing direct mortality, or decrease the water quality of habitat. The inclusion of the retention pond in the southern portion of the action area and implementation of BMPs will avoid the potential for exposure to hazardous chemicals. Therefore the potential for adverse effects to listed fish and their associated critical habitat due to hazardous chemicals is discountable.

The placement of RSP will occur above the OHWM and will include the addition of native alluvium and loam materials. Given that no in-water work is proposed, impacts to critical habitat are discountable.

Conclusion

Based on this analysis, NMFS concurs with BIA that the proposed action is not likely to adversely affect the subject listed species and designated critical habitats

Reinitiation of Consultation

Reinitiation of consultation is required and shall be requested by BIA or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this concurrence letter; or if (3) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16). This concludes the ESA portion of this consultation.

Conservation Recommendations

Section 7(a) (l) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary agency activities intended to minimize or avoid adverse effects of a proposed project on listed species or critical habitat, to help implement recovery plans, or to develop information. BIA also has the same responsibilities, and informal consultation offers action agencies an opportunity to address their conservation responsibilities under section 7(a)(1). In order to fulfill the requirements of section7(a)(l), NMFS recommends the following conservation measures:

(1) Bank stabilization work should occur when listed species are least likely to occupy the proposed action area.

(2) BIA should take measures to protect the Sacramento River in the action area from contaminants, debris, dust, and dirt.

(3) BIA should provide fiscal and staffing support to anadromous salmonid and sturgeon monitoring programs throughout the region to improve the understanding of migration and habitat utilization by anadromous fish in this region.

Please contact Neal McIntosh at the NMFS California Central Valley Office at 916-930-5647 or neal.mcintosh@noaa.gov if you have any questions concerning this letter or if you require additional information.

Sincerely,

Amanda Cranford

Amanda Cranford
Sacramento Basin Branch Supervisor

cc: To the file 151422-WCR2019-SA00511

APPENDIX O-2

U.S. FISH AND WILDLIFE SERVICE
CONSULTATION CORRESPONDENCE

United States Department of the Interior

BUREAU OF INDIAN AFFAIRS
Pacific Regional Office
2800 Cottage Way
Sacramento, California 95825

MAR 13 2019

U.S. Fish and Wildlife Service
Attention: Jennifer Norris
2800 Cottage Way, Room W-2605
Sacramento, CA, 95825

Dear Ms. Norris:

The Bureau of Indian Affairs (BIA) respectfully requests to initiate informal consultation pursuant to Section 7 of the Endangered Species Act of 1973, as amended, for the Redding Rancheria (Tribe) Fee-to-Trust and Casino Project near the City of Redding in Shasta County, California. The proposed action includes the conveyance of approximately 232 acres into Federal trust status for the benefit of the Tribe.

Enclosed for your review is the Biological Assessment (BA) for the Redding Rancheria Tribe Fee-to-Trust and Casino Project. The Proposed Project (Alternative A) consists of the acquisition of a 232-acre site (Strawberry Fields Site; Action Area) into federal trust status for the Tribe, and the development of the site with a casino, hotel, and related facilities, including inter-related and interdependent actions such as water and wastewater pipelines and traffic mitigation.

Prior to conducting field surveys, a summary of federally listed special-status species with the potential to occur within the region was obtained from USFWS, the California Natural Diversity Database (CNDDB), and the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants. The USFWS list, along with queries from the CNDDB and CNPS search results, are included in Attachment A of the BA. Although no designated critical habitat for wildlife was identified within the Action Area, the Action Area was found to contain potential habitat for two federally listed wildlife species: the valley elderberry longhorn beetle (VELB; *Desmocerus californicus dimorphus*), and the California red-legged frog (CRLF; *Rana draytonii*). No suitable habitat for federally listed plant species was observed on or adjacent to the Action Area.

As analyzed in the BA, VELB has a low potential to occur within the Action Area. Although one elderberry shrub was observed during biological surveys in 2016 and 2017, no evidence of VELB was observed. While VELB has the potential to occur within the Action Area, occurrence is unlikely given that the Action Area contains one elderberry shrub void of VELB indicators and consists of otherwise unsuitable habitat surrounded by and subjected to intensive human disturbance.

Although unlikely, if VELB were to be present at the time of construction of the Proposed Project, construction-related activities have the potential to cause VELB mortality. Conservation measures are included in the BA to avoid the potential for harm to VELB during project related activities by minimizing permanent and temporary disturbances to the extent feasible, and ensuring that appropriate measures are taken during construction to avoid potential to harm to VELB. With the implementation of these conservation measures, the Proposed Action **may affect, but is not likely to adversely affect** VELB.

CRLF was also determined to have a low potential to occur within the Action Area. According to CNDDB records, the nearest CRLF population occurs approximately 33 miles from the Action Area. Potential CRLF breeding habitat within the Action Area consists of the two pond features and the riverine area of the Sacramento River. The riverine habitat lacks permanent water year-round and contains fish during times of high water. Additionally, bullfrogs, a natural predator to CRLF, were observed in the Action Area's pond features. No CRLF or evidence of CRLF were observed during a protocol-level survey conducted in 2007 (Attachment C of the BA). While CRLF has the potential to occur within the Action Area, CRLF is unlikely to breed or live within the area given that no occurrences have been observed, and the rest of the Action Area will be otherwise unsuitable habitat surrounded by and subjected to intensive human disturbance.

Although unlikely, if CRLF were to be present at the time of construction of the Proposed Project and off-site infrastructure improvements, construction-related activities have the potential to cause CRLF mortality. Conservation measures are included in the BA to avoid the potential for harm to CRLF during project related activities by minimizing permanent and temporary disturbances to the extent feasible, and ensuring that appropriate measure are taken during construction to avoid potential to harm to CRLF. With the implementation of these conservation measures, the Proposed Action **may affect, but is not likely to adversely affect** CRLF.

The BIA has determined that the proposed action **may affect, but is not likely to adversely affect** candidate, threatened, or endangered species or their critical habitat, based on the surveys conducted and the conservation measures that are proposed, and hereby requests your concurrence with this finding.

Please do not hesitate to contact Chad Broussard, Environmental Protection Specialist, at (916) 978-6165 if you have any questions or would like to discuss further.

Sincerely,

Amy L Dutschke

Regional Director

Enclosure

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

BUREAU OF INDIAN AFFAIRS
2019 MAR 29 PM 5:35

In Reply Refer to:
08ESMF00-
2019-I-1400-1

MAR 27 2019

Memorandum

To: Environmental Protection Specialist, Bureau of Indian Affairs, Pacific Regional Office, Sacramento, California

From: Chief, Sacramento Valley Division, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California Kellie J. Berry

Subject: Informal Consultation on the Redding Rancheria Fee-to-Trust and Casino Project in Shasta County, California

This memorandum (memo) is in response to the Bureau of Indian Affairs' (Bureau) March 13, 2019, request for initiation of informal consultation with the U.S. Fish and Wildlife Service (Service) on the Redding Rancheria Fee-to-Trust and Casino Project (proposed project) in Shasta County, California. The Service received your memo and the attached biological assessment on March 15, 2019. The federal action is the conveyance of approximately 232 acres into federal-trust status for the benefit of the Redding Rancheria. The findings presented in your request conclude that the proposed project may affect, but is not likely to adversely affect the federally-threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (beetle) and California red-legged frog (*Rana draytonii*) (frog).

The Service has not received all of the information necessary to initiate consultation on the proposed project as outlined in the regulations governing interagency consultations (50 CFR 402). To complete the initiation package, we will require the following information.

1. Please describe the construction and operations of the development (potential timelines, equipment, access roads, staging areas, etc.) and how these may affect listed species per 50 CFR 402.12(f)(4).

2. Please clarify the effects of the proposed project on the beetle. You may find the decision tree in the *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)* and the recent history of the area useful in analyzing the effects of the proposed project on the beetle. Additionally, if Conservation Measure G (relocating the elderberry shrub) for the beetle is implemented, it may adversely affect the beetle since the elderberry shrub is the sole host plant of the beetle. Therefore, please clarify your determination for the beetle based on your revised analysis.

3. The biological assessment and the recovery plan for the frog state that the proposed project occurs outside of the current known range for the frog. Since you are outside of the range of the frog, consultation for the frog isn't required per 50 CFR 402.12(d)(1). If the frog will not be part of the consultation, please revise your initiation request.

We appreciate the coordination on this consultation thus far; however, the consultation process for the proposed project will not begin until we receive all of the information, or a statement explaining why that information cannot be made available. We will notify you when we receive this additional information.

If you have any questions regarding this memo, please contact either Sam Sosa, Fish and Wildlife Biologist (samuel_sosa@fws.gov), or myself (kellie_berry@fws.gov) at (916) 414-6631.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

FEB 20 2020

In Reply Refer to:
08ESMF00-
2019-I-1400-2

Memorandum

To: Regional Director, Bureau of Indian Affairs, Pacific Regional Office, Sacramento, California

From: Chief, Sacramento Valley Division, Sacramento Fish and Wildlife Office, Sacramento, California Kellie J. Berry

Subject: Informal Consultation on the Redding Rancheria Fee-to-Trust and Casino Project in Shasta County, California (Bureau Reference: DECRMS)

This memorandum (memo) is in response to the Bureau of Indian Affair's (Bureau's) March 13, 2019, request for initiation of informal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed Redding Rancheria Fee-to-Trust and Casino Project (proposed project) in Shasta County, California. Your initiation request and the accompanying July 2018 *Biological Assessment for the Redding Rancheria Fee-to-Trust and Casino Project* (biological assessment) prepared by Analytical Environmental Services (consultant) was received by the Service on March 15, 2019; however, all of the information necessary to begin consultation was not received until February 11, 2020. At issue are the proposed project's effects on the federally threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (beetle). This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act), and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR 402).

The federal action on which we are consulting is the acquisition of a 232-acre site adjacent to the southern border of the city of Redding by the Bureau that will be transferred into federal trust status for the purposes of gaming. Pursuant to 50 CFR 402.12(j), you submitted a biological assessment for our review and requested concurrence with the findings presented therein. These findings conclude that the proposed project may affect, but is not likely to adversely affect the beetle. The proposed project is not within designated or proposed critical habitat for any federally-listed species.

In considering your request, we based our evaluation on the following: 1) your March 13, 2019, letter requesting initiation of consultation with the enclosed July 2018 biological assessment; 2) your February 5, 2020, memo responding to the Service's request to clarify the effects of the proposed project on the beetle and the California red-legged frog (*Rana draytonii*) with the enclosed December 2019 updated biological assessment; 3) the April 2019 Draft Environmental Impact Statement; 4) the Sacramento River Streambank Stabilization section (revised November 2019) of the draft Final Environmental Impact Statement; 5) the February 11, 2020, meeting between the Service, the Bureau, and the consultant to discuss the streambank stabilization aspect of the proposed project; and 6) other information available to the Service.

The approximately 232-acre proposed project is in unincorporated Shasta County and is bound by the city of Redding to the north, the Sacramento River (River) to the west, and Interstate 5 to the east. The proposed project is the acquisition of a 232-acre site that will be transferred into federal trust status and the development of the site with a casino-resort and other facilities.

Development will be limited to a 66-acre area in the northeastern corner of the 232-acre site. The proposed casino-resort will have a gross footprint of approximately 383,893 square feet. At build-out, the gaming component of the facility will consist of approximately 1,200 electronic gaming devices and 36 table games. A 9-story hotel will be located in the northwest portion of the development area and will be comprised of 225 standard guest rooms and 25 suites. The hotel will also include an outdoor pool, a winter garden, an outdoor amphitheater, a spa, and a fitness center. The hotel tower will be approximately 119 feet tall. An event center will be located in the southwest portion of the development area and be approximately 52,200 square feet. A parking structure will be located in the southeast portion of the development area and will provide 1,650 parking spaces. An additional 600 surface parking spaces will be provided outside of the parking structure for a total of 2,250 parking spaces.

The proposed project also includes the following components:

- Further development of the trust property with uses including, but not limited to, restaurants, retail facilities, and other supporting facilities;
- Development of on-site and off-site infrastructure improvements needed to support the casino, including water, sewer, stormwater, gas, and electrical infrastructure;
- Stabilization of the eastern bank of the River along the northwestern property boundary (described below);
- Improvement of off-site access roads to access the site from either the north or the north and the south;
- Implementation of off-site traffic mitigation improvements; and
- Closure of the existing Win-River Casino and the redevelopment of the facility into tribal services and housing uses.

The eastern bank of the River contains established riparian oak trees (*Quercus* sp.) extending 200 feet from the northern boundary. Scattered willows (*Salix* sp.) grow near the ordinary high water mark between the riparian oaks and additional riparian trees approximately 750 feet to the south. Between the two riparian areas is a nearly vertical loam bank that varies in height from about 8 feet in the north to about 4 feet in the south. The loam is underlain by sandy gravelly cobble, which extends from the vertical loam bank at an approximately 50 percent slope towards the River. There are three elderberry shrubs (*Sambucus* sp.), the host plant for the beetle, growing in the cobble below the vertical loam bank.

The northwestern edge of the development area parallels the eastern bank of the River. Since 1961, the eastern bank appears to have shifted 45 feet along a sparsely-vegetated area approximately 450 feet south of the northern boundary. However, the bank does not appear to have moved along the well-vegetated northern boundary during the same timeframe. Streambank stabilization includes setting the buildings 150 feet from the existing bank, re-establishing native trees in the setback area, and stabilizing the cobble bank using willow cuttings. Native streamside trees, such as oak, cottonwood (*Populus* sp.), and sycamore (*Acer* sp.), will stabilize the loam mantel in the setback area. These trees will be planted 15 to 50 feet east of the vertical bank with an average spacing of 30 feet. Willow cuttings will stabilize the riverbank between the ordinary high water mark and the toe of the vertical loam bank. The willow cuttings will be placed no more than 3 feet apart using the live stake method with cuttings taken from on-site. The plants will be monitored annually for five years and will be replaced as necessary during that period.

Construction is anticipated to begin in the summer of 2021 with full buildout being achieved in 2025. The cumulative duration of construction activities is expected to be approximately 18 to 30 months. Construction will involve grading and excavation for building pads and parking lots. It is anticipated that the 94,000 cubic yards of cut and fill needed will be balanced with no import or export of material required. The cut will mostly be in the development area, but may occur within the 150-foot setback area. Construction staging areas will be located outside of the floodplain within the 232-acre site. Construction traffic will enter and exit by either Bechelli Lane to the north or Adra Road to the south.

Conservation Measures

The following conservation measures proposed by the Bureau are to avoid adverse effects to the beetle. Industry standard best management practices will be implemented during construction.

1. **Fencing.** The elderberry shrubs located along the River shall be fenced or flagged for avoidance as close to construction limits as feasible.
2. **Avoidance Area.** Construction activities potentially impacting the shrub shall apply a buffer of at least 6 meters (20 feet) from the drip-line when feasible.
3. **Worker Education.** A qualified biologist shall provide training for construction personnel. Training shall include the status of the beetle, its host plant and habitat, the need to avoid damaging the elderberry shrub, and the possible penalties for noncompliance.
4. **Timing.** To the degree feasible, activities occurring within 50 meters (164 feet) of an elderberry shrub shall be limited to the season when the beetle is not active (August to February).
5. **Chemical Usage.** 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.
6. **Mowing.** 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 shrub.
7. **Erosion Control and Revegetation.** Erosion control will be implemented and the affected area will be re-vegetated with appropriate native plants.
8. **Monitoring.** 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 depends on project-specifics and shall be discussed with the Service.

Valley Elderberry Longhorn Beetle

After reviewing all of the available information, we concur with your determination that the proposed project may affect, but is not likely to adversely affect the beetle. The proposed project reached the 'may affect' level since the proposed project is within the known range of the beetle and there are three elderberry shrubs in the 232-acre site. The proposed project is at approximately 440 feet in elevation and occurs in the Sacramento River Management Unit identified in the *Revised Recovery Plan for the Valley Elderberry Longhorn Beetle* (Service 2019). The life cycle of the beetle takes one to two years to complete, during which it spends most of its time within the stems of its sole host plant, the elderberry shrub. There are four known occurrences for the beetle within 10 miles of the proposed project according to the California Natural Diversity Database (2020). The closest known occurrence is approximately 2 miles to the southeast in dense riparian habitat with exit holes found in elderberry shrubs in 2012.

There are three elderberry shrubs along the River near the northern boundary. The consultant conducted an exit-hole survey on May 21, 2019, and did not find any exit holes. However, the elderberry shrubs are below the vertical loam bank and will be completely avoided by heavy equipment due to their location. Therefore, due to the implementation of the proposed conservation measures including the complete avoidance of elderberry shrubs, the Service believes that any potential effects to the beetle from the proposed project will be extremely unlikely to occur, and are therefore discountable for the purposes of this consultation.

This concludes the Service's review of the proposed Redding Rancheria Fee-to-Trust and Casino Project. No further action pursuant to the Act is necessary unless new information reveals effects of the proposed project that may affect listed species or critical habitat in a manner or to an extent not previously considered; the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or a new species is listed or critical habitat designated that may be affected by the identified action.

If you have any questions regarding the Redding Rancheria Fee-to-Trust and Casino Project in Shasta County, please contact Sam Sosa, Fish and Wildlife Biologist (samuel_sosa@fws.gov), at the letterhead address or at (916) 414-6560.

cc:
Chad Broussard, Bureau of Indian Affairs, Sacramento, California
Ryan Sawyer, Analytical Environmental Services, Sacramento, California

LITERATURE CITED

California Natural Diversity Database. 2020. Biogeographic Data Branch, Department of Fish and Wildlife, Sacramento, California. Government version dated 1 February 2020. Retrieved February 13, 2020 from https://map.dfg.ca.gov/rarefind/view/RareFind.aspx

[Service] U.S. Fish and Wildlife Service. 2019. Revised Recovery Plan for Valley Elderberry Longhorn Beetle. U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California iii + 18 pp.

APPENDIX O-3

REVISED BIOLOGICAL ASSESSMENT

UPDATED BIOLOGICAL ASSESSMENT

U.S. FISH AND WILDLIFE SERVICE

REDDING RANCHERIA
FEE-TO-TRUST AND CASINO PROJECT

FEBRUARY 2020

NEPA LEAD AGENCY:

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

UPDATED BIOLOGICAL ASSESSMENT
U.S. FISH AND WILDLIFE SERVICE

REDDING RANCHERIA
FEE-TO-TRUST AND CASINO PROJECT

FEBRUARY 2020

NEPA LEAD AGENCY:

U.S. Department of the Interior
Bureau of Indian Affairs
Pacific Region Office
2800 Cottage Way # W2820
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Sacramento, CA 95811
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BIOLOGICAL ASSESSMENT
REDDING RANCHERIA FEE-TO-TRUST AND CASINO PROJECT

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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;
- 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.

Additional details of the Proposed Project are provided below, and the full description can be found in the EIS.

Casino-Resort

The proposed casino-resort would have a gross footprint of approximately 383,893 sf. At build-out, the gaming component of the facility would consist of approximately 1,200 EGDs and 36 table games. The 9-story hotel would be located in the northwest portion of the development and would be comprised of 225 standard guest rooms and 25 suites; it would also include an outdoor pool, winter garden, outdoor amphitheater, spa, and fitness center. The hotel tower would be approximately 119 feet tall. The event center would be located in the southwest portion and be approximately 52,200-sf. One parking structure would be located in the southeast portion of the Strawberry Fields Site and would provide 1,650 parking spaces. Additionally, approximately 600 surface parking spaces would be provided for a total of 2,250 parking spaces.

Big-Box/Region Retail

130,000 sf of regional retail space would be developed. The Tribe proposes leasing this space for the development of an outdoor sporting goods retail facility (inclusive of hunting, fishing, camping, and related merchandise).

Sacramento River Streambank Stabilization and Vegetative Buffer

The eastern bank of the Sacramento River is actively eroding in areas adjacent to the proposed development during exceptionally high river flows. Vegetative streambank stabilization measures have been incorporated into project design to slow the rate of erosion and reduce sedimentation. Streambank stabilization measures would consist of the implementation of a bioengineered section along the east bank of the Sacramento River, extending approximately 1,000 feet south of the northern project site boundary.

Bio-technical stabilization would be implemented within the cobbly portion of the riverbank and would include establishment of willows from the ordinary high-water line to the toe of the nearly vertical loam bank. The loam mantel would be stabilized by planting of native streamside trees in the zone between fifteen feet and fifty feet east of the top of without disturbing the bank swallow nesting habitat. This vegetative buffer area would be implemented in a 150-foot buffer or setback between the riverbank and other project improvements.

Off-site Access Improvements

Access to the Strawberry Fields Site would be provided by either the North Access or a combination of the North Access and South Access (Site Access Options 1 and 2), and these areas would not be taken into federal trust:

- Option 1 access to the Strawberry Fields Site would be provided from the north only. This option involves widening Bechelli Lane from two lanes to four laned. The improved Bechelli Lane would consist of four 12-foot lanes and a 4-foot shoulder in each direction, with a 6-foot sidewalk on the western side of the road, to connect the existing sidewalk north of Sunnyhill Lane to the Strawberry Fields Site.
- Option 2 access to the Strawberry Fields Site would be provided from both the north and the south. Improvements to the North Access area would be as described above, and a southern access would be provided through a new roadway connecting the Strawberry Fields Site to Smith Road. The new roadway would be constructed along the alignment of an existing rural driveway (referred to as Adra Way) that currently provides access to the Strawberry Fields Site and several private properties located to the east. Per Shasta County development standards, the new roadway would have two 12-foot lanes with 4-foot paved shoulders and a 60-foot designated ROW.

Construction

Construction of the Proposed Project is anticipated to begin in the summer of 2021 and continue over a number of years, with full buildout being achieved in 2025. The cumulative duration of construction activities is expected to be approximately 18-30 months. Industry standard BMPs would be implemented during construction. In many cases, such as SWPPPs prepared for coverage under the NPDES General Construction Permit, certain BMPs are requisite conditions of permit compliance. The following types of construction activities would occur at different intervals throughout construction:

- Earthwork – grading, excavation, backfill;
- Concrete – forming, rebar placement, concrete delivery and placement;
- Structural steel work – assembly, welding;
- Masonry construction;
- Electrical/instrumentation work;
- Trenching; and
- Installation of mechanical equipment and piping.

Equipment used during construction may include, but is not limited to, the following:

- Bulldozers;
- Scrapers;
- Compactors;
- Excavators;
- Loaders;
- Graders;
- Water Trucks;
- Material hauler trucks;
- Pipe layer trucks;
- Pickup Trucks;
- Forklifts;
- Generator sets;
- Tractors;
- Welders;
- Compressors;
- Roller;
- Paver; and
- Paving Equipment.

Construction would involve grading and excavation for building pads and parking lots. Up to approximately 37 acres of impervious surfaces would be created on site. As discussed in the Grading and Drainage Analysis Report (Appendix C of the Draft EIS), it is anticipated that 94,000 cubic yards of cut and fill would be balanced under Alternative A, with no import or export of material required. Finished floor elevations (there will be no basements) will be approximately 3 feet above the Federal Emergency Management Agency (FEMA) 100-year floodplain.

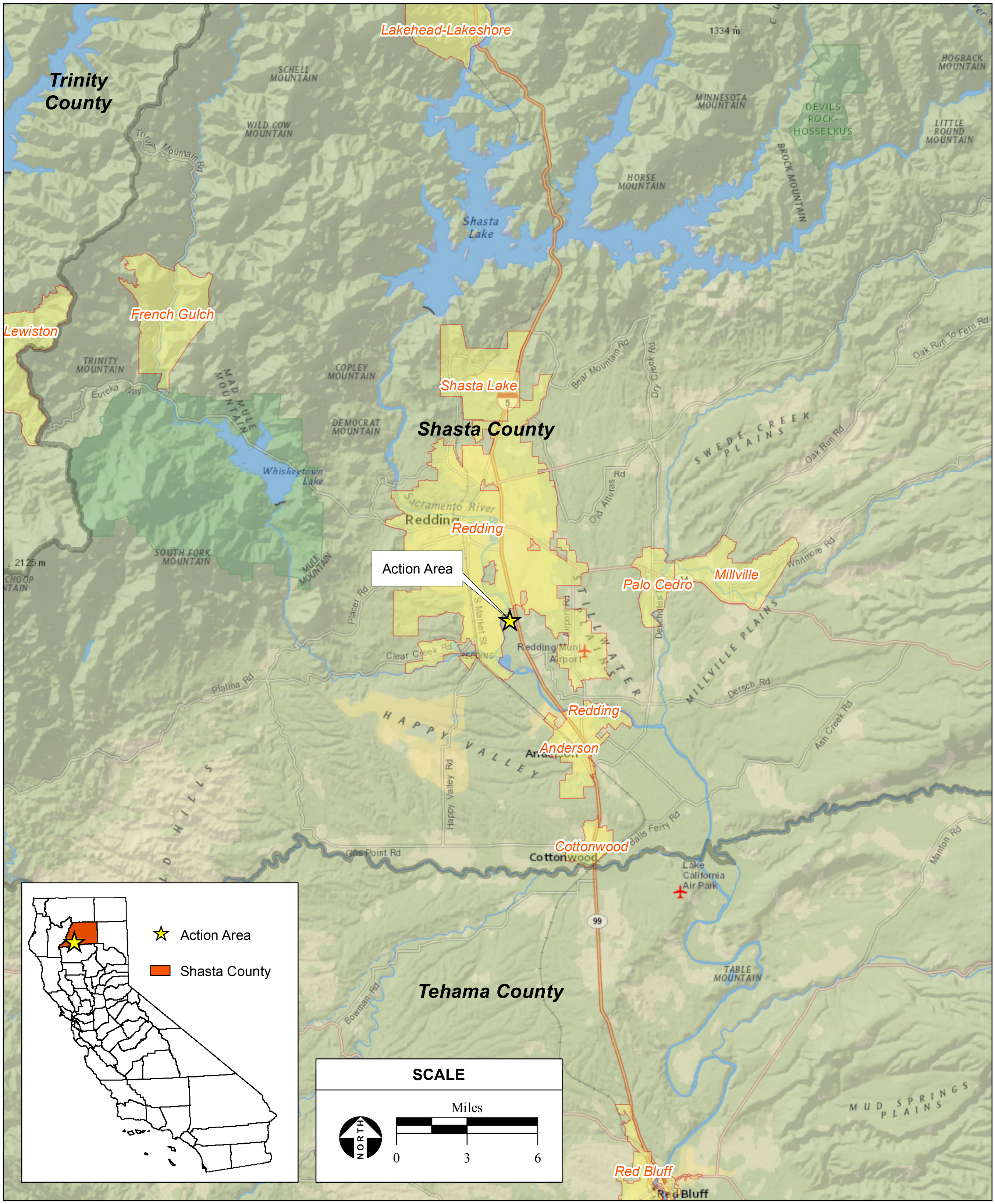
Construction staging areas for the Proposed Project would be located within the Action Area, outside of the floodplain. Construction traffic would enter and exit the Action Area via Site Access Options 1 and 2 as described above.

Project Operation

The Proposed Project would employ approximately 1,075 casino/resort employees. The casino resort would be managed by the Tribe and its team of highly qualified professionals and would operate 24 hours per day, 7 days per week.

1.3 ACTION AREA

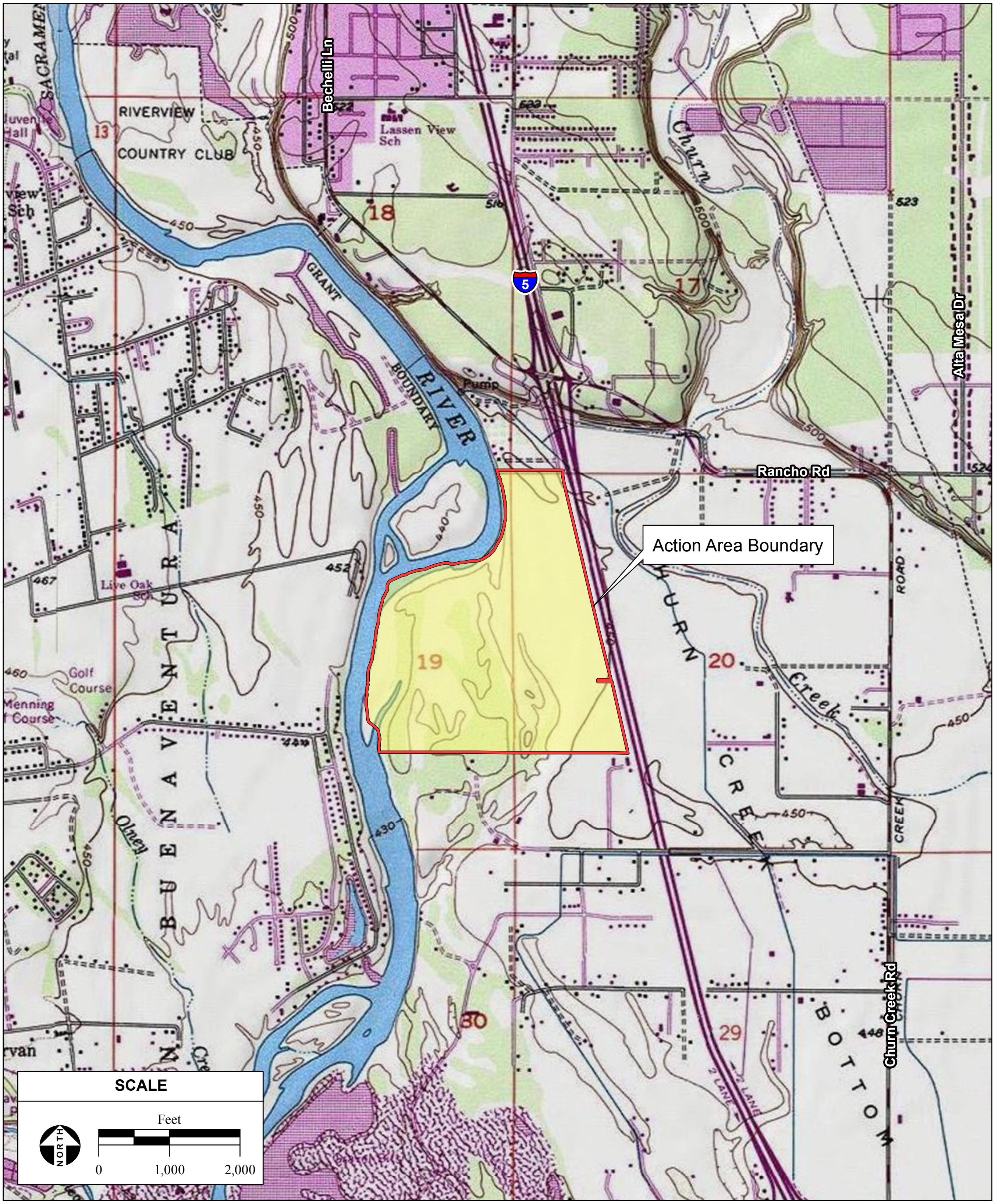
The Action Area is located within southern Shasta County (County), bordering the City of Redding (City) (**Figures 1** and **2**). The approximately 232-acre property is comprised of seven tax parcels and is bound by private property to the north, the Sacramento River to the west, Interstate 5 (I-5), 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**.



SOURCE: NatGeo, 2017; AES, Date: 8/8/2017

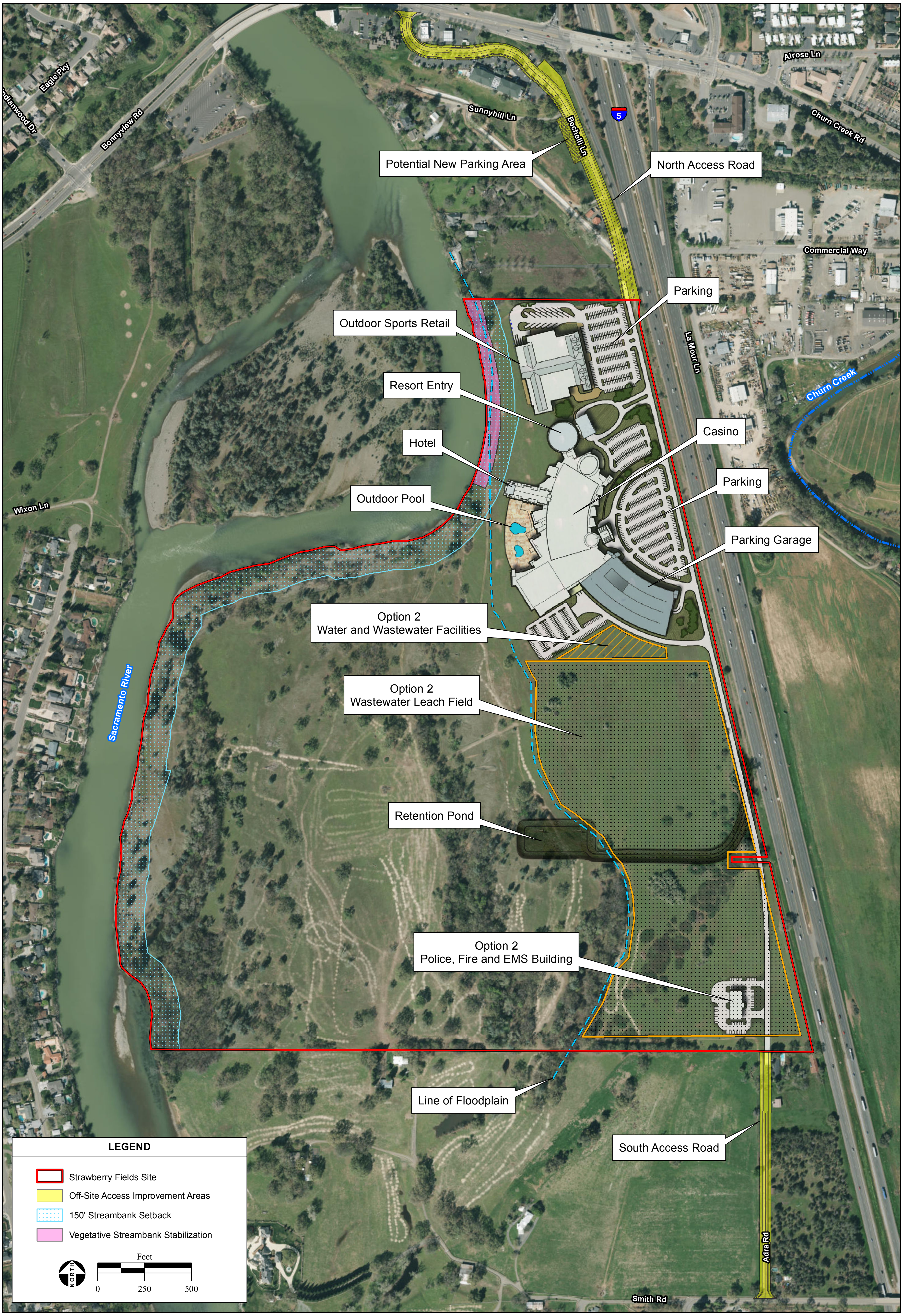
Redding Rancheria Fee-to-Trust USFWS BA / 214584 ■

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: HBG, 9/18/2019; SRTA aerial photograph, 3/17/2016; ESRI, 2019; AES, 11/18/2019

Figure 3
Site Plan

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**);
- 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); and
- Biological Resources Assessment on the Strawberry Fields Study Area by North State Resources, Inc. (NSR, 2007; **Attachment B**).

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. These 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 Valley Elderberry Longhorn Beetle (VELB) were conducted (**Attachment B**) in accordance with the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS, 1999). In addition to the surveys listed above, a VELB-focused survey was conducted on May 21, 2019 within the areas proposed for development as shown on Figure 3. This survey was performed in accordance with *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS, 1999). Elderberry shrubs identified during the survey were visually assessed for exit holes and VELB indicators.

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, 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

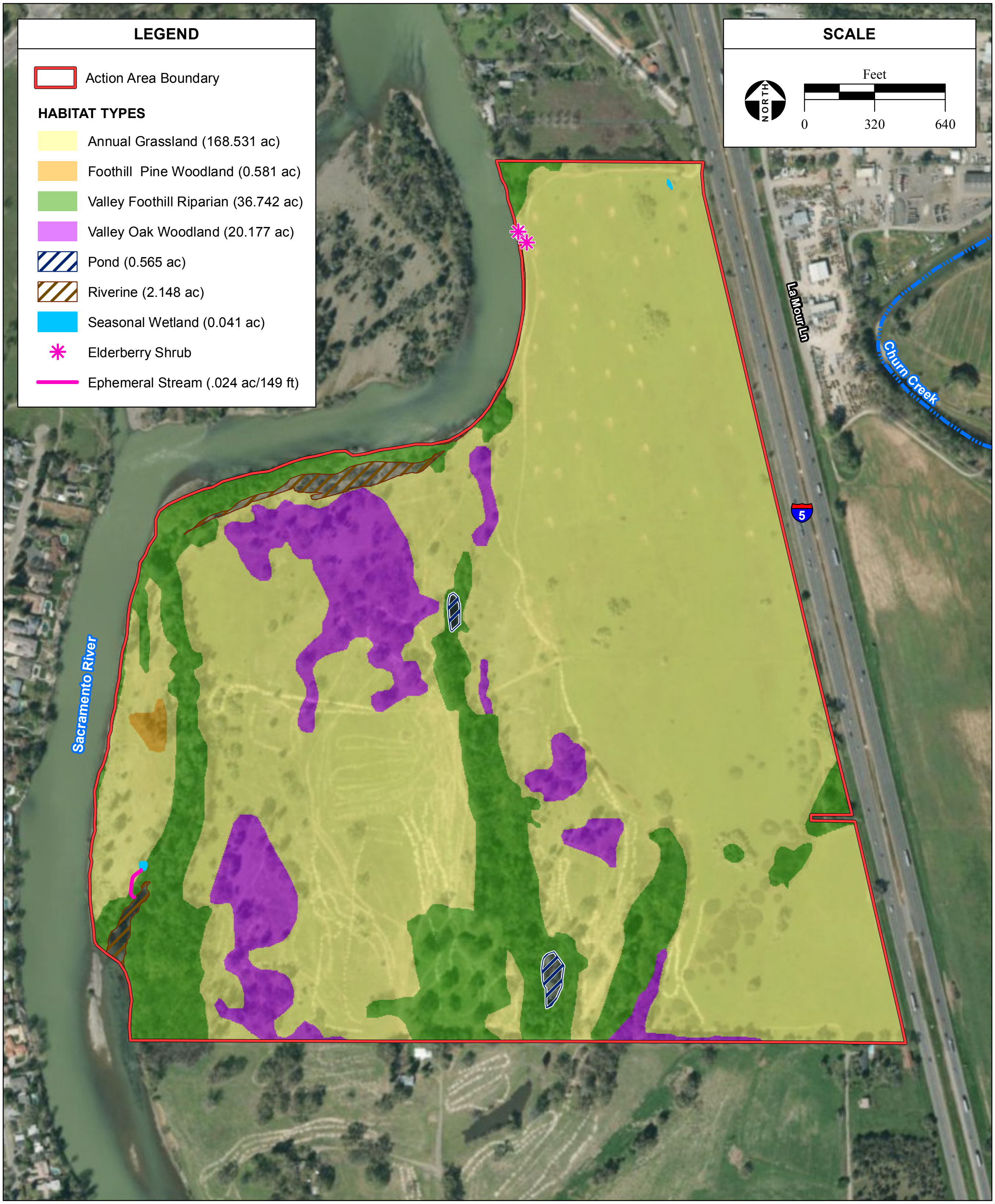
Five terrestrial habitats were identified within the Action Area (**Figure 4**): non-native annual grassland, valley foothill riparian, valley oak woodland, riverine, and foothill pine woodland. Habitat types of the North and South Access Improvement Areas consist of ruderal/developed that has been paved or altered. 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

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 foothill pine (*Pinus sabiniana*), whiteleaf manzanita (*Arctostaphylos manzanita*), Himalayan blackberry, and poison oak (*Toxicodendron diversilobum*).



SOURCE: USDA aerial photograph, 7/26/2014; ESRI Data, 2016; AES, 11/20/2019

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

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 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 has the potential to occur within the Action Area: valley elderberry longhorn beetle (*Desmocerus californicus dimorphus;* VELB) (USFWS, 2017a; CDFW, 2017a). No suitable habitat for federally listed plants was observed within the Action Area (USFWS, 2017a; CNPS, 2017; CDFW, 2017a).
Both Access Improvement Areas are paved or altered, and do not contain suitable habitat to support federally listed species.

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. Two occurrences of VELB have been recorded within five miles of the project site in 1991 and 2012 (CDFW, 2017b).

A VELB protocol-level survey in 2007 recorded 13 elderberry shrubs with VELB exit holes (**Attachment B**). All elderberry shrubs with exit holes identified 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 2016–2017 surveys is located in the northwestern portion of the site along the Sacramento River, and did not contain indicators of VELB presence.

The 2019 survey identified additional elderberry shrubs to the singular shrub (**Figure 6**), and the results are shown in **Table 1**. Three elderberry shrubs were observed along the Sacramento River and within close proximity (<20 ft.) to the location of the singular elderberry shrub identified in the 2016–2017 surveys (**Figure 7**). Diameters of stems at ground level were 1–3 in. with the exception of four being >3 in. but <5 in. No indicators or boreholes for VELB were observed in these three elderberry shrubs.

TABLE 1
2019 SURVEY RESULTS OF VELB HABITAT

# of Individual Shrubs	# of Stems by Diameter Class				Exit Holes?	Riparian Habitat?
	< 1”*	≥ 1” – ≤ 3”	>3” – ≤ 5”	> 5”		
3	0	10	4	0	N	Y

*The USFWS does not consider elderberry shrubs comprised of stems <1.0 inch at ground level as potential habitat for VELB.

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.

PHOTO 1: Single elderberry shrub, looking south.

PHOTO 2: Single elderberry shrub, looking southwest

PHOTO 3: Two newly identified elderberry shrubs, looking north

PHOTO 4: Two newly identified elderberry shrubs, looking west

SOURCE: AES, 12/10/2019

Figure 6
Elderberry Shrub Photographs

SOURCE: USDA aerial photograph, 7/26/2014; ESRI Data, 2016; AES, 12/10/2019

Figure 7
Elderberry Shrub Locations

4.2 FEDERALLY LISTED SPECIES

No suitable habitat for federally listed plant species occurs within the Action Area. One federally listed wildlife species has the potential to occur within the Action Area: VELB. Potential effects to VELB are discussed below.

Valley Elderberry Longhorn Beetle

Effects

Three elderberry shrubs occur within the Action Area; during the 2019 surveys, these shrubs exhibited no boreholes that would indicate the presence of VELB. In addition to these three elderberry shrubs, five elderberry shrubs were identified—along with riparian habitat—within 0.1 mile of the Action Area to the northeast. These shrubs possessed stems >1 in., and therefore could provide suitable habitat for VELB. The elderberry shrubs within the Action Area have the potential to be impacted during implementation of the river bank stabilization measures, but would not be removed. The proposed bank stabilization, as discussed in **Section 1.2**, would involve the removal of existing stream bank material above the ordinary high water mark (OHWM). Removed material would be replaced with a combination of native grasses, shrubs, erosion resistant soil and gravel so as to blend with the surrounding plant habitat. This bank stabilization method would not require the removal of the elderberry shrubs and, consequently, the shrubs would be preserved.

Potential adverse effects to riparian habitat would be avoided to the maximum extent feasible via project design to the areas south and north of the Action Area that contain riparian habitat (**Figure 4**). Approximately 36.74 acres of riparian habitat occurs within the Action Area, however only 0.07 acres of riparian would be impacted by the Proposed Project. Approximately 99.8% of riparian habitat would be avoided. Therefore, the Proposed Project would not significantly affect the continuity of VELB habitat as avoidance of the riparian habitat would reduce potential indirect impacts to VELB.

Although there is suitable habitat (elderberry shrubs), it is unlikely that VELB would be present during construction due to the absence of boreholes in the elderberry shrubs in the Action Area boundary. However, if VELB were to be present at the time of construction of the Proposed Project or during the implementation of the bank stabilization measures, construction-related activities have the potential to result in VELB mortality. Potential adverse effects 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 VELB 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 the commencement of construction activities occurring within 50 meters (164 feet) of the elderberry shrubs in order to reduce or eliminate potential damage to them:

A. **Fencing.** The elderberry shrubs located on the northwest portion of the Strawberry Fields Site along the Sacramento River shall be fenced or flagged for avoidance as close to construction limits as feasible.

B. **Avoidance Area**. Construction activities potentially impacting the shrub (e.g., grading activities related to bank stabilization) shall apply a buffer of at least 6 meters (20 feet) from the drip-line when feasible.

C. **Worker Education**. 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.

D. **Timing**. 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).

E. **Chemical Usage**. 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. **Mowing**. 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 shrub.

G. **Erosion Control and Re-vegetation**. Erosion control will be implemented and the affected area will be re-vegetated with appropriate native plants.

H. **Monitoring.** 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.

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 8**). 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

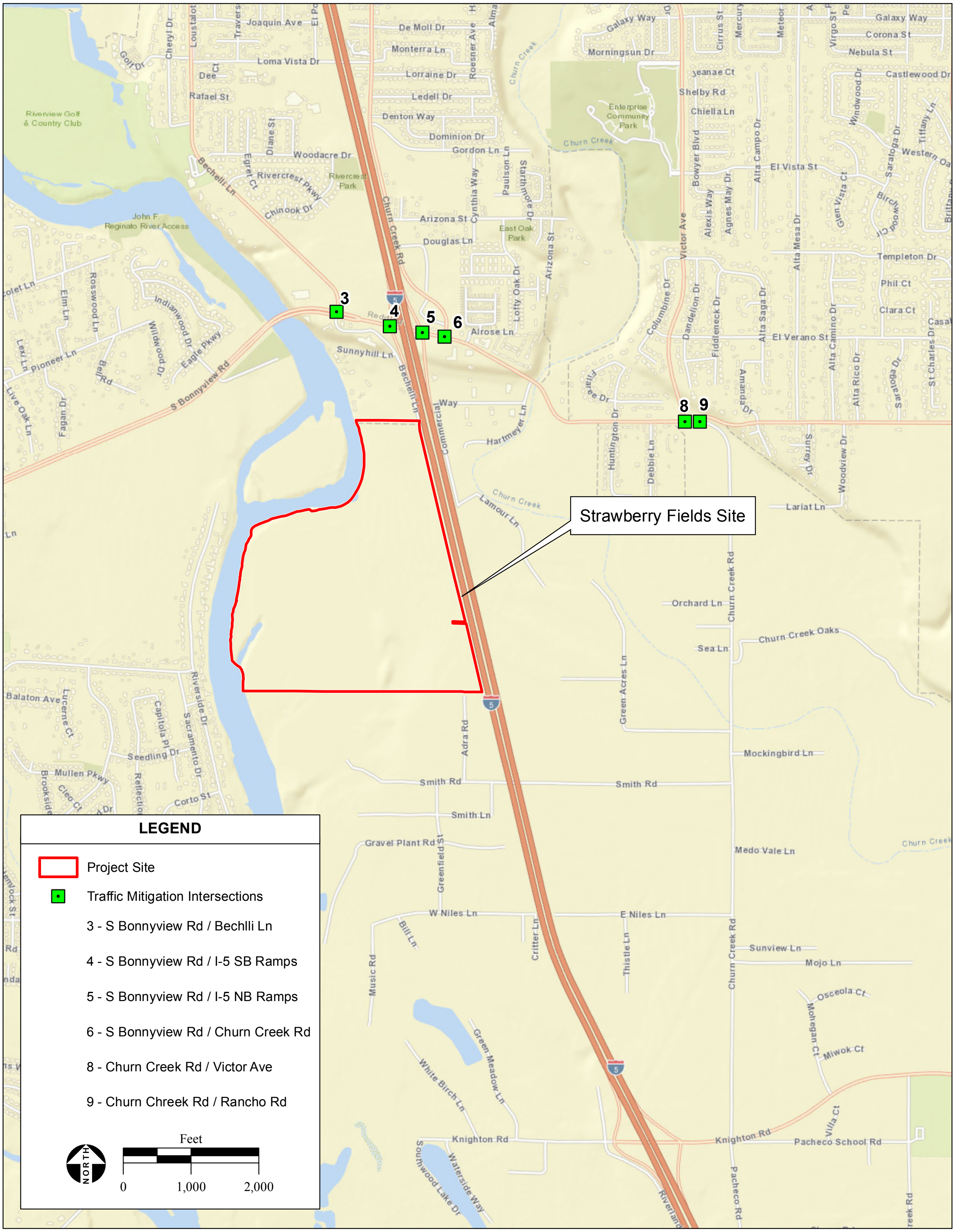
Off-site utility connections are an optional project component and involve tying the Action Area into the City of Redding's water and wastewater system with new pipeline connections. Connecting to the municipal water supply infrastructure would require the construction of approximately 777 linear feet 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 Sunnyhill Lift Station, located at 5100 Bechelli Lane (see **Figure 9**).

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. 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. No federally listed plant or animal species have the potential to occur within the proposed utility improvements area. Construction of proposed utility improvements would result in no effect to federally listed species.

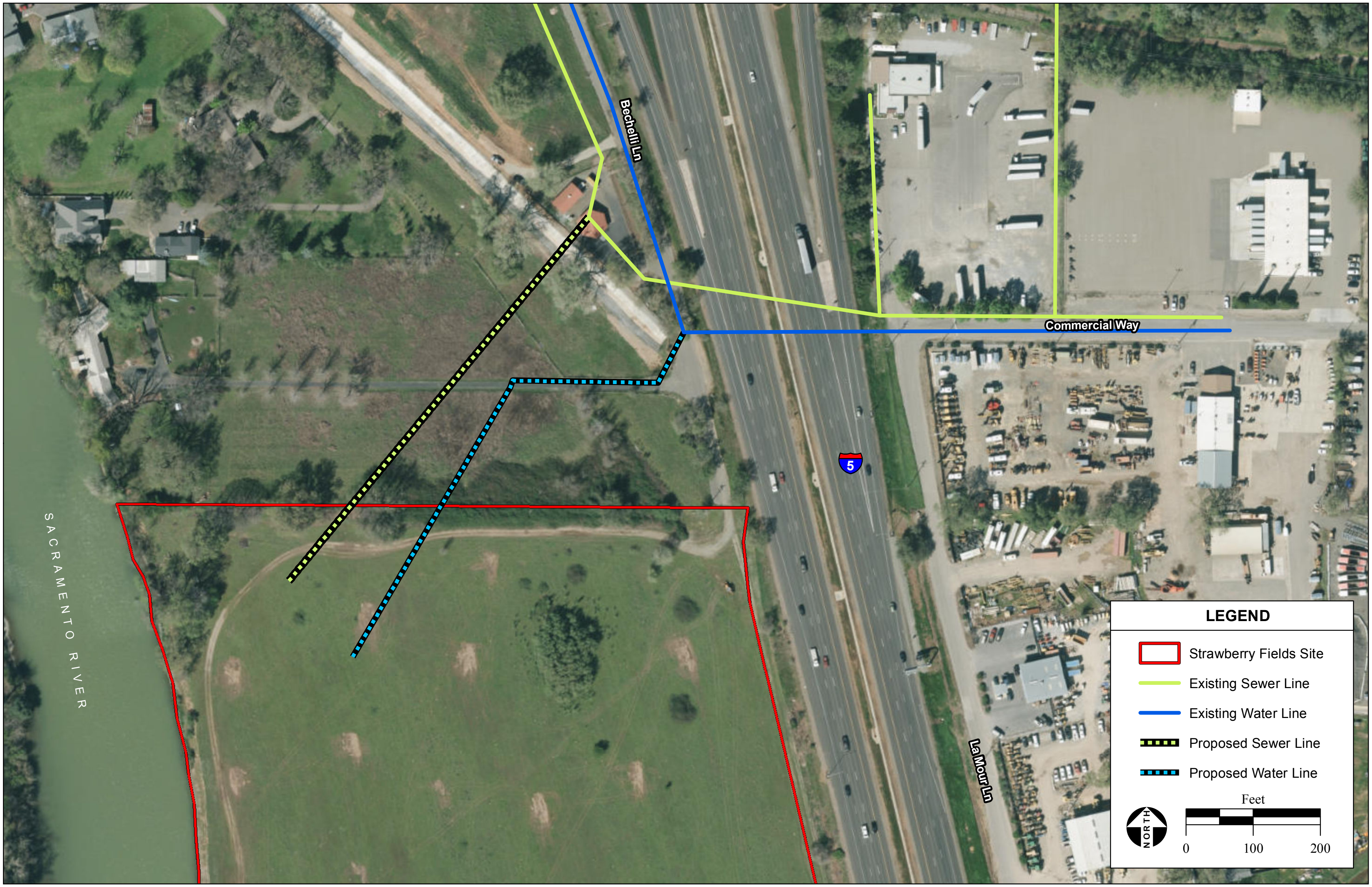
5.0 CONCLUSIONS

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 associated habitats.



SOURCE: ESRI WorldStreetmap, 2017; AES, 12/10/2019

Figure 8
Traffic Mitigation Locations



SOURCE: City of Redding 2016 SRTA Imagery, 3/2016; Coleman Engineering Feasability Study, 7/14/17; AES, 12/10/2019

Figure 9
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

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Shasta County, California

Local office

Sacramento Fish And Wildlife Office

☎ (916) 414-6600
📠 (916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species

[1] are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
Northern Spotted Owl Strix occidentalis caurina There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/1123	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt Hypomesus transpacificus There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/321	Threatened
Steelhead Oncorhynchus (=Salmo) mykiss There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/1007	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle Desmocerus californicus dimorphus There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/7850	Threatened

Crustaceans

NAME	STATUS
Conservancy Fairy Shrimp Branchinecta conservatio There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp Branchinecta lynchi There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp Lepidurus packardi There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
Slender Orcutt Grass Orcuttia tenuis There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/1063	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act

[1] and the Bald and Golden Eagle Protection Act[2].

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service

[3]. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The migratory birds species listed below are species of particular conservation concern (e.g. Birds of Conservation Concern) that may be potentially affected by activities in this location. It is not a list of every bird species you may find in this location, nor a guarantee that all of the bird species on this list will be found on or near this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the AKN Histogram Tools and Other Bird Data Resources. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

NAME	SEASON(S)
Bald Eagle Haliaeetus leucocephalus https://ecos.fws.gov/ecp/species/1626	Year-round

Black Swift Cypseloides niger https://ecos.fws.gov/ecp/species/8878	Breeding
Burrowing Owl Athene cunicularia https://ecos.fws.gov/ecp/species/9737	Year-round
Calliope Hummingbird Stellula calliope https://ecos.fws.gov/ecp/species/9526	Breeding
Fox Sparrow Passerella iliaca	Breeding
Lewis's Woodpecker Melanerpes lewis https://ecos.fws.gov/ecp/species/9408	Wintering
Loggerhead Shrike Lanius ludovicianus https://ecos.fws.gov/ecp/species/8833	Year-round
Nuttall's Woodpecker Picoides nuttallii https://ecos.fws.gov/ecp/species/9410	Year-round
Oak Titmouse Baeolophus inornatus https://ecos.fws.gov/ecp/species/9656	Year-round
Olive-sided Flycatcher Contopus cooperi https://ecos.fws.gov/ecp/species/3914	Breeding
Peregrine Falcon Falco peregrinus https://ecos.fws.gov/ecp/species/8831	Year-round
Rufous Hummingbird selasphorus rufus https://ecos.fws.gov/ecp/species/8002	Migrating
Short-eared Owl Asio flammeus https://ecos.fws.gov/ecp/species/9295	Wintering

Swainson's Hawk Buteo swainsoni https://ecos.fws.gov/ecp/species/1098	Breeding
Western Grebe aechmophorus occidentalis https://ecos.fws.gov/ecp/species/6743	Wintering
Williamson's Sapsucker Sphyrapicus thyroideus https://ecos.fws.gov/ecp/species/8832	Year-round
Willow Flycatcher Empidonax traillii https://ecos.fws.gov/ecp/species/3482	Breeding
Yellow-billed Magpie Pica nuttalli https://ecos.fws.gov/ecp/species/9726	Year-round

What does IPaC use to generate the list of migratory bird species potentially occurring in my specified location?

Landbirds:

Migratory birds that are displayed on the IPaC species list are based on ranges in the latest edition of the National Geographic Guide, Birds of North America (6th Edition, 2011 by Jon L. Dunn, and Jonathan Alderfer). Although these ranges are coarse in nature, a number of U.S. Fish and Wildlife Service migratory bird biologists agree that these maps are some of the best range maps to date. These ranges were clipped to a specific Bird Conservation Region (BCR) or USFWS Region/Regions, if it was indicated in the 2008 list of Birds of Conservation Concern (BCC) that a species was a BCC species only in a particular Region/Regions. Additional modifications have been made to some ranges based on more local or refined range information and/or information provided by U.S. Fish and Wildlife Service biologists with species expertise. All migratory birds that show in areas on land in IPaC are those that appear in the 2008 Birds of Conservation Concern report.

Atlantic Seabirds:

Ranges in IPaC for birds off the Atlantic coast are derived from species distribution models developed by the National Oceanic and Atmospheric Association (NOAA) National Centers for Coastal Ocean Science (NCCOS) using the best available seabird survey data for the offshore Atlantic Coastal region to date. NOAANCCOS assisted USFWS in developing seasonal species ranges from their models for specific use in IPaC. Some of these birds are not BCC species but were of interest for inclusion because they may occur in high abundance off the coast at different times throughout the year, which potentially makes them more susceptible to certain types of development and activities taking place in that area. For more refined details about the abundance and richness of bird species within your project area off the Atlantic Coast, see the Northeast Ocean Data Portal. The Portal also offers data and information about other types of taxa that may be helpful in your project review.

About the NOAANCCOS models: the models were developed as part of the NOAANCCOS project: Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf. The models resulting from this project are being used in a number of decision-support/mapping products in order to help guide decision-making on activities off the Atlantic Coast with the goal of reducing impacts to migratory birds. One such product is the Northeast Ocean Data Portal, which can be used to explore details about the relative occurrence and abundance of bird species in a particular area off the Atlantic Coast.

All migratory bird range maps within IPaC are continuously being updated as new and better information becomes available.

Can I get additional information about the levels of occurrence in my project area of specific birds or groups of birds listed in IPaC?

Landbirds:

The Avian Knowledge Network (AKN) provides a tool currently called the "Histogram Tool", which draws from the data within the AKN (latest,survey, point count, citizen science datasets) to create a view of relative abundance of species within a particular location over the course of the year. The results of the tool depict the frequency of detection of a species in survey events, averaged between multiple datasets within AKN in a particular week of the year. You may access the histogram tools through the Migratory Bird Programs AKN Histogram Tools webpage.

The tool is currently available for 4 regions (California, Northeast U.S., Southeast U.S. and Midwest), which encompasses the following 32 states: Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North, Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

In the near future, there are plans to expand this tool nationwide within the AKN, and allow the graphs produced to appear with the list of trust resources generated by IPaC, providing you with an additional level of detail about the level of occurrence of the species of particular concern potentially occurring in your project area throughout the course of the year.

Atlantic Seabirds:

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAANCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Facilities

Wildlife refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGES AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND
- PEMF

FRESHWATER FORESTED/SHRUB WETLAND
- PSSA
- PFOC

FRESHWATER POND
- PUBF
- PUBFx

RIVERINE

R2UBH

A full description for each wetland code can be found at the National Wetlands Inventory website: https://ecos.fws.gov/ipac/wetlands/decoder

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
Oncorhynchus tshawytscha chinook salmon - Central Valley spring-run ESU	AFCHA0205A	Threatened	Threatened	G5	S1	
Oncorhynchus tshawytscha 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
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: 24

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	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Listing Status	Federal Listing Status
Agrostis hendersonii	Henderson's bent grass	Poaceae	annual herb	Apr-Jun	3.2		
Cryptantha crinita	silky cryptantha	Boraginaceae	annual herb	Apr-May	1B.2		
Juncus leiospermus var. leiospermus	Red Bluff dwarf rush	Juncaceae	annual herb	Mar-Jun	1B.1		
Legenere limosa	legenere	Campanulaceae	annual herb	Apr-Jun	1B.1		
Orcuttia tenuis	slender Orcutt grass	Poaceae	annual herb	May-Sep (Oct)	1B.1	CE	FT
Sidalcea celata	Redding checkerbloom	Malvaceae	perennial herb	Apr-Aug	3		

Suggested Citation

California Native Plant Society, Rare Plant Program. 2017. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 26 July 2017].

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

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:
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

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APPENDICES

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

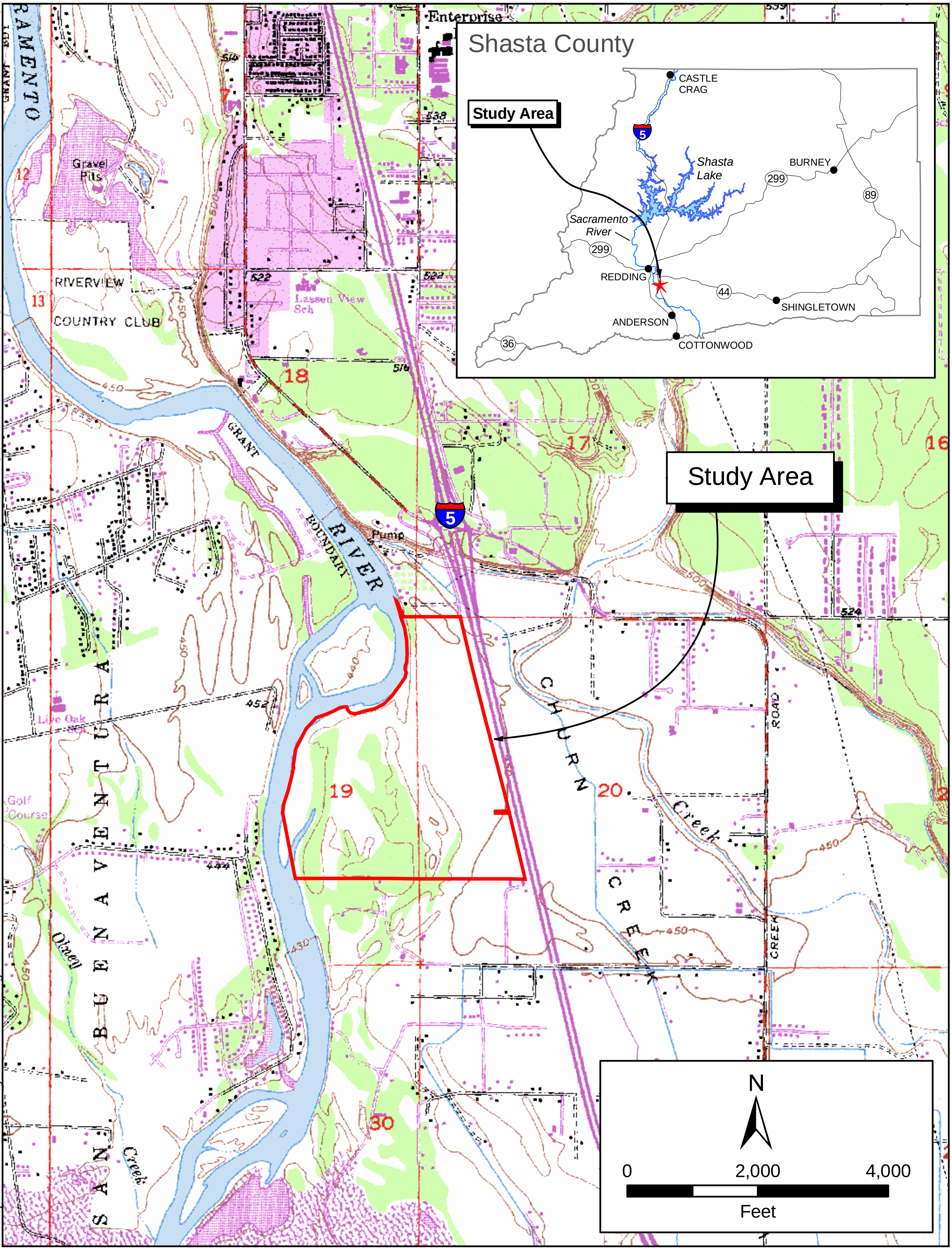
The study area is located south of the City of Redding in Shasta County, California and can be found within the *Enterprise*, *California* U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Township 31 North, Range 4 West, Sections 19 and 20). The central western and eastern boundaries 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.



G:\Projects\50780 Stawberry Fields\50780 Fig 1 Location.mxd Source: NSR, Inc; City of Redding; USGS 7.5-Minute Topographic Quadrangle, Enterprise 07-05-06 rjo

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.

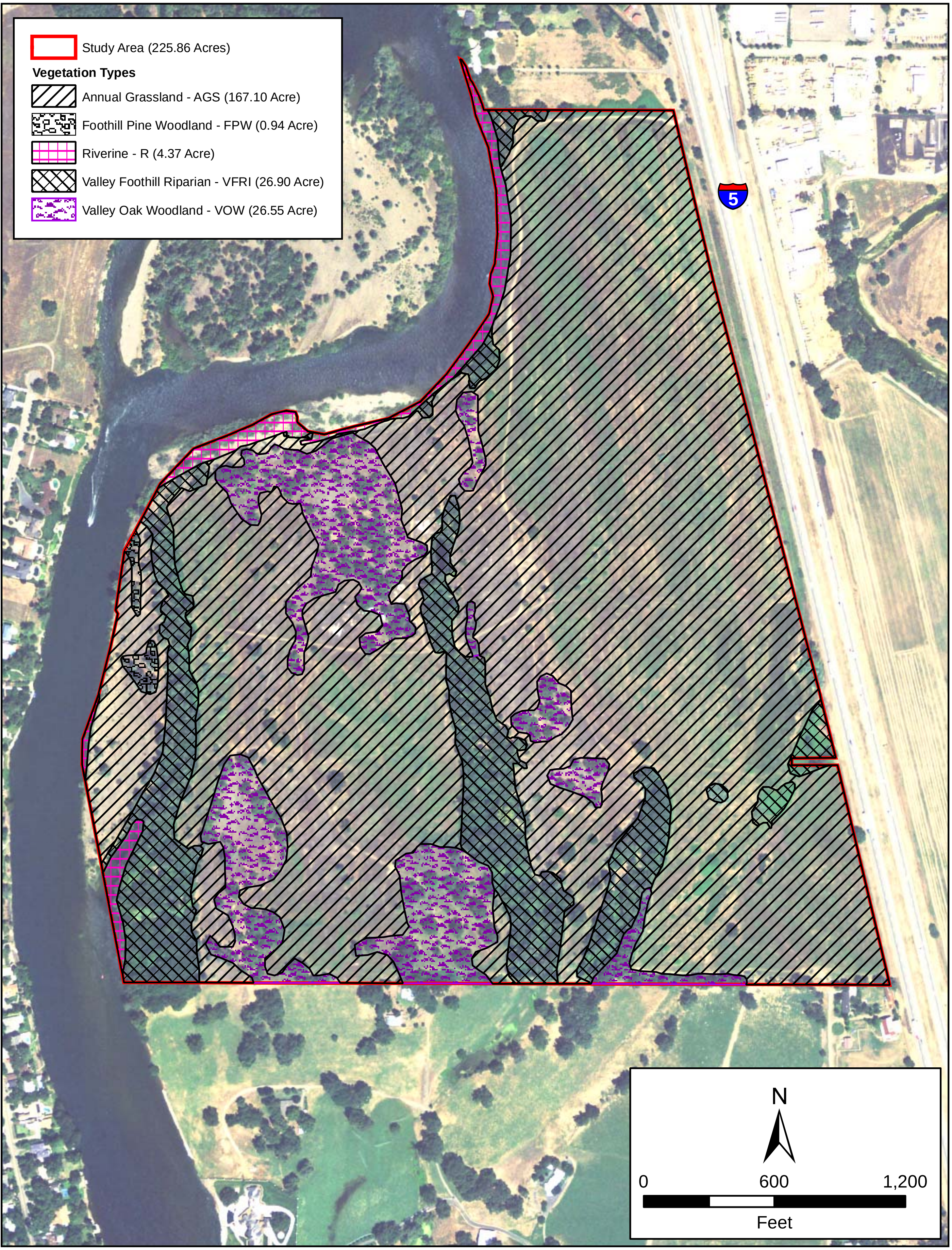
Riverine

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	CNPS = California Native Plant Society
ST = State	CNPS Codes:
Federal & State Codes:	List 1B = Rare, Threatened or Endangered in CA and Elsewhere;
E = Endangered; T = Threatened	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

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

California Department of Fish and Game
Natural Diversity Database
Selected Elements by Scientific Name - Portrait

	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).

APPENDIX O-4

REVISED 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:
Consultation Code: 08ESMF00-2020-SLI-0385
Event Code: 08ESMF00-2020-E-01082
Project Name: Redding Rancheria

November 19, 2019

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.

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:	08ESMF00-2020-SLI-0385
Event Code:	08ESMF00-2020-E-01082
Project Name:	Redding Rancheria
Project Type:	DEVELOPMENT
Project Description:	The proposed project includes the transfer of the approximately 232-acre Strawberry Fields Site in Redding, CA, to federal trust status (Proposed Action) for gaming purposes. The proposed casino-resort would have a gross footprint of approximately 383,893 sf.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/40.52893583595265N122.35386227320467W

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 Species survey guidelines: https://ecos.fws.gov/ipac/guideline/survey/population/205/office/11420.pdf	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	Threatened	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	G5T1T2Q	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

CNPS PLANT LIST

CNPS California Native Plant Society

Inventory of Rare and Endangered Plants

*The database used to provide updates to the Online Inventory is under construction. View updates and changes made since May 2019 here.

Plant List

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	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
Agrostis hendersonii	Henderson's bent grass	Poaceae	annual herb	Apr-Jun	3.2	S2	G2Q
Cryptantha crinita	silky cryptantha	Boraginaceae	annual herb	Apr-May	1B.2	S2	G2
Juncus leiospermus var. leiospermus	Red Bluff dwarf rush	Juncaceae	annual herb	Mar-Jun	1B.1	S2	G2T2
Legenere limosa	legenere	Campanulaceae	annual herb	Apr-Jun	1B.1	S2	G2
Orcuttia tenuis	slender Orcutt grass	Poaceae	annual herb	May-Sep(Oct)	1B.1	S2	G2
Sidalcea celata	Redding checkerbloom	Malvaceae	perennial herb	Apr-Aug	3	S2S3	G2G3

Suggested Citation

California Native Plant Society, Rare Plant Program. 2019. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 17 October 2019].

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

APPENDIX P

ADDITIONAL CULTURAL RESOURCES CONSULTATION

United States Department of the Interior

BUREAU OF INDIAN AFFAIRS
Pacific Regional Office
2800 Cottage Way
Sacramento, California 95825

IN REPLY REFER TO:

JAN 15 2020

Honorable Andrew Alejandre, Chairman
Paskenta Rancheria
P.O. Box 709
Corning, CA 96021

Dear Chairman Alejandre:

Under the provisions of Section 106 of the National Historic Preservation Act (NHPA) as amended, the Bureau of Indian Affairs (BIA) is extending an invitation to the Paskenta Rancheria to participate as a consulting party in our proposed federal undertaking that concerns the approval of a fee to trust land conveyance for the Redding Rancheria, Shasta County, CA. The Redding Rancheria is proposing to move its existing casino to what has been referred as the "Strawberry Fields Site", and which is located directly west of Interstate 5 and to the south of South Bonnyview Road in Redding. CA. Additionally, this federal action would involve several off-site improvements related to traffic flow and parking.

BIA is in receipt of the comment letter from your legal counsel dated June 17, 2019 on the draft environmental impact statement (DEIS), and in which is expressed concern over cultural resources that may be impacted as the result of this federal undertaking. We will take these comments into consideration as we initiate the Section 106 process with the State Historic Preservation Office (SHPO).

If your tribe has additional knowledge of, or concerns about historic properties with which you ascribe religious or cultural importance in relation to this proposed federal undertaking, we would like to include such comments in our correspondence with the SHPO. Please be advised, that the BIA understands the sensitive nature of such information, and that it is to be used only to meet the requirements under Section 101(d)(6)(B) of the NHPA, thereby affording tribes the opportunity to comment on proposed actions that may have the potential to affect historic properties.

If you have any questions or require additional information please contact Dan Hall, Regional Archeologist, at (916) 978-6041, or Felix Kitto, Regional Environmental Scientist, at (916) 978-6051.

Sincerely,

Acting Regional Director

State of California • Natural Resources Agency **Gavin Newsom, *Governor***

DEPARTMENT OF PARKS AND RECREATION **Armando Quintero, *Director***
OFFICE OF HISTORIC PRESERVATION
Julianne Polanco, State Historic Preservation Officer
1725 23rd Street, Suite 100, Sacramento, CA 95816-7100
Telephone: (916) 445-7000 FAX: (916) 445-7053
calshpo.ohp@parks.ca.gov www.ohp.parks.ca.gov

May 9, 2023

Reply In Reference To: BIA_2019_1017_001

VIA ELECTRONIC MAIL

Ryan Hunter – Acting Regional Director
United States Department of Interior
Bureau of Indian Affairs – Pacific Regional Office
2800 Cottage Way
Sacramento, CA 95825

RE: Fee-to-Trust Transfer of 232-acres for the Redding Rancheria, Shasta County

Dear Mr. Hunter;

The State Historic Preservation Officer (SHPO) received the Bureau of Indian Affairs (BIA) letter of 24 February 2023 on 3 March 2023 continuing consultation on the above referenced undertaking pursuant to 36 CFR Part 800 (as amended 8-05-04) regulations implementing Section 106 of the National Historic Preservation Act (NHPA). BIA is consulting on an undertaking that was previously reviewed for Section 106 and, with the current submission, has proposed determinations of not eligible for two potential historic properties in the Area of Potential Effects (APE) and, as understood, requests SHPO consensus on the determinations and SHPO concurrence on a change in the finding of effect to “*no historic properties affected*.”

Per the 15 April 2020 letter written for the previous SHPO review, on behalf of the Redding Rancheria BIA proposed the transfer of a 232-acre parcel located near the City of Redding and known as Strawberry Fields from fee to trust status. BIA had determined that the undertaking would be for the transfer of land only albeit the Rancheria had proposed the future development of a casino on a 37-acre construction site located within the larger parcel. BIA determined the APE to be the 232-acre parcel.

In the previous submission, BIA requested SHPO concurrence on a finding of “*no historic properties affected*.” However, the SHPO could not agree as the finding implies the absence of historic properties and Section 106 work documented two in the APE. The properties were identified as prehistoric site CA-SHA-1433 and an “*historic pump house*.” Both properties had been delineated within the 37-acre casino construction site. A National Register evaluation had been included in the submission for the former, however SHPO consultation was not requested. The submission did not address the potential eligibility of the “*historic pump house*.”

Based on the presence of two potential historic properties in the APE, the SHPO found the consultation inconsistent with a finding of "*no historic properties affected*." As an alternative, in her 15 April 2020 letter the SHPO advised BIA that she could agree with a finding of "*no adverse effect*" given the absence of ground disturbing work for the fee-to-trust transfer only. The SHPO received no formal response to her letter.

Per additional communications concerning the current submission, BIA explained that it had accepted the SHPO's proposed finding as it had considered the undertaking to involve the conveyance of land only and "*did not take into account (the) future development*" of the casino. Per these communications and the acquisition of additional materials noted below, subsequent to the SHPO letter the Rancheria had requested BIA seek SHPO review of the CA-SHA-1433 evaluation to assist in its planning efforts for the casino. As understood, the Rancheria too had requested SHPO review of the evaluation it recently completed for the "*historic pump house*."

Per additional communications with BIA, CA-SHA-1433 and the "*historic pump house*" are the only potential historic properties in the 232-acre APE. In support of the current consultation, BIA provided the following materials:

- BIA letter of 24 February 2023 continuing consultation with the SHPO
- *Pump House Evaluation Memo, Redding Rancheria Fee-To-Trust and Casino Project of 1 December 2022* (AES 2022)
- SHPO letter of 15 April 2020 prepared for the prior consultation

Per a request for additional information, BIA provided copies of the following materials that were prepared by the Redding Rancheria in support of the undertaking:

- *Extended Phase I Survey, Redding Rancheria, Fee-to-Trust Project (AES 2019A)*
  - *Strawberry Fields Study Area, Archaeological Resources Reconnaissance Investigation of 225.86 +/- acre, Shasta County California* (Crawford 2007)
- *CA-SHA-4413 Phase II Testing and Evaluation Report, Redding, CA, Redding Rancheria, Fee-to-Trust Project (AES 2019B)*

CA-SHA-1433

Per the Phase I report, excavation of 27 backhoe trenches in 2016 at the 37-acre casino construction site resulted in consolidating a number of archaeological resources recorded during a 2007 field-survey of the 232-acre APE into one site it identified as CA-SHA-1433. Ten of the trenches yielded samples of cores, flakes and shatter; battered cobbles; fire cracked rock (FCR) and charcoal; and one fragment each of shell, faunal material and projectile points. Cultural strata, a hearth, and one deposit described as a cooking feature were also observed in three of the trenches. The remaining trenches yielded no archaeological materials or features. To assist in project planning, as understood, the Phase I report recommended the Rancheria (1) complete a more comprehensive program of excavation and (2) determine the site's potential for listing on the NRHP and needs for developing an appropriate plan of action for avoiding and/or mitigating potential effects should the property be found eligible.

Per the Phase II report, additional work involved digging four 1.0 meter-square and 24 1.0-m by 50.0-centimeter (cm) excavation units in proximity to the Phase I backhoe trenches with positive results. This work recovered a sample of 600 artifacts that was dominated by large basalt and small obsidian flakes, but too contained low counts of cores, bifaces, lithics, bone, and battered and ground stone. The work also discovered two hearth features in association with low frequencies of lithics and flakes; baked earth; charcoal; fragments of shell and faunal material; and high frequencies of FCR. As understood, the depth of deposit ranged from surface grade to approximately 80.0-centimeters (cm) with artifact frequencies declining below 40.0 to 50.0-cm and the upper 30.0-cm of ground exhibiting evidence of (agricultural) plow disturbance.

The Phase II report determined the archaeological record of CA-SHA-1433 to be consistent with the Shasta Complex of regional prehistory, or "*the most common and best-understood archaeological pattern in the Redding area*." The report's interpretation of the archaeological record was discerned through an application of excavation information to a research design that contained analytical domains and data requirements relevant to the study of cultural chronology, paleoenvironment, site formation processes, subsistence, technology, exchange and interaction, and patterns of land use. Laboratory techniques included radiocarbon dating, obsidian hydration and sourcing, X-Ray fluorescence of basalt, and faunal analysis of archaeological materials.

As described, [redacted] Based on archaeological work prepared for the Phase II report, CA-SHA-1433 was determined not eligible to the NRHP.

"*Historic Pump House*"

Per the Evaluation Memo of 1 December 2022 the potential historic property was described in the 2007 study as:

"*An abandoned, defunct (and partially collapsed) pump house located on the west edge of study area at the east bank of the Sacramento River, under the canopy of several black walnut trees near the northern property boundary. The pump house has <u>apparently been reconstructed</u> at least twice (newer foundation is built atop older foundation, siding has been replaced, roof has been replaced, plumbing and electrical have been replaced, etc.) <u>exact determination of age difficult</u>. There is a scatter of refuse and debris (e.g., pipes, glass fragments, and the grill of an Oliver tractor) in the general area, <u>none of which appear to be as old as the structure itself</u>. Observed architectural features include: normally pitched, common rafter, roof; older no-course uncut stone foundation supporting newer cement foundation (raising the overall height of the original building, providing a little more flood protection, and slowing wall rot); siding is corrugated tin (probably replaced older board and bat or horizontal board siding); framing is wooden balloon braced by wire-cut nails; cement valve boxes; iron and galvanized valves and piping; horizontal board front gable (probably original) with wooden louvered sash (probably original); corrugated tin roofing (probably* *replaced wooden shakes); single-unit one story simple ground plan; no floor (pump house extends over river and houses pumps mounted on frames suspended over the river)*."

Per photos attached to the memo, NSR-RRa-005 appears today (2023) to constitute a collapsed building and scatter of historic and non-historic debris. Based on an application of the "*Criteria for evaluation*" found at 36 CFR § 60.4 and presented in the memo, the potential historic property was determined not eligible to the NRHP.

My following comments are based on a review of submitted materials:

1. Pursuant to 36 CFR § 800.4(a)(1), having reviewed the 232-acre APE for the previous consultation I have no additional comments on its delineation as it appears unchanged.
2. Pursuant to 36 CFR § 800.4(b)(1), as understood from the previous and current submissions, BIA has documented a reasonable and good faith effort to identify historic properties.
3. Pursuant to 36 CFR § 800.4(c)(2), BIA has determined that CA-SHA-1433 and the "*historic pump house*" (NSR-RRa-005) do not meet the "*Criteria for evaluation*" and are not eligible to the National Register. **I agree**.
4. Pursuant to 36 CFR § 800.4(d)(1), BIA finds that the proposed undertaking (consisting of the fee-to-trust transfer and casino construction) will result in "*no historic properties affected*." Based on BIA's determinations of not eligible for CA-SHA-1433 and the "*historic pump house*" and the absence of any other historic property or properties potentially eligible for or listed on the National Register in the APE, **I agree**.
5. Be aware that consultation with my office on the potential of any inadvertent discovery encountered during project implementation being a historic property potentially eligible to the NRHP should comply with 36 CFR § 800.13 for "*Post Review Discoveries*."
6. Be aware that pursuant to 36 CFR § 800.4(c)(2) determinations of eligibility to the National Register are to be completed in consultation with the SHPO (meaning that "*the SHPO agrees*" with the results) and, as such, Section 106 submissions should always include requests for SHPO consensus.

You may have additional Section 106 responsibilities for the undertaking under conditions such as changes in project scope or design. Please direct questions to Jeff Brooke, Associate State Archaeologist, at (916) 445-7003 or Jeff.Brooke@parks.ca.gov.

Sincerely,

Julianne Polanco
State Historic Preservation Officer

APPENDIX Q

UPDATED TRAFFIC IMPACT STUDY

TRAFFIC IMPACT STUDY

Redding Rancheria

PREPARED FOR:

ANALYTICAL ENVIRONMENTAL SERVICES

UPDATED FEBRUARY 2023

Prepared By:

Kimley»Horn

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EXECUTIVE SUMMARY

Kimley-Horn was retained by Analytical Environmental Services (AES) to prepare a traffic impact study in support of an Environmental Impact Statement (EIS) for the Redding Rancheria Casino Project (Proposed Project) located in Shasta County, California.

Following the publishing of the Draft Environmental Impact Statement (DEIS) for the Proposed Project, comments specific to the original traffic impact study (TIS) were received from multiple agencies (including Caltrans, Shasta County, and the City of Redding) and members of the public. As deemed appropriate, these comments have been addressed and incorporated in this Updated TIS. A separate response to comments memorandum has also been prepared in which comprehensive responses and supporting information have been provided.

As noted in this Updated TIS, Opening Year traffic volumes are intended to be representative of year 2025 conditions. Although the projected Opening Year for the project has been delayed to 2026, the continued use of year 2025 to approximate the Opening Year volume conditions is considered to be appropriate based on published travel trends.

Since the time of preparation of the original TIS, the *River Crossing Marketplace Specific Plan Traffic Impact Analysis Report* and related offsite mitigation improvements were completed. This Updated TIS incorporates these changes to the Opening Year and Cumulative conditions and adjusts the proposed project's mitigation responsibilities accordingly.

The Project consists of a new casino and resort, including an approximately 69,515 square foot casino, 250-room hotel, an event/convention center, and a retail center. The project site, also referred to as the Strawberry Fields Site, is located in the southwest quadrant of the Interstate 5 (I-5) interchange with South Bonnyview Road. While the I-5/South Bonnyview Road interchange is located within the City of Redding's jurisdiction, the project site is located farther south, within unincorporated Shasta County.

As part of the project, six total development alternatives (four of which are on the project site, two of which are located off site) were evaluated. The development alternatives evaluated and their respective project sites are as follows:

Strawberry Fields Site:
- Alternative A: Proposed Project
- Alternative B: Proposed Project with No Retail Alternative
- Alternative C: Reduced Intensity Alternative
- Alternative D: Non-Gaming Alternative

Anderson Site:
- Alternative E: Anderson Site Alternative (City of Anderson)

Win River Casino Site:
- Alternative F: Expansion of the Existing Win River Casino Resort

In addition, three project access options were evaluated for each development alternative on the Strawberry Fields Site. The access options are listed below:

- North Access Only – access to South Bonnyview Road via Bechelli Lane
- North and South Access – access to South Bonnyview Road via Bechelli Lane and access to Smith Road via a new connecting roadway (overpass only at Smith Road)
- South Access Only – access to Smith Road via a new connecting roadway and a new Interstate 5 (I-5) Interchange at Smith Road

The traffic study was completed for the following scenarios:

- Existing (2016) Conditions
- Opening Year (2025) Conditions
- Opening Year (2025) plus Proposed Project Conditions
- Cumulative (2040) Conditions
- Cumulative (2040) plus Proposed Project Conditions

Significant findings of this study include:

- Several intersections, primarily in and around the South Bonnyview Road/I-5 interchange, operate unacceptably with the addition of the proposed project for various study scenarios and access options. Each impact can be mitigated to be ***less than significant***.

INTRODUCTION

Kimley-Horn was retained by Analytical Environmental Services (AES) to prepare a traffic impact study in support of an Environmental Impact Statement (EIS) for the Redding Rancheria Casino Project (Proposed Project), located in Shasta County, California. The purpose of this study is to address the traffic and transportation effects of the Proposed Project.

Following the publishing of the Draft Environmental Impact Statement (DEIS) for the Proposed Project, comments specific to the original traffic impact study (TIS) were received from multiple agencies (including Caltrans, Shasta County, and the City of Redding) and members of the public. As deemed appropriate, these comments have been addressed and are incorporated in this Updated TIS. A separate response to comments memorandum has also been prepared in which comprehensive responses and supporting information have been provided.

As noted in this Updated TIS, Opening Year traffic volumes are intended to be representative of year 2025 conditions. Although the projected Opening Year for the project has been delayed, the continued use of year 2025 to approximate the Opening Year volume conditions is considered to be appropriate based on published travel trends. To support this conclusion, travel behaviors, pre- and post-COVID, are useful in establishing current traffic dynamics and understanding recent changes in the broad population's trip making characteristics in recent years. Specific to Shasta County, while the County's population has increased 2% between 2019 and 2022, data shows that total trips have outpaced the population growth and increased 6%[1]. Furthermore, the data[1] reveal that the actual traditional peak-periods experience lower volumes now compared to 2019 (i.e., the "flattening" of the peak hour volume curves). In summary, trip growth has outpaced the County's population growth 2019-2022, while the peak-period volumes are shown to be less. As a result of this dynamic (demonstrated reduction in peak-period volumes) it is reasonable to continue to use the previously established Opening Year 2025 conditions to assess the effect of the addition of the project on the near-term transportation network.

Since the time of preparation of the original TIS, the City proceeded with a concurrent transportation impact study and Final Environmental Impact Report (EIR) for a nearby development known as the River Crossing Marketplace, and certain offsite traffic mitigations recommended in the *River Crossing Marketplace Specific Plan Traffic Impact Analysis Report*[2] have been constructed. The City provided the associated improvement plans for the construction of South Bonnyview Road improvements at Bechelli Lane and the I-5 interchange ramps[3,4]. These improvements have been fully

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[1] Replica Big Data Platform, replicahq.com

[2] *Final Environmental Impact Report, State Clearinghouse No. 2017052030, River Crossing Marketplace Specific Plan*.

[3] *Project Plans for the Construction of S. Bonnyview Rd/I-5 Phase II Improvements Bechelli Ln Roundabout*, GHD, October 2021.

[4] *Project Plans for Construction on State Highway in Shasta County in and Near Redding From 0.4 Miles South to 0.5 miles north of Churn Creek Road Overcrossing*, GHD, October 2021.

constructed and the facilities were opened to traffic in November 2022. This Updated TIS incorporates these changes to the Opening Year and Cumulative conditions and adjusts the proposed project's mitigation responsibilities accordingly.

Lastly, since the time of preparation of the original TIS, the Redding Rancheria has formulated plans to construct a new Tribal Health Center (THC) to be located in the vicinity of the South Market Street (State Highway 273) intersection with Clear Creek Road in Shasta County. The proposed THC project site is located north of Clear Creek across from the existing Win-River Resort and Casino and other existing Rancheria facilities. The proposed THC project site would be accessible from the Win-River complex via a new vehicular and pedestrian bridge. General project access would be provided via one full access driveway on Clear Creek Road and via the aforementioned bridge connecting the site to the existing Win-River complex. Because this project would be connected/accessible to the adjacent Win-River complex, and because it would result in a relatively low number of localized, peak-hour trips, the Cumulative analyses previously completed for Alternative F in the original TIS accurately capture the THC project's effects.

Project Description

The Project consists of a new casino and resort, including an approximately 69,515 square foot casino, 250-room hotel, an event/convention center, a retail center, as well as associated parking and infrastructure. The Strawberry Fields Site is located in the southwest quadrant of the Interstate 5 (I-5) interchange with South Bonnyview Road.

Strawberry Fields Site Development Alternatives

As part of the project, four development alternatives at the Strawberry Fields Site were evaluated. The development alternatives evaluated are as follows:

- Alternative A: Proposed Project
- Alternative B: Proposed Project with No Retail Alternative
- Alternative C: Reduced Intensity Alternative
- Alternative D: Non-Gaming Alternative

Strawberry Fields Site Access Alternatives

As part of the project, three project access options were evaluated for each development alternative on the Strawberry Fields Site. The access options evaluated are listed below:

- North Access Only (Option 1) – access to South Bonnyview Road via Bechelli Lane
- North and South Access (Option 2) – access to South Bonnyview Road via Bechelli Lane and access to Smith Road via a new connecting roadway (overpass only at Smith Road)
- South Access Only (Option 3) – access to Smith Road via a new connecting roadway and a new I-5 Interchange at Smith Road

Site Alternatives

In addition to the alternatives listed above, two additional site alternatives were evaluated. These additional alternatives are as follows:

- Alternative E: Anderson Site Alternative (City of Anderson)
- Alternative F: Expansion of the Existing Win River Casino Resort

Study Methodology

This traffic study was based on relevant information from the Shasta County General Plan (amended September 2004), the City of Redding General Plan Transportation Element (adopted October 2000) and Caltrans.

Development Conditions

The traffic study was based on the following study scenarios:

- **Existing (2016) Conditions**
  Evaluates current traffic counts, existing roadway geometry/traffic control, and existing development conditions.

- **Opening Year (2025) Conditions**
  Evaluates year 2025 traffic volumes. Volumes for intersections #1-9 were taken directly from the 2017 *River Crossing Marketplace Specific Plan Traffic Impact Analysis Report*[5] Year 2020 Plus Project Conditions volumes[6]. Volumes for intersections #10-23 were developed by linearly interpolating between existing and 2040 traffic volumes. The scenario assumes existing roadway geometry/traffic control.

- **Opening Year (2025) plus Proposed Project Conditions**
  Evaluates year 2025 traffic volumes and traffic generated by the project.

- **Cumulative (2040) Conditions**
  Volumes for intersections #1-9 were taken directly from the 2017 *River Crossing Marketplace Specific Plan Traffic Impact Analysis Report* Year 2040 Plus Project Conditions volumes[6]. Volumes for intersections #10-23 were developed using the Shasta County Regional Travel Demand Model (SCRTDF)[7] Version 1.1. The scenario assumes existing roadway geometry/traffic control.

- **Cumulative (2040) plus Proposed Project Conditions**
  Evaluates year 2040 traffic volumes and traffic generated by the project.

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[5] *River Crossing Marketplace Specific Plan Traffic Impact Analysis*, Omni-Means, A GHD Company, 2017.

[6] Note: Some movements presented in the *Redding Rancheria Traffic Impact Study* are higher than those presented in the *River Crossing Marketplace Specific Plan Traffic Impact Analysis* report.

[7] Adjusted SCRTDF Model based on I-5 / S. Bonnyview Interchange PSR Technical Memorandum 1–15, Omni-Means to City of Redding – Engineering, May 06, 2016 – April 28, 2017.

Operating Conditions and Criteria

Operating conditions experienced by drivers are described in terms of Level of Service (LOS), which is a qualitative measure of factors such as delay, speed, travel time, freedom to maneuver, and driving comfort and convenience. Levels of service are represented by a letter scale from LOS A to LOS F, with LOS A representing the best performance and LOS F representing the poorest performance.

Table 1 relates the operational characteristics associated with each level of service category for both signalized and unsignalized intersections. **Table 2** and **Table 3** list the level of service thresholds for roadway segments, one-lane and multilane respectively. Level of service thresholds for two-lane highways are based on average travel speed and the percent time spent following based on the segment's classification. Level of service on Class I facilities is defined in terms of average travel speed as well as percent time-spent-following (where mobility is critical). Percent time-spent-following is defined as the average percent of total travel time that vehicles must travel in platoons behind slower vehicles due to inability to pass on a two-lane highway. The level of service on Class II facilities is based only on the percent time-spent-following. Level of service thresholds for multilane highways are based on density measured in passenger cars per mile per lane. **Table 4** lists the level of service thresholds for freeway segments which is also based on density.

Table 1 – Intersection Level of Service Definitions

Level of Service	Description	Signalized (Avg. control delay per vehicle)	Unsignalized (Avg. control delay per vehicle)	Volume to Capacity
A	Free flow with no delays. Users are virtually unaffected by others in the traffic stream	<= 10	<= 10	And <= 1.0
B	Stable traffic. Traffic flows smoothly with few delays.	> 10 – 20	> 10 – 15	And <= 1.0
C	Stable flow but the operation of individual users becomes affected by other vehicles. Modest delays.	> 20 – 35	> 15 – 25	And <= 1.0
D	Approaching unstable flow. Operation of individual users becomes significantly affected by other vehicles. Delays may be more than one cycle during peak hours.	> 35 – 55	> 25 – 35	And <= 1.0
E	Unstable flow with operating conditions at or near the capacity level. Long delays and vehicle queuing.	> 55 – 80	> 35 – 50	And <= 1.0
F	Forced or breakdown flow that causes reduced capacity. Stop and go traffic conditions. Excessive long delays and vehicle queuing.	> 80	> 50	Or > 1.0

Source: Transportation Research Board, *Highway Capacity Manual 2010*, National Research Council, 2010.

Table 2 – Roadway Segment Level of Service Thresholds: Two-Lane Highway

Level of Service	Class I[a] Percent Time Spent Following (%)	Class I[a] Average Travel Speed (mph)	Class II[b] Percent Time Spent Following (%)
A	<= 35	=> 55	<= 40
B	> 35 – 50	> 50 – 55	> 40 – 55
C	> 50 – 65	> 45 – 50	> 55 – 70
D	> 65 – 80	> 40 – 45	> 70 – 85
E	> 80	<= 40	> 85

Source: Transportation Research Board, *Highway Capacity Manual 2010*, National Research Council, 2010.

[a]Class I: Highways on which motorists expect to travel at relatively high speeds, including major intercity routes, primary arterials, and daily commuter routes.

[b]Class II: Highways on which motorists do not necessarily expect to travel at high speeds, including access routes, scenic and recreational routes that are not primarily arterials, and routes through rugged terrain.

LOS F applies whenever the flow rate exceeds the segment capacity.

Table 3 – Roadway Segment Level of Service Thresholds: Multilane Highway

Level of Service (LOS)	Free Flow Speed (mph)	Density (pc/mi/ln)
A	All	> 0 – 11
B	All	> 11 – 18
C	All	> 18 – 26
D	All	> 26 – 35
E	60 55 50 45	> 35 – 40 > 35 – 41 > 35 – 43 > 35 – 45
F (demand exceeds capacity)	60 55 50 45	> 40 > 41 > 43 > 45

Source: Highway Capacity Manual, 2010

Note: Passenger Cars per Mile per Lane (pc/mi/ln)

Table 4 – Freeway Facility Level of Service Criteria

Level of Service (LOS)	Basic Segments Density (pc/mi/ln)	Merge/Diverge Segments Density (pc/mi/ln)
A	≤ 11	≤ 10
B	> 11 – 18	> 10 – 20
C	> 18 – 26	> 20 – 28
D	> 26 – 35	> 28 – 35
E	> 35 – 45	> 35
F*	> 45*	*

Source: Highway Capacity Manual, 2010

* Demand exceeds capacity

Note: Passenger Cars per Mile per Lane (pc/mi/ln)

Table 5 summarizes the local level of service standards.

Table 5 – Local Level of Service Standards

Jurisdiction	Satisfactory Criteria	Significance Criteria
Shasta County	LOS C	Project causes LOS to fall below LOS C. The project is considered to have a significant impact if the project increases the average delay by more than 5 seconds per vehicle at an intersection having an unacceptable LOS without project traffic.
Redding	LOS C/D	Project causes LOS to fall below LOS C for arterial streets and intersections. The project is considered to have a significant impact if the project increases the average delay by more than 5 seconds per vehicle (and meets peak hour volume signal warrants for stop controlled intersections) at an intersection having an unacceptable LOS without project traffic. *Note LOS D is considered acceptable for areas in the downtown area, as well as along streets within the state highway system and corresponding intersections.
Anderson	LOS D	Project causes LOS to fall below LOS D.
Caltrans	LOS D	Project causes LOS to fall below LOS D at intersections and highways. If LOS is already below criteria, the existing LOS and related measure of effectiveness (i.e. delay, percent time-spent-following, and average speed) are to be maintained.

Sources:
Shasta County General Plan, Circulation Element, September 2004
City of Redding General Plan, October 2000
City of Redding *Traffic Impact Analysis Guidelines*, January 2009
City of Anderson General Plan, May 2007
Caltrans Guide for the Preparation of Traffic Impact Studies, December 2002
State Route 273 Transportation Concept Report, Caltrans District 2, Office of Planning, December 2004

Traffic analysis was completed using Synchro and VISSIM software at intersections and Highway Capacity Software (HCS) at roadway and freeway segments. Both software platforms are based on the methodology of the *Highway Capacity Manual (HCM, 2010)*.

The following is a summary of the technical analysis parameters that were used for each software platform:

Synchro:

- Lane configurations: on an intersection basis
- Lane width: 12 feet
- Turn lane lengths: on an intersection basis
- Peak-Hour turning movement volumes: on an intersection basis
- Traffic control: on an intersection basis
- Signal timing plans: on an intersection basis
- Peak-Hour Factor (PHF): 0.92
- % Heavy Vehicles: 2%
- Ideal Saturation Flow Rate (vphpl): 1,900
- Pedestrian and bicycle crossings per hour: 0

VISSIM:

- Each network link that loads volume was coded with passenger vehicle and truck percentages based on traffic count data available
    - % Heavy Vehicles at I-5 Northbound Off-Ramps: 5%
    - % Heavy Vehicles elsewhere: 2%
- Default North American vehicle type distribution was used
    - This distribution relates to the percentage of sedans, sport utility vehicles (SUVs), light trucks, vans, and other vehicles that are typically on the road
- A seeding period of 15 minutes was used to load the network
- Network simulation ran for 60 minutes from which the data was collected
- Static vehicle routes were coded from origin to destination link
    - The distribution was based on the turning movements per intersection
- Lane change distance was adjusted for select links in to allow for smoother driver behavior and realistic queueing
    - Lane change distance adjustments were 1,000 – 1,500 ft range
- All signals were coded as Ring Barrier Controller (RBC) with detections for each approach (actuated controllers)
- Right-turn on red was coded at all right-turns with signalized intersections
- Conflict rules were coded for all links where vehicles had to yield to opposing traffic
- Corridor speeds were coded based on speed limit signs along the corridor
- Right-turn speed was coded in as 10 – 13 mph
- Left-turn speed was coded has 15 – 18 mph
- Priority rules were used for “Do Not Block Intersection” conditions
- Signal timing for the diverging diamond interchange (DDI) was coded to optimize throughput
- Roundabout circulation speed was coded at 15 – 18 mph
- Roundabout approach speed was set at 30 mph
- Roundabout gap times were visual calibrated and were set with a minimum headway range of 2.5 – 3.5 seconds

Significant Impact and Mitigation Thresholds

Shasta County

The Shasta County General Plan, Circulation Element, dated September 2004, was used to determine the Proposed Project impacts to facilities within the County's jurisdiction. These guidelines state that Shasta County shall adopt LOS C standards for any new roads. New developments shall not be approved unless traffic impacts are adequately mitigated. Such mitigation may take the form of, but not limited to, provision of capacity improvements and demand reduction measures. The County has determined that a project may have significant impacts on traffic and circulation if it does any of the following:

- Causes an intersection or roadway segment that operates acceptable without the project to degrade to an unacceptable LOS due to the addition of traffic from the project
- Causes an intersection that is operating at an unacceptable LOS without the project and experiences an increase of 5 or more seconds of control delay due to the addition of the project traffic.
- Causes a roadway segment that operates unacceptably to experience an in increase in its daily volume to a capacity ration of 0.05 or greater due to the addition of project traffic.

City of Redding

The *City of Redding Traffic Impact Analysis Guidelines*, dated January 2009, was used to determine the Proposed Project impacts to facilities within the City of Redding's jurisdiction. These guidelines state that the minimum LOS standard to be used in the analysis shall be LOS C for most arterial streets and their intersections and LOS D for the Downtown area or for streets within the State highway system and interchanges. When an existing Redding facility is operating at less than appropriate target LOS, the following thresholds are used to determine significant impacts:

- The project increases the delay by more than 5 seconds per vehicle at an intersection having an unacceptable LOS without project traffic.
- The project causes the v/c ratio to increase by more than 0.05 on a roadway having an unacceptable LOS without project traffic.
- The project causes the amount of traffic on a local street to exceed 2,000 daily vehicles or 180 peak hour vehicles; or adds any amount of traffic to a local street which exceeds these limits without the project.
- The project causes the amount of traffic on a residential collector, having individual access to single family lots, to exceed 4,000 daily vehicles or 360 peak hour vehicles; or adds any amount of traffic to a residential collector which exceeds these limits without the project.

For impacts that occur in cumulative conditions, the project applicant is responsible for mitigating the impact by providing a fair share contribution. According to the City's Traffic Impact Analysis Guidelines (Section 3.1 (B)), the following scenarios are defined as "cumulative":

- "Existing plus Approved/Pending Projects List
- Existing plus Approved/Pending Projects List plus Proposed Project
- 2030 Shasta County Travel Demand Model (SCTDM) without Proposed Project
- 2030 SCTDM plus Proposed Project"

Accordingly, the Traffic Impact Study's (TIS) inclusion of both "Opening Year (2025) Conditions" (conditions representative of Existing plus Approved/Pending Projects) and "Cumulative (2040) Conditions", are considered to satisfy the City's requirement for comprehensive "cumulative" analyses. Furthermore, as required by the City's Guidelines, the fair share mitigations identified for Opening Year (2025) and Cumulative (2040) Conditions were calculated based the methodology provided in Caltrans' Guide for the Preparation of Traffic Impact Studies (2002).

If the project's fair share is 25 percent or more, then the recommended improvements shall be installed at the time of the development, subject to a reimbursement agreement. If the recommended improvement is included in the current list of Traffic Impact Fee projects, reimbursement will be in the form of either TIF credit or payment from the TIF. If the project's fair share is less than 25 percent, then the project will be required to pay its fair share of the cost of the improvements to be constructed later by others, prior to the realization of the impact. If the recommended improvement is included in the current list of TIF projects, then payment of the project's TIF fee will be considered mitigation for the impact.

City of Anderson

The City of Anderson General Plan, Circulation Element, dated May 2007, was used to determine the Proposed Project impacts to facilities within the City of Anderson's jurisdiction. These guidelines state that the City of Anderson strives to maintain a LOS D as the minimum acceptable service standard for intersections during peak periods. For this study, the Shasta County significance was used for City of Anderson facilities.

Caltrans

The *Caltrans Guide for the Preparation of Traffic Impact Studies*, dated December 2002, was used to determine the Proposed Project impacts to facilities within Caltrans's jurisdiction. These guidelines state that Caltrans endeavors to maintain a target LOS at the transition between LOS C and LOS D for all of its facilities. However, in the *State Route 273 Transportation Concept Report*, Caltrans indicated that a lower level of service (LOS D) is acceptable before mitigation would be required[8]. When an existing State Highway facility is operating at less than appropriate target LOS, the existing measure of effectiveness (MOE) for that facility should be maintained. This means that,

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[8] *State Route 273 Transportation Concept Report*, Caltrans District 2, Office of Planning, December 2004.

for facilities that operate at a LOS E or F, a significant project impact would occur if a project causes a decrease in the MOE for that facility.

Cumulative traffic impacts are those projected to occur when project traffic is added to future traffic, and where this resulting combined future traffic exceeds each Jurisdiction's significance criteria. Future traffic is based on additional proposed developments in the area (short and long-term cumulative). The project applicant would be responsible for mitigating its cumulatively considerable impact by providing a fair share contribution towards the implementation of mitigation measures needed to improve the intersection or roadway segment to an acceptable LOS or to a level that is equal to better than pre-project operations. A fair share contribution is based on the projects proportionate traffic contribution to the overall future traffic volumes at locations which exceed the significance criteria.

Study Areas

The proposed project site is located in the southwest quadrant of the I-5 interchange with South Bonnyview Road. While the I-5/South Bonnyview Road interchange is located within the City of Redding's jurisdictions, the project site is located immediately south of and outside the City's boundary within unincorporated Shasta County.

Two additional site alternatives were evaluated. The Anderson Site is located at the northwest quadrant of the I-5 and North Street Interchange, off of Oak Street within the City of Anderson. The Win River Casino Site is located at the intersection of Market Street (SR-273) and Canyon Road, off of Redding Rancheria Road in Shasta County.

Intersections Included in Analysis

The Project would generate new vehicular trips that would increase traffic volumes on the nearby street network. To assess changes in traffic conditions associated with the Project, the following study intersections were selected based on relevance to the Project and additional site alternatives, and the existing traffic conditions. **Figure 1** illustrates the study intersections for the Strawberry Fields Site:

1. South Bonnyview Road @ Market Street (SR-273) – Caltrans
2. South Bonnyview Road @ East Bonnyview Road – City of Redding
3. South Bonnyview Road @ Bechelli Lane – City of Redding
4. South Bonnyview Road @ I-5 SB Ramps – Caltrans
5. South Bonnyview Road @ I-5 NB Ramps – Caltrans
6. South Bonnyview Road @ Churn Creek Road – City of Redding
7. Churn Creek Road @ Alrose Lane – City of Redding
8. Churn Creek Road @ Victor Avenue – City of Redding
9. Churn Creek Road @ Rancho Road – City of Redding
10. Churn Creek Road @ Smith Road – Shasta County
24. Smith Road @ Proposed Project South Driveway *(Options 1 & 2)*–Shasta County
25. Smith Road @ I-5 SB Ramps *(Option 2)* – Caltrans
26. Smith Road @ I-5 NB Ramps *(Option 2) – Caltrans*

101. Churn Creek Road @ Commercial Way
102. Knighton Road @ I-5 Southbound Ramps
103. Knighton Road @ I-5 Northbound Ramps
104. Churn Creek Road @ Knighton Road
105. Bechelli Lane @ Sunnyhill Lane

Figure 2 illustrates the study intersections for the Anderson Site (City of Anderson):

17. Market Street (SR-273) @ North Street – Caltrans
18. North Street @ Oak Street – City of Anderson
19. North Street @ I-5 SB Off Ramp – Caltrans
20. North Street @ I-5 NB On-Ramp/ McMurray Drive – Caltrans
21. Balls Ferry Road @ Oak Street – City of Anderson
22. Balls Ferry Road @ I-5 SB On-Ramp/ Ventura Street – Caltrans
23. Balls Ferry Road @ I-5 NB Off-Ramp/ McMurray Drive – Caltrans

Figure 3 illustrates the study intersections for the Win River Casino Site:

1. South Bonnyview Road @ Market Street (SR-273) – Caltrans
11. Market Street (SR-273) @ Westwood Avenue – Caltrans
12. Market Street (SR-273) @ Clear Creek Road – Caltrans
13. Market Street (SR-273) @ Girvan Road – Caltrans
14. Market Street (SR-273) @ Redding Rancheria Road – Caltrans
15. Redding Rancheria Road @ Canyon Road – City of Redding
16. Market Street (SR-273) @ Happy Valley Road – Caltrans

Roadway Segments Included in Analysis

Roadway segments were selected for evaluation. Roadway segments studied are illustrated in **Figures 1-3**.

Strawberry Fields Site:

1. South Bonnyview Road, west of Bechelli Lane
2. Bechelli Lane, south of South Bonnyview Road
3. Churn Creek Road, east of Alrose Lane
4. Smith Road, west of Churn Creek Road
101. Knighton Road, between I-5 Southbound Ramps and I-5 Northbound Ramps
102. Knighton Road, between I-5 Northbound Ramps and Churn Creek Road
103. Churn Creek Road, between Knighton Road and Smith Road

Anderson Site:

1. North Street west of Oak Street
2. Oak Street south of North Street
3. North Street east of Oak Street
4. Oak Street north of North Street

Win River Casino Site:

1. Market Street (SR-273) north of Redding Rancheria Road

2. Market Street (SR-273) south of Redding Rancheria Road
3. Canyon Road south of Redding Rancheria Road

Freeway Segments Included in Analysis

Freeway segments were selected for evaluation. Freeway segments studied are illustrated in **Figures 1-3**.

Strawberry Fields Site:

Northbound and Southbound:

1. I-5 south of Bonnyview Road Off-Ramp
2. Bonnyview Road Off-Ramp
3. I-5 between Bonnyview Road Off-Ramp and On-Ramp
4. Bonnyview Road On-Ramp
5. I-5 North of Bonnyview Road On-Ramp
6. I-5 South of Smith Road Off-Ramp*
7. Smith Road Off-Ramp*
8. I-5 between Smith Road Off-Ramp and On-Ramp*
9. Smith Road On-Ramp*

   *(*Option 2 only)*

Alternative Site (City of Anderson):

Northbound and Southbound:

1. I-5 South of Balls Ferry Road Off-Ramp
2. Balls Ferry Road On-Ramp/Off-Ramp
3. I-5 between Balls Ferry Road Off-Ramp and North Street On-Ramp
4. North Street On-Ramp/Off-Ramp
5. I-5 between North Street On/Off-Ramp and Riverside Ave On/Off-Ramp

Win River Casino Site:

- None

Figure 1

Study Intersections and Roadway Segments for the Strawberry Fields Site

Figure 2

Study Intersections and Roadway Segments for the Anderson Site

Figure 3

Study Intersections and Roadway Segments for the Win River Casino Site

EXISTING (2016) CONDITIONS

Existing Roadways

Below is a description of the roadway facilities and roadway segments included in this study.

I-5 is a major interstate freeway. It runs north-south and connects the cities in northern California and Oregon to the Sacramento Valley in the south. I-5 is also a major truck route, designated as part of the National STAA Network. I-5 runs along the eastern edge of the Proposed Project Site in Redding and the eastern edge of the Alternative Project Site in Anderson. Across the study area, I-5 has a four-lane divided cross section.

Market Street (SR-273) is a divided, four-lane expressway, running north-south along the Southern Pacific Railroad tracks. The expressway serves to connect Redding and Anderson, with limited access to adjacent land. SR-273 is designated a terminal access STAA Route. It intersects South Bonnyview Road north of the Win River Casino Site. All intersections are at grade.

South Bonnyview Road is a two to four lane arterial within the City of Redding with curbs and gutters. The road runs east-west, connecting SR-273, I-5, and Churn Creek Road. A class II bike path runs along the route from SR-273 to I-5. Sidewalks are present from SR-273 to Alrose Lane on the east side of I-5.

East Bonnyview Road is a two-lane collector within the City of Redding with curb and gutter on the east side of the roadway. The road runs north-south connecting residential housing to South Bonnyview Road. Sidewalks are present along the east side of the roadway.

Bechelli Lane is a two-lane arterial north of South Bonnyview Road and a two-lane local roadway south of Bonnyview Road within the City of Redding. The roadway connects residential housing to Cypress Avenue and South Bonnyview Road. It runs north-south, parallel to I-5.

Churn Creek Road runs north-south from SR-299 to Knighton Road within the City of Redding. North of South Bonnyview Road, Churn Creek Road is a four-lane divided arterial. After the intersection with Bonnyview Road, Churn Creek Road narrows to two lanes and runs east-west for about a mile before continuing south to Airport Road.

Alrose Lane is a two-lane local roadway within the City of Redding. The roadway runs north-south and connects residential housing to Churn Creek Road.

Victor Avenue is a two-lane arterial roadway within the City of Redding. The roadway runs north-south and connects Churn Creek Road with SR-44 to the north.

Rancho Road is a two-lane arterial roadway within the City of Redding. The roadway runs east-west and connects Churn Creek Road with residential housing to the east.

Smith Road is a two-lane local roadway within Shasta County running east-west from Churn Creek Road to the Sacramento River.

Knighton Road is a two-lane arterial roadway within the City of Redding. The roadway runs east-west, connecting I-5 and Churn Creek Road.

Westwood Avenue is a two-lane local roadway within the City of Redding. The roadway runs east-west and connects SR-273 to residential housing to the west.

Clear Creek Road is a two-lane arterial roadway within the City of Redding. The roadway runs east-west and connects SR-273 to residential housing and businesses to the west.

Girvan Road is a two-lane collector roadway within the City of Redding. The roadway runs east-west and connects SR-273 to residential housing to the east.

Redding Rancheria Road is a two-lane collector. It joins Canyon Road and intersects SR-273 just east of the Win River Casino Resort. It is the major access point for the existing Win River Casino Resort facilities.

Canyon Road is a two-lane arterial running northeast and southwest within the City of Redding. The road extends from SR-273 to Happy Valley Road.

North Street is a four-lane arterial roadway running east-west from the Sacramento River to SR-273. This road is a designated Truck Route under the City of Anderson Municipal Code.

Balls Ferry Road is a four-lane arterial roadway running east-west from the I-5 to SR-273.

Oak Street is a two-lane local road running parallel to SR-273 within the City of Anderson, to the east of the alternative project site.

McMurray Drive is a two-lane local road running parallel to I-5 within the City of Anderson. The roadway connects the I-5 Northbound ramps.

Ventura Street is a two-lane local road running parallel to I-5 within the City of Anderson. The roadway connects North Street with Balls Ferry Road.

Happy Valley Road is a two-lane arterial running northeast and southwest within Shasta County. The road extends from SR-273 to Canyon Road, continuing south to Gas Point Road.

Existing Lane Configurations and Traffic Control

Existing intersection lane configurations and traffic control at study intersections are illustrated in **Figures 4-6**. Traffic signals are located at 16 of the 23 study intersections.

Existing Traffic Turning Movement Volumes

Friday and Saturday intersection turning movement volumes were manually collected in July 2016 at project study area intersections #1-#26. Additional intersection turning movement counts were manually collected in September 2016. Traffic volume data sheets are included in **Appendix A**. Volumes were collected during the PM peak period, from 5:00 PM to 7:00 PM on both Friday and Saturday, when the combination of background traffic and casino traffic is at the highest levels. Based on existing traffic volume information and expected trip generation from the Project, it was determined that the Friday and Saturday evening peak periods represent the worst case periods to evaluate.

Additionally, September traffic counts were higher than July traffic counts, suggesting seasonal variation in the Project vicinity. At the four (4) locations where traffic count locations were re-collected, the September counts were higher than July counts by approximately 7%. As such, the remaining study intersection volumes were increased accordingly to establish a conservative baseline for the traffic impact analysis. The seasonal adjustment factors used are provided in **Appendix A**.

Friday and Saturday intersection turning movement volumes were also manually collected in September 2019 at project study area intersections #101-#105. Traffic volume data sheets are included in **Appendix A**. The resulting Existing Friday and Saturday afternoon peak hour volumes are shown in **Figures 7-9**.

It should be noted that in 2010, the Cache Creek Casino Resort Traffic Impact Study[9] studied Friday PM Peak Hour (5:00 PM – 7:00 PM) and Saturday PM Peak Hour (5:00 PM – 7:00 PM), with the highest volumes occurring between 5:15 PM and 6:15 PM. Consistent with previous studies conducted for casino and hotel facilities in California, the analysis periods of Friday PM Peak Hour (5:00 PM – 7:00 PM) and Saturday PM Peak Hour (5:00 PM – 7:00 PM) were used to analyze the Redding Rancheria project.

Redding Rancheria traffic counts collected between 5:00 pm and 7:00 pm at the intersection of Canyon Road/Redding Rancheria Road, which serves as the primary access to the existing casino, reported a Friday PM peak hour between 5:00 pm and 6:00 pm and a Saturday PM peak hour between 5:15 pm and 6:15 pm. Therefore, assuming a traditional PM peak period between 4:00 pm and 6:00 would have excluded the true peak hour of the existing casino represented by the adjacent intersection.

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[9] *Cache Creek Casino Resort Event Center, Draft Impact Study*, Kimley-Horn and Associates, Inc., June 2010.

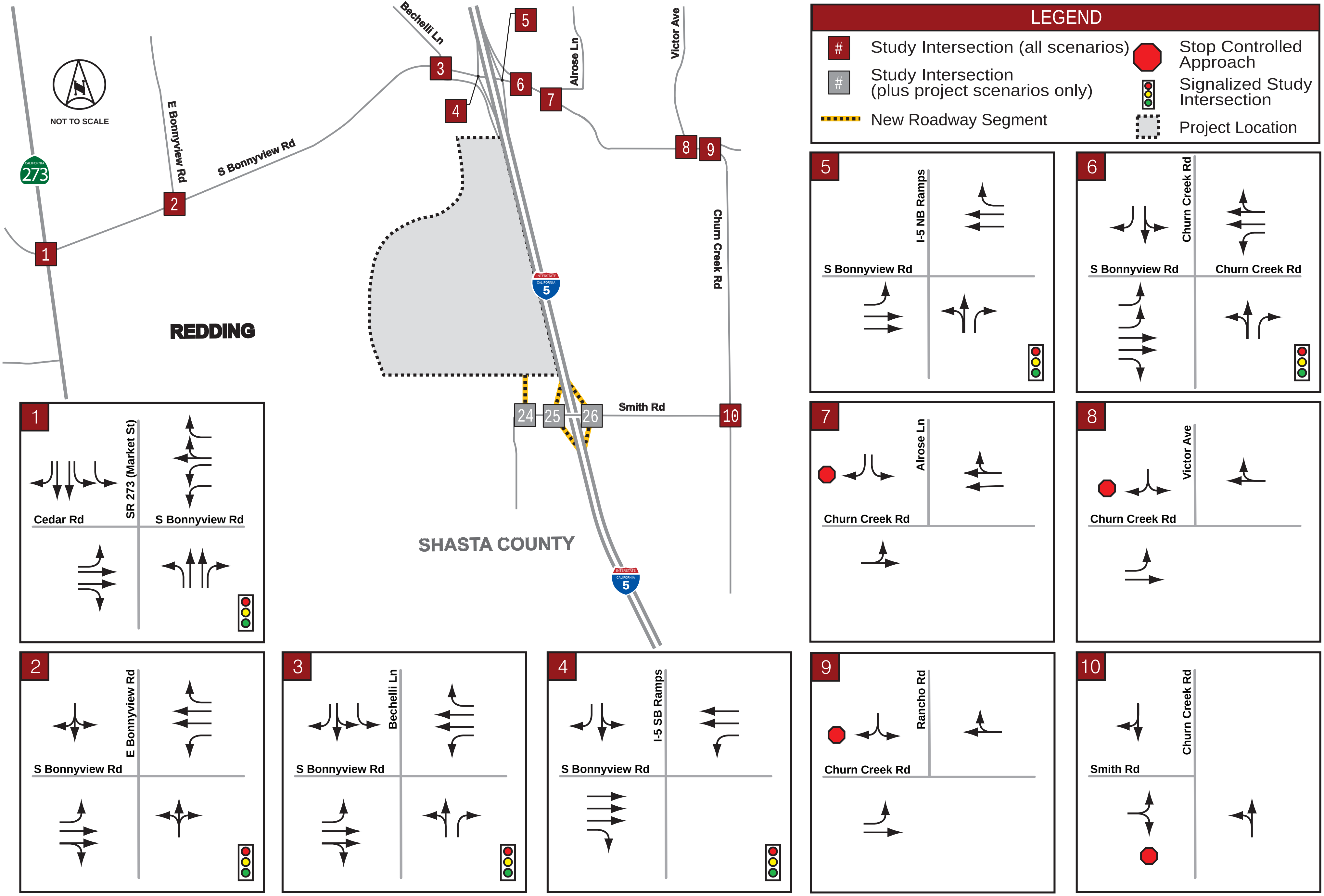
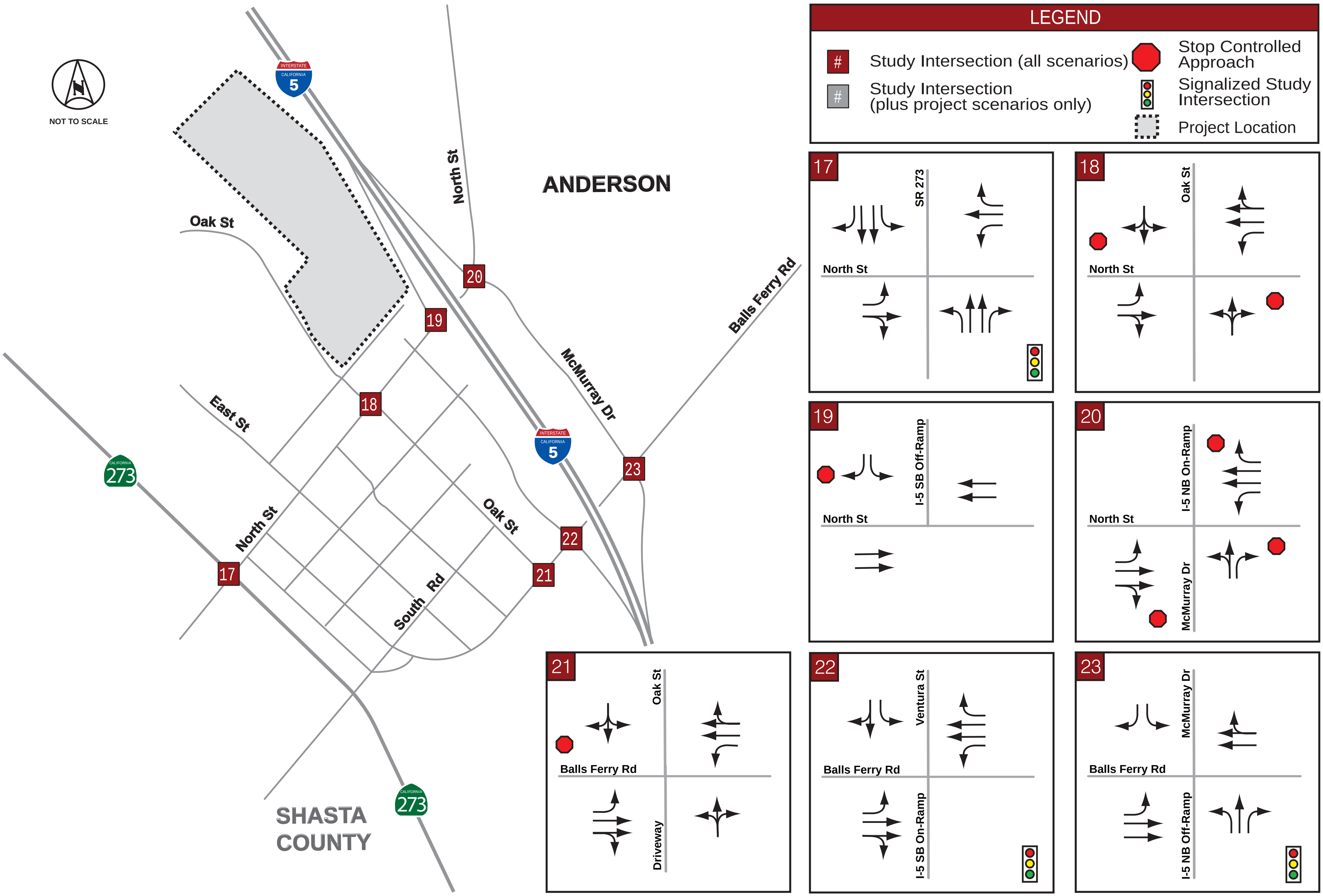


Figure 4

Lane Configurations and Traffic Control for the Strawberry Fields Site



Kimley»Horn

Figure 5

Lane Configurations and Traffic Control for the Anderson Site

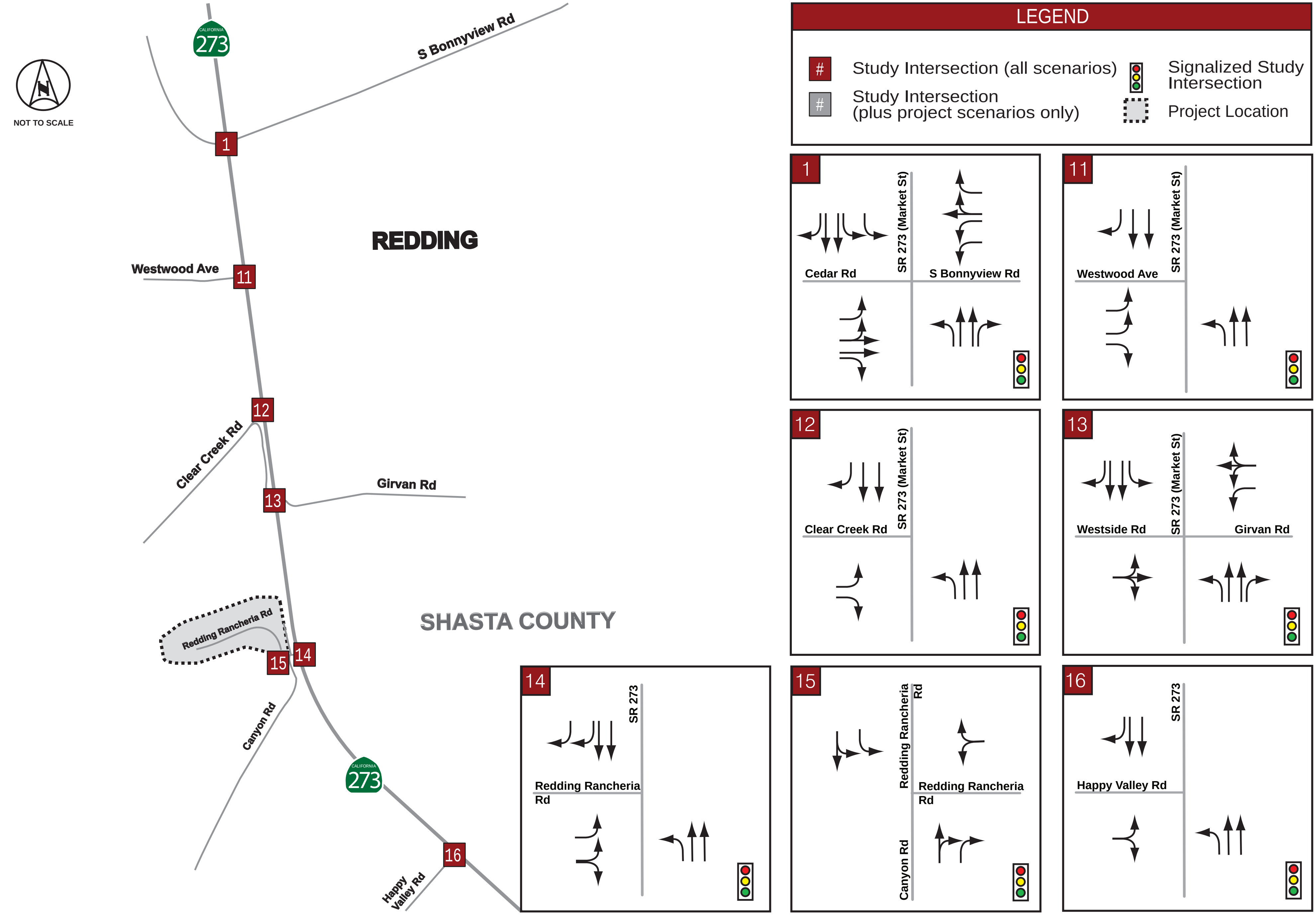
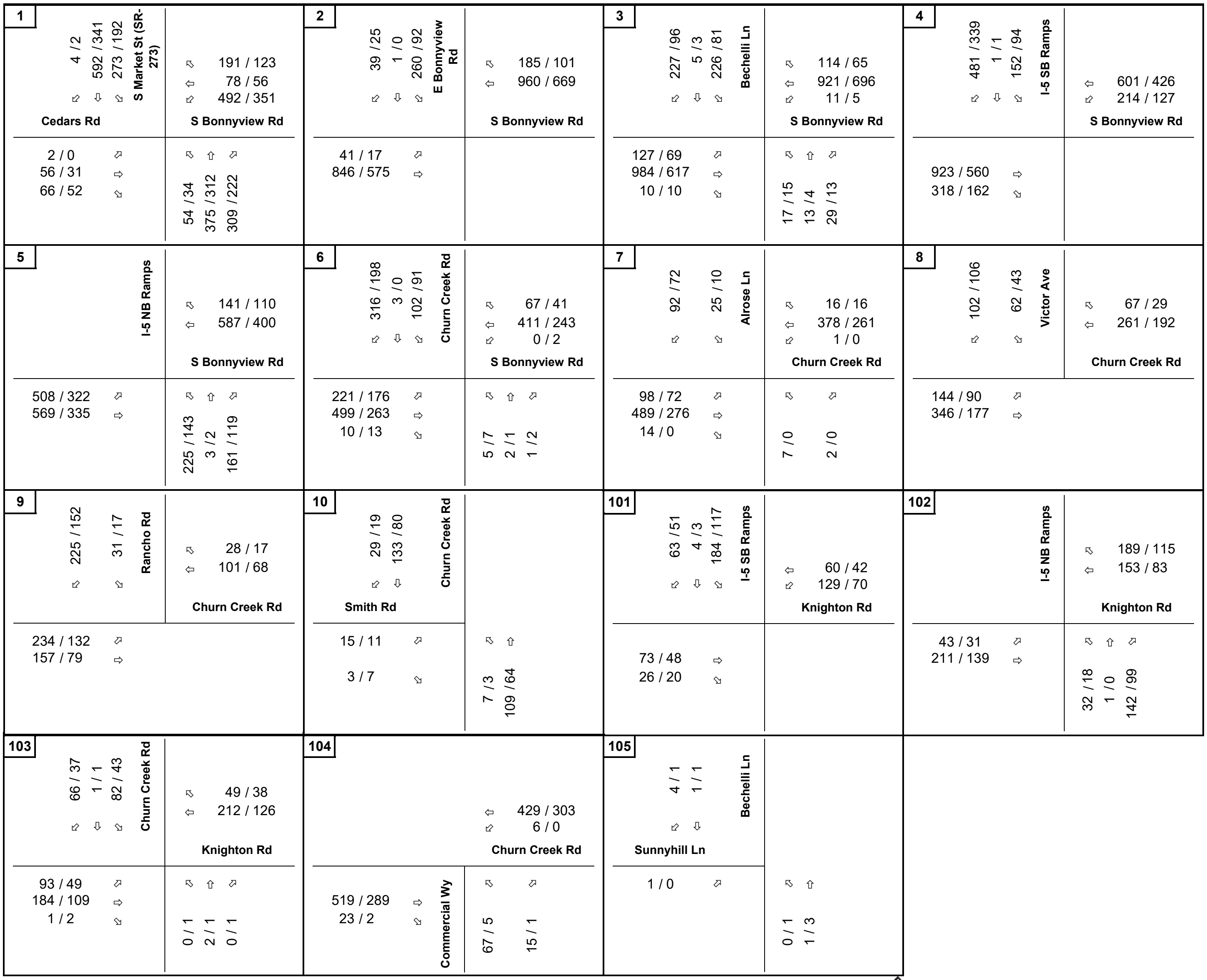
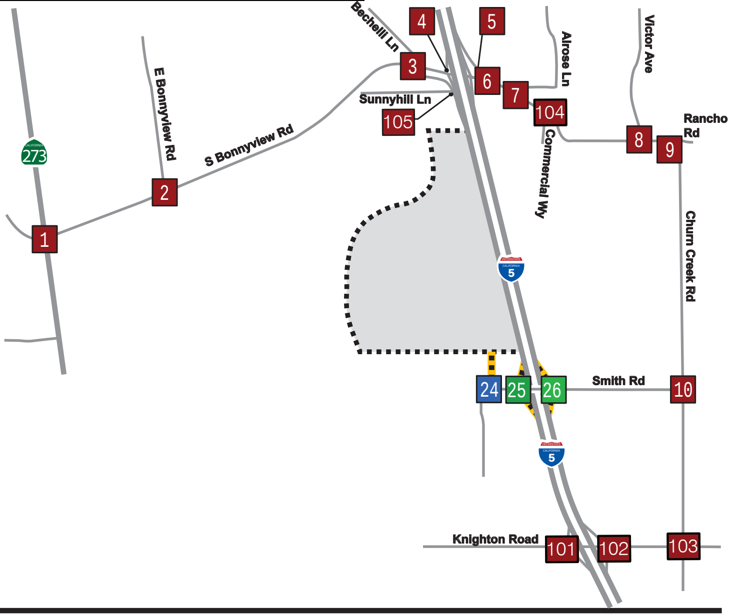


Figure 6

Lane Configurations and Traffic Control for the Win River Casino Site





LEGEND

🟥 Study Intersection

🟦 Future Intersection*

🟩 Future Intersection**

▨ Site Boundaries [Proposed Project Site]

*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Figure 7: Existing Friday/Saturday Peak Hour Volumes for the Strawberry Fields Site

Figure 8:
Existing (2016) Friday/Saturday Peak Hour Volumes for the Anderson Site

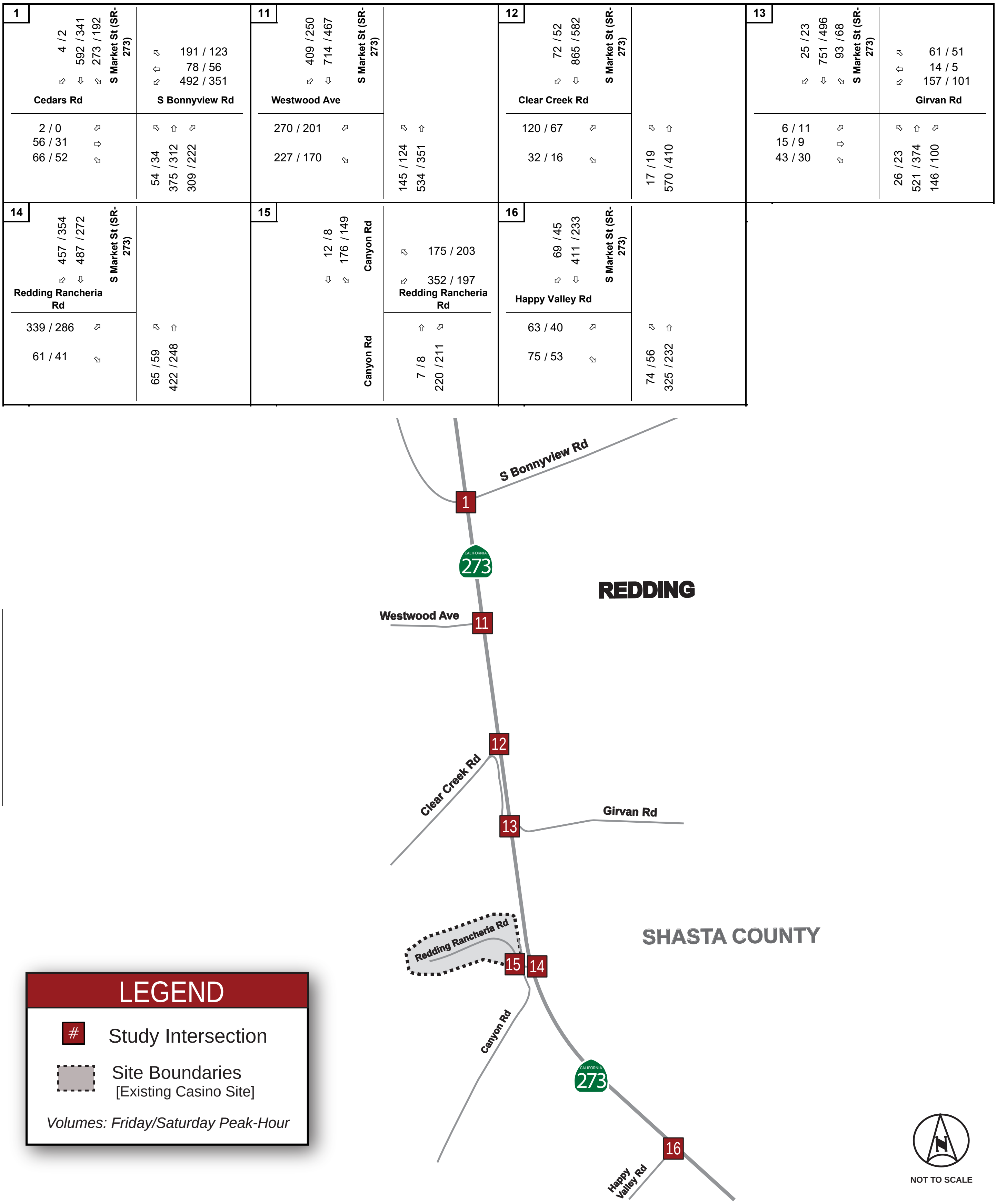


Figure 9: Existing (2016) Friday/Saturday Peak Hour Volumes for the Win River Casino Site

Existing Pedestrian and Bicycle Facilities

According to the *Go Shasta Regional Active Transportation Plan: 2019*[10], there is a class II bicycle facility running along South Bonnyview Road, from SR-273 to Bechelli Road, and on Churn Creek Road east of South Bonnyview Road. Bicycle facilities are planned for South Bonnyview Road between Bechelli Lane and Churn Creek Road. There are additional class II facilities extending north on East Bonnyview Road, Bechelli Lane and Victor Avenue. None of these facilities connect directly to the Strawberry Fields Site; however, bicycle facilities are planned along the eastern side of the Sacramento River adjacent to the Strawberry Fields Site. Additionally, sidewalks are present on Bechelli Lane north of the Strawberry Fields Site. No sidewalks exist on Smith Road.

According to the *Go Shasta Regional Active Transportation Plan*: *2019* , the Anderson Site in the City of Anderson is not located in close proximity to existing bicycle facilities. However, bicycle access is provided along sections of Market Street (SR-273) and I-5 north and south of the Anderson Site. Bicycle facilities are planned on local roads in the City of Anderson on East Street, North Street, Ventura Street, and Balls Ferry Road in the project vicinity. Additionally, sidewalks are present on North Street and Oak Street south of Mill Street in the project vicinity.

The Win River Casino Site is located adjacent to Market Street (SR-273) which has 15 miles open to bicyclists between the City of Redding to the City of Anderson. Additionally, sidewalks are present on both sides of Redding Rancheria Road.

Existing Transit Service

Transit service in Redding and Anderson is provided by the Redding Area Bus Authority (RABA). There are no transit stops in close proximity to the Strawberry Fields Site.

Route 3 and the Anderson Commuter (AC) Route serve the SR-273 corridor with stops near the Anderson Site at North Street, and near the Win River Casino Site at Canyon Road. Route 3 includes stops along the western portion of South Bonnyview Road west of the Strawberry Fields Site. The Route 3 transit services operate during the week and Saturdays, with buses running every hour. The Anderson Commuter only operates between select commuting hours (7-9 AM) on weekday mornings. Additionally, Route 9 provides service within the City of Anderson with stops on North Street near the Anderson Site.

The existing Win River Resort and Casino offers a shuttle between the Casino site and the Hilton Garden Inn, which is located off of Bechelli Lane.

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[10] Shasta County, *Go Shasta Regional Active Transportation Plan*, 2019.

Existing Levels of Service at Study Intersections

Traffic operations were evaluated under existing traffic conditions. Results of the analysis are presented in **Table 6**, along with the jurisdictional standard for acceptable level of service (as previously described in Operating Conditions and Criteria). The method of intersection control is listed as Signal for a signalized intersection, AWSC for an all-way stop-controlled intersection and SSSC for a side-street stop-controlled intersection. The overall level of service is reported for signalized intersections and all-way stop-controlled intersections. Only the worst movement is reported in the table for SSSC intersections per the methodology of the *Highway Capacity Manual (2010)*. Additional detail of the analysis is provided in **Appendix B**. Results of the analysis indicate that the existing study area intersections currently operate at acceptable levels of service based on established significance criteria.

Table 6 – Existing Intersection Level of Service Summary

ID	Intersection	Control	Target LOS	Peak Hour	Existing	
					Delay (sec) (a)	LOS (b)
1	S Bonnyview Rd @ SR-273 (Market St)	Signal	D	FRI PM	19.6	B
				SAT PM	16.7	B
2	S Bonnyview Rd @ E Bonnyview Rd	Signal	D	FRI PM	11.4	B
				SAT PM	5.2	A
3	S Bonnyview Rd @ Bechlli Ln	Signal	D	FRI PM	20.4	C
				SAT PM	10.9	B
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	33.8	C
				SAT PM	25.6	C
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	30.5	C
				SAT PM	15.5	B
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	15.0	B
				SAT PM	32.3	C
7	Churn Creek Rd @ Alrose Ln	SSSC*	C	FRI PM	12.7	B
				SAT PM	10.2	B
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	24.5	C
				SAT PM	12.5	B
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	12.9	B
				SAT PM	10.1	B
10	Churn Creek Rd @ Smith Rd	SSSC*	C	FRI PM	10.1	B
				SAT PM	9.3	A
11	SR-273 (Market St) @ Westwood Ave	Signal	D	FRI PM	12.1	B
				SAT PM	9.9	A
12	SR-273 (Market St) @ Clear Creek Rd	Signal	D	FRI PM	5.9	A
				SAT PM	5.2	A
13	SR-273 (Market St) @ Girvan Rd	Signal	D	FRI PM	13.8	B
				SAT PM	11.8	B
14	SR-273 (Market St) @ Redding Rancheria Rd	Signal	D	FRI PM	8.7	A
				SAT PM	7.8	A
15	Canyon Rd @ Redding Rancheria Rd	Signal	D	FRI PM	11.6	B
				SAT PM	10.0	B
16	SR-273 (Market St) @ Happy Valley Rd	Signal	D	FRI PM	7.3	A
				SAT PM	6.4	A
101	Knighton Road @ I-5 Southbound Ramps	SSSC*	D	FRI PM	15.8	C
				SAT PM	11.1	B
102	Knighton Road @ I-5 Northbound Ramps	SSSC*	D	FRI PM	11.4	B
				SAT PM	9.9	A
103	Churn Creek Road @ Knighton Road	Signal	C	FRI PM	8.3	A
				SAT PM	7.6	A
104	Churn Creek Road @ Commercial Way	SSSC*	C	FRI PM	24.5	C
				SAT PM	12.8	B
105	Bechelli Lane @ Sunnyhill Lane	SSSC*	C	FRI PM	8.5	A
				SAT PM	7.2	A

Notes:
(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection, delay refers to the worst movement.
(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual*

Table 6 – Existing Intersection Level of Service Summary (Continued)

ID	Intersection	Control	Target LOS	Peak Hour	Existing (2016)	
					Delay (sec) (a)	LOS (b)
17	SR-273 (Market St) @ North St	Signal	D	FRI PM	14.9	B
				SAT PM	12.6	B
18	North St @ Oak St	SSSC*	D	FRI PM	20.8	C
				SAT PM	13.7	B
19	North St @I-5 SB Off Ramp	AWSC	D	FRI PM	11.7	B
				SAT PM	8.8	A
20	North Street @ McMurray Dr/I-5 NB On Ramp	AWSC	D	FRI PM	22.6	C
				SAT PM	21.1	C
21	Balls Ferry Rd @ Oak St	SSSC*	D	FRI PM	13.2	B
				SAT PM	11.5	B
22	Balls Ferry Rd @ Venutra St/I-5 SB On Ramp	Signal	D	FRI PM	26.6	C
				SAT PM	23.7	C
23	Balls Ferry Rd @ McMurray Dr/I-5 NB Off Ramp	Signal	D	FRI PM	19.2	B
				SAT PM	17.6	B

Notes:
(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection, delay refers to the worst movement.
(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual*

Existing Conditions Traffic Signal Warrant Analysis

Traffic signals may be justified when traffic operations fall below acceptable thresholds and when one or more signal warrants are satisfied.

Existing traffic volumes at the unsignalized study intersections were compared against the peak-hour warrant in the *California Manual of Uniform Traffic Control Devices*, November 2014. Traffic Signal Warrant #3 – Peak-Hour Volume Warrant is satisfied when traffic volumes on the major and minor approaches exceed thresholds for one hour of the day.

This warrant is generally the first warrant to be satisfied. The warrant applies to traffic conditions during a one-hour peak that are sufficiently high such that minor street traffic experiences excessive delay in entering and crossing the main street due to the high traffic volumes on the main street. The results of a signal warrant analysis are not indicative of impacts, but are provided for informational purposes. When intersections satisfy the peak-hour volume warrant, it does not necessarily mean that a signal will or should be installed. For example, in some instances, the intersection may operate at an acceptable level even though volumes satisfy one or more signal warrants, e.g. a right in/out driveway.

Results of the analysis show that the following intersections currently satisfy Traffic Signal Warrant #3:

- #20 – North Street at McMurray Dr/ I-5 NB On Ramp

Other warrants such as for minimum vehicle volumes, interruption of continuous traffic, and traffic progression were not evaluated because they generally require additional traffic volumes to be satisfied. A copy of the analysis worksheets for Traffic Signal Warrant #3 is included in **Appendix C.**

Existing Levels of Service on Study Roadway Segments

Traffic analyses were completed to evaluate the existing PM peak hour of Friday and Saturday operation of the study segments. Results of the analyses are presented in **Table 7** and **Table 8.** Results of the analysis indicate that all of the study roadway segments currently operate at acceptable levels of service based on established significance criteria. Additional detail of the analysis is provided in **Appendix B**.

Existing Levels of Service on Study Freeway Segments

Traffic analyses were completed to evaluate the existing PM peak hour of Friday and Saturday operation of the study segments. Results of the analyses are presented in **Table 9** and **Table 10.** Results of the analysis indicate that all of the study freeway segments currently operate at acceptable levels of service based on established significance criteria. Additional details of the analysis are provided in **Appendix B**.

Table 7 – Existing Roadway Segment Level of Service Summary (Two-Lane)

Location	Peak-Hour	Analysis Direction	LOS	PFFS (%)	v/c
Bechelli Ln south of Bonnyview Rd	FRI	NB	A	93.8	0.04
		SB	A	93.8	0.02
	SAT	NB	A	94.3	0.02
		SB	A	94.3	0.01
Churn Creek Rd east of Alrose Ln	FRI	EB	C	81.1	0.33
		WB	C	83.0	0.25
	SAT	EB	B	85.2	0.19
		WB	B	85.2	0.18
Smith Rd west of Churn Creek Rd	FRI	EB	A	98.1	0.01
		WB	A	98.1	0.02
	SAT	EB	A	94.6	0.01
		WB	A	94.6	0.01
Knighton Road between I-5 SB Ramps and I-5 NB Ramps	FRI	EB	B	86.4	0.17
		WB	B	86.7	0.12
	SAT	EB	B	90.6	0.11
		WB	B	88.9	0.07
Knighton Road between I-5 NB Ramps and Churn Creek Rd	FRI	EB	B	84.2	0.18
		WB	B	84.2	0.18
	SAT	EB	B	86.9	0.11
		WB	B	87.1	0.11
Churn Creek Rd between Knighton Rd and Smith Rd	FRI	NB	B	87.1	0.09
		SB	B	87.3	0.1
	SAT	NB	B	91.6	0.06
		SB	B	91.6	0.05
Canyon Rd south of Redding Rancheria Rd	FRI	NB	B	85.1	0.15
		SB	B	85.0	0.15
	SAT	NB	B	85.1	0.15
		SB	B	84.6	0.24
North St east of Oak St	FRI	EB	A	97.4	0.05
		WB	A	97.4	0.04
	SAT	EB	A	97.7	0.03
		WB	A	97.7	0.04
North St west of Oak St	FRI	EB	B	85.6	0.21
		WB	B	85.4	0.25
	SAT	EB	B	90.4	0.14
		WB	B	90.4	0.14
Oak St north of North St	FRI	NB	B	83.9	0.28
		SB	B	84.1	0.25
	SAT	NB	B	89	0.16
		SB	B	89	0.17
Oak St south of North St	FRI	NB	A	98.2	0.02
		SB	A	98.2	0.02
	SAT	NB	A	98.3	0.01
		SB	A	98.3	0.01

Notes:

PFFS = Percent Free-Flow Speed, v/c = Volume to Capacity

Table 8 – Existing Roadway Segment Level of Service Summary (Multilane)

Location	Peak-Hour	Analysis Direction	LOS	Density (pc/mi/ln)
Bonnyview Rd west of Bechelli Ln	FRI	EB	B	14.2
		WB	B	14.8
	SAT	EB	A	8.8
		WB	A	10.2
Market St (SR 275) north of Canyon Rd	FRI	NB	A	6.8
		SB	A	8.4
	SAT	NB	A	4.7
		SB	A	5.6
Market St (SR 275) south of Canyon Rd	FRI	NB	A	4.3
		SB	A	4.9
	SAT	NB	A	2.7
		SB	A	2.8

Table 9 – Existing Freeway Segment Level of Service Summary (Strawberry Fields Site)

I-5				Existing (2016)	
Direction	**Segment**	**Type**	**Peak Hour**	**Density[a]**	**LOS**
Northbound	South of Bonnyview Rd Off-Ramp	Basic	FRI PM	15.1	B
			SAT PM	10.7	A
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	13.2	B
			SAT PM	10.1	B
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	8.3	A
			SAT PM	6.1	A
	Bonnyview Rd On-Ramp	Merge	FRI PM	16.5	B
			SAT PM	12.3	B
	North of Bonnyview Rd On-Ramp	Basic	FRI PM	11.4	B
			SAT PM	8.2	A
Southbound	North of Bonnyview Rd Off-Ramp	Basic	FRI PM	14.0	B
			SAT PM	9.9	A
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	22.4	C
			SAT PM	16.9	B
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	10.9	A
			SAT PM	7.9	A
	Bonnyview Rd On-Ramp	Merge	FRI PM	18.7	B
			SAT PM	13.4	B
	South of Bonnyview Rd On-Ramp	Basic	FRI PM	21.1	C
			SAT PM	13.6	B

Notes:

a- Density measured in passenger cars/lane/mile (pc/ln/mi)

Table 10 – Existing Freeway Segment Level of Service Summary (Anderson Site)

I-5				Existing (2016)	
Direction	**Segment**	**Type**	**Peak Hour**	**Density[a]**	**LOS**
Northbound	South of Balls Ferry Rd Off-Ramp	Basic	FRI PM	17.1	B
			SAT PM	12.9	B
	Balls Ferry Rd Off-Ramp	Diverge	FRI PM	20.3	C
			SAT PM	15.3	B
	Balls Ferry Rd Off-Ramp to North St On-Ramp	Basic	FRI PM	13.5	B
			SAT PM	10.4	A
	North St On-Ramp	Merge	FRI PM	19.1	B
			SAT PM	17.3	B
	North St On-Ramp to Riverside Ave Off-Ramp	Basic	FRI PM	16.0	B
			SAT PM	12.0	B
Southbound	Riverside Ave On-Ramp to North St Off-Ramp	Basic	FRI PM	22.1	C
			SAT PM	15.5	B
	North St Off-Ramp	Diverge	FRI PM	27.6	C
			SAT PM	21.9	C
	North St Off-Ramp to Balls Ferry On-Ramp	Basic	FRI PM	18.8	C
			SAT PM	13.7	B
	Balls Ferry On-Ramp	Merge	FRI PM	25.7	C
			SAT PM	19.4	B
	South of Balls Ferry Rd On-Ramp	Basic	FRI PM	22.0	C
			SAT PM	16.0	B

Notes:

a- Density measured in passenger cars/lane/mile (pc/ln/mi)

BASELINE CONDITIONS

The Baseline represents the evaluation of traffic conditions without the Proposed Project. Traffic conditions were evaluated for the Opening Year (2025) and Cumulative (2040) forecast.

Opening Year (2025) Traffic Volumes without Project

Opening Year (2025) traffic volumes for intersections #1-9 were taken directly from the 2017 *River Crossing Marketplace Specific Plan Traffic Impact Analysis Report*[5] Year 2020 Plus Project Conditions volumes[6]. Volumes for intersections #10-105 were developed by linearly interpolating between existing and 2040 traffic volumes. Opening Year (2025) traffic volumes assume the full buildout of the River Crossing Marketplace, including a 152,101-square foot Costco, located in the northwest quadrant of the South Bonnyview Road/I-5 interchange.

As stated in the Omni-Means Technical Memorandum No. 3, dated June 10, 2016, “Omni-Means used the latest version of the Shasta Regional Travel Demand Model (Model) to derive the Year 2025 volumes. The following adjustments were made to the Model for this project:

1. Dwelling units and numbers of employees were updated.
2. Assumed 160ksf BoxCo, 16 fueling positions & 30 ksf general retail. The BoxCo TAZ was artificially adjusted in the Model to match Institute of Transportation Engineers’ (ITE) rates. ITE rates for the fueling positions were reduced by 50% for internal capture with the BoxCo (i.e. 50% of the fueling trips are new trips to the TAZ).
3. Assumed 80% development. The California Gold (S. Bonnyview / Churn Creek Retail) TAZ was artificially adjusted in the Model to approximately match the ITE methodology used in the Use Permit application's May 2016 traffic analysis by Omni-Means.
4. Assumed full development. The Terraces TAZ was artificially adjusted in the Model to approximately match the ITE methodology used in the 10-15-16 Use Permit pre-application traffic analysis by KD Anderson.”

The Friday PM peak-hour volumes were obtained directly from the *River Crossing Marketplace Specific Plan Traffic Impact Analysis Report* and thus represent typical weekday (Tuesday-Thursday) PM peak-hour volumes. This clarification explains why the weekday volumes are similar between the two studies. Furthermore, all TIS forecast Saturday peak-hour volumes were established by applying a factor to the forecast weekday (as obtained directly from the *River Crossing Marketplace Specific Plan Traffic Impact Analysis Report* for weekday, (Tuesday-Thursday)) PM peak-hour volumes. This factor was established based on the existing relationship between Friday PM peak-hour and Saturday PM peak-hour. Traffic counts were collected in 2016 during Friday and Saturday PM peak-hours. A relative change calculation was performed for all movements at each study intersection to determine the appropriate factor for projecting Saturday forecast volumes from the weekday (as obtained directly from the *River*

Crossing Marketplace Specific Plan Traffic Impact Analysis Report study for weekday, (Tuesday-Thursday)) forecast volumes. **Figures 10-12** show the Opening Year traffic volumes at the study intersections. These volumes represent anticipated traffic levels in the year 2025, without the proposed project.

Cumulative (2040) Forecasted Traffic Volumes without Project

Volumes for intersections #1-9 were taken directly from the 2017 *River Crossing Marketplace Specific Plan Traffic Impact Analysis Report*[5] Year 2040 Plus Project Conditions volumes[6]*.* Volumes for intersections #10-105 were developed using the Shasta County Regional Travel Demand Model (SCRTDF) Version 1.1. Cumulative (2040) traffic volumes assume the full buildout of the River Crossing Marketplace, including a 152,101-square foot Costco, located in the northwest quadrant of the South Bonnyview Road/I-5 interchange.

It should be clarified that the Friday PM peak-hour volumes were obtained directly from the *River Crossing Marketplace Specific Plan Traffic Impact Analysis Report* and thus represent typical weekday (Tuesday-Thursday) PM peak-hour volumes. This clarification explains why the weekday volumes are similar between the two studies. Furthermore, all TIS forecast Saturday peak-hour volumes were established by applying a factor to the forecast weekday (Friday) PM peak-hour volumes. This factor was established based on the existing relationship between weekday (Friday) PM peak-hour and Saturday PM peak-hour. Traffic counts were collected in 2016 during Friday and Saturday PM peak-hours. A relative change calculation was performed for all movements at each study intersection to determine the appropriate factor for projecting Saturday forecast volumes from the weekday (Friday) forecast volumes.

The Shasta County Regional Transportation Agency (SRTA) develops and maintains the regional travel demand model, which forecasts land use and corresponding travel behavior into the future for the Shasta County region. The transportation network in the model was updated to be current as of December 31, 2013, reflects recent improvements over the last few years, and includes forecasted improvements through 2040.

The Long-Term forecast for this study is based on the year 2040 directional link volumes from an adjusted Shasta County Regional Travel Demand Model (SCRTDF) Version 1.1 provided by Omni-Means[11]. While the model maintained by Shasta County RTPA is the applicable regional planning resource, modifications to the model have been made to address specific impacts of development proposals within the vicinity of the Strawberry Fields Site. Adjustments to the model include:

- Updated dwelling units and number of employees
- Full development of California Gold site
- Full development of River Crossing Marketplace site
- Full development of Terraces TAZ

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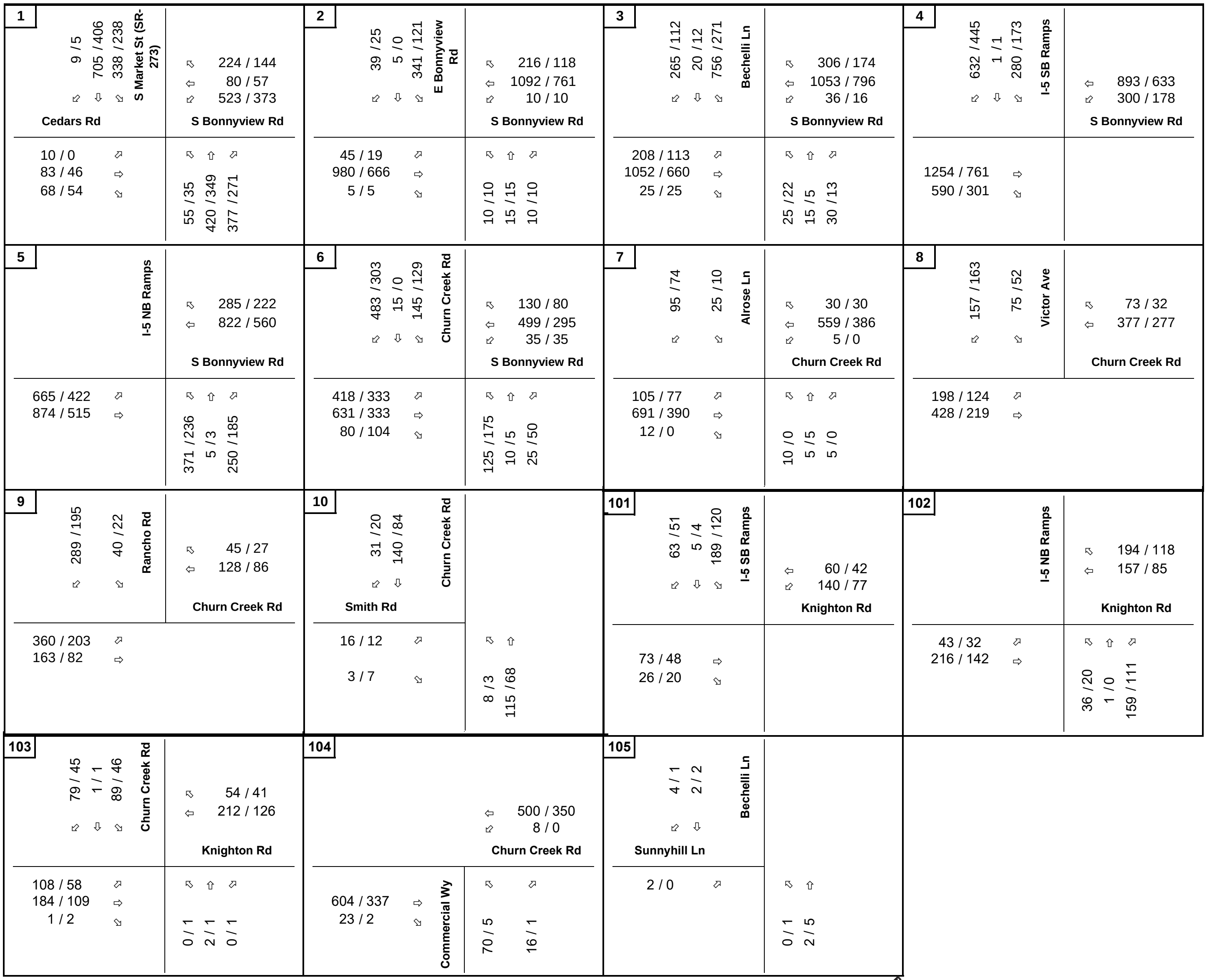
[11] I-5 / S. Bonnyview Interchange PSR Technical Memorandum 1 – 15, Omni-Means to City of Redding – Engineering, May 06, 2016 – April 28, 2017.

Approach volumes were then converted to turning movement volumes using methodologies from National Cooperative Highway Research Program (NCHRP) 255 – Highway Traffic Data for Urbanized Area Project Planning and Design, Chapter 8. NCHRP Report 255 is a compilation of the best techniques that are currently being used in urban areas to forecast future traffic volumes. These techniques were identified through a survey of state and local agencies with follow-up field visits to obtain detailed information on procedural steps and typical applications. The method used to forecast the future turning movement volumes evaluation is the NCHRP's "Directional Volume Forecast". For this method, existing and future peak hour volumes, existing peak hour turning movements, and projected directional "D" factors are used to calculate future year turning movements. Existing peak hour intersection turning movements were counted in the field. Future peak hour volumes were obtained from the forecast model. Using the "Directional Volume Forecast" technique, the existing turning movements at each study intersection were factored based on increases in peak hour approach traffic and D factors. Each respective movement was derived using an iterative approach that balances the inflows and outflows for each approach.

Figures 13-15 show the Cumulative (2040) traffic volumes.



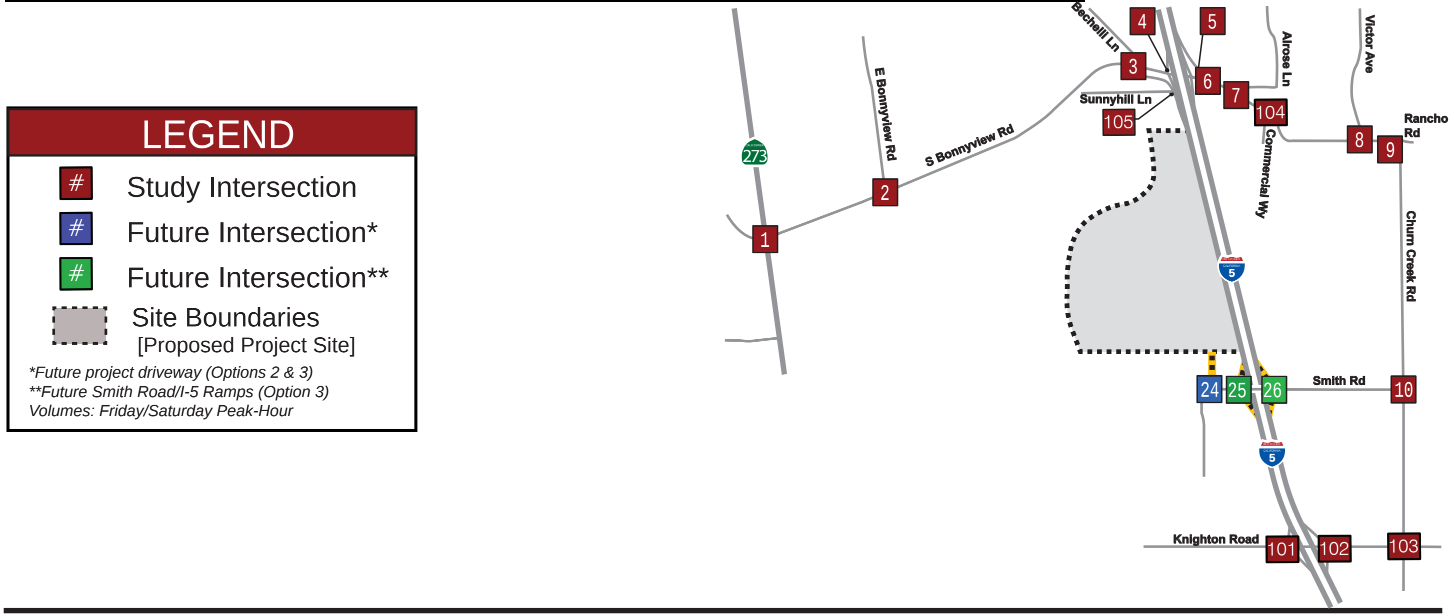
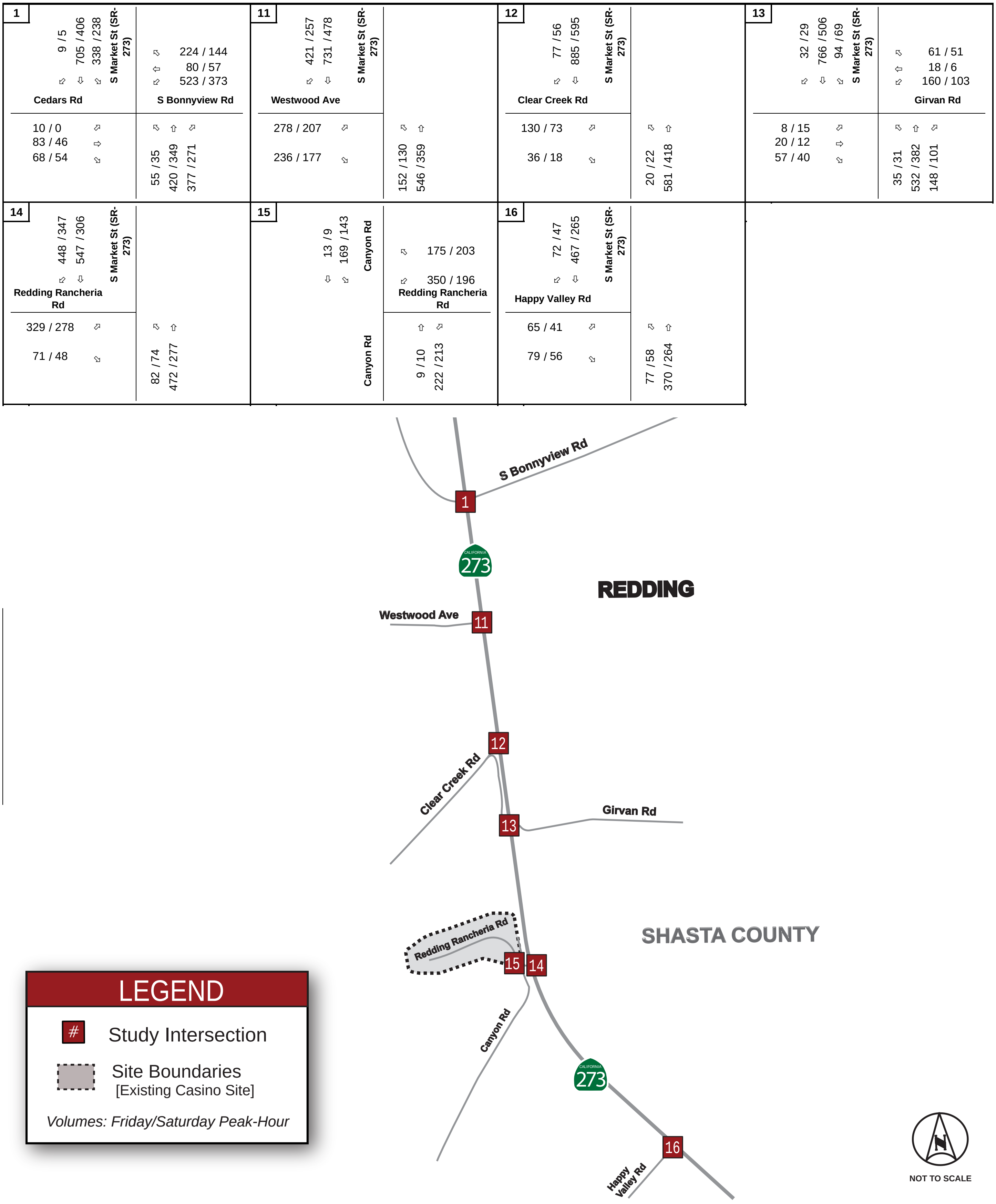


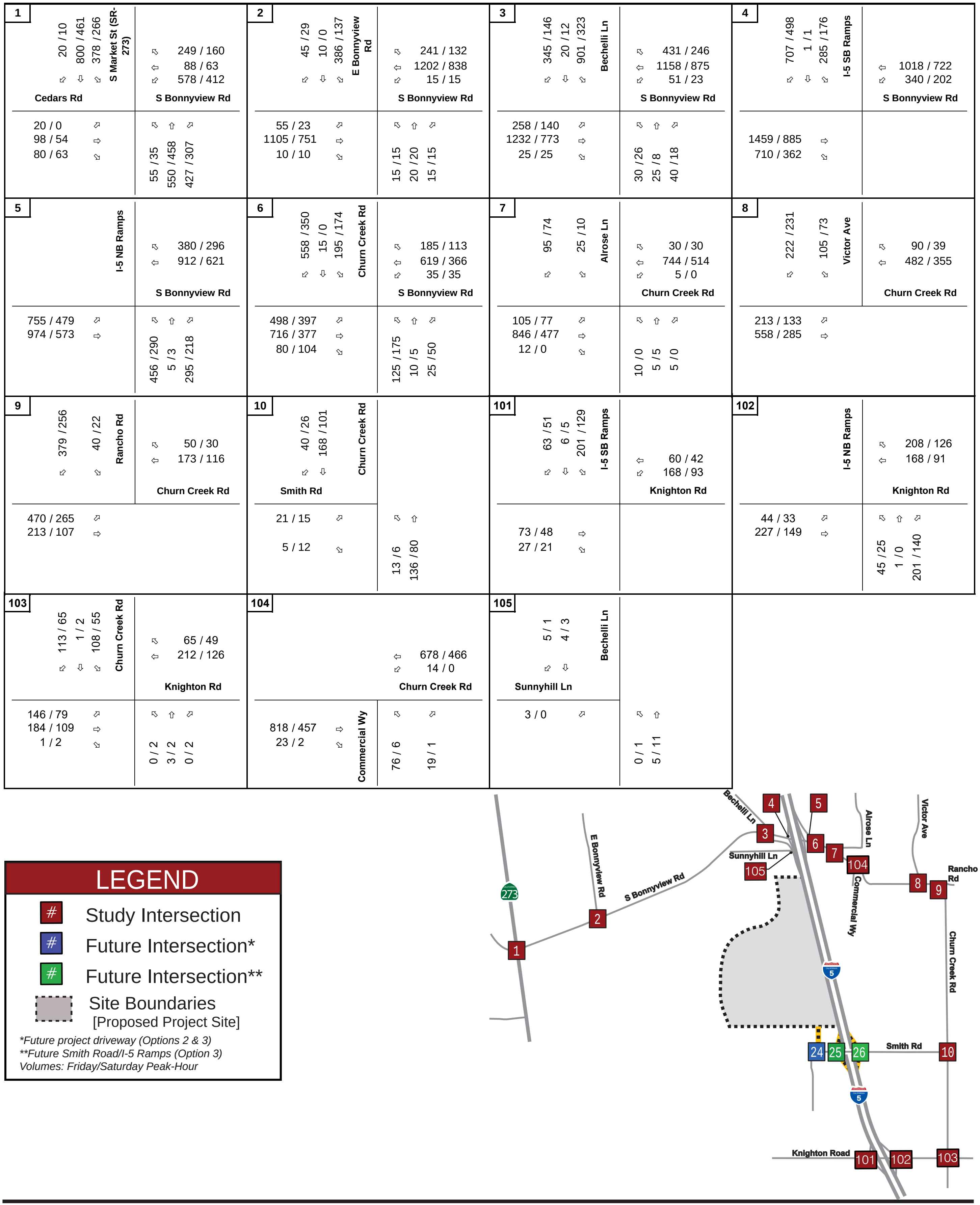
Figure 10: Year 2025 Friday/Saturday Peak Hour Volumes for the Strawberry Fields Site

Figure 11
Year 2025 Friday/Saturday Peak Hour Volumes for the Anderson Site



Kimley»Horn

Figure 12: Year 2025 Friday/Saturday Peak Hour Volumes for the Win River Casino Site



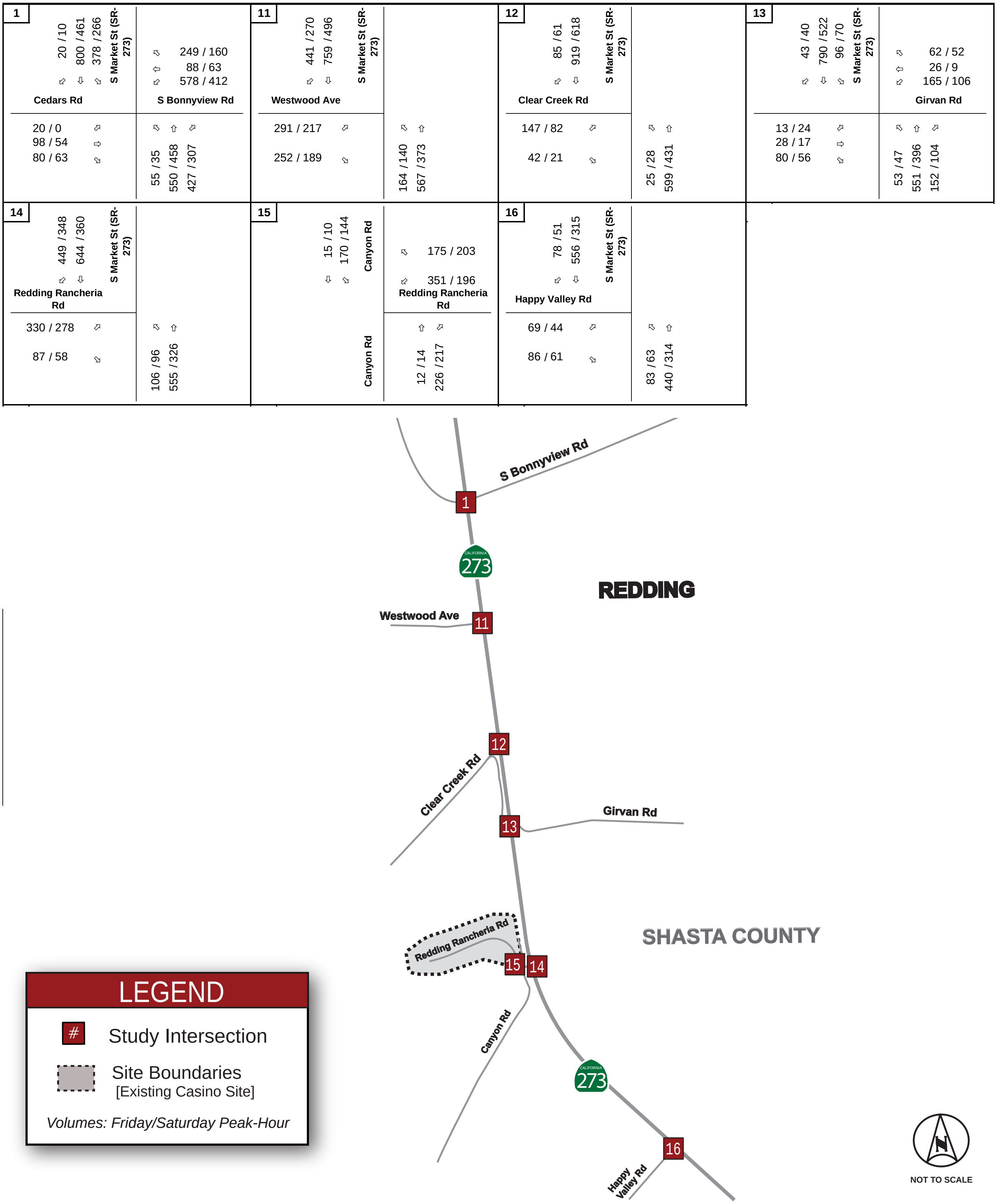
*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Figure 13: Year 2040 Friday/Saturday Peak Hour Volumes for the Strawberry Fields Site

Kimley»Horn

Figure 14

Year 2040 Friday/Saturday Peak Hour Volumes for the Anderson Site



Kimley»Horn

Figure 15: Year 2040 Friday/Saturday Peak Hour Volumes for the Win River Casino Site

LOS Conditions and Impacts at Intersections

Traffic operations were evaluated under the following development conditions:

- Opening Year (2025) conditions without Proposed Project
- Cumulative (2040) conditions without Proposed Project

Results of the analysis are presented in **Table 11**. Queuing analysis results for Cumulative (2040) conditions are provided in **Appendix D**. Additional details are provided in **Appendix E**. **Appendix E** also includes a figure of the diverging diamond interchange concept modeled under Cumulative (2040) conditions. As seen in **Table 11**, the following intersections will fail to meet acceptable level of service thresholds in the Opening Year (2025) and Cumulative (2040) conditions based on established significance criteria.

Opening Year (2025) without Project Intersections Operating Deficiently

- #4 – Bonnyview Road at I-5 SB Ramps
- #6 – Bonnyview Road at Churn Creek Road
- #8 – Churn Creek Road at Victor Avenue
- #20 – North Street McMurray Drive/I-5 NB On-Ramp
- #104 – Churn Creek Road at Commercial Way

Cumulative (2040) without Project Intersections Operating Deficiently

- #3 – Bonnyview Road at Bechelli Lane
- #8 – Churn Creek Road at Victor Avenue
- #9 – Churn Creek Road at Rancho Road
- #20 – North Street McMurray Drive/I-5 NB On-Ramp
- #104 – Churn Creek Road at Commercial Way

Table 11 – Baseline Intersection Level of Service Summary

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (2025)		Cumulative Year (2040)	
					Delay (sec) (a)	LOS (b)	Delay (sec) (a)	LOS (b)
1	S Bonnyview Rd @ SR-273 (Market St)	Signal	D	FRI PM	23.2	C	28.4	C
				SAT PM	20.2	C	18.7	B
2	S Bonnyview Rd @ E Bonnyview Rd	Signal	D	FRI PM	17.8	B	24.8	C
				SAT PM	7.5	A	8.3	A
3	S Bonnyview Rd @ Bechlli Ln	Signal	D	FRI PM	49.9	D	116.9	**F**
				SAT PM	15.1	B	89.2	**F**
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	103.1	**F**	46.1	D
				SAT PM	27.9	C	38.1	D
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	54.6	D	32.3	C
				SAT PM	19.7	B	19.7	B
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	96.2	**F**	39.4	D
				SAT PM	43.6	D	20.5	C
7	Churn Creek Rd @ Alrose Ln	SSSC*	C	FRI PM	17.2	C	10.8	B
				SAT PM	11.2	B	1.6	A
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	68.0	**F**	439.6	**F**
				SAT PM	16.6	C	31.7	D
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	21.1	C	72.2	**F**
				SAT PM	11.2	B	12.8	B
10	Churn Creek Rd @ Smith Rd	SSSC*	C	FRI PM	10.3	B	10.8	B
				SAT PM	9.3	A	9.5	A
11	SR-273 (Market St) @ Westwood Ave	Signal	D	FRI PM	12.7	B	13.8	B
				SAT PM	10.2	B	10.3	B
12	SR-273 (Market St) @ Clear Creek Rd	Signal	D	FRI PM	6.2	A	6.6	A
				SAT PM	5.4	A	5.6	A
13	SR-273 (Market St) @ Girvan Rd	Signal	D	FRI PM	14.7	B	18.4	B
				SAT PM	12.3	B	14.2	B
14	SR-273 (Market St) @ Redding Rancheria Rd	Signal	D	FRI PM	9.1	A	10.4	B
				SAT PM	8.1	A	8.5	A
15	Canyon Rd @ Redding Rancheria Rd	Signal	D	FRI PM	11.5	B	11.6	B
				SAT PM	10.0	A	10.0	B
16	SR-273 (Market St) @ Happy Valley Rd	Signal	D	FRI PM	7.4	A	17.6	A
				SAT PM	6.4	A	6.4	A
101	Knighton Road @ I-5 Southbound Ramps	SSSC*	D	FRI PM	16.8	C	20.1	C
				SAT PM	11.3	B	11.9	B
102	Knighton Road @ I-5 Northbound Ramps	SSSC*	D	FRI PM	11.7	B	12.6	B
				SAT PM	10.1	B	10.4	B
103	Churn Creek Road @ Knighton Road	Signal	C	FRI PM	8.6	A	9.4	A
				SAT PM	7.8	A	8.1	A
104	Churn Creek Road @ Commercial Way	SSSC*	C	FRI PM	33.8	**D**	118.2	**F**
				SAT PM	13.9	B	17.7	C
105	Bechelli Lane @ Sunnyhill Lane	SSSC*	C	FRI PM	8.6	A	8.6	A
				SAT PM	1.2	A	0.6	A

Notes:

Bold represents unacceptable operations.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual*

(c) Under Cumulative (2040) conditions, LOS calculations for intersections 3-7 were performed using VISSIM, all other intersections were performed using Synchro 9.0. (Shaded text represents intersections analyzed with VISSIM.)

Table 11 – Baseline Intersection Level of Service Summary (Continued)

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (2025)		Cumulative Year (2040)	
					Delay (sec) (a)	LOS (b)	Delay (sec) (a)	LOS (b)
17	SR-273 (Market St) @ North St	Signal	D	FRI PM	15.9	B	20.0	B
				SAT PM	12.7	B	13.8	B
18	North St @ Oak St	SSSC*	D	FRI PM	24.3	C	33.1	D
				SAT PM	14.6	B	16.6	C
19	North St @I-5 SB Off Ramp	AWSC	D	FRI PM	12.2	B	13.7	B
				SAT PM	9.0	A	9.4	A
20	North Street @ McMurray Dr/I-5 NB On Ramp	AWSC	D	FRI PM	36.2	**E**	72.3	**F**
				SAT PM	13.7	B	18.8	C
21	Balls Ferry Rd @ Oak St	SSSC*	D	FRI PM	15.0	C	19.6	C
				SAT PM	12.8	B	15.0	C
22	Balls Ferry Rd @ Venutra St/I-5 SB On Ramp	Signal	D	FRI PM	26.5	C	28.3	C
				SAT PM	8.6	A	23.0	D
23	Balls Ferry Rd @ McMurray Dr/I-5 NB Off Ramp	Signal	D	FRI PM	23.3	C	41.7	D
				SAT PM	8.3	A	42.2	D

Notes:

Bold represents unacceptable operations.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection, delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual*

(c) LOS calculations for intersections 3-7 were performed using VISSIM, all other intersections were performed using Synchro 9.0

Traffic Signal Warrant Analysis

Opening Year (2025) and Cumulative (2040) traffic volumes at unsignalized study intersections were compared against the peak-hour warrant in the *2014 California Manual on Uniform Traffic Control Devices (CMUTCD)*.

Results of the analysis showed that the following intersections will satisfy Traffic Signal Warrant #3 by the year 2025 and 2040.

- #8 – Churn Creek Road at Victor Ave
- #9 – Churn Creek Road at Rancho Road
- #18 – North Street at Oak Street
- #19 – North Street at I-5 Off-Ramp
- #20 – North Street at McMurry Drive and I-5 Northbound On-Ramp

Other warrants, such as minimum vehicle volumes, interruption of continuous traffic, and traffic progression, were not evaluated because they generally require additional traffic volumes to be satisfied. A copy of the analysis worksheets for Traffic Signal Warrant #3 is included in **Appendix C**.

LOS Conditions and Impacts on Roadway Segments without Project

Opening Year (2025) and Cumulative (2040) roadway segment volumes were determined from the turning movement approach volumes at the study intersections within the study area.

Results of the analysis are presented in **Table 12** and **Table 13**. As shown in **Table 12** and **Table 13**, the roadway segments are expected to operate at acceptable levels of service based on established significance criteria under Opening Year (2025) and Cumulative (2040) Conditions. Additional detail of the analysis is provided in **Appendix E**.

LOS Conditions and Impacts on Freeway Segments without Project

Opening Year (2025) and Cumulative (2040) freeway segment volumes were determined from the year 2040 directional link volumes from the Shasta County Regional Travel Demand Model (SCRTDF) Version 1.1[7].

Results of the analysis are presented in **Table 14** and **Table 15**. As shown in the **Table 13 and Table 15**, the freeway segments are expected to operate at acceptable levels of service based on established significance criteria under Opening Year (2025) and Cumulative (2040) Conditions. Additional details of the analysis are provided in **Appendix E**.

Table 12 – Baseline Roadway Segment Level of Service Summary (Two-Lane)

Location	Peak-Hour	Analysis Direction	Opening Year (2025)			Cumulative (2040)		
			LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c
Bechelli Ln south of Bonnyview Rd	FRI	NB	A	92.7	0.05	A	91.9	0.06
		SB	A	92.7	0.05	A	91.9	0.06
	SAT	NB	A	93.6	0.03	A	93.3	0.03
		SB	A	93.6	0.03	A	93.3	0.04
Churn Creek Rd east of Alrose Ln	FRI	EB	C	77.9	0.46	D	73.9	0.56
		WB	C	78.6	0.38	D	71.4	0.5
	SAT	EB	C	82.8	0.26	C	81.7	0.31
		WB	C	82.8	0.27	C	80.8	0.35
Smith Rd west of Churn Creek Rd	FRI	EB	A	98.1	0.01	A	97.8	0.02
		WB	A	98.1	0.03	A	97.8	0.03
	SAT	EB	A	94.5	0.01	A	94.3	0.02
		WB	A	94.5	0.02	A	94.3	0.02
Knighton Road between I-5 SB Ramps and I-5 NB Ramps	FRI	EB	B	86.2	0.17	B	85.9	0.18
		WB	B	86.6	0.13	B	86.2	0.14
	SAT	EB	B	90.4	0.12	B	89.8	0.12
		WB	B	88.7	0.07	B	88.4	0.08
Knighton Road between I-5 NB Ramps and Churn Creek Rd	FRI	EB	B	83.9	0.19	C	83.2	0.22
		WB	B	83.9	0.19	C	83.3	0.21
	SAT	EB	B	86.4	0.11	B	85.8	0.13
		WB	B	86.4	0.12	B	85.8	0.13
Churn Creek Rd between Knighton Rd and Smith Rd	FRI	NB	B	85.7	0.11	B	83.9	0.14
		SB	B	85.9	0.11	B	83.8	0.14
	SAT	NB	B	91.1	0.07	B	88.9	0.08
		SB	B	90.8	0.06	B	88.6	0.08
Canyon Rd south of Redding Rancheria Rd	FRI	NB	B	85	0.15	B	84.9	0.16
		SB	B	84.6	0.24	B	84.5	0.24
	SAT	NB	B	86.9	0.15	B	86.8	0.15
		SB	B	86.9	0.13	B	86.8	0.14
North St east of Oak St	FRI	EB	C	82.6	0.31	C	80.5	0.36
		WB	C	82.9	0.28	C	80.7	0.33
	SAT	EB	B	88.1	0.17	B	86.6	0.2
		WB	B	88.1	0.19	B	86.6	0.22
North St west of Oak St	FRI	EB	B	84.4	0.24	C	82.5	0.28
		WB	B	84.0	0.26	C	82	0.33
	SAT	EB	B	89.6	0.15	C	88.2	0.18
		WB	B	89.6	0.15	B	88.2	0.18
Oak St north of North St	FRI	NB	A	97.4	0.05	A	97.3	0.05
		SB	A	97.4	0.04	A	97.3	0.04
	SAT	NB	A	97.7	0.03	A	97.6	0.03
		SB	A	97.7	0.04	A	97.6	0.05
Oak St south of North St	FRI	NB	A	98.1	0.02	A	98	0.02
		SB	A	98.1	0.02	A	98	0.02
	SAT	NB	A	98.4	0.01	A	98.4	0.01
		SB	A	98.4	0.01	A	98.4	0.01

Notes:

PFFS = Percent Free-Flow Speed, v/c = Volume to Capacity

Table 13 – Baseline Roadway Segment Level of Service Summary (Multilane)

Location	Peak-Hour	Analysis Direction	Opening Year (2025)		Cumulative (2040)	
			LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
Bonnyview Rd west of Bechelli Ln	FRI	EB	B	17	A	2.1
		WB	B	17.7	C	20.8
	SAT	EB	A	10.1	B	12
		WB	B	12.5	B	14.5
Market St (SR 273) north of Canyon Rd	FRI	NB	A	7.1	A	7.8
		SB	A	8.8	A	9.7
	SAT	NB	A	4.9	A	5.4
		SB	A	5.8	A	6.3
Market St (SR 273) south of Canyon Rd	FRI	NB	A	4.9	A	5.9
		SB	A	5.5	A	6.5
	SAT	NB	A	3.1	A	3.7
		SB	A	3.1	A	3.7

Table 14 – Baseline Freeway Segment Level of Service Summary (Strawberry Fields Site)

c- Weave segment LOS calculated using Leisch Method				Opening Year 2025		Cumulative 2040	
Direction	**Segment**	**Type**	**Peak Hour**	**Density[a]**	**LOS**	**Density[a]**	**LOS**
Northbound	South of Bonnyview Rd Off-Ramp	Basic	FRI PM	17.1	B	13.6	B
			SAT PM	12.6	B	10.8	A
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	12.9	B	18.2	B
			SAT PM	10.2	B	12.3	B
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	8.3	A	9.9	A
			SAT PM	6.5	A	8.4	A
	Bonnyview Rd On-Ramp	Merge	FRI PM	24.0	C	26.2	C
			SAT PM	17.9	B	21.6	C
	North of Bonnyview Rd On-Ramp	Basic	FRI PM	12.9	B	15.5	B
			SAT PM	9.6	A	12.1	B
Southbound	North of Bonnyview Rd Off-Ramp	Basic	FRI PM	16.0	B	19.7	C
			SAT PM	11.8	B	15.0	B
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	20.0	C	28.7	D
			SAT PM	15.9	B	19.7	B
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	11.4	B	14.2	B
			SAT PM	8.8	A	11.6	B
	Bonnyview Rd On-Ramp	Merge	FRI PM	26.8	C	31.5	D
			SAT PM	18.4	B	22.6	C
	South of Bonnyview Rd On-Ramp	Basic	FRI PM	26.1	D	20.1	C
			SAT PM	16.7	B	14.4	B

Notes:

a- Density measured in passenger cars/lane/mile (pc/ln/mi)

b- **Bold** represents unacceptable operations

c- Weave segment LOS calculated using Leisch Method

Table 15 – Baseline Freeway Segment Level of Service Summary (Anderson Site)

I-5				Opening Year 2025		Cumulative 2040	
Direction	**Segment**	**Type**	**Peak Hour**	**Density**[a]	**LOS**	**Density**[a]	**LOS**
Northbound	South of Balls Ferry Rd Off-Ramp	Basic	FRI PM	20.6	C	16.9	B
			SAT PM	16.0	B	14.0	B
	Balls Ferry Rd Off-Ramp	Diverge	FRI PM	24.5	C	17.2	B
			SAT PM	18.9	B	13.5	B
	Balls Ferry Rd Off-Ramp to North St On-Ramp	Basic	FRI PM	16.2	B	13.7	B
			SAT PM	13.3	B	11.9	B
	North St On-Ramp	Merge	FRI PM	22.6	C	18.3	B
			SAT PM	18.0	B	15.2	B
	North St On-Ramp to Riverside Ave Off-Ramp	Basic	FRI PM	19.0	C	15.7	B
			SAT PM	15.0	B	13.2	B
Southbound	Riverside Ave On-Ramp to North St Off-Ramp	Basic	FRI PM	28.6	D	22.3	C
			SAT PM	20.5	C	17.8	B
	North St Off-Ramp	Diverge	FRI PM	33.8	D	2.9	A
			SAT PM	25.8	C	2.9	A
	North St Off-Ramp to Balls Ferry On-Ramp	Basic	FRI PM	24.1	C	19.6	C
			SAT PM	18.4	C	16.4	B
	Balls Ferry On-Ramp	Merge	FRI PM	31.9	D	26.4	C
			SAT PM	25.3	C	22.1	C
	South of Balls Ferry Rd On-Ramp	Basic	FRI PM	29.3	D	23.4	C
			SAT PM	21.6	C	19.1	C

Notes:

a- Density measured in passenger cars/lane/mile (pc/ln/mi)

b- **Bold** represents unacceptable operations

c- Weave segment LOS calculated using Leisch Method

PROPOSED PROJECT

Strawberry Fields Site

As part of the project, four development alternatives at the proposed project site were evaluated.

- **Alternative A: Proposed Project** – Consists of a new casino and resort, including an approximately 69,515 square foot casino, 250-room hotel, an event/ convention center, and a retail center, as well as associated parking and infrastructure.
- **Alternative B: Proposed Project with No Retail –** Consists of the same land uses and intensities as the Proposed project without the retail center.
- **Alternative C: Reduced Intensity Alternative –** Consists of a reduced version of the Proposed Project including a new casino and resort, an approximately 250-room hotel, an event/ convention center, and a retail center, as well as associated parking and infrastructure.
- **Alternative D: Non-Gaming Alternative** – Consists of an approximately 128-room hotel, restaurants, and a retail center, as well as associated parking and infrastructure.

Site Access

As part of the project, three project access options were evaluated for each development alternatives listed above (A through D). The first option has north access only. For this option, the only access point to the project will be from Bechelli Lane off of Bonnyview Road. The second option has both north and south access. For this second option, the primary access point to the project will be from Bechelli Lane off of Bonnyview Road while secondary access will be provided from a new connecting roadway off of Smith Road. The third option has south access only with a new I-5 interchange at Smith Road. For this option, the only access point to the project will be from a new connecting roadway off of Smith Road. The access options evaluated are listed below:

- North Access Only (Option 1) – access to South Bonnyview Road via Bechelli Lane
- North and South Access (Option 2) – access to South Bonnyview Road via Bechelli Lane and access to Smith Road via a new connecting roadway (overpass only at Smith Road)
- South Access Only (Option 3) – access to Smith Road via a new connecting roadway and a new I-5 Interchange at Smith Road

Project Trip Generation

The following section discusses trip generation for casino land uses and the other land uses related to the Proposed Project. Trip generation estimates for Project Alternatives A-D are summarized in **Tables 16-19**.

Trip Generation for Casino Uses

Based on existing traffic volume information and expected trip generation from the Proposed Project, it was determined that the Friday and Saturday PM peak periods between 5:00 and 7:00 PM represent the worst-case periods to evaluate in this traffic impact study. It is during these periods that the combination of background traffic and casino traffic are anticipated to be at the highest levels. Friday and Saturday PM (5:00 – 7:00 PM) periods represent peak casino trip generation. Although background traffic may be lower on Friday and Saturday evenings (from 5:00 – 7:00 PM) than traditional peak weekday periods, the combination of peak casino trip generation with the background traffic is considered to be the peak for the Proposed Project.

> Trip generation for tribal gaming facilities generally peaks on Saturday evenings. However, as mentioned above, background traffic on adjacent streets is lower during this period than during traditional peak weekday periods, resulting in a lower total number of vehicles on the adjacent streets. In addition, casino facilities are open 24 hours a day, 7 days a week and typically do not generate extreme peaks of traffic like other uses. Instead, casino traffic patterns typically follow a smoother curve that builds steadily from early morning until approximately 7:00 PM, after which traffic levels slowly decline. See **Appendix F** for a graphical presentation of this curve.
>
> Trip generation for development projects is typically based on rates contained in the most recent edition of the Institute of Transportation Engineers' (ITE) publication Trip Generation Manual. This manual is a standard reference used by jurisdictions throughout the country and is based on actual trip generation studies at multiple locations, in areas of varying population. However, ITE's Trip Generation Manual does not have a land use category for casinos similar to the type proposed for the Redding Rancheria Casino Project. ITE trip rates for hotel/casinos represent sites of the nature commonly found in Las Vegas and Reno. For this reason, the information is generally not applicable to this smaller, more rural/suburban project. As a result, the trip generation estimates developed for this project rely on information obtained from other Native American casino and hotel facilities in California.
>
> For the purposes of this study, casino trip generation research focused on review of available data associated with studies of three existing tribal casinos in northern California:
>
> - Thunder Valley Casino (previously referred to as Auburn Rancheria Gaming Facility)
> - Cache Creek Casino Resort
> - Win River Casino Resort

As part of a traffic impact study prepared for the Thunder Valley Casino, trip generation was collected at four northern California gaming facilities[12]. Later, Kimley-Horn supplemented the traffic study data with more recent information collected in 2005 at the completed Thunder Valley Casino[13]. Similarly, the traffic study prepared for the proposed expansion of Cache Creek Casino included traffic data collection at the existing casino resort, which was used to establish trip generation rates for the site[14]. See **Appendix F** for the observed trip generation rates for Thunder Valley Casino, Cache Creek Casino Resort (pre-expansion), and existing Win River Casino Resort.

The trip generation rates shown in **Appendix F** include patrons of the slot machines and table games, as well as ancillary uses such as restaurants, bars, back-of-house, employees arriving and departing on a shift change, and general activities occurring at the casino during the peak hour. Because all functions are included in the rates summarized in **Appendix F**, separate calculations for the non-casino functions (excluding hotel and convention areas) are not necessary, nor appropriate. Excluding the restaurants and other ancillary uses does not suggest that they do not generate trips; rather it is a statement that the methodology already incorporates the trips in the calculated rates based on gaming positions.

Trip generation for casinos can be based on one or more independent variables, including gaming floor area, number of gaming positions, or overall casino floor area. The gaming floor area or number of gaming positions is considered by most professionals to be a more reliable factor to determining the number of trips likely to be generated for a facility such as the Redding Rancheria Casino, rather than the entire building floor area. Gaming area is the “engine” that brings trips to the facility. The other functions such as restaurants, hotels, and shopping are used to keep patrons at the facility for a longer period of time.

The proposed Redding Rancheria Casino includes 1,510 gaming positions, a 250 room hotel, an event center and a conference center, a retail center, and associated parking and infrastructure. Although the Thunder Valley Casino, Cache Creek Casino, and existing Win River Casino also offer similar amenities, the facilities’ proximity to freeways, location relative to large population centers, and size are documented to influence trip generation rates.

Tribal gaming facilities located adjacent to freeways generate a higher number of trips compared to similarly sized facilities located along rural roadways due to the facilities’ daily exposure to higher traffic volumes. Both the Thunder Valley

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[12] *Revised Draft Traffic Impact Study for the Auburn Rancheria Gaming Facility*, Fehr & Peers, October, 2000. Not available on the Internet.

[13] *Draft Existing Conditions Traffic Study – Thunder Valley Casino Expansion Project*, Kimley-Horn and Associates, Inc., June, 2005.

[14] *Final Traffic Impact Study – Cache Creek Casino Resort Event Center Project*, Kimley-Horn and Associates, Inc., June, 2010.

Casino and the Proposed Project are located in similar proximity to major freeway facilities, while the Cache Creek Casino is located along a rural highway. Consequently, the Cache Creek Casino is documented to have considerably lower trip generation rates compared to these other sites. Given the Proposed Project's close proximity to I-5, it is initially considered reasonable to anticipate that it would exhibit similar trip generation characteristics as the Thunder Valley Casino.

The existing Win River Casino Resort and the Proposed Project site are both located in the Redding area in Northern California, whereas the Thunder Valley Casino and Cache Creek Casino are located in the Sacramento metropolitan area. The differences in location could account for some of the differences in trip generation rates between the existing Win River Casino Resort, the Thunder Valley Casino, and the Cache Creek Casino.

Finally, the casino size also influences the trip generation rate. Trip rates are not linearly related to the size of the casino, see **Appendix F** for a graphical representation of this relationship. Smaller casinos exhibit higher trip generation rates relative to casino floor area. It is important to note that the Proposed Project is closer in size to existing Win River Casino than either the Thunder Valley Casino or the Cache Creek Casino.

It should be noted that the trip rate calculated for the existing Win River Casino Resort was higher than the Thunder Valley Casino trip rate despite the fact that the existing casino is located along a rural highway. This data suggests that the applying the Thunder Valley Casino trip rate to the Proposed Project would not adequately reflect the facilities' differences in both geographic location and proximity to facility size. Based on the similarities in location and size between the existing Win River Casino Resort and the Proposed Project, it is considered appropriate to use the more conservative, existing Win River Casino trip generation rates for the Proposed Project. These rates were developed based on traffic counts collected in July 2016 and are more representative of the trips generated by smaller casino sites in similar rural locations.

Pass-By and Diverted Link Trips for Casino Uses

Certain types of land uses attract trips that are already on the adjacent road that stop as they pass by the site, or divert to the site from a nearby road. These are not new vehicle trips, but are considered to be pass-by trips or diverted link trips.

> *Pass-by trips* represent trips already on the adjacent street which stop as they pass by the site as a matter of convenience on their path to another destination. These trips enter and exit the site at the driveways but are not new trips on the surrounding roadway network.

> *Diverted link trips* also are trips already on the road, but require a diversion from their current roadway to another roadway to access the site. Diverted link trips are common for retail-oriented developments located adjacent to highways or interstates. Like pass-by trips, diverted link trips are not new trips on the regional roadway network.

The location of the project site also influences the amount of pass-by and diverted link trips. If a project is located along a major roadway where drivers can conveniently turn from the roadway into a site driveway, then pass-by is generally greater and diverted link is lower. Conversely, if the project is located in a somewhat isolated location without direct access to a major street, but within the vicinity of a major highway, then pass-by is often lower and diverted link is greater.

It is reasonable to assume that some trips to the casino site will be diverted link trips, particularly with the site in close proximity to I-5, which carries over 45,000 vehicles per day[15]. No empirical data was readily available at this time to establish specific pass-by rate/diverted link rates for casino uses; thus a conservative estimate of 10 percent diverted link trips was applied to the casino use in Alternatives A, B, and C which is consistent with Caltrans guidance[16]. In all cases, only diverted link trip reductions (freeway pass-by trips that are diverted and routed through the study intersections) are used to account for those trips assumed to already be on the adjacent network.

Peak Time of Day
As shown in **Appendix F**, casino traffic increases steadily in the evening, reaching a maximum trip generation rate at approximately 7:00 PM. In addition, the *Cache Creek Hotel Expansion Project Traffic Impact Study*[17] calculated casino trip generation based on existing trips to and from the existing casino site collected at project driveways between 5:00 and 7:00 PM, with the highest volumes occurring between 5:15 and 6:15 PM. Consistent with previous studies conducted for casino and hotel facilities in California, the analysis periods of Friday and Saturday PM peak-hour (5:00 – 7:00 PM) were used to analyze the Redding Rancheria project.

To supplement this methodology, Redding Rancheria traffic counts were collected at the intersection of Canyon Road/Redding Rancheria Road, which serves as the primary access to the existing casino. These counts resulted in a Friday PM peak-hour between 5:00 and 6:00 PM and a Saturday PM peak-hour between 5:15 and 6:15 PM. In addition, as shown in **Appendix F**, Saturday mid-day casino peak-hour volume is approximately 50% less than Saturday PM casino peak-hour volume. Peak periods for casino traffic experienced at the

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[15] Caltrans Traffic and Vehicle Data Systems Unit, http://traffic-counts.dot.ca.gov/2014all/
[16] Caltrans Guide for the Preparation of Traffic Impact Studies (December 2002).
[17] *Cache Creek Casino Hotel Expansion Project, Traffic Impact Study*, Kimley-Horn and Associates, Inc., July 2016.

adjacent intersection are consistent with data presented in **Appendix F**, as well as peak casino trip assumptions reported in the Cache Creek study.

Peak Day of Week
ITE's *Trip Generation Characteristics of Small to Medium Sized Casinos* study[18] provides daily traffic counts collected over a consecutive eleven-day period for small to medium sized casinos near Omaha, Nebraska. For comparison purposes, Harvey's Casino and Ameristar Casino were referenced due to the shared characteristics of these casinos with Redding Rancheria. According to the study, casino PM peak period traffic generally occurs on weekends (Friday – Sunday) and after 5:30 PM (see **Appendix F**). In addition, only one (1) of the eleven days where casino traffic counts were collected reported a PM peak-hour between the hours of 4:00 PM and 5:00 PM. Thursdays generally provided the highest PM peak-hour during the weekdays (Monday through Thursday).

See **Appendix F** for the volumes associated with casino peak trip generation during Thursdays, Fridays, and Saturdays at Harvey's and Ameristar casinos. As shown in **Appendix F**, on average, the casino peak trip volume during the Thursday PM peak-hour is 18% less than the Friday PM peak-hour, and 17% less than Saturday PM peak-hour volume. In addition, peak casino traffic generally occurs between 5:00 and 7:00 PM, except for Thursday (7/20/2000 at the Ameristar Casino). It is important to note that the PM peak-hour volumes reported on Thursdays (shown above) occur outside of the traditional PM peak-hour period (4:00 PM to 6:00PM).

Thus, it can be concluded that Friday and Saturday PM (5:00 – 7:00 PM) periods represent peak casino trip generation. Additionally, weekday (Tuesday-Thursday) peak casino trip generation generally occurs outside of traditional PM peak periods (before 4:00 PM, or after 6:00 PM). Therefore, analyzing the background traffic for a traditional weekday PM peak-hour period in combination with the traditional weekday PM peak-hour casino trip generation would result in a less conservative analysis.

In order to assess the reasonableness of the methodology described above and used in this study, traffic studies for other casino projects were reviewed. The following list contains studies for other Indian gaming facilities which used similar methodologies of estimating peak traffic flows:

- Muckleshoot Indian Tribe – Emerald Downs Fee-To-Trust Project (https://www.emeralddownsea.com/)
- Ho-Chunk Nation – Fee-To-Trust and Casino Project (https://www.ho-chunkbeloiteis.com/)
- Tule River Tribe – Fee-To-Trust and Eagle Mountain Casino Relocation (https://www.tulerivereis.com/)

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[18] *Trip Generation Characteristics of Small to Medium Casinos*, M. Trueblood and T. Gude, ITE, August 2008.

Trip Generation for Other Uses

Hotel Trip Generation

Trip generation for the hotel use proposed in Alternatives A, B, and C was calculated based on data from the ITE Trip Generation Manual, 9th Edition, but was also adjusted with the assumption that most guests at the hotel would also be guests of the casino. Typically, casinos with on-site hotel facilities implement a pricing structure for the rooms that favors casino guests. Therefore, the ITE hotel trip generation rate was reduced by 75 percent to account for internal capture to and from the casino. Reducing the base hotel rate by 75 percent is based on professional judgment and is generally consistent with the hotel trip generation adjustments demonstrated in the traffic studies for other northern California gaming facilities, such as the Red Hawk Casino[19] (previously referred to as Shingle Springs Casino) and Graton Rancheria Casino[20], as well as the adjustments documented for on-site hotel uses at tribal gaming facilities in the San Diego Region[21]. The full ITE hotel trip rate was used for Alternative D, which does not include casino uses.

Conference Center Trip Generation

Project Alternatives A, B, and C include a 10,080 square foot conference center. These facilities are typically used for a variety of events, such as conventions, concerts, performances, etc. Based on traditional space-planning practices for conference facilities, the estimated capacity of the conference center is calculated to be approximately 672 people[22]. For the purposes of this traffic analysis, the peak trip generation for the conference facility assumes an event with 85 percent of the capacity filled, which corresponds to approximately 571 attendees. For most events, it is assumed that a number of attendees will stay at the on-site hotel and walk to the convention facility. For this analysis, it is assumed that 25 percent of the on-site hotel rooms would be occupied by event attendees (250 rooms * 0.25 = 63 rooms at an assumed 1.3 persons per room = 81 event attendees staying at the on-site hotel). The remaining 490 event attendees (571 – 81 = 490) are assumed to drive to the project site.

Auto occupancy rates and arrival patterns of various types of events were used to develop expected vehicle trip generation rates for the conference center. The majority of the trips generated by the facility are expected to occur outside of the PM peak-hour, as most events will likely have a start time between 7:00 AM and 8:00 AM. For the trip generation calculations, it was assumed that 50 percent of the patrons would arrive during the peak hour, with an expected vehicle occupancy rate of 2.2 persons per

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[19] *Shingle Springs Interchange Project – Final Environmental Impact Report/Environmental Assessment,* David Evans and Associates, Inc., September 2002.

[20] *Graton Rancheria Casino and Hotel – Final Traffic Impact Study Update,* Kimley-Horn and Associates, Inc., January 2013.

[21] *Traffic Needs Assessment of Tribal Development Projects in the San Diego Region,* County of San Diego, March 2003.

[22] Assuming an average density of 15 square feet per guest, conference area capacity is estimated at 672 people.

vehicle. Based on these estimates, approximately 111 peak-hour trips (0.5 * 490 / 2.2 = 111) would be expected to be generated by the on-site conference facility during the weekday and Saturday PM peak-hours. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits.

These assumptions are largely consistent with the assumptions used for conference center trip generation estimates for other traffic studies for tribal gaming facilities in northern California, including the Thunder Valley Casino Expansion study, Cache Creek Resort Event Center study, and the traffic study for the Red Hawk Casino. The same methodology was applied to Alternative F, the expansion of the existing Win River Casino Resort.

Event Center Trip Generation

Trip generation rates for the proposed event center were based on a previous study of a similar facility at the Cache Creek Casino[9]. As previously discussed, although the location of the gaming facility influences the trip generation characteristics, the interaction between the casino and the event facilities at the Cache Creek Casino and the Proposed Project is likely consistent. However, the vehicle occupancy rates would likely be different depending on the casino locations. As previously mentioned, the Cache Creek Casino is located in the Sacramento metropolitan area, while the Proposed Project is located in Redding, California. The rural nature of the Proposed Project is likely to result in higher vehicle occupancies, as people are more likely to carpool to the farther destination. Rather than selecting the vehicle occupancy rate found in Cache Creek Casino study (2.6 persons per vehicle), it was determined that a rate of 2.2 people per vehicle would be more appropriate for the Proposed Project event center. The rate of 2.2 people per vehicle is consistent with the Wilton Rancheria Casino study[23], and is more conservative than the rate used in the Cache Creek Casino study.

The previous Cache Creek Casino study considered the top sixteen drawing events which occurred on Fridays or Saturdays over the course of a twelve-month period. Ticket counts for each event, along with person counts via automatic counters at the multiple entrances to the event facility, were used to estimate the proportion of patrons arriving from outside and within the casino resort. More specifically, for each day included in the sample, daily patron counts from the automatic counters were used to calculate an average total daily patron count on event days. Of the sixteen samples, the average number of attendees at the event center was then compared to the average facility patron count from a sampling of the most recent non-event days. If people attending the events did not participate in gaming activities during their same visit, the increase in the daily patron count on event days would be equal to the average attendance at the events considered. However, the actual difference in person counts visiting the facility as a whole on event days versus non-event days was several

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[23] *Wilton Rancheria Fee-To-Trust Casino Project – Final Traffic Impact Study,* Kimley-Horn and Associates, Inc., August 2015.

hundred people. Using this data, it was possible to reasonably to conclude that approximately 70-percent of the event center would have visited the facility even without an event. As a result, the remaining 30-percent of the patrons represents new trips that would not be expected to occur without the event venue.

Given the findings of the Cache Creek Casino study, it is assumed that most of the patrons visiting the event are already on-site at the casino, and only 30 percent of the patrons represent new trips. Assuming an average auto occupancy of 2.2 people per vehicle, approximately 245 new trips (0.3 * 1,800 / 2.2 = 245) are generated by the event facility. It was conservatively assumed that of the "new" trips generated by the proposed event center, 50 percent of the patrons would arrive in the PM peak-hour before the event would start. Based on these assumptions, 123 new trips (0.5 * 245 = 123) would be generated by the 1,800-seat event center. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits. This approach yields a total of 233 new peak hour trips (111 + 123 = 233) from the conference center and event center land uses for Alternatives A, B, C, and E.

Restaurant Trip Generation

The non-gaming alternative includes hotel, restaurant and retail facilities located on the Proposed Project Site. As mentioned previously, the full hotel trip rate was used to account for trips to the hotel facility. The Hotel use category (ITE 310) includes supporting facilities such as restaurants, cocktail lounges, and/or retail and service shops. However, the amount of restaurant facilities in the non-gaming land use option was higher than typical for an average hotel. It is more conservative to treat the restaurants as a separate land use category. Therefore, for the purposes of this trip generation analysis, only the Cafe/Deli and Bakery are considered part of the amenities provided by the hotel. The separate land use categories for the sports bar and specialty restaurant are "High Turnover Restaurant" (ITE 932) and "Quality Restaurant" (ITE 931), respectively. For this alternative, the trip generation estimates were adjusted to reflect diverted link trips.

Outdoor Sports Retail Trip Generation

Trip generation for the Outdoor Sports Retail facility proposed as part of Alternatives A, C, D, and E was calculated based on data from the ITE Trip Generation Manual, 9th Edition. For the purposes of this analysis, it was conservatively assumed that the peak hour of generator corresponds with the peak-hour of the Casino Facility.

Summary of Trip Reductions

To be conservative, no pass-by reductions were applied to the trip generation estimates. Due to the proximity of the site to the I-5 freeway, which carries over 45,000 vehicles per day, a considerable proportion of the project trips are anticipated to be diverted link trips from the freeway. The diverted link rate assumed for this trip generation analysis was set at 10 percent, which is consistent with Caltrans guidance[16].

Detailed trip generation calculations are included in **Tables 16-19**.

Table 16 – Project Trip Generation at Strawberry Fields Site (Alternative A)

Land Use	ITE Code	Quantity	Units	Friday	Friday PM Peak Hour			Saturday	Saturday Peak Hour		
				Daily	In	Out	Total	Daily	In	Out	Total
Casino	N/A	48,060	Gaming Floor Area	9277	302	302	605	8273	348	213	561
Conference Center	N/A	10,080	SF	965	111	11	122	965	111	11	122
Event Center	N/A	1,800	Seats	1063	123	12	135	1063	123	12	135
Hotel	310	250	Rooms	511	19	18	38	512	25	20	45
Sporting Goods Superstore	861	130,000	SF	2927	115	124	239	3819	255	245	499
Subtotal Vehicle Trips				14742	670	468	1139	14632	862	501	1363
Diverted Link Trips(10%)- Applied only to Casino And Sporting Goods Store				(1220)	(42)	(43)	(84)	(1209)	(60)	(46)	(106)
Net New Vehicle Trips				13521	629	426	1054	13423	801	455	1257

SF- Square Feet

Casino			
Friday PM Peak Hour	T=12.58 x (1000 SF Gaming Floor Area)	50% In	50% Out
Friday Daily	T=(504 Friday Daily Trips/60 Friday PM Peak Hour Trips) x 122 Friday PM Peak Hour Trips		
Saturday Peak Hour	T=11.67 x (1000 SF Gaming Floor Area)	62% In	38% Out
Saturday Daily	T=(504 Saturday Daily Trips/60 Weekday PM Peak Hour Trips) x 122 Saturday PM Peak Hour Trips		
Hotel			
Weekday PM Peak Hour (ITE 310)	T=0.15 x (Rooms)	51% In	49% Out
Weekday Daily (ITE 310)	T=2.04 x (Rooms)	50% In	50% Out
Saturday Peak Hour (ITE 310)	T=0.18 x (Rooms)	56% In	44% Out
Saturday Daily (ITE 310)	T=2.05 x (Rooms)	50% In	50% Out
Sports Retail			
Weekday PM Peak Hour (ITE 861)	T=1.84 x (1000 SF)	48% In	52% Out
Friday Daily	T=(22.88 Weekday Daily Rate/1.87 Weekday PM Peak Hour Rate) x 122 Weekday PM Peak Hour Trips		
Saturday Peak Hour (ITE 861)	T=3.84 x (1000 SF)	51% In	49% Out
Saturday Daily	T=(25.40 Saturday Daily Rate/1.87 Saturday PM Peak Hour Rate) x 499 Saturday PM Peak Hour Trips		

(1) Source of Land Use Information: Redding Rancheria Casino Master Plan (February, 2016) and subsequent correspondence with Analytical Environmental Services.

(2) Casino trip generation rates based on local traffic data collected for existing Win River Casino. This rate is also consistent with the traffic data collected for the Win River Casino in 2007. (Omni-Means, 2007). The directional distributions were based on the existing conditions.

(3) The proposed casino facility includes other auxiliary/internal uses in addition to gaming area, such as restaurants, back of house, lounges, etc.
However, only the number of gaming position is used as the independent variable for the purposes of estimating trip generation. This is because the trip generation rates use gaming positions as the independent variable, and were developed based on empirical data from similar existing casino facilities, and include the trips associated with all of the casino uses (gaming areas, restaurants, lounges, back of house, etc.), excluding hotel facilities and convention space.

(4) The project site is located adjacent to Interstate, which carries over 45,000 vehicles per day. For the purposes of this analysis, the base daily and peak hour trip generation estimates are adjusted based on an average diverted link rate of 10 percent. This adjustment is likely conservative and is within the range identified by Caltrans' guidance for pass-by/diverted link trip reductions (Caltrans Guide for the Preparation of Traffic Impact Studies, 2002). Only diverted link trip reductions are used to account for all trips assumed to already be on the adjacent network, including pass-by trips. The diverted link trip reduction is applied only to the trips generated by the casino and the sporting good store.

(5) Trip generation for the proposed conference center was developed based on the estimated number of attendees. The maximum number of event attendees/seats was estimated to be 672 people, based on an average of 15 SF per attendee, which is consistent with industry best practices for conference/event space planning. For the purposes of this traffic analysis, the peak trip generation for the conference center assumes an event with 85 percent of the capacity filled, which corresponds to approximately 571 attendees.
Based on the 2016 study of Cache Creek Casino Resort, it is assumed that when conference/meeting activities are scheduled, 25 percent of the 250 on-site hotel rooms would be occupied by event attendees with an average occupancy of 1.3 attendees per room. Thus, 81 attendees would stay on-site, and not drive to/from an event. The remaining attendees (490) would drive to the site. Assuming an average auto occupancy of 2.2 people per vehicle, approximately 223 vehicles trips would generated. The majority of event trips are anticipated to occur outside of the PM peak traffic period (4:00 PM to 6:00 PM), as events typically have a start time between 7:00 AM and 8:00 AM. It was assumed that 50 percent of event attendees would arrive during the peak hour. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits.

(6) Trip generation rates for the proposed event center were based on a previous study of a similar facility at the Cache Creek Casino and Resort. This assumes that most of the patrons visiting the event are already onsite at the casino, and only 30 percent of the patrons represent new trips. Assuming an average auto occupancy of 2.2 people per vehicle, approximately 245 new trips are generated by event facility. It was assumed that 50 percent of patrons would arrive during the peak hour. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits.

(7) Trip generation rates for the Hotel (ITE 310) and Sporting Goods Superstore (ITE 861) are based on ITE Trip Generation Manual, 9th Edition. The trip generation rate for the Hotel (ITE 310) is reduced by 75 percent to account for internal capture to/from the casino. For the Sporting Goods Store (ITE 861), it was conservatively assumed that the peak hour of Generator occurs during the peak hour for the Casino Facility.

(8) Daily rates for Casino, Conference Center and Event Center are calculated from the peak hour to daily relationships from Kimley-Horn's 2016 Ione Casino and Cache Creek Casino studies; daily rates for Sporting Goods Superstore are are calculated from the peak hour to daily relationships from the ITE use of Department Store (ITE 875)

Table 17 – Project Trip Generation at Strawberry Fields Site (Alternative B)

Land Use	ITE Code	Quantity	Units	Friday	Friday PM Peak Hour			Saturday	Saturday Peak Hour		
				Daily	In	Out	Total	Daily	In	Out	Total
Casino	N/A	48,060	Gaming Floor Area	9277	302	302	605	8273	348	213	561
Conference Center	N/A	10,080	SF	965	111	11	122	965	111	11	122
Event Center	N/A	1,800	Seats	1063	123	12	135	1063	123	12	135
Hotel	310	250	Rooms	511	19	18	38	512	25	20	45
Subtotal Vehicle Trips				11815	556	344	900	10813	607	256	863
Diverted Link Trips(10%)- Applied only to Casino				(928)	(30)	(30)	(60)	(827)	(35)	(21)	(56)
Net New Vehicle Trips				10887	525	314	839	9986	572	235	807

SF- Square Feet

Casino

Friday PM Peak Hour	T=12.58 x (1000 SF Gaming Floor Area)	50% In	50% Out
Saturday Peak Hour	T=11.67 x (1000 SF Gaming Floor Area)	62% In	38% Out

Hotel

Weekday PM Peak Hour (ITE 310)	T=0.15 x (Rooms)	51% In	49% Out
Weekday Daily (ITE 310)	T=2.04 x (Rooms)	50% In	50% Out
Saturday Peak Hour (ITE 310)	T=0.18 x (Rooms)	56% In	44% Out
Saturday Daily (ITE 310)	T=2.05 x (Rooms)	50% In	50% Out

(1) Source of Land Use Information: Redding Rancheria Casino Master Plan (February, 2016) and subsequent correspondence with Analytical Environmental Services.

(2) Casino trip generation rates based on local traffic data collected for existing Win River Casino. This rate is also consistent with the traffic data collected for the Win River Casino in 2007. (Omni-Means, 2007). The directional distributions were based on the existing conditions.

(3) The proposed casino facility includes other auxiliary/internal uses in addition to gaming area, such as restaurants, back of house, lounges, etc.
However, only the number of gaming position is used as the independent variable for the purposes of estimating trip generation. This is because the trip generation rates use gaming positions as the independent variable, and were developed based on empirical data from similar existing casino facilities, and include the trips associated with all of the casino uses (gaming areas, restaurants, lounges, back of house, etc.), excluding hotel facilities and convention space.

(4) The project site is located adjacent to Interstate, which carries over 45,000 vehicles per day. For the purposes of this analysis, the base daily and peak hour trip generation estimates are adjusted based on an average diverted link rate of 10 percent. This adjustment is likely conservative and is within the range identified by Caltrans' guidance for pass-by/diverted link trip reductions (Caltrans Guide for the Preparation of Traffic Impact Studies, 2002). Only diverted link trip reductions are used to account for all trips assumed to already be on the adjacent network, including pass-by trips. The diverted link trip reduction is applied only to the trips generated by the casino and the sporting good store.

(5) Trip generation for the proposed conference center was developed based on the estimated number of attendees. The maximum number of event attendees/seats was estimated to be 672 people, based on an average of 15 SF per attendee, which is consistent with industry best practices for conference/event space planning. For the purposes of this traffic analysis, the peak trip generation for the conference center assumes an event with 85 percent of the capacity filled, which corresponds to approximately 571 attendees.
Based on the 2016 study of Cache Creek Casino Resort, it is assumed that when conference/meeting activities are scheduled, 25 percent of the 250 on-site hotel rooms would be occupied by event attendees with an average occupancy of 1.3 attendees per room. Thus, 81 attendees would stay on-site, and not drive to/from an event. The remaining attendees (490) would drive to the site. Assuming an average auto occupancy of 2.2 people per vehicle, approximately 223 vehicles trips would generated. The majority of event trips are anticipated to occur outside of the PM peak traffic period (4:00 PM to 6:00 PM), as events typically have a start time between 7:00 AM and 8:00 AM. It was assumed that 50 percent of event attendees would arrive during the peak hour. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits.

(6) Trip generation rates for the proposed event center were based on a previous study of a similar facility at the Cache Creek Casino and Resort. This assumes that most of the patrons visiting the event are already onsite at the casino, and only 30 percent of the patrons represent new trips. Assuming an average auto occupancy of 2.2 people per vehicle, approximately 245 new trips are generated by event facility. It was assumed that 50 percent of patrons would arrive during the peak hour. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits.

(7) Trip generation rates for the Hotel (ITE 310) is based on ITE Trip Generation Manual, 9th Edition. The trip generation rate for the Hotel (ITE 310) is reduced by 75 percent to account for internal capture to/from the casino.

(8) Daily rates for Casino, Conference Center and Event Center are calculated from the peak hour to daily relationships from Kimley-Horn's 2016 Ione Casino and Cash Creek Casino studies.

Table 18 – Project Trip Generation at Strawberry Fields Site (Alternative C)

Land Use	ITE Code	Quantity	Units	Friday	Friday PM Peak Hour			Saturday	Saturday Peak Hour		
				Daily	In	Out	Total	Daily	In	Out	Total
Casino	N/A	36,060	Gaming Floor Area	6960	227	227	454	6208	261	160	421
Conference Center	N/A	10,080	SF	965	111	11	122	965	111	11	122
Event Center	N/A	1,800	Seats	1063	123	12	135	1063	123	12	135
Hotel	310	250	Rooms	511	19	18	38	512	25	20	45
Sporting Goods Superstore	861	130,000	SF	2927	115	124	239	3819	255	245	499
Subtotal Vehicle Trips				12425	595	393	988	12566	775	448	1223
Diverted Link Trips(10%)- Applied only to Casino And Sporting Goods Store				(989)	(34)	(35)	(69)	(1003)	(52)	(40)	(92)
Net New Vehicle Trips				11437	561	358	919	11564	723	407	1131

SF- Square Feet

Casino

Friday PM Peak Hour	T=12.58 x (1000 SF Gaming Floor Area)	50% In	50% Out
Saturday Peak Hour	T=11.67 x (1000 SF Gaming Floor Area)	62% In	38% Out

Hotel

Weekday PM Peak Hour (ITE 310)	T=0.15 x (Rooms)	51% In	49% Out
Weekday Daily (ITE 310)	T=2.04 x (Rooms)	50% In	50% Out
Saturday Peak Hour (ITE 310)	T=0.18 x (Rooms)	56% In	44% Out
Saturday Daily (ITE 310)	T=2.05 x (Rooms)	50% In	50% Out

Sports Retail

Weekday PM Peak Hour (ITE 861)	T=1.84 x (1000 SF)	48% In	52% Out
Saturday Peak Hour (ITE 861)	T=3.84 x (1000 SF)	51% In	49% Out

(1) Source of Land Use Information: Redding Rancheria Casino Master Plan (February, 2016) and subsequent correspondence with Analytical Environmental Services.

(2) Casino trip generation rates based on local traffic data collected for existing Win River Casino. This rate is also consistent with the traffic data collected for the Win River Casino in 2007. (Omni-Means, 2007). The directional distributions were based on the existing conditions.

(3) The proposed casino facility includes other auxiliary/internal uses in addition to gaming area, such as restaurants, back of house, lounges, etc.
However, only the number of gaming position is used as the independent variable for the purposes of estimating trip generation. This is because the trip generation rates use gaming positions as the independent variable, and were developed based on empirical data from similar existing casino facilities, and include the trips associated with all of the casino uses (gaming areas, restaurants, lounges, back of house, etc.), excluding hotel facilities and convention space.

(4) The project site is located adjacent to Interstate, which carries over 45,000 vehicles per day. For the purposes of this analysis, the base daily and peak hour trip generation estimates are adjusted based on an average diverted link rate of 10 percent. This adjustment is likely conservative and is within the range identified by Caltrans' guidance for pass-by/diverted link trip reductions (Caltrans Guide for the Preparation of Traffic Impact Studies, 2002). Only diverted link trip reductions are used to account for all trips assumed to already be on the adjacent network, including pass-by trips. The diverted link trip reduction is applied only to the trips generated by the casino and the sporting good store.

(5) Trip generation for the proposed conference center was developed based on the estimated number of attendees. The maximum number of event attendees/seats was estimated to be 672 people, based on an average of 15 SF per attendee, which is consistent with industry best practices for conference/event space planning. For the purposes of this traffic analysis, the peak trip generation for the conference center assumes an event with 85 percent of the capacity filled, which corresponds to approximately 571 attendees.
Based on the 2016 study of Cache Creek Casino Resort, it is assumed that when conference/meeting activities are scheduled, 25 percent of the 250 on-site hotel rooms would be occupied by event attendees with an average occupancy of 1.3 attendees per room. Thus, 81 attendees would stay on-site, and not drive to/from an event. The remaining attendees (490) would drive to the site. Assuming an average auto occupancy of 2.2 people per vehicle, approximately 223 vehicles trips would generated. The majority of event trips are anticipated to occur outside of the PM peak traffic period (4:00 PM to 6:00 PM), as events typically have a start time between 7:00 AM and 8:00 AM. It was assumed that 50 percent of event attendees would arrive during the peak hour. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits.

(6) Trip generation rates for the proposed event center were based on a previous study of a similar facility at the Cache Creek Casino and Resort. This assumes that most of the patrons visiting the event are already onsite at the casino, and only 30 percent of the patrons represent new trips. Assuming an average auto occupancy of 2.2 people per vehicle, approximately 245 new trips are generated by event facility. It was assumed that 50 percent of patrons would arrive during the peak hour. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits.

(7) Trip generation rates for the Hotel (ITE 310) and Sporting Goods Superstore (ITE 861) are based on ITE Trip Generation Manual, 9th Edition. The trip generation rate for the Hotel (ITE 310) is reduced by 75 percent to account for internal capture to/from the casino. For the Sporting Goods Store (ITE 861), it was conservatively assumed that the peak hour of Generator occurs during the peak hour for the Casino Facility.

(8) Daily rates for Casino, Conference Center and Event Center are calculated from the peak hour to daily relationships from Kimley-Horn's 2016 Ione Casino and Cash Creek Casino studies; daily rates for Sporting Goods Superstore are are calculated from the peak hour to daily relationships from the ITE use of Department Store (ITE 861)

Table 19 – Project Trip Generation at Strawberry Fields Site (Alternative D)

Land Use	ITE Code	Quantity	Units	Friday	Friday PM Peak Hour			Saturday	Saturday Peak Hour		
				Daily	In	Out	Total	Daily	In	Out	Total
Hotel	310	128	Rooms	1046	39	38	77	1048	52	41	92
High Turnover Restaurant	932	99	Seats	478	23	17	41	615	28	25	52
Quality Restaurant	931	66	Seats	189	11	6	17	185	13	9	22
Sporting Goods Superstore	862	120,000	SF	2702	106	115	221	3525	235	226	461
Subtotal Vehicle Trips				4414	180	176	355	5374	327	300	627
Diverted Link Trips(15%)- Applied to All Uses				(662)	(27)	(26)	(53)	(806)	(49)	(45)	(94)
Net New Vehicle Trips				3752	153	149	302	4568	278	255	533

SF- Square Feet

Hotel			
Weekday PM Peak Hour (ITE 310)	T=0.6 x (Rooms)	51% In	49% Out
Weekday Daily (ITE 310)	T=8.17 x (Rooms)	50% In	50% Out
Saturday Peak Hour (ITE 310)	T=0.72 x (Rooms)	56% In	44% Out
Saturday Daily (ITE 310)	T=8.19 x (Rooms)	50% In	50% Out
High Turnover Restaurant : Sports Bar			
Weekday PM Peak Hour (ITE 932)	T=0.41 x (Seats)	57% In	43% Out
Weekday Daily (ITE 932)	T=4.83 x (Seats)	50% In	50% Out
Saturday Peak Hour (ITE 932)	T=0.53 x (Seats)	53% In	47% Out
Saturday Daily (ITE 932)	T=6.21 x (Seats)	50% In	50% Out
Quality Restaurant : Specialty Restaurants			
Weekday PM Peak Hour (ITE 931)	T=0.26 x (Seats)	67% In	33% Out
Weekday Daily (ITE 931)	T=2.86 x (Seats)	50% In	50% Out
Saturday Peak Hour (ITE 931)	T=0.33 x (Seats)	59% In	41% Out
Saturday Daily (ITE 931)	T=2.81 x (Seats)	50% In	50% Out
Sports Retail			
Weekday PM Peak Hour (ITE 861)	T=1.84 x (1000 SF)	48% In	52% Out
Saturday Peak Hour (ITE 861)	T=3.84 x (1000 SF)	51% In	49% Out

(1) Source of Land Use Information:*Redding Rancheria Casino Master Plan* (February, 2016) and subsequent correspondence with Analytical Environmental Services.

(2) According to the ITE Trip Generation Manual, 9th Edition, the land use category Hotel (ITE 310) includes supporting facilities such as restaurants, cocktail lounges, and/or retail and service shops. However, the amount of restaurant facilities in the non-gaming land use option was more than would normally be present at an average hotel. It is more conservative to treat the excess restaurants as a separate land use category. Therefore, for the purposes of this trip generation analysis, only the Cafe/Deli and Bakery are considered part of the amendities provided by the hotel. The separate land use categories for the sports bar and specialty restaurant are "High Turnover Restaurant" (ITE 932) and "Quality Restaurant" (ITE 931), respectively.

(3) For Alternative C, a diverted link trip reduction of 15 percent was applied. This adjustment is likely conservative and is within the range identified by Caltrans' guidance for pass-by/diverted link trip reductions. (Caltrans Guide for the Preparation of Traffic Impact Studies, 2002). Only diverted link trip reductions are used to account for all trips assumed to already be on the adjacent network, including pass-by trips.

(4) Daily rates for Sporting Goods Superstore are are calculated from the peak hour to daily relationships from the ITE use of Department Store (ITE 861)

Project Trip Distribution and Assignment

Because of the unique nature of casino developments, customers and employees are expected to travel from nearby locations, as well as from the regions surrounding Redding, mainly from within Shasta County. The Proposed Project Site is located just outside of Redding's southern city limit. Based on the likely customer and employee base for the site, the immediate roadway system, and the north-south split of traffic on I-5, it was estimated that approximately half of the project traffic would originate from destinations north of the project site. The majority of these trips are expected to use SR-273 and I-5. Many of the trips from Redding's residential developments located east of I-5 are expected to travel along I-5 to the project site, as well as from neighboring cities to the north. A smaller proportion of trips are expected to use Bechelli Road to/from communities directly north of the Proposed Project Site. Approximately 37 percent of the project traffic is expected to come from south of the site, with the majority of this traffic traveling along I-5 from Anderson, Red Bluff, and other neighboring communities. The project traffic distribution for the proposed site is shown in **Figure 16.**

Project traffic assigned to the study intersections based on the assumed trip distribution and generation for the four development alternatives and three site access alternatives are shown in **Figures 17-28.**

Figure 16

Project Traffic Distribution for the Strawberry Fields Site

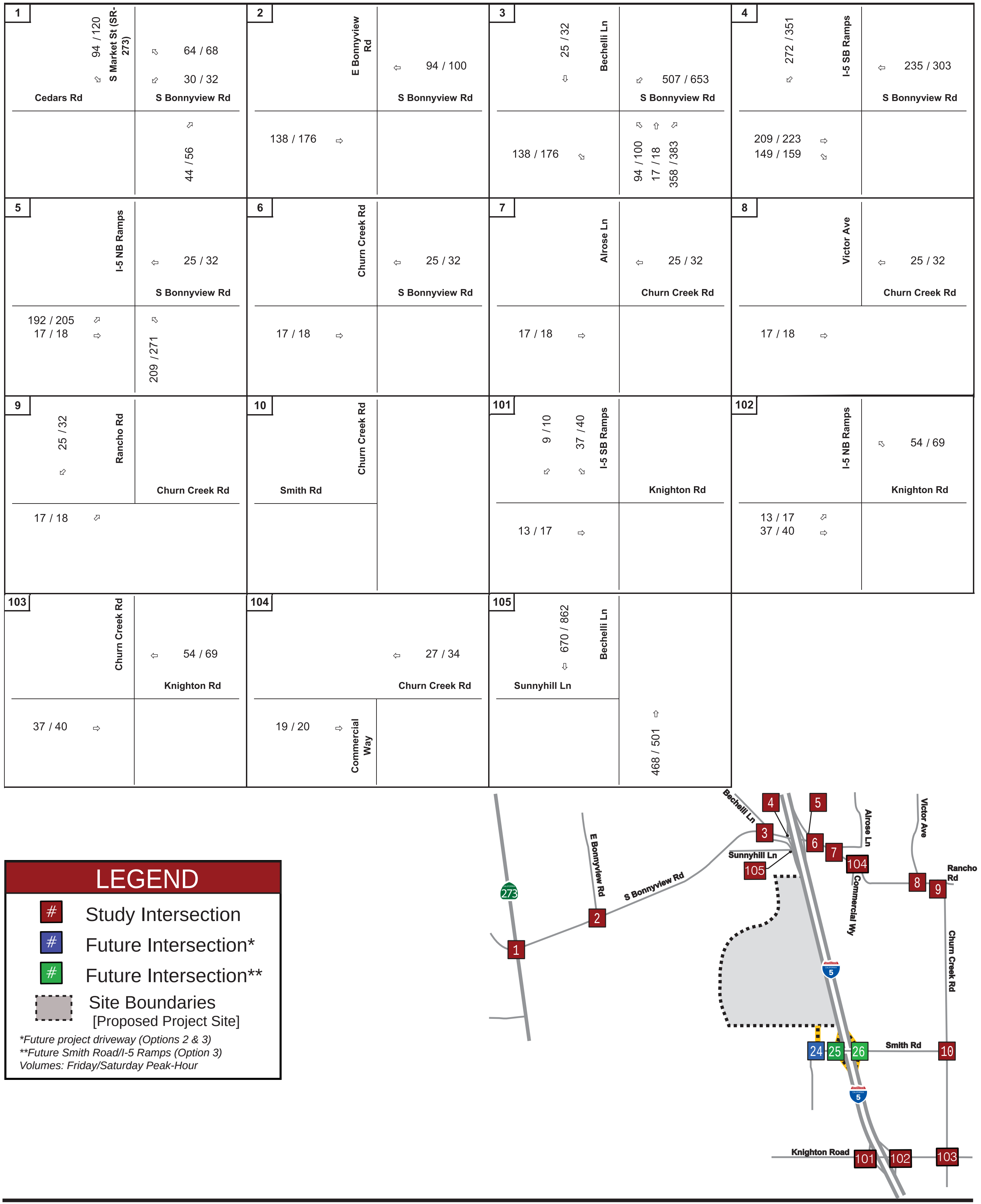

Figure 17

Project Trip Assignment for the Strawberry Fields Site (1A)

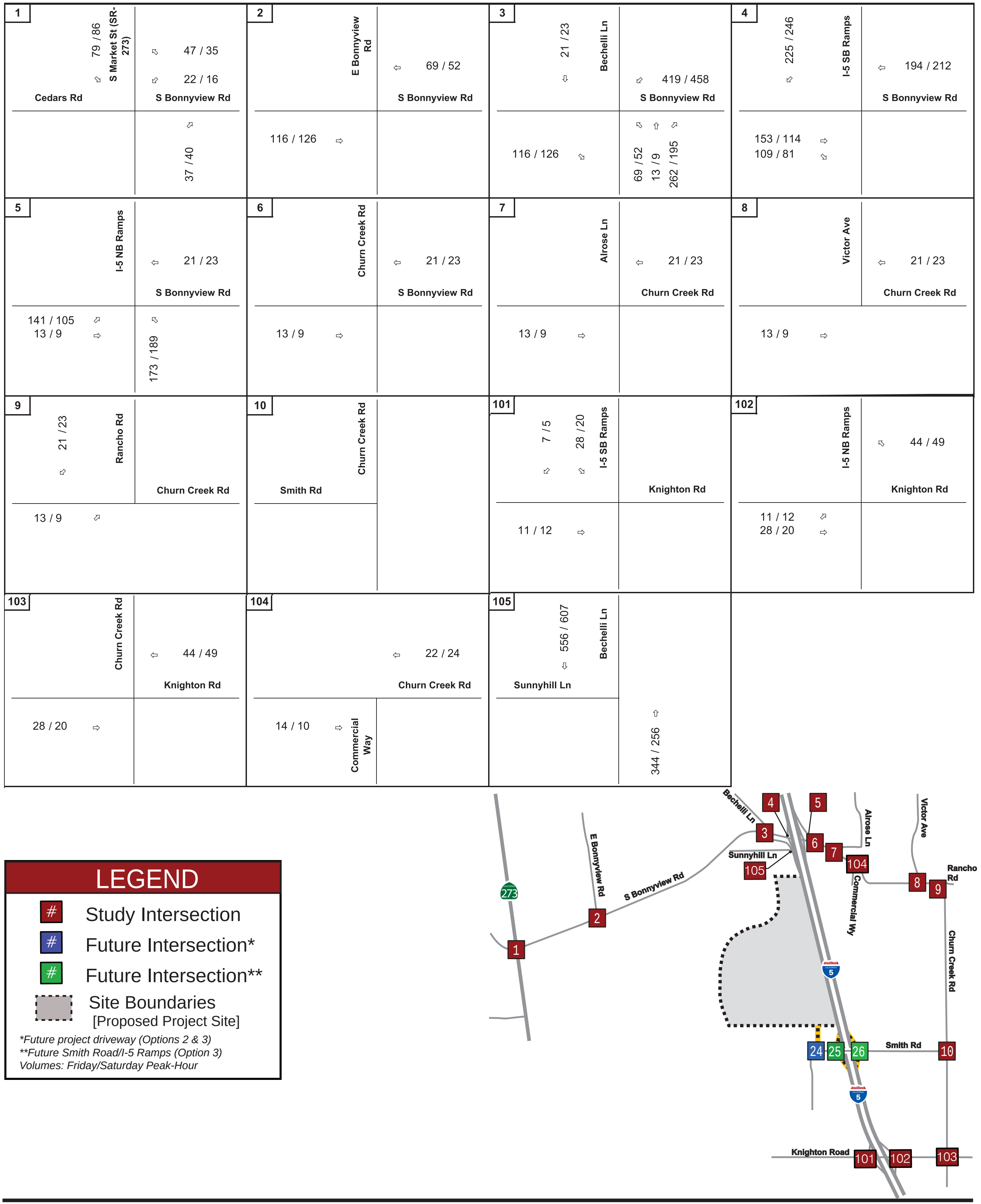

Figure 18

Project Trip Assignment for the Strawberry Fields Site (1B)

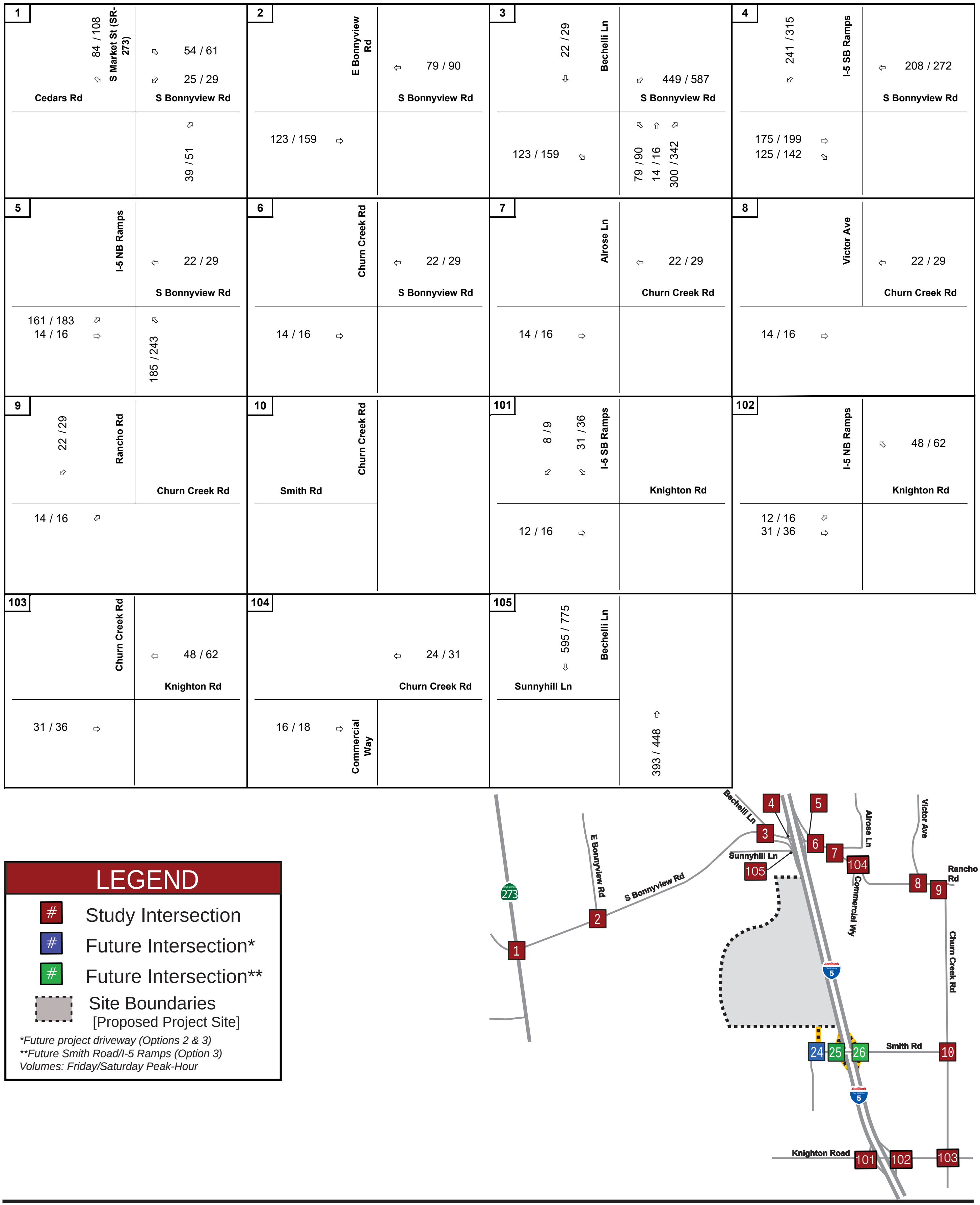

Figure 19
Project Trip Assignment for the Strawberry Fields Site (1C)

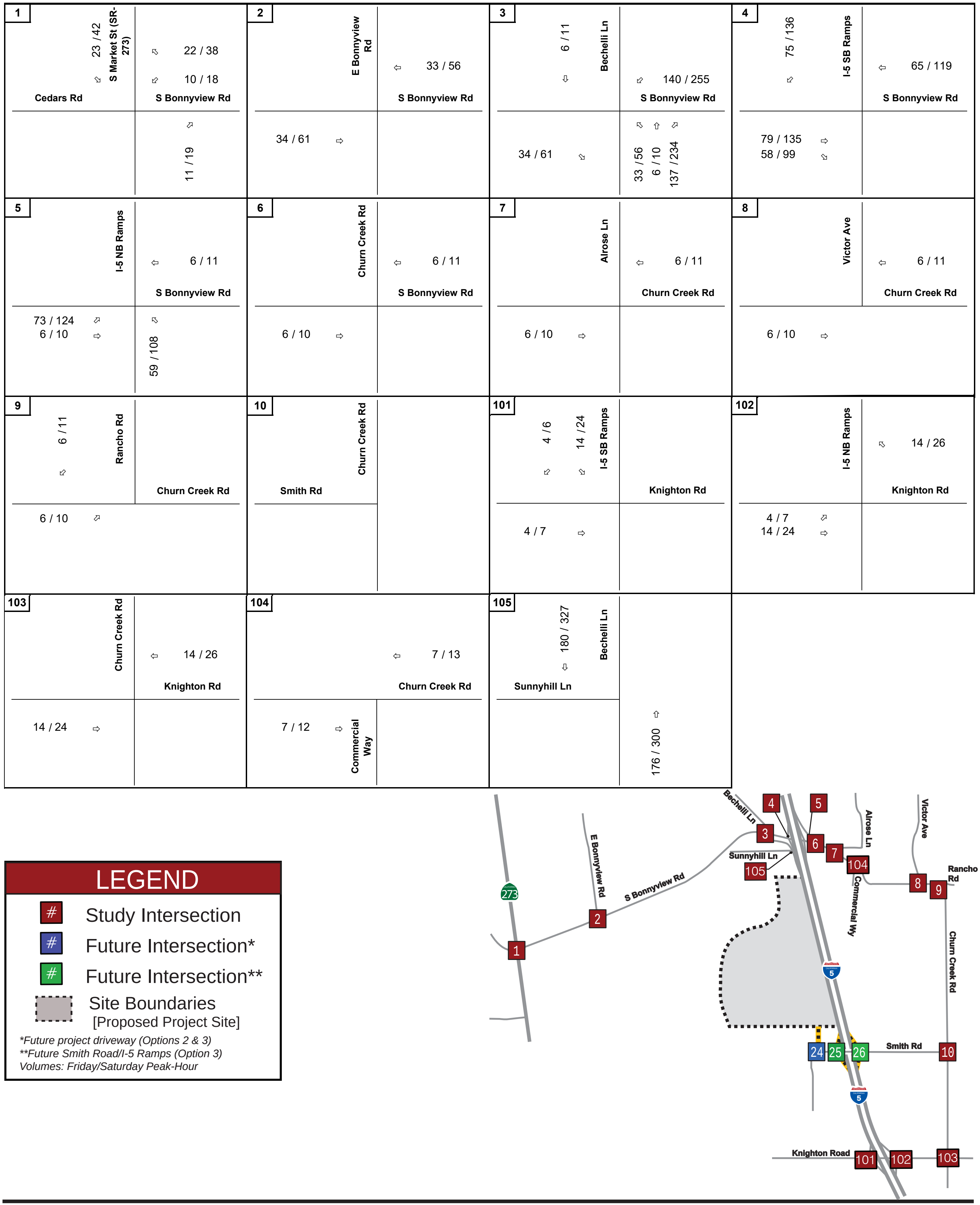

Figure 20
Project Trip Assignment for the Strawberry Fields Site (1D)

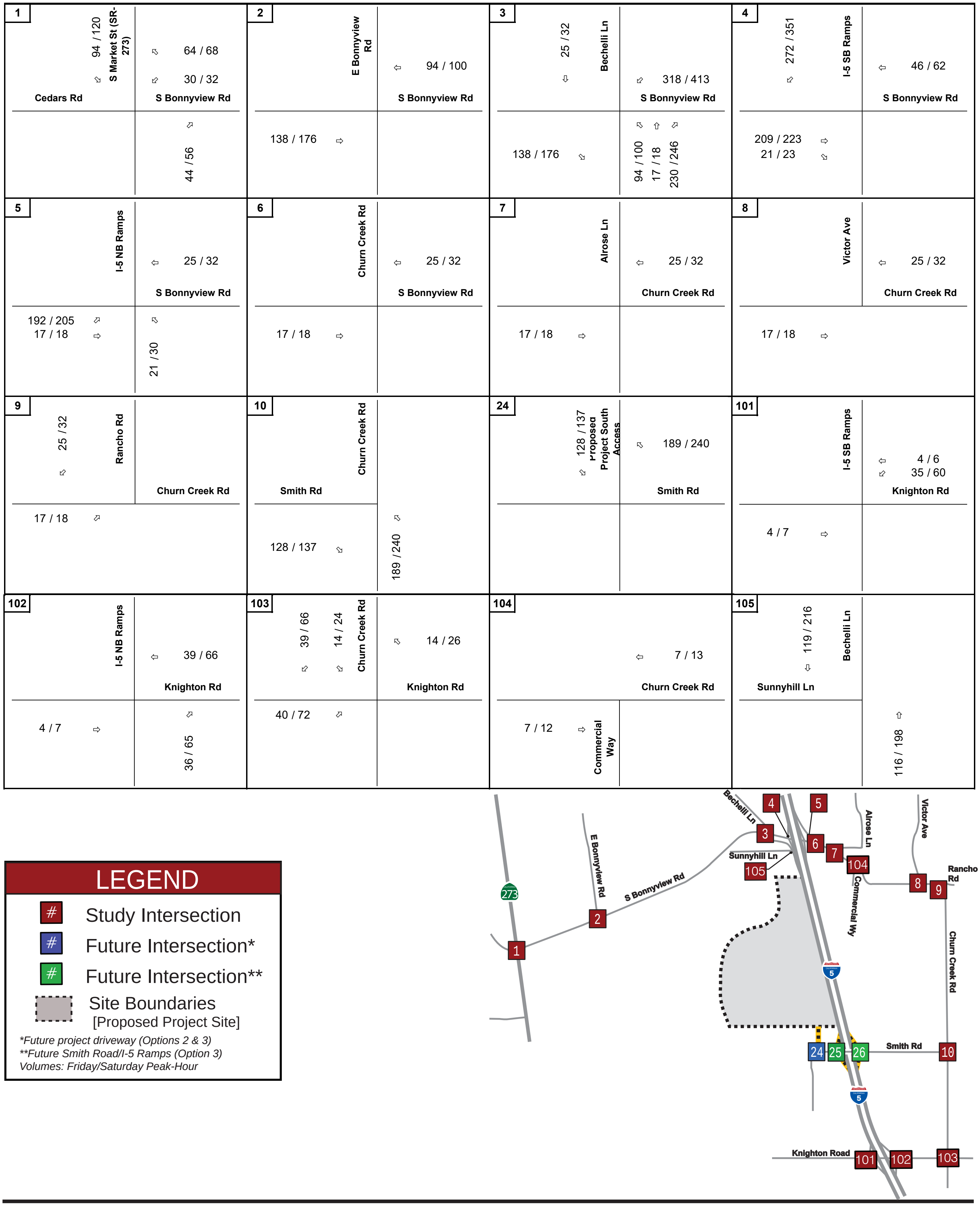

Figure 21

Project Trip Assignment for the Strawberry Fields Site (2A)

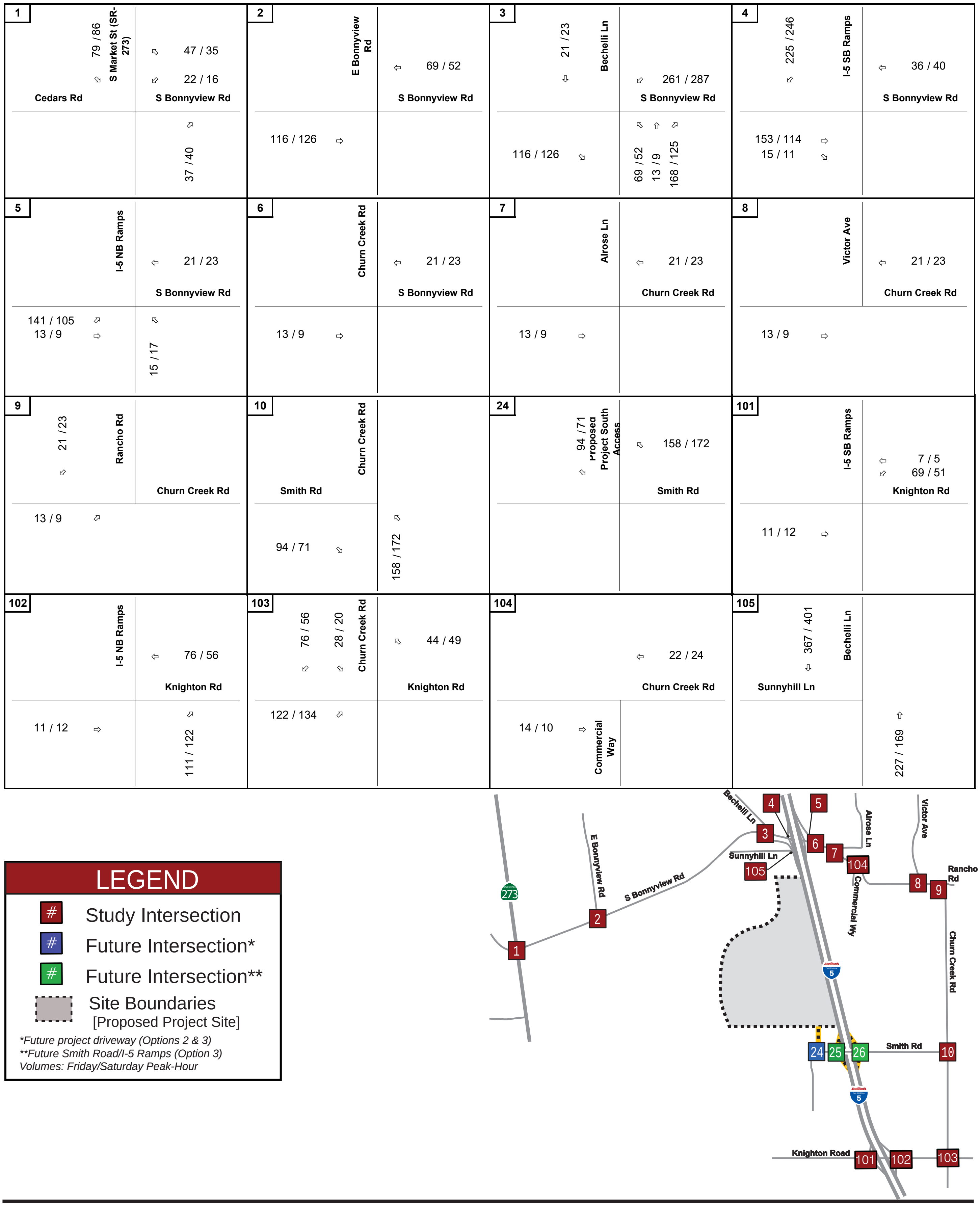

Figure 22
Project Trip Assignment for the Strawberry Fields Site (2B)

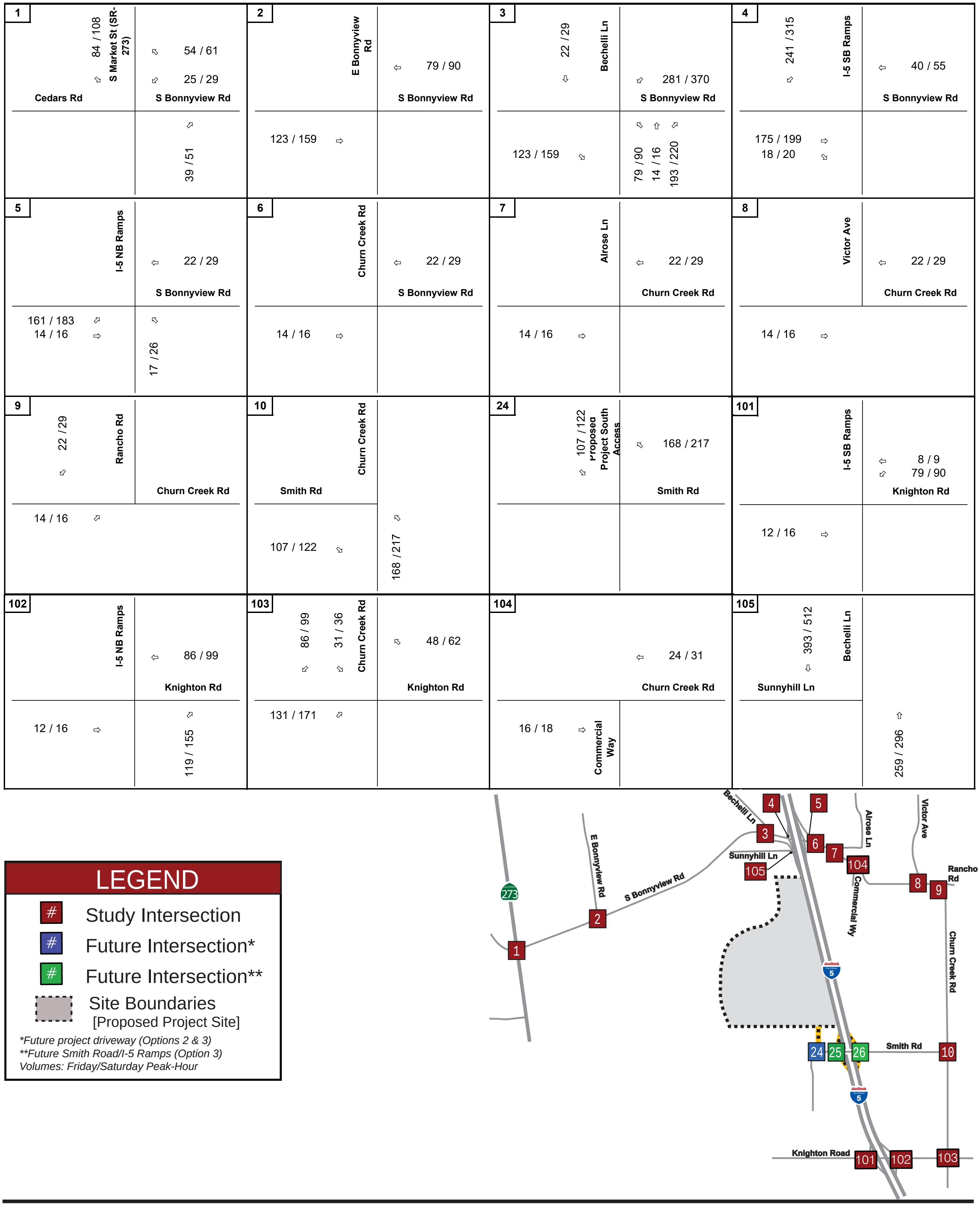

Figure 23
Project Trip Assignment for the Strawberry Fields Site (2C)

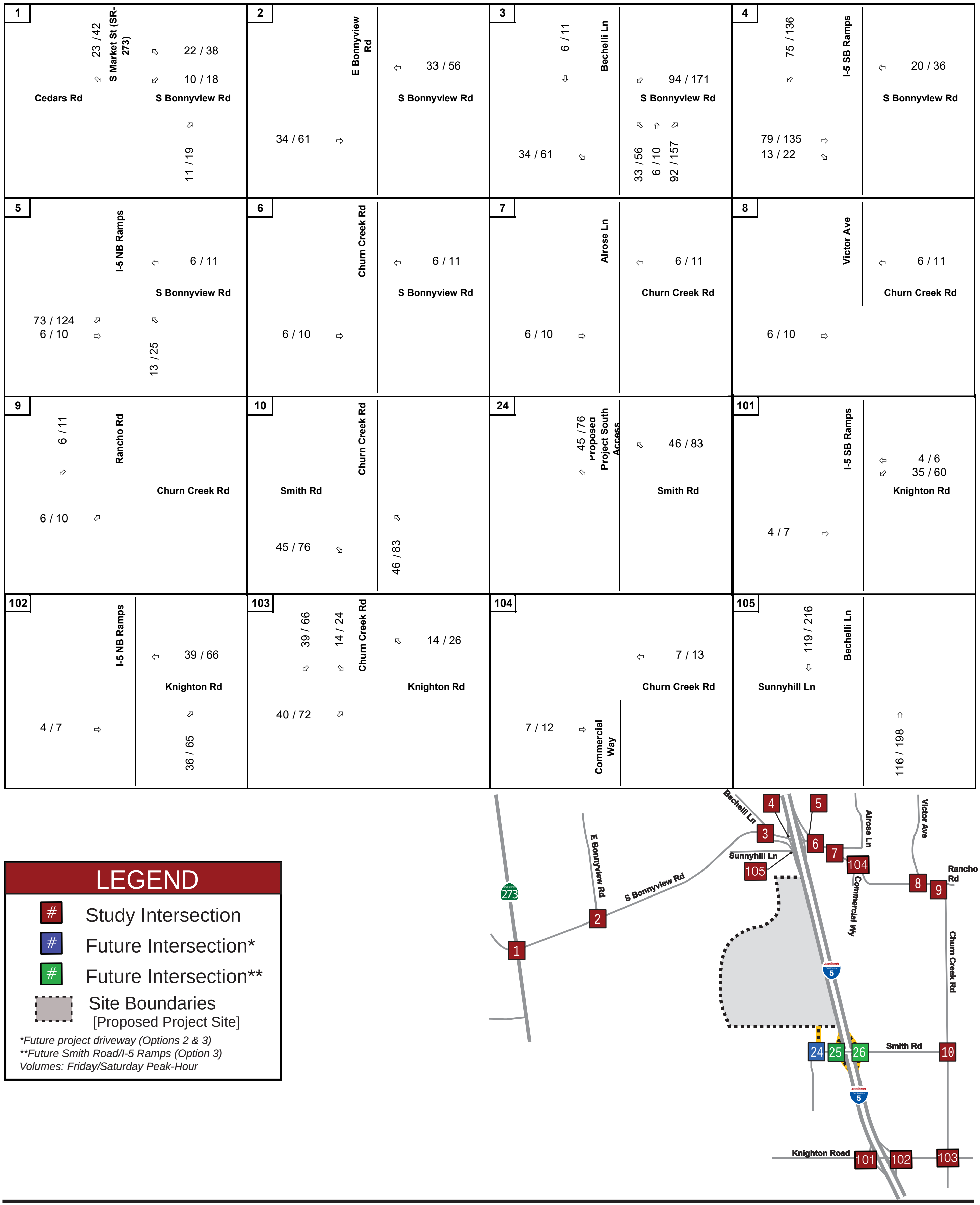

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Figure 24

Project Trip Assignment for the Strawberry Fields Site (2D)

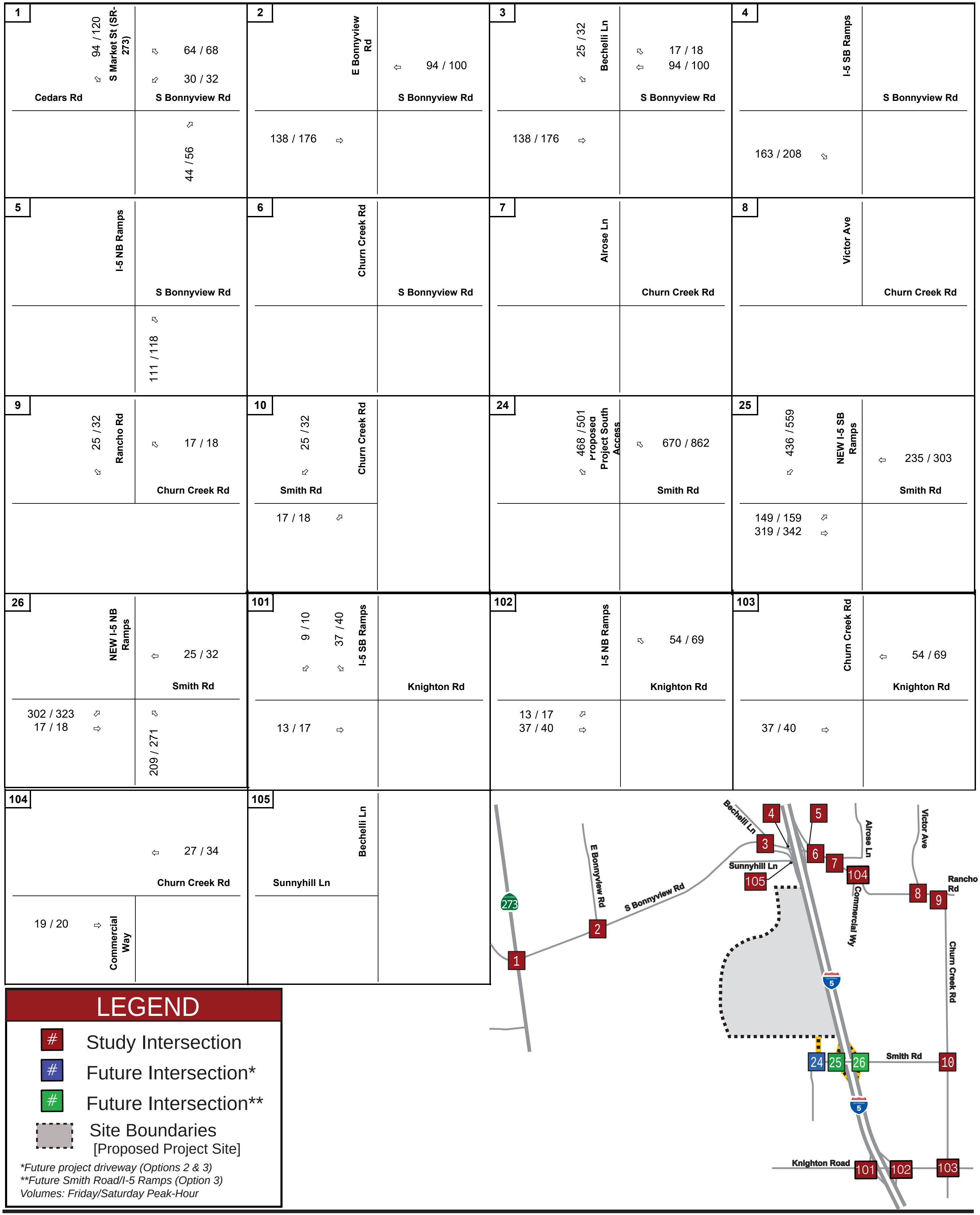


Figure 25

Project Trip Assignment for the Strawberry Fields Site (3A)

Redding Rancheria: Traffic Impact Study

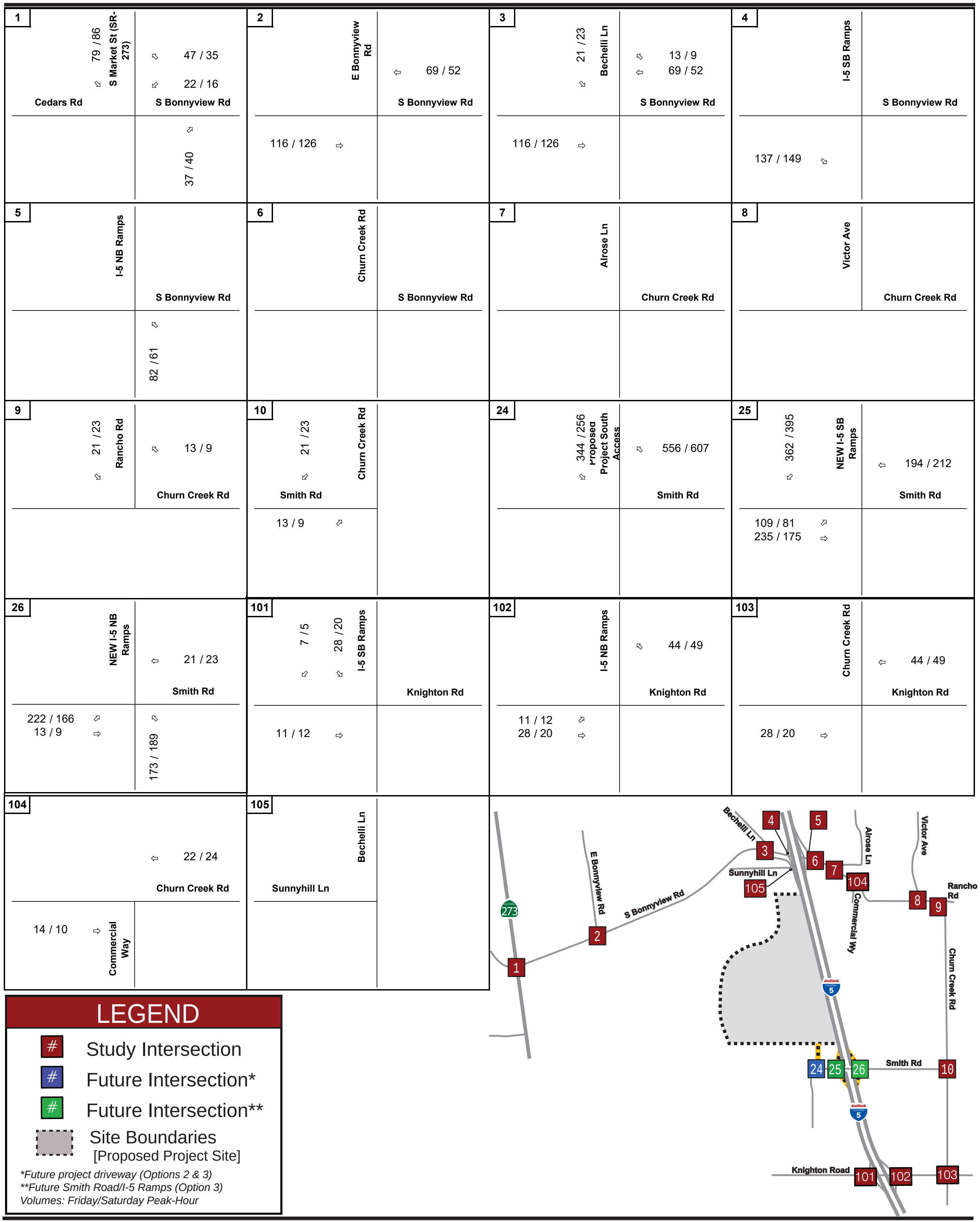
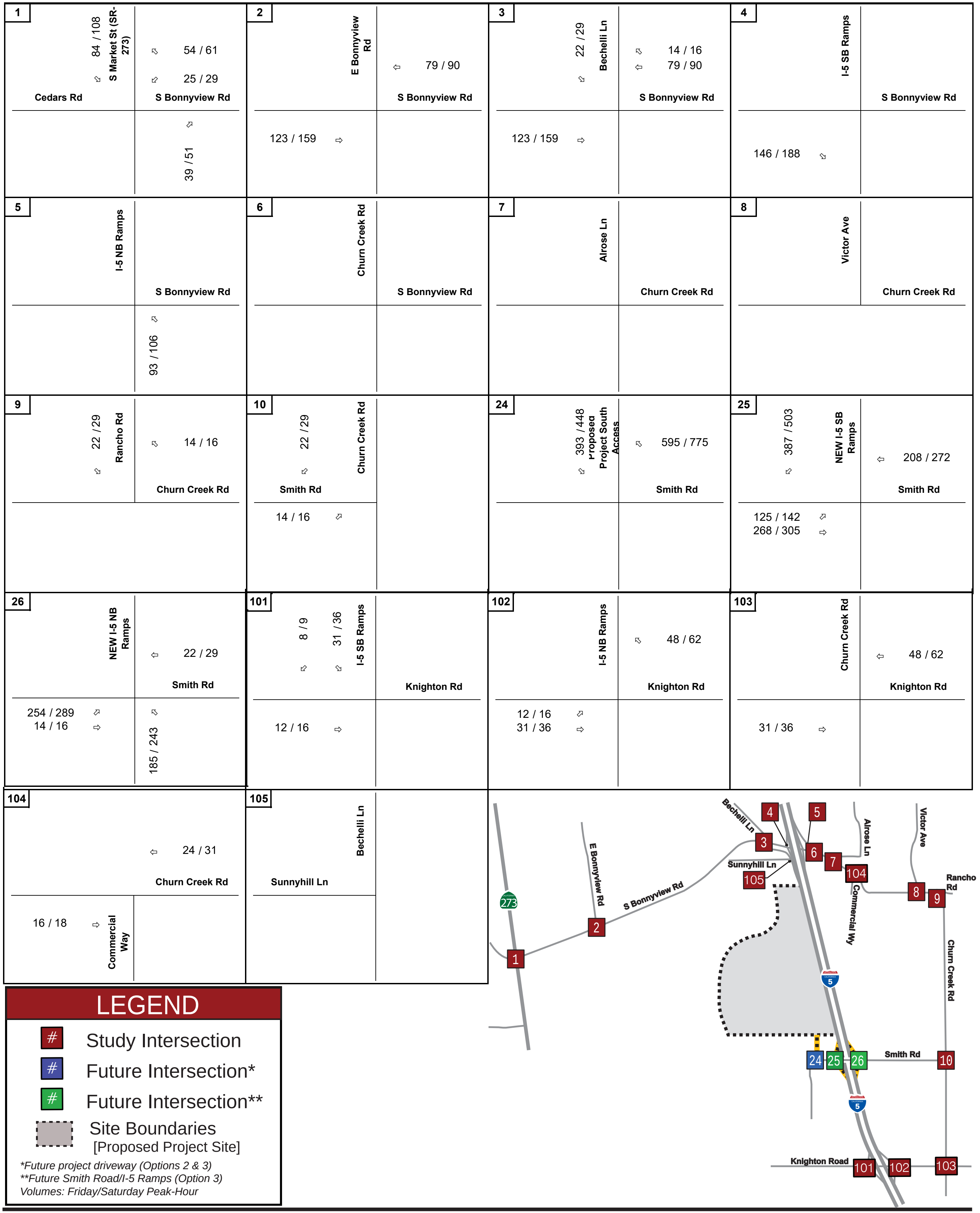


Figure 26

Project Trip Assignment for Strawberry Fields Site (3B)



*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

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Figure 27
Project Trip Assignment for Strawberry Fields Site (3C)

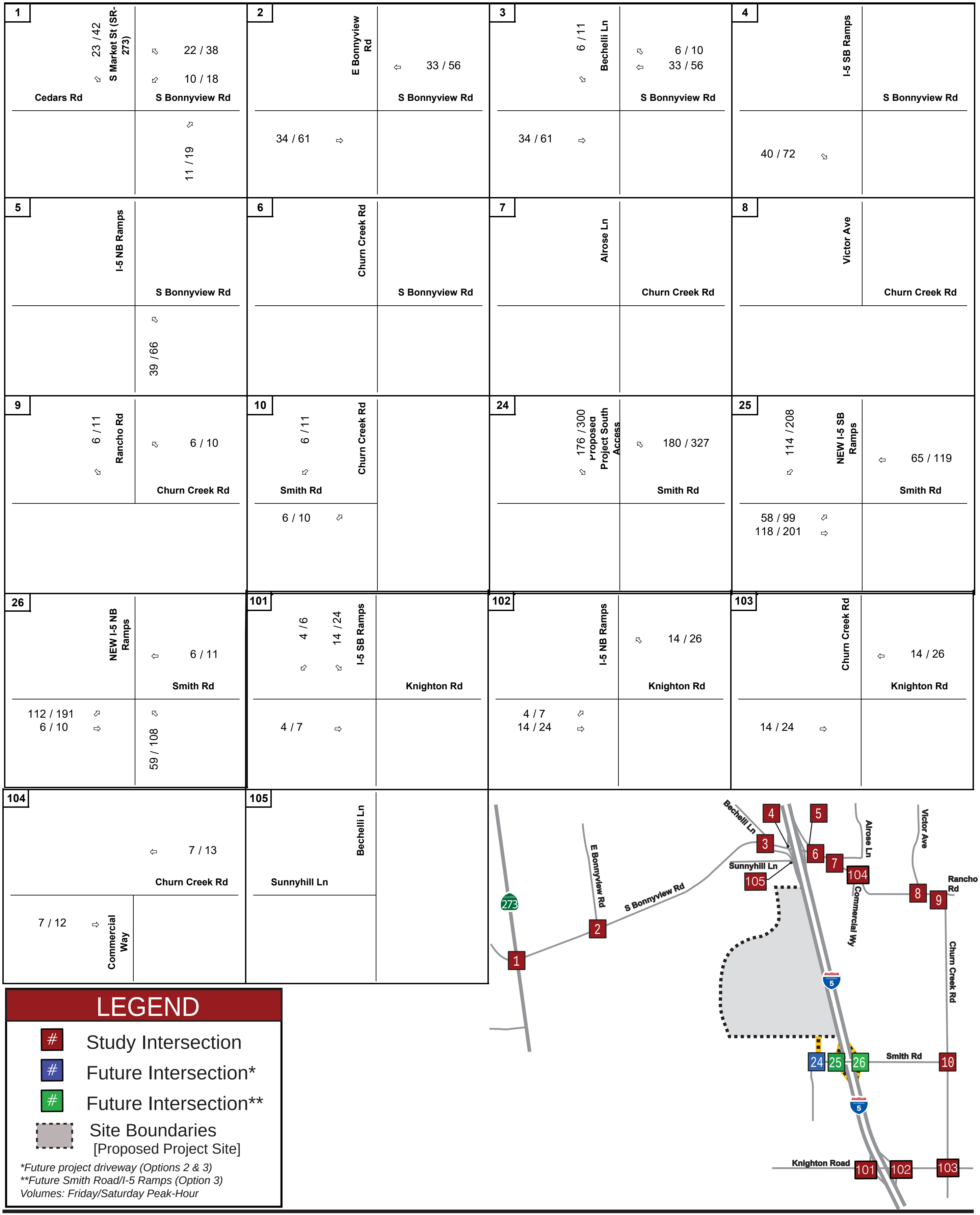

Figure 28

Project Trip Assignment for Strawberry Fields Site (3D)

Existing Win River Casino Resort Operations

With the construction of the new casino at the Strawberry Fields Site, the existing Win River Resort and Casino is expected to close and be redeveloped into tribal services and housing uses. This change in use at the existing casino site is expected to result in approximately one-third of the trips that currently access the existing Win River Casino Resort remaining on the network. As a result, to accurately evaluate the conditions at the study intersections, roadway segments, and freeway facilities with the addition of the proposed project, the existing Win River Casino Resort's trips were first removed from the network and the trips anticipated to be generated by the redevelopment of the site (one-third of the existing trips per the logic explained above) were the added to the network.

The removal of the existing site's trips from the network required an evaluation of the existing trips' travel patterns. To accomplish this, an origin-destination study using Wi-fi technology in which individual unique devices are matched as multiple locations, was completed during both peak periods to establish patterns for the traffic originating from and destined for the existing site. The Wi-fi data was collected on Market Street (SR-273) north and south of Redding Rancheria Road and along Bonnyview Road to determine the travel patterns of the existing Win River Resort and Casino patrons and the tribal services. The existing casino traffic distribution is shown in **Figure 29**. The existing tribal services traffic distribution is shown in **Figure 30**. Origin-destination data is included in **Appendix G**.

The number of trips that currently access the Win River Resort and Casino was determined based on traffic volume counts taken at the existing casino driveways in July 2016. The number of trips anticipated to be generated by the redevelopment of the existing Win River Resort and Casino was derived using data included in Trip Generation Manual, 9th Edition, published by ITE. Trip generation estimates for the existing casino and the proposed redeveloped are summarized in **Table 20**.

The number of trips estimated to be currently accessing the existing casino were subtracted from the roadway network based on the existing casino traffic distribution and the number of trips estimated to be generated by the proposed redevelopment were then added back into the roadway network based on the existing tribal services traffic distribution. The resulting existing Win River Resort and Casino adjustments are shown in **Figure 31**.

Table 20 – Existing Win River Casino Resort Adjustments

Land Use	ITE Code	Quantity	Units	Daily	Friday PM Peak Hour			Saturday PM Peak Hour		
					In	Out	Total	In	Out	Total
Existing Site					203	208	411	238	143	381
Proposed Land Use Changes										
Mid-Rise Apartment	223	180	Dwelling Units	1,198	41	29	70	28	28	56
General Office Building	710	45	KSF	498	11	56	67	10	9	19
Net New Vehicle Trips				1,696	52	85	137	38	37	75

Note: Saturday Peak Hour and Daily trips for Mid-Rise Apartment (ITE 223) estimated based on Apartment (220) Land Use

Figure 29

Existing Win River Resort and Casino Traffic Distribution

Figure 30
Existing Tribal Services Traffic Distribution

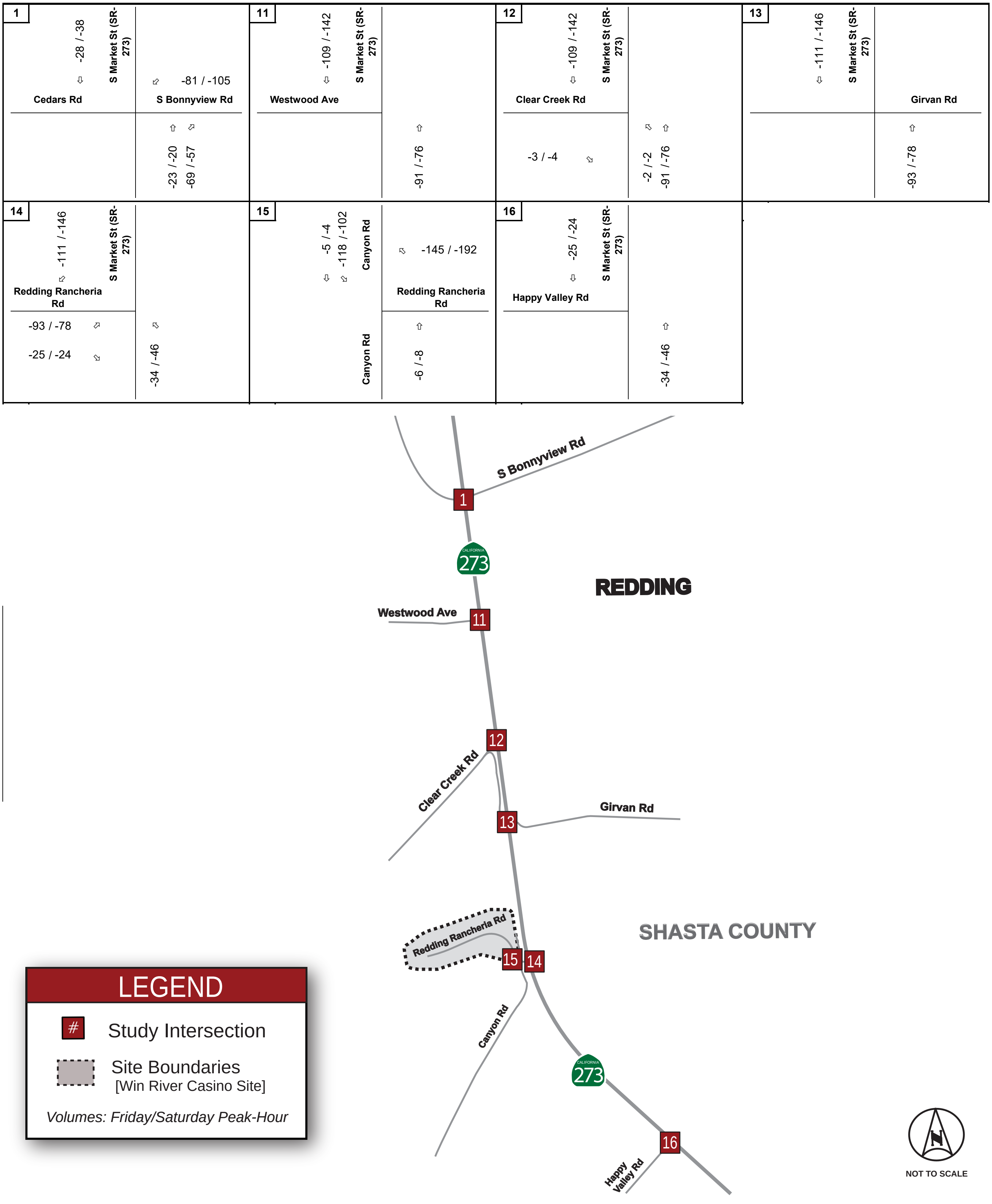

Figure 31

Existing Win River Resort and Casino Adjustments

Anderson Site

As part of the project, a development at an alternative site in the City of Anderson was evaluated.

- **Alternative E: Anderson Site Alternative (City of Anderson) -** Consists of a new casino and resort, including an approximately 69,515 square foot casino, 250-room hotel, an event/ convention center, and a retail center, as well as associated parking and infrastructure.

Site Access

The project site will be located in the northwest quadrant of the I-5 interchange and North Street in the City of Anderson. Site access for the Alternative Project Site is provided by Oak Street, located west of the I-5/North Street interchange in the City of Anderson.

Project Trip Generation

Trip generation rates are consistent with the proposed site trip generation alternatives (described above). Trip generation estimates for Project Alternative E are summarized in **Table 21**.

To accurately evaluate the conditions at the study intersections, roadway segments, and freeway facilities, the existing Win River Casino Resort's trips were removed from the network and the trips anticipated to be generated by the redevelopment of the site were added on the network.

Table 21 – Project Trip Generation at Anderson Site (Alternative E)

Land Use	ITE Code	Quantity	Units	Weekday	Weekday PM Peak Hour			Saturday	Saturday Peak Hour		
				Daily	In	Out	Total	Daily	In	Out	Total
Casino	N/A	48,060	Gaming Floor Area	9277	302	302	605	8273	348	213	561
Conference Center	N/A	10,080	SF	965	111	11	122	965	111	11	122
Event Center	N/A	1,800	Seats	1063	123	12	135	1063	123	12	135
Hotel	310	250	Rooms	511	19	18	38	512	25	20	45
Sporting Goods Superstore	861	120,000	SF	2702	106	115	221	3525	235	226	461
Subtotal Vehicle Trips				14517	661	459	1120	14338	842	482	1324
Diverted Link Trips(10%)- Applied only to Casino And Sporting Goods Store				(1198)	(41)	(42)	(83)	(1180)	(58)	(44)	(102)
Net New Vehicle Trips				13319	621	417	1038	13158	784	438	1222

SF- Square Feet

Casino			
Weekday PM Peak Hour	T=12.58 x (1000 SF Gaming Floor Area)	50% In	50% Out
Saturday Peak Hour	T=11.67 x (1000 SF Gaming Floor Area)	62% In	38% Out
Hotel			
Weekday PM Peak Hour (ITE 310)	T=0.15 x (Rooms)	51% In	49% Out
Weekday Daily (ITE 310)	T=2.04 x (Rooms)	50% In	50% Out
Saturday Peak Hour (ITE 310)	T=0.18 x (Rooms)	56% In	44% Out
Saturday Daily (ITE 310)	T=2.05 x (Rooms)	50% In	50% Out
Sports Retail			
Weekday PM Peak Hour (ITE 861)	T=1.84 x (1000 SF)	48% In	52% Out
Saturday Peak Hour (ITE 861)	T=3.84 x (1000 SF)	51% In	49% Out

(1) Source of Land Use Information: Redding Rancheria Casino Master Plan (February, 2016) and subsequent correspondence with Analytical Environmental Services.

(2) Casino trip generation rates based on local traffic data collected for existing Win River Casino. This rate is also consistent with the traffic data collected for the Win River Casino in 2007. (Omni-Means, 2007). The directional distributions were based on the existing conditions.

(3) The proposed casino facility includes other auxiliary/internal uses in addition to gaming area, such as restaurants, back of house, lounges, etc.
However, only the number of gaming position is used as the independent variable for the purposes of estimating trip generation. This is because the trip generation rates use gaming positions as the independent variable, and were developed based on empirical data from similar existing casino facilities, and include the trips associated with all of the casino uses (gaming areas, restaurants, lounges, back of house, etc.), excluding hotel facilities and convention space.

(4) The project site is located adjacent to Interstate, which carries over 45,000 vehicles per day. For the purposes of this analysis, the base daily and peak hour trip generation estimates are adjusted based on an average diverted link rate of 10 percent. This adjustment is likely conservative and is within the range identified by Caltrans' guidance for pass-by/diverted link trip reductions (Caltrans Guide for the Preparation of Traffic Impact Studies, 2002). Only diverted link trip reductions are used to account for all trips assumed to already be on the adjacent network, including pass-by trips. The diverted link trip reduction is applied only to the trips generated by the casino and the sporting good store.

(5) Trip generation for the proposed conference center was developed based on the estimated number of attendees. The maximum number of event attendees/seats was estimated to be 672 people, based on an average of 15 SF per attendee, which is consistent with industry best practices for conference/event space planning. For the purposes of this traffic analysis, the peak trip generation for the conference center assumes an event with 85 percent of the capacity filled, which corresponds to approximately 571 attendees.
Based on the 2016 study of Cache Creek Casino Resort, it is assumed that when conference/meeting activities are scheduled, 25 percent of the 250 on-site hotel rooms would be occupied by event attendees with an average occupancy of 1.3 attendees per room. Thus, 81 attendees would stay on-site, and not drive to/from an event. The remaining attendees (490) would drive to the site. Assuming an average auto occupancy of 2.2 people per vehicle, approximately 223 vehicles trips would generated. The majority of event trips are anticipated to occur outside of the PM peak traffic period (4:00 PM to 6:00 PM), as events typically have a start time between 7:00 AM and 8:00 AM. It was assumed that 50 percent of event attendees would arrive during the peak hour. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits.

(6) Trip generation rates for the proposed event center were based on a previous study of a similar facility at the Cache Creek Casino and Resort. This assumes that most of the patrons visiting the event are already onsite at the casino, and only 30 percent of the patrons represent new trips. Assuming an average auto occupancy of 2.2 people per vehicle, approximately 245 new trips are generated by event facility. It was assumed that 50 percent of patrons would arrive during the peak hour. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits.

(7) Trip generation rates for the Hotel (ITE 310) and Sporting Goods Superstore (ITE 861) are based on ITE Trip Generation Manual, 9th Edition. The trip generation rate for the Hotel (ITE 310) is reduced by 75 percent to account for internal capture to/from the casino. For the Sporting Goods Store (ITE 861), it was conservatively assumed that the peak hour of Generator occurs during the peak hour for the Casino Facility.

(8) Daily rates for Casino, Conference Center and Event Center are calculated from the peak hour to daily relationships from Kimley-Horn's 2016 Ione Casino and Cash Creek Casino studies; daily rates for Sporting Goods Superstore are are calculated from the peak hour to daily relationships from the ITE use of Department Store (ITE 861)

Project Trip Distribution and Assignment

Most of the casino project trips are expected to travel to and from I-5 with origins and destinations in Redding to the north and Red Bluff and neighboring communities to the south. A significant portion of the trips are expected to come from Redding, given the city's population relative to neighboring cities. Therefore, based on the likely customer and employee base for the site and orientation of the regional roadway network, it was estimated that approximately 73 percent of the project traffic would come from the north – the vast majority of these trips using I-5 and SR-273. A smaller proportion of the trips coming from communities in eastern Anderson are expected to use North Street. Approximately 20 percent of the project traffic would come from the south of the site via I-5, with an additional 7 percent traveling to the site from within Anderson via North Street, South Road and Balls Ferry Road. The project traffic distribution for the alternative site is shown in **Figure 32.**

Project traffic assigned to the study intersections based on the assumed trip distribution and generation for the alternative site alternative is shown in **Figure 33.**

Figure 32

Project Traffic Distribution for the Anderson Site

Figure 33

Project Trip Assignment for the Anderson Site

Win River Casino Site

As part of the project, the expansion of the existing Win River Casino Resort was evaluated.

- **Alternative F: Expansion of Existing Win River Casino Resort-** Consists of the remodeling of the existing event center into additional casino area, a new event center and a 7-story parking garage.

Site Access

Site access to the Win River Casino Site is provided by Redding Rancheria Road, located west of Market Street (SR-273).

Project Trip Generation

Trip generation rates are consistent with the proposed site trip generation alternatives (described above). Trip generation estimates for Project Alternative F are summarized in **Table 22**.

Unlike the other alternatives, this alternative “credits” the proposed project with the trips associated with the existing casino’s operations and evaluates the “proposed project” as only the additional trips anticipated to be generated by the expansion.

Project Trip Distribution and Assignment

The trip distribution for the expansion of the existing Win River Casino Resort was estimated based on the location of the site and the surrounding land uses, as well as the existing traffic flow patterns. The Win River Casino Site is located in southwest Redding, just off SR-273. SR-273 and I-5 will likely carry the vast majority of the project trips. SR-273 is expected to carry an estimated 25 percent of the trips from neighborhoods in southwest Redding, as well as the City of Anderson. Additionally, an estimated 25 percent of the project trips are expected to travel south from downtown Redding and the surrounding developments. The remaining half of the project trips are also expected to use I-5, with a small proportion traveling along Churn Creek Road. The trips will travel then along South Bonnyview Road before reaching SR-273. The project traffic distribution for the existing casino site is shown in **Figure 34.**

Project traffic assigned to the study intersections based on the assumed trip distribution and generation for the existing site alternative is shown in **Figure 35**.

Table 22 – Project Trip Generation at Win River Casino Site (Alternative F)

Land Use	ITE Code	Quantity	Units	Weekday	Weekday PM Peak Hour			Saturday	Saturday Peak Hour		
				Daily	In	Out	Total	Daily	In	Out	Total
Proposed Expansion											
Casino	N/A	9,826	Gaming Floor Area	1897	62	62	124	1691	71	44	115
Subtotal Vehicle Trips				1897	62	62	124	1691	71	44	115
Diverted Link Trips(0%)- Applied only to CasinoTrips											
Net New Vehicle Trips				1897	62	62	124	1691	71	44	115

SF- Square Feet

Casino

Weekday PM Peak Hour	T=12.58 x (1000 SF Gaming Floor Area)	50% In	50% Out
Saturday Peak Hour	T=11.67 x (1000 SF Gaming Floor Area)	62% In	38% Out

Hotel

Weekday PM Peak Hour (ITE 310)	T=0.15 x (Rooms)	51% In	49% Out
Saturday Peak Hour (ITE 310)	T=0.18 x (Rooms)	56% In	44% Out

(1) Source of Land Use Information: Redding Rancheria Casino Master Plan (February, 2016) and subsequent correspondence with Analytical Environmental Services.

(2) Casino trip generation rates based on local traffic data collected for existing Win River Casino. This rate is also consistent with the traffic data collected for the Win River Casino in 2007. (Omni-Means, 2007). The directional distributions were based on the existing conditions.

(3) The proposed casino facility includes other auxiliary/internal uses in addition to gaming area, such as restaurants, back of house, lounges, etc.
However, only the number of gaming position is used as the independent variable for the purposes of estimating trip generation. This is because the trip generation rates use gaming positions as the independent variable, and were developed based on empirical data from similar existing casino facilities, and include the trips associated with all of the casino uses (gaming areas, restaurants, lounges, back of house, etc.), excluding hotel facilities and convention space.

(4) Trip generation rates for the proposed event center were based on a previous study of a similar facility at the Cache Creek Casino and Resort. This assumes that most of the patrons visiting the event are already onsite at the casino, and only 30 percent of the patrons represent new trips. Assuming an average auto occupancy of 2.2 people per vehicle, approximately 245 new trips are generated by event facility. It was assumed that 50 percent of patrons would arrive during the peak hour. Conservatively, 10-percent of these trips were also added as exiting trips during the peak-hour to reflect potential drop-off/pick-up activities and short duration site visits.

(5) Daily rates for Casino, Conference Center and Event Center are calculated from the peak hour to daily relationships from Kimley-Horn's 2016 Ione Casino and Cash Creek Casino studies; daily rates for Sporting Goods Superstore are are calculated from the peak hour to daily relationships from the ITE use of Department Store (ITE 861)

(6) Unlike the other alternatives, this alternative “credits” the proposed project with the trips associated with the existing casino’s operations and evaluates the “proposed project” as only the additional trips anticipated to be generated by the expansion. It was assumed that the expansion will include the replacement of the existing event center with 9,826 square feet of additional Casino space, a new event center nearly equivalent in size to the existing event center, and a 7-story parking garage.

Figure 34

Project Traffic Distribution for the Win River Casino Site

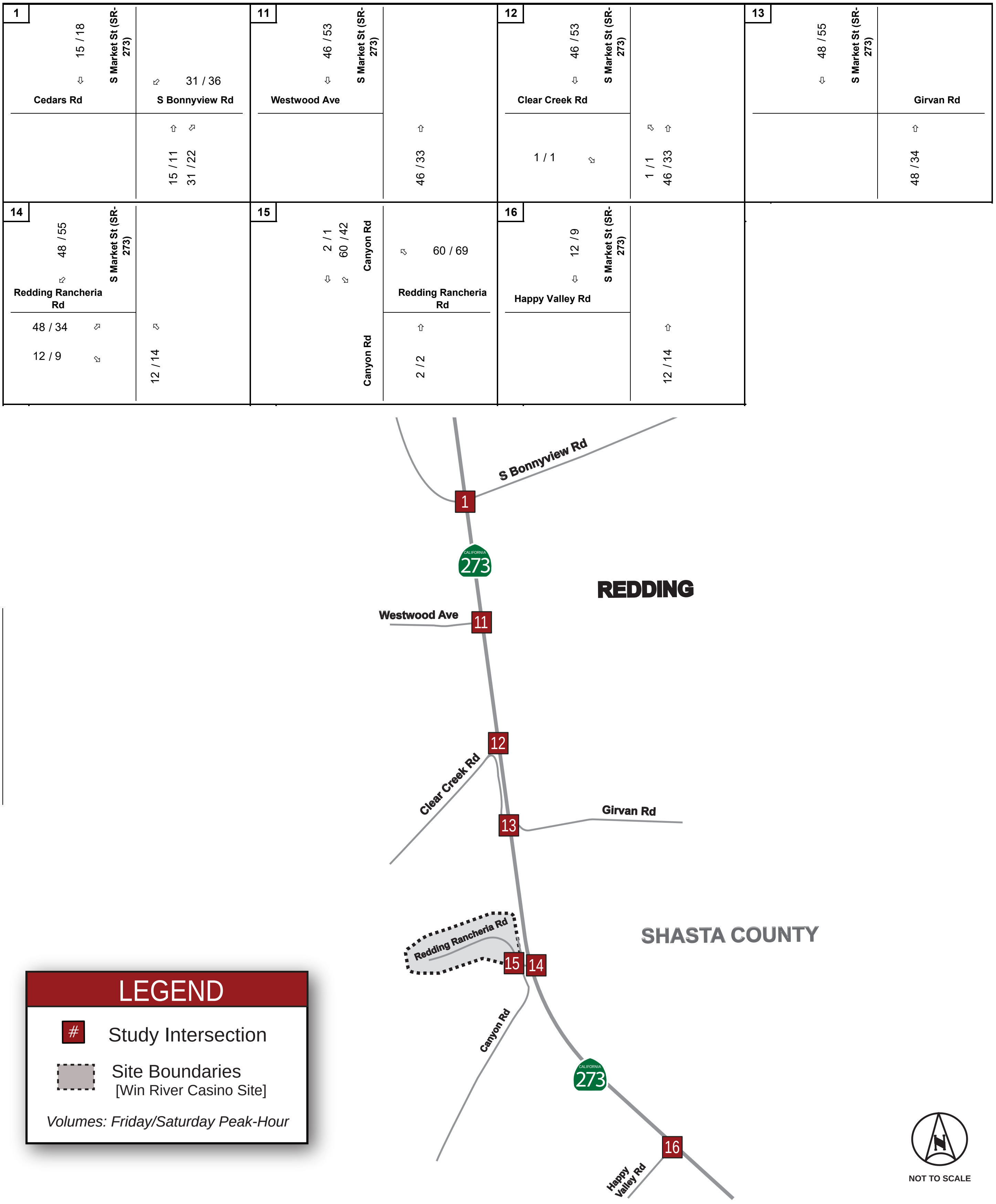

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Figure 35

Project Trip Assignment for the Win River Casino Site

Opening Year (2025) Plus Project Traffic Volumes

Opening Year (2025) traffic volumes were combined with vehicle trips expected to be generated by the proposed Project. **Figures 36-49** illustrate the Opening Year (2025) Plus Project turning movement volumes at the study intersections for all alternatives.

Cumulative (2040) Plus Project Traffic Volumes

Cumulative (2040) traffic volumes were combined with vehicle trips expected to be generated by the proposed project. **Figures 50-63** illustrate the Cumulative (2040) Plus Project turning movement volumes at the study intersections for all alternatives.

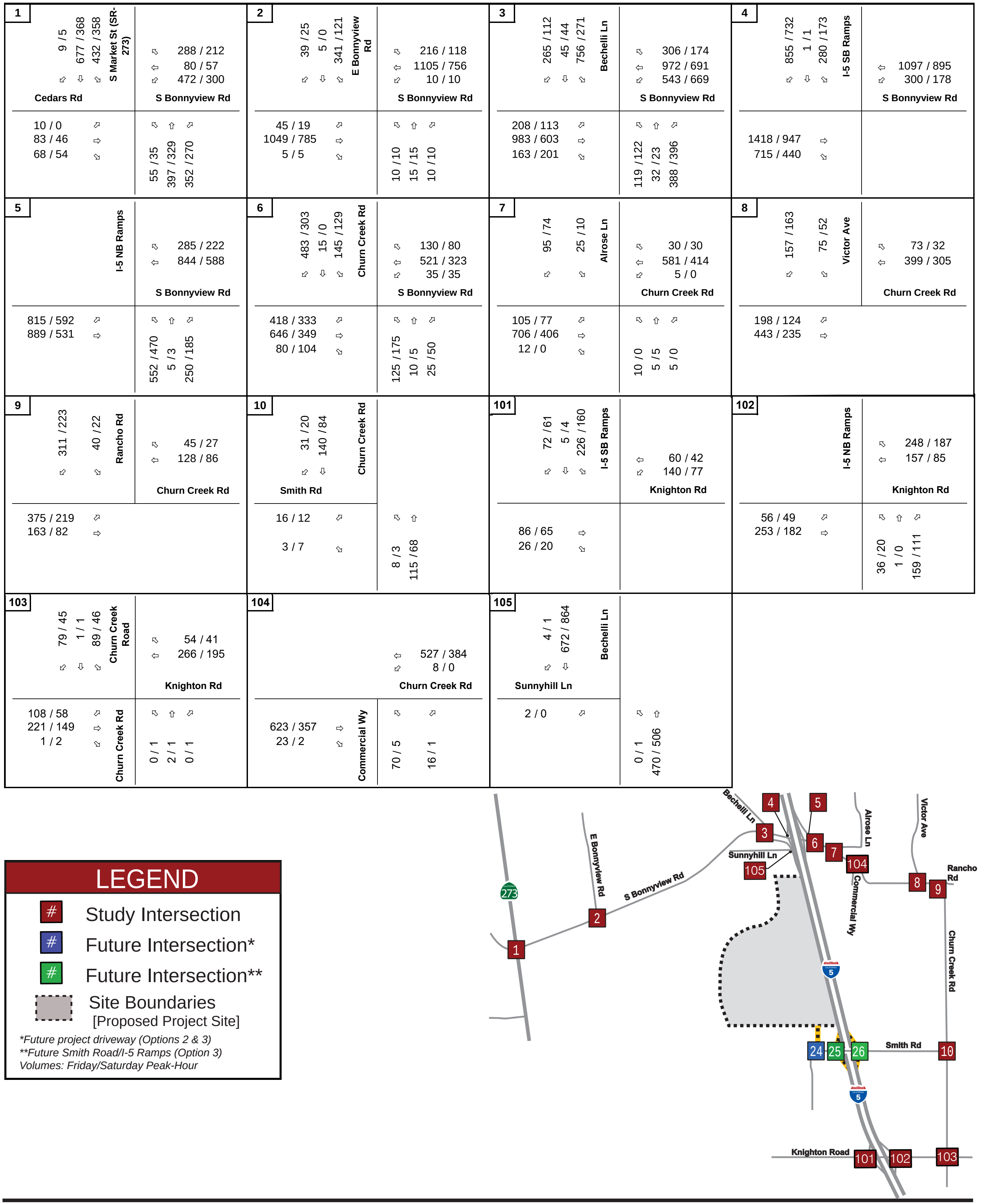

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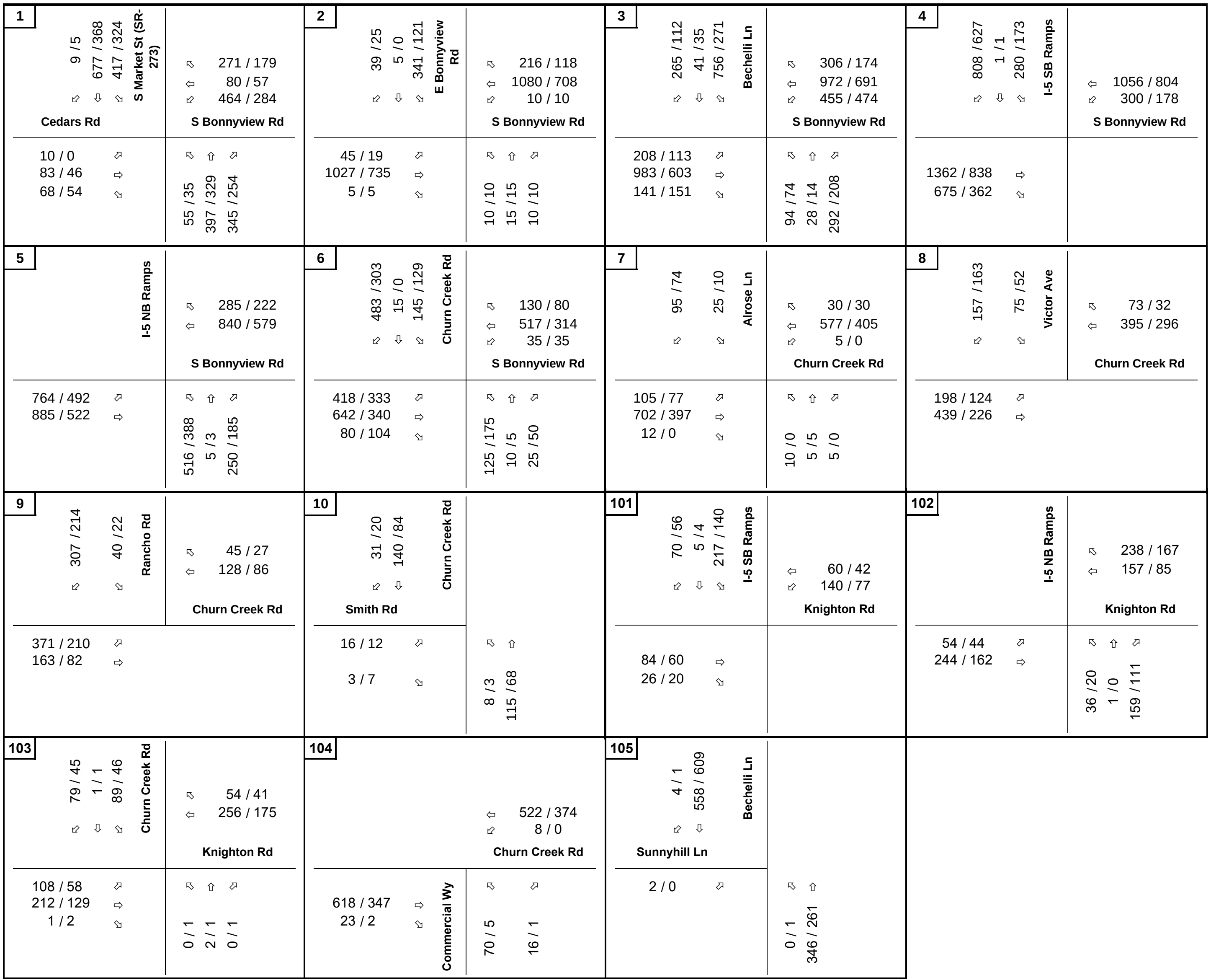
Figure 36

Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (1A)



LEGEND

🟥 # Study Intersection

🟦 # Future Intersection*

🟩 # Future Intersection**

▨ Site Boundaries
[Proposed Project Site]

*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

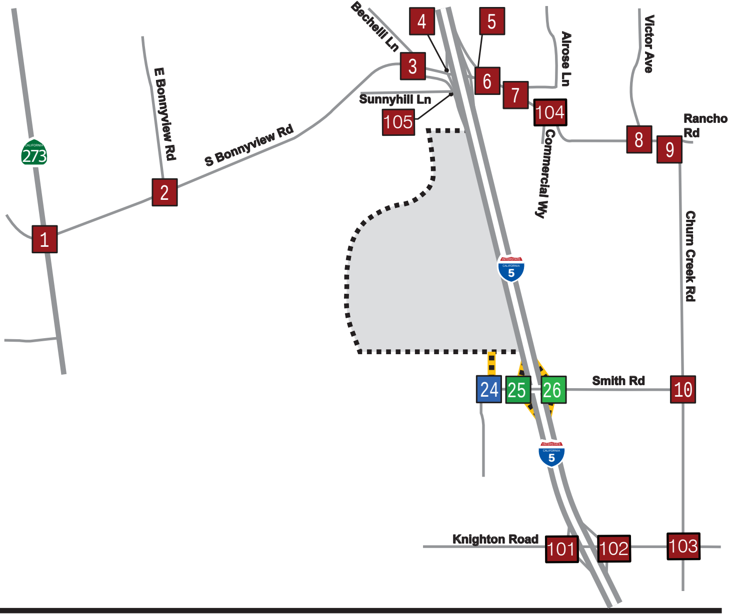
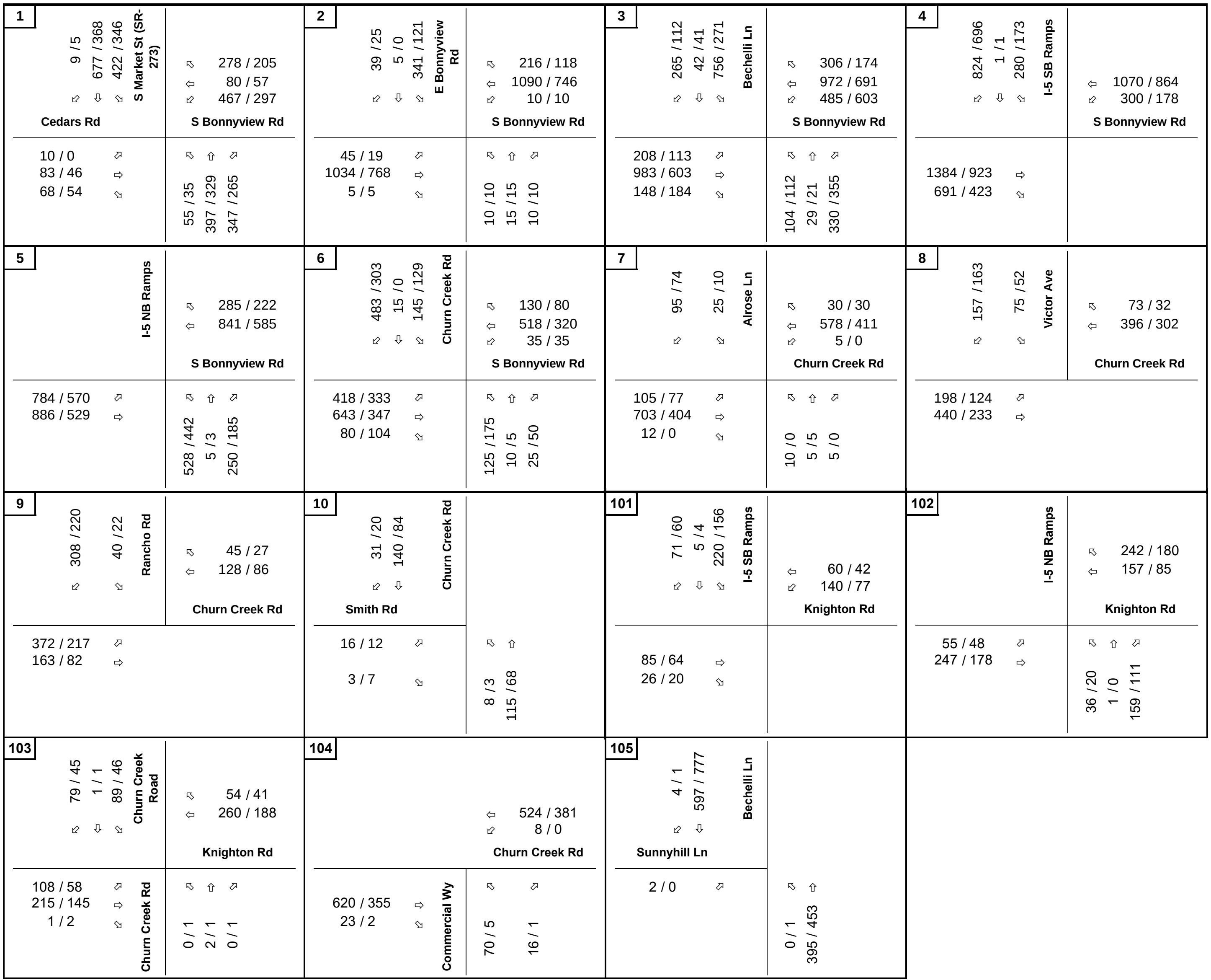
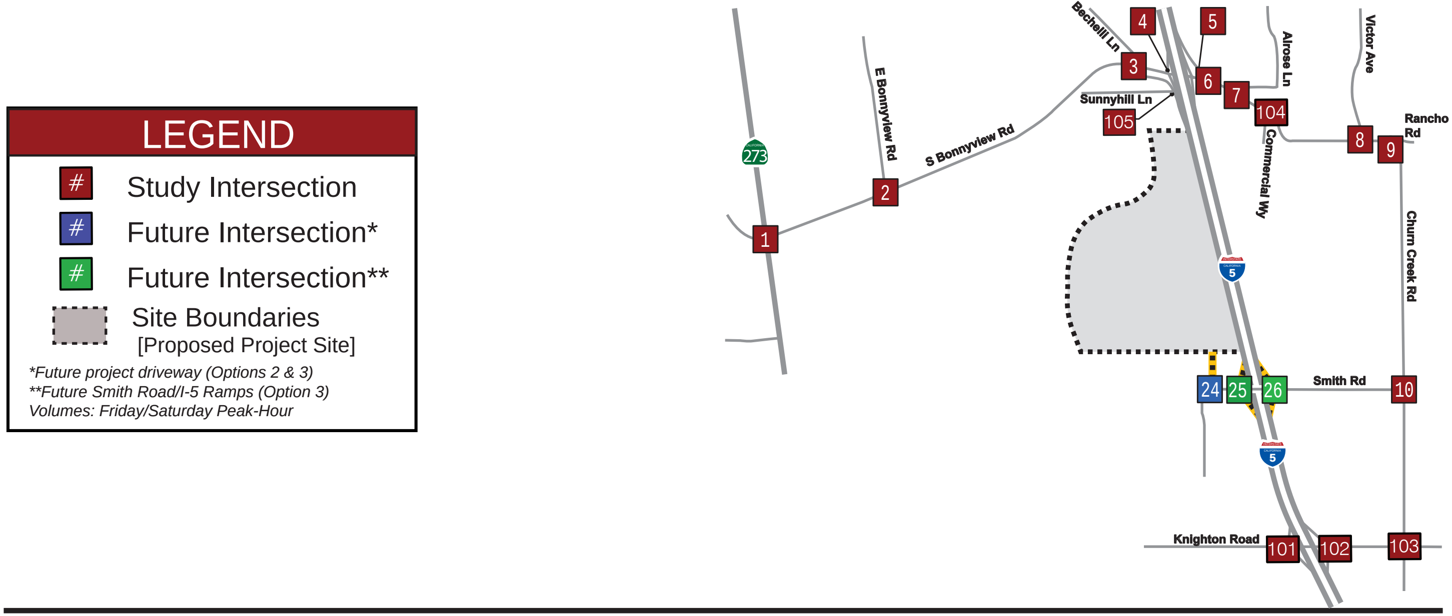


Figure 37

Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (1B)





*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Figure 38
Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (1C)

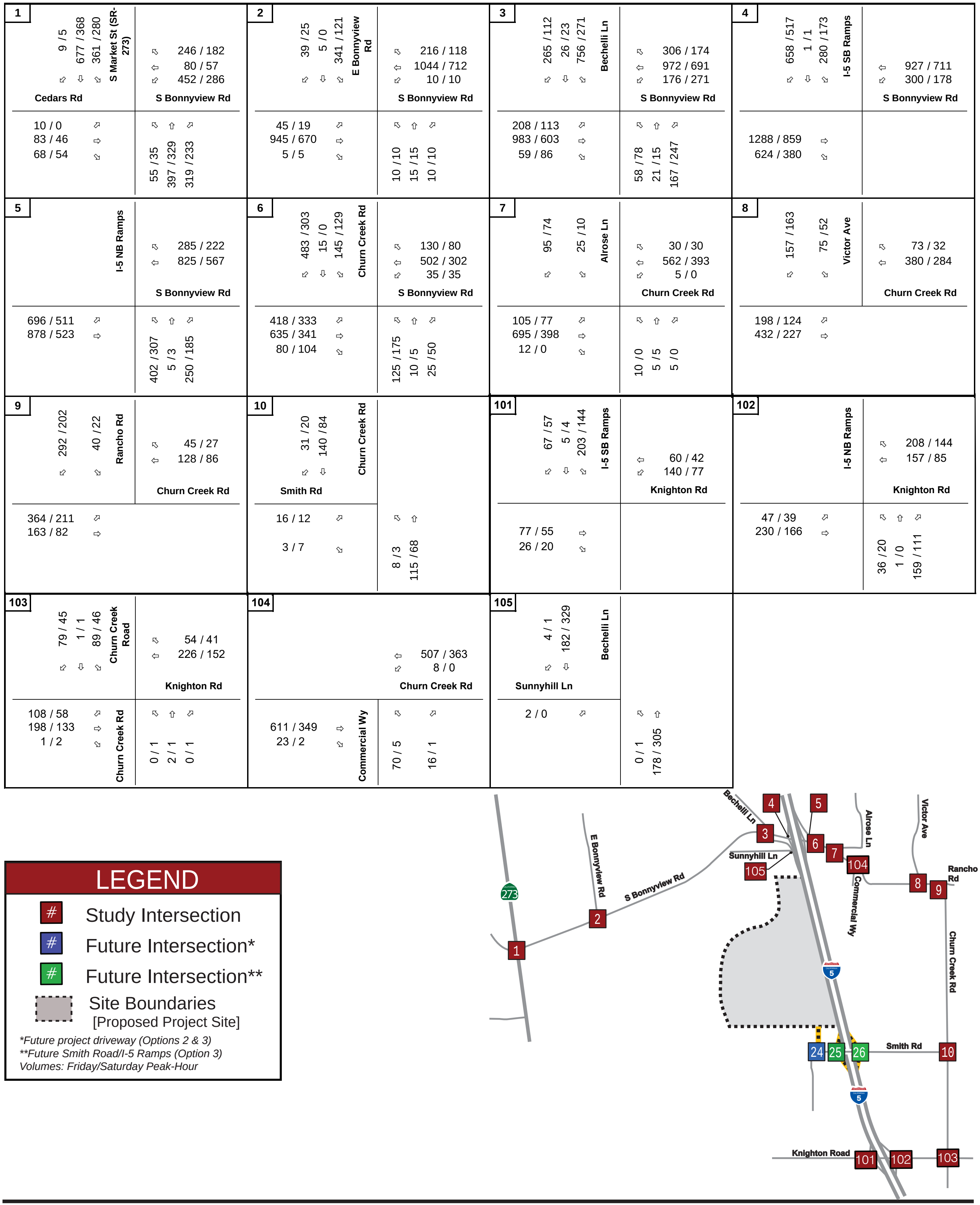
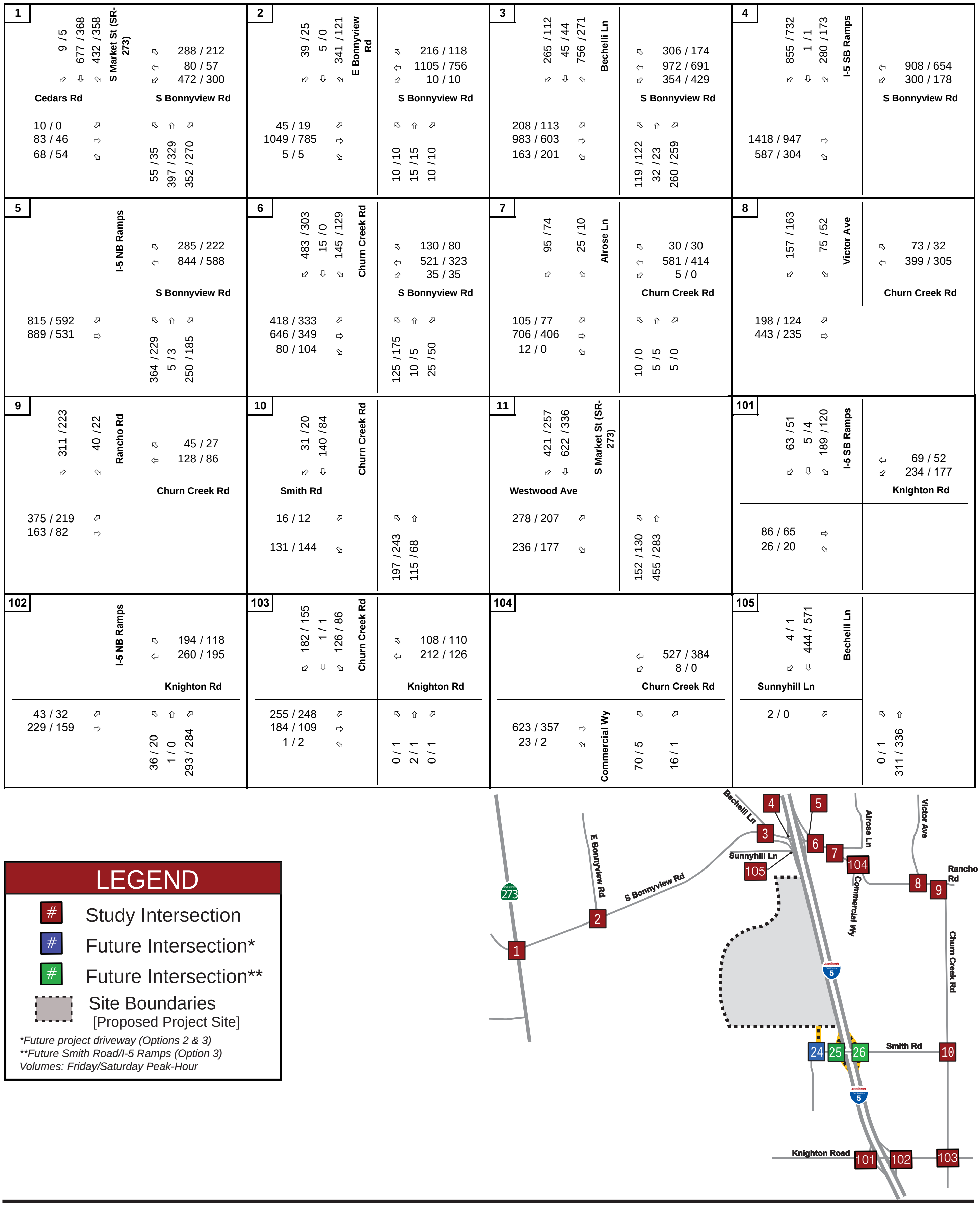


Figure 39

Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (1D)



*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Figure 40
Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (2A)

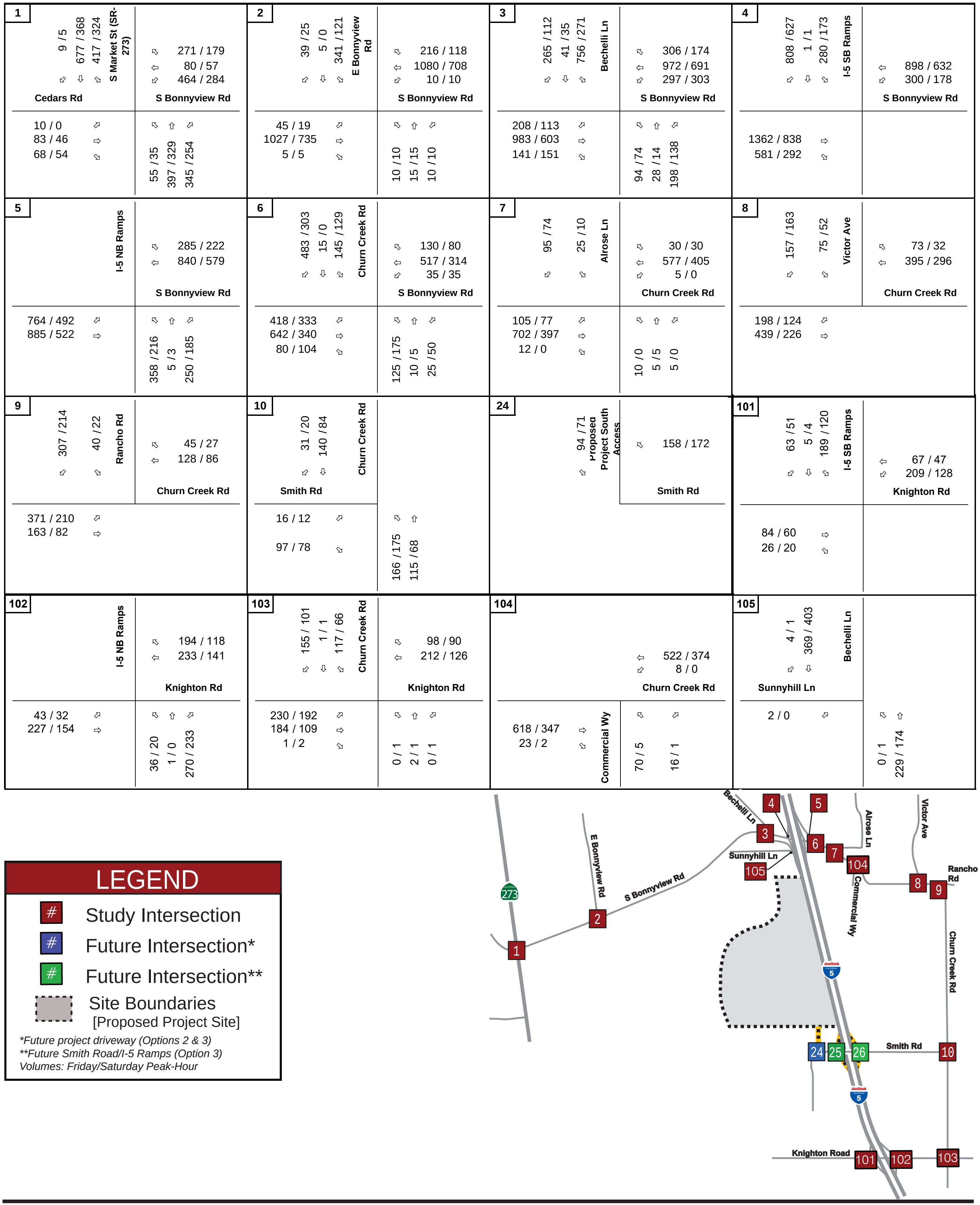


Figure 41
Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (2B)

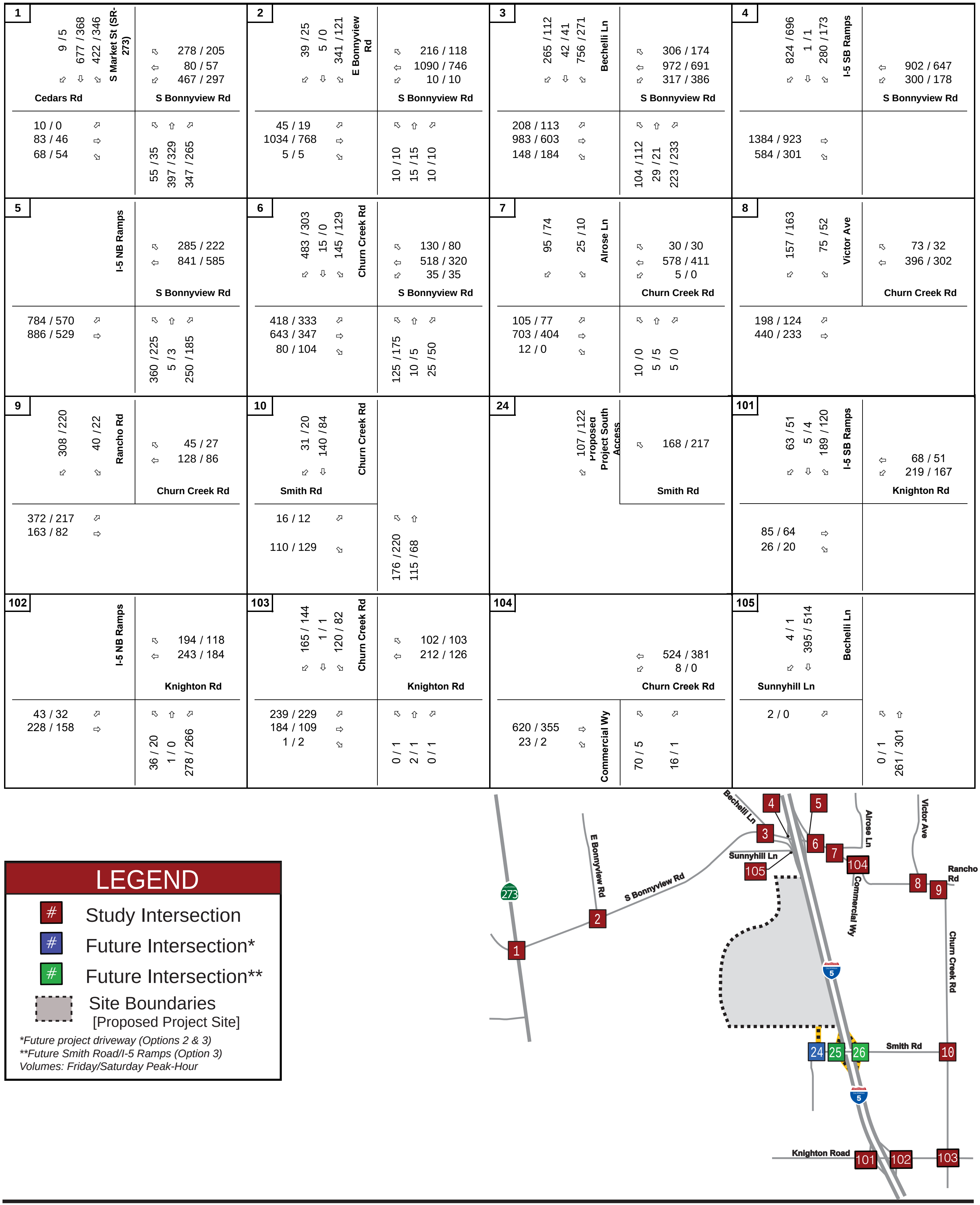
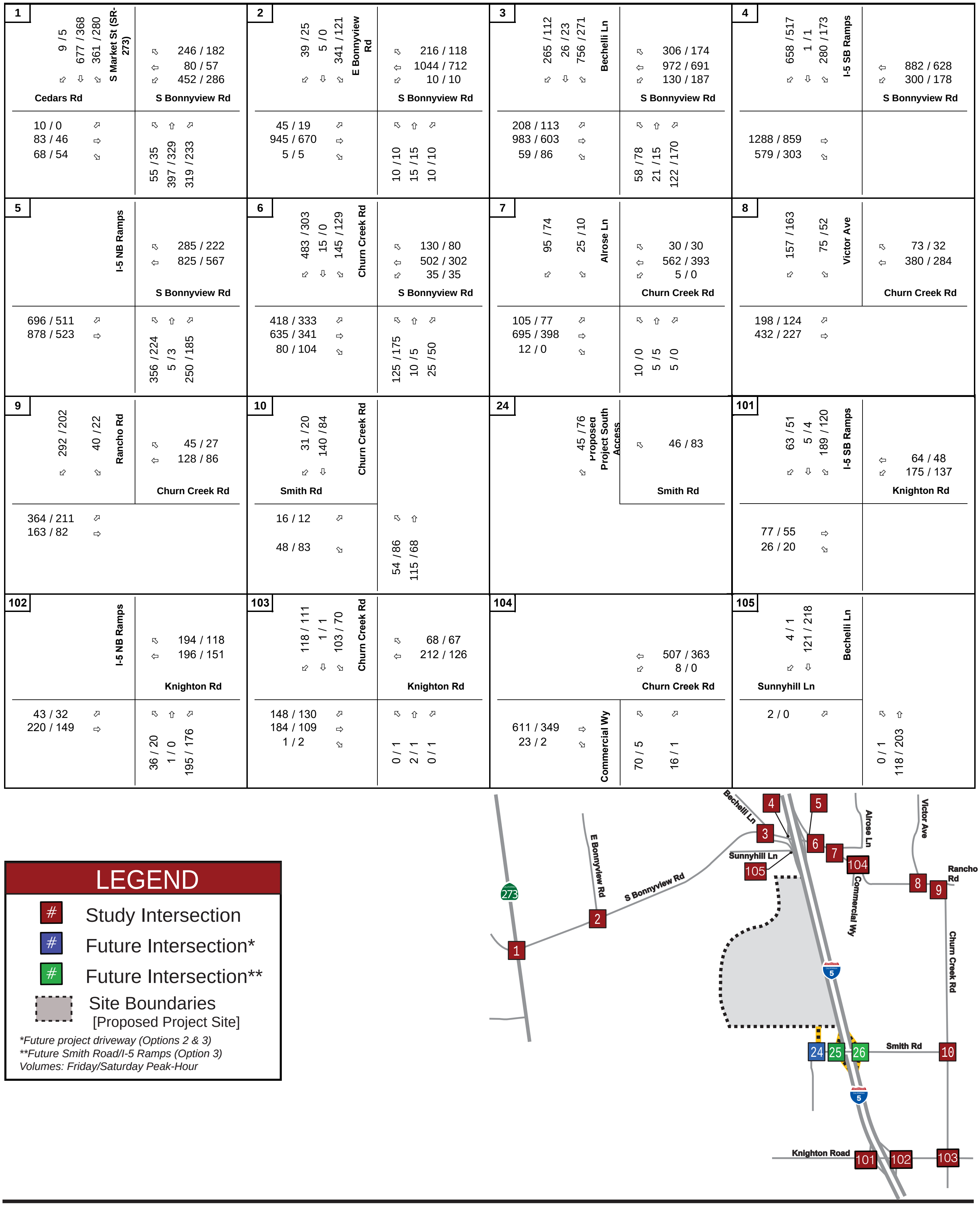


Figure 42

Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (2C)



*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

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Figure 43
Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (2D)

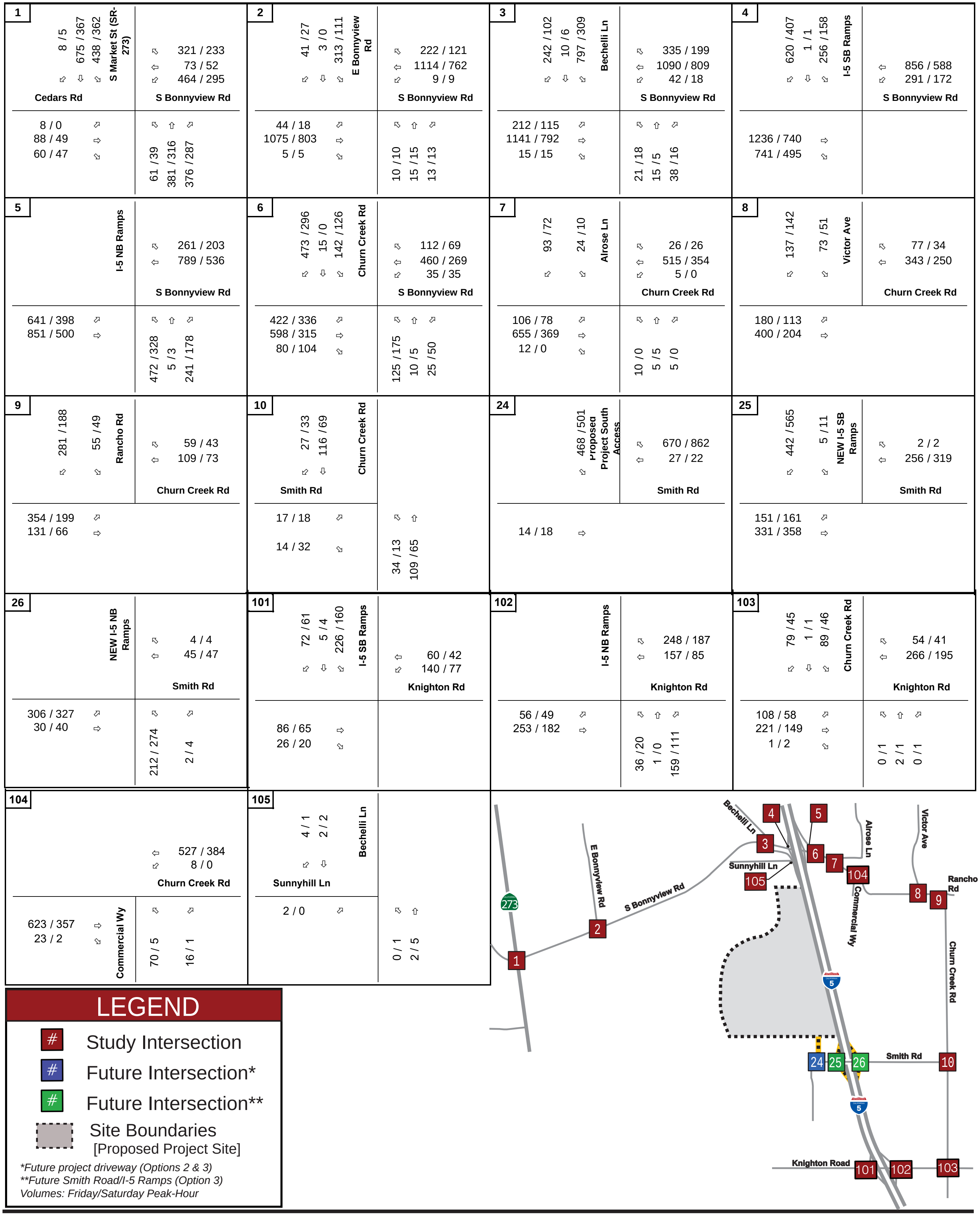
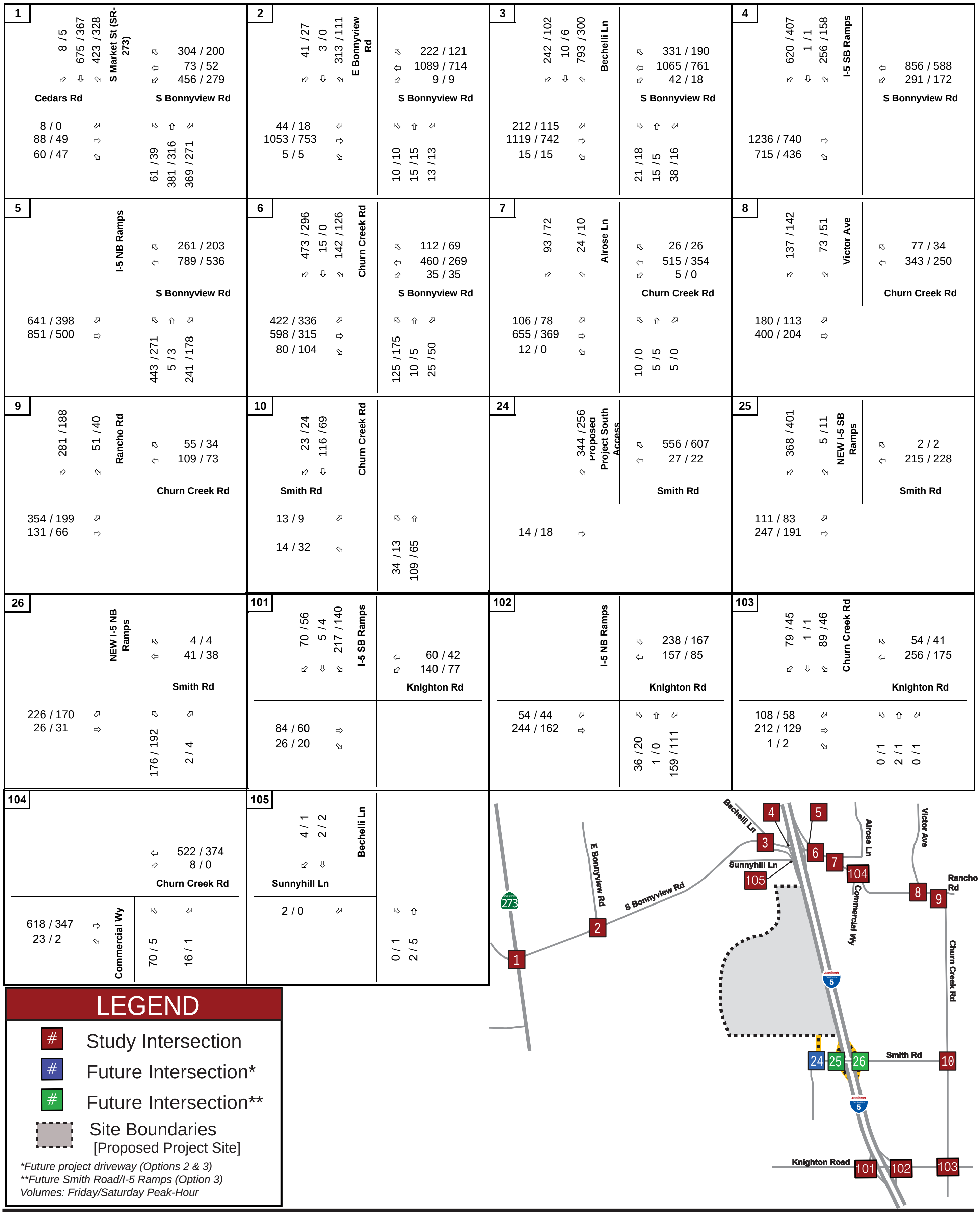


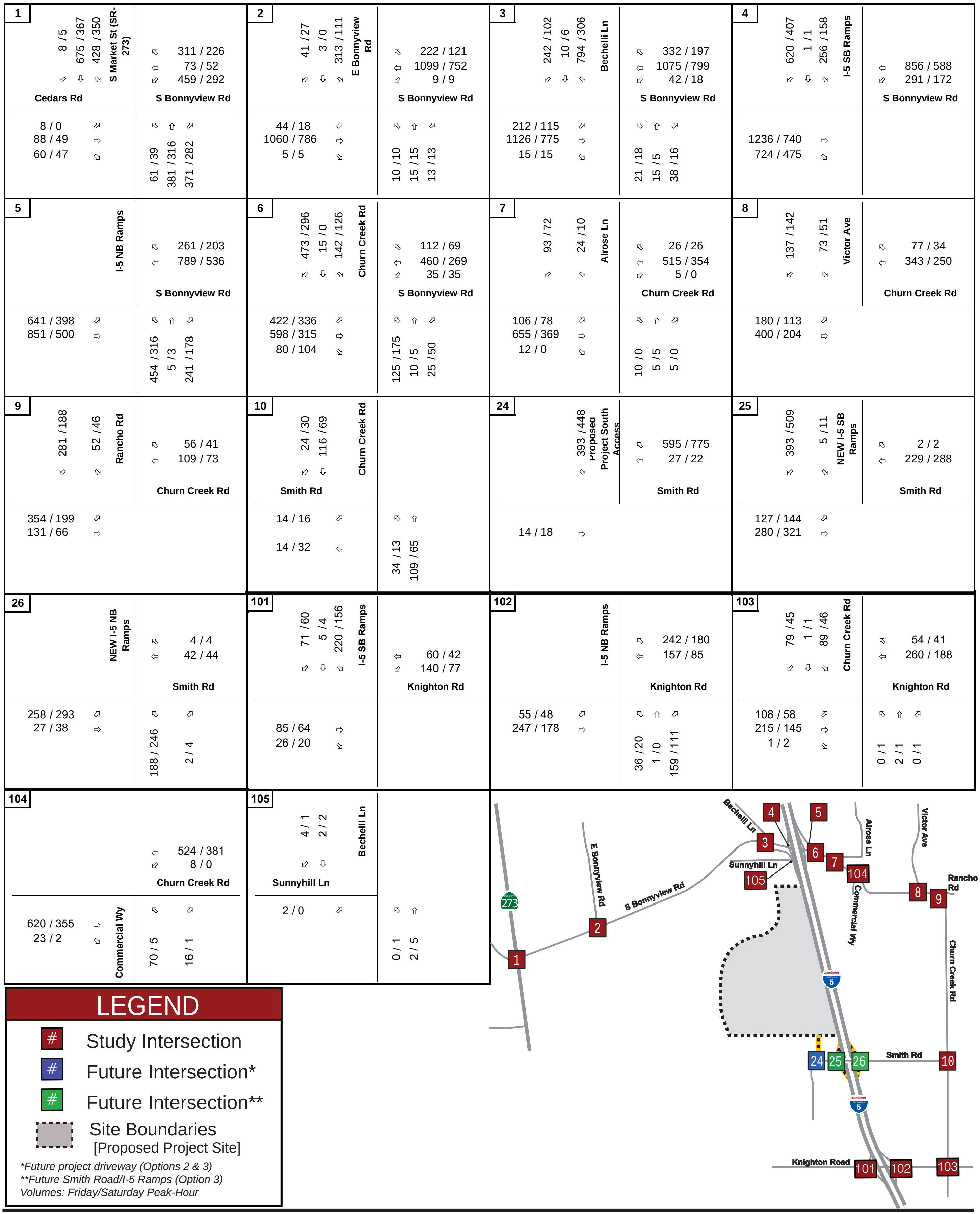
Figure 44

Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (3A)



*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Figure 45
Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (3B)



LEGEND

- 🟥 # Study Intersection
- 🟦 # Future Intersection*
- 🟩 # Future Intersection**
- ▨ Site Boundaries [Proposed Project Site]

*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Kimley»Horn

Figure 46
Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (3C)

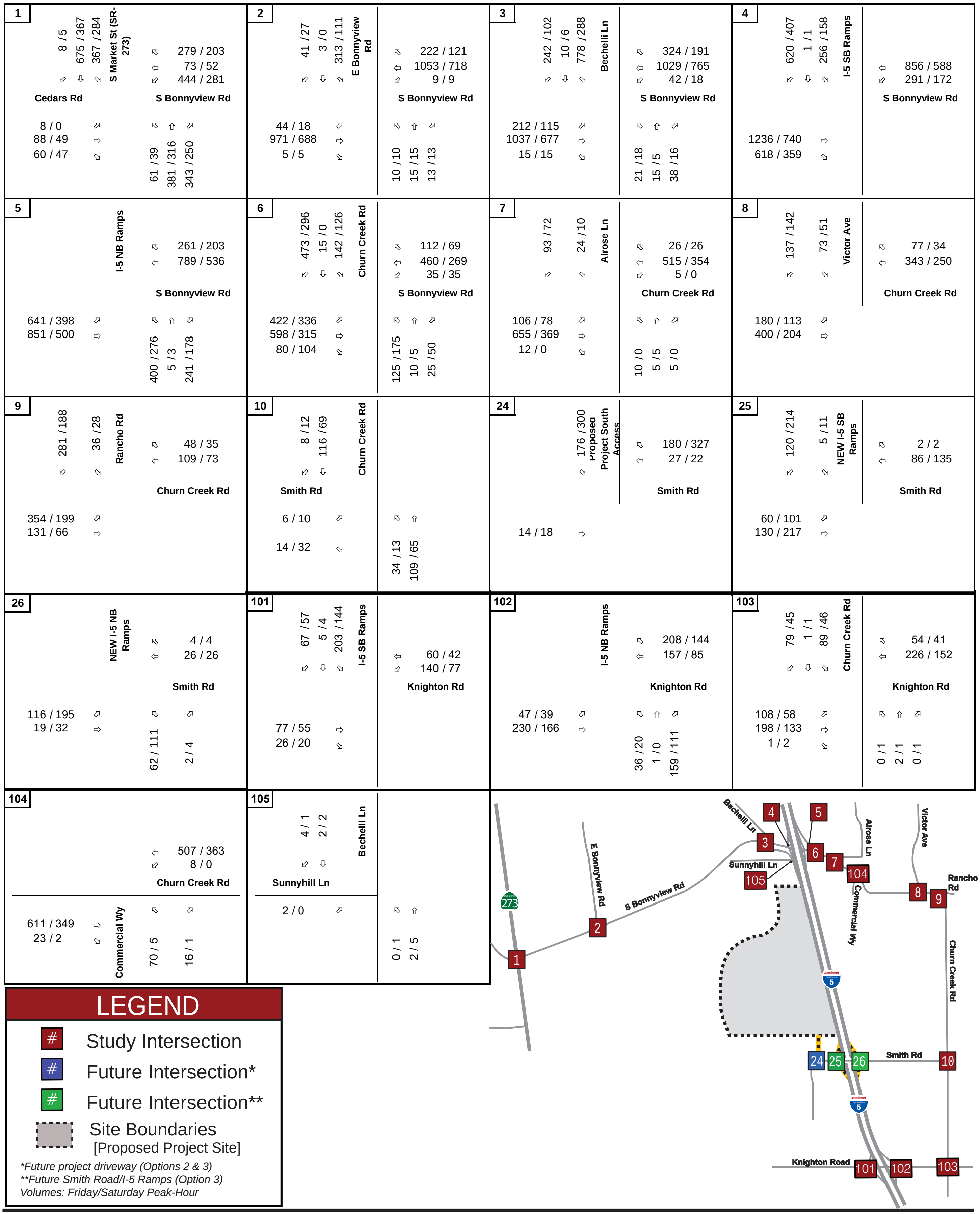


Figure 47

Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (3D)

Figure 48

Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (E)

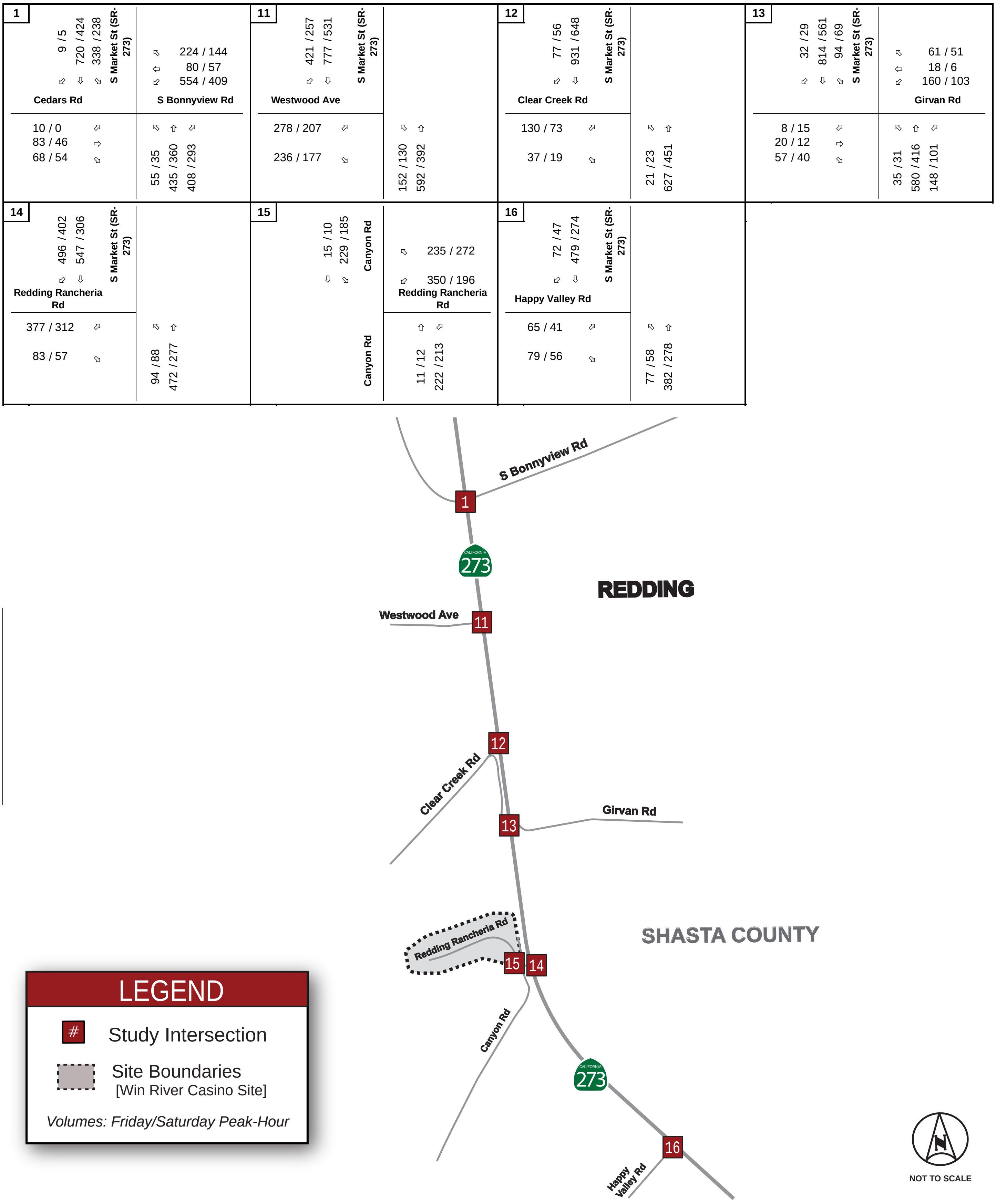
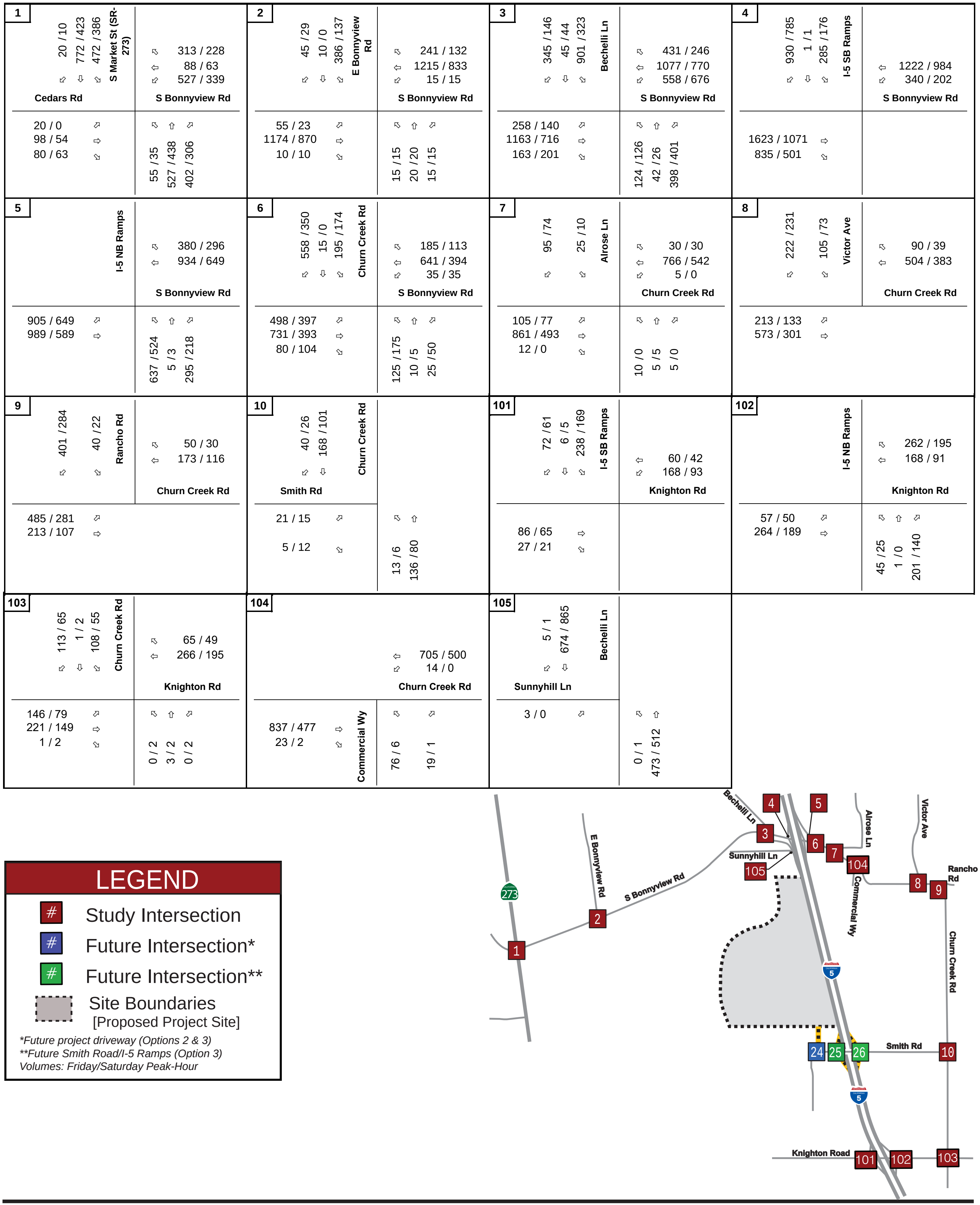


Figure 49

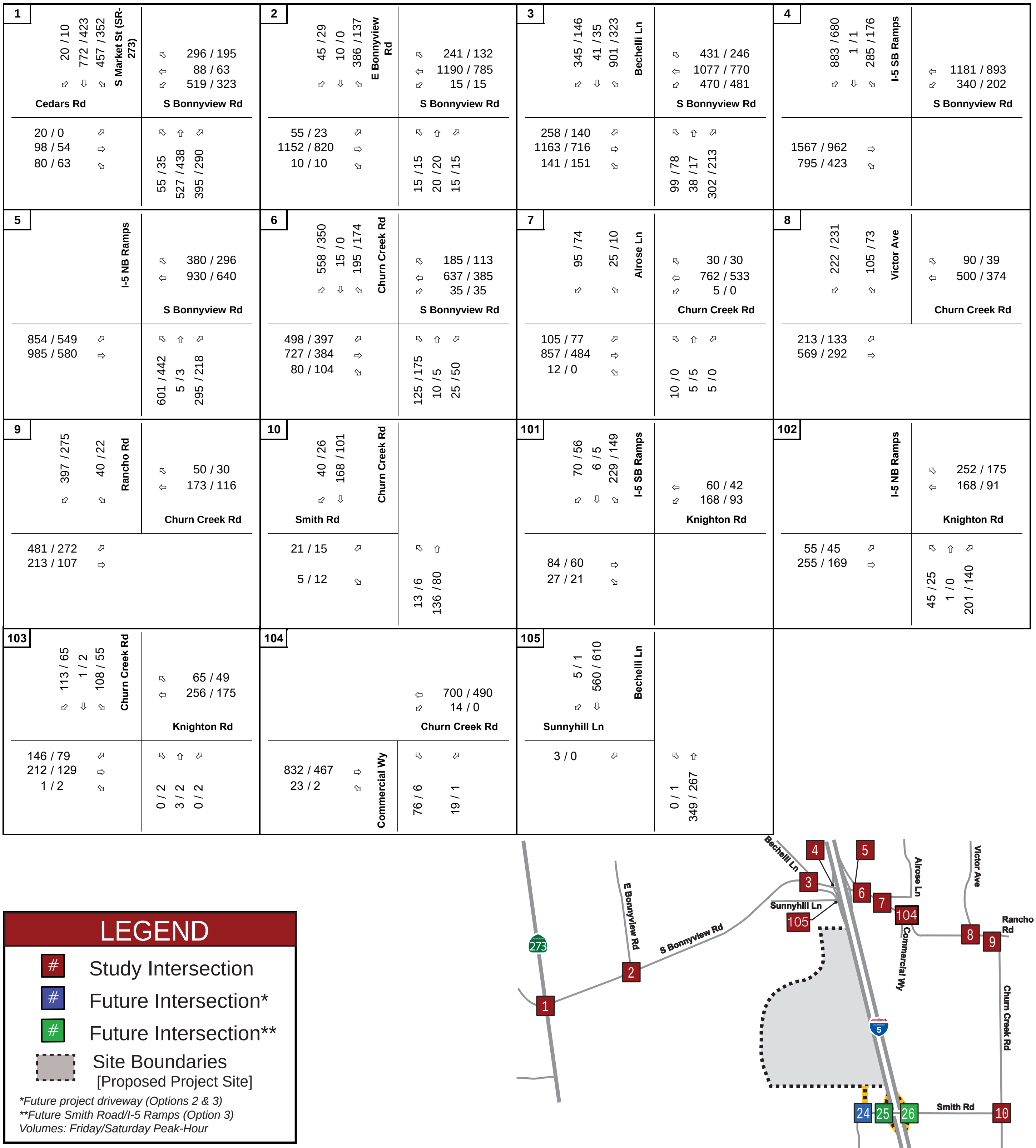
Year 2025 plus Project Friday/Saturday Peak-Hour Volumes (F)



*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

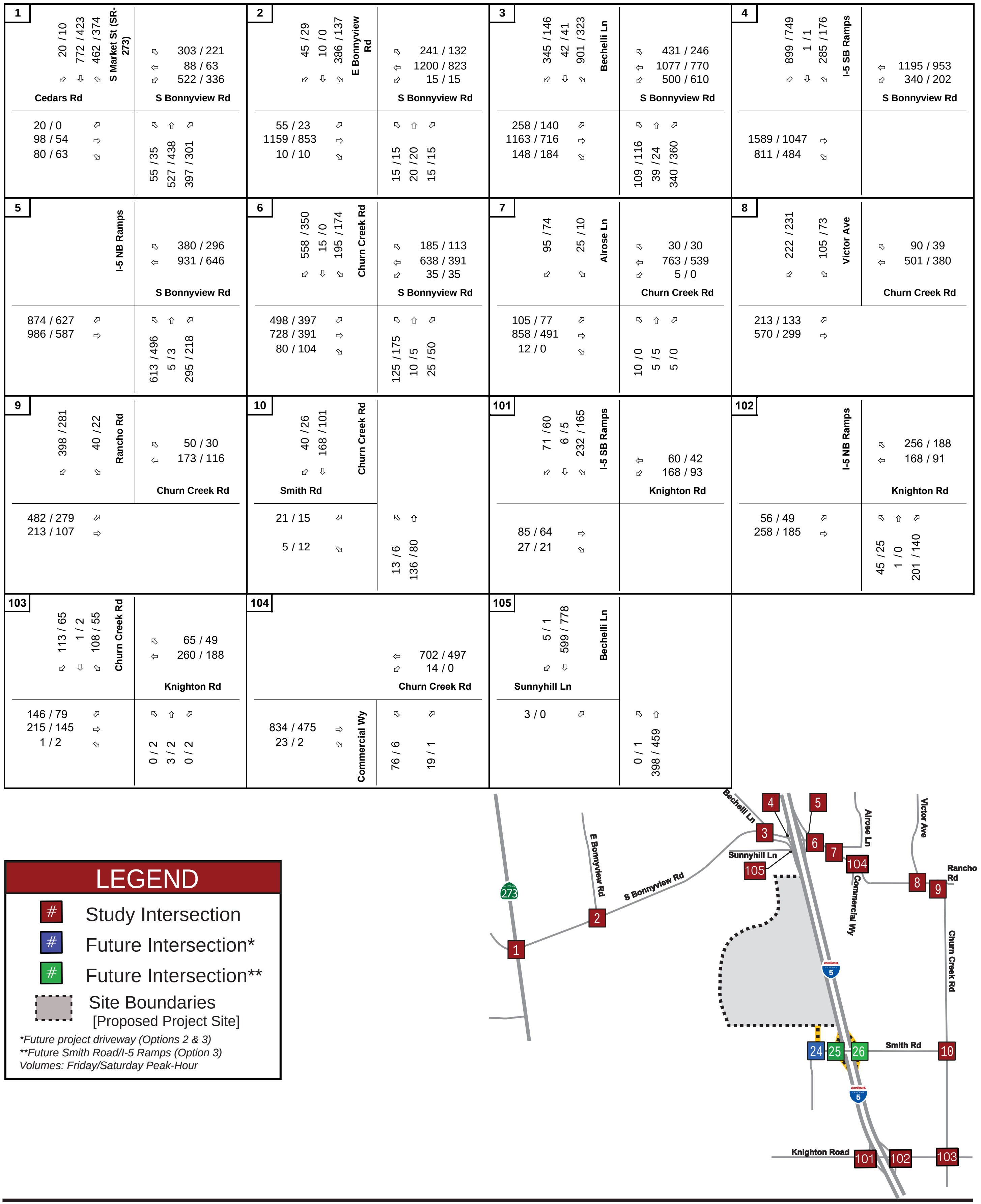
Figure 50

Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (1A)



Kimley»Horn

Figure 51
Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (1B)



Kimley»Horn

Figure 52

Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (1C)

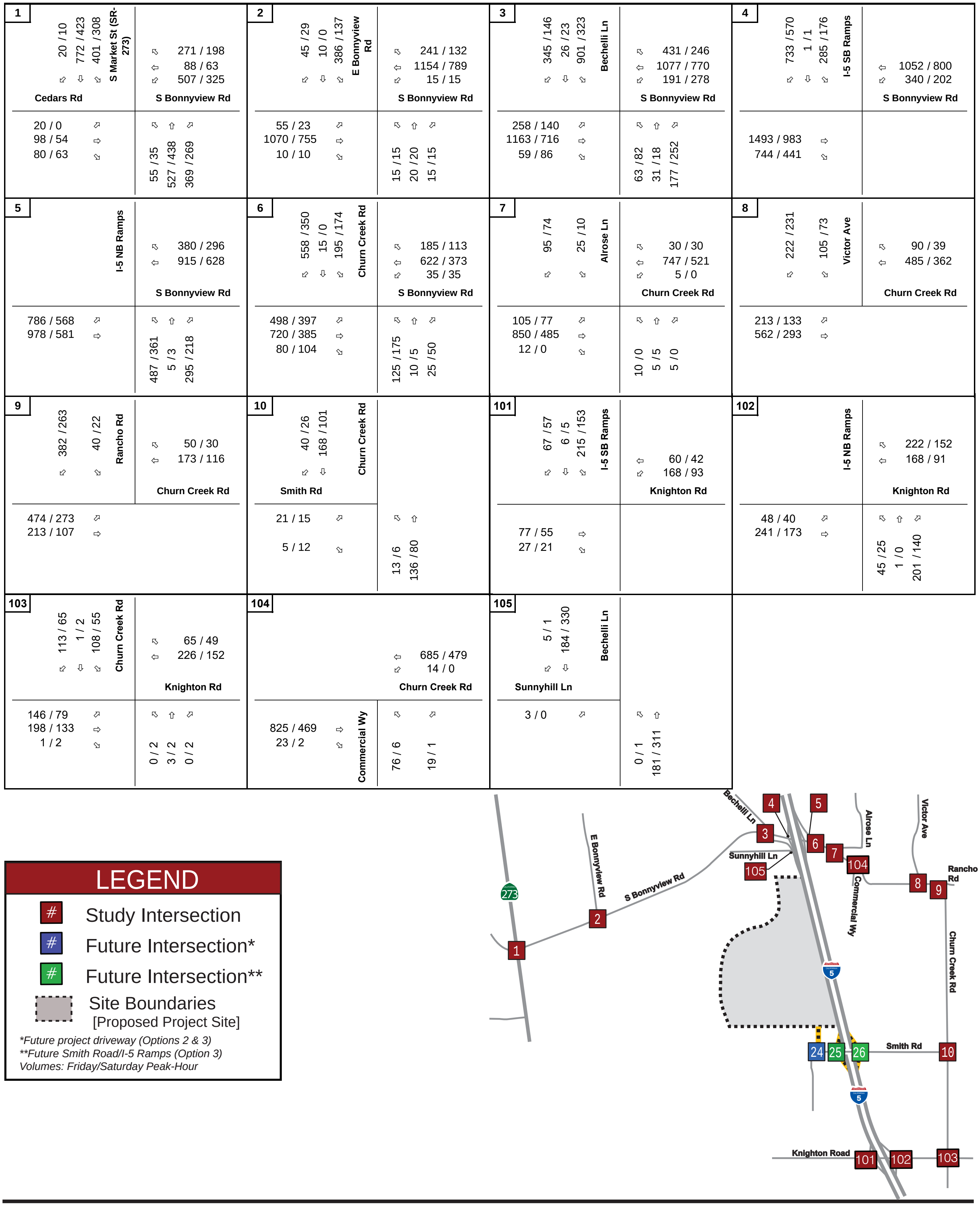
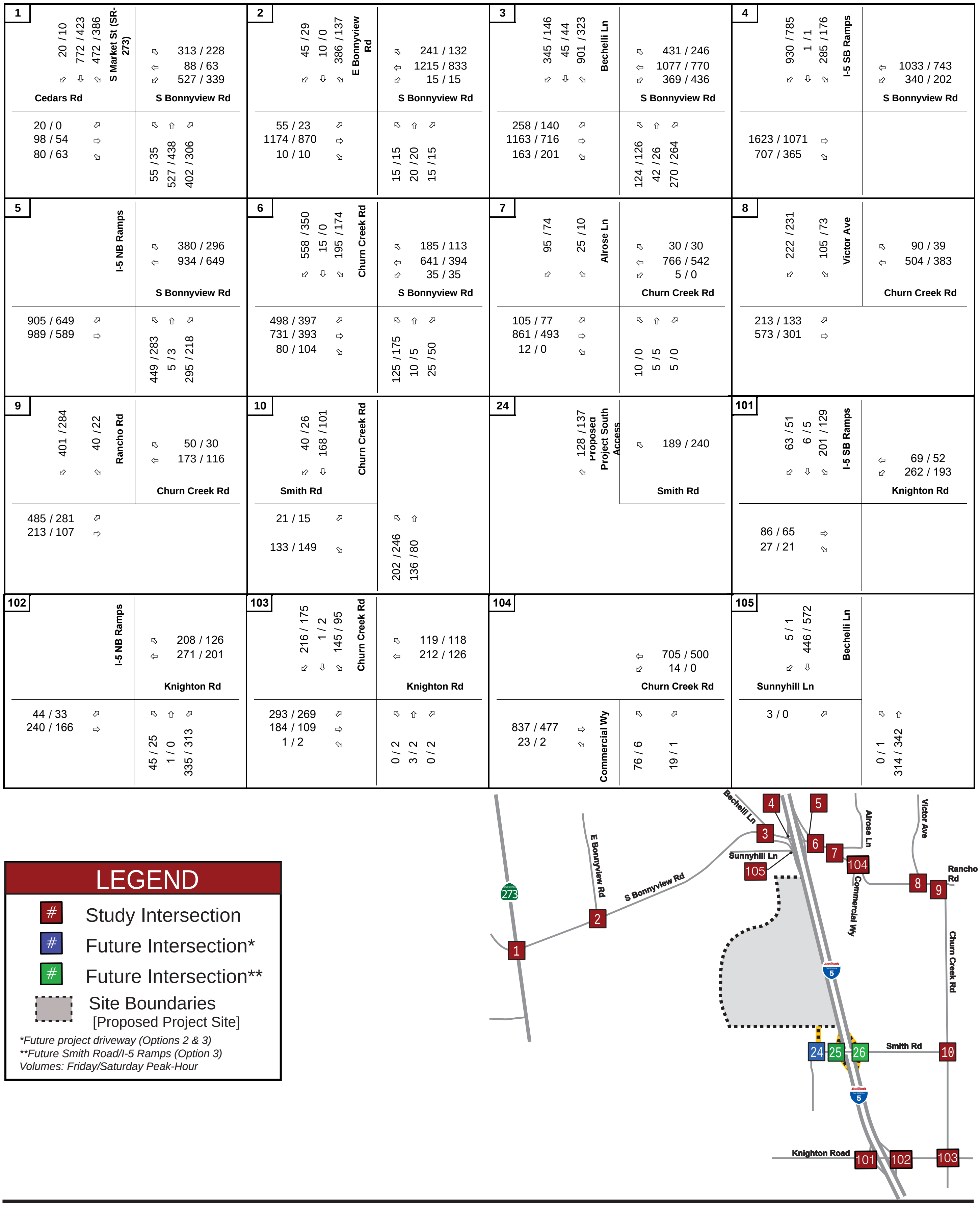


Figure 53

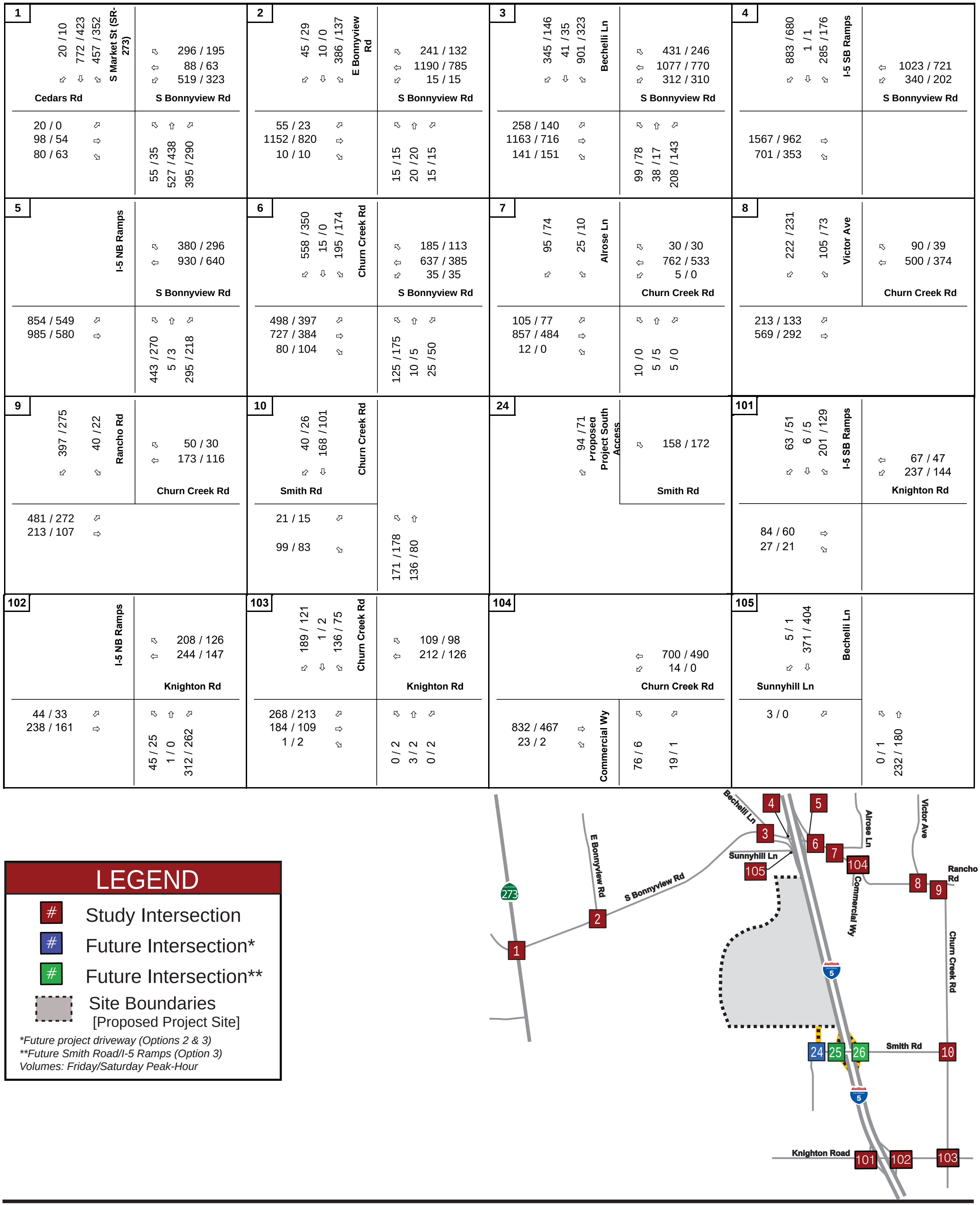
Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (1D)



*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Kimley»Horn

Figure 54
Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (2A)



LEGEND

🟥 # Study Intersection

🟦 # Future Intersection*

🟩 # Future Intersection**

▨ Site Boundaries
[Proposed Project Site]

*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Kimley»Horn

Figure 55

Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (2B)

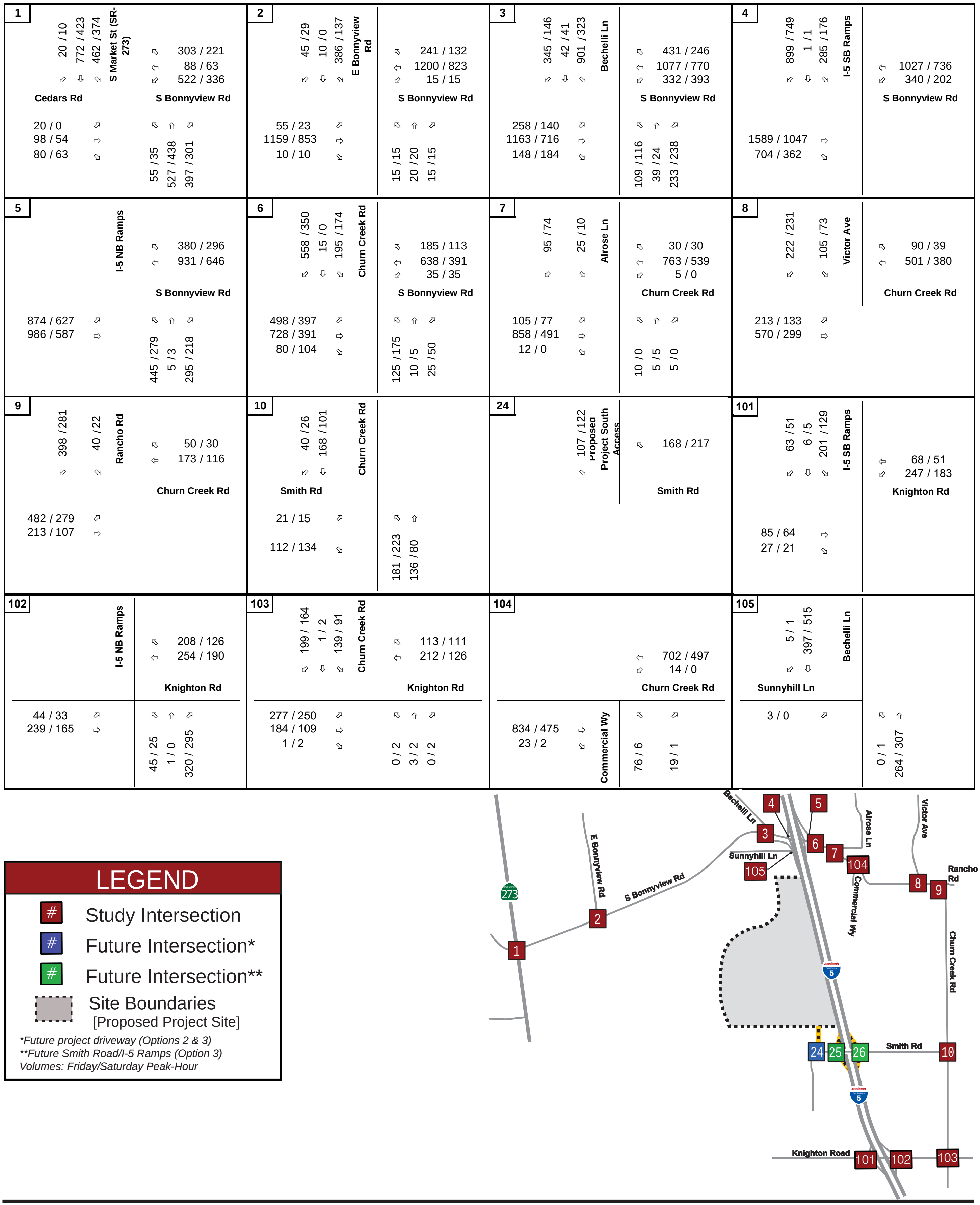
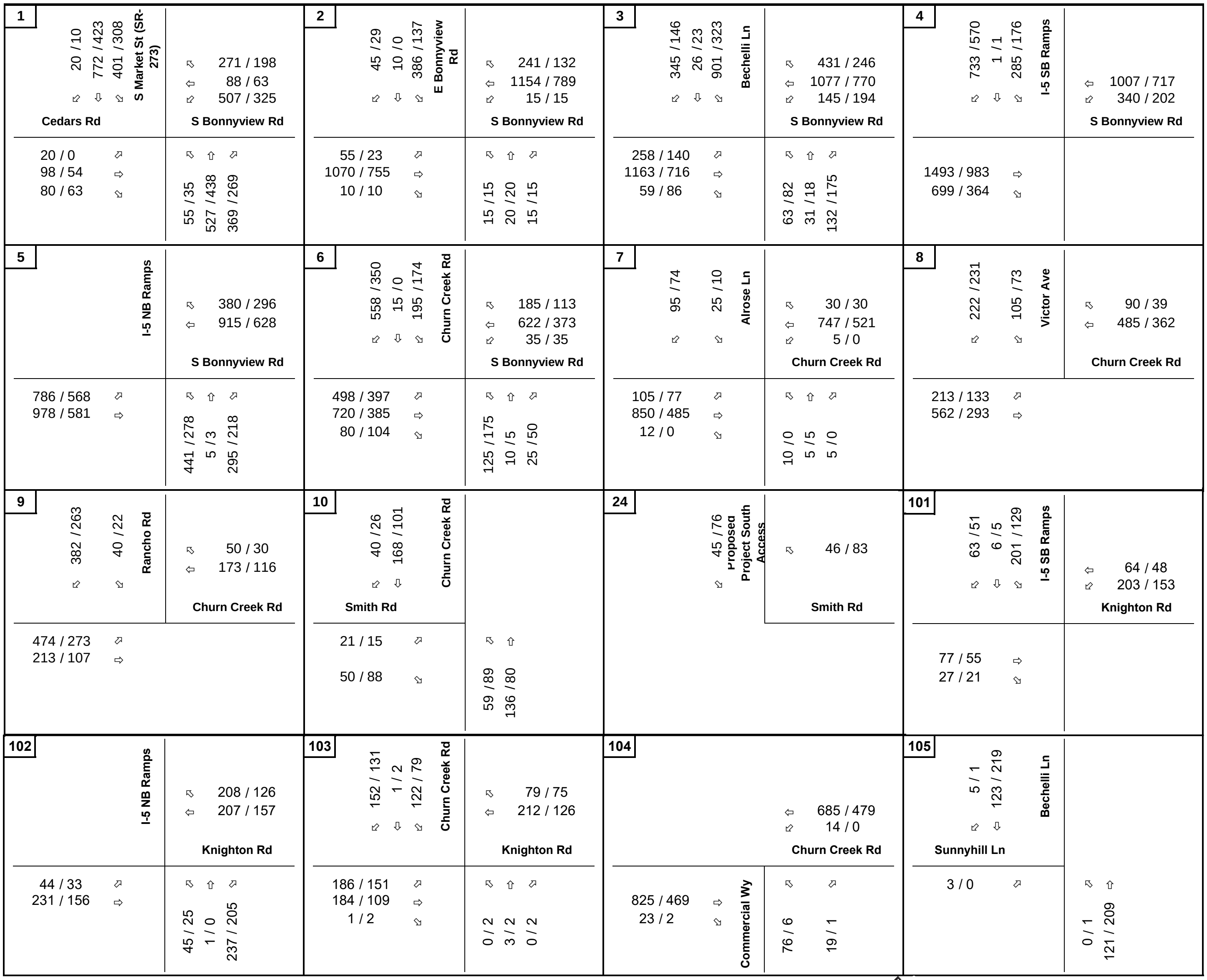
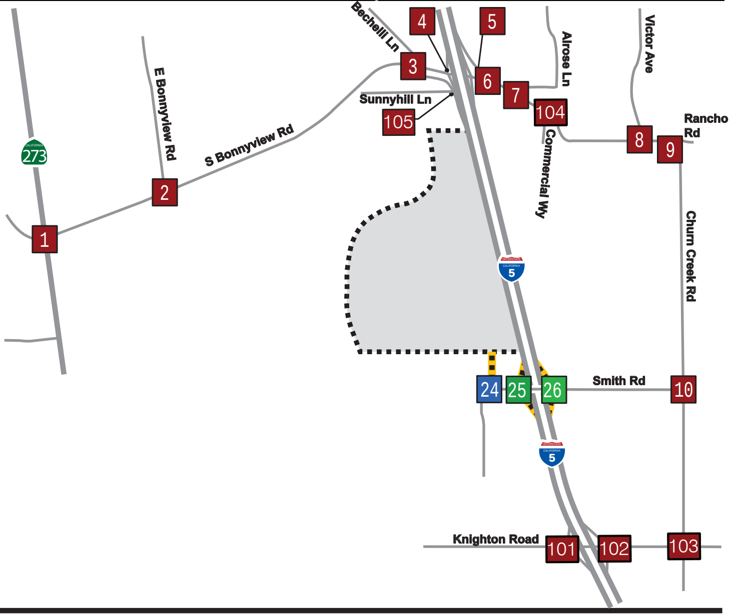


Figure 56

Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (2C)





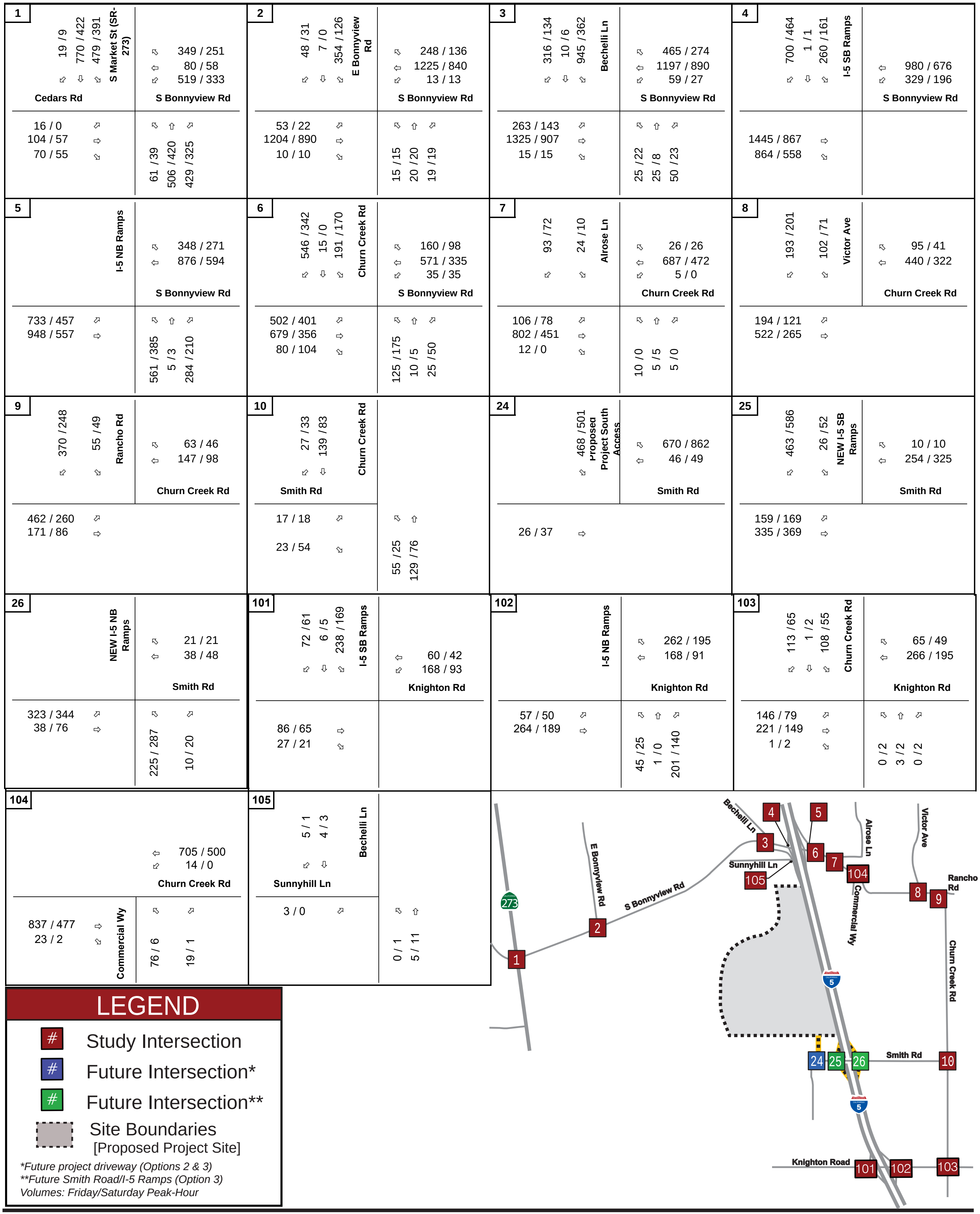
LEGEND

- 🟥 Study Intersection
- 🟦 Future Intersection*
- 🟩 Future Intersection**
- ▨ Site Boundaries [Proposed Project Site]

*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Kimley»Horn

Figure 57
Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (2D)



*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Kimley»Horn

Figure 58
Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (3A)

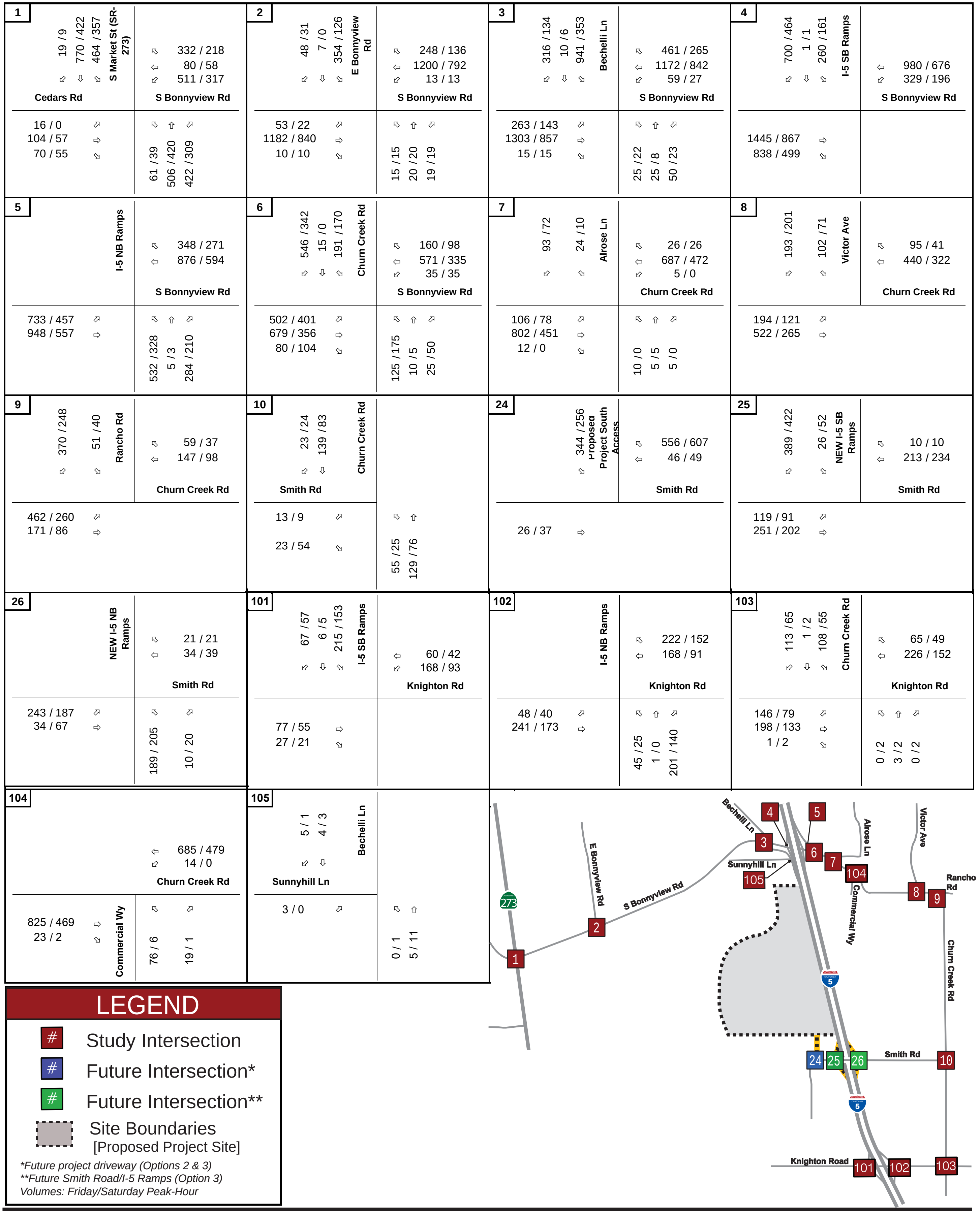
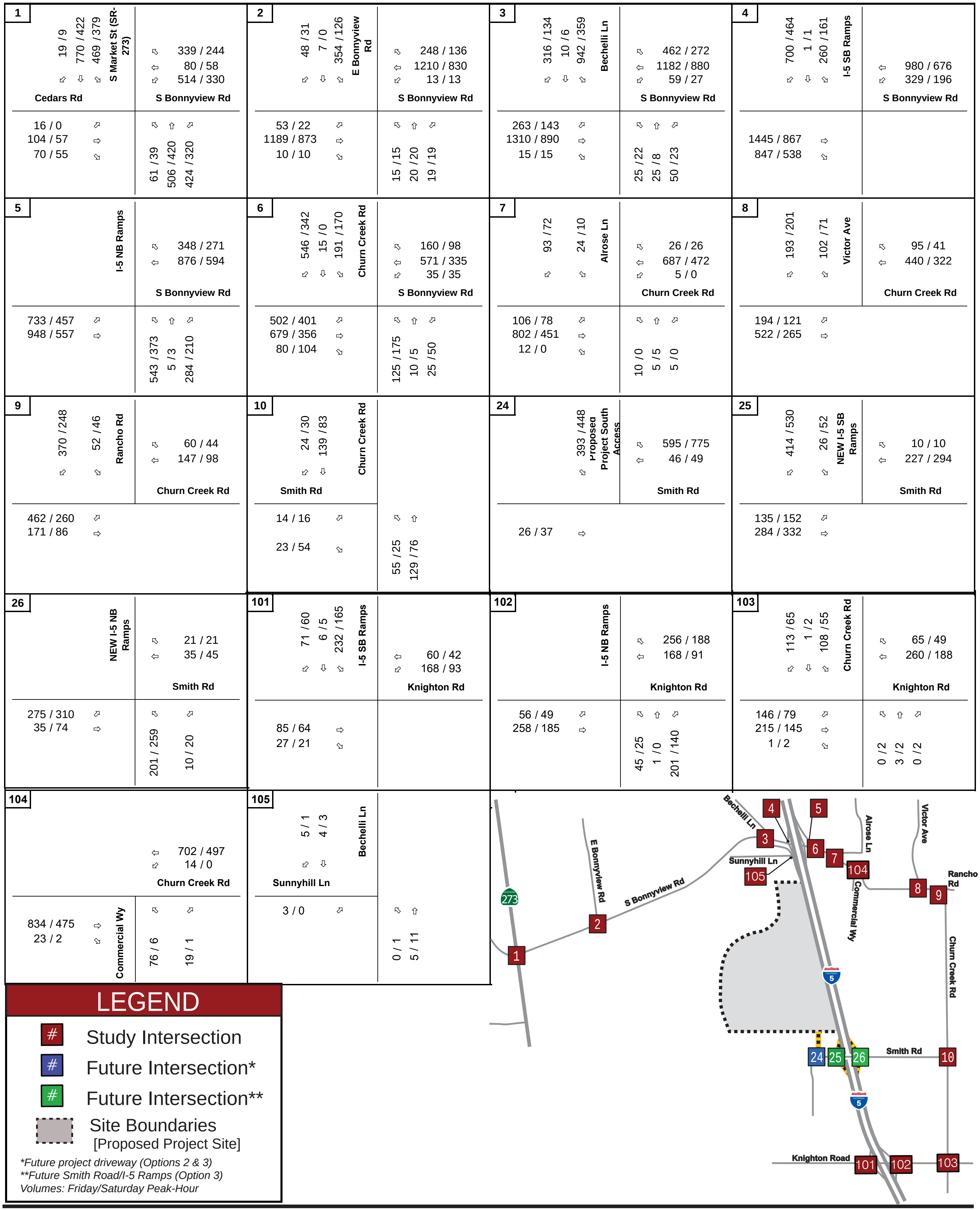


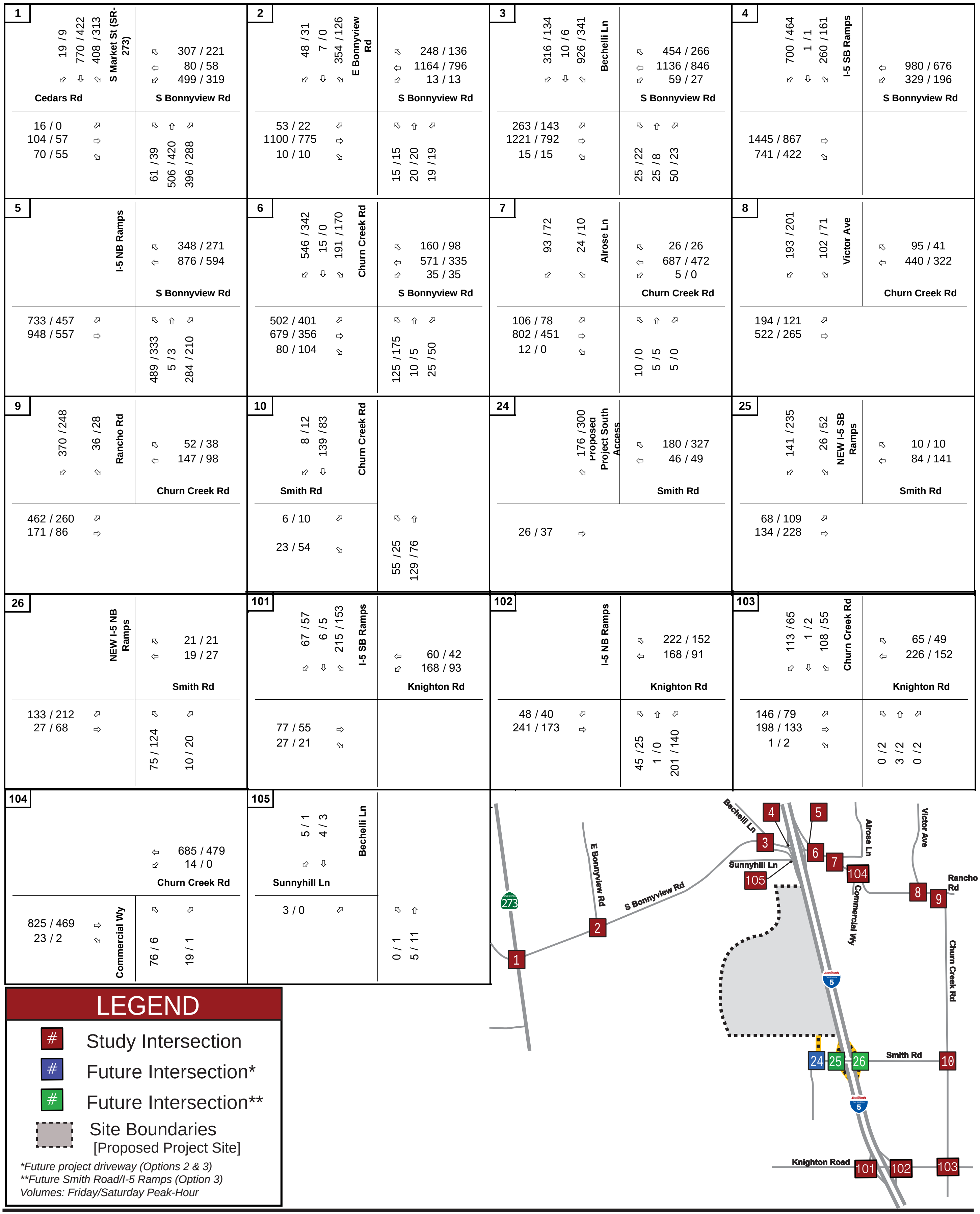
Figure 59

Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (3B)



**Future project driveway (Options 2 & 3)*
***Future Smith Road/I-5 Ramps (Option 3)*
Volumes: Friday/Saturday Peak-Hour

Figure 60
Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (3C)



LEGEND

🟥 # Study Intersection

🟦 # Future Intersection*

🟩 # Future Intersection**

▨ Site Boundaries [Proposed Project Site]

*Future project driveway (Options 2 & 3)
**Future Smith Road/I-5 Ramps (Option 3)
Volumes: Friday/Saturday Peak-Hour

Figure 61
Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (3D)

Figure 62

Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (E)

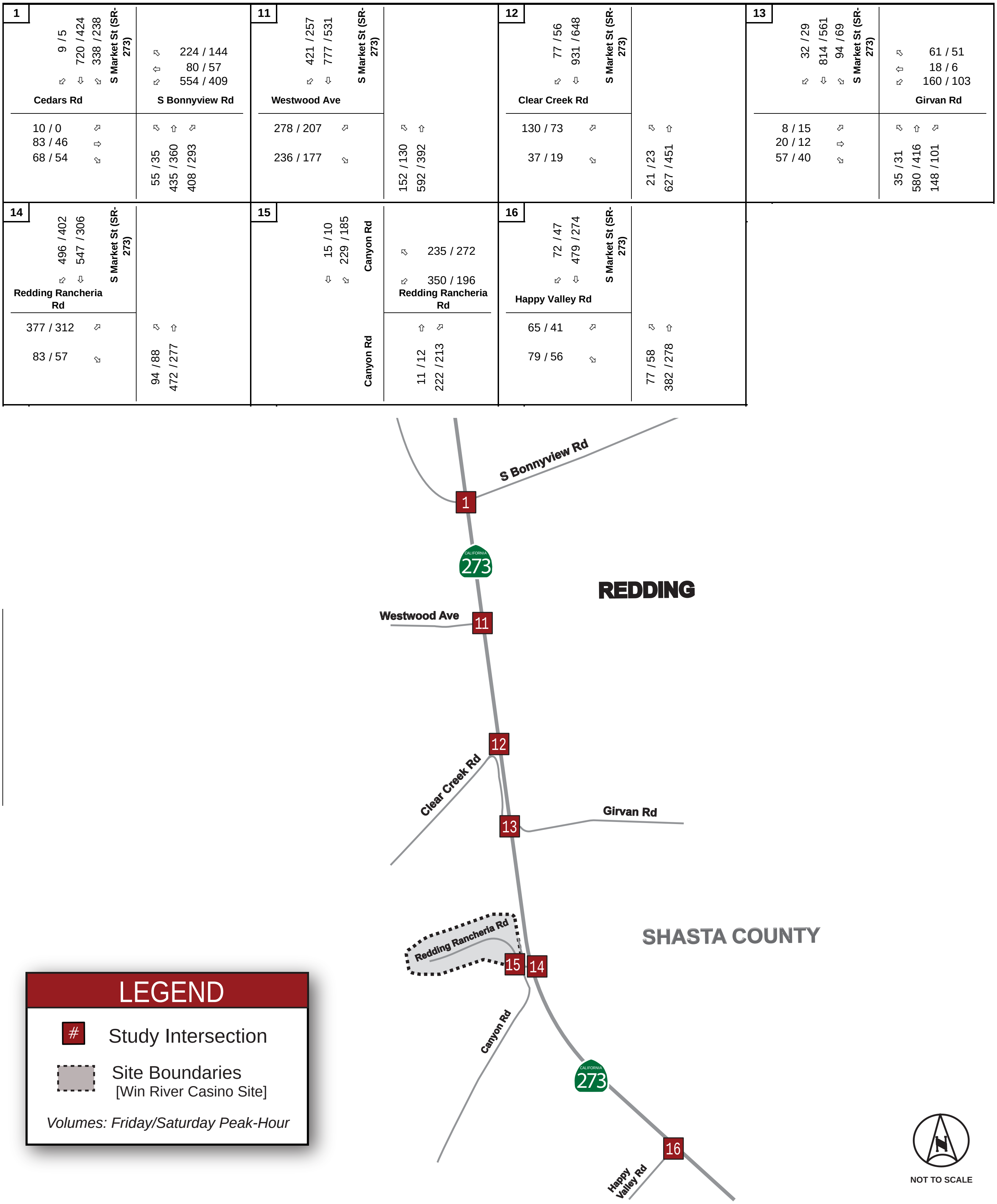


Figure 63

Year 2040 plus Project Friday/Saturday Peak-Hour Volumes (F)

Proposed Project LOS Conditions and Impacts at Intersections

Traffic operations were evaluated under Opening Year (2025) and Cumulative (2040) development conditions.

Opening Year (2025) plus Project

Results of the analysis under Opening Year (2025) plus Project Conditions are presented in **Tables 23-27**. Additional details are provided in **Appendix H**.

Table 23 – Opening Year (2025) plus Proposed Project Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with North Only Access Alternative (Option 1)

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (2025)		Opening Year (2025) plus Proposed Project (1A)		Opening Year (2025) plus Proposed Project (1B)		Opening Year (2025) plus Proposed Project (1C)		Opening Year (2025) plus Proposed Project (1D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	S Bonnyview Rd @ SR-273 (Market St)	Signal	D	FRI PM	23.2	C	24.2	C	23.4	C	22.8	C	21.4	C
				SAT PM	20.2	C	17.8	B	17.1	B	17.6	B	16.2	B
2	S Bonnyview Rd @ E Bonnyview Rd	Signal	D	FRI PM	17.8	B	18.3	B	17.9	B	18.1	B	17.3	B
				SAT PM	7.5	A	7.5	A	7.4	A	7.5	A	7.4	A
3	S Bonnyview Rd @ Bechlli Ln	Signal	D	FRI PM	49.9	**D**	402.3	**F**	302.2	**F**	334.3	**F**	89.6	**F**
				SAT PM	15.1	B	531.5	**F**	253.2	**F**	438.9	**F**	92.5	**F**
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	103.1	**F**	179.4	**F**	157.3	**F**	165.5	**F**	115.8	**F**
				SAT PM	27.9	C	76.9	**E**	54.6	D	68.8	**E**	35.0	D
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	54.6	D	119.3	**F**	99.0	**F**	106.4	**F**	64.7	**E**
				SAT PM	19.7	B	63.3	**E**	30.8	C	52.9	D	27.2	C
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	96.2	**F**	95.8	**F**	95.9	**F**	95.9	**F**	96.1	**F**
				SAT PM	43.6	D	43.5	D	43.6	D	43.5	D	43.5	D
7	Churn Creek Rd @ Alrose Ln	SSSC*	C	FRI PM	17.2	C	17.9	C	17.7	C	17.8	C	17.3	C
				SAT PM	11.2	B	11.4	B	11.4	B	11.4	B	11.3	B
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	68.0	**F**	80.8	**F**	78.9	**F**	78.9	**F**	70.3	**F**
				SAT PM	16.6	C	17.7	C	17.3	C	17.6	C	16.9	C
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	21.1	C	23.1	C	22.5	C	22.6	C	21.4	C
				SAT PM	11.2	B	11.5	B	11.3	B	11.4	B	11.3	B
10	Churn Creek Rd @ Smith Rd	SSSC*	C	FRI PM	10.3	B	10.3	B	10.3	B	10.3	B	10.3	B
				SAT PM	9.3	A	9.3	A	9.3	A	9.3	A	9.3	A
101	Knighton Road @ I-5 Southbound Ramps	SSSC*	D	FRI PM	16.8	C	19.7	C	19.0	C	19.2	C	17.8	C
				SAT PM	11.3	B	12.3	B	11.8	B	12.2	B	11.8	B
102	Knighton Road @ I-5 Northbound Ramps	SSSC*	D	FRI PM	11.7	B	12.3	B	12.1	B	12.2	B	11.9	B
				SAT PM	10.1	B	10.5	B	10.3	B	10.4	B	10.3	B
103	Churn Creek Road @ Knighton Road	Signal	C	FRI PM	8.6	A	8.7	A	8.7	A	8.7	A	8.6	A
				SAT PM	7.8	A	7.8	A	7.9	A	7.8	A	7.7	A
104	Churn Creek Road @ Commercial Way	SSSC*	C	FRI PM	33.8	**D**	37.3	**E**	36.2	**E**	36.8	**E**	34.7	**D**
				SAT PM	13.9	B	14.6	B	14.4	B	14.5	B	14.2	B
105	Bechelli Lane @ Sunnyhill Lane	SSSC*	C	FRI PM	8.6	A	23.9	C	18.2	C	20.1	C	10.9	B
				SAT PM	1.2	A	0.0	A	0.0	A	0.0	A	0.0	A

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

Table 24 – Opening Year (2025) plus Proposed Project Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with North and South Access Alternative (Option 2)

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (2025)		Opening Year (2025) plus Proposed Project (2A)		Opening Year (2025) plus Proposed Project (2B)		Opening Year (2025) plus Proposed Project (2C)		Opening Year (2025) plus Proposed Project (2D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	S Bonnyview Rd @ SR-273 (Market St)	Signal	D	FRI PM	23.2	C	23.3	C	22.6	C	22.8	C	20.7	C
				SAT PM	20.2	C	17.8	B	17.1	B	17.6	B	16.2	B
2	S Bonnyview Rd @ E Bonnyview Rd	Signal	D	FRI PM	17.8	B	18.3	B	17.9	B	18.1	B	17.3	B
				SAT PM	7.5	A	7.5	A	7.4	A	7.5	A	7.4	A
3	S Bonnyview Rd @ Bechlli Ln	Signal	D	FRI PM	49.9	**D**	210.6	**F**	159.1	**F**	179.8	**F**	68.9	**E**
				SAT PM	15.1	B	224.1	**F**	97.0	**F**	177.8	**F**	42.9	D
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	103.1	F	165.5	**F**	147.6	**F**	154.2	**F**	109.7	**F**
				SAT PM	27.9	C	82.2	**F**	56.8	**E**	72.9	**E**	35.1	D
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	54.6	D	91.7	**F**	77.3	**E**	82.8	**F**	60.6	**E**
				SAT PM	19.7	B	41.7	D	22.3	C	36.9	D	25.6	C
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	96.2	F	95.8	**F**	95.9	**F**	95.9	**F**	96.1	**F**
				SAT PM	43.6	D	43.5	D	43.6	D	43.5	D	43.5	D
7	Churn Creek Rd @ Alrose Ln	SSSC*	C	FRI PM	17.2	C	17.9	C	17.7	C	17.8	C	17.3	C
				SAT PM	11.2	B	11.4	B	11.4	B	11.4	B	11.3	B
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	68.0	**F**	80.8	**F**	78.9	**F**	78.9	**F**	70.3	**F**
				SAT PM	16.6	C	17.7	C	17.3	C	17.6	C	16.9	C
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	21.1	C	23.1	C	22.5	C	22.6	C	21.4	C
				SAT PM	11.2	B	11.5	B	11.3	B	11.4	B	11.3	B
10	Churn Creek Rd @ Smith Rd	SSSC*	C	FRI PM	10.3	B	11.2	B	10.9	B	11.0	B	10.1	B
				SAT PM	9.3	A	10.4	B	10.0	B	10.3	B	9.6	A
24	Smith Rd @ Proposed Project South Dwy	SSSC*	C	FRI PM	-	-	10.1	B	9.7	A	9.8	A	9.0	A
				SAT PM	-	-	10.3	B	9.5	A	10.1	B	9.3	A
101	Knighton Road @ I-5 Southbound Ramps	SSSC*	D	FRI PM	16.8	C	30.3	D	25.1	D	27.1	D	20.2	C
				SAT PM	11.3	B	15.2	C	13.0	B	14.7	B	13.2	B
102	Knighton Road @ I-5 Northbound Ramps	SSSC*	D	FRI PM	11.7	B	14.1	B	13.6	B	13.8	B	12.2	B
				SAT PM	10.1	B	11.9	B	11.2	B	11.7	B	10.6	B
103	Churn Creek Road @ Knighton Road	Signal	C	FRI PM	8.6	A	21.0	C	14.6	B	16.5	B	9.4	A
				SAT PM	7.8	A	15.2	B	11.3	B	13.2	B	9.1	A
104	Churn Creek Road @ Commercial Way	SSSC*	C	FRI PM	33.8	**D**	37.3	**E**	36.2	**E**	36.8	**E**	34.7	**D**
				SAT PM	13.9	B	14.6	B	14.4	B	14.5	B	14.2	B
105	Bechelli Lane @ Sunnyhill Lane	SSSC*	C	FRI PM	8.6	A	15.6	C	13.4	B	14.1	B	10.0	B
				SAT PM	1.2	A	0.0	A	0.0	A	0.0	A	0.0	A

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

Table 25 – Opening Year (2025) plus Proposed Project Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with South Only and New Interchange Access Alternative (Option 3)

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (2025)		Opening Year (2025) plus Proposed Project (3A)		Opening Year (2025) plus Proposed Project (3B)		Opening Year (2025) plus Proposed Project (3C)		Opening Year (2025) plus Proposed Project (3D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	S Bonnyview Rd @ SR-273 (Market St)	Signal	D	FRI PM	23.2	C	22.9	C	23.1	C	23.4	C	21.1	C
				SAT PM	20.2	C	17.4	B	17.2	B	17.8	B	16.4	B
2	S Bonnyview Rd @ E Bonnyview Rd	Signal	D	FRI PM	17.8	B	17.0	B	16.7	B	16.8	B	16.1	B
				SAT PM	7.5	A	7.3	A	7.2	A	7.3	A	7.2	A
3	S Bonnyview Rd @ Bechlli Ln	Signal	D	FRI PM	49.9	D	53.5	D	52.7	D	53.0	D	51.5	D
				SAT PM	15.1	B	15.7	B	15.4	B	15.6	B	15.2	B
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	103.1	F	123.5	**F**	119.0	**F**	120.6	**F**	103.0	**F**
				SAT PM	27.9	C	27.3	C	26.5	C	26.9	C	26.0	C
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	54.6	D	64.4	**E**	59.3	**E**	61.0	**E**	53.1	D
				SAT PM	19.7	B	21.7	C	20.1	C	21.3	C	20.4	C
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	96.2	F	95.3	**F**	95.3	**F**	95.3	**F**	95.3	**F**
				SAT PM	43.6	D	44.3	D	44.3	D	44.3	D	44.3	D
7	Churn Creek Rd @ Alrose Ln	SSSC*	C	FRI PM	17.2	C	15.6	C	15.6	C	15.6	C	15.6	C
				SAT PM	11.2	B	10.9	B	10.9	B	10.9	B	10.9	B
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	68.0	**F**	42.8	**E**	42.8	**E**	42.8	**E**	42.8	**E**
				SAT PM	16.6	C	15.0	C	15.0	C	15.0	C	15.0	C
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	21.1	C	24.4	C	22.6	C	23.0	C	17.8	C
				SAT PM	11.2	B	12.5	B	11.9	B	12.3	B	11.3	B
10	Churn Creek Rd @ Smith Rd	SSSC*	C	FRI PM	10.3	B	10.1	B	9.9	A	10.0	B	9.5	A
				SAT PM	9.3	A	9.3	A	9.1	A	9.2	A	9.1	A
24	Smith Rd @ Proposed Project South Dwy	SSSC*	C	FRI PM	-	-	12.9	B	11.1	B	11.7	B	9.7	A
				SAT PM	-	-	13.4	B	15.2	C	12.4	B	10.6	B
25	Smith Rd @ I-5 SB Ramps	Signal	D	FRI PM	-	-	6.6	A	6.9	A	6.9	A	7.0	A
				SAT PM	-	-	9.7	A	15.9	C	8.3	A	6.6	A
26	Smith Rd @ I-5 NB Ramps	AWSC	D	FRI PM	-	-	11.5	B	9.9	A	10.4	B	8.0	A
				SAT PM	-	-	13.1	B	17.2	C	11.8	B	9.0	A
101	Knighton Road @ I-5 Southbound Ramps	SSSC*	D	FRI PM	16.8	C	19.7	C	19.0	C	19.2	C	17.8	C
				SAT PM	11.3	B	12.3	B	11.8	B	12.2	B	11.8	B
102	Knighton Road @ I-5 Northbound Ramps	SSSC*	D	FRI PM	11.7	B	12.3	B	12.1	B	12.2	B	11.9	B
				SAT PM	10.1	B	10.5	B	10.3	B	10.4	B	10.3	B
103	Churn Creek Road @ Knighton Road	Signal	C	FRI PM	8.6	A	8.7	A	8.7	A	8.7	A	8.6	A
				SAT PM	7.8	A	7.8	A	7.9	A	7.8	A	7.7	A
104	Churn Creek Road @ Commercial Way	SSSC*	C	FRI PM	33.8	**D**	37.3	**E**	36.2	**E**	36.8	**E**	34.7	**D**
				SAT PM	13.9	B	14.6	B	14.4	B	14.5	B	14.2	B

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

Table 26 – Opening Year (2025) plus Proposed Project Intersection Level of Service Summary at Anderson Site (Alternative E)

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (2025)		Opening Year (2025) plus Proposed Project (E)	
					Delay (sec)	LOS	Delay (sec)	LOS
17	SR-273 (Market St) @ North St	Signal	D	FRI PM	15.9	B	25.1	C
				SAT PM	12.7	B	19.6	B
18	North St @ Oak St	SSSC*	D	FRI PM	24.3	C	-	**F**
				SAT PM	14.6	B	-	**F**
19	North St @I-5 SB Off Ramp	AWSC	D	FRI PM	12.2	B	36.1	**E**
				SAT PM	9.0	A	26.5	D
20	North Street @ McMurray Dr/I-5 NB On Ramp	AWSC	D	FRI PM	36.2	E	60.7	**F**
				SAT PM	13.7	B	18.5	C
21	Balls Ferry Rd @ Oak St	SSSC*	D	FRI PM	15.0	C	24.2	C
				SAT PM	12.8	B	19.2	C
22	Balls Ferry Rd @ Venutra St/I-5 SB On Ramp	Signal	D	FRI PM	26.5	C	26.8	C
				SAT PM	8.6	A	23.1	C
23	Balls Ferry Rd @ McMurray Dr/I-5 NB Off Ramp	Signal	D	FRI PM	23.3	C	25.1	C
				SAT PM	8.3	A	21.4	C

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

Table 27 – Opening Year (2025) plus Proposed Project Intersection Level of Service Summary at Win River Casino Site (Alternative F)

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (2025)		Opening Year (2025) plus Proposed Project (F)	
					Delay (sec)	LOS	Delay (sec)	LOS
1	S Bonnyview Rd @ SR-273 (Market St)	Signal	D	FRI PM	23.2	C	23.2	C
				SAT PM	20.2	C	17.2	B
11	SR-273 (Market St) @ Westwood Ave	Signal	D	FRI PM	12.7	B	12.7	B
				SAT PM	10.2	B	9.8	A
12	SR-273 (Market St) @ Clear Creek Rd	Signal	D	FRI PM	6.2	A	6.2	A
				SAT PM	5.4	A	5.4	A
13	SR-273 (Market St) @ Girvan Rd	Signal	D	FRI PM	14.7	B	15.0	B
				SAT PM	12.3	B	12.4	B
14	SR-273 (Market St) @ Redding Rancheria Rd	Signal	D	FRI PM	9.1	A	9.8	A
				SAT PM	8.1	A	8.6	A
15	Canyon Rd @ Redding Rancheria Rd	Signal	D	FRI PM	11.5	B	11.9	B
				SAT PM	10.0	A	10.2	B
16	SR-273 (Market St) @ Happy Valley Rd	Signal	D	FRI PM	7.4	A	7.4	A
				SAT PM	6.4	A	6.3	A

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

As shown in the **Tables 23-27**, the following intersections would fail to meet acceptable level of service thresholds in the Opening Year (2025) scenario. These intersections fail based on established significance criteria and with the addition of project-related traffic to create a potentially significant impact.

Opening Year (2025) Intersection Operating Deficiently

Strawberry Fields Site: North Only Access Alternative (Option 1)

- #3 – Bonnyview Road at Bechelli Lane (Alternatives A, B, C, D)
- #4 – Bonnyview Road at I-5 SB Ramps (Alternatives A, B, C, D)
- #5 – Bonnyview Road at I-5 NB Ramps (Alternative A, B, C, D)
- #6 – Bonnyview Road at Churn Creek Road (Alternative A, B, C, D)
- #8 – Churn Creek Road at Victor Avenue (Alternatives A, B, C, D)
- # 104 – Churn Creek Road at Commercial Way (Alternatives A, B, C, D)

Strawberry Fields Site: North and South Access Alternative (Option 2)

- #3 – Bonnyview Road at Bechelli Lane (Alternatives A, B, C, D)
- #4 – Bonnyview Road at I-5 SB Ramps (Alternatives A, B, C, D)
- #5 – Bonnyview Road at I-5 NB Ramps (Alternative A, B, C, D)
- #6 – Bonnyview Road at Churn Creek Road (Alternative A, B, C, D)
- #8 – Churn Creek Road at Victor Avenue (Alternatives A, B, C, D)
- # 104 – Churn Creek Road at Commercial Way (Alternatives A, B, C, D)

Strawberry Fields Site: South Only Access with New Interchange Alternative (Option 3)

- #4 – Bonnyview Road at I-5 SB Ramps (Alternatives A, B, C, D)
- #5 – Bonnyview Road at I-5 NB Ramps (Alternative A, B, C, D)
- # 104 – Churn Creek Road at Commercial Way (Alternatives A, B, C, D)

Anderson Site (Alternative E)

- #18 – North Street at Oak Street
- #19 – North Street at I-5 Southbound Off Ramp
- #20 – North Street at McMurray Drive and I-5 Northbound On-Ramp

Cumulative (2040) plus Project

Results of the analysis under Cumulative (2040) plus Project Conditions are presented in **Tables 28-32**. Additional details are provided in **Appendix I**. Queuing analysis results are provided in **Appendix D**.

Table 28 – Cumulative (2040) plus Proposed Project Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with North Only Access Alternative (Option 1)

ID	Intersection	Control	Target LOS	Peak Hour	Cumulative (2040)		Cumulative (2040) plus Proposed Project (1A)		Cumulative (2040) plus Proposed Project (1B)		Cumulative (2040) plus Proposed Project (1C)		Cumulative (2040 plus Proposed Project (1D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	S Bonnyview Rd @ SR-273 (Market St)	Signal	D	FRI PM	28.4	C	28.5	C	27.5	C	27.8	B	24.6	C
				SAT PM	18.7	B	19.4	B	18.6	B	19.1	B	17.6	B
2	S Bonnyview Rd @ E Bonnyview Rd	Signal	D	FRI PM	24.8	C	26.0	C	25.0	C	25.3	C	23.4	C
				SAT PM	8.3	A	8.4	A	8.3	A	8.4	A	8.3	A
3	S Bonnyview Rd @ Bechlli Ln	Signal	D	FRI PM	116.9	**F**	301.7	**F**	281.3	**F**	297.2	**F**	206.9	**F**
				SAT PM	89.2	**F**	536.5	**F**	435.9	**F**	440.5	**F**	343.4	**F**
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	46.1	D	194.9	**F**	167.6	**F**	189.7	**F**	119.8	**F**
				SAT PM	38.1	D	338.4	**F**	308.7	**F**	252.1	**F**	223.0	**F**
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	32.3	C	167.2	**F**	144.6	**F**	153.8	**F**	68.3	**E**
				SAT PM	19.7	B	291.5	**F**	253.9	**F**	232.6	**F**	133.3	**F**
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	39.4	D	221.0	**F**	202.4	**F**	213.1	**F**	82.4	**F**
				SAT PM	20.5	C	361.8	**F**	313.8	**F**	357.2	**F**	109.9	**F**
7	Churn Creek Rd @ Alrose Ln	SSSC*	C	FRI PM	10.8	B	234.3	**F**	222.3	**F**	257.1	**F**	77.6	**F**
				SAT PM	1.6	A	456.0	**F**	420.3	**F**	430.1	**F**	98.5	**F**
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	439.6	**F**	486.0	**F**	476.3	**F**	476.3	**F**	439.6	**F**
				SAT PM	31.7	D	36.6	**E**	34.6	D	35.9	E	33.2	D
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	72.2	**F**	91.3	**F**	87.6	**F**	88.3	**F**	76.7	**F**
				SAT PM	12.8	B	13.3	B	13.1	B	13.2	B	12.9	B
10	Churn Creek Rd @ Smith Rd	SSSC*	C	FRI PM	10.8	B	10.8	B	10.8	B	10.8	B	10.8	B
				SAT PM	9.5	A	9.5	A	9.5	A	9.5	A	9.5	A
101	Knighton Road @ I-5 Southbound Ramps	SSSC*	D	FRI PM	20.1	C	24.9	C	23.7	C	24.1	C	21.6	C
				SAT PM	11.9	B	13.1	B	12.5	B	13.0	B	12.5	B
102	Knighton Road @ I-5 Northbound Ramps	SSSC*	D	FRI PM	12.6	B	13.4	B	13.2	B	13.3	B	12.9	B
				SAT PM	10.4	B	10.9	B	10.7	B	10.8	B	10.7	B
103	Churn Creek Road @ Knighton Road	Signal	C	FRI PM	9.4	A	9.6	A	9.6	A	9.6	A	9.4	A
				SAT PM	8.1	A	8.2	A	8.2	A	8.2	A	8.1	A
104	Churn Creek Road @ Commercial Way	SSSC*	C	FRI PM	118.2	**F**	139.3	**F**	133.6	**F**	136.4	**F**	128.1	**F**
				SAT PM	17.7	C	18.8	C	18.4	C	18.7	C	18.2	C
105	Bechelli Lane @ Sunnyhill Lane	SSSC*	C	FRI PM	8.6	A	24.2	C	18.3	C	20.3	C	11.0	B
				SAT PM	0.6	A	0.0	A	0.0	A	0.0	A	0.0	A

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

(c) LOS calculations for intersections 3-7 were performed using VISSIM, all other intersections were performed using Synchro 9.0

Table 29 – Cumulative (2040) plus Proposed Project Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with North and South Access Alternative (Option 2)

ID	Intersection	Control	Target LOS	Peak Hour	Cumulative (2040)		Cumulative (2040) plus Proposed Project (2A)		Cumulative (2040) plus Proposed Project (2B)		Cumulative (2040) plus Proposed Project (2C)		Cumulative (2040 plus Proposed Project (2D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	S Bonnyview Rd @ SR-273 (Market St)	Signal	D	FRI PM	28.4	C	28.5	C	27.5	C	27.8	C	24.6	C
				SAT PM	18.7	B	19.4	B	18.6	B	19.1	B	17.6	B
2	S Bonnyview Rd @ E Bonnyview Rd	Signal	D	FRI PM	24.8	C	26.0	C	25.0	C	25.3	C	23.4	C
				SAT PM	8.3	A	8.4	A	8.3	A	8.4	A	8.3	A
3	S Bonnyview Rd @ Bechlli Ln	Signal	D	FRI PM	116.9	**F**	291.5	**F**	256.8	**F**	244.9	**F**	185.3	**F**
				SAT PM	89.2	**F**	405.8	**F**	285.9	**F**	373.2	**F**	250.6	**F**
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	46.1	D	181.9	**F**	148.7	**F**	155.6	**F**	104.9	**F**
				SAT PM	38.1	D	325.7	**F**	240.8	**F**	298.5	**F**	181.7	**F**
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	32.3	C	130.8	**F**	99.7	**F**	117.6	**F**	56.5	**E**
				SAT PM	19.7	B	229.8	**F**	149.4	**F**	193.6	**F**	97.4	**F**
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	39.4	D	178.4	**F**	125.0	**F**	147.4	**F**	72.6	**E**
				SAT PM	20.5	C	273.6	**F**	147.4	**F**	188.7	**F**	97.7	**F**
7	Churn Creek Rd @ Alrose Ln	SSSC*	C	FRI PM	10.8	B	201.1	**F**	127.9	**F**	171.2	**F**	64.2	**F**
				SAT PM	1.6	A	281.3	**F**	133.9	**F**	181.7	**F**	88.6	**F**
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	439.6	**F**	486.0	**F**	26.4	**F**	476.3	**F**	25.5	**F**
				SAT PM	31.7	D	36.6	**E**	34.6	D	35.9	**E**	33.2	D
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	72.2	**F**	91.3	**F**	87.6	**F**	88.3	**F**	76.7	**F**
				SAT PM	12.8	B	13.3	B	13.1	B	13.2	B	12.9	B
10	Churn Creek Rd @ Smith Rd	SSSC*	C	FRI PM	10.8	B	12.2	B	11.8	B	11.9	B	10.7	B
				SAT PM	9.5	A	11.0	B	10.4	B	10.7	B	9.9	A
24	Smith Rd @ Proposed Project South Dwy	SSSC*	C	FRI PM	-	-	10.2	B	9.8	A	9.9	A	9.1	A
				SAT PM	-	-	10.4	B	9.6	A	10.2	B	9.4	A
101	Knighton Road @ I-5 Southbound Ramps	SSSC*	D	FRI PM	20.1	C	43.3	**E**	34.0	D	37.2	**E**	25.5	D
				SAT PM	11.9	B	16.6	C	13.9	B	15.9	C	14.2	B
102	Knighton Road @ I-5 Northbound Ramps	SSSC*	D	FRI PM	12.6	B	16.1	C	15.3	C	15.6	C	13.4	B
				SAT PM	10.4	B	12.6	B	11.8	B	12.3	B	11.1	B
103	Churn Creek Road @ Knighton Road	Signal	C	FRI PM	9.4	A	36.7	D	25.3	C	29.0	C	11.7	B
				SAT PM	8.1	A	20.6	C	12.3	B	15.9	B	9.5	A
104	Churn Creek Road @ Commercial Way	SSSC*	C	FRI PM	118.2	**F**	139.3	**F**	133.6	**F**	136.4	**F**	128.1	**F**
				SAT PM	17.7	C	18.8	C	18.4	C	18.7	C	18.2	C
105	Bechelli Lane @ Sunnyhill Lane	SSSC*	C	FRI PM	8.6	A	15.7	C	13.5	B	14.2	B	10.0	B
				SAT PM	0.6	A	0.0	A	0.0	A	0.0	A	0.0	A

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

(c) LOS calculations for intersections 3-7 were performed using VISSIM, all other intersections were performed using Synchro 9.0

Table 30 – Cumulative (2040) plus Proposed Project Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with South Only and New Interchange Access Alternative (Option 3)

ID	Intersection	Control	Target LOS	Peak Hour	Cumulative (2040)		Cumulative (2040) plus Proposed Project (3A)		Cumulative (2040) plus Proposed Project (3B)		Cumulative (2040) plus Proposed Project (3C)		Cumulative (2040 plus Proposed Project (3D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	S Bonnyview Rd @ SR-273 (Market St)	Signal	D	FRI PM	28.4	C	28.4	C	28.3	C	28.6	C	25.2	C
				SAT PM	18.7	B	20.3	C	18.8	B	19.4	B	17.9	B
2	S Bonnyview Rd @ E Bonnyview Rd	Signal	D	FRI PM	24.8	C	23.3	C	22.6	C	22.8	C	21.2	C
				SAT PM	8.3	A	8.2	A	8.1	A	8.1	A	8.0	A
3	S Bonnyview Rd @ Bechlli Ln	Signal	D	FRI PM	116.9	**F**	114.2	**F**	120.6	**F**	116.4	**F**	119.4	**F**
				SAT PM	89.2	**F**	94.5	**F**	87.8	**F**	94.7	**F**	88.4	**F**
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	46.1	D	45.9	D	47.3	D	46.3	D	46.9	D
				SAT PM	38.1	D	38.3	D	37.2	D	38.3	D	37.8	D
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	32.3	C	33.6	C	33.6	C	33.7	C	33.2	C
				SAT PM	19.7	B	22.3	C	21.1	C	22.3	C	21.0	C
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	39.4	D	35.9	D	37.3	D	37.1	D	36.6	D
				SAT PM	20.5	C	19.6	B	20.1	C	19.3	B	20.2	C
7	Churn Creek Rd @ Alrose Ln	SSSC*	C	FRI PM	10.8	B	7.6	A	7.3	A	8.2	A	7.6	A
				SAT PM	1.6	A	1.5	A	1.5	A	1.5	A	1.6	A
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	439.6	**F**	270.3	**F**	270.3	**F**	270.3	**F**	270.3	**F**
				SAT PM	31.7	D	23.8	C	23.8	C	23.8	C	23.8	C
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	72.2	**F**	97.6	**F**	81.0	**F**	83.9	**F**	41.2	**E**
				SAT PM	12.8	B	15.2	C	14.1	B	14.8	B	12.9	B
10	Churn Creek Rd @ Smith Rd	SSSC*	C	FRI PM	10.8	B	10.4	B	10.2	B	10.3	B	9.7	A
				SAT PM	9.5	A	9.5	A	9.3	A	9.4	A	9.2	A
24	Smith Rd @ Proposed Project South Dwy	SSSC*	C	FRI PM	-	-	13.1	B	11.2	B	11.9	B	9.7	A
				SAT PM	-	-	13.4	B	10.2	B	12.4	B	10.6	B
25	Smith Rd @ I-5 SB Ramps	Signal	D	FRI PM	-	-	17.8	B	12.3	B	13.5	B	7.7	A
				SAT PM	-	-	35.4	D	12.5	B	22.9	C	9.0	A
26	Smith Rd @ I-5 NB Ramps	AWSC	D	FRI PM	-	-	11.5	B	9.9	A	11.0	B	8.1	A
				SAT PM	-	-	13.1	B	9.4	A	11.8	B	9.0	A
101	Knighton Road @ I-5 Southbound Ramps	SSSC*	D	FRI PM	20.1	C	24.9	C	23.7	C	24.1	C	21.6	C
				SAT PM	11.9	B	13.1	B	12.5	B	13.0	B	12.5	B
102	Knighton Road @ I-5 Northbound Ramps	SSSC*	D	FRI PM	12.6	B	13.4	B	13.2	B	13.3	B	12.9	B
				SAT PM	10.4	B	10.9	B	10.7	B	10.8	B	10.7	B
103	Churn Creek Road @ Knighton Road	Signal	C	FRI PM	9.4	A	9.6	A	9.6	A	9.6	A	9.4	A
				SAT PM	8.1	A	8.2	A	8.2	A	8.2	A	8.1	A
104	Churn Creek Road @ Commercial Way	SSSC*	C	FRI PM	118.2	**F**	139.3	**F**	133.6	**F**	136.4	**F**	128.1	**F**
				SAT PM	17.7	C	18.8	C	18.4	C	18.7	C	18.2	C

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

(c) LOS calculations for intersections 3-7 were performed using VISSIM, all other intersections were performed using Synchro 9.0

Table 31 – Cumulative (2040) plus Proposed Project Intersection Level of Service Summary at Anderson Site (Alternative E)

ID	Intersection	Control	Target LOS	Peak Hour	Cumulative (2040)		Cumulative (2040) plus Proposed Project (E)	
					Delay (sec)	LOS	Delay (sec)	LOS
17	SR-273 (Market St) @ North St	Signal	D	FRI PM	20.0	B	42.2	D
				SAT PM	13.8	B	28.2	C
18	North St @ Oak St	SSSC*	D	FRI PM	33.1	D	-	**F**
				SAT PM	16.6	C	-	**F**
19	North St @I-5 SB Off Ramp	AWSC	D	FRI PM	13.7	B	52.3	**F**
				SAT PM	9.4	A	35.7	**E**
20	North Street @ McMurray Dr/I-5 NB On Ramp	AWSC	D	FRI PM	72.3	F	95.7	**F**
				SAT PM	18.8	C	26.5	D
21	Balls Ferry Rd @ Oak St	SSSC*	D	FRI PM	19.6	C	43.6	**E**
				SAT PM	15.0	C	26.0	D
22	Balls Ferry Rd @ Venutra St/I-5 SB On Ramp	Signal	D	FRI PM	28.3	C	33.0	C
				SAT PM	23.0	D	23.8	C
23	Balls Ferry Rd @ McMurray Dr/I-5 NB Off Ramp	Signal	D	FRI PM	41.7	D	43.0	D
				SAT PM	42.2	D	40.8	D

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

Table 32 – Cumulative (2040) plus Proposed Project Intersection Level of Service Summary at Win River Casino Site (Alternative F)

ID	Intersection	Control	Target LOS	Peak Hour	Cumulative (2040)		Cumulative (2040) plus Proposed Project (F)	
					Delay (sec)	LOS	Delay (sec)	LOS
1	S Bonnyview Rd @ SR-273 (Market St)	Signal	D	FRI PM	28.4	C	31.8	C
				SAT PM	18.7	B	19.5	B
11	SR-273 (Market St) @ Westwood Ave	Signal	D	FRI PM	13.8	B	13.8	B
				SAT PM	10.3	B	10.3	B
12	SR-273 (Market St) @ Clear Creek Rd	Signal	D	FRI PM	6.6	A	6.7	A
				SAT PM	5.6	A	5.6	A
13	SR-273 (Market St) @ Girvan Rd	Signal	D	FRI PM	18.4	B	18.7	B
				SAT PM	14.2	B	14.2	B
14	SR-273 (Market St) @ Redding Rancheria Rd	Signal	D	FRI PM	10.4	B	11.3	B
				SAT PM	8.5	A	9.0	A
15	Canyon Rd @ Redding Rancheria Rd	Signal	D	FRI PM	11.6	B	12.0	B
				SAT PM	10.0	B	10.3	B
16	SR-273 (Market St) @ Happy Valley Rd	Signal	D	FRI PM	7.6	A	7.6	A
				SAT PM	6.4	A	6.4	A

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

As shown in the **Tables 28-32**, the following intersections would fail to meet acceptable level of service thresholds in the Cumulative (2040) scenario. These intersections fail based on established significance criteria and with the addition of project-related traffic to create a potentially significant impact.

<u>Cumulative (2040) Intersection Operating Deficiently</u>

Strawberry Fields Site: North Only Access Alternative (Option 1)

- #3 – Bonnyview Road at Bechelli Lane (Alternatives A, B, C, D)
- #4 – Bonnyview Road at I-5 SB Ramps (Alternatives A, B, C, D)
- #5 – Bonnyview Road at I-5 NB Ramps (Alternative A, B, C, D)
- #6 – Bonnyview Road at Churn Creek Road (Alternative A, B, C, D)
- #7 – Churn Creek Rd at Alrose Lane (Alternative A, B, C, D)
- #8 – Churn Creek Road at Victor Avenue (Alternatives A, B, C, D)
- #9 – Churn Creek Road at Rancho Road (Alternatives A, B, C, D)
- # 104 – Churn Creek Road at Commercial Way (Alternatives A, B, C, D)

Strawberry Fields Site: North and South Access Alternative (Option 2)

- #3 – Bonnyview Road at Bechelli Lane (Alternatives A, B, C, D)
- #4 – Bonnyview Road at I-5 SB Ramps (Alternatives A, B, C, D)
- #5 – Bonnyview Road at I-5 NB Ramps (Alternative A, B, C, D)
- #6 – Bonnyview Road at Churn Creek Road (Alternative A, B, C, D)
- #7 – Churn Creek Rd at Alrose Lane (Alternative A, B, C, D)
- #8 – Churn Creek Road at Victor Avenue (Alternatives A, B, C, D)
- #9 – Churn Creek Road at Rancho Road (Alternatives A, B, C, D)
- # 104 – Churn Creek Road at Commercial Way (Alternatives A, B, C, D)

Strawberry Fields Site: South Only Access with New Interchange Alternative (Option 3)

- #3 – Bonnyview Rd at Bechelli Lane (Alternatives A, B, C, D)
- #9 – Churn Creek Road at Rancho Road (Alternatives A, B, C, D)
- # 104 – Churn Creek Road at Commercial Way (Alternatives A, B, C, D)

Anderson Site (Alternative E)

- #18 – North Street at Oak Street
- #19 – North Street at I-5 Southbound Off-Ramp
- #20 – North Street at McMurray Drive and I-5 Northbound On-Ramp
- #21 – Balls Ferry Road at Oak Street

Proposed Project Traffic Signal Warrant Analysis

Opening Year (2025) Plus Project and Cumulative (2040) Plus Project traffic volumes at unsignalized study intersections were compared against the peak-hour warrant in the *2014 California Manual on Uniform Traffic Control Devices (MUTCD)*.

Results of the analysis showed that the following intersections would satisfy Traffic Signal Warrant #3 by year 2025 and 2040.

Strawberry Fields Site (Alternatives A, B, C, and D)

- #7 – Churn Creek Road at Alrose Lane
- #8 – Churn Creek Road at Victor Ave
- #9 – Churn Creek Road at Rancho Road
- #19 – North Street at I-5 Off-Ramp
- #20 – North Street at McMurry Drive and I-5 Northbound On-Ramp

Alternative Site Alternative (Alternative E)

- #18 – North Street at Oak Street
- #19 – North Street at I-5 Southbound Off-Ramp
- #20 – North Street at McMurray Drive and I-5 Northbound On-Ramp

It should be noted that intersections #8, #9, and #20 meet the Traffic Signal Warrant in the Baseline scenarios as well. Other warrants such as for minimum vehicle volumes, interruption of continuous traffic, and traffic progression were not evaluated because they generally require higher traffic volumes to be satisfied. A copy of the analysis summary for Traffic Signal Warrant #3 is included in **Appendix C**.

Proposed Project LOS Conditions and Impacts on Roadway Segments

Project trips generated by the proposed Project were added to the Opening Year (2025) and Cumulative (2040) forecast roadway segment volumes.

Traffic analyses were completed to evaluate the operation of the study roadway segments in the Opening Year (2025) and Cumulative (2040), with the addition of the project.

Opening Year (2025) plus Project

Results of the Opening Year (2025) Plus Project analysis are presented in **Tables 33-34**. For the proposed project site, only Development Alternative A (Proposed Project) was evaluated. Development Alternative A has the highest trip generation and therefore represents a worst-case scenario. Additional details of the analysis are provided in **Appendix H**.

As shown in **Tables 33-34**, the roadway segments are expected to operate at acceptable levels of service based on established significance criteria under Opening Year (2025) plus Project Conditions.

Table 33 – Opening Year (2025) plus Proposed Project Roadway Segment Level of Service Summary (Two-Lane)

Location	Peak-Hour	Analysis Direction	Opening Year 2025			Opening Year 2025 + Project (1A)			Opening Year 2025 + Project (2A)			Opening Year 2025 + Project (3A)			Opening Year 2025 + Project (E)			Opening Year 2025 + Project (F)		
			LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c
Study Area 1																				
Bechelli Ln south of Bonnyview Rd	FRI	NB	A	92.7	0.05	C	77.7	0.35	C	81.6	0.27	A	92.9	0.05	-	-	-	-	-	-
		SB	A	92.7	0.05	C	76.6	0.48	C	80.3	0.36	A	93.0	0.04	-	-	-	-	-	-
	SAT	NB	A	93.6	0.03	C	75.6	0.35	C	80.5	0.26	A	93.8	0.03	-	-	-	-	-	-
		SB	A	93.6	0.03	C	74.1	0.58	C	78.6	0.43	A	93.8	0.03	-	-	-	-	-	-
Churn Creek Rd east of Alrose Ln	FRI	EB	C	77.9	0.46	C	77.5	0.47	C	77.5	0.47	C	78.9	0.44	-	-	-	-	-	-
		WB	C	78.6	0.38	C	78.2	0.4	C	78.2	0.4	C	79.6	0.35	-	-	-	-	-	-
	SAT	EB	C	82.8	0.26	C	82.6	0.27	C	82.6	0.27	C	83.1	0.24	-	-	-	-	-	-
		WB	C	82.8	0.27	C	82.2	0.29	C	82.2	0.29	C	83.1	0.25	-	-	-	-	-	-
Smith Rd west of Churn Creek Rd	FRI	EB	A	98.1	0.01	A	98.1	0.01	B	90.9	0.1	A	97.6	0.02	-	-	-	-	-	-
		WB	A	98.1	0.03	A	98.1	0.03	A	92.2	0.15	A	97.6	0.04	-	-	-	-	-	-
	SAT	EB	A	94.5	0.01	A	94.5	0.01	B	87.2	0.1	A	93.7	0.03	-	-	-	-	-	-
		WB	A	94.5	0.02	A	94.5	0.02	B	87.4	0.17	A	93.7	0.03	-	-	-	-	-	-
Knighton Road between I-5 SB Ramps and I-5 NB Ramps	FRI	EB	B	86.2	0.17	B	85.5	0.2	B	85.1	0.18	B	85.5	0.20	-	-	-	-	-	-
		WB	B	86.6	0.13	B	86.1	0.13	B	84.9	0.20	B	86.1	0.13	-	-	-	-	-	-
	SAT	EB	B	90.4	0.12	B	89.6	0.15	B	87.0	0.13	B	89.6	0.15	-	-	-	-	-	-
		WB	B	88.7	0.07	B	88.1	0.07	B	86.9	0.14	B	88.1	0.07	-	-	-	-	-	-
Knighton Road between I-5 NB Ramps and Churn Creek Rd	FRI	EB	B	83.9	0.19	C	83.1	0.22	C	81.0	0.29	C	83.1	0.22	-	-	-	-	-	-
		WB	B	83.9	0.19	C	82.9	0.23	C	81.4	0.26	C	82.9	0.23	-	-	-	-	-	-
	SAT	EB	B	86.4	0.11	B	85.4	0.14	C	82.8	0.24	B	85.4	0.14	-	-	-	-	-	-
		WB	B	86.4	0.12	B	85.0	0.16	B	83.9	0.19	B	85.0	0.16	-	-	-	-	-	-
Churn Creek Rd between Knighton Rd and Smith Rd	FRI	NB	B	85.7	0.11	-	-	-	C	80.9	0.23	-	-	-	-	-	-	-	-	-
		SB	B	85.9	0.11	-	-	-	C	81.7	0.20	-	-	-	-	-	-	-	-	-
	SAT	NB	B	91.1	0.07	-	-	-	C	81.2	0.23	-	-	-	-	-	-	-	-	-
		SB	B	90.8	0.06	-	-	-	C	83.0	0.16	-	-	-	-	-	-	-	-	-
Study Area 2																				
Canyon Rd south of Redding Rancheria Rd	FRI	NB	B	85.0	0.15	-	-	-	-	-	-	-	-	-	-	-	-	B	85.0	0.15
		SB	B	84.6	0.24	-	-	-	-	-	-	-	-	-	-	-	-	B	84.6	0.24
	SAT	NB	B	86.9	0.15	-	-	-	-	-	-	-	-	-	-	-	-	B	86.8	0.15
		SB	B	86.9	0.13	-	-	-	-	-	-	-	-	-	-	-	-	B	86.9	0.14
Study Area 3																				
North St east of Oak St	FRI	EB	C	82.6	0.31	-	-	-	-	-	-	-	-	-	D	73.9	0.52	-	-	-
		WB	C	82.9	0.28	-	-	-	-	-	-	-	-	-	D	74.1	0.43	-	-	-
	SAT	EB	B	88.1	0.17	-	-	-	-	-	-	-	-	-	C	77.8	0.45	-	-	-
		WB	B	88.1	0.19	-	-	-	-	-	-	-	-	-	C	78.2	0.35	-	-	-
North St west of Oak St	FRI	EB	B	84.4	0.24	-	-	-	-	-	-	-	-	-	C	80.7	0.34	-	-	-
		WB	B	84.0	0.26	-	-	-	-	-	-	-	-	-	C	80.6	0.35	-	-	-
	SAT	EB	B	89.6	0.15	-	-	-	-	-	-	-	-	-	B	84.6	0.28	-	-	-
		WB	B	89.6	0.15	-	-	-	-	-	-	-	-	-	B	84.9	0.22	-	-	-
Oak St north of North St	FRI	NB	A	97.4	0.05	-	-	-	-	-	-	-	-	-	C	77.5	0.47	-	-	-
		SB	A	97.4	0.04	-	-	-	-	-	-	-	-	-	C	78.1	0.33	-	-	-
	SAT	NB	A	97.7	0.03	-	-	-	-	-	-	-	-	-	D	74.6	0.57	-	-	-
		SB	A	97.7	0.04	-	-	-	-	-	-	-	-	-	D	75.0	0.35	-	-	-
Oak St south of North St	FRI	NB	A	98.1	0.02	-	-	-	-	-	-	-	-	-	A	92.8	0.13	-	-	-
		SB	A	98.1	0.02	-	-	-	-	-	-	-	-	-	A	92.0	0.09	-	-	-
	SAT	NB	A	98.4	0.01	-	-	-	-	-	-	-	-	-	A	92.5	0.15	-	-	-
		SB	A	98.4	0.01	-	-	-	-	-	-	-	-	-	A	91.7	0.09	-	-	-

Notes:

PFFS = Percent Free-Flow Speed, v/c = Volume to Capacity

Table 34 – Opening Year (2025) plus Proposed Project Roadway Segment Level of Service Summary (Multilane)

Location	Peak-Hour	Analysis Direction	Opening Year 2025		Opening Year 2025 + Project (1A)		Opening Year 2025 + Project (2A)		Opening Year 2025 + Project (3A)		Opening Year 2025 + Project (E)		Opening Year 2025 + Project (F)	
			LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
Study Area 1														
Bonnyview Rd west of Bechelli Ln	FRI	EB	B	17	B	17.3	B	17.3	B	17.8	-	-	-	-
		WB	B	17.7	C	23.1	C	20.7	C	18.6	-	-	-	-
	SAT	EB	A	10.1	A	10.6	A	10.6	B	11.6	-	-	-	-
		WB	B	12.5	C	19.5	B	16.4	B	13	-	-	-	-
Study Area 2														
Market St (SR 273) north of Canyon Rd	FRI	NB	A	7.1	-	-	-	-	-	-	-	-	A	7.5
		SB	A	8.8	-	-	-	-	-	-	-	-	A	9.2
	SAT	NB	A	4.9	-	-	-	-	-	-	-	-	A	5.2
		SB	A	5.8	-	-	-	-	-	-	-	-	A	6.3
Market St (SR 273) south of Canyon Rd	FRI	NB	A	4.9	-	-	-	-	-	-	-	-	A	5
		SB	A	5.5	-	-	-	-	-	-	-	-	A	5.6
	SAT	NB	A	3.1	-	-	-	-	-	-	-	-	A	3.2
		SB	A	3.1	-	-	-	-	-	-	-	-	A	3.2

Cumulative (2040) plus Project

Results of the Cumulative (2040) Plus Project analysis are presented in **Tables 35-36**. For the proposed project site, only Development Alternative A (Proposed Project) was evaluated. Development Alternative A has the highest trip generation and therefore represents a worst-case scenario. Additional details of the analysis are provided in **Appendix I**.

As shown in **Tables 35-36**, the roadway segments are expected to operate at acceptable levels of service based on established significance criteria under Cumulative (2040) plus Project Conditions.

Table 35 – Cumulative (2040) plus Proposed Project Roadway Segment Level of Service Summary (Two-Lane)

Location	Peak-Hour	Analysis Direction	Cumulative 2040			Cumulative 2040 + Project (1A)			Cumulative 2040 + Project (2A)			Cumulative 2040 + Project (3A)			Cumulative 2040+ Project (E)			Cumulative 2040 + Project F		
			LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c	LOS	PFFS (%)	v/c
Study Area 1																				
Bechelli Ln south of Bonnyview Rd	FRI	NB	A	91.9	0.06	C	77.1	0.36	C	81.1	0.28	A	92.2	0.07	-	-	-	-	-	-
		SB	A	91.9	0.06	C	76.2	0.49	C	79.9	0.37	A	91.9	0.06	-	-	-	-	-	-
	SAT	NB	A	93.3	0.03	C	75.4	0.35	C	80.3	0.27	A	93.5	0.03	-	-	-	-	-	-
		SB	A	93.3	0.04	D	73.9	0.59	C	78.5	0.44	A	93.5	0.03	-	-	-	-	-	-
Churn Creek Rd east of Alrose Ln	FRI	EB	D	73.9	0.56	D	73.5	0.57	D	73.5	0.57	C	75.3	0.53	-	-	-	-	-	-
		WB	D	71.4	0.5	D	73.6	0.51	D	73.6	0.51	C	75.5	0.46	-	-	-	-	-	-
	SAT	EB	C	81.7	0.31	C	81.2	0.32	C	81.2	0.32	C	82	0.3	-	-	-	-	-	-
		WB	C	80.8	0.35	C	80.4	0.37	C	80.4	0.37	C	81.4	0.32	-	-	-	-	-	-
Smith Rd west of Churn Creek Rd	FRI	EB	A	97.8	0.02	A	97.8	0.02	B	91.4	0.1	A	97.1	0.03	-	-	-	-	-	-
		WB	A	97.8	0.03	A	97.8	0.03	A	91.7	0.16	A	97.1	0.05	-	-	-	-	-	-
	SAT	EB	A	94.3	0.02	A	94.3	0.02	B	87	0.11	A	93.2	0.05	-	-	-	-	-	-
		WB	A	94.3	0.02	A	94.3	0.02	B	86.9	0.18	A	93.2	0.04	-	-	-	-	-	-
Knighton Road between I-5 SB Ramps and I-5 NB Ramps	FRI	EB	B	85.9	0.18	B	85.1	0.21	B	84.7	0.19	B	85.1	0.21	-	-	-	-	-	-
		WB	B	86.2	0.14	B	85.7	0.14	B	84.5	0.21	B	85.7	0.14	-	-	-	-	-	-
	SAT	EB	B	89.8	0.12	B	89.0	0.16	B	86.8	0.13	B	89.0	0.16	-	-	-	-	-	-
		WB	B	88.4	0.08	B	87.9	0.08	B	86.6	0.15	B	87.9	0.08	-	-	-	-	-	-
Knighton Road between I-5 NB Ramps and Churn Creek Rd	FRI	EB	C	83.2	0.22	C	82.3	0.24	C	80.2	0.31	C	82.3	0.24	-	-	-	-	-	-
		WB	C	83.3	0.21	C	82.2	0.25	C	80.6	0.28	C	82.2	0.25	-	-	-	-	-	-
	SAT	EB	B	85.8	0.13	B	85.0	0.15	C	82.4	0.25	B	85.0	0.15	-	-	-	-	-	-
		WB	B	85.8	0.13	B	84.6	0.17	B	83.4	0.20	B	84.6	0.17	-	-	-	-	-	-
Churn Creek Rd between Knighton Rd and Smith Rd	FRI	NB	B	83.9	0.14	-	-	-	C	79.8	0.27	-	-	-	-	-	-	-	-	-
		SB	B	83.8	0.14	-	-	-	C	80.4	0.23	-	-	-	-	-	-	-	-	-
	SAT	NB	B	88.9	0.08	-	-	-	C	80.6	0.25	-	-	-	-	-	-	-	-	-
		SB	B	88.6	0.08	-	-	-	C	82.2	0.18	-	-	-	-	-	-	-	-	-
Study Area 2																				
Canyon Rd south of Redding Rancheria Rd	FRI	NB	B	84.9	0.16	-	-	-	-	-	-	-	-	-	-	-	-	B	84.9	0.16
		SB	B	84.5	0.24	-	-	-	-	-	-	-	-	-	-	-	-	B	84.5	0.24
	SAT	NB	B	86.8	0.15	-	-	-	-	-	-	-	-	-	-	-	-	B	86.7	0.15
		SB	B	86.8	0.14	-	-	-	-	-	-	-	-	-	-	-	-	B	86.8	0.14
Study Area 3																				
North St east of Oak St	FRI	EB	C	80.5	0.36	-	-	-	-	-	-	-	-	-	D	71.5	0.57	-	-	-
		WB	C	80.7	0.33	-	-	-	-	-	-	-	-	-	D	71.5	0.48	-	-	-
	SAT	EB	B	86.6	0.2	-	-	-	-	-	-	-	-	-	C	76.4	0.47	-	-	-
		WB	B	86.6	0.22	-	-	-	-	-	-	-	-	-	C	76.7	0.38	-	-	-
North St west of Oak St	FRI	EB	C	82.5	0.28	-	-	-	-	-	-	-	-	-	C	78.5	0.38	-	-	-
		WB	C	82.0	0.33	-	-	-	-	-	-	-	-	-	C	78.4	0.4	-	-	-
	SAT	EB	C	88.2	0.18	-	-	-	-	-	-	-	-	-	B	83.3	0.3	-	-	-
		WB	B	88.2	0.18	-	-	-	-	-	-	-	-	-	B	83.8	0.25	-	-	-
Oak St north of North St	FRI	NB	A	97.3	0.05	-	-	-	-	-	-	-	-	-	C	77.5	0.47	-	-	-
		SB	A	97.3	0.04	-	-	-	-	-	-	-	-	-	C	78.0	0.33	-	-	-
	SAT	NB	A	97.6	0.03	-	-	-	-	-	-	-	-	-	D	74.5	0.57	-	-	-
		SB	A	97.6	0.05	-	-	-	-	-	-	-	-	-	D	74.8	0.36	-	-	-
Oak St south of North St	FRI	NB	A	98.0	0.02	-	-	-	-	-	-	-	-	-	A	92.6	0.13	-	-	-
		SB	A	98.0	0.02	-	-	-	-	-	-	-	-	-	A	92.0	0.1	-	-	-
	SAT	NB	A	98.4	0.01	-	-	-	-	-	-	-	-	-	A	92.4	0.15	-	-	-
		SB	A	98.4	0.01	-	-	-	-	-	-	-	-	-	B	91.7	0.09	-	-	-

Notes:

PFFS = Percent Free-Flow Speed, v/c = Volume to Capacity

Table 36 – Cumulative (2040) plus Proposed Project Roadway Segment Level of Service Summary (Multilane)

Location	Peak-Hour	Analysis Direction	Cumulative 2040		Cumulative 2040 + Project (1A)		Cumulative 2040 + Project (2A)		Cumulative 2040 + Project (3A)		Cumulative 2040 + Project (E)		Cumulative 2040 + Project (F)	
			LOS	D (pc/mi/ln)	LOS	D (pc/mi/ln)	LOS	D (pc/mi/ln)	LOS	D (pc/mi/ln)	LOS	D (pc/mi/ln)	LOS	D (pc/mi/ln)
Study Area 1														
Bonnyview Rd west of Bechelli Ln	FRI	EB	A	2.1	C	20.7	C	20.7	C	21.1	-	-	-	-
		WB	C	20.8	D	26.2	C	23.8	C	21.9	-	-	-	-
	SAT	EB	B	12	B	12.5	B	12.5	B	13.5	-	-	-	-
		WB	B	14.5	C	21.5	C	18.4	B	15.1	-	-	-	-
Study Area 2														
Market St (SR 273) north of Canyon Rd	FRI	NB	A	7.8	-	-	-	-	-	-	-	-	A	8.3
		SB	A	9.7	-	-	-	-	-	-	-	-	A	10.1
	SAT	NB	A	5.4	-	-	-	-	-	-	-	-	A	5.7
		SB	A	6.3	-	-	-	-	-	-	-	-	A	6.8
Market St (SR 273) south of Canyon Rd	FRI	NB	A	5.9	-	-	-	-	-	-	-	-	A	6
		SB	A	6.5	-	-	-	-	-	-	-	-	A	6.6
	SAT	NB	A	3.7	-	-	-	-	-	-	-	-	A	3.9
		SB	A	3.7	-	-	-	-	-	-	-	-	A	3.8

Notes:

D = Density

Proposed Project LOS Conditions and Impacts on Freeway Segments

Project trips generated by the proposed project were added to the Opening Year (2025) and Cumulative (2040) forecast freeway segment volumes.

Traffic analyses were completed to evaluate the operation of the study freeway segments in the Opening Year (2025) and Cumulative (2040), with the addition of the project.

Opening Year (2025) plus Project

Results of the Opening Year (2025) Plus Project analysis are presented in **Tables 37-39** For the proposed project site, only Development Alternative A (Proposed Project) was evaluated. Development Alternative A has the highest trip generation and therefore represents a worst-case scenario. Additional details of the analysis are provided in **Appendix H**.

As shown in **Tables 37-39**, the freeway segments, except for the diverge segment of I-5 at the North Street southbound off-ramp, are expected to operate at acceptable levels of service based on established significance criteria under Opening Year (2025) plus Project Conditions.

Table 37 – Opening Year (2025) plus Proposed Project Freeway Segment Level of Service Summary (Strawberry Fields Site)

I-5				Opening Year 2025 + Project (1A)		Opening Year 2025 + Project (2A)	
Direction	Segment	Type	Peak Hour	Density[a]	LOS	Density[a]	LOS
Northbound	South of Bonnyview Rd Off-Ramp	Basic	FRI PM	19.0	C	17.4	B
			SAT PM	14.6	B	12.8	B
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	14.1	B	13.0	B
			SAT PM	11.6	B	10.3	B
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	8.5	A	8.5	A
			SAT PM	6.7	A	6.7	A
	Bonnyview Rd On-Ramp	Merge	FRI PM	26.2	C	26.2	C
			SAT PM	20.4	C	20.4	C
	North of Bonnyview Rd On-Ramp	Basic	FRI PM	13.9	B	13.9	B
			SAT PM	10.6	A	10.6	A
Southbound	North of Bonnyview Rd Off-Ramo	Basic	FRI PM	17.5	B	17.5	B
			SAT PM	13.5	B	13.5	B
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	20.9	C	20.9	C
			SAT PM	17.1	B	17.1	B
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	11.7	B	11.7	B
			SAT PM	9.1	A	9.1	A
	Bonnyview Rd On-Ramp	Merge	FRI PM	28.7	D	27.0	C
			SAT PM	20.6	C	18.8	B
	South of Bonnyview Rd On-Ramp	Basic	FRI PM	28.3	D	26.7	D
			SAT PM	18.4	C	17.3	B

Notes:

a- Density measured in passenger cars/lane/mile (pc/ln/mi)

b- **Bold** represents unacceptable operations

c- Weave segment LOS calculated using Leisch Method

Table 38 – Opening Year (2025) plus Proposed Project Freeway Segment Level of Service Summary (Strawberry Fields Site) (Continued)

I-5				Opening Year 2025 + Project (3A)	
Direction	**Segment**	**Type**	**Peak Hour**	**Density**[a]	**LOS**
Northbound	South of Smith Rd Off-Ramp	Basic	FRI PM	20.1	C
			SAT PM	21.6	C
	Smith Rd Off-Ramp	Diverge	FRI PM	28.1	D
			SAT PM	29.6	D
	Smith Rd Off-Ramp to On-Ramp	Basic	FRI PM	18.2	C
			SAT PM	19.0	C
	Smith Rd On-Ramp	Merge	FRI PM	28.1	D
			SAT PM	2.8	A
	Smith Rd On-Ramp to Bonnyview Rd Off-Ramp	Basic	FRI PM	21.0	C
			SAT PM	22.2	C
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	15.2	B
			SAT PM	15.5	B
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	10.0	A
			SAT PM	11.5	B
	Bonnyview Rd On-Ramp	Merge	FRI PM	24.2	C
			SAT PM	22.8	C
	North of Bonnyview Rd On-Ramp	Basic	FRI PM	14.4	B
			SAT PM	14.5	B
Southbound	North of Bonnyview Rd Off-Ramp	Basic	FRI PM	18.5	C
			SAT PM	19.2	C
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	23.0	C
			SAT PM	24.7	C
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	13.8	B
			SAT PM	16.0	B
	Bonnyview Rd On-Ramp	Merge	FRI PM	30.3	D
			SAT PM	28.4	D
	Bonnyview Rd On-Ramp to Smith Rd On-Ramp	Basic	FRI PM	34.9	D
			SAT PM	36.1	E
	Smith Rd On-Ramp	Diverge	FRI PM	15.2	B
			SAT PM	15.5	B
	Smith Rd On-Ramp to Smith Rd Off-Ramp	Basic	FRI PM	10.0	A
			SAT PM	11.5	B
	Smith Rd Off-Ramp	Merge	FRI PM	24.2	C
			SAT PM	22.8	C
	South of Smith Rd Off-Ramp	Basic	FRI PM	14.4	B
			SAT PM	14.5	B

Notes:

a- Density measured in passenger cars/lane/mile (pc/ln/mi)

b- **Bold** represents unacceptable operations

c- Weave segment LOS calculated using Leisch Method

Table 39 – Opening Year (2025) plus Proposed Project Freeway Segment Level of Service Summary (Anderson Site)

I-5				Opening Year 2025 + Project (E)	
Direction	**Segment**	**Type**	**Peak Hour**	**Density**[a]	**LOS**
Northbound	South of Balls Ferry Rd Off-Ramp	Basic	FRI PM	21.8	C
			SAT PM	17.4	B
	Balls Ferry Rd Off-Ramp	Diverge	FRI PM	25.9	C
			SAT PM	20.7	C
	Balls Ferry Rd Off-Ramp to North St On-Ramp	Basic	FRI PM	17.3	B
			SAT PM	14.7	B
	North St On-Ramp	Merge	FRI PM	25.6	C
			SAT PM	21.5	C
	North St On-Ramp to Riverside Ave Off-Ramp	Basic	FRI PM	22.1	C
			SAT PM	18.1	C
Southbound	Riverside Ave On-Ramp to North St Off-Ramp	Basic	FRI PM	32.7	D
			SAT PM	24.1	C
	North St Off-Ramp	Diverge	FRI PM	36.9	**E**
			SAT PM	29.7	D
	North St Off-Ramp to Balls Ferry On-Ramp	Basic	FRI PM	24.1	C
			SAT PM	18.4	C
	Balls Ferry On-Ramp	Merge	FRI PM	32.8	D
			SAT PM	26.2	C
	South of Balls Ferry Rd On-Ramp	Basic	FRI PM	30.7	D
			SAT PM	22.5	C

Notes:

a- Density measured in passenger cars/lane/mile (pc/ln/mi)

b- **Bold** represents unacceptable operations

c- Weave segment LOS calculated using Leisch Method

Cumulative (2040) plus Project

Results of the Cumulative (2040) plus Project analysis are presented in **Tables 40-42**. For the proposed project site, only Development Alternative A (Proposed Project) was evaluated. Development Alternative A has the highest trip generation and therefore represents a worst-case scenario. Additional details of the analysis are provided in **Appendix I**.

As shown in **Tables 40-42**, the freeway segments are expected to operate at acceptable levels of service based on established significance criteria under Cumulative (2040) plus Project Conditions.

Table 40 – Cumulative (2040) plus Proposed Project Freeway Segment Level of Service Summary (Strawberry Fields Site)

I-5				Cumulative 2040 + Project (1A)		Cumulative 2040 + Project (2A)	
Direction	Segment	Type	Peak Hour	Density[a]	LOS	Density[a]	LOS
Northbound	South of Bonnyview Rd Off-Ramp	Basic	FRI PM	14.7	B	13.7	B
			SAT PM	12.1	B	10.9	A
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	20.1	C	18.3	B
			SAT PM	16.9	B	14.5	B
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	10.1	A	10.1	A
			SAT PM	8.5	A	8.5	A
	Bonnyview Rd On-Ramp	Merge	FRI PM	28.6	D	27.6	C
			SAT PM	23.1	C	21.8	C
	North of Bonnyview Rd On-Ramp	Basic	FRI PM	16.6	B	16.6	B
			SAT PM	13.1	B	13.1	B
Southbound	North of Bonnyview Rd Off-Ramp	Basic	FRI PM	21.5	C	21.5	C
			SAT PM	16.9	B	16.9	B
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	30.6	D	30.6	D
			SAT PM	26.1	C	26.1	C
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	14.5	B	14.5	B
			SAT PM	12.0	B	12.0	B
	Bonnyview Rd On-Ramp	Merge	FRI PM	33.9	D	32.9	D
			SAT PM	26.1	C	25.0	C
	South of Bonnyview Rd On-Ramp	Basic	FRI PM	21.2	C	20.4	C
			SAT PM	15.5	B	14.8	B

Notes:

a- Density measured in passenger cars/lane/mile (pc/ln/mi)

b- **Bold** represents unacceptable operations

c- Weave segment LOS calculated using Leisch Method

Table 41 – Cumulative (2040) plus Proposed Project Freeway Segment Level of Service Summary (Strawberry Fields Site) (Continued)

I-5				Cumulative 2040 + Project (3A)	
Direction	**Segment**	**Type**	**Peak Hour**	**Density[a]**	**LOS**
Northbound	South of Smith Rd Off-Ramp	Basic	FRI PM	15.4	B
			SAT PM	16.3	B
	Smith Rd Off-Ramp	Diverge	FRI PM	15.6	B
			SAT PM	16.4	B
	Smith Rd Off-Ramp to On-Ramp	Basic	FRI PM	14.3	B
			SAT PM	14.8	B
	Smith Rd On-Ramp	Merge	FRI PM	21.2	C
			SAT PM	2.8	A
	Smith Rd On-Ramp to Bonnyview Rd Off-Ramp	Basic	FRI PM	15.9	B
			SAT PM	16.5	B
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	15.2	B
			SAT PM	15.5	B
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	11.6	B
			SAT PM	13.4	B
	Bonnyview Rd On-Ramp	Merge	FRI PM	28.0	D
			SAT PM	22.8	C
	North of Bonnyview Rd On-Ramp	Basic	FRI PM	17.2	B
			SAT PM	17.3	B
Southbound	North of Bonnyview Rd Off-Ramp	Basic	FRI PM	22.5	C
			SAT PM	23.4	C
	Bonnyview Rd Off-Ramp	Diverge	FRI PM	23.0	C
			SAT PM	24.7	C
	Bonnyview Rd Off-Ramp to On-Ramp	Basic	FRI PM	16.7	B
			SAT PM	19.3	C
	Bonnyview Rd On-Ramp	Merge	FRI PM	34.9	D
			SAT PM	28.4	D
	Bonnyview Rd On-Ramp to Smith Rd On-Ramp	Basic	FRI PM	24.2	C
			SAT PM	24.3	C
	Smith Rd On-Ramp	Diverge	FRI PM	15.2	B
			SAT PM	15.5	B
	Smith Rd On-Ramp to Smith Rd Off-Ramp	Basic	FRI PM	11.6	B
			SAT PM	13.4	B
	Smith Rd Off-Ramp	Merge	FRI PM	28.0	D
			SAT PM	22.8	C
	South of Smith Rd Off-Ramp	Basic	FRI PM	17.2	B
			SAT PM	17.3	B

Notes:

a- Density measured in passenger cars/lane/mile (pc/ln/mi)

b- **Bold** represents unacceptable operations

c- Weave segment LOS calculated using Leisch Method

Table 42 – Cumulative (2040) plus Proposed Project Freeway Segment Level of Service Summary (Anderson Site)

I-5				Cumulative 2040 + Project (E)	
Direction	**Segment**	**Type**	**Peak Hour**	**Density[a]**	**LOS**
Northbound	South of Balls Ferry Rd Off-Ramp	Basic	FRI PM	17.6	B
			SAT PM	14.9	B
	Balls Ferry Rd Off-Ramp	Diverge	FRI PM	17.8	B
			SAT PM	14.3	B
	Balls Ferry Rd Off-Ramp to North St On-Ramp	Basic	FRI PM	14.3	B
			SAT PM	12.8	B
	North St On-Ramp	Merge	FRI PM	20.8	C
			SAT PM	18.1	B
	North St On-Ramp to Riverside Ave Off-Ramp	Basic	FRI PM	17.5	B
			SAT PM	15.2	B
Southbound	Riverside Ave On-Ramp to North St Off-Ramp	Basic	FRI PM	24.3	C
			SAT PM	19.9	C
	North St Off-Ramp	Diverge	FRI PM	2.9	A
			SAT PM	2.9	A
	North St Off-Ramp to Balls Ferry On-Ramp	Basic	FRI PM	19.6	C
			SAT PM	16.4	B
	Balls Ferry On-Ramp	Merge	FRI PM	27.3	C
			SAT PM	23.0	C
	South of Balls Ferry Rd On-Ramp	Basic	FRI PM	24.1	C
			SAT PM	19.6	C

Notes:

a- Density measured in passenger cars/lane/mile (pc/ln/mi)

b- **Bold** represents unacceptable operations

c- Weave segment LOS calculated using Leisch Method

Proposed Project Mitigations

The evaluation revealed that several intersection improvements, and one freeway improvement, are needed for the Opening Year (2025) and Cumulative (2040) conditions to mitigate project impacts. The improvements required to mitigate project impacts are described below. The project applicant would be responsible for mitigating its cumulatively considerable impact by providing a fair share contribution towards the implementation of mitigation measures needed to improve the intersection or roadway segment to an acceptable LOS or to a level that is equal to better than pre-project operations. A fair share contribution is based on the projects proportionate traffic contribution to the overall future traffic volumes at locations which exceed the significance criteria. The City of Redding requires that improvements be constructed by the project proponent when the fair share is 25% or more. Based on the Caltrans *Guide for the Preparation of Traffic Impact Studies* (2002), the fair share calculation for cumulative impacts at an intersection is shown in the following equation:

$$P = T / (T_B - T_E)$$

Where:
P = The equitable share for the proposed project's traffic impact.
T = The vehicle trips generated by the project during the peak hour of adjacent State highway facility in vehicles per hour, vph.
T_B = The forecasted traffic volume on an impacted State highway facility at the time of general plan build-out (e.g., 20 year model or the furthest future model data feasible), vph.
T_E = The traffic volume existing on the impacted State highway facility plus other approved projects that will generate traffic that has yet to be constructed/opened, vph.

Fair share calculations are provided in **Appendix J**. Fair share percentages were calculated for the appropriate peak-hour during which a subject impact was triggered. When an impact was triggered in both Friday and Saturday peak-hours, the higher (worse) resulting LOS and fair share percentage were used to define the impacts.

It should be noted that the fair share percentages provided in the Updated TIS are generally higher than the Original TIS. In the Updated TIS, the fair share percentages for Opening Year (2025) Conditions are based on 2025 background traffic volumes, whereas in the Original TIS, the fair share percentages for Opening Year (2025) Conditions were based on 2040 background traffic volumes. The Opening Year (2025) Conditions fair share percentages are generally higher than Cumulative (2040) Conditions fair share percentages due to lower background traffic volumes.

For Cumulative (2040) Conditions, the fair share percentages are based on 2040 background traffic volumes. However, if a Cumulative (2040) Conditions mitigation measure was determined to be the same as the respective Opening Year (2025) Conditions mitigation measure, then the fair share calculation refers back to the Opening Year (2025) Conditions fair share calculation.

Opening Year (2025) Intersections Operating Deficiently

Intersections with LOS below established thresholds were investigated to determine the role of the proposed project traffic in under Opening Year (2025) Conditions.

Strawberry Fields Site: North Only Access Alternative (1)

Impact #1 – Bonnyview Road at Bechelli Lane – Intersection #3

As of the original TIS, this intersection was then expected to exceed significance thresholds for unacceptable operations under baseline conditions and was expected to experience an increase in delay due to the proposed project. The intersection was expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D.

However, as described in the Introduction of this Updated TIS and as per the *River Crossing Marketplace Specific Plan EIR*[24], "Under the Year 2040 with Rancheria plus Project scenario…cumulative impacts at intersection #5 [South Bonnyview Road/Bechelli Lane] would be mitigated with implementation of Mitigation Measure TRANS-1.1 [Reconstruct the intersection and approaches into a four-leg, two-lane roundabout in accordance with the specifications of the City Engineer]." The City provided improvement plans for the construction of South Bonnyview Road improvements at Bechelli Lane and the I-5 interchange ramps[25,26], the combination of which are understood to be representative of the aforementioned "TRANS-1.1." These improvements have been fully constructed and the facilities were opened to traffic in November 2022. This constructed mitigation was specifically noted as accommodating the cumulative "Year 2040 with Rancheria plus Project" conditions, which included regional growth in the Shasta County Regional Travel Demand Model (SCRTDF), as well as the known projects in the project vicinity. These projects specifically included the Redding Rancheria Casino Project, Alternative A, which was described as "a new casino and resort, an approximately 69,515-square-foot casino, a 250-room hotel, an event- convention center, and a retail center, as well as associated parking and infrastructure"[27]. Because year 2040 conditions are broadly recognized as being more conservative (higher volumes) than Opening Year conditions, this noted improvement is considered to have adequately mitigated this significant impact. Accordingly, the impact is no longer significant and the project has no mitigation responsibility.

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[24] *Final Environmental Impact Report, State Clearinghouse No. 2017052030, River Crossing Marketplace Specific Plan*, Pages 7-7 and 7-8, PlaceWorks, March 2020.

[25] *Project Plans for the Construction of S. Bonnyview Rd/I-5 Phase II Improvements Bechelli Ln Roundabout*, GHD, October 2021.

[26] *Project Plans for Construction on State Highway in Shasta County in and Near Redding From 0.4 Miles South to 0.5 miles north of Churn Creek Road Overcrossing*, GHD, October 2021.

[27] *Recirculated Draft Environmental Impact Report, State Clearinghouse No. 2017052030, River Crossing Marketplace Specific Plan*, Pages 4.12-43 through 4.12-49, PlaceWorks, December 2019.

Impact #2 – Bonnyview Road at I-5 SB Ramps – Intersection #4

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #2 – Alternatives A, B, C, and D

The significant impact at this intersection can be mitigated with the following improvements: Construct a southbound right turn channelized lane with yield control. The City provided improvement plans for the construction of South Bonnyview Road improvements at the I-5 interchange ramps[26]. These improvements have been fully constructed and the facilities were opened to traffic in November 2022. While these constructed improvements are different than the specified mitigation, they are considered to partially mitigate the subject intersection. Nevertheless, because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 53% for Alternative A, 30% for Alternative B, 49% for Alternative C, and 9% for Alternative D.

Impact #3 – Bonnyview Road at I-5 NB Ramps – Intersection #5

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D . Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #3 – Alternatives A, B, C, and D

The significant impact at this intersection can be mitigated with the following improvements: Construct a northbound left turn lane. The City provided improvement plans for the construction of South Bonnyview Road improvements at the I-5 interchange ramps[26]. These improvements have been fully constructed and the facilities were opened to traffic in November 2022. While these constructed improvements are different than the specified mitigation, they are considered to partially mitigate the subject intersection. Nevertheless, because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 39% for Alternative A, 20% for Alternative B, 22% for Alternative C, and 6% for Alternative D.

Impact #4 – Bonnyview Road at Churn Creek Road – Intersection #6

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #4.1 – Alternative A

The significant impact at this intersection can be mitigated with the following improvements: Construct a southbound right turn lane. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 4% for Alternative A.

Mitigation #4.2 – Alternatives B, C, and D

The significant impact at this intersection can be mitigated with the following improvements: Add a southbound right turn permitted overlap signal phase. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 3% for Alternative B, 3% for Alternative C, and 1% for Alternative D.

Impact #5 – Churn Creek Road at Victor Avenue – Intersection #8

This intersection is expected to exceed significance thresholds for unacceptable operations under baseline conditions and is expected to experience an increase in delay due to the proposed project. The intersection is expected to operate unacceptably under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #5 – Alternatives A, B, C, and D

The significant impact at this intersection can be mitigated with the following improvements: Install a traffic signal. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 10% for Alternative A, 8% for Alternative B, 9% for Alternative C, and 2% for Alternative D.

Strawberry Fields Site: North and South Access Alternative (2)

Impact #6 – Bonnyview Road at Bechelli Lane – Intersection #3

As of the original TIS, this intersection was then expected to exceed significance thresholds for unacceptable operations under baseline conditions and was expected to experience an increase in delay due to the proposed project. The intersection was expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D.

However, as described in the Introduction of this Updated TIS and as per the *River Crossing Marketplace Specific Plan EIR*[24], “Under the Year 2040 with Rancheria plus Project scenario…cumulative impacts at intersection #5 [South Bonnyview Road/Bechelli Lane] would be mitigated with implementation of Mitigation Measure TRANS-1.1 [Reconstruct the intersection and approaches into a four-leg, two-lane roundabout in accordance with the specifications of the City Engineer].” The City provided improvement plans for the construction of South Bonnyview Road improvements at Bechelli Lane and the I-5 interchange ramps[25,26], the combination of which are understood to be representative of the aforementioned “TRANS-1.1.” These improvements have been fully constructed and the facilities were opened to traffic in November 2022. This constructed mitigation was specifically noted as accommodating the cumulative "Year 2040 with Rancheria plus Project" conditions, which included regional growth in the Shasta County Regional Travel Demand Model (SCRTDF), as well as the known projects in the project vicinity. These projects specifically included the Redding Rancheria Casino Project, Alternative A, which was described as “a new casino and resort, an approximately 69,515-square-foot casino, a 250-room hotel, an event- convention center, and a retail center, as well as associated parking and infrastructure”[27]. Because year 2040 conditions are broadly recognized as being more conservative (higher volumes) than Opening Year conditions, this noted improvement is considered to have adequately mitigated this significant impact. Accordingly, the impact is no longer significant and the project has no mitigation responsibility.

Impact #7 – Bonnyview Road at I-5 SB Ramps – Intersection #4
This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #7 – Alternatives A, B, C, and D
The significant impact at this intersection can be mitigated with the following improvements: Construct a southbound right turn channelized lane with yield control. The City provided improvement plans for the construction of South Bonnyview Road improvements at the I-5 interchange ramps[26]. These improvements have been fully constructed and the facilities were opened to traffic in November 2022. While these constructed improvements are different than the specified mitigation, they are considered to partially mitigate the subject intersection. Nevertheless, because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 39% for Alternative A, 24% for Alternative B, 35% for Alternative C, and 3% for Alternative D.

Impact #8 – Bonnyview Road at I-5 NB Ramps – Intersection #5

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #8 – Alternatives A, B, C, and D

The significant impact at this intersection can be mitigated with the following improvements: Construct a northbound left turn lane. The City provided improvement plans for the construction of South Bonnyview Road improvements at the I-5 interchange ramps[26]. These improvements have been fully constructed and the facilities were opened to traffic in November 2022. While these constructed improvements are different than the specified mitigation, they are considered to partially mitigate the subject intersection. Nevertheless, because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 14% for Alternative A, 10% for Alternative B, 11% for Alternative C, and 2% for Alternative D.

Impact #9 – Bonnyview Road at Churn Creek Road – Intersection #6

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #9 – Alternatives A, B, C, and D

The significant impact at this intersection can be mitigated with the following improvements: Add a southbound right turn permitted overlap signal phase. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 4% for Alternative A, 3% for Alternative B, 3% for Alternative C, and 1% for Alternative D.

Impact #10 – Churn Creek Road at Victor Avenue – Intersection #8

This intersection is expected to exceed significance thresholds for unacceptable operations under baseline conditions and is expected to experience an increase in delay due to the proposed project. The intersection is expected to operate unacceptably under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #10 – Alternatives A, B, C, and D

The significant impact at this intersection can be mitigated with the following improvements: Install a traffic signal. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 10% for Alternative A, 8% for Alternative B, 9% for Alternative C, and 2% for Alternative D.

Strawberry Fields Site: South Only Access with New Interchange Alternative (3)

Impact #11 – Bonnyview Road at I-5 SB Ramps – Intersection #4

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D.

Mitigation #11 – Alternatives A, B, C, and D

The significant impact at this intersection can be mitigated with the following improvements: Construct a southbound right turn channelized lane with yield control. The City provided improvement plans for the construction of South Bonnyview Road improvements at the I-5 interchange ramps[26]. These improvements have been fully constructed and the facilities were opened to traffic in November 2022. While these constructed improvements are different than the specified mitigation, they are considered to partially mitigate the subject intersection. Nevertheless, because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 1% for Alternative A. Fair share percentages for Alternatives B, C, and D are 0%.

Impact #12 – Bonnyview Road at I-5 NB Ramps – Intersection #5

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, and C.

Mitigation #12 – Alternatives A, B, and C

The significant impact at this intersection can be mitigated with the following improvements: Optimize signal timings. The City provided improvement plans for the construction of South Bonnyview Road improvements at the I-5 interchange ramps[26]. These improvements have been fully constructed and the facilities were opened to traffic in November 2022. While these constructed improvements are different than the specified mitigation, they are considered to partially mitigate the subject intersection. Nevertheless, because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 3% for Alternative A, 1% for Alternative B, and 2% for Alternative C.

Anderson Site

Impact #13 – North Street at Oak Street – Intersection #18

This intersection is expected to exceed significance thresholds for unacceptable operations under Development Alternative E. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #13 – Alternative E

The significant impact at this intersection can be mitigated with the following improvements: Install a traffic signal or roundabout. The intersection satisfies Traffic Signal Warrant #3 under Opening Year (2025) plus project conditions. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 96%.

Impact #14 – North Street at I-5 Southbound Ramp – Intersection #19

This intersection is expected to exceed significance thresholds for unacceptable operations under Development Alternative E. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #14 – Alternative E

The significant impact at this intersection can be mitigated with the following improvements: Install a traffic signal or roundabout. The intersection satisfies Traffic Signal Warrant #3 under Opening Year (2025) and Cumulative (2040) plus project conditions. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 86%.

Impact #15 – North Street at McMurray Drive and I-5 Northbound On-Ramp – Intersection #20

This intersection is expected to exceed significance thresholds for unacceptable operations under Development Alternative E. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #15 – Alternative E

The significant impact at this intersection can be mitigated with the following improvements: Install a traffic signal or roundabout. The intersection satisfies Traffic Signal Warrant #3 under Existing (2016) conditions without the addition of the proposed project. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 64%.

Freeway Impact #16 – I-5 Southbound Off Ramp at North Street Diverge Segment
In addition to the impacts at the study intersections, the project Alternative E (Anderson Site) results in an impact to the diverge freeway segment at the I-5 southbound off-ramp at North Street.

> **Mitigation #16 –** This impact can be mitigated by increasing the length of the deceleration lane to 360-feet, or by adding a third lane to I-5 in the southbound direction. The freeway is anticipated to be improved to three lanes in the southbound and northbound directions by 2040.

With the implementation of all mitigation measures listed above, the proposed project would have no significant traffic impacts. **Tables 43-46** summarize the expected intersection levels of service with the identified mitigations under the Opening Year (2025) plus Project conditions. As mentioned above, a fair share percentage calculation summary is provided in **Appendix J**. Additional details of the analysis are provided in **Appendix K.**

Table 43 – Opening Year (2025) plus Proposed Project Mitigated Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with North Access Alternative (Option 1)

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (2025) plus Proposed Project (1A)		After Mitigation (1A)		Opening Year (2025) plus Proposed Project (1B)		After Mitigation (1B)		Opening Year (2025) plus Proposed Project (1C)		After Mitigation (1C)		Opening Year (2025) plus Proposed Project (1D)		After Mitigation (1D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	179.4	**F**	36.7	D	157.3	**F**	32.4	C	165.5	**F**	26.4	C	115.8	**F**	26.8	C
				SAT PM	76.9	**E**	16.3	B	54.6	D	16.2	B	68.8	**E**	12.4	B	35.0	D	12.9	B
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	119.3	**F**	54.9	D	99.0	**F**	47.8	D	106.4	**F**	49.2	D	64.7	**E**	40.5	D
				SAT PM	63.3	**E**	40.3	D	30.8	C	22.4	C	52.9	D	30.9	C	27.2	C	29.2	C
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	95.8	**F**	52.1	D	95.9	**F**	47.0	D	95.9	**F**	47.0	D	96.1	**F**	47.0	D
				SAT PM	43.5	D	40.1	D	43.6	D	38.9	D	43.5	D	40.8	D	43.5	D	40.7	D
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	80.8	**F**	7.6	A	78.9	**F**	7.4	A	78.9	**F**	6.1	A	70.3	**F**	6.1	A
				SAT PM	17.7	C	6.5	A	17.3	C	6.5	A	17.6	C	5.8	A	16.9	C	10.3	B

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

Table 44 – Opening Year (2025) plus Proposed Project Mitigated Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with North and South Access Alternative (Option 2)

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (2025) plus Proposed Project (2A)		After Mitigation (2A)		Opening Year (2025) plus Proposed Project (2B)		After Mitigation (2B)		Opening Year (2025) plus Proposed Project (2C)		After Mitigation (2C)		Opening Year (2025) plus Proposed Project (2D)		After Mitigation (2D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	165.5	**F**	26.5	C	147.6	**F**	22.8	C	154.2	**F**	22.9	C	109.7	**F**	25.7	C
				SAT PM	82.2	**F**	13.1	B	56.8	**E**	16.0	B	72.9	**E**	13.0	B	35.1	D	13.1	B
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	91.7	**F**	48.9	D	77.3	**E**	49.6	D	82.8	**F**	52.2	D	60.6	**E**	47.0	D
				SAT PM	41.7	D	31.2	C	22.3	C	22.4	C	36.9	D	31.2	C	25.6	C	29.2	C
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	95.8	**F**	47.0	D	95.9	**F**	47.0	D	95.9	**F**	41.0	D	96.1	**F**	41.0	D
				SAT PM	43.5	D	40.8	D	43.6	D	38.9	D	43.5	D	40.8	D	43.5	D	38.9	D
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	80.8	**F**	7.6	A	78.9	**F**	7.4	A	78.9	**F**	6.1	A	70.3	**F**	6.1	A
				SAT PM	17.7	C	6.5	A	17.3	C	6.5	A	17.6	C	5.8	A	16.9	C	10.3	B

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

Table 45 – Opening Year (2025) plus Proposed Project Mitigated Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with South Only and Interchange Access Alternative (Option 3)

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (3025) plus Proposed Project (3A)		After Mitigation (3A)		Opening Year (3025) plus Proposed Project (3B)		After Mitigation (3B)		Opening Year (3025) plus Proposed Project (3C)		After Mitigation (3C)		Opening Year (3025) plus Proposed Project (3D)		After Mitigation (3D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	123.5	**F**	27.0	C	119.0	**F**	28.0	C	120.6	**F**	27.6	C	103.0	**F**	26.4	C
				SAT PM	27.3	C	21.6	C	26.5	C	12.5	B	26.9	C	12.5	B	26.0	C	12.4	B
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	64.4	**E**	46.4	D	59.3	**E**	48.0	D	61.0	**E**	49.1	D	53.1	D	-	-
				SAT PM	21.7	C	23.6	C	20.1	C	27.3	C	21.3	C	28.2	C	20.4	C	-	-

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection (SSSC*), delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

Table 46 – Opening Year (2025) plus Proposed Project Mitigated Intersection Level of Service Summary at Anderson Site (Alternative E)

ID	Intersection	Control	Target LOS	Peak Hour	Opening Year (2025) plus Proposed Project (E)		After Mitigation (E)	
					Delay (sec)	LOS	Delay (sec)	LOS
18	North St @ Oak St	SSSC*	D	FRI PM	-	**F**	15.8	B
				SAT PM	-	**F**	21.6	C
19	North St @I-5 SB Off Ramp	AWSC	D	FRI PM	36.1	**E**	10.3	B
				SAT PM	26.5	D	9.9	A
20	North Street @ McMurray Dr/I-5 NB On Ramp	AWSC	D	FRI PM	60.7	**F**	14.4	B
				SAT PM	18.5	C	12.2	B

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection, delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

Cumulative (2040) Intersections Operating Deficiently

Intersections with LOS below established thresholds were investigated to determine the role of the proposed project traffic in under Cumulative (2040) Conditions.

Strawberry Fields Site: North Only Access Alternative (1)

Impact #17 – Bonnyview Road at Bechelli Lane – Intersection #3
As of the original TIS, this intersection was then expected to exceed significance thresholds for unacceptable operations under baseline conditions and was expected to experience an increase in delay due to the proposed project. The intersection was expected to operate unacceptably under development alternatives A, B, C, and D.

However, as described in the Introduction of this Updated TIS and as per the *River Crossing Marketplace Specific Plan EIR*[24], “Under the Year 2040 with Rancheria plus Project scenario…cumulative impacts at intersection #5 [South Bonnyview Road/Bechelli Lane] would be mitigated with implementation of Mitigation Measure TRANS-1.1 [Reconstruct the intersection and approaches into a four-leg, two-lane roundabout in accordance with the specifications of the City Engineer].” The City provided improvement plans for the construction of South Bonnyview Road improvements at Bechelli Lane and the I-5 interchange ramps[25,26], the combination of which are understood to be representative of the aforementioned “TRANS-1.1.” These improvements have been fully constructed and the facilities were opened to traffic in November 2022. Accordingly, the impact is no longer significant and the project has no mitigation responsibility.

Impact #18 – Bonnyview Road at I-5 SB Ramps – Intersection #4
This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #18 – Alternative A, B, C, and D**
> The significant impact at this intersection can be mitigated with the following improvements: Install a diverging diamond interchange at the I-5 northbound and southbound ramps. This improvement is consistent with the Alternative 4B concept proposed by Omni-Means[11]. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 44% for Alternative A, 30% for Alternative B, 40% for Alternative C, and 22% for Alternative D.

Impact #19 – Bonnyview Road at I-5 NB Ramps – Intersection #5

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #19 – Alternatives A, B, C, and D**
>
> The significant impact at this intersection can be mitigated with the improvements described in Mitigation #18. Mitigation #18 would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 30% for Alternative A, 19% for Alternative B, 27% for Alternative C, and 14% for Alternative D.

Impact #20 – Bonnyview Road at Churn Creek Road – Intersection #6

This intersection is expected to exceed significance thresholds for unacceptable operations under Development Alternative A. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #20 – Alternatives A, B, C, and D**
>
> The significant impact at this intersection can be mitigated with the following improvements: Install a roundabout. This improvement is consistent with the Alternative 4B concept proposed by Omni-Means[11]. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 4% for Alternative A, 2% for Alternative B, 3% for Alternative C, and 1% for Alternative D.

Impact #21 – Churn Creek Road at Alrose Lane – Intersection #7

This intersection is expected to exceed significance thresholds for unacceptable operations under Development Alternative A. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #21 – Alternatives A, B, C, and D**
>
> The significant impact at this intersection can be mitigated with the improvements described in Mitigations #18 and #20. Mitigations #18 and #20 would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Under Cumulative (2040) conditions, Intersection #7 meets traffic signal warrants. Fair share calculations are 8% for Alternative A, 5% for Alternative B, 8% for Alternative C, and 3% for Alternative D.

Impact #22 – Churn Creek Road at Victor Avenue – Intersection #8

This intersection is expected to exceed significance thresholds for unacceptable operations under baseline conditions and is expected to experience an increase in delay due to the proposed project. The intersection is expected to operate unacceptably under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #22 – Alternatives A, B, C, and D
The significant impact at this intersection can be mitigated with the following improvements: Install a traffic signal. The intersection satisfies Traffic Signal Warrant #3 under Cumulative (2040) without project conditions. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. For fair share calculations, see Mitigation #5.

Impact #23 – Churn Creek Road at Rancho Road – Intersection #9
This intersection is expected to exceed significance thresholds for unacceptable operations under baseline conditions and is expected to experience an increase in delay due to the proposed project. The intersection is expected to operate unacceptably under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #23 – Alternatives A, B, C, and D
The significant impact at this intersection can be mitigated with the following improvements: Add a southbound left turn pocket. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Under Cumulative (2040) conditions, Intersection #7 meets traffic signal warrants. Fair share calculations are 6% for Alternative A, 5% for Alternative B, 5% for Alternative C, and 1% for Alternative D.

Strawberry Fields Site: North and South Access Alternative (2)

Impact #24 – Bonnyview Road at Bechelli Lane – Intersection #3
As of the original TIS, this intersection was then expected to exceed significance thresholds for unacceptable operations under baseline conditions and was expected to experience an increase in delay due to the proposed project. The intersection was expected to operate unacceptably under development alternatives A, B, C, and D.

However, as described in the Introduction of this Updated TIS and as per the *River Crossing Marketplace Specific Plan EIR*[24], “Under the Year 2040 with Rancheria plus Project scenario…cumulative impacts at intersection #5 [South Bonnyview Road/Bechelli Lane] would be mitigated with implementation of Mitigation Measure TRANS-1.1 [Reconstruct the intersection and approaches into a four-leg, two-lane roundabout in accordance with the specifications of the City Engineer].” The City provided improvement plans for the construction of South Bonnyview Road improvements at Bechelli Lane and the I-5 interchange ramps[25,26], the combination of which are understood to be representative of the aforementioned “TRANS-1.1.” These improvements have been fully constructed and the facilities were opened to traffic in

November 2022. Accordingly, the impact is no longer significant and the project has no mitigation responsibility.

Impact #25 – Bonnyview Road at I-5 SB Ramps – Intersection #4
This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #25 – Alternative A, B, C, and D**
> The significant impact at this intersection can be mitigated with the following improvements: Install a diverging diamond interchange at the I-5 northbound and southbound ramps. This improvement is consistent with the Alternative 4B concept proposed by Omni-Means[11]. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 30% for Alternative A, 18% for Alternative B, 27% for Alternative C, and 13% for Alternative D.

Impact #26 – Bonnyview Road at I-5 NB Ramps – Intersection #5
This intersection is expected to exceed significance thresholds for unacceptable operations under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #26 – Alternatives A, B, C, and D**
> The significant impact at this intersection can be mitigated with the improvements described in Mitigation #25. Mitigation #25 would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 17% for Alternative A, 7% for Alternative B, 14% for Alternative C, and 8% for Alternative D.

Impact #27 – Bonnyview Road at Churn Creek Road – Intersection #6
This intersection is expected to exceed significance thresholds for unacceptable operations under Development Alternative A. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #27 – Alternatives A, B, C, and D**
> The significant impact at this intersection can be mitigated with the following improvements: Install a roundabout. This improvement is consistent with the Alternative 4B concept proposed by Omni-Means[11]. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 4% for Alternative A, 2% for Alternative B, 3% for Alternative C, and 1% for Alternative D.

Impact #28 – Churn Creek Road at Alrose Lane – Intersection #7

This intersection is expected to exceed significance thresholds for unacceptable operations under Development Alternative A. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #28 – Alternatives A, B, C, and D**
>
> The significant impact at this intersection can be mitigated with the improvements described in Mitigations #25 and #27. Mitigations #25 and #27 would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Under Cumulative (2040) conditions, Intersection #7 meets traffic signal warrants. Fair share calculations are 8% for Alternative A, 5% for Alternative B, 8% for Alternative C, and 3% for Alternative D.

Impact #29 – Churn Creek Road at Victor Avenue – Intersection #8

This intersection is expected to exceed significance thresholds for unacceptable operations under baseline conditions and is expected to experience an increase in delay due to the proposed project. The intersection is expected to operate unacceptably under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #29 – Alternatives A, B, C, and D**
>
> The significant impact at this intersection can be mitigated with the following improvements: Install a traffic signal. The intersection satisfies Traffic Signal Warrant #3 under Cumulative (2040) without project conditions. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. For fair share calculations, see Mitigation #10.

Impact #30 – Churn Creek Road at Rancho Road – Intersection #9

This intersection is expected to exceed significance thresholds for unacceptable operations under baseline conditions and is expected to experience an increase in delay due to the proposed project. The intersection is expected to operate unacceptably under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #30 – Alternatives A, B, C, and D**
>
> The significant impact at this intersection can be mitigated with the following improvements: Add a southbound left turn pocket. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Under Cumulative (2040) conditions, Intersection #7 meets traffic signal warrants. Fair share calculations are 6% for Alternative A, 5% for Alternative B, 5% for Alternative C, and 1% for Alternative D.

Strawberry Fields Site: South Only Access with New Interchange Alternative (3)

Impact #31 – Bonnyview Road at Bechelli Lane – Intersection #3

As of the original TIS, this intersection was then expected to exceed significance thresholds for unacceptable operations under baseline conditions and was expected to experience an increase in delay due to the proposed project. The intersection was expected to operate unacceptably under development alternatives A, B, C, and D.

However, as described in the Introduction of this Updated TIS and as per the *River Crossing Marketplace Specific Plan EIR*[24], "Under the Year 2040 with Rancheria plus Project scenario…cumulative impacts at intersection #5 [South Bonnyview Road/Bechelli Lane] would be mitigated with implementation of Mitigation Measure TRANS-1.1 [Reconstruct the intersection and approaches into a four-leg, two-lane roundabout in accordance with the specifications of the City Engineer]." The City provided improvement plans for the construction of South Bonnyview Road improvements at Bechelli Lane and the I-5 interchange ramps[25,26], the combination of which are understood to be representative of the aforementioned "TRANS-1.1." These improvements have been fully constructed and the facilities were opened to traffic in November 2022. Accordingly, the impact is no longer significant and the project has no mitigation responsibility.

Impact #32 – Churn Creek Road at Rancho Road – Intersection #9

This intersection is expected to exceed significance thresholds for unacceptable operations under baseline conditions and is expected to experience an increase in delay due to the proposed project. The intersection is expected to operate unacceptably under development alternatives A, B, C, and D. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #32 – Alternatives A, B, C, D**
>
> The significant impact at this intersection can be mitigated with the following improvements: Construct a southbound right turn lane. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Under Cumulative (2040) conditions, Intersection #7 meets traffic signal warrants. Fair share calculations are 8% for Alternative A, 6% for Alternative B, 6% for Alternative C, and 2% for Alternative D.

Anderson Site

Impact #33 – North Street at Oak Street – Intersection #18

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternative E. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #33 – Alternative E

The significant impact at this intersection can be mitigated with the following improvements: Install a traffic signal. The intersection satisfies Traffic Signal Warrant #3 under Opening Year (2025) and Cumulative (2040) plus project conditions. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 90%.

Impact #34 – North Street at I-5 Southbound Off Ramp – Intersection #19

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternative E. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #34 – Alternative E

The significant impact at this intersection can be mitigated with the following improvements: Install a traffic signal or roundabout. The intersection satisfies Traffic Signal Warrant #3 under Opening Year (2025) and Cumulative (2040) plus project conditions. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 81%.

Impact #35 – North Street at McMurray Drive and I-5 Northbound On-Ramp – Intersection #20

This intersection is expected to exceed significance thresholds for unacceptable operations under baseline conditions and is expected to experience an increase in delay due to the proposed project. This intersection is expected to exceed significance thresholds for unacceptable operations under development alternative E. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

Mitigation #35 – Alternative E

The significant impact at this intersection can be mitigated with the following improvements: Install a traffic signal or roundabout. The intersection satisfies Traffic Signal Warrant #3 under Existing conditions without the addition of the proposed project. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. For fair share calculations see Mitigation #15.

Impact #36 – Balls Ferry Road at Oak Street – Intersection #21

This intersection is expected to exceed significance thresholds for unacceptable operations under development alternative E. Because this impact is projected to occur when project traffic is added to future traffic, this is a significant cumulative impact.

> **Mitigation #36 – Alternative E**
>
> The significant impact at this intersection can be mitigated with the following improvements: Install all way stop control. Because the impact is a cumulative impact, the project would be responsible for a proportionate share of the mitigation costs. Modifying the intersection as proposed in this mitigation would reduce the impact to less than significant and improve the intersection to an acceptable LOS. Fair share calculations are 43%.

With the implementation of all mitigation measures listed above, the proposed project would have no significant traffic impacts. **Tables 47-50** summarize the expected intersection levels of service with the identified mitigations under the Cumulative (2040) plus Proposed Project conditions. As mentioned above, a fair share percentage calculation summary is provided in **Appendix J**. Additional details of the analysis are provided in **Appendix L.**

Table 47 – Cumulative (2040) plus Proposed Project Mitigated Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with North Access Alternative (Option 1)

ID	Intersection	Control	Target LOS	Peak Hour	Cumulative (2040) plus Proposed Project (1A)		After Mitigation (1A)		Cumulative (2040) plus Proposed Project (1B)		After Mitigation (1B)		Cumulative (2040) plus Proposed Project (1C)		After Mitigation (1C)		Cumulative (2040) plus Proposed Project (1D)		After Mitigation (1D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	194.9	**F**	26.9	C	167.6	**F**	25.3	C	189.7	**F**	25.5	C	119.8	**F**	22.7	C
				SAT PM	338.4	**F**	21.9	C	308.7	**F**	16.0	B	252.1	**F**	19.4	B	223.0	**F**	14.3	B
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	167.2	**F**	19.5	B	144.6	**F**	15.6	B	153.8	**F**	16.9	B	68.3	**E**	12.4	B
				SAT PM	291.5	**F**	10.1	B	253.9	**F**	9.8	A	232.6	**F**	9.8	A	133.3	**F**	9.6	A
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	221.0	**F**	20.7	C	202.4	**F**	12.3	B	213.1	**F**	14.8	B	82.4	**F**	8.0	A
				SAT PM	361.8	**F**	5.0	A	313.8	**F**	5.0	A	357.2	**F**	4.9	A	109.9	**F**	5.1	A
7	Churn Creek Rd @ Alrose Ln	SSSC*	C	FRI PM	234.3	**F**	11.1	B	222.3	**F**	9.5	A	257.1	**F**	9.5	A	77.6	**F**	9.1	A
				SAT PM	456.0	**F**	7.6	A	420.3	**F**	7.6	A	430.1	**F**	7.6	A	98.5	**F**	7.8	A
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	486.0	**F**	25.2	C	476.3	**F**	26.6	C	476.3	**F**	26.8	C	439.6	**F**	25.8	C
				SAT PM	36.6	**E**	13.8	B	34.6	D	13.6	B	35.9	**E**	13.7	B	33.2	D	13.4	
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	91.3	**F**	14.8	B	87.6	**F**	14.6	B	88.3	**F**	14.7	B	76.7	**F**	14.4	
				SAT PM	13.3	B	15.8	B	13.1	B	15.6	B	13.2	B	15.7	B	12.9	B	15.4	

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection, delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

(c) LOS calculations for intersections 3-7 were performed using VISSIM, all other intersections were performed using Synchro 9.0

Table 48 – Cumulative (2040) plus Proposed Project Mitigated Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with North and South Access Alternative (Option 2)

ID	Intersection	Control	Target LOS	Peak Hour	Cumulative (2040) plus Proposed Project (2A)		After Mitigation (2A)		Cumulative (2040) plus Proposed Project (2B)		After Mitigation (2B)		Cumulative (2040) plus Proposed Project (2C)		After Mitigation (2C)		Cumulative (2040) plus Proposed Project (2D)		After Mitigation (2D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
4	S Bonnyview Rd @ I-5 SB Ramps	Signal	D	FRI PM	181.9	**F**	22.7	C	148.7	**F**	22.1	C	155.6	**F**	22.1	C	104.9	**F**	21.8	C
				SAT PM	325.7	**F**	20.0	C	240.8	**F**	15.6	B	298.5	**F**	18.1	B	181.7	**F**	14.5	B
5	S Bonnyview Rd @ I-5 NB Ramps	Signal	D	FRI PM	130.8	**F**	11.9	B	99.7	**F**	11.8	B	117.6	**F**	11.7	B	56.5	**E**	11.8	B
				SAT PM	229.8	**F**	9.7	A	149.4	**F**	9.7	A	193.6	**F**	9.4	A	97.4	**F**	9.4	A
6	S Bonnyview Rd @ Churn Creek Rd	Signal	D	FRI PM	178.4	**F**	7.9	A	125.0	**F**	8.2	A	147.4	**F**	8.7	A	72.6	**E**	8.3	A
				SAT PM	273.6	**F**	5.1	A	147.4	**F**	5.0	A	188.7	**F**	5.3	A	97.7	**F**	5.2	A
7	Churn Creek Rd @ Alrose Ln	SSSC*	C	FRI PM	201.1	**F**	9.2	A	127.9	**F**	9.3	A	171.2	**F**	9.1	A	64.2	**F**	9.5	A
				SAT PM	281.3	**F**	7.7	A	133.9	**F**	7.7	A	181.7	**F**	7.6	A	88.6	**F**	7.7	A
8	Churn Creek Rd @ Victor Ave	SSSC*	C	FRI PM	486.0	**F**	25.2	C	26.4	**F**	26.6	C	476.3	**F**	26.8	C	25.5	**F**	25.8	C
				SAT PM	36.6	**E**	13.8	B	34.6	D	13.6	B	35.9	**E**	13.7	B	33.2	D	13.4	0
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	91.3	**F**	14.8	B	87.6	**F**	14.6	B	88.3	**F**	14.7	B	76.7	**F**	14.4	0
				SAT PM	13.3	B	15.8	B	13.1	B	15.6	B	13.2	B	15.7	B	12.9	B	15.4	0

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection, delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

(c) LOS calculations for intersections 3-7 were performed using VISSIM, all other intersections were performed using Synchro 9.0

Table 49 – Cumulative (2040) plus Proposed Project Mitigated Intersection Level of Service Summary at Strawberry Fields Site (Alternatives A-D) with South Only and Interchange Access Alternative (Option 3)

ID	Intersection	Control	Target LOS	Peak Hour	Cumulative (2040) plus Proposed Project (3A)		After Mitigation (3A)		Cumulative (2040) plus Proposed Project (3B)		After Mitigation (3B)		Cumulative (2040) plus Proposed Project (3C)		After Mitigation (3C)		Cumulative (2040) plus Proposed Project (3D)		After Mitigation (3D)	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
9	Churn Chreek Rd @ Rancho Rd	SSSC*	C	FRI PM	97.6	**F**	22.4	C	81.0	**F**	21.0	C	83.9	**F**	21.3	C	41.2	**E**	17.2	C
				SAT PM	15.2	C	12.2	B	14.1	B	11.8	B	14.8	B	12.0	B	12.9	B	11.4	B

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection resulting from the project alternative.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection, delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

(c) LOS calculations for intersections 3-7 were performed using VISSIM, all other intersections were performed using Synchro 9.0

Table 50 – Cumulative (2040) plus Proposed Project Mitigated Intersection Level of Service Summary at Anderson Site (Alternative E)

ID	Intersection	Control	Target LOS	Peak Hour	Cumulative (2040) plus Proposed Project (E)		After Mitigation (E)	
					Delay (sec)	LOS	Delay (sec)	LOS
18	North St @ Oak St	SSSC*	D	FRI PM	-	**F**	23.1	C
				SAT PM	-	**F**	34.4	C
19	North St @I-5 SB Off Ramp	AWSC	D	FRI PM	52.3	**F**	13.1	B
				SAT PM	35.7	**E**	11.6	B
20	North Street @ McMurray Dr/I-5 NB On Ramp	AWSC	D	FRI PM	95.7	**F**	17.9	B
				SAT PM	26.5	D	13.3	B
21	Balls Ferry Rd @ Oak St	SSSC*	D	FRI PM	43.6	**E**	13.6	B
				SAT PM	26.0	D	11.5	B

Notes:

Bold represents unacceptable operations. Shading indicates a significant impact at the intersection.

(a) Delay refers to the average control delay for the entire intersection, measured in seconds per vehicle. At a two-way stop-controlled intersection, delay refers to the worst movement.

(b) LOS calculations are based on the methodology outlined in the *2010 Highway Capacity Manual* and performed using Synchro 9.0

ADDITIONAL CONSIDERATIONS

Future Bicycle and Pedestrian Facilities

According to the *Go Shasta Regional Active Transportation Plan: 2019*[10], bicycle facility upgrades are planned along the Sacramento River adjacent to the Strawberry Fields Site. It is recommended that the project implement strategies to avoid impacts to these planned bicycle facilities. Furthermore, there are no impacts to existing or planned bicycle or pedestrian travel at the alternative project sites (Anderson Site and Win River Casino Site).

As a result, the proposed project would not result in the elimination of existing or planned bicycle or pedestrian facilities, interfere with the implementation of a planned bikeway, or result in unsafe conditions for bicyclists or pedestrians. Nevertheless, it is recommended that the project provide safe, continuous, and accessible bicycle and pedestrian facilities within the project vicinity. As presented in the *Redding Rancheria Draft Access Alternative Concepts* memorandum (January 5, 2017), improvements to Bechelli Lane and new access roadways would include sidewalks and shoulders with adequate width to accommodate bicyclists. In addition, it is recommended that the project consider access to transit services and consider travel demand management programs for employees.

Appendices to the Traffic Study are available upon request.

Please contact the following person for a copy:

Chad Broussard
Environmental Protection Specialist,
Bureau of Indian Affairs
Pacific Regional Office,
2800 Cottage Way, Room W–2820,
Sacramento, CA 95825
telephone: (916) 978–6165
e-mail: chad.broussard@bia.gov

APPENDIX R

INTERGOVERNMENTAL AGREEMENT

SEND FULLY EXECUTED ORIGINAL TO:

SHASTA CO. CLERK OF THE BOARD
1450 Court Street, Suite 308B
Redding, CA 96001

INTERGOVERNMENTAL AGREEMENT

This Intergovernmental Agreement ("Agreement") is made effective as of 08/15/ 2023, by and between the County of Shasta (the "County"), a political subdivision of the State of California, and the Redding Rancheria (the "Tribe"), a federally recognized Indian tribe.

RECITALS

WHEREAS, the Tribe is a federally recognized, sovereign Indian tribe responsible for the promotion of economic and social welfare of its members; and

WHEREAS, the Tribe was restored to federally recognized status pursuant to *Hardwick v. United States,* Case No. 79-1710 (N.D. Cal. 1983); and

WHEREAS, the Redding Rancheria Tribal Council is authorized to conduct business on behalf of the Tribe, including the negotiation, execution, and implementation of agreements for the provision of services; and

WHEREAS, the Tribe owns approximately 232 acres of undeveloped land known as the "I-5 Property" in fee simple; and

WHEREAS, the I-5 Property is within an unincorporated area of the County in close proximity to land currently held in trust for the Tribe by the United States on which the Tribe currently conducts gaming activities at its existing Win-River Casino; and

WHEREAS, the Tribe has requested that the I-5 Property be accepted into trust by the United States for the Tribe's use and benefit and for gaming purposes; and

WHEREAS, in connection with its request that the I-5 Property be accepted into trust for gaming purposes, the Tribe has stated that it intends to close its existing Win-River Casino prior to conducting any gaming activities at the I-5 Property; and

WHEREAS, decisions whether to accept the I-5 Property in trust for gaming purposes are federal determinations subject to the National Environmental Policy Act and other federal laws, and over which the County does not have any legal authority to approve or disapprove; and

WHEREAS, the United States Department of the Interior, Bureau of Indian Affairs considers the impacts of trust acquisitions on local governments pursuant to its regulations at 25 C.F.R. Part 151; and

WHEREAS, the Tribe and the County each have an interest in ensuring adequate public services and public safety and law enforcement at the I-5 Property and in the surrounding area; and

WHEREAS, if and when the I-5 Property is accepted into trust by the United States for the Tribe's use and enjoyment, the County will no longer have land-use authority over the I-5 Property; and

WHEREAS, the Tribe's proposed development of the I-5 Property may result in impacts to the County, as described in an Environmental Impact Statement prepared by the Bureau of Indian Affairs under the National Environmental Policy Act; and

WHEREAS, pursuant to the Tribal State Compact Between the State of California and the Redding Rancheria, California (Compact) the Tribe has agreed, subject to ratification by the California Legislature and approval by the Department of Interior, to establish an Impact Mitigation Fund for purposes of providing assistance to non-Tribal law enforcement, emergency services, and services agencies with demonstrated impacts from the Tribe's operation of gaming on Shasta County and the City of Redding, and their respective departments, and the California Department of Transportation, or for other agreed upon purposes; and

WHEREAS, the Tribe recognizes that it may be necessary and appropriate to provide to the County mitigation in addition to that provided for in the Compact through the establishment of the Impact Mitigation Fund to address impacts potentially resulting from the Tribe's development and operation of a new gaming facility on the I-5 Property; and

WHEREAS, the Tribe and the County are committed to continuing their long-term government-to-government relationship by addressing issues of mutual interest and concern; and

NOW, THEREFORE, the Parties hereby agree as follows:

1. Definitions

The terms not defined elsewhere in this Agreement shall have the following meanings:

"BIA" means the Bureau of Indian Affairs of the United States Department of the Interior.

"Call For Law Enforcement Service" means any call, originating on the I-5 Property and verifiable by electronic call records, seeking response by the Shasta County Sheriff's Office for law enforcement services that, in fact, results in a response by the Shasta County Sheriff's Office to the I-5 Property.

"Call For Fire Service" means any call, originating on the I-5 Property and verifiable by electronic call records, seeking response by the Shasta County Fire Department for fire and emergency services that, in fact, results in a response by the Shasta County Fire Department to the I-5 Property.

"CEQA" means the California Environmental Quality Act, California Public Resources Code § 21000 et seq., and any amendments thereto, and the regulations promulgated thereunder, as the same may be amended or modified from time to time.

"Compact" means the Tribal-State Compact between the State and the Tribe, governing the conduct of Gaming Activities on the I-5 Property pursuant to IGRA, as is currently in effect, and as the same may be amended from time to time.

"Draft Environmental Impact Statement" means the Draft Environmental Impact Statement prepared by the BIA for the Project pursuant to the National Environmental Policy Act of 1970, as amended (42 U.S.C. §§ 4371 et seq.), notice of which was published in the Federal Register on April 10, 2019, at 84 Fed. Reg. 14391.

"Gaming Activities" means Class III gaming activities authorized by the Compact.

"Gaming Device" means any slot machine within the meaning of Article IV, Section 19, Subdivision (f) of the California Constitution as defined in the Compact.

"Gaming Facility" or "Facility" means any building or structure in which Gaming Activities or any

Gaming Operations occur, as defined under Section 2.12 of the Compact, and all rooms, buildings, and areas, including hotels, restaurants, parking lots, and walkways, which are attached to and whose principal purpose of which is to serve the activities of the Gaming Operations rather than providing that operation with an incidental benefit.

“Gaming Operations” means the operation of Gaming Activities, whether exclusively or otherwise, as the term “Gaming Activities” is defined under this Agreement.

“IGRA” means the Indian Gaming Regulatory Act of 1988 (P.L. 100-497, 18 U.S.C. § 1166 et seq. and 25 U.S.C. § 2701 et seq.), and any amendments thereto, and the regulations promulgated thereunder, as the same may be amended or modified from time to time.

“Opening Date” means the day on which the commencement of Gaming Activities at the Gaming Facility occurs on the I-5 Property.

“Party” means the Tribe or the County.

“Parties” mean the Tribe and the County.

“Project means the development, construction and operation on the I-5 Property of all or any part of the project identified as the Proposed Project in the Draft Environmental Impact Statement.

“I-5 Property” means certain contiguous parcels totaling approximately 232 acres of land currently located within an unincorporated area of the County and identified in the Draft Environmental Impact Statement as the Strawberry Fields Site, as more particularly depicted and described in Appendix B of the Compact, or any portion of such land, which is to be taken by the United States of America in trust for the benefit of the Tribe.

“State” means the State of California.

2. Non-Recurring Payments

The Tribe agrees to make non-recurring (one-time) payments as set forth in this Section for the purpose of helping to insure that specified measures are in place no later than one hundred and eighty (180) days after Opening Date.

A. Non-recurring Payment in Lieu of Property Taxes and Fees

The Tribe agrees to make a non-recurring payment to the County in the amount of One Million Six Hundred Thousand dollars ($1,600,000) in lieu of property taxes, permit fees, and other impact fees. This Payment will be made in three installments. In the first installment, the Tribe shall make a payment of Three Hundred Thousand dollars ($300,000) upon breaking ground for the Project. In the second installment, the Tribe shall make a payment of Three Hundred Thousand dollars ($300,000) one hundred and eighty (180) days prior to the Opening Date. In the third and final installment, the Tribe shall make a payment of One Million dollars ($1,000,000) no later than one hundred and eighty (180) days after the Opening Date.

B. Non-recurring Law Enforcement Payment

To address potential impacts of the Project on law enforcement resources of the County, upon breaking ground for the Project, the Tribe shall make a non-recurring payment to the

County in the amount of One Million dollars ($1,000,000) to help fund the initial costs associated with providing law enforcement services for the Project.

C. Non-recurring Fire and Emergency Services Payment

To address potential impacts of the Project on fire and emergency services resources of the County, the Tribe shall make a non-recurring payment to the County in the amount of One Million dollars ($1,000,000) at least one year (365) days prior to the Opening Date, to help fund costs associated with providing fire and emergency services for the Project.

D. Non-recurring Traffic Mitigation Payments

To address potential impacts of the Project on roads within the jurisdiction of the County, the Tribe shall make non-recurring payments to the County one hundred and eight (180) days prior to the Opening Date to mitigate the impacts of the Project on roads within the jurisdiction of the County as may be determined in the Record of Decision. The Tribe shall pay its fair share in accordance with the methodology described in the Final Environmental Impact Statement and/or Record of Decision.

3. Recurring Mitigation Payments

The Tribe agrees to make recurring payments to the County in accordance with Section 4 of this Agreement to insure that specified measures remain in place after the Opening Date.

A. Recurring Law Enforcement Payments

In support of the Parties' mutual interest of promoting public safety, the Tribe will make a recurring payment to the County based on the annual number of Calls For Law Enforcement Service multiplied by a rate of One Thousand dollars ($1,000) per Call For Law Enforcement Service. This rate shall be increased annually by the CPI Adjustment. Disputes regarding the annual number of Calls For Law Enforcement Services shall be resolved pursuant to the provisions of Section **8(B)** of this Agreement. This Payment is in consideration of the Shasta County Sheriff's Office providing law enforcement services to the Project and the 1-5 Property, and the potential for related impacts to the District Attorney, Public Defender, and Probation.

B. Recurring Fire and Emergency Services Payments

In support of the Parties' mutual interest of promoting public safety, the Tribe will make a recurring payment to the County based on the annual number of Calls For Fire Service multiplied by a rate of Ten Thousand dollars ($10,000) per Call For Fire Service. This rate shall be increased annually by the CPI Adjustment. Disputes regarding annual number of Calls For Fire Service shall be resolved pursuant to the provisions of Section 8(B) of this Agreement. This Payment is in consideration of the Shasta County Fire providing fire and emergency services to the Project and the 1-5 Property.

C. Transient Occupancy Tax In Lieu Payment

Following the opening of a hotel at the Gaming Facility, the Tribe shall levy a tribal transient occupancy tax in the same manner and at the same rate as the County transient occupancy tax. The Tribe shall collect and deposit proceeds from the tribal transient occupancy tax in a tribal tax fund.

D. Recurring Roadway and Traffic Controls

In support of the Parties' mutual interest in promoting safe access to the I-5 Project, the Tribe will make a recurring payment to the County in the amount of Fifty Thousand dollars ($50,000) to maintain the County's roads and traffic controls, as the County, in its sole discretion, determines will improve the overall roadway systems to serve all its users, provided that access to the I-5 Property is secured and maintained by the County for commercial and business traffic. The Parties will work together in good faith to resolve any access concerns that may arise during the term of this Agreement.

4. Payment Terms

This Agreement requires the Tribe to make annual recurring payments to the County under Section 3. These annual recurring payments shall commence twelve (12) months after the Opening Date, which shall be defined as the Payment Date. Thereafter, the Tribe shall make these annual recurring payments to the County on or by the Payment Date of each succeeding calendar year.

Notwithstanding any other provision of this Agreement, the Parties acknowledge and agree that except for the non-recurring payments to be made prior to the Opening Date as set forth in section 2 of this Agreement, the Tribe's payments shall be contingent upon the occurrence of the Opening Date. In the event the Opening Date does not occur for any reason, payments payable after the Opening Date shall not be due.

5. Term

A. Effective Date

This Agreement shall not become effective unless and until the following events have occurred:

(i) this Agreement has been approved by the Shasta County Board of Supervisors and executed and delivered by the County; and

(ii) this Agreement has been approved by the Redding Rancheria Tribal Council and the General Council, approved as to form by legal counsel to the Tribe, and executed and delivered by the Tribe.

B. Term of Agreement

Once effective, this Agreement shall be in full force and effect until the earlier of (i) December 31, 2053, or (ii) the date the Tribe permanently ceases the operation of Gaming Activities at the Gaming Facility at the I-5 Property.

6. Termination

Unless otherwise agreed by the Parties, this Agreement shall automatically terminate in the event, and on the date, that the Tribe permanently ceases development and construction of the Project or ceases the operation of Gaming Activities at the Gaming Facility at the I-5 Property.

7. Suspension Events

If, due to Force Majeure (as hereinafter defined), an act of God, valid business considerations or any other reason, any portion of the Gaming Operations conducted by the Tribe on the I-5 Property are completely suspended or terminated for a period of at least three months during the Tribe's Fiscal Year, the Tribe's obligations to make annual financial payments pursuant to Section 4 of this Agreement shall be cancelled for that Fiscal Year. For the purposes of this Section, the "Tribe's Fiscal Year" shall cover the period from September 1st to August 31st of the next year. For the purposes of this Section, the term "Force Majeure" shall include, without limitation, the following circumstances that result in complete suspension or termination of any portion of the Gaming Operations: earthquake; flood; fire; other natural disasters; changes in law, regulation or governmental policy; pandemic; riots; war; terrorism; or any unforeseen event or series of events that makes it impractical or impossible to maintain Gaming Operations. When a Force Majeure event occurs that causes the Tribe to suspend any portion of the Gaming Operations conducted by the Tribe on the I-5 Property, the Tribe shall provide written notice to the County within 72 hours of the Force Majeure event.

8. Renegotiation Provision

A. Renegotiation Events

The Tribe may request that the County renegotiate one or more of the provisions of this Agreement if there is a change in law, facts, or other unforeseen circumstances that fundamentally changes the Tribe's financial assumptions made in entering into this Agreement and significantly adversely affects the Tribe's gaming revenue. Such fundamental changes shall be deemed to include, without limitation, the following:

(i) any change ending the prohibition on Class III gaming (as defined in IGRA) or operation of Gaming Devices by non-Indians in California that substantially affects the Project's financial projections or actual revenues by at least 15%; and

(ii) a substantial reduction in the scope of gaming permitted to be conducted by the Tribe on the I-5 Property, whether pursuant to a change in federal, state or local constitutions, laws, rules or regulations, the Compact or otherwise.

The County may request that the Tribe renegotiate one or more of the provisions of this Agreement if there is a change in law, facts, or other unforeseen circumstances that fundamentally changes the County's financial assumptions made in entering into this Agreement.

B. Renegotiation Procedures

All requests to renegotiate or amend this Agreement shall be by written notice and include reference to the provisions of this Agreement to be renegotiated. Upon receipt of such notice, the Parties shall renegotiate this Agreement in good faith. The Parties shall confer promptly and determine a schedule for commencing negotiations within fifteen (15) days of the notice. Each Party is hereby authorized to designate the person or agency responsible for conducting the negotiations and shall execute any documents necessary to confirm such authorization. The purpose of the negotiations will be to renegotiate the provisions of this Agreement in good faith so that the Parties retain substantially the same rights, levels of mitigation, and community benefits contemplated as of the effective date of this Agreement. If the Parties are unable to renegotiate, either Party may trigger the dispute resolution provisions contained in Section 10.

9. Severability

If any provision of this Agreement is held to be illegal, invalid, or unenforceable under present or future laws, such provision shall be fully severable, this Agreement shall be construed and enforced as if such void, illegal, invalid, or unenforceable provision had never comprised a part of this Agreement, and the remaining provisions of this Agreement shall remain in full force and effect and shall not be affected by the void, illegal, invalid, or unenforceable provision or by its severance from this Agreement. In the event that the entire Agreement is declared void, illegal, invalid, unenforceable or unauthorized, the Parties shall enter into good faith negotiations to negotiate a new agreement that maintains the expectation of each Party in entering into this Agreement. If any of the events referenced in this Section occurs, the Parties shall endeavor in good faith negotiations to replace the applicable provisions or provisions with a substitute provision, the economic and other effects of which comes as close as possible to that of the provision which has been severed. Such negotiations shall be conducted pursuant to the provisions of Section 8(B) of this Agreement.

10. Enforcement, Waiver of Sovereign Immunity and Related Matters

A. Enforcement

So that the Tribe and the County will be sure that it and/or they may enforce the terms and conditions of this Agreement or resolve any dispute arising between them, the Tribe and the County each covenants and agrees that each of them may sue or be sued to enforce or interpret the terms, covenants and conditions of this Agreement, or to enforce any obligations or rights of the Parties set forth in this Agreement, in accordance with the terms and conditions set forth in this Section 10.

B. Informal Resolution

Any disagreement or dispute arising between the County and the Tribe under this Agreement shall be resolved, whenever possible, by meeting and conferring. Either Party may request a meeting by giving notice to the other. Upon such notice, the Parties shall meet within ten (10) days. If the disagreement or dispute cannot be resolved to the mutual satisfaction of the Parties within thirty (30) days after the meeting, then each Party shall have the rights provided below.

C. Arbitration

Any controversy, dispute or claim arising out of or relating to the terms of this Agreement, any modification or extension of this Agreement, or any alleged breach thereof (including the question whether any particular matter is arbitrable hereunder) shall be settled by binding arbitration in accordance with the Center for Public Resources Rules for Non-Administered Arbitration of Business Disputes by three arbitrators, of whom the Party initiating the arbitration shall appoint one with the defending Party appointing one (with the third arbitrator being appointed by the other two arbitrators). The place of arbitration shall be Redding, California. The parties shall bear equally the fees of the arbitrator(s) and related expenses of arbitration. The arbitration shall be governed by the United States Arbitration Act, 9 U.S.C. §§ 1-16, and judgment upon the award rendered by the arbitrators may be entered by any court having jurisdiction thereof as provided herein, provided that any award shall be stayed thirty (30) days to all the losing party to seek judicial review. If a party seeks judicial review, the arbitration award shall be stayed pending the final outcome of the judicial review. If the arbitrator award conflicts with a judicial order, the judicial order shall control.

D. Limited Waiver of Sovereign Immunity

The Tribe specifically, expressly, and irrevocably grants a limited waiver of its sovereign immunity and that of its officers and agents as to the County hereunder for disputes arising out of the terms of this Agreement. The Tribe's limited waiver of sovereign immunity is expressly subject to and limited by compliance with each and every one of the following conditions: (i) the claim is made by the County, and no other entity or person, and alleges the breach by the Tribe of its agreements contained herein; (ii) the claim is made against the Tribe and/or its officers and agents in their official capacity for the Tribe; (iii) the claim is brought in the United States District Court, Northern District of California or, in the absence of federal court jurisdiction, the Superior Court of California, for the County of Shasta; (iv) the claim seeks specific performance and/or actual damages, or is brought by the County to interpret or enforce this Agreement or to enforce the dispute resolution provisions of this Section 10. Claims for general, compensatory, consequential, incidental, special, indirect, liquidated, punitive or any other damages are hereby expressly declared to be outside the scope of this limited waiver of sovereign immunity. The Tribe irrevocably agrees that any final judgment of any arbitration or court proceeding relating to or arising under this Agreement shall be conclusive and may be enforced in the United States District Court, Northern District of California, or the Superior Court of California, for the County of Shasta. The Tribe's limited waiver of sovereign immunity regarding any money damage award is expressly limited to recourse against the proceeds of the Gaming Operations located on the I-5 Property. Nothing contained in this Agreement shall be construed as waiving sovereign immunity in any suit for payment of damages from any other Tribal assets including, without limitation, proceeds from the Tribe's non-gaming operations, Tribal governmental funds, or lands or funds held in trust for the Tribe by the United States. Further, nothing in this limited waiver of sovereign immunity shall be construed as consent by the Tribe to be bound by the laws of the State of California or the laws of the United States to which the Tribe is not bound, except as expressly agreed herein or in the Compact.

11. Representations and Warranties

Each Party represents, warrants and covenants to the other Party as follows:

A. Authority

Such Party has the legal power and authority to execute and deliver this Agreement and to perform its obligations under this Agreement.

B. Due Authorization

The approval, execution, and delivery of this Agreement, and waiver of sovereign immunity, and the performance by such Party of its obligations under this Agreement, have been authorized by all requisite actions of such Party.

C. Due Execution and Delivery

The persons executing this Agreement on behalf of such Party are duly authorized to execute and deliver this Agreement on behalf of such Party.

D. Enforceability

This Agreement constitutes the legal, valid and binding obligation of such Party, enforceable against such Party in accordance with its terms, and (subject to Section 6), once executed and delivered, cannot be invalidated pursuant to any subsequent action of the Shasta County Board of Supervisors or the Redding Rancheria Tribal Council or General Council of the Tribe, as applicable.

E. No Conflict

The approval, execution, delivery and performance of this Agreement does not conflict with any other agreement to which such Party is a party and does not violate or require any action which has not been taken under any law, statute, rule, regulation, ordinance, general plan, tribal law, specific plan or court order or decree applicable to such Party.

F. Waivers

A waiver of any breach of any provision of this Agreement shall not constitute or operate as a waiver of any other breach of such provision or of any other provisions, nor shall any failure to enforce any provision operate as a waiver of such provision or of any other provisions.

12. No Submission to Jurisdiction

The Parties acknowledge and agree that this Agreement, except as otherwise explicitly specified, is not intended to constitute, and shall not be construed as constituting, a submission by the Tribe to the jurisdiction of (i) the County or any or any of its subdivisions, departments or courts, (ii) any of its or their respective officials, employees, inspectors or contractors, or (iii) any of its or their respective laws, rules, regulations, ordinances, general plan or specific plans.

13. Third Party Matters

This Agreement is not intended to, and shall not be construed to, create any right on the part of any third party to bring any action or otherwise enforce any of its terms.

14. Notice

All notices required by this Agreement shall be deemed to have been given when made in writing and delivered or mailed to the respective Parties and their representatives at their respective addresses as set forth below or such other addresses as they may provide to the other Party from time to time:

For the County:
County Counsel
1450 Court Street, Suite 332
Redding, CA 96001

With copies to:
County Administrator
1450 Court Street, Suite 308A
Redding, CA 96001

For the Tribe:
Redding Rancheria CEO
2000 Redding Rancheria Road
Redding, CA 96001

With copies to:
Redding Rancheria Tribal Attorney
2000 Redding Rancheria Road
Redding, CA 96001

15. Governing Law

This Agreement shall be governed by, and construed in accordance with, the laws of the United States and the State of California.

16. Construction of Agreement

This Agreement, including all recitals, together with all Exhibits, if any, constitutes the entire agreement between the Parties and supersedes all prior negotiations, representations, drafts regarding this Agreement, whether written or oral. In the event of a dispute between the Parties as to the language of this Agreement or any amendment to this Agreement or the construction or meaning of any term contained in this Agreement or any amendment to this Agreement, this Agreement or any amendment to this Agreement shall be deemed to have been drafted by the Parties in equal parts so that no presumptions or inferences concerning its terms or interpretation may be construed against, or in favor of, either Party based on the preparation or negotiation of this Agreement or any amendment to this Agreement. The headings contained in this Agreement are for convenience of reference only and shall not effect this Agreement's construction or interpretation.

17. Binding Agreement

This Agreement is intended to be, and shall be construed to be, binding upon the Parties and all successors and successors-in-interest of each Party, including all officers, agents and employees, and, in the case of the County, future County Boards of Supervisors, and, in the case of the Tribe, future Tribal Councils.

18. CEQA

This Agreement creates a government funding mechanism and does not involve any commitment to any specific project which may result in a potentially significant physical impact on the environment. This Agreement requires the Tribe to make funding available for identified measures and other programs; however, the County retains discretion to approve, condition, or disapprove any specific projects. In the event the County elects not to approve or implement identified measures, it will meet and confer with the Tribe and re-allocate the Tribal payment to other measures designed to address the relevant potential impact.

To the extent that the County is required to comply with CEQA prior to approving or implementing any improvements, programs or activities identified in or related to this Agreement, the County will comply with CEQA prior to approving, implementing, or otherwise committing to such improvements, programs or activities. This Agreement does not restrict the County's discretion to evaluate the impacts of such improvement, programs or activities; to identify and adopt mitigation for such impacts; to consider and approve alternatives designed to lessen such impacts; or to deny or condition approvals necessary for such improvement, programs or activities.

19. Amendments

This Agreement may be modified or amended only by mutual and written agreement of the Parties.

IN WITNESS WHEREOF, the Parties have executed this Agreement as of the effective date set forth above.

COUNTY OF SHASTA, CALIFORNIA

Date: 8/4/2023

By: __________________________
Patrick Jones, Chair
Board of Supervisors

REDDING RANCHERIA

Date: 08/15/2023

By: Tracy Edwards
Tracy Edwards
Chief Executive Officer

APPROVED AS TO FORM BY TRIBAL ATTORNEY

Date: 8/15/2023

By: __________________________
Tribal Attorney

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