APPENDIX E

Shalako Detention Basin Alternative

MacKay & Somps
ENGINEERS PLANNERS SURVEYORS
1552 Eureka Road, Suite 100, Roseville, CA 95661 (916) 773-1189

TECHNICAL MEMORANDUM

Date:	July 28, 2010
To:	Bob Shattuck, Lennar Communities
From:	Ken Giberson, MacKay & Somps
TM No.:	Technical Memorandum No. 4
Subject:	Shalako Detention Basin Alternatives SunCreek Specific Plan Rancho Cordova, CA
Job No.:	7991-10
Task No.:	Task B.3

A. Introduction

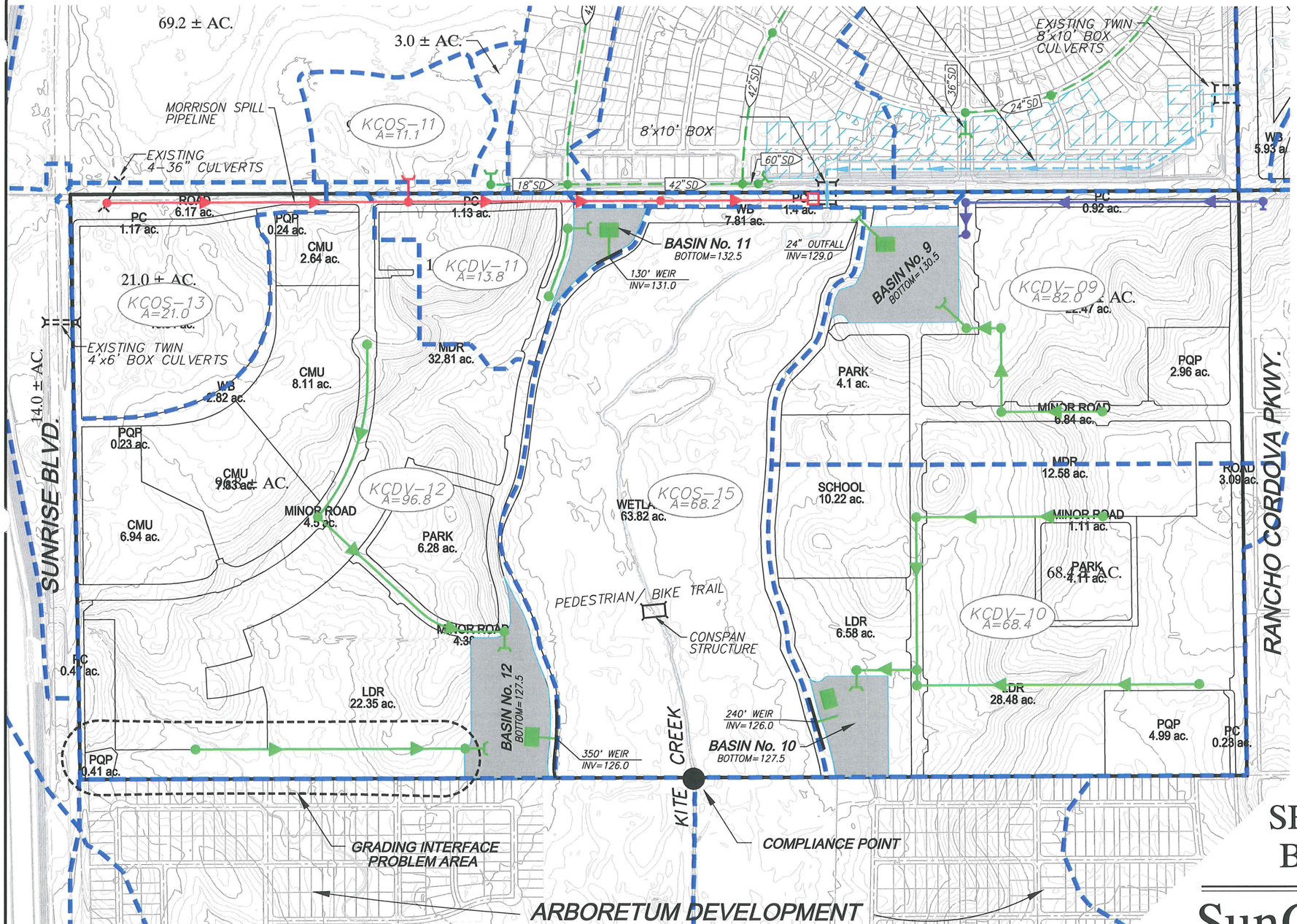
The Shalako property is located in the most southwestern corner of the SunCreek Specific Plan area. The southern boundary of the Shalako property abuts the northwestern portions of the Arboretum project. Figure 1 depicts the Shalako and the northwestern portions Arboretum projects.

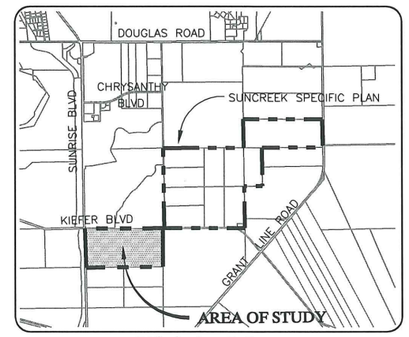
A tributary to Laguna Creek, Kite Creek, bisects the Shalako property in a north-south direction dividing the development into two separate areas – a western area and an eastern area. The southern portion of the western area Shalako property naturally drains towards the Arboretum project.

Development of the Shalako property will redirect this southern portion of the western area watershed easterly to a proposed detention basin located at the western edge of the Kite Creek preserve area near the south boundary of the Shalako property. This redirection would assure that the Shalako property will not drain onto the Arboretum project post development.

This redirection is, also, required to conform to the requirements of the Conceptual Level Strategy for wetland preservation for the SunCreek Specific Plan area that, in part, mandates that runoff from the developed portions of the SunCreek project not drain directly to the preserve area. Instead, these flows are to be directed to strategically located detention basins for water quality treatment and peak flow attenuation prior to discharge to Kite Creek and the preserve areas.

In order to accomplish this redirection, several feet of fill will need to be placed along the most southern tier of lots of the Shalako property. The resulting lot pad





Vicinity Map

Legend

- PROPOSED CHANNEL
- EXISTING CHANNEL
- PROPOSED STORM DRAIN
- PROPOSED STORM DRAIN (DEDICATED TO OPEN SPACE)
- PROPOSED STORM DRAIN (INCLUDES OFFSITE DEVELOPED FLOWS)
- DEVELOPED SHED BOUNDARY

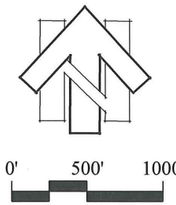


FIGURE #1
SHALAKO DETENTION BASIN ALTERNATIVE

SunCreek Specific Plan

County of Sacramento, California *July, 2010*

MacKay & Somps
ENGINEERS PLANNERS SURVEYORS

7991-00

elevations would be 2± to 6± feet higher than the adjoining tier of lots on the Arboretum site.[1]

This difference in elevations between adjoining lots will create a significant slope between adjoining lots, an undesirable condition requiring slopes and excessive lot depths on the lower lots or the construction of expensive retaining walls to retain the slope.

In an effort to resolve this situation, the question has been raised whether a redesign of the basic grading/drainage concepts incorporated into the Storm Drainage Master Plan (SDMP) for SunCreek in this portion of the Shalako property could alleviate this problem. The intent would be to achieve a more compatible grading interface between the two projects.

The solution to this problem lies in determining whether the detention basin (Basin 12) that will serve this portion of the Shalako development can be reduced in size (depth) to lower the pad grades of the most southern tier of lots along the south boundary of the Shalako development. Figure 1 also shows the location of the Shalako detention basins in relation to the grading interface problem area, as well as the wetland preserve and Kite Creek areas. To compensate for the loss in flood storage volume in Basin 12, Basins 9, 10 and 11 will be increased in the size to over-detain post development flows sufficiently to compensate for the elimination of the 100-year peak flow storage volume of the basin in question (Basin 12).[2]

The intent of this technical memorandum is to document the analysis necessary to determine whether redistribution of storage volumes in these four detention basins is feasible. For purposes of this analysis, a compliance point in Kite Creek at the southern boundary of the Shalako property will be used to test whether reconfiguration of the flood control volumes of these four basins is feasible. The test for feasibility will be whether one can achieve a "no-net change" condition in the flows exiting the site at the point Kite Creek crosses the south boundary of the Shalako property.

B. **Methodology**

Building on the storm drainage Sac-Calc Baseline Conditions modeling contained in the SDMP, the approach to this analysis is briefly summarized as follows:

1. The stand-alone hydromodification flow duration control volume requirements for Basin 12 will be quantified and separated from the total

[1] Personal Conversation with Sean Davis of RJA Engineers on July 27, 2010.
[2] Water quality and hydromodification flow duration control volumes in Basin 12 would not change under this scenario.

detention volume of the basin.

2. Basin 12 will be reduced in size sufficiently to allow the overland release from the southwestern portion of the Shalako property to pass through the basin unattenuated and discharge directly into Kite Creek while retaining the requisite water quality and hydromodification volumes. This will allow the magnitude of filling that is needed to occur along the common property line between the two adjoining projects to be reduced to minimize and/or eliminate the grading interface problem.
3. The flood control volumes in the three remaining basins will be increased on an incremental basis until the hydraulic model reflects a "no net change" condition at the compliance point mentioned above.
4. Compare the magnitude of the flows at the compliance point to demonstrate a "no net change" condition at the compliance point.

C. **Analysis**

In accordance with the methodology outlined above, the following analysis was performed:

1. Determine Requisite Stand-Alone Hydromodification Flow Duration Control Volumes For Basin 12.

   The detention basins shown on the Baseline Conditions Model for SunCreek were designed as combined water quality, hydromodification flow duration control and flood control basins. As such, because of the timing of flows entering these detention basins from the developed portions of the SunCreek project some of the storage volume above the 1.5 foot deep hydromodification weir is jointly used for additional hydromodification storage and peak flow attenuation storage for the 100-year design event.

   Since hydromodification includes design events up to the 10-year design event, Basin 12 can only be reduced by the amount of the jointly used volume. Based on the hydromodification analysis performed by CBEC for the SDMP, CBEC estimated that magnitude of this joint storage volume to be approximately 50% of the flood storage volume of the detention basin plus the 1.5 foot high hydromodification weir.[3][4]

[3] Personal communication between Ken Giberson of MacKay & Somps and Chris Campbell of CBEC on December 14, 2009 (approximately 50% for 10-year/24-hour storm).

This joint storage volume was then estimated for each of the four basins under study. Also, the water quality and 1.5' pool volumes of each of the basins were determined. The results of this analysis are summarized in Table 1.

Table 1
Requisite Detention Basin Volumes
(Assuming Baseline Conditions Model)

Basin No.	1.5' Hydro-Modification Storage Volume (AF)	Baseline Conditions Model 100-Year Storage Volume (AF)	Total Storage Volume (AF)	Joint Detention Volume (AF)	Water Quality Volume (AF)
9	3.0	14.0	17.0	5.5	1.5
10	1.5	10.1	11.5	7.1	1.7
11	0.2	1.0	1.2	0.4	0.4
12	3.5	13.0	16.5	4.8	3.0
Total	8.1	38.8	46.1	17.8	6.6

2. Redesign Basin 12 To Minimize And/Or Eliminate The Grading Interface Problem.

   An effort was then undertaken to redesign Basin 12 to lower the overland release elevation for the southwest portion of the Shalako property and, thereby, lower the basin depth and the pad elevations of the southern tier of Shalako lots along the common boundary line with the Arboretum property. This redesign effort reduced the pad elevations in question in the magnitude of 1± to 3± feet.[5] This effectively eliminated and/or minimizes the grading interface problem between the two projects.

3. Determine Additional Peak Flow Storage Volumes in Basins 9, 10 and 11 Required To Achieve A "No Net Change" Condition.

   The storage volumes of Basins 9, 10 and 11 were then incrementally increased and the model re-run each time until a "no-net change" condition was achieved at the compliance point. Figure 2 is a tabular

[4] Design level analysis should be performed prior to approval of improvement plans for the project to verify this accuracy of this analysis.
[5] Personal conversation with Sean Davis at RJA Engineers on July 27, 2010.

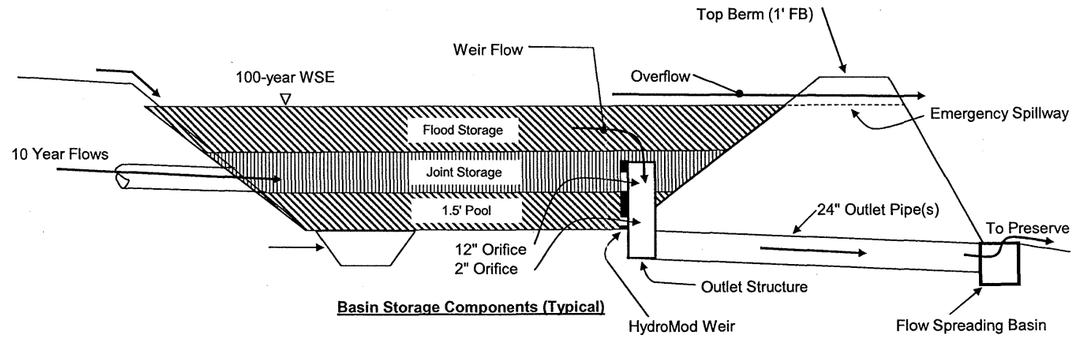
Figure 2

Shalako Detention Requirements
Excluding Basin 12 For Flood Detention
SunCreek Drainage Master Plan

	Baseline Conditions Model														Current Scenario										
Basin No.	Acreage	Bottom (Ac)	100-Year Flood Detention Volume, (Ac.-Ft.)			HydroMod Volume (Ac.-Ft.)					Subtotal Flood Volume + 1.5' Pool (Ac.-Ft.)		Water Quality Volume (Ac.-Ft.)	Total (Ac.-Ft.)	100-Year Flood Detention Volume, (Ac.-Ft.)			HydroMod Volume, Ac.-Ft. (2)					Subtotal Flood Volume + 1.5' Pool (Ac.-Ft.) (3)		Water Quality Volume (Ac.-Ft.)	Total (Ac.-Ft.)
						Total (1)		Joint Use	1.5' Pool									Total		Joint Use	1.5' Pool					
9	4.00	2.00	14.0	82%	100 Year/ 24 Hour	8.5	50%	5.5	3.0	18%	17.0	100%	1.5	**18.5**	26.0	90%	100 Year/ 10 Day	8.5	29%	5.5	3.0	10%	29.0	100%	1.5	**30.5**
10	2.50	1.00	10.0	87%	100 Year/ 10 Day	5.8	50%	4.3	1.5	13%	11.5	100%	1.7	**13.2**	20.0	93%	100 Year/ 10 Day	5.8	27%	4.3	1.5	7%	21.5	100%	1.7	**23.2**
11	0.80	0.12	1.0	85%	100 Year/ 24 Hour	0.6	50%	0.4	0.2	15%	1.2	100%	0.4	**1.6**	2.3	93%	100 Year/ 10 Day	0.6	24%	0.4	0.2	7%	2.5	100%	0.4	**2.9**
12	4.20	2.30	13.0	79%	100 Year/ 24 Hour	8.2	50%	4.8	3.5	21%	16.5	100%	3.0	**19.5**	0.0	0%	n/a	8.2	100%	4.8	3.5	n/a	8.2	100%	3.0	**11.2**
Total	11.50	5.42	38.0	82%		23.1		14.9	8.1		46.1		6.6	**52.7**	48.3			23.1		14.9	8.1		61.2		6.6	**67.8**

Notes:

1. HydroMod Volume for Current Scenario = Approx. 50% of "Subtotal Flood Volume + 1.5' Pool" for 10-Year/24 Hour Storm (Approx. 75% for 100-Year/10 Day Storm).
2. HydroMod Volume for Proposed Scenario = Baseline Model Volumes.
3. Basin 12 volume controlled by total hydromod volume requirement.
4. Numbers may not total due to round-off error.



Basin Storage Components (Typical)

computation and pictorial representation of this analysis. Table 3 shows the resulting storage volumes in the basins under study.

Table 2
Requisite Detention Basin Volumes
(Assuming Current Scenario)

Basin No.	1.5' Hydro-Modification Storage Volume (AF)	Current Scenario 100-Year Storage Volume (AF)	Total Storage Volume (AF)	Joint Detention Volume (AF)	Water Quality Volume (AF)
9	3.0	26.0	29.0	5.5	1.5
10	1.5	20.0	21.5	7.1	1.7
11	0.2	2.3	2.5	0.4	0.4
12	3.5	0.0	8.2	4.8	3.0
Total	8.1	48.3	46.1	17.8	6.6

4. Compare the Magnitude of the Flows at the Compliance Point to Demonstrate a "No Net Change" Condition at the Compliance Point.

   The results of this analysis were then tabulated to demonstrate that a "no-net change" condition was achieved. Table 3 includes the results of this analysis demonstrating a "no-net change" condition. The final results of the Baseline Conditions Model SAC-CALC analysis are included in Appendix A.

D. Summary of Results

This technical memorandum demonstrates that it is technically feasible to achieve an increase the peak flow storage volumes of Basins 9, 10 and 11 such that the peak flow storage volume of Basin 12 can be reduced sufficiently to minimize and/or eliminate the grading interface problem between the Shalako and Arboretum projects. As shown in Table 2, this can be accomplished while meeting the "no-net change" requirement at the compliance point.

Table 3
"No-Net Change" at Compliance Point Tabulation

Scenario	10-Year Flow at Compliance Point	100-Year/24 Hour Flow at Compliance Point
Baseline Conditions Model	617 cfs	1,024 cfs
Current Scenario	613 cfs	1,034 cfs[6]

One significant result of such a redistribution of storage volumes between Basins 9, 10, 11 and 12 is the significant increase in storage volumes in Basins 9, 10 and 11 required to achieve a "no-net change" condition. The increase in the aggregate storage volumes of Basins 9, 10 and 11 significantly exceed the reduction in volume in Basin 12.

This phenomenon is principally due the differences in response time of the drainage system and the fact that placing additional storage volumes upstream to compensate for the elimination of downstream storage volumes is inefficient. That is to say that it takes a greater amount of upstream storage to mitigate the effect of unattenuated downstream discharges.

E. Conclusion

Notwithstanding the adverse impacts on developable area within the Shalako property, it appears technically achievable to eliminate and/or minimize the grading interface problem. This can be done by reducing the size of Basin 12 and providing a compensating increase in storage volumes in Basins 9, 10 and 11 while still achieving a "no-net change" condition at the compliance point.

[6] Based on professional experience this flow rate will actually be lower than the Baseline Conditions Model results when using HEC-RAS Unsteady State analysis. Accordingly, this result is acceptable and deemed to meet the "no-net change" standard utilized in this analysis.

Appendix A

Baseline Conditions Modeling

Sacramento Hydrologic Calculator Report

July 28, 2010 11:24

Project Title: Basin n Proposed Conditions
Comments: Proposed Conditions. with local detention - Baseline Condition 10 yr and 100 yr 24 hour storrms
Prepared by: KEC
Method: Sacramento County HEC-1 method
Date: 8/6/2008

Watershed Hydrologic Summary Data

Watershed	Area (acres)	Mean Elevation (ft)	Lag Times		Basin "n"		Loss Rates		Percent Impervious	
			Method	Lag Time (min)	Method	Basin "n"	Method	Loss Rate (in/hr)	Method	Impervious Area (%)
KCOS1	16.8	203.5	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCDV2	120.2	199.7	Basin "n"	-	Specified	0.043	Computed	-	Computed	-
KCDV3	76.9	185	Basin "n"	-	Computed	-	Computed	-	Computed	-
KCDV5	201.3	175	Basin "n"	-	Specified	0.051	Computed	-	Computed	-
KCDV4	134.1	174	Basin "n"	-	Specified	0.044	Computed	-	Computed	-
KCDV7	52	153.5	Basin "n"	-	Specified	0.037	Computed	-	Computed	-
KCDV8	126.2	152.9	Basin "n"	-	Specified	0.043	Computed	-	Computed	-
KCDV9	82.2	144.2	Basin "n"	-	Specified	.051	Computed	-	Computed	-
KCOS02	54.9	166.3	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCOS03	30.4	153	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
OSKC05	102.3	181.5	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCDV06	94.2	166.5	Basin "n"	-	Specified	0.039	Computed	-	Computed	-
KCOS04	29.3	145.2	Basin "n"	-	Specified	.070	Computed	-	Computed	-
KCOS06	20.3	166	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCA3	297.3	151	Basin "n"	-	Specified	0.049	Computed	-	Computed	-
KCOS11	11.1	157.5	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCDV11	13.8	145.1	Basin "n"	-	Specified	0.044	Computed	-	Computed	-
KCDV10	68.4	140.1	Basin "n"	-	Specified	0.045	Computed	-	Computed	-
KCDV12	96.8	138.3	Basin "n"	-	Specified	.042	Computed	-	Computed	-
KCOS12	65	156.5	Basin "n"	-	Specified	0.070	Computed	-	Computed	-
KCOS13	21	154	Basin "n"	-	Specified	0.070	Computed	-	Computed	-
KCOS14	14	145.5	Basin "n"	-	Specified	.070	Computed	-	Computed	-
KCOS15	68.2	122.5	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCOS3A	168.5	213	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
EXKC13	73.3	140	Basin "n"	-	Computed	-	Computed	-	Computed	-
EXKC14	95.1	120	Basin "n"	-	Computed	-	Computed	-	Computed	-

Basin "n" Method Data for Lag Time Computation

Watershed	Channel Length (ft)	Centroid Length (ft)	Slope (ft/ft)	Channelization	Land Use Impervious Area Percent (% or acres)																	
					95	90	85	80	75	70	60	50	40	30	25	20	15	10	5	2	1	1*
KCOS1	1576	850	0.0159	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV2	3940	750	0.0156	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV3	1920	444	0.0042	Undeveloped	2.6	6.8					8.1	21.4							12.9	25.1		
				Developed	0	0					0	0							0	0		
KCDV5	4464	1907	0.0103	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV4	3297	917	0.003	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV7	1655	580	0.0091	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV8	4054	2363	0.0081	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV9	4360	2120	.0083	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS02	3900	2145	.005	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS03	2089	415	.0048	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OSKC05	4804	2082	.0081	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV06	3313	1851	.0063	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS04	2745	1385	005	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS06	2377	1387	0027	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCA3	7016	3899	.006	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS11	726	572	.0069	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV11	850	322	.0213	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV10	2474	1482	.0178	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV12	3407	1720	.0119	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS12	2632	1237	.0057	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS13	1370	566	.0088	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS14	1990	908	.0085	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS15	3317	1334	.0027	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS3A	3787	1555	.0132	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EXKC13	4651	2747	0105	Undeveloped																100		
				Developed																0		
EXKC14	79700	3064	.003	Undeveloped																100		
				Developed																0		

Refer to the Drainage manual for Land Use Impervious Area Percent

*Dense Oaks, Shrubs, Vines

Infiltration Loss Rate Data

Watershed	Soil Cover Group	Land Use Impervious Area Percent (% or acres)																	
		95	90	85	80	75	70	60	50	40	30	25	20	15	10	5	2	1	1*
KCOS1	B																		
	C																4.8		
	D																12		
KCDV2	B																		
	C	1.1						26.2	12.2							8.2	2.2		
	D	2						36.7	21.6							2.2	7.8		
KCDV3	B																		
	C																		
	D	2.6	6.8					8.1	21.4							12.9	25.1		
KCDV5	B																		
	C															1.1			
	D	7.2					3.7	25.9	81.2							23.7	58.5		
KCDV4	B																		
	C																4.7		
	D						6.4	57.5	6.4	41						14	5.3		
KCDV7	B																		
	C	2.6														1			
	D	4.2	12.4				11.6	15.7								4.5			
KCDV8	B																		
	C	1.6																	
	D	5						58.9	37.2							18.3	5.2		
KCDV9	B																		
	C																		
	D	16.2	2.5						24.5	1						9.8	28		
KCOS02	B																		
	C																16.3		
	D																38.6		
KCOS03	B																		
	C																12.7		
	D																17.7		
OSKC05	B																		
	C																		
	D																102.3		
KCDV06	B																		
	C	0.9																	
	D	23					10.9	46.9								5.5	7		
KCOS04	B																		
	C																20.4		
	D																8.9		
KCOS06	B																		
	C																		
	D																20.3		
KCA3	B																		
	C								120							0.6	26.3		
	D								78.4							4.4	67.6		
KCOS11	B																		
	C																5.9		
	D																5.2		
KCDV11	B																		
	C																		
	D	2.1							8.9							2.8			
KCDV10	B																		
	C																		
	D	5	5						13.2	32.5						8	4.7		
KCDV12	B																		
	C	1.5															1		
	D	5.5	24						23.2	24.9						15.8	1.3		
KCOS12	B																		
	C																27.1		
	D																37.9		
	B																		

KCOS13	C															1.3		
	D															19.7		
KCOS14	B																	
	C																	
	D															14		
KCOS15	B																	
	C																	
	D															68.2		
KCOS3A	B																	
	C															32.6		
	D															135.9		
EXKC13	B																	
	C															6.5		
	D															66.8		
EXKC14	B																	
	C															4.1		
	D															91		

Refer to the help file for Land Use Impervious Area Percent

*Dense Oaks, Shrubs, Vines

Hydrograph Routing – Muskingum–Cunge (Standard)

Routing ID	Route From	Route To	Channel Type	Length (ft)	Slope (ft/ft)	Width or Diameter (ft)	Side Slope (H:V)	Mannings "n"
R1	DET03	J1	Pipe	2814	0.005	3	3:1	0.015
R6A	OSKC05	J06	Trapezoidal	555	0.007	20	4:1	0.030
R4	J03	J04	Trapezoidal	2319	0.0048	30	4:1	0.014
R5	J04	J05	Trapezoidal	2582	0.0039	20	3:1	0.015
R7	J06	J7	Trapezoidal	2058	0.0025	20	3:1	0.025
R2A	KCOS1	J02	Trapezoidal	1510	0.0159	05	3:1	0.03
R2	J1	J02	Trapezoidal	644	0.0047	5	3:1	0.03
R3	J02	J03	Trapezoidal	3485	.0313	5	3:1	0.03
R6	J05	J06	Trapezoidal	2283	0.0031	20	3:1	0.03
R8	J7	J08	Trapezoidal	95	0.0025	10	1:1	0.025
R8A	KCOS11	J08	Pipe	1147	0.005	3		0.015
R9	J08	J9	Trapezoidal	3214	0.0019	20	3:1	0.03
R10B	KCOS12	J10B	Trapezoidal	524	0.005	20	3:1	0.03
R10C	J10B	J10C	Trapezoidal	1398	0.005	10	3:1	0.03
R10D	J10C	J10	Pipe	2907	0.0034	4		0.015
R3A	KCOS3A	J1	Pipe	2628	0.005	5		0.015
R10	J10	J11	Trapezoidal	1028	0.0022	15	2.5:1	0.07
R11	J11	J12	Trapezoidal	2966	0.0022	15	2.5:1	0.07

Detention Basin Data

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
A3DET	Elevation (ft)	0	Elevation (ft)	127.4	128.5	128.5	130.5	131.5						124.41	.54	.61	0.5
			Area (ac)	6.38	6.61	6.89	7.23	7.81						128.50	84	2.6	1.5
	Pump Data															
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5				
			Pump Discharge (cfs)													
			Elevation at which Pump Turns On (ft)													
			Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET02	Elevation (ft)	171	Elevation (ft)	171	172	173	174	175	176	177				171.875	2.41	.61	0.5
			Area (ac)	3.228	3.403	3.582	3.765	3.954	4.147	4.344				176.5	230	2.6	1.5
	Pump Data															
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5				
			Pump Discharge (cfs)													
			Elevation at which Pump Turns On (ft)													
			Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET03	Elevation (ft)	170.5	Elevation (ft)	170.5	171.5	172.5	173.5	174.5	175.5	176.5				171.	.785	.61	0.5
			Area (ac)	2.654	2.812	2.975	3.143	3.315	3.492	3.673				176	190	2.6	1.5
	Pump Data															
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5				
			Pump Discharge (cfs)													
			Elevation at which Pump Turns On (ft)													
			Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET04	Elevation (ft)	161.5	Elevation (ft)	161.5	162.5	163.5	164.5	165.5	166.5	167.5				162.375	2.41	.61	0.5
			Area (ac)	3.954	4.147	4.344	4.546	4.753	4.964	5.18				167	251	2.6	1.5
	Pump Data															
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5				
			Pump Discharge (cfs)													
			Elevation at which Pump Turns On (ft)													
			Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
	Elevation	156.5	Elevation (ft)	156.5	157.5	158.5	159.5	160.5	161.5	162.5				157.0	3.14	.61	0.5

	(ft)		Area (ac)	5.739	5.971	6.208	6.449	6.694	6.944	7.199				162	315	2.6	1.5

DET05	Pump Data							
	Pump Hydrograph Name		Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	
		Pump Discharge (cfs)						
		Elevation at which Pump Turns On (ft)						
		Elevation at which Pump Turns Off (ft)						

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET06	Elevation (ft)	152.5	Elevation (ft)	152.5	153.5	154.5	155.5	156.5	157.5	158.5				153.	1.57	.61	0.5
			Area (ac)	2.812	2.975	3.143	3.315	3.492	3.676	3.859				158	170	2.6	1.5

DET06	Pump Data							
	Pump Hydrograph Name		Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	
		Pump Discharge (cfs)						
		Elevation at which Pump Turns On (ft)						
		Elevation at which Pump Turns Off (ft)						

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET07	Elevation (ft)	139.5	Elevation (ft)	139.5	140.5	143.5	141.5	142.5	144.5	145.5				140.	1.57	.61	0.5
			Area (ac)	0.965	1.061	1.162	1.268	1.378	1.493	1.612				145	135	2.6	1.5

DET07	Pump Data							
	Pump Hydrograph Name		Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	
		Pump Discharge (cfs)						
		Elevation at which Pump Turns On (ft)						
		Elevation at which Pump Turns Off (ft)						

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET08	Elevation (ft)	135.5	Elevation (ft)	135.5	136.5	137.5	139.5	138.5	140.5	141.5				136.875	2.41	.61	0.5
			Area (ac)	4.147	4.344	4.546	4.753	4.964	5.18	5.4				141	235	2.6	1.5

DET08	Pump Data							
	Pump Hydrograph Name		Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	
		Pump Discharge (cfs)						
		Elevation at which Pump Turns On (ft)						
		Elevation at which Pump Turns Off (ft)						

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET09	Elevation (ft)	131.5	Elevation (ft)	131.5	132.5	133.5	134.5	135.5	136.5	137.5				132.125	1.23	.61	0.5
			Area (ac)	2.425	2.576	2.732	2.893	3.058	3.228	3.403				137	130	2.6	1.5

DET09	Pump Data							
	Pump Hydrograph Name		Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	
		Pump Discharge (cfs)						
		Elevation at which Pump Turns						

		On (ft)														
		Elevation at which Pump Turns Off (ft)														
Detention Basin	Initial Condition		Pond Storage Relation											Outlet Data			
														Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET11	Elevation (ft) 130.5	Elevation (ft)	130.5	131.5	132.5	133.5	134.5	135.5	136.5					131.5	.785	.61	0.5
		Area (ac)	0.112	0.147	0.186	0.23	0.278	0.331	0.388					136	50	2.6	1.5
	Pump Data																
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5					
		Pump Discharge (cfs)															
		Elevation at which Pump Turns On (ft)															
		Elevation at which Pump Turns Off (ft)															
Detention Basin	Initial Condition		Pond Storage Relation											Outlet Data			
														Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET10	Elevation (ft) 127.5	Elevation (ft)	127.5	128.5	129.5	130.5	131.5	132.5	133.5					128.0	1.57	.61	0.5
		Area (ac)	1.493	1.612	1.736	1.865	1.998	2.136	2.278					133	150	2.6	1.5
	Pump Data																
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5					
		Pump Discharge (cfs)															
		Elevation at which Pump Turns On (ft)															
		Elevation at which Pump Turns Off (ft)															
Detention Basin	Initial Condition		Pond Storage Relation											Outlet Data			
														Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET12	Elevation (ft) 126.5	Elevation (ft)	126.5	127.5	128.5	129.5	130.5	131.5	132.5					127.0	2.355	.61	0.5
		Area (ac)	2.278	2.425	2.576	2.732	2.893	3.058	3.228					132	200	2.6	1.5
	Pump Data																
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5					
		Pump Discharge (cfs)															
		Elevation at which Pump Turns On (ft)															
		Elevation at which Pump Turns Off (ft)															

View HEC-1 output

Sacramento method results
(Project: Basin n Proposed Conditions)
(100-year, 1-day rainfall)

ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
KCOS15	82.	12:30	.11			
KCA3	338.	12:34	.46			
A3DET	278.	12:46	.46	130.	15.	
OSKC05	117.	12:33	.16			
R6A	117.	12:34	.16			
KCOS06	60.	12:04	.03			
KCOS02	61.	12:33	.09			
KCOS1	31.	12:14	.03			
R2A	31.	12:18	.03			
KCDV3	115.	12:21	.12			
DET03	7.9	16:02	.12	175.	14.	
R1	7.9	16:09	.12			
KCDV2	253.	12:11	.19			
DET02	24.	13:55	.19	176.	18.	
KCOS3A	225.	12:25	.26			
R3A	224.	12:28	.26			
J1	251.	12:28	.57			
R2	250.	12:30	.57			
J02	271.	12:29	.60			
R3	271.	12:33	.60			
KCDV4	239.	12:15	.21			
DET04	23.	15:07	.21	166.	22.	
J03	353.	12:33	.89			
R4	352.	12:37	.89			
KCOS03	54.	12:15	.05			
KCDV5	302.	12:21	.31			
DET05	32.	15:18	.31	161.	31.	
J04	404.	12:36	1.25			
R5	403.	12:40	1.25			
KCOS04	74.	12:07	.05			
KCDV06	170.	12:15	.15			
DET06	16.	15:15	.15	157.	16.	.00
J05	433.	12:40	1.45			
R6	428.	12:45	1.45			
KCDV7	138.	12:06	.08			

DET07	16.	13:08	.08	144.	6.1	.00
KCDV8	201.	12:19	.20			
DET08	22.	15:14	.20	140.	22.	.00
J06	571.	12:44	1.92			
R7	567.	12:48	1.92			
J7	844.	12:48	2.38			
R8	844.	12:48	2.38			
KCOS11	23.	12:10	.02			
R8A	23.	12:13	.02			
KCDV9	119.	12:23	.13			
DET09	12.	15:27	.13	136.	14.	
KCDV11	43.	12:04	.02			
DET11	7.9	12:35	.02	136.	1.0	
J08	868.	12:48	2.55			
R9	851.	12:56	2.55			
J9	901.	12:55	2.66			
KCOS14	23.	12:18	.02			
KCOS13	40.	12:13	.03			
KCOS12	89.	12:23	.10			
R10B	89.	12:25	.10			
J10B	115.	12:23	.13			
R10C	115.	12:27	.13			
J10C	133.	12:26	.16			
R10D	132.	12:31	.16			
KCDV10	137.	12:12	.11			
DET10	16.	13:43	.11	132.	8.8	.00
KCDV12	179.	12:14	.15			
DET12	24.	13:52	.15	131.	13.	.00
J10	1020.	12:54	3.07			
R10	1007.	12:57	3.07			
EXKC13	151.	12:11	.11			
J11	1039.	12:57	3.19			
R11	1008.	13:07	3.19			
EXKC14	34.	15:09	.15			
J12	1024.	13:07	3.33			

(10-year, 1-day rainfall)

ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
KCOS15	48.	12:30	.11			
KCA3	199.	12:34	.46			

A3DET	153.	12:51	.46	129.	12.	
OSKC05	68.	12:33	.16			
R6A	68.	12:35	.16			
KCOS06	33.	12:04	.03			
KCOS02	36.	12:34	.09			
KCOS1	17.	12:14	.03			
R2A	17.	12:19	.03			
KCDV3	67.	12:21	.12			
DET03	6.1	15:28	.12	173.	8.4	
R1	6.1	15:36	.12			
KCDV2	145.	12:11	.19			
DET02	18.	13:41	.19	174.	12.	
KCOS3A	130.	12:25	.26			
R3A	130.	12:29	.26			
J1	150.	12:29	.57			
R2	150.	12:31	.57			
J02	162.	12:30	.60			
R3	162.	12:35	.60			
KCDV4	138.	12:15	.21			
DET04	18.	14:04	.21	165.	14.	.00
J03	213.	12:35	.89			
R4	212.	12:39	.89			
KCOS03	30.	12:15	.05			
KCDV5	176.	12:21	.31			
DET05	24.	14:34	.31	160.	19.	.00
J04	248.	12:38	1.25			
R5	247.	12:43	1.25			
KCOS04	41.	12:07	.05			
KCDV06	99.	12:15	.15			
DET06	13.	14:12	.15	156.	9.8	
J05	268.	12:42	1.45			
R6	265.	12:49	1.45			
KCDV7	79.	12:06	.08			
DET07	13.	13:06	.08	143.	3.7	.00
KCDV8	117.	12:19	.20			
DET08	16.	14:30	.20	139.	15.	
J06	352.	12:48	1.92			
R7	350.	12:53	1.92			
J7	502.	12:53	2.38			
R8	502.	12:53	2.38			
KCOS11	13.	12:10	.02			

R8A	13.	12:13	.02			
KCDV9	70.	12:23	.13			
DET09	9.3	15:00	.13	135.	8.3	.00
KCDV11	24.	12:04	.02			
DET11	6.2	12:30	.02	134.	.6	.00
J08	520.	12:53	2.55			
R9	510.	13:02	2.55			
J9	538.	13:01	2.66			
KCOS14	13.	12:18	.02			
KCOS13	23.	12:13	.03			
KCOS12	51.	12:23	.10			
R10B	51.	12:26	.10			
J10B	66.	12:24	.13			
R10C	66.	12:28	.13			
J10C	76.	12:27	.16			
R10D	76.	12:33	.16			
KCDV10	79.	12:12	.11			
DET10	13.	13:36	.11	131.	5.4	.00
KCDV12	104.	12:14	.15			
DET12	19.	13:41	.15	130.	7.8	.00
J10	613.	13:00	3.07			
R10	605.	13:04	3.07			
EXKC13	86.	12:11	.11			
J11	625.	13:04	3.19			
R11	607.	13:16	3.19			
EXKC14	20.	15:09	.15			
J12	617.	13:16	3.33			

Current Scenario Modeling Results

Sacramento Hydrologic Calculator Report

July 28, 2010 8:22

Project Title: Basin n Proposed Conditions
Comments: Proposed Conditions. with local detention Basin 12 removed, Basins 9, 10 and 11 upsized
Prepared by: KEC
Method: Sacramento County HEC-1 method
Date: 8/6/2008

Watershed Hydrologic Summary Data

Watershed	Area (acres)	Mean Elevation (ft)	Lag Times		Basin "n"		Loss Rates		Percent Impervious	
			Method	Lag Time (min)	Method	Basin "n"	Method	Loss Rate (in/hr)	Method	Impervious Area (%)
KCOS1	16.8	203.5	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCDV2	120.2	199.7	Basin "n"	-	Specified	0.043	Computed	-	Computed	-
KCDV3	76.9	185	Basin "n"	-	Computed	-	Computed	-	Computed	-
KCDV5	201.3	175	Basin "n"	-	Specified	0.051	Computed	-	Computed	-
KCDV4	134.1	174	Basin "n"	-	Specified	0.044	Computed	-	Computed	-
KCDV7	52	153.5	Basin "n"	-	Specified	0.037	Computed	-	Computed	-
KCDV8	126.2	152.9	Basin "n"	-	Specified	0.043	Computed	-	Computed	-
KCDV9	82.2	144.2	Basin "n"	-	Specified	.051	Computed	-	Computed	-
KCOS02	54.9	166.3	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCOS03	30.4	153	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
OSKC05	102.3	181.5	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCDV06	94.2	166.5	Basin "n"	-	Specified	0.039	Computed	-	Computed	-
KCOS04	29.3	145.2	Basin "n"	-	Specified	.070	Computed	-	Computed	-
KCOS06	20.3	166	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCA3	297.3	151	Basin "n"	-	Specified	0.049	Computed	-	Computed	-
KCOS11	11.1	157.5	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCDV11	13.8	145.1	Basin "n"	-	Specified	0.044	Computed	-	Computed	-
KCDV10	68.4	140.1	Basin "n"	-	Specified	0.045	Computed	-	Computed	-
KCDV12	96.8	138.3	Basin "n"	-	Specified	.042	Computed	-	Computed	-
KCOS12	65	156.5	Basin "n"	-	Specified	0.070	Computed	-	Computed	-
KCOS13	21	154	Basin "n"	-	Specified	0.070	Computed	-	Computed	-
KCOS14	14	145.5	Basin "n"	-	Specified	.070	Computed	-	Computed	-
KCOS15	68.2	122.5	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
KCOS3A	168.5	213	Basin "n"	-	Specified	0.07	Computed	-	Computed	-
EXKC13	73.3	140	Basin "n"	-	Computed	-	Computed	-	Computed	-
EXKC14	95.1	120	Basin "n"	-	Computed	-	Computed	-	Computed	-

Basin "n" Method Data for Lag Time Computation

Watershed	Channel Length (ft)	Centroid Length (ft)	Slope (ft/ft)	Channelization	Land Use Impervious Area Percent (% or acres)																
					95	90	85	80	75	70	60	50	40	30	25	20	15	10	5	2	1	1*
KCOS1	1576	850	0.0159	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV2	3940	750	0.0156	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV3	1920	444	0.0042	Undeveloped	2.6	6.8					8.1	21.4							12.9	25.1		
				Developed	0	0					0	0							0	0		
KCDV5	4464	1907	0.0103	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV4	3297	917	0.003	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV7	1655	580	0.0091	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV8	4054	2363	0.0081	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV9	4360	2120	.0083	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS02	3900	2145	.005	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS03	2089	415	.0048	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OSKC05	4804	2082	.0081	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV06	3313	1851	.0063	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS04	2745	1385	005	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS06	2377	1387	0027	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCA3	7016	3899	.006	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS11	726	572	.0069	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV11	850	322	.0213	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV10	2474	1482	.0178	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCDV12	3407	1720	.0119	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS12	2632	1237	.0057	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS13	1370	566	.0088	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS14	1990	908	.0085	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS15	3317	1334	.0027	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KCOS3A	3787	1555	.0132	Undeveloped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				Developed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EXKC13	4651	2747	0105	Undeveloped																100		
				Developed																0		
EXKC14	79700	3064	.003	Undeveloped																100		
				Developed																0		

Refer to the Drainage manual for Land Use Impervious Area Percent

*Dense Oaks, Shrubs, Vines

Infiltration Loss Rate Data

Watershed	Soil Cover Group	Land Use Impervious Area Percent (% or acres)																	
		95	90	85	80	75	70	60	50	40	30	25	20	15	10	5	2	1	1*
KCOS1	B																		
	C																4.8		
	D																12		
KCDV2	B																		
	C	1.1						26.2	12.2							8.2	2.2		
	D	2						36.7	21.6							2.2	7.8		
KCDV3	B																		
	C																		
	D	2.6	6.8					8.1	21.4							12.9	25.1		
KCDV5	B																		
	C															1.1			
	D	7.2					3.7	25.9	81.2							23.7	58.5		
KCDV4	B																		
	C																4.7		
	D						6.4	57.5	6.4	41						14	5.3		
KCDV7	B																		
	C	2.6														1			
	D	4.2	12.4				11.6	15.7								4.5			
KCDV8	B																		
	C	1.6																	
	D	5						58.9	37.2							18.3	5.2		
KCDV9	B																		
	C																		
	D	16.2	2.5						24.5	1						9.8	28		
KCOS02	B																		
	C																16.3		
	D																38.6		
KCOS03	B																		
	C																12.7		
	D																17.7		
OSKC05	B																		
	C																		
	D																102.3		
KCDV06	B																		
	C	0.9																	
	D	23					10.9	46.9								5.5	7		
KCOS04	B																		
	C																20.4		
	D																8.9		
KCOS06	B																		
	C																		
	D																20.3		
KCA3	B																		
	C								120							0.6	26.3		
	D								78.4							4.4	67.6		
KCOS11	B																		
	C																5.9		
	D																5.2		
KCDV11	B																		
	C																		
	D	2.1							8.9							2.8			
KCDV10	B																		
	C																		
	D	5	5						13.2	32.5						8	4.7		
KCDV12	B																		
	C	1.5															1		
	D	5.5	24						23.2	24.9						15.8	1.3		
KCOS12	B																		
	C																27.1		
	D																37.9		
	B																		

KCOS13	C																1.3		
	D																19.7		
KCOS14	B																		
	C																		
	D																14		
KCOS15	B																		
	C																		
	D																68.2		
KCOS3A	B																		
	C																32.6		
	D																135.9		
EXKC13	B																		
	C																6.5		
	D																66.8		
EXKC14	B																		
	C																4.1		
	D																91		

Refer to the help file for Land Use Impervious Area Percent

*Dense Oaks, Shrubs, Vines

Hydrograph Routing – Muskingum–Cunge (Standard)

Routing ID	Route From	Route To	Channel Type	Length (ft)	Slope (ft/ft)	Width or Diameter (ft)	Side Slope (H:V)	Mannings "n"
R1	DET03	J1	Pipe	2814	0.005	3	3:1	0.015
R6A	OSKC05	J06	Trapezoidal	555	0.007	20	4:1	0.030
R4	J03	J04	Trapezoidal	2319	0.0048	30	4:1	0.014
R5	J04	J05	Trapezoidal	2582	0.0039	20	3:1	0.015
R7	J06	J7	Trapezoidal	2058	0.0025	20	3:1	0.025
R2A	KCOS1	J02	Trapezoidal	1510	0.0159	05	3:1	0.03
R2	J1	J02	Trapezoidal	644	0.0047	5	3:1	0.03
R3	J02	J03	Trapezoidal	3485	.0313	5	3:1	0.03
R6	J05	J06	Trapezoidal	2283	0.0031	20	3:1	0.03
R8	J7	J08	Trapezoidal	95	0.0025	10	1:1	0.025
R8A	KCOS11	J08	Pipe	1147	0.005	3		0.015
R9	J08	J9	Trapezoidal	3214	0.0019	20	3:1	0.03
R10B	KCOS12	J10B	Trapezoidal	524	0.005	20	3:1	0.03
R10C	J10B	J10C	Trapezoidal	1398	0.005	10	3:1	0.03
R10D	J10C	J10	Pipe	2907	0.0034	4		0.015
R3A	KCOS3A	J1	Pipe	2628	0.005	5		0.015
R10	J10	J11	Trapezoidal	1028	0.0022	15	2.5:1	0.07
R11	J11	J12	Trapezoidal	2966	0.0022	15	2.5:1	0.07

Detention Basin Data

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
A3DET	Elevation (ft)	0	Elevation (ft)	127.4	128.5	128.5	130.5	131.5					124.41	.54	.61	0.5
			Area (ac)	6.38	6.61	6.89	7.23	7.81					128.50	84	2.6	1.5
	Pump Data															
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5				
			Pump Discharge (cfs)													
			Elevation at which Pump Turns On (ft)													
			Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET02	Elevation (ft)	171	Elevation (ft)	171	172	173	174	175	176	177			171.875	2.41	.61	0.5
			Area (ac)	3.228	3.403	3.582	3.765	3.954	4.147	4.344			176.5	230	2.6	1.5
	Pump Data															
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5				
			Pump Discharge (cfs)													
			Elevation at which Pump Turns On (ft)													
			Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET03	Elevation (ft)	170.5	Elevation (ft)	170.5	171.5	172.5	173.5	174.5	175.5	176.5			171.	.785	.61	0.5
			Area (ac)	2.654	2.812	2.975	3.143	3.315	3.492	3.673			176	190	2.6	1.5
	Pump Data															
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5				
			Pump Discharge (cfs)													
			Elevation at which Pump Turns On (ft)													
			Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET04	Elevation (ft)	161.5	Elevation (ft)	161.5	162.5	163.5	164.5	165.5	166.5	167.5			162.375	2.41	.61	0.5
			Area (ac)	3.954	4.147	4.344	4.546	4.753	4.964	5.18			167	251	2.6	1.5
	Pump Data															
	Pump Hydrograph Name			Pump 1		Pump 2		Pump 3		Pump 4		Pump 5				
			Pump Discharge (cfs)													
			Elevation at which Pump Turns On (ft)													
			Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
	Elevation	156.5	Elevation (ft)	156.5	157.5	158.5	159.5	160.5	161.5	162.5			157.0	3.14	.61	0.5

	(ft)		Area (ac)	5.739	5.971	6.208	6.449	6.694	6.944	7.199				162	315	2.6	1.5
DET05	Pump Data																
	Pump Hydrograph Name							Pump 1		Pump 2		Pump 3		Pump 4		Pump 5	
				Pump Discharge (cfs)													
				Elevation at which Pump Turns On (ft)													
				Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET06	Elevation (ft)	152.5	Elevation (ft)	152.5	153.5	154.5	155.5	156.5	157.5	158.5				153.	1.57	.61	0.5
			Area (ac)	2.812	2.975	3.143	3.315	3.492	3.676	3.859				158	170	2.6	1.5
	Pump Data																
	Pump Hydrograph Name							Pump 1		Pump 2		Pump 3		Pump 4		Pump 5	
				Pump Discharge (cfs)													
				Elevation at which Pump Turns On (ft)													
				Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET07	Elevation (ft)	139.5	Elevation (ft)	139.5	140.5	143.5	141.5	142.5	144.5	145.5				140.	1.57	.61	0.5
			Area (ac)	0.965	1.061	1.162	1.268	1.378	1.493	1.612				145	135	2.6	1.5
	Pump Data																
	Pump Hydrograph Name							Pump 1		Pump 2		Pump 3		Pump 4		Pump 5	
				Pump Discharge (cfs)													
				Elevation at which Pump Turns On (ft)													
				Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET08	Elevation (ft)	135.5	Elevation (ft)	135.5	136.5	137.5	139.5	138.5	140.5	141.5				136.875	2.41	.61	0.5
			Area (ac)	4.147	4.344	4.546	4.753	4.964	5.18	5.4				141	235	2.6	1.5
	Pump Data																
	Pump Hydrograph Name							Pump 1		Pump 2		Pump 3		Pump 4		Pump 5	
				Pump Discharge (cfs)													
				Elevation at which Pump Turns On (ft)													
				Elevation at which Pump Turns Off (ft)													

Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET09	Elevation (ft)	131.5	Elevation (ft)	131.5	132.5	133.5	134.5	135.5	136.5	137.5				131.83	.349	.61	0.5
			Area (ac)	4.753	4.954	5.18	5.4	5.625	5.855	6.089				137	130	2.6	1.5
	Pump Data																
	Pump Hydrograph Name							Pump 1		Pump 2		Pump 3		Pump 4		Pump 5	
				Pump Discharge (cfs)													
				Elevation at which Pump Turns													

			On (ft)												
			Elevation at which Pump Turns Off (ft)												
Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET11	Elevation (ft)	130.5	Elevation (ft)	130.5	131.5	132.5	133.5	134.5	135.5	136.5			130.75	.197	.61	0.5
			Area (ac)	0.304	0.359	0.418	0.483	0.552	0.625	0.703			136	50	2.6	1.5
	Pump Data															
	Pump Hydrograph Name							Pump 1		Pump 2		Pump 3	Pump 4		Pump 5	
			Pump Discharge (cfs)													
			Elevation at which Pump Turns On (ft)													
			Elevation at which Pump Turns Off (ft)													
Detention Basin	Initial Condition		Pond Storage Relation										Outlet Data			
													Elev. (ft)	Area (sq ft)	Q Coef.	Exponent
DET10	Elevation (ft)	127.5	Elevation (ft)	127.5	128.5	129.5	130.5	131.5	132.5	133.5			127.83	.349	.61	0.5
			Area (ac)	3.582	3.765	3.954	4.147	4.344	4.546	4.753			133	150	2.6	1.5
	Pump Data															
	Pump Hydrograph Name							Pump 1		Pump 2		Pump 3	Pump 4		Pump 5	
			Pump Discharge (cfs)													
			Elevation at which Pump Turns On (ft)													
			Elevation at which Pump Turns Off (ft)													

View HEC-1 output

Sacramento method results
(Project: Basin n Proposed Conditions)
(100-year, 1-day rainfall)

ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
KCOS15	82.	12:30	.11			
KCA3	338.	12:34	.46			
A3DET	278.	12:46	.46	130.	15.	
OSKC05	117.	12:33	.16			
R6A	117.	12:34	.16			
KCOS06	60.	12:04	.03			
KCOS02	61.	12:33	.09			
KCOS1	31.	12:14	.03			
R2A	31.	12:18	.03			
KCDV3	115.	12:21	.12			
DET03	7.9	16:02	.12	175.	14.	
R1	7.9	16:09	.12			
KCDV2	253.	12:11	.19			
DET02	24.	13:55	.19	176.	18.	
KCOS3A	225.	12:25	.26			
R3A	224.	12:28	.26			
J1	251.	12:28	.57			
R2	250.	12:30	.57			
J02	271.	12:29	.60			
R3	271.	12:33	.60			
KCDV4	239.	12:15	.21			
DET04	23.	15:07	.21	166.	22.	
J03	353.	12:33	.89			
R4	352.	12:37	.89			
KCOS03	54.	12:15	.05			
KCDV5	302.	12:21	.31			
DET05	32.	15:18	.31	161.	31.	
J04	404.	12:36	1.25			
R5	403.	12:40	1.25			
KCOS04	74.	12:07	.05			
KCDV06	170.	12:15	.15			
DET06	16.	15:15	.15	157.	16.	.00
J05	433.	12:40	1.45			
R6	428.	12:45	1.45			
KCDV7	138.	12:06	.08			

DET07	16.	13:08	.08	144.	6.1	.00
KCDV8	201.	12:19	.20			
DET08	22.	15:14	.20	140.	22.	.00
J06	571.	12:44	1.92			
R7	567.	12:48	1.92			
J7	844.	12:48	2.38			
R8	844.	12:48	2.38			
KCOS11	23.	12:10	.02			
R8A	23.	12:13	.02			
KCDV9	119.	12:23	.13			
DET09	2.7	24:20	.13	135.	19.	
KCDV11	43.	12:04	.02			
DET11	2.1	15:06	.02	135.	2.2	
J08	854.	12:48	2.55			
R9	837.	12:56	2.55			
J9	887.	12:55	2.66			
KCDV12	179.	12:14	.15			
KCOS14	23.	12:18	.02			
KCOS13	40.	12:13	.03			
KCOS12	89.	12:23	.10			
R10B	89.	12:25	.10			
J10B	115.	12:23	.13			
R10C	115.	12:27	.13			
J10C	133.	12:26	.16			
R10D	132.	12:31	.16			
KCDV10	137.	12:12	.11			
DET10	2.8	24:06	.11	131.	16.	
J10	1025.	12:53	3.07			
R10	1013.	12:56	3.07			
EXKC13	151.	12:11	.11			
J11	1046.	12:56	3.19			
R11	1019.	13:05	3.19			
EXKC14	34.	15:09	.15			
J12	1034.	13:05	3.33			

(10-year, 1-day rainfall)

ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
KCOS15	48.	12:30	.11			
KCA3	199.	12:34	.46			
A3DET	153.	12:51	.46	129.	12.	

OSKC05	68.	12:33	.16			
R6A	68.	12:35	.16			
KCOS06	33.	12:04	.03			
KCOS02	36.	12:34	.09			
KCOS1	17.	12:14	.03			
R2A	17.	12:19	.03			
KCDV3	67.	12:21	.12			
DET03	6.1	15:28	.12	173.	8.4	
R1	6.1	15:36	.12			
KCDV2	145.	12:11	.19			
DET02	18.	13:41	.19	174.	12.	
KCOS3A	130.	12:25	.26			
R3A	130.	12:29	.26			
J1	150.	12:29	.57			
R2	150.	12:31	.57			
J02	162.	12:30	.60			
R3	162.	12:35	.60			
KCDV4	138.	12:15	.21			
DET04	18.	14:04	.21	165.	14.	.00
J03	213.	12:35	.89			
R4	212.	12:39	.89			
KCOS03	30.	12:15	.05			
KCDV5	176.	12:21	.31			
DET05	24.	14:34	.31	160.	19.	.00
J04	248.	12:38	1.25			
R5	247.	12:43	1.25			
KCOS04	41.	12:07	.05			
KCDV06	99.	12:15	.15			
DET06	13.	14:12	.15	156.	9.8	
J05	268.	12:42	1.45			
R6	265.	12:49	1.45			
KCDV7	79.	12:06	.08			
DET07	13.	13:06	.08	143.	3.7	.00
KCDV8	117.	12:19	.20			
DET08	16.	14:30	.20	139.	15.	
J06	352.	12:48	1.92			
R7	350.	12:53	1.92			
J7	502.	12:53	2.38			
R8	502.	12:53	2.38			
KCOS11	13.	12:10	.02			
R8A	13.	12:13	.02			

KCDV9	70.	12:23	.13			
DET09	2.1	19:59	.13	134.	12.	
KCDV11	24.	12:04	.02			
DET11	1.7	13:43	.02	134.	1.3	.00
J08	509.	12:53	2.55			
R9	499.	13:02	2.55			
J9	527.	13:01	2.66			
KCDV12	104.	12:14	.15			
KCOS14	13.	12:18	.02			
KCOS13	23.	12:13	.03			
KCOS12	51.	12:23	.10			
R10B	51.	12:26	.10			
J10B	66.	12:24	.13			
R10C	66.	12:28	.13			
J10C	76.	12:27	.16			
R10D	76.	12:33	.16			
KCDV10	79.	12:12	.11			
DET10	2.2	18:42	.11	130.	9.7	
J10	607.	12:59	3.07			
R10	600.	13:03	3.07			
EXKC13	86.	12:11	.11			
J11	619.	13:03	3.19			
R11	603.	13:15	3.19			
EXKC14	20.	15:09	.15			
J12	613.	13:15	3.33			