

EXCELSIOR OAKS

DRAINAGE STUDY LEVEL 2

Control No.: PLN2019-00054

WATERSHED: Linda Creek

VERTICAL DATUM: NGVD29

ORANGEVALE COMMUNITY, CA

JULY 03, 2023



Prepared by:
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Job Number: 2022-055

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1. Introduction

This drainage study is intended to document JTS Engineering Consultants, Inc.'s (JTS) evaluation of the drainage conditions of the project site for review and acceptance by the County of Sacramento Department of Water Resources. This study is to be used as supporting documentation for the Tentative Subdivision Map being developed by JTS Engineering.

a. Existing Conditions

The 25.17± acre parcel (project site) is located north of Excelsior Avenue, directly south of the Placer County borderline, west of Peerless Avenue, and east of Hazel Avenue (see **Exhibit A**). The project site has an Assessor's Parcel Number 227-0010-002 and is currently undeveloped. The adjacent properties to the north, in Placer County, have a land use description of single family residence, half plex. The adjacent properties to the south, and east, are Agricultural-Residential with a 2 acre lot size minimum. Adjacent to the property on the west side is a Strawberry farm that is also zoned for Agricultural-Residential with a 2 acre lot size minimum.

b. Project Description

The site improvements will consist of two new public roads, 12 houses, and 12 driveways. The project site development includes the extension of Excelsior Avenue through the property, approximately 400 feet, ending in a cul-de-sac. A road will be added that runs parallel to, and north of, the south property line. These roads will provide access to the development site. Twelve single family residential homes are also being proposed for the site, they will each have a lot size of no less than 2 acres. The proposed design consists of approximately 17.87 acres of pervious surfaces and approximately 7.30 acres of impervious surfaces. The impervious areas will consist of new roads, driveways and houses. The permeable area will consist of grass, trees, bushes and other landscaping.

c. Applicable Standards

- i. Sacramento County Drainage Study Requirements
- ii. Sacramento County Floodplain Management Ordinance
- iii. Sacramento City/County Drainage Manual Volume 2: Hydrology Standards
- iv. Sacramento County Improvement Standards – Section 9
- v. Stormwater Quality Design Manual for the Sacramento Region.

d. Previous Studies

No previous drainage studies have been used or referenced for this project.

e. Objectives of Analysis

The purpose of this study is to address the following items:

1. Develop and evaluate a hydrologic and hydraulic model for the watersheds affecting the project site. The 10-year and 100-year storms shall be analyzed in existing and with-proposed conditions.
2. Develop and evaluate a hydraulic model that shows the main drainage ditches, driveway culverts, and cross section culverts have been designed to pass the 10- year storm event. Additionally, the model will show that the roads will flood no deeper the one foot during the 100-year design storm.
3. Develop and evaluate Low Impact Development, storm water quality, and hydromodification of the site.
4. Develop and design a model that will not exceed the existing peak flow downstream of the project site.

2. Baseline (Existing Conditions):

a. Historical Land-use:

The historical land usage of the subject parcel is unknown.

b. Topographic Sources

Topographic data of the subject parcel is based on a field survey provided by the client. Existing elevations within the vicinity of the site range from $219 \pm$ to $306 \pm$ feet per the National Geodetic vertical datum 1929 (NGVD29). Offsite topographic data relied on 2-foot LiDAR generated contours from the Sacramento County Open Data website based on the NGVD29 datum.

c. Offsite Drainage

The area surrounding the site is developed, offsite or public underground storm drain (SD) facilities are only present to the north west corner of the site. Based on the LIDAR map and the provided topographic survey it was determined that there is sheet flow across the property. The sheet flow generally runs from the east to the west across the site. The site, in general is lower than the areas surrounding it. See **Exhibit B** for Watershed areas. The area to the north that has a watershed boundary around it is not included in the analysis. This area has runoff that bypasses the site and as such was not evaluated.

Upstream

Watershed area WS-001, and WS-004 are the upstream watersheds. Watershed area WS-001 is developed as 2 acre agricultural lots and drains to the center of the easterly property line of the site. Watershed area WS-004 is also developed as 2 acre agricultural lots and flows to the site near the south middle of the site.

Downstream

Watersheds area WS-005 and WS-006 are the downstream watersheds. After the water drains across the site it outfalls approximately at the center of the westerly property line. This area is zoned for 2 acre agricultural lots but is currently a strawberry farm. There are no existing drainage facilities set up to convey water, on site or, once it leaves the site.

d. Onsite Drainage

The current site area is undeveloped and has an overland sheet flow that generally flows from east to west and from north to south. Watersheds WS-002 and WS-003 are the upstream watersheds that generally drain into watershed WS-005. Watersheds WS-005 and WS-006 are watersheds that drain into the strawberry farm to the west of the property.

e. Hydrologic Modeling Assumptions

Sacramento County Hydrologic Calculator version 1.1.0.25 (SacCalc) was used to complete the hydrological analysis of all watersheds. The Sacramento Method was used to analyze the 10- and 100-year, 24-hour design storms. All runoff is generated within hydrologic zone 3 of Sacramento County per the hydrology standards.

The Existing Watershed Map (**Exhibit B**) indicates that there are six water shed areas on and around the site. Overland runoff from the watershed areas generally drains from east to west where it runs into the existing Strawberry farm and then into Hazel Avenue.

Per the National Resources Conservation Service (NRCS) Web Soil Survey website, the project site, is primarily of type 'C' soil (**Exhibit C**) per the USDA hydrologic soil group classification. To the southwest of the site is a small amount of soil type 'B'. To the southeast of the site is mostly comprised of soil type 'C'.

The Existing Land Use Delineation Map can be seen on **Exhibit D**. WS-001 and WS-004 are comprised of agricultural residential 2 acre, (AR-2) lots. WS-002, WS-003 and WS-006 are open space zoned for AR-2. WS-005 is a combination of AR-2 and open space zoned for AR-2. Parameters defining the percent impervious areas for each water shed area can be seen in **Exhibit E**.

The basin 'n' method was used for the lag transformation for each watershed. SacCalc input parameters, such as the longest water course or channel length, distance to centroid and land use can be seen on **Exhibit E**. The longest water course for each input was reduced to 90% of its original value, consistent with county hydrology standards. Peak runoff values for 100-year and 10-year storm events can be seen in **Exhibit F**. For the 10-year storm event it was assumed that runoff WS-004 would not be captured within underground storm water facilities.

f. Hydraulic Modeling Assumptions

For the hydraulic modeling HEC-RAS 6.3.1 was used to analyze both on and offsite flow rates. Hydrologic input was generated using SacCalc, as referred to in the previous section. Hydrologic model Assumptions, were input into HEC-RAS. A HEC-1 DSS file was generated from SacCalc hydrology model and was input into the unsteady flow data in HEC-RAS, as hydrographs and lateral flow hydrographs. These hydrographs were input into the cross-sections where the watershed discharged along the modeled channel. The Upstream project limit was determined to be at the cross section 2250 (**Exhibit G**) to best represent the upstream flow. The downstream boundary is cross section 94, this is west of the westerly property line. For the flow leaving the site it all drains into the center of the westerly property line and then flows on to Hazel Avenue.

For the upstream boundary conditions it was assumed that the slope of the Energy grade line would be the same as of the existing ground. For the downstream boundary condition the normal depth was used as the channel ends, without buildings, culverts, or any other stricter, making it open-ended. Normal depth value was determined by following the steps outlined in the HEC-RAS manual for an open-ended reach. Manning's n value was set to be 0.06 based on Sacramento City/County Drainage Manual Volume 2: Hydrology Standards, Chapter 7, Table 7-5 Manning's "n" for Channel Flow. For all the cross-sections locations please see **Exhibit G**. No structures, storage areas, or pumps are currently on the site. For the summary of discharges please see **Exhibit H**.

g. Profiles

Exhibit I shows the profile of the River, both 10 year and 100 year.

h. Floodplain Extents

Exhibit G and **Exhibit H** show the 10 year and 100 year floodplain extents respectively.

3. Mitigated Project (Proposed Condition):

a. Proposed Land Use:

The site is to be develop into 12 lots, having approximately 2 acres for each lot. There is no change to the current zoning. A road near the southerly property line that spans most of the length of the property, ending in a cul-de-sac, is being proposed. Excelsior Avenue will be extended through the property, approximately 400 feet, ending in a cul-de-sac.

b. Grading Plan and Tentative Subdivision Map

The Tentative subdivision map can be seen on **Exhibit J** and proposed grading can be seen on **Exhibit K**. All runoff generated onsite will be directed to follow the existing flow path. The Preliminary Grading Plan does not reflect one swale, impute into Sac-Calc as SA002. This swale is located at the East side of cul-de-sac that is along the road that runs north south. See the callout on Exhibit J, Preliminary Grading Plan. The swale will be addressed at the design phase and will still meet applicable standards. At the design phase either the grading plan will be changed to match the swale in the model, or the model will be updated to match the grading as shown, or the model and the Grading plan will be updated.

c. Offsite Drainage Improvements:

Due to the no adverse impact to offsite drainage, no offsite drainage improvements are recommended at this time. No public drainage systems will need to be installed or altered.

d. Onsite Drainage Improvements

Onsite drainage flow paths can be seen on **Exhibit L**. Several culverts will be needed where the road intersects the driveways, where the flow path crosses the street along the south property line and at the proposed intersection. The culverts vary in size from 12 inches to 48 inches, additionally there are two 7'x 3' box culverts that were also added along the southerly extension of Excelsior Avenue. The road elevations along the extension of Excelsior Ave. are limited by the existing Excelsior Avenue. This limits the max height of the box culvert to be a max height of 3'. The shape and size of the culvert, along Excelsior Avenue, will be finalized in the design phase of the project.

During the design phase pipe sizing will be finalized to stander pipe dimensions. There are 13 proposed locations that require culverts, some locations require multiple pipes to convey the flow and some are proposed to be rectangular. Small culverts are also proposed at various locations to provide an outlet for the roadside ditches to the main drainage system. These roadside drainage outlets will be evaluated during the design phase to provide an alternative that will be expectable to the CoDOT and will drain without drop inlets. Emergency overland release is provided over Excelsior Avenue, the 38' public road, where Excelsior Avenue intersects the end of the property line (**Exhibit K**). This location has an elevation of 230.46' at the center of the road. Based on the Sacramento LIDAR no existing buildings are impacted as the lowest elevation of the nearest building is approximately 235'. A bio-retention planter will be put near each building pad to meet Low Impact Development (LID) requirements (see **Exhibit T**). Each bio-retention pond will be maintained by the owner of the property that the bio-retention pond is located on. The overall site does not require LIDs (see **Exhibit S** and **Exhibit U**).

e. Hydrologic Model Assumptions:

Sacramento County Hydrologic Calculator version 1.1.0.25 (SacCalc) was used to complete the hydrological analysis of all watersheds. The Sacramento Method was used to analyze the 10- and 100-year, 24-hour design storms. All runoff is generated within hydrologic zone 3 of Sacramento County per the hydrology standards.

The Proposed Watershed Map (**Exhibit L**) indicates that there are fifteen water shed areas on and around the site. Overland runoff from the watershed areas generally drains from east to west where it runs into the existing Strawberry farm and then into Hazel Avenue.

No changes to the soil type will be made. Per the National Resources Conservation Service (NRCS) Web Soil Survey website, the project site, is primarily of type 'C' soil (**Exhibit C**) per the USDA hydrologic soil group classification.

There are no land use changes proposed for offsite. For the onsite land use it is proposed that the land will be developed from a vacant lot into twelve 2 acre lots, no zoning changes will be made.

The basin ‘n’ method was used for the lag transformation for each watershed. SacCalc input parameters, such as the longest water course or channel length, distance to centroid, and land use, information can be seen on **Exhibit M**. Detention will occur in upstream of several driveways, this is clearly shown in **Exhibit P**. These detention areas will also reduce the peak flow and the water surface elevations. The longest water course for each input was reduced to 90% of its original value, consistent with county hydrology standards. There are multiple junction points on the model additionally, in the hydraulic model they are input as separate models. Peak runoff values for 100-year and 10-year storm events can be seen on **Exhibit N**.

f. Hydraulic Model Assumptions

For the hydraulic modeling HEC-RAS 6.3.1 was used to analyze both on and offsite flow rates. Hydrologic input was generated using SacCalc, as referred to in the previous section. A HEC-1 DSS file was generated from SacCalc hydrology model and was input into the unsteady flow data in HEC-RAS, as hydrographs and lateral flow hydrographs. These hydrographs were input into the cross-sections where the watershed discharged along the modeled channel. The Upstream project limit was determined to be east of the property line. The flow that comes from WS-001 was added at the cross section 2235 (**Exhibit O** and **Exhibit P**) to best represent the upstream flow. This was chosen as the upstream starting point as the water that flows through the site begins in WS-001. Cross section 2235 of the proposed model and 2250 of the existing model are in the same location. The downstream boundary is cross section 94 (**Exhibit O** and **Exhibit P**) this is west of the westerly property line. Flow leaving the site flows on to Hazel Avenue. The roadside ditches flow path, which can be seen on the Tentative Parcel, was not modeled however, the area was accounted for by adding it to SacCalc. The design of the proposed roadside ditches will be coordinated at the design phase with CoDOT.

For the upstream boundary conditions it was assumed that the slope of the Energy grade line would be the same as of the existing ground. For the downstream boundary condition the normal depth was used as the channel ends, without buildings, culverts, or any other stricter, making it open-ended. Normal depth value was determined by following the steps outlined in the HEC-RAS manual for an open-ended reach. Manning’s n value was set to be 0.06 based on Sacramento City/County Drainage Manual Volume 2: Hydrology Standards, Chapter 7, Table 7-5 Manning’s “n” for Channel Flow. For all the cross-sections locations please see **Exhibit O** and **Exhibit P**. Culverts were used where the road intersects the driveways, where the flow path crosses the street along the south property line and at the proposed intersection. The 10 year inundations can be seen on **Exhibit O** and 100 year on **Exhibit P**. The summary of discharges can be found on both **Exhibit O** and **Exhibit P**.

g. Profiles

Exhibit Q shows the profile of the River, both 10 year and 100 year.

h. Floodplain Extents

Exhibit O and **Exhibit P** show the 10 year and 100 year floodplain extents respectively.

i. Hydromodifications

The Sacramento Area Hydrology Model, SAHM, was used for determining what Hydromodifications would be needed. For this site a bio-retention planter of length of 100 ft and width of 20 ft will be added near each pad to mitigate runoff from the house and pad. To view the project report for the SAHM model see the attached same modeling in the zip file.

j. LID

The 2018-Commercial-LID-CreditsPW – Excel worksheet was used to determine if any additional treatment would be needed. For this it was required to have an overall site, minus the pads, LID worksheet and a LID of only the pads. Only one LID was done for the pads, as the largest pad area was used for each pad. **Exhibit S** shows the overall site, minus the pads, LID, **Exhibit T** shows the Pad LID, and **Exhibit U** shows the weighted LID total. When a bio-retention planter of 2,000 square foot for each pad was used no additional treatment was required.

4. Summary of Findings:

The following table shows the flow and the water surface elevation for the cross sections located at the beginning of the site, where the water runs off site to the south, where the water runs back onto the site and then where the water runs off the site to the west. Although proposed and existing cross section numbering was not given the same values in HEC-RAS they are in the same locations. In HEC-RAS the river cross section 94 was used as the downstream reference for both proposed and existing conditions. In the proposed condition the length of the river was increased, to reflect the driveways and culverts, resulting in an inconsistency in the proposed cross section numbering seen in the table below.

Existing Conditions				Proposed Conditions				Difference	
cross section	year	Q, flow	W.S. Elev.	cross section	year	Q, flow	W.S. Elev.	Q, flow	W.S. Elev.
2250	10	2.7	274.29	2355	10	2	274.26	-0.7	-0.03
	100	9.18	274.33		100	9.5	274.39	0.32	0.06
1418	10	13.17	247.51	1492.6	10	12.03	247.51	-1.14	0
	100	26.84	247.68		100	10.87	247.49	-15.97	-0.19
786	10	33.47	231.82	860	10	18.86	231.63	-14.61	-0.19
	100	45.23	231.91		100	44.26	231.84	-0.97	-0.07
94	10	43.44	215.97	94	10	31.24	215.96	-12.2	-0.01
	100	76.53	216.2		100	62.26	216.14	-14.27	-0.06

TABLE 1 CRITICAL CROSS SECTION VALUES

The difference column Q, Flow and W.S. Elev. represent the Proposed Condition minus the Existing Condition. Thus, positive numbers shows where the Proposed Condition is greater than the Existing Condition. Likewise a negative shows where the Existing Condition is greater than the Proposed Condition. For detailed locations of cross sections please see Exhibit G, H, O and P. Cross Section numbering is different due to the proposed and existing conditions river lengths having different lengths. Cross sections 2250 and 2355 are both located at the east boundary of the site in the middle of the property line.

Cross sections 1418 and 1492.57 are located to the south of the site approximately 620ft from the southeast property corner. Cross sections 786 and 860 are located to the south of the site approximately 1210ft from the southeast corner of the property. Cross sections 94 and 94 are located approximately 168ft from the middle of the west property line. The table above shows that between the existing and proposed condition there is no increase in water surface elevation greater than 0.09 feet.

For the site improvements culverts will need to be added where the road intersects the driveways, where the flow path crosses the street along the south property line, at the proposed intersection and through the cul-de-sac. Upstream, of the driveways, will be used as detention see **Exhibit P**. In addition bio-retention planters of 2,000 square foot will be added at the edge of each building pad in accordance with LID and SAHM modeling.

5. Conclusion:

Both proposed and existing hydrologic models were developed using SacCalc. All hydraulic modeling was done using HEC-RAS. It was determined that the 100-year flood water surface elevations would be below the proposed buildings pads and the finished floor by 1.2 and 1.5 feet, respectively. For the 10-year and 100-year floods no road or driveway will be over top. No increase to the offsite runoff or offsite adverse impacts will occur. The changes that are being proposed to the site will result in an increase 7.3 acres of impervious area. Culverts were put in at all locations where it is needed throughout the site. Main drainage ditches, driveway culverts, and cross section culverts were designed to pass the 10 year storm event. A bio-retention planter will be implemented on the side of each building pad in accordance with Sacramento storm water quality standards for water runoff.

EXHIBITS

**EXHIBIT A:
VICINITY MAP**

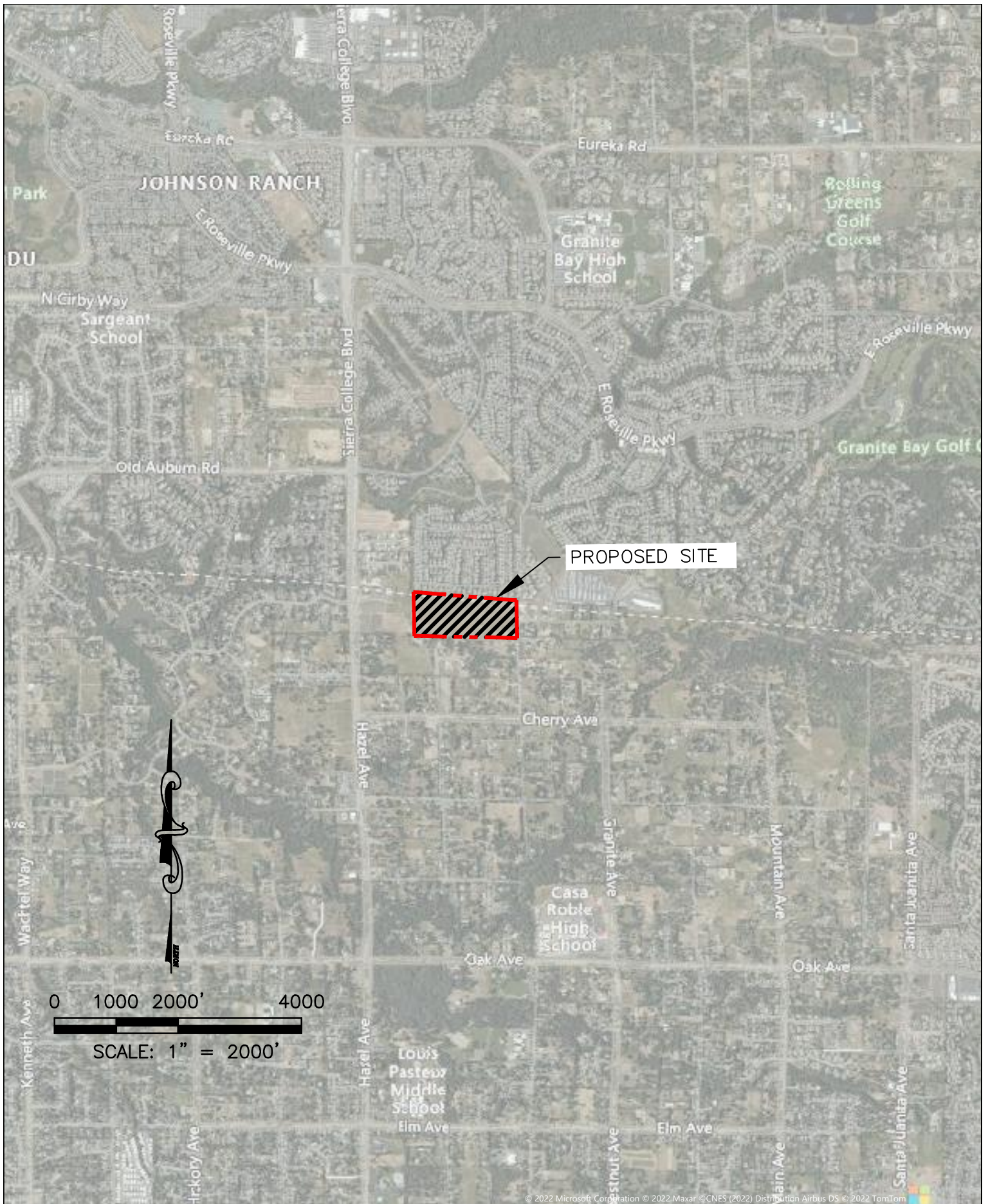


EXHIBIT B:
EXISTING WATERSHED MAP

EXHIBIT B
EXISTING WATERSHED MAP

EXCELSIOR OAKS
EXCELSIOR AVENUE, 0.02 MILES
EAST OF HAZEL AVE.
ORANGEVALE, CA
APN: 227-0010-002-0000
MAY 15, 2023

LEGEND

- WATERSHED BOUNDARY
- LONGEST WATER LINE
- CENTROID
- LONGEST WATER LINE TO CENTROID
- PROJECT SITE
- MAJOR CONTOURS
- MINOR CONTOURS
- NORTH WATERSHED BOUNDARY
NOT INCLUDED IN CALCULATIONS SEE
REPORT FOR MORE INFORMATION.

NOTES

- 1) ELEVATIONS REFERENCE NGVD29
- 2) PARCEL BOUNDARIES PER COUNTY GIS
- 3) SEE EXHIBIT E FOR A SUMMARY OF WATERSHED PARAMETERS

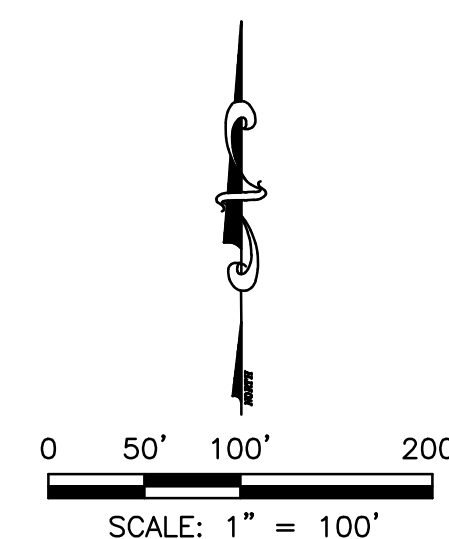


EXHIBIT C: HYDROLOGIC SOIL GROUP

EXHIBIT C
HYDROLOGIC SOIL GROUP MAP

EXCELSIOR OAKS
EXCELSIOR AVENUE, 0.02 MILES
EAST OF HAZEL AVE.
ORANGEVALE, CA
APN: 227-0010-002-0000
MAY 15, 2023

LEGEND

- WATERSHED BOUNDARY
- NORTH WATERSHED BOUNDARY
NOT INCLUDED IN CALCULATIONS SEE
REPORT FOR MORE INFORMATION.
- HYDROLOGIC SOIL GROUP B
- HYDROLOGIC SOIL GROUP C
- PROJECT SITE

NOTES

ELEVATIONS REFERENCE NGVD29
PARCEL BOUNDARIES PER COUNTY GIS
HYDROLOGIC SOIL GROUP PER WEB SOIL SURVEY

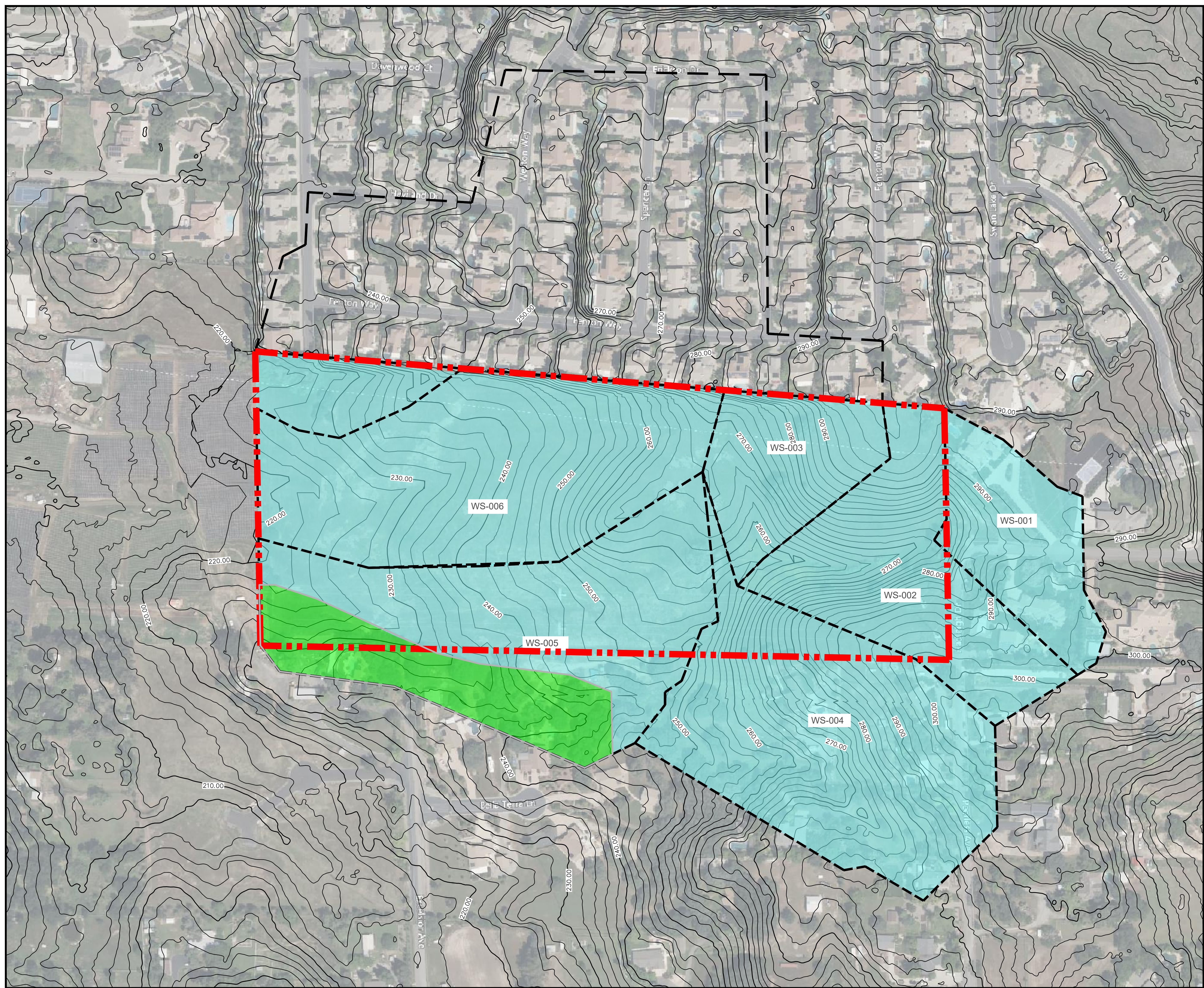


EXHIBIT D:
EXISTING LAND USED DELINEATION

EXHIBIT D
EXISTING LAND USE
DELINEATION

EXCELSIOR OAKS
EXCELSIOR AVENUE, 0.02 MILES
EAST OF HAZEL AVE.
ORANGEVALE, CA
APN: 227-0010-002-0000
MAY 15, 2023

LEGEND

--- WATERSHED BOUNDARY
--- PROJECT BOUNDARY

LAND-USE / IMPERVIOUS PERCENTAGE

OPEN SPACE (ZONED FOR AR-2) (2% IMPERVIOUS)
AR-2 AGRICULTURAL-RESIDENTIAL - 2 ACRES (10% IMPERVIOUS)
AR-2 AGRICULTURAL-RESIDENTIAL - 2 ACRES (APPROXIMATELY 30% IMPERVIOUS)

NOTES

- 1) ELEVATIONS PER NGVD29
- 2) PARCEL BOUNDARIES PER COUNTY GIS
- 3) IMPERVIOUS AREAS APPROXIMATED FROM MAP OVERLAY AND ARE CONSISTENT WITH TABLE 5-3 AND FIGURE 2-5 OF THE SACRAMENTO CITY/COUNTY DRAINAGE MANUAL VOLUME 2: HYDROLOGY STANDARDS.

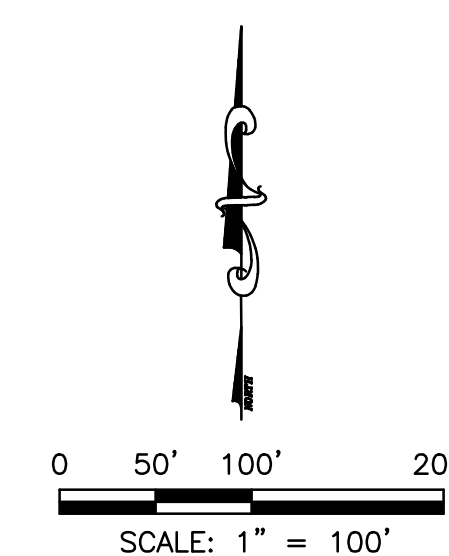


EXHIBIT E:
SACRAMENTO HYDROLOGIC CALCULATOR
REPORT

EXHIBIT E

Sacramento Hydrologic Calculator Report

May 15, 2023 16:04

Project Title: EXCELSIOR OAKS-EXISTING

Method:

Sacramento County HEC-1 method

Comments: Model represents the existing conditions of Excelsior Oaks for preliminary drainage study by JTS Engineering Consultants

Date:

11/23/2022

Prepared by: RWA/TEG

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 (%)
WS-001	3.18	290	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-002	5.5	274	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-003	2.99	280	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-006	9.17	252	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-005	9.82	262	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-004	9.13	278	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*
WS-001	582	201	0.054	Undeveloped										100								
				Developed									0									
WS-002	1076	409	0.055	Undeveloped										1.52						3.97		
				Developed									0							0		
WS-003	808	256	0.075	Undeveloped																100		
				Developed									0							0		
WS-006	1230	575	0.051	Undeveloped																100		
				Developed																0		
WS-005	1671	611	0.03	Undeveloped													3.36		6.46			
				Developed													0		0			
WS-004	1169	392	0.048	Undeveloped	0.35												7.39		1.39			
				Developed	0												0		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*
WS-001	B																		
	C									100									
	D																		
WS-002	B																		
	C									1.52							3.97		
	D																		
WS-003	B																		
	C																100		
	D																		
WS-006	B																		
	C																100		
	D																		
WS-005	B														2.43		0.77		
	C														0.93		5.69		
	D																		
WS-004	B																		
	C	0.35													7.39		1.39		
	D																		

Refer to the help file for Land Use Impervious Area Percent

*Dense Oaks, Shrubs, Vines

EXHIBIT F: SACRAMENTO METHOD RESULTS

[View HEC-1 output](#)**Sacramento method results****(Project: EXCELSIOR OAKS-EXISTING)****(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)
WS-001	9.2	12:05	.00	NO VALUES WERE GIVEN FOR PEAK STAGE, PEAK STORAGE, OR DIVERSION VOLUME		
WS-002	11.	12:12	.01			
WS-003	7.0	12:09	.00			
WS-006	17.	12:15	.01			
WS-005	16.	12:19	.02			
WS-004	19.	12:11	.01			

(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)
WS-001	5.4	12:05	.00	NO VALUES WERE GIVEN FOR PEAK STAGE, PEAK STORAGE, OR DIVERSION VOLUME		
WS-002	6.7	12:12	.01			
WS-003	4.1	12:09	.00			
WS-006	9.7	12:16	.01			
WS-005	9.3	12:19	.02			
WS-004	11.	12:11	.01			

**EXHIBIT G:
EXISTING 10 YEAR FLOODPLAIN EXTENTS AND
HEC-RAS OUTPUT TABLE**

EXHIBIT G
EXISTING 10 YEAR FLOODPLAIN
EXTENTS AND HEC-RAS OUTPUT TABLE

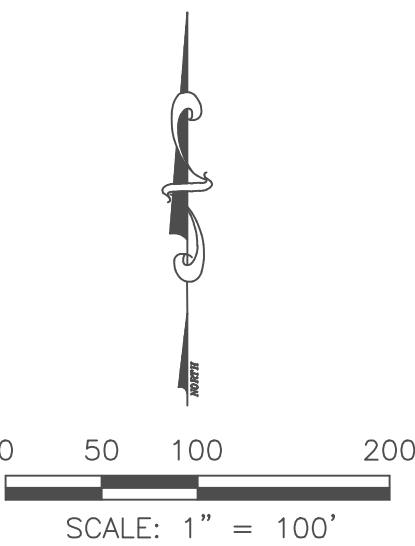
EXCELSIOR OAKS
EXCELSIOR AVENUE, 0.02 MILES EAST OF
HAZEL AVE.
ORAGEVALE, CA
APN: 227-0010-002-0000
MAY 15, 2023

LEGEND

- PROJECT BOUNDARY
- WATERSHED BOUNDARY
- HYDRAULIC RIVER 1
- EXISTING 10-YEAR FLOODPLAIN
- MAJOR CONTOURS
- MINOR CONTOURS
- CROSS SECTIONS

NOTES

ELEVATIONS BASED ON NGVD29
CONTOURS OBTAINED FROM SACRAMENTO COUNTY OPEN DATA WEBSITE
SITE CONTOURS OBTAINED FROM CLIENT



River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
2250	Max WS	EX 10YR	2.7	274.05	274.29		274.36	0.085582	2.03	1.33	8.91	0.93
2250	Max WS	EX 100YR	9.18	274.05	274.33	274.47	274.82	0.562955	5.64	1.63	9.72	2.43
2135	Max WS	EX 10YR	10.92	268.5	269.14		269.26	0.048489	2.76	3.96	10.9	0.81
2135	Max WS	EX 100YR	9.08	268.5	269.23		269.28	0.017671	1.81	5.02	12.22	0.5
1995	Max WS	EX 10YR	2.7	264.86	265.08		265.1	0.050256	1.21	2.23	21.91	0.67
1995	Max WS	EX 100YR	2.7	264.86	265.08		265.1	0.050256	1.21	2.23	21.91	0.67
1857	Max WS	EX 10YR	11.41	259.56	259.89	259.93	260.07	0.141739	3.38	3.38	15.44	1.27
1857	Max WS	EX 100YR	11.41	259.56	259.89	259.93	260.07	0.141739	3.38	3.38	15.44	1.27
1718	Max WS	EX 10YR	12.16	255.1	255.6		255.71	0.054549	2.63	4.62	15.05	0.84
1718	Max WS	EX 100YR	19.96	255.1	255.75		255.87	0.047874	2.87	6.96	18	0.81
1663	Max WS	EX 10YR	15.47	253.53	254.25		254.33	0.032304	2.31	6.71	17.94	0.66
1663	Max WS	EX 100YR	26.91	253.53	254.38		254.51	0.042286	2.94	9.16	20.85	0.78
1537	Max WS	EX 10YR	15.46	250.11	250.66		250.77	0.053994	2.69	5.74	17.88	0.84
1537	Max WS	EX 100YR	26.9	250.11	250.79		250.95	0.058724	3.2	8.4	21.51	0.9
1418	Max WS	EX 10YR	13.17	247	247.51		247.54	0.010771	1.34	9.82	26	0.38
1418	Max WS	EX 100YR	26.84	247	247.68		247.74	0.013877	1.83	14.64	29.31	0.46
1258	Max WS	EX 10YR	8.1	243.05	243.34		243.38	0.045173	1.5	5.4	35.49	0.68
1258	Max WS	EX 100YR	26.78	243.05	243.38	243.46	243.62	0.252898	3.92	6.84	38.75	1.64
1142	Max WS	EX 10YR	10.6	239.94	240.74		240.74	0.000267	0.29	36.4	59.58	0.07
1142	Max WS	EX 100YR	10.6	239.94	240.74		240.74	0.000267	0.29	36.4	59.58	0.07
1040	Max WS	EX 10YR	44.58	237.42	237.78	237.86	238.04	0.240975	4.14	10.76	54.12	1.64
1040	Max WS	EX 100YR	45.84	237.42	237.79	237.87	238.04	0.214329	4.02	11.41	54.97	1.56

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
910	Max WS	EX 10YR	33.35		233		233.98	0.005061	1.31	25.68	42.55	0.29
910	Max WS	EX 100YR	45.3		233		234.09	0.005699	1.5	30.92	50.33	0.31
786	Max WS	EX 10YR	33.47	231.16	231.82		231.91	0.030847	2.37	14.1	34.93	0.66
786	Max WS	EX 100YR	45.23	231.16	231.91		232.02	0.031697	2.59	17.43	38.58	0.68
698	Max WS	EX 10YR	31.94	228.91	229.6		229.66	0.025852	1.97	16.2	46.49	0.59
698	Max WS	EX 100YR	45.17	228.91	229.71		229.77	0.024353	2.09	21.56	54.02	0.58
597	Max WS	EX 10YR	31.44	226.03	226.87		226.99	0.039594	2.83	11.12	25.54	0.76
597	Max WS	EX 100YR	45.14	226.03	227.04		227.17	0.031267	2.83	15.93	30.55	0.69
502	Max WS	EX 10YR	27.52	224.52	225.23		225.25	0.004205	1	27.4	55.35	0.25
502	Max WS	EX 100YR	45.13	224.52	225.36		225.38	0.005708	1.3	34.58	59.34	0.3
440	Max WS	EX 10YR	27.46	223.12	223.71		223.79	0.046309	2.35	11.67	39.76	0.77
440	Max WS	EX 100YR	45.15	223.12	223.81		223.93	0.053125	2.8	16.14	47	0.84
382	Max WS	EX 10YR	26.43	221.52	222.17		222.19	0.008196	1.16	22.92	64.13	0.33
382	Max WS	EX 100YR	45.14	221.52	222.29		222.32	0.010501	1.5	30.47	70.78	0.39
282	Max WS	EX 10YR	28.62	219.96	220.11	220.16	220.29	0.264647	3.35	8.54	63.28	1.61
282	Max WS	EX 100YR	45.13	219.96	220.19	220.23	220.36	0.164517	3.37	13.4	69.05	1.35
205	Max WS	EX 10YR	34.75	217.54	218.19		218.22	0.021037	1.38	25.23	106.25	0.5
205	Max WS	EX 100YR	60.96	217.54	218.31		218.35	0.018108	1.55	39.3	123.7	0.49
94	Max WS	EX 10YR	43.44	215.57	215.97	215.97	216.07	0.08909	2.61	16.67	79.57	1
94	Max WS	EX 100YR	76.53	215.57	216.2	216.07	216.26	0.023805	1.97	38.77	104.35	0.57

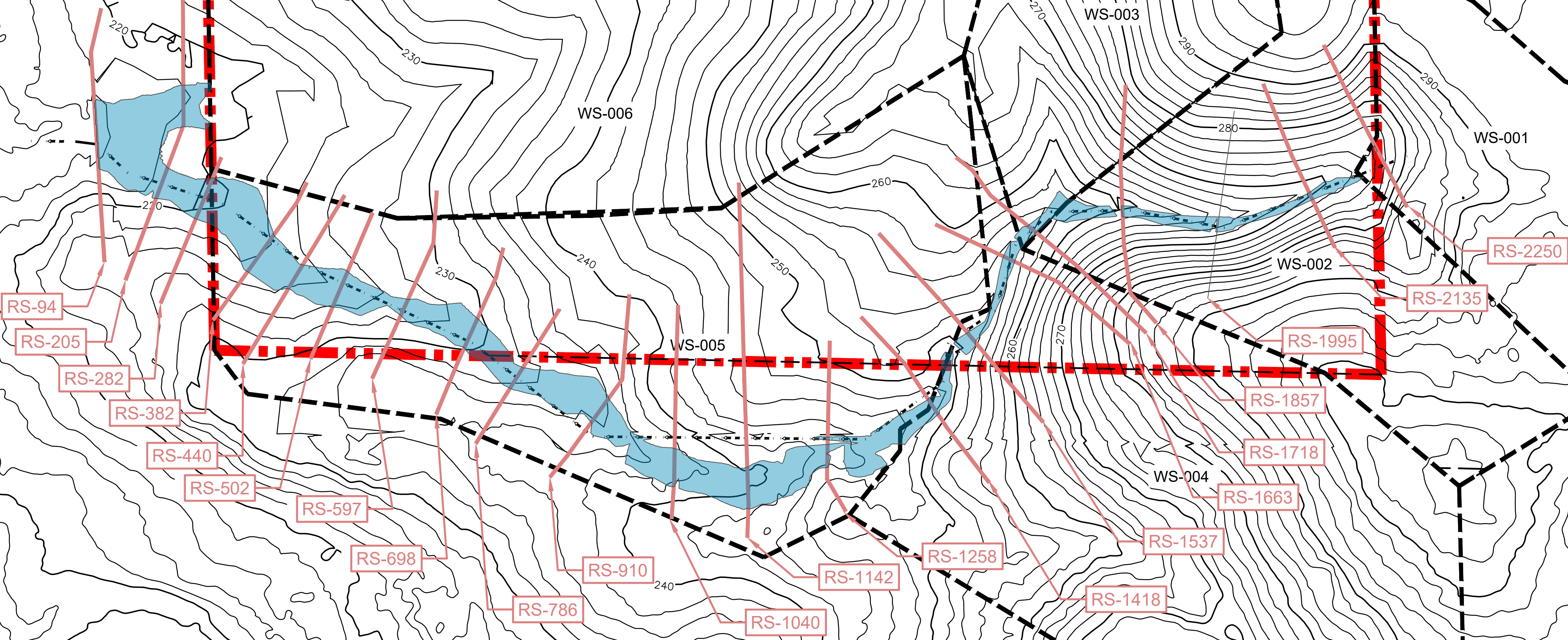


EXHIBIT H:
EXISTING 100 YEAR FLOODPLAIN EXTENTS AND
HEC-RAS OUTPUT TABLE

EXHIBIT H
EXISTING 100 YEAR FLOODPLAIN
EXTENTS AND HEC-RAS OUTPUT TABLE

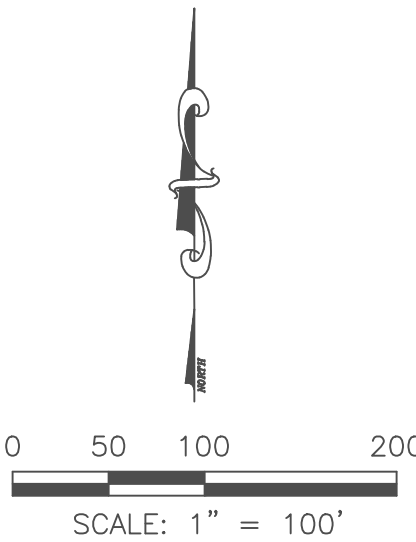
EXCELSIOR OAKS
EXCELSIOR AVENUE, 0.02 MILES EAST OF
HAZEL AVE.
ORAGEVALE, CA
APN: 227-0010-002-0000
MAY 15, 2023

LEGEND

- PROJECT BOUNDARY
- WATERSHED BOUNDARY
- HYDRAULIC RIVER 1
- EXISTING 100-YEAR FLOODPLAIN
- MAJOR CONTOURS
- MINOR CONTOURS
- CROSS SECTIONS

NOTES

ELEVATIONS BASED ON NGVD29
CONTOURS OBTAINED FROM SACRAMENTO COUNTY OPEN DATA WEBSITE
SITE CONTOURS OBTAINED FROM CLIENT



River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
2250	Max WS	EX 10YR	2.7	274.05	274.29		274.36	0.085582	2.03	1.33	8.91	0.93
2250	Max WS	EX 100YR	9.18	274.05	274.33	274.47	274.82	0.562955	5.64	1.63	9.72	2.43
2135	Max WS	EX 10YR	10.92	268.5	269.14		269.26	0.048489	2.76	3.96	10.9	0.81
2135	Max WS	EX 100YR	9.08	268.5	269.23		269.28	0.017671	1.81	5.02	12.22	0.5
1995	Max WS	EX 10YR	2.7	264.86	265.08		265.1	0.050256	1.21	2.23	21.91	0.67
1995	Max WS	EX 100YR	2.7	264.86	265.08		265.1	0.050256	1.21	2.23	21.91	0.67
1857	Max WS	EX 10YR	11.41	259.56	259.89	259.93	260.07	0.141739	3.38	3.38	15.44	1.27
1857	Max WS	EX 100YR	11.41	259.56	259.89	259.93	260.07	0.141739	3.38	3.38	15.44	1.27
1718	Max WS	EX 10YR	12.16	255.1	255.6		255.71	0.054549	2.63	4.62	15.05	0.84
1718	Max WS	EX 100YR	19.96	255.1	255.75		255.87	0.047874	2.87	6.96	18	0.81
1663	Max WS	EX 10YR	15.47	253.53	254.25		254.33	0.032304	2.31	6.71	17.94	0.66
1663	Max WS	EX 100YR	26.91	253.53	254.38		254.51	0.042286	2.94	9.16	20.85	0.78
1537	Max WS	EX 10YR	15.46	250.11	250.66		250.77	0.053994	2.69	5.74	17.88	0.84
1537	Max WS	EX 100YR	26.9	250.11	250.79		250.95	0.058724	3.2	8.4	21.51	0.9
1418	Max WS	EX 10YR	13.17	247	247.51		247.54	0.010771	1.34	9.82	26	0.38
1418	Max WS	EX 100YR	26.84	247	247.68		247.74	0.013877	1.83	14.64	29.31	0.46
1258	Max WS	EX 10YR	8.1	243.05	243.34		243.38	0.045173	1.5	5.4	35.49	0.68
1258	Max WS	EX 100YR	26.78	243.05	243.38	243.46	243.62	0.252898	3.92	6.84	38.75	1.64
1142	Max WS	EX 10YR	10.6	239.94	240.74		240.74	0.000267	0.29	36.4	59.58	0.07
1142	Max WS	EX 100YR	10.6	239.94	240.74		240.74	0.000267	0.29	36.4	59.58	0.07
1040	Max WS	EX 10YR	44.58	237.42	237.78	237.86	238.04	0.240975	4.14	10.76	54.12	1.64
1040	Max WS	EX 100YR	45.84	237.42	237.79	237.87	238.04	0.214329	4.02	11.41	54.97	1.56

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
910	Max WS	EX 10YR	33.35	233	233.98		234	0.005061	1.31	25.68	42.55	0.29
910	Max WS	EX 100YR	45.3	233	234.09		234.13	0.005699	1.5	30.92	50.33	0.31
786	Max WS	EX 10YR	33.47	231.16	231.82		231.91	0.030847	2.37	14.1	34.93	0.66
786	Max WS	EX 100YR	45.23	231.16	231.91		232.02	0.031697	2.59	17.43	38.58	0.68
698	Max WS	EX 10YR	31.94	228.91	229.6		229.66	0.025852	1.97	16.2	46.49	0.59
698	Max WS	EX 100YR	45.17	228.91	229.71		229.77	0.024353	2.09	21.56	54.02	0.58
597	Max WS	EX 10YR	31.44	226.03	226.87		226.99	0.039594	2.83	11.12	25.54	0.76
597	Max WS	EX 100YR	45.14	226.03	227.04		227.17	0.031267	2.83	15.93	30.55	0.69
502	Max WS	EX 10YR	27.52	224.52	225.23		225.25	0.004205	1	27.4	55.35	0.25
502	Max WS	EX 100YR	45.13	224.52	225.36		225.38	0.005708	1.3	34.58	59.34	0.3
440	Max WS	EX 10YR	27.46	223.12	223.71		223.79	0.046309	2.35	11.67	39.76	0.77
440	Max WS	EX 100YR	45.15	223.12	223.81		223.93	0.053125	2.8	16.14	47	0.84
382	Max WS	EX 10YR	26.43	221.52	222.17		222.19	0.008196	1.16	22.92	64.13	0.33
382	Max WS	EX 100YR	45.14	221.52	222.29		222.32	0.010501	1.5	30.47	70.78	0.39
282	Max WS	EX 10YR	28.62	219.96	220.11	220.16	220.29	0.264647	3.35	8.54	63.28	1.61
282	Max WS	EX 100YR	45.13	219.96	220.19	220.23	220.36	0.164517	3.37	13.4	69.05	1.35
205	Max WS	EX 10YR	34.75	217.54	218.19		218.22	0.021037	1.38	25.23	106.25	0.5
205	Max WS	EX 100YR	60.96	217.54	218.31		218.35	0.018108	1.55	39.3	123.7	0.49
94	Max WS	EX 10YR	43.44	215.57	215.97	215.97	216.07	0.08909	2.61	16.67	79.57	1
94	Max WS	EX 100YR	76.53	215.57	216.2	216.07	216.26	0.023805	1.97	38.77	104.35	0.57

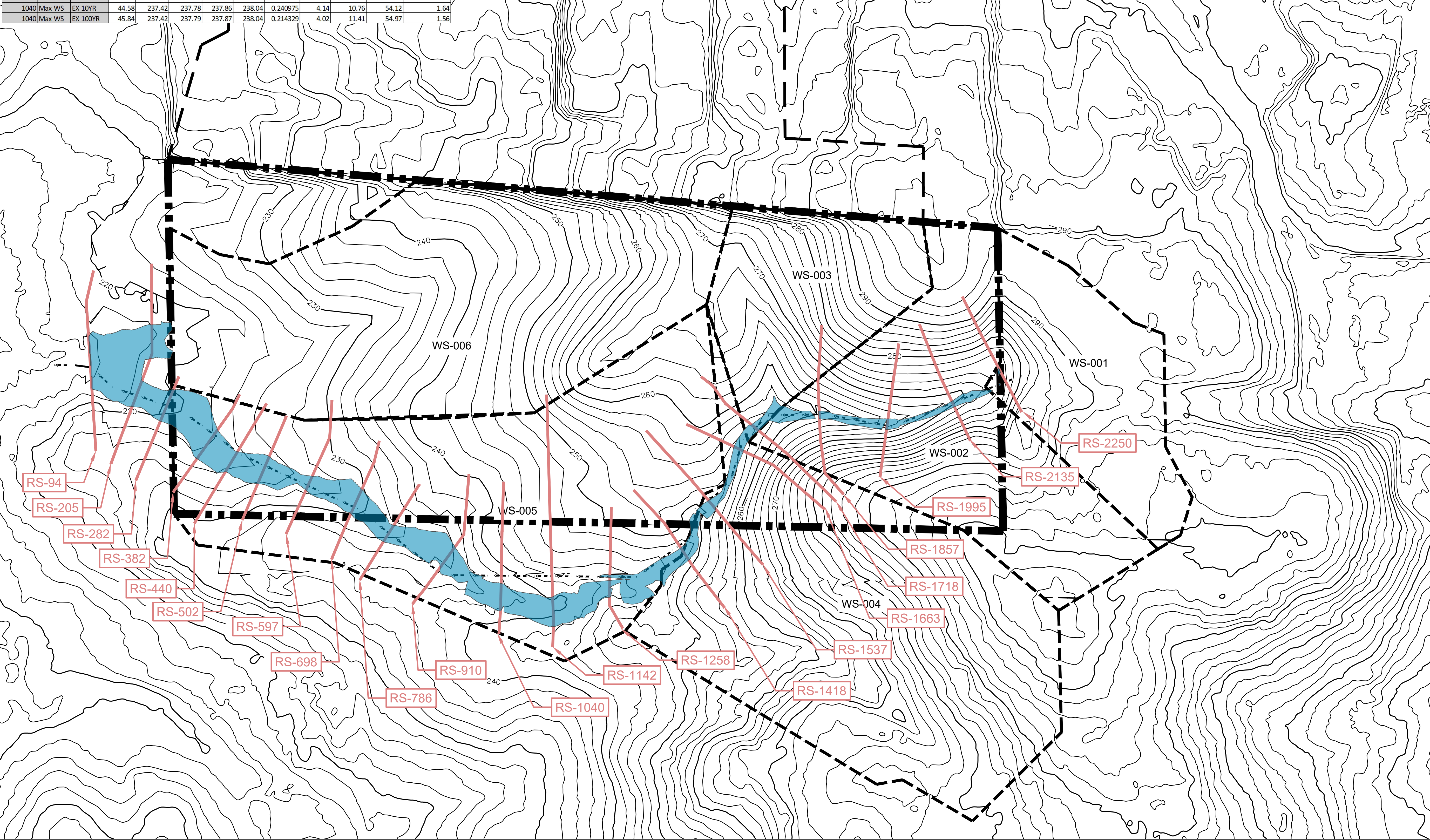


**EXHIBIT I:
HEC-RAS 10 AND 100 YEAR FLOOD PROFILES FOR
EXISTING CONDITIONS**

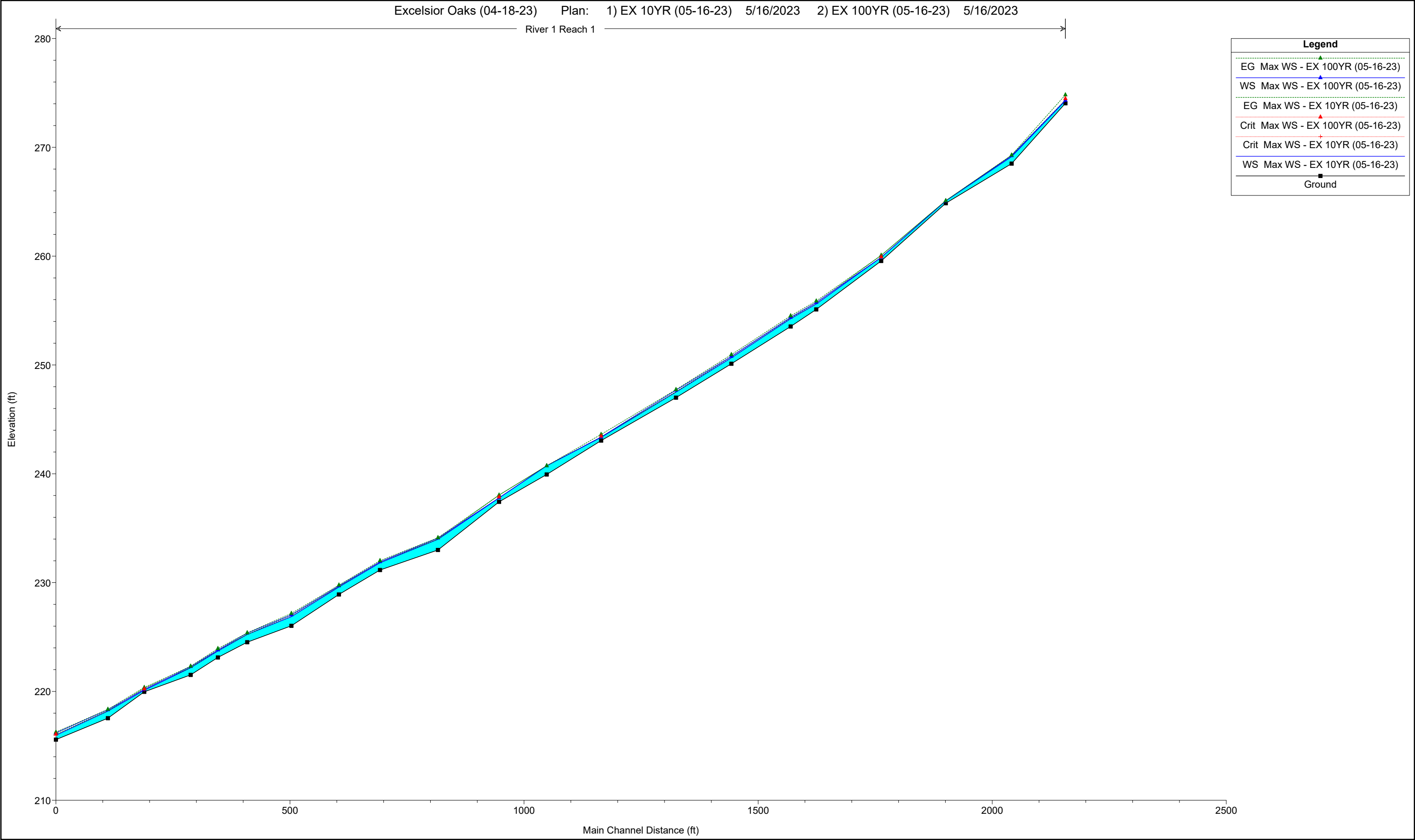
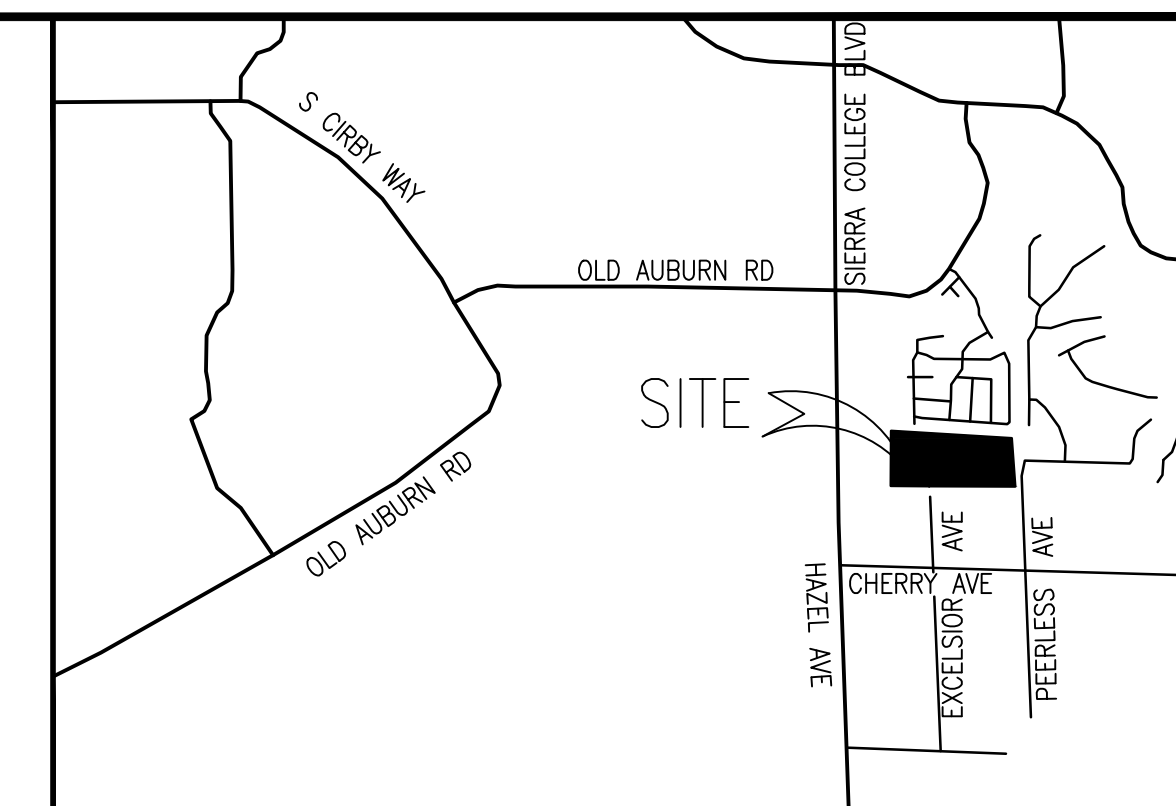
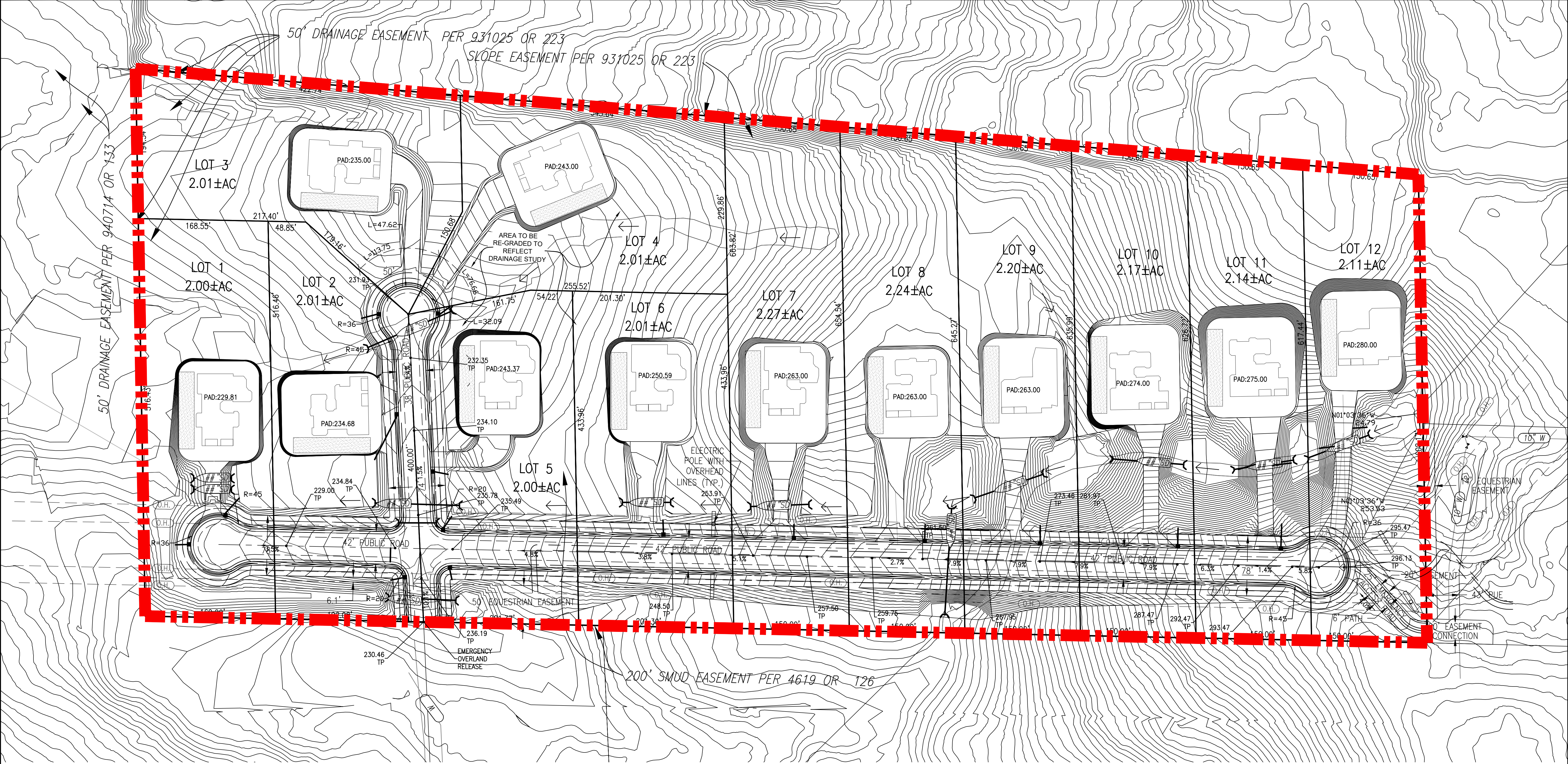


EXHIBIT J:
TENTATIVE SUBDIVISION MAP

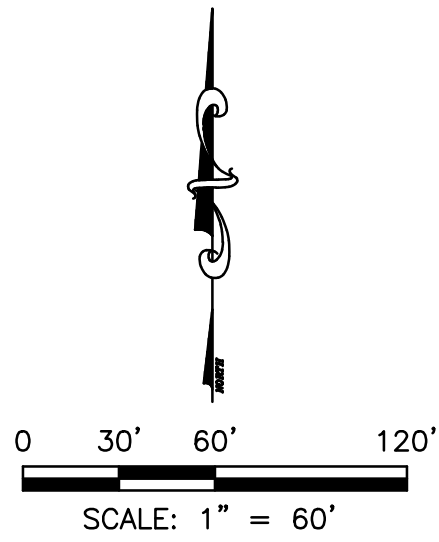


DATE: 05-15-23
SHEET
C1
OF 1

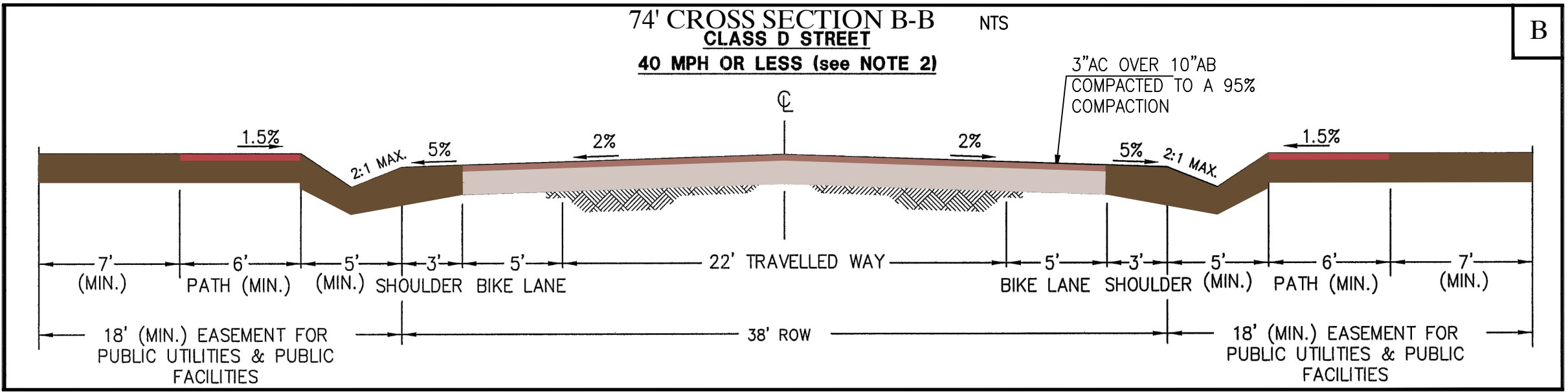
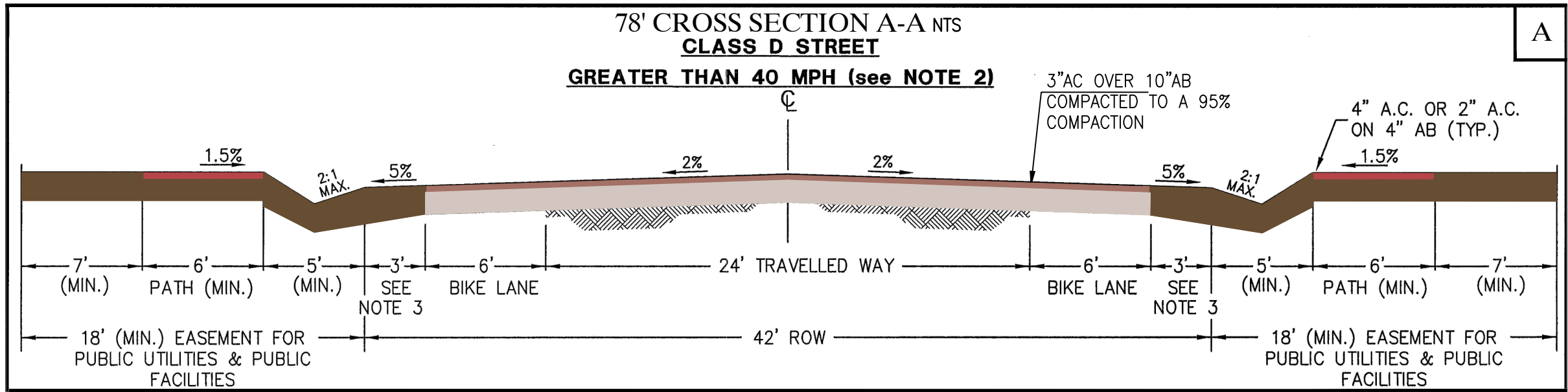
**EXHIBIT K:
PRELIMINARY GRADING PLAN**



- LEGEND**
- RUNOFF DIRECTION
 - ← OVERLAND RELEASE
 - XX.XX TP SPOT ELEVATION
 - 50' EXISTING MAJOR CONTOUR
 - 50' EXISTING MINOR CONTOUR
 - 50' PROPOSED MAJOR CONTOUR
 - 50' PROPOSED MINOR CONTOUR
 - PROPOSED DRAINAGE INLET



- NOTES:**
1. TOPOGRAPHIC SURVEY COMPLETED BY ROSE ENGINEERING
 2. DWELLING UNITS SHOWN FOR CONCEPTUAL PURPOSES ONLY. ACTUAL BUILDING FOOTPRINTS SHALL BE PER BUILDING PLANS
 3. WALLS AROUND BUILDING PADS SHALL BE BUILT PER STRUCTURAL DESIGN AND FURTHER EVALUATED IN DESIGN PHASE OF PROJECT



BENCHMARK ELEVATION: USGS

JTS ENGINEERING CONSULTANTS, INC.
1808 J STREET
SACRAMENTO, CALIFORNIA 95811 (916) 441-6708

DESIGNED: TEG
DRAWN: RWA
CHECKED: FNW
SUBMITTED: JAVED T. SIDDIQUI
SCALE: H:1"=60'
V:
RCE: 25924



NO.	DESCRIPTION	ENGR INIT	APPROVAL BY	DATE

PRELIMINARY GRADING PLAN
EXCELSIOR OAKS

COUNTY OF SACRAMENTO APN: 227-0010-002

CALIFORNIA

DATE: 07-03-23
SHEET 1 OF 1

FIELD BOOK NUMBER: PAGE:

EXHIBIT L:
PROPOSED WATERSHED MAP

EXHIBIT L
PROPOSED WATERSHED MAP

EXCELSIOR OAKS
EXCELSIOR AVENUE, 0.02 MILES
EAST OF HAZEL AVE.
ORANGEVALE, CA
APN: 227-0010-002-0000
MAY 15, 2023

LEGEND

- WATERSHED BOUNDARY
- LONGEST WATER LINE
- CENTROID
- LONGEST WATER LINE TO CENTROID
- STREAMS
- PROJECT SITE
- MAJOR CONTOURS
- MINOR CONTOURS
- PROPOSED BIO-RETENTION

NOTES

- ELEVATIONS REFERENCE NGVD29
- PARCEL BOUNDARIES PER COUNTY GIS
- SEE EXHIBIT M FOR A SUMMARY OF WATERSHED PARAMETERS

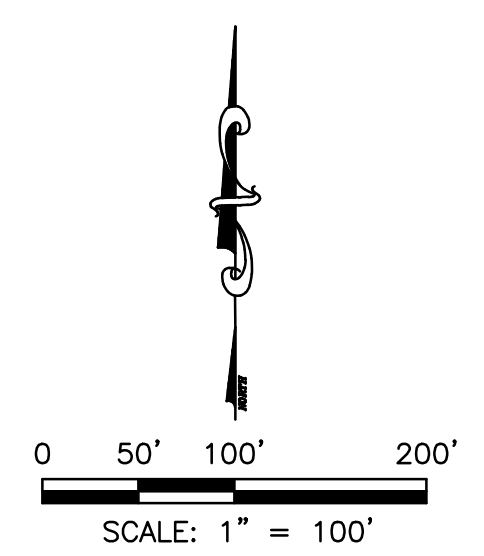
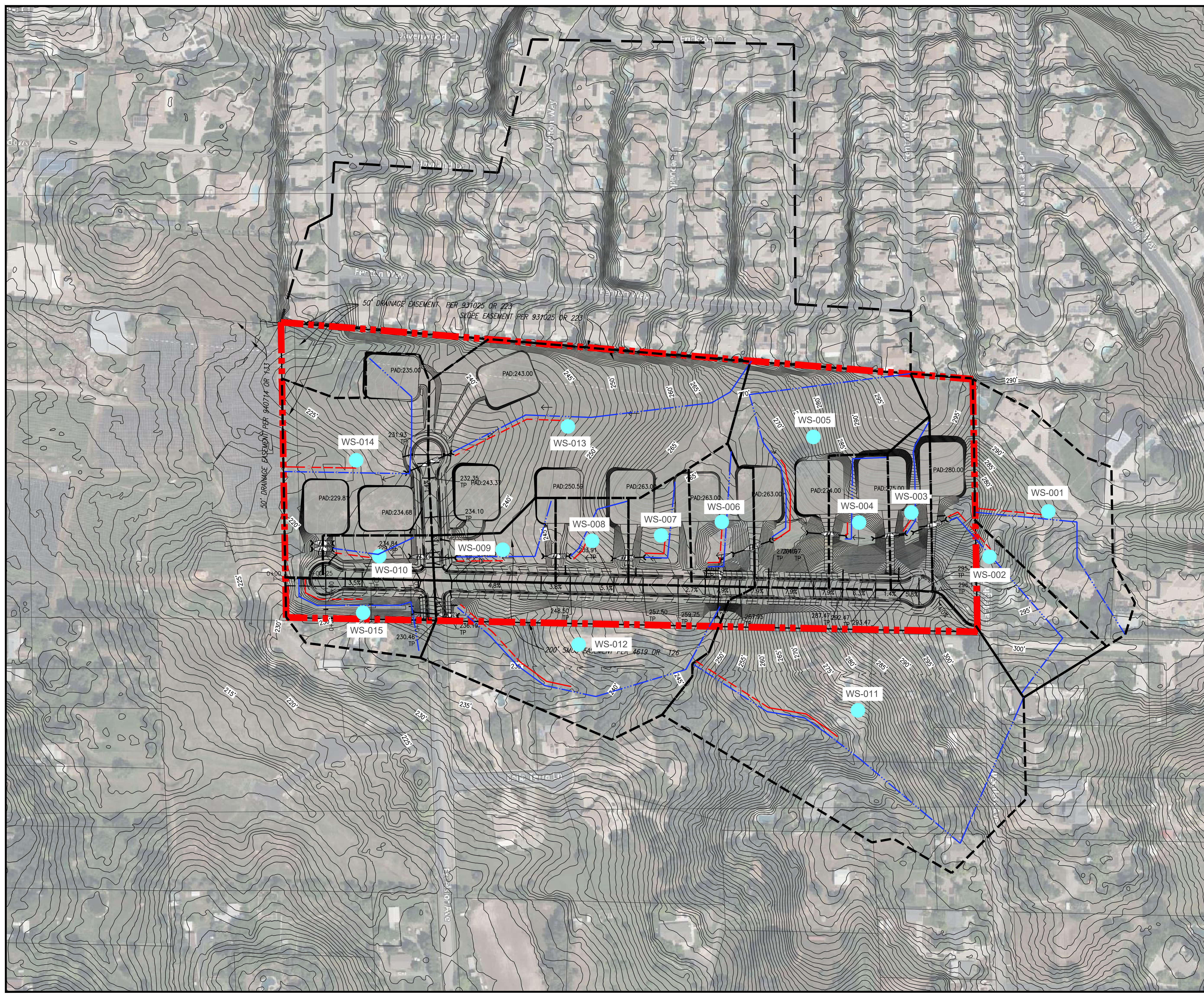


EXHIBIT M:
SACRAMENTO HYDROLOGIC CALCULATOR
REPORT PROPOSED CONDITIONS

Sacramento Hydrologic Calculator Report

May 16, 2023 13:36

Project Title: EXCELSIOR OAKS-PROPOSED

Method: Sacramento County HEC-1 method

Comments: Model represents the proposed conditions of Excelsior Oaks for preliminary drainage study by JTS Engineering Consultants

Prepared by: RWA/TEG

Date: 12/2/2022

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 (%)
WS-001	3.13	290	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-002	2.87	290	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-003	0.88	291	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-006	1.09	263	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-005	3.41	276	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-004	1.08	282	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-007	0.82	258	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-008	0.83	252	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-009	0.96	240	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-010	0.65	230	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-011	9.17	280	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-012	4.54	250	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-013	6.05	250	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-014	3.3	230	Basin "n"	-	Computed	-	Computed	-	Computed	-
WS-015	1.35	230	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*
WS-001	523	177	0.07	Undeveloped										100								
				Developed										0								
WS-002	577	159	0.04	Undeveloped	11.49									50.81						37.7		
				Developed	0									0						0		
WS-003	288	51	0.08	Undeveloped	44.16															55.84		
				Developed	0															0		
WS-006	328	126	0.052	Undeveloped	42.33															57.67		
				Developed	0															0		
WS-005	772	219	0.054	Undeveloped	18.19															81.81		
				Developed	0															0		
WS-004	291	35	0.06	Undeveloped	44.55															55.45		
				Developed	0															0		
WS-007	240	90	0.034	Undeveloped	42.14															57.86		
				Developed	0															0		
WS-008	205	63	0.03	Undeveloped	38.56															61.44		
				Developed	0															0		
WS-009	340	126	0.048	Undeveloped	33.83															66.17		
				Developed	0															0		
WS-010	219	108	0.016	Undeveloped	35.32											64.68				0.47		
				Developed	0											0				0		
WS-011	1052	392	.026	Undeveloped	9.09													81.14		9.76		
				Developed	0													0		0		
WS-012	765	350	0.041	Undeveloped	11.74													64.21		24.05		
				Developed	0													0		0		
WS-013	741	331	0.049	Undeveloped	22.24													77.76				
				Developed	0													0				
WS-014	545	154	0.017	Undeveloped	33.54													66.46				
				Developed	0													0				
WS-015	405	172	0.013	Undeveloped	17.33													41.08		41.59		
				Developed	0													0		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*
WS-001	B																		
	C										100								
	D																		
WS-002	B																		
	C	11.49									50.81						37.7		
	D																		
WS-003	B																		
	C	44.16															55.84		
	D																		
WS-006	B																		
	C	42.33															57.67		
	D																		
WS-005	B																		
	C	18.19															81.81		
	D																		
WS-004	B																		
	C	44.55															55.45		
	D																		
WS-007	B																		
	C	42.14															57.86		
	D																		
WS-008	B																		
	C	38.56															61.44		
	D																		
WS-009	B																		
	C	33.83															66.17		
	D																		
WS-010	B																		
	C	35.32															64.68		
	D																		
WS-011	B																		
	C	9.09													81.14		9.76		
	D																		
WS-012	B														26.97				
	C	11.74													37.24		24.05		
	D																		
WS-013	B																		
	C	22.24													77.76				
	D																		
WS-014	B																		
	C	33.54													66.46				
	D																		
WS-015	B	8.67													41.08		32.77		
	C	8.66															8.82		
	D																		

Refer to the help file for Land Use Impervious Area Percent

*Dense Oaks, Shrubs, Vines

EXHIBIT N:
SACRAMENTO METHOD RESULTS PROPOSED
CONDITIONS

[View HEC-1 output](#)

Sacramento Method Results
(Project: EXCELSIOR OAKS-EXISTING)
(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)
WS-001	9.5	12:05	.00			
WS-002	8.1	12:06	.00			
WS-003	3.2	12:02	.00			
WS-006	3.5	12:04	.00			
WS-005	8.5	12:08	.01			
WS-004	4.0	12:02	.00			
WS-011	19.	12:12	.01			
WS-012	10.	12:09	.01			
WS-015	3.5	12:07	.00			
WS-014	9.2	12:06	.01			
WS-013	15.	12:08	.01			
SA002	9.7	12:17	.01	2.3	.1	.00
RS-205	17.	12:08	.01			
WS-010	2.2	12:03	.00			
WS-009	3.0	12:04	.00			
WS-008	3.0	12:02	.00			
WS-007	2.8	12:03	.00			
SA005	4.5	0:00	.00	.5	.0	
JNC001	5.8	12:03	.00			
SA004	5.8	12:03	.00	.8	.0	
JNC002	8.8	12:03	.00			
SA003	7.5	12:06	.00	1.4	.0	
JNC010	9.6	12:03	.01			
SA010	7.7	12:10	.01	1.5	.0	

(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)
WS-001	5.5	12:05	.00			
WS-002	4.7	12:06	.00			
WS-003	1.9	12:02	.00			
WS-006	2.1	12:04	.00			
WS-005	5.0	12:08	.01			
WS-004	2.3	12:02	.00			
WS-011	11.	12:12	.01			
WS-012	6.1	12:09	.01			
WS-015	2.0	12:07	.00			
WS-014	5.4	12:06	.01			
WS-013	8.9	12:08	.01			
SA002	6.6	12:15	.01	1.1	.1	
RS-205	11.	12:08	.01			
WS-010	1.3	12:03	.00			
WS-009	1.8	12:04	.00			
WS-008	1.7	12:02	.00			
WS-007	1.6	12:03	.00			
SA005	4.5	0:00	.00	.5	.0	
JNC001	4.5	0:00	.00			
SA004	4.5	0:00	.00	.5	.0	
JNC002	5.1	12:03	.00			
SA003	5.1	12:03	.00	.6	.0	.00
JNC010	6.4	12:03	.01			
SA010	6.4	12:03	.01	1.0	.0	.00

EXHIBIT O:
PROPOSED 10 YEAR FLOODPLAIN EXTENTS AND
HEC-RAS OUTPUT TABLE

EXHIBIT O
PROPOSED 10 YEAR FLOODPLAIN
EXTENTS AND HEC-RAS OUTPUT TABLE

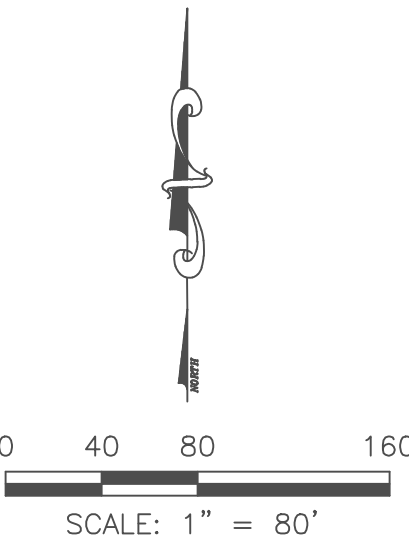
EXCELSIOR OAKS
EXCELSIOR AVENUE, 0.02 MILES EAST OF
HAZEL AVE.
ORAGEVALE, CA
APN: 227-0010-002-0000
JULY 06, 2023

LEGEND

- WATERSHED BOUNDARY
- HYDRAULIC RIVER 1
- PROJECT SITE
- CROSS SECTIONS
- PROPOSED BIO-RETENTION
- PROPOSED 10-YEAR FLOODPLAIN

NOTES

- ELEVATIONS BASED ON NGVD29
- CONTOURS OBTAINED FROM SACRAMENTO COUNTY OPEN DATA WEBSITE
- SITE CONTOURS OBTAINED FROM CLIENT
- A FLOW PATH WAS USED THAT MATCHES THE EXISTING WATER FLOW PATH. THIS RESULTS IN WATER BEING DIRECTED TO THE SOUTH OF THE PROPERTY AND THEN BEING DIRECTED BACK ONTO THE PROPERTY. THIS IN NO WAY IMPEDES ON THE EXISTING STRUCTURES LOCATED TO THE SOUTH OF THE PROPERTY.



River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/s)	Vel Chnl (sq ft)	Flow Area (ft)	Top Width (ft)	Froude # Chl
2359	Max WS	Pr. 10-Yr	2	274.05	274.26		274.32	0.090226	1.9	1.05	8.09	0.93
2355	Max WS	Pr. 100-Yr	9.5	274.05	274.39	274.48	274.66	0.238804	4.15	2.29	11.39	1.63
2322.474	Max WS	Pr. 10-Yr	5.42	272.19	272.47		272.51	0.051199	1.68	3.23	19.69	0.73
2322.474	Max WS	Pr. 100-Yr	9.12	272.19	272.74		272.75	0.006225	0.91	10.05	31.77	0.28
2261.424	Max WS	Pr. 10-Yr	10.02	271.02	272.19		272.19	0.000306	0.39	25.48	31.69	0.07
2261.424	Max WS	Pr. 100-Yr	17.09	271.02	272.58		272.59	0.000265	0.46	37.46	34.39	0.07
2241		Culvert										
2205.839	Max WS	Pr. 10-Yr	8.65	266.93	268.97		268.97	0.000008	0.1	87.37	66.15	0.01
2205.839	Max WS	Pr. 100-Yr	13.16	266.93	270.3		270.3	0.000003	0.08	155.75	73.51	0.01
2180.016	Max WS	Pr. 10-Yr	8.64	266.69	268.97		268.97	0.000003	0.07	128.81	72.55	0.01
2180.016	Max WS	Pr. 100-Yr	13.14	266.69	270.3		270.3	0.000001	0.06	230.69	79.17	0.01
2157.563	Max WS	Pr. 10-Yr	9.64	266.72	268.97		268.97	0.000007	0.1	92.4	55.61	0.01
2157.563	Max WS	Pr. 100-Yr	14.51	266.72	270.3		270.3	0.000003	0.09	156.67	63.84	0.01
2130		Culvert										
2094.676	Max WS	Pr. 10-Yr	9.54	265.52	266.22		266.37	0.055668	3.11	3.07	7.72	0.87
2094.676	Max WS	Pr. 100-Yr	13.04	265.52	266.51		266.59	0.019599	2.29	5.7	10.35	0.54
2052.899	Max WS	Pr. 10-Yr	8.47	263.97	265.24		265.24	0.000027	0.13	63.1	58.85	0.02
2052.899	Max WS	Pr. 100-Yr	12.13	263.97	266.16		266.16	0.000007	0.1	120.21	65.03	0.01

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/s)	Vel Chnl (sq ft)	Flow Area (ft)	Top Width (ft)	Froude # Chl
2014.92	Max WS	Pr. 10-Yr	9.46	263.17	265.24		265.24	0.000009	0.12	81.63	52.13	0.01
2014.92	Max WS	Pr. 100-Yr	13.11	263.17	266.16		266.16	0.000005	0.11	121.48	56.74	0.01
1980		Culvert										
1936.194	Max WS	Pr. 10-Yr	9.44	261.7	262.19		262.26	0.17402	3.83	2.46	10.81	1.41
1936.194	Max WS	Pr. 100-Yr	12.91	261.7	262.25		262.32	0.178433	4.07	3.17	12.97	1.45
1887.243	Max WS	Pr. 10-Yr	7.02	256.16	258.4		258.4	0.000001	0.05	148.23	74.3	0.01
1887.243	Max WS	Pr. 100-Yr	8.32	256.16	259.18		259.18	0.000001	0.04	212.34	92.45	0
1828.987	Max WS	Pr. 10-Yr	8.73	256	258.4		258.4	0.000003	0.07	128.3	63.01	0.01
1828.987	Max WS	Pr. 100-Yr	10.19	256	259.18		259.18	0.000001	0.06	178.14	68.11	0.01
1780		Culvert										
1737.762	Max WS	Pr. 10-Yr	8.67	255	258.36		258.36	0	0.03	259.6	90.67	0
1737.762	Max WS	Pr. 100-Yr	10.07	255	259.12		259.12	0	0.03	331.39	97.25	0
1727	Max WS	Pr. 10-Yr	8.68	255.03	258.36		258.36	0.000001	0.03	254.96	94.61	0
1727	Max WS	Pr. 100-Yr	10.07	255.03	259.12		259.12	0	0.03	329.14	99.96	0
1676.82	Max WS	Pr. 10-Yr	9.67	255.03	258.36		258.36	0.000002	0.06	153.2	63.17	0.01
1676.82	Max WS	Pr. 100-Yr	11.06	255.03	259.12		259.12	0.000001	0.05	201.52	68.28	0.01
1637		Culvert										
1586.04	Max WS	Pr. 10-Yr	8	248.94	249.35		249.4	0.0476	1.77	4.51	23.99	0.72
1586.04	Max WS	Pr. 100-Yr	11.06	248.94	249.35		249.45	0.101935	2.54	4.35	23.78	1.05
1492.568	Max WS	Pr. 10-Yr	12.03	247	247.51		247.54	0.008679	1.21	9.93	26.08	0.35
1492.568	Max WS	Pr. 100-Yr	10.87	247	247.49		247.51	0.008766	1.17	9.25	25.6	0.34

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/s)	Vel Chnl (sq ft)	Flow Area (ft)	Top Width (ft)	Froude # Chl
1333	Max WS	Pr. 10-Yr	8	243.05	243.34		243.38	0.046358	1.51	5.31	35.26	0.68
1333	Max WS	Pr. 100-Yr	6	243.05	243.31		243.34	0.044277	1.36	4.41	33	0.66
1216	Max WS	Pr. 10-Yr	25.28	239.94	240.66		240.67	0.002242	0.79	31.89	57.34	0.19
1216	Max WS	Pr. 100-Yr	22.84	239.94	240.77		240.77	0.00106	0.59	38.38	60.53	0.13
1115	Max WS	Pr. 10-Yr	27.08	237.42	237.7		237.78	0.31203	4.01	6.76	43.35	1.79
1115	Max WS	Pr. 100-Yr	27.55	237.42	237.72		237.91	0.218632	3.55	7.77	45.77	1.52
984	Max WS	Pr. 10-Yr	18.89	233	234.49		234.49	0.000259	0.34	56.17	72.41	0.07
984	Max WS	Pr. 100-Yr	27.26	233	234.58		234.58	0.000394	0.43	62.75	75.42	0.08
860	Max WS	Pr. 10-Yr	18.86	231.16	231.63		231.71	0.054302	2.27	8.32	39.15	0.81
860	Max WS	Pr. 100-Yr	44.26	231.16	231.84		231.95	0.042707	2.65	16.67	51.17	0.77
756	Max WS	Pr. 10-Yr	18.86	229.56	230.1		230.13	0.008652	1.46	12.95	33.4	0.36
756	Max WS	Pr. 100-Yr	43.65	229.56	230.6		230.64	0.004775	1.66	26.23	37.44	0.3
724		Culvert										
692	Max WS	Pr. 10-Yr	18.86	226.53	227.08		227.19	0.14966	4.9	3.85	10.43	1.42
692	Max WS	Pr. 100-Yr	43.65	226.53	227.37		227.53	0.131783	5.99	7.28	13.22	1.42
624	Max WS	Pr. 10-Yr	18.86	223.84	224.72		224.79	0.012025	2.07	9.12	13.48	0.44
624	Max WS	Pr. 100-Yr	43.26	223.84	225.22		225.33	0.011103	2.6	16.61	16.25	0.45
565	Max WS	Pr. 10-Yr	18.85	223.15	224.19		224.25	0.009107	1.93	9.75	12.88	0.39
565	Max WS	Pr. 100-Yr	42.31	223.15	224.72		224.81	0.00895	2.43	17.4	15.98	0.41
511	Max WS	Pr. 10-Yr	18.84	222.53	223.84		223.87	0.004862	1.54	12.26	14.28	0.29
511	Max WS	Pr. 100-Yr	41.44	222.53	224.36		224.42	0.005655	2.01	20.61	17.91	0.33

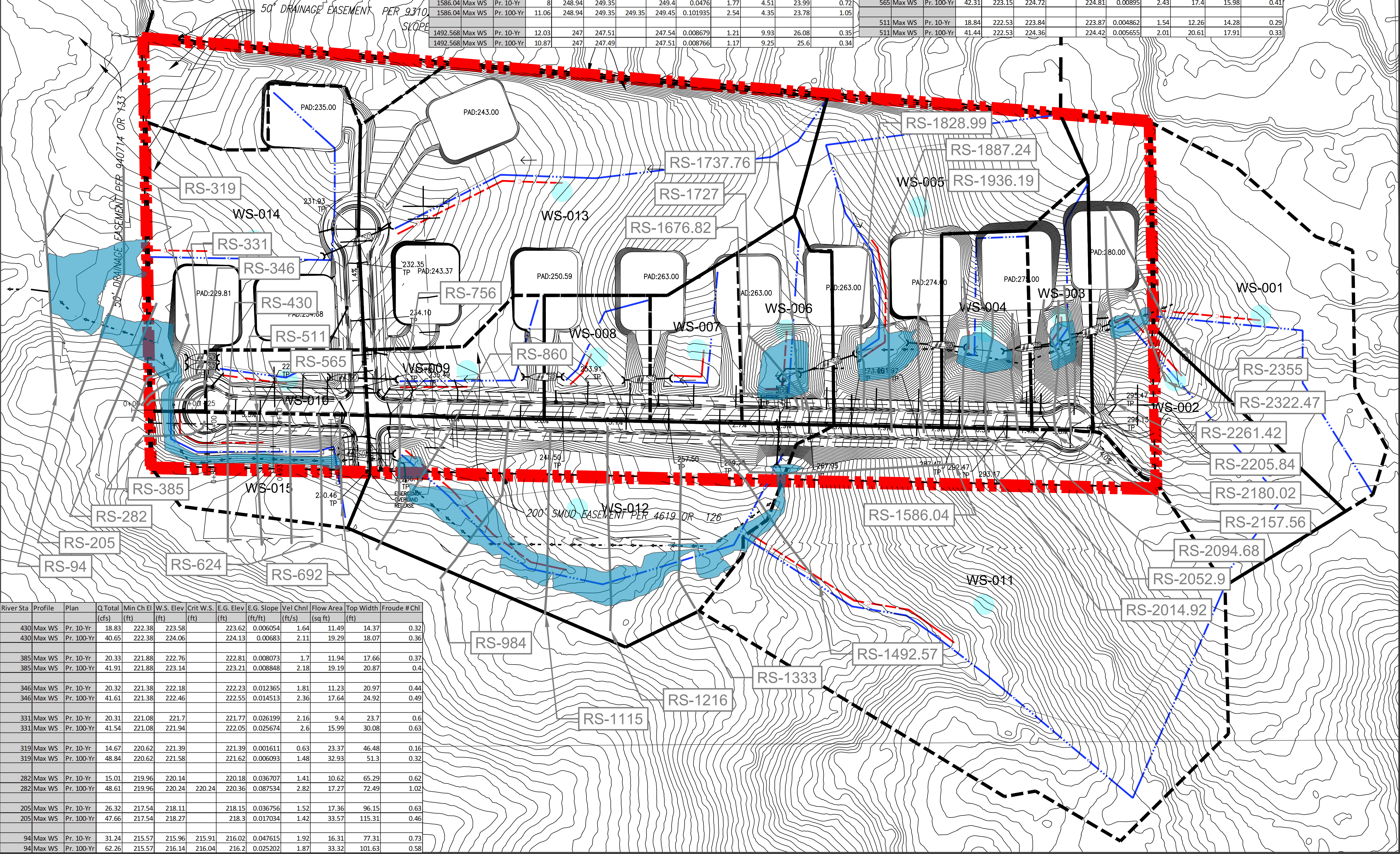


**EXHIBIT P:
PROPOSED 100 YEAR FLOODPLAIN EXTENTS AND
HEC-RAS OUTPUT TABLE**

EXHIBIT P
PROPOSED 100 YEAR FLOODPLAIN
EXTENTS AND HEC-RAS OUTPUT TABLE

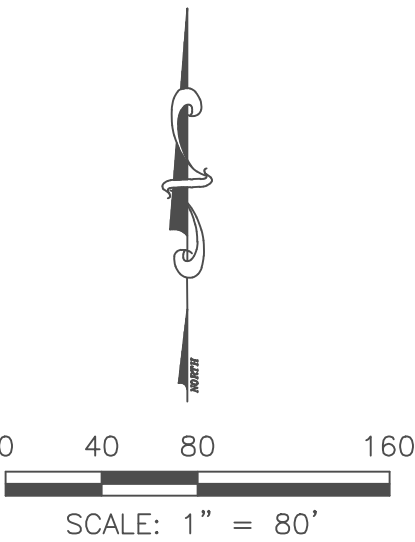
EXCELSIOR OAKS
EXCELSIOR AVENUE, 0.02 MILES EAST
OF HAZEL AVE.
ORAGEVALE, CA
APN: 227-0010-002-0000
JULY 06, 2023

LEGEND

- WATERSHED BOUNDARY
- HYDRAULIC RIVER 1
- PROJECT SITE
- CROSS SECTIONS
- PROPOSED BIO-RETENTION
- PROPOSED 100-YEAR FLOODPLAIN

NOTES

- ELEVATIONS BASED ON NGVD29
- CONTOURS OBTAINED FROM SACRAMENTO COUNTY OPEN DATA WEBSITE
- SITE CONTOURS OBTAINED FROM CLIENT
- A FLOW PATH WAS USED THAT MATCHES THE EXISTING WATER FLOW PATH. THIS RESULTS IN WATER BEING DIRECTED TO THE SOUTH OF THE PROPERTY AND THEN BEING DIRECTED BACK ONTO THE PROPERTY. THIS IN NO WAY IMPEDES ON THE EXISTING STRUCTURES LOCATED TO THE SOUTH OF THE PROPERTY.



River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
2355	Max WS	Pr. 10-Yr	2	274.05	274.26		274.32	0.090226	1.9	1.05	8.09	0.93
2355	Max WS	Pr. 100-Yr	9.5	274.05	274.39	274.48	274.66	0.238804	4.15	2.29	11.39	1.63
2322.474	Max WS	Pr. 10-Yr	5.42	272.19	272.47		272.51	0.051199	1.68	3.23	19.69	0.73
2322.474	Max WS	Pr. 100-Yr	9.12	272.19	272.74		272.75	0.006225	0.91	10.05	31.77	0.28
2261.424	Max WS	Pr. 10-Yr	10.02	271.02	272.19		272.19	0.000306	0.39	25.48	31.69	0.07
2261.424	Max WS	Pr. 100-Yr	17.09	271.02	272.58		272.59	0.000265	0.46	37.46	34.39	0.07
2241		Culvert										
2205.839	Max WS	Pr. 10-Yr	8.65	266.93	268.97		268.97	0.000008	0.1	87.37	66.15	0.01
2205.839	Max WS	Pr. 100-Yr	13.16	266.93	270.3		270.3	0.000003	0.08	155.75	73.51	0.01
2180.016	Max WS	Pr. 10-Yr	8.64	266.69	268.97		268.97	0.000003	0.07	128.81	72.55	0.01
2180.016	Max WS	Pr. 100-Yr	13.14	266.69	270.3		270.3	0.000001	0.06	230.69	79.17	0.01
2157.563	Max WS	Pr. 10-Yr	9.64	266.72	268.97		268.97	0.000007	0.1	92.4	55.61	0.01
2157.563	Max WS	Pr. 100-Yr	14.51	266.72	270.3		270.3	0.000003	0.09	156.67	63.84	0.01
2130		Culvert										
2094.676	Max WS	Pr. 10-Yr	9.54	265.52	266.22		266.37	0.055668	3.11	3.07	7.72	0.87
2094.676	Max WS	Pr. 100-Yr	13.04	265.52	266.51		266.59	0.019599	2.29	5.7	10.35	0.54
2052.899	Max WS	Pr. 10-Yr	8.47	263.97	265.24		265.24	0.000027	0.13	63.1	58.85	0.02
2052.899	Max WS	Pr. 100-Yr	12.13	263.97	266.16		266.16	0.000007	0.1	120.21	65.03	0.01

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
2014.92	Max WS	Pr. 10-Yr	9.46	263.17	265.24		265.24	0.000009	0.12	81.63	52.13	0.01
2014.92	Max WS	Pr. 100-Yr	13.11	263.17	266.16		266.16	0.000005	0.11	121.48	56.74	0.01
1980		Culvert										
1936.194	Max WS	Pr. 10-Yr	9.44	261.7	262.19		262.26	0.17402	3.83	2.46	10.81	1.41
1936.194	Max WS	Pr. 100-Yr	12.91	261.7	262.25		262.32	0.178433	4.07	3.17	12.97	1.45
1887.243	Max WS	Pr. 10-Yr	7.02	256.16	258.4		258.4	0.000001	0.05	148.23	74.3	0.01
1887.243	Max WS	Pr. 100-Yr	8.32	256.16	259.18		259.18	0.000001	0.04	212.34	92.45	0.0
1828.987	Max WS	Pr. 10-Yr	8.73	256	258.4		258.4	0.000003	0.07	128.3	63.01	0.01
1828.987	Max WS	Pr. 100-Yr	10.19	256	259.18		259.18	0.000001	0.06	178.14	68.11	0.01
1780		Culvert										
1737.762	Max WS	Pr. 10-Yr	8.67	255	258.36		258.36	0	0.03	259.6	90.67	0
1737.762	Max WS	Pr. 100-Yr	10.07	255	259.12		259.12	0	0.03	331.39	97.25	0
1727	Max WS	Pr. 10-Yr	8.68	255.03	258.36		258.36	0.000001	0.03	254.96	94.61	0
1727	Max WS	Pr. 100-Yr	10.07	255.03	259.12		259.12	0	0.03	329.14	99.96	0
1676.82	Max WS	Pr. 10-Yr	9.67	255.03	258.36		258.36	0.000002	0.06	153.2	63.17	0.01
1676.82	Max WS	Pr. 100-Yr	11.06	255.03	259.12		259.12	0.000001	0.05	201.52	68.28	0.01
1637		Culvert										
1586.04	Max WS	Pr. 10-Yr	8	248.94	249.35		249.4	0.0476	1.77	4.51	23.99	0.72
1586.04	Max WS	Pr. 100-Yr	11.06	248.94	249.35		249.45	0.101935	2.54	4.35	23.78	1.05
1492.568	Max WS	Pr. 10-Yr	12.03	247	247.51		247.54	0.008679	1.21	9.93	26.08	0.35
1492.568	Max WS	Pr. 100-Yr	10.87	247	247.49		247.51	0.008766	1.17	9.25	25.6	0.34

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1333	Max WS	Pr. 10-Yr	8	243.05	243.34		243.38	0.046358	1.51	5.31	35.26	0.68
1333	Max WS	Pr. 100-Yr	6	243.05	243.31		243.34	0.044277	1.36	4.41	33	0.66
1216	Max WS	Pr. 10-Yr	25.28	239.94	240.66		240.67	0.002242	0.79	31.89	57.34	0.19
1216	Max WS	Pr. 100-Yr	22.84	239.94	240.77		240.77	0.00106	0.59	38.38	60.53	0.13
1115	Max WS	Pr. 10-Yr	27.08	237.42	237.7		237.78	0.31203	4.01	6.76	43.35	1.79
1115	Max WS	Pr. 100-Yr	27.55	237.42	237.72		237.91	0.218632	3.55	7.77	45.77	1.52
984	Max WS	Pr. 10-Yr	18.89	233	234.49		234.49	0.000259	0.34	56.17	72.41	0.07
984	Max WS	Pr. 100-Yr	27.26	233	234.58		234.58	0.000394	0.43	62.75	75.42	0.08
860	Max WS	Pr. 10-Yr	18.86	231.16	231.63		231.71	0.054302	2.27	8.32	39.15	0.81
860	Max WS	Pr. 100-Yr	44.26	231.16	231.84		231.95	0.042707	2.65	16.67	51.17	0.77
756	Max WS	Pr. 10-Yr	18.86	229.56	230.1		230.13	0.008652	1.46	12.95	33.4	0.36
756	Max WS	Pr. 100-Yr	43.65	229.56	230.6		230.64	0.004775	1.66	26.23	37.44	0.3
724		Culvert										
692	Max WS	Pr. 10-Yr	18.86	226.53	227.08		227.19	0.14966	4.9	3.85	10.43	1.42
692	Max WS	Pr. 100-Yr	43.65	226.53	227.37		227.53	0.131783	5.99	7.28	13.22	1.42
624	Max WS	Pr. 10-Yr	18.86	223.84	224.72		224.79	0.012025	2.07	9.12	13.48	0.44
624	Max WS	Pr. 100-Yr	43.26	223.84	225.22		225.33	0.011103	2.6	16.61	16.25	0.45
565	Max WS	Pr. 10-Yr	18.85	223.15	224.19		224.25	0.009107	1.93	9.75	12.88	0.39
565	Max WS	Pr. 100-Yr	42.31	223.15	224.72		224.81	0.00895	2.43	17.4	15.98	0.41
511	Max WS	Pr. 10-Yr	18.84	222.53	223.84		223.87	0.004862	1.54	12.26	14.28	0.29
511	Max WS	Pr. 100-Yr	41.44	222.53	224.36		224.42	0.005655	2.01	20.61	17.91	0.33

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
430	Max WS	Pr. 10-Yr	18.83	222.38	223.58		223.62	0.006054	1.64	11.49	14.37	0.32
430	Max WS	Pr. 100-Yr	40.65	222.38	224.06		224.13	0.00683	2.11	19.29	18.07	0.36
385	Max WS	Pr. 10-Yr	20.33	221.88	222.76		222.81	0.008073	1.7	11.94	17.66	0.37
385	Max WS	Pr. 100-Yr	41.91	221.88	223.14		223.21	0.008848	2.18	19.19	20.87	0.4
346	Max WS	Pr. 10-Yr	20.32	221.38	222.18		222.23	0.012365	1.81	11.23	20.97	0.44
346	Max WS	Pr. 100-Yr	41.61	221.38	222.46		222.55	0.014513	2.36	17.64	24.92	0.49
331	Max WS	Pr. 10-Yr	20.31	221.08	221.7		221.77	0.026199	2.16	9.4	23.7	0.6
331	Max WS	Pr. 100-Yr	41.54	221.08	221.94		222.05	0.025674	2.6	15.99	30.08	0.63
319	Max WS	Pr. 10-Yr	14.67	220.62	221.39		221.39	0.001611	0.63	23.37	46.48	0.16
319	Max WS	Pr. 100-Yr	48.84	220.62	221.58		221.62	0.006093	1.48	32.93	51.3	0.32
282	Max WS	Pr. 10-Yr	15.01	219.96	220.14		220.18	0.036707	1.41	10.62	65.29	0.62
282	Max WS	Pr. 100-Yr	48.61	219.96	220.24	220.24	220.36	0.087534	2.82	17.27	72.49	1.02
205	Max WS	Pr. 10-Yr	26.32	217.54	218.11		218.15	0.036756	1.52	17.36	96.15	0.63
205	Max WS	Pr. 100-Yr	47.66	217.54	218.27		218.3	0.017034	1.42	33.57	115.31	0.46
94	Max WS	Pr. 10-Yr	31.24	215.57	215.96	215.91	216.02	0.047615	1.92	16.31	77.31	0.73
94	Max WS	Pr. 100-Yr	62.26	215.57	216.14	216.04	216.2	0.025202	1.87	33.32	101.63	0.58

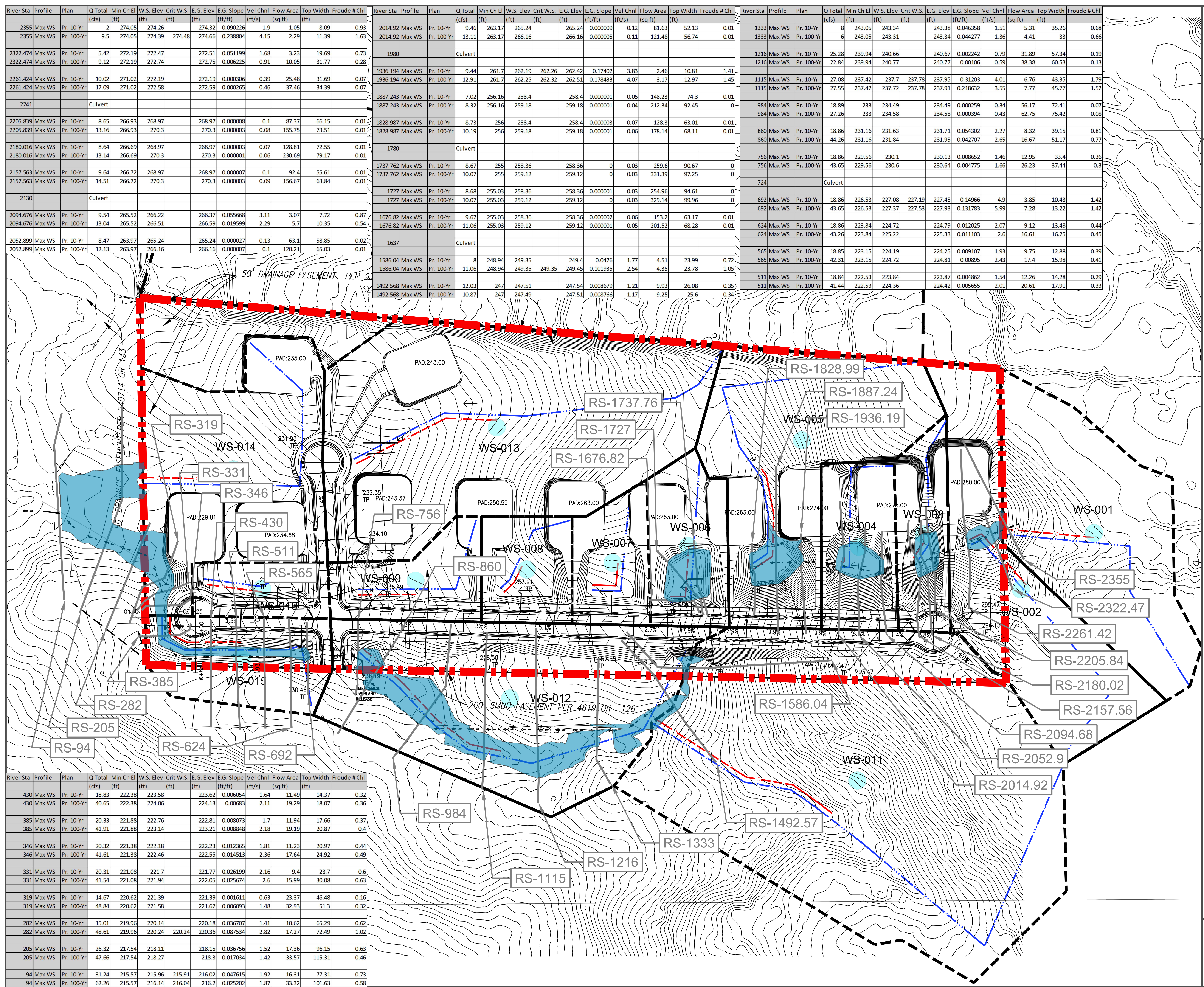


EXHIBIT Q:
HEC-RAS 10 AND 100 YEAR FLOOD PROFILES FOR
PROPOSED CONDITIONS

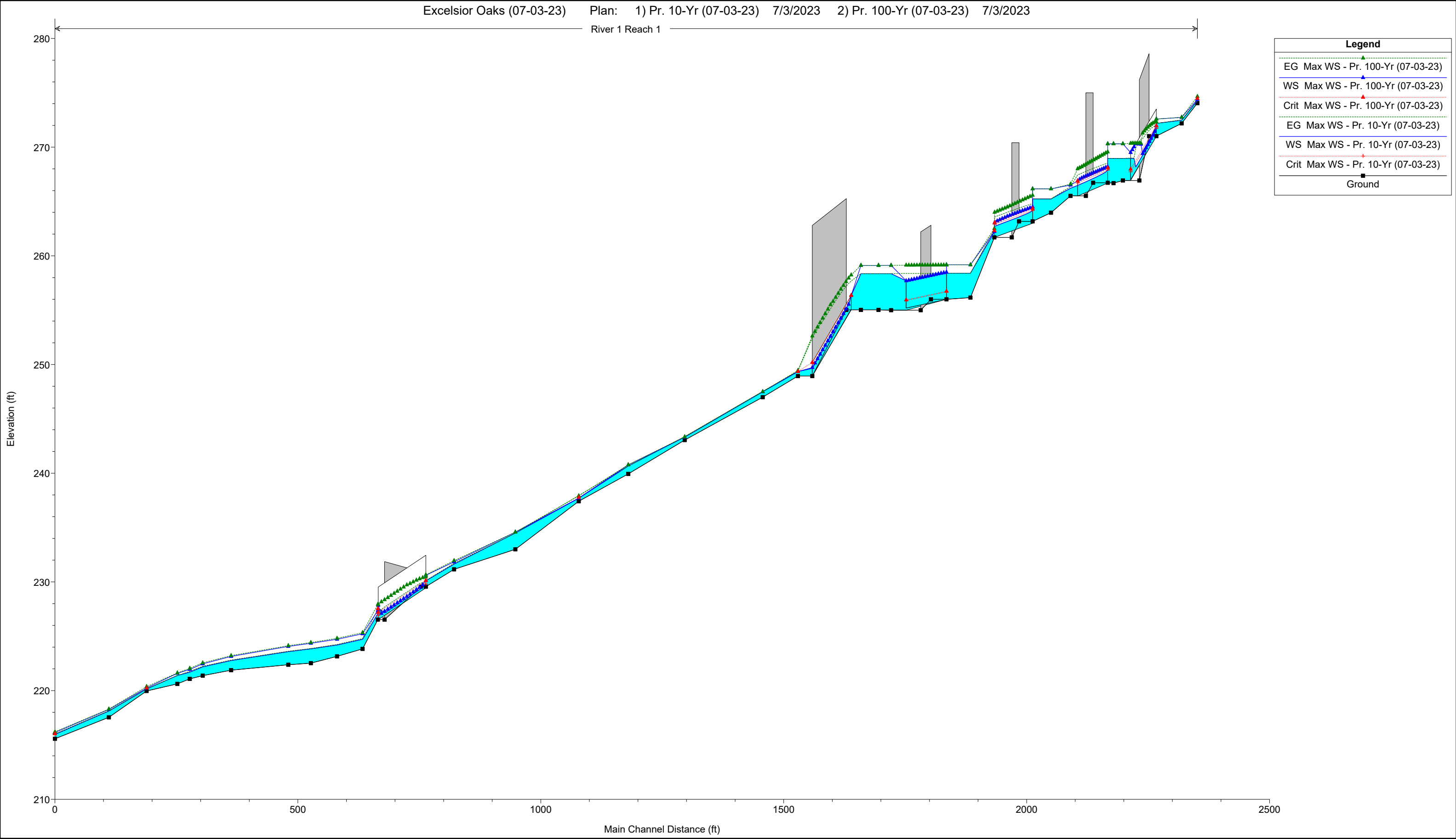


EXHIBIT R:
SAHM PROJECT REPORT

EXHIBIT R

SAHM

PROJECT REPORT

**SEE ATTACHED SAHM MODELING
ZIP FILE FOR COMPLETE REPORT**

**EXHIBIT S:
COMMERCIAL SITE (LID) CREDITS FOR OVER ALL
SIGHT**

Appendix D-2: Commercial Sites: Low Impact Development (LID) Credits and Treatment BMP Sizing Calculations

Name of Drainage Shed:Linda Creek

Location of project:Sacramento

Fill in Blue Highlighted boxes

Step 1 - Open Space and Pervious Area Credits

Is your project within the drainage area of a common drainage plan that includes open space? If not, skip to 1 b.

1 a. Common Drainage Plan Area

0 acres

A_{CDP}

Common Drainage Plan Open Space (Off-project)

0 acres

A_{OS}

see area example below

a. Natural storage reservoirs and drainage corridors

0 acres

b. Buffer zones for natural water bodies

0 acres

c. Natural areas including existing trees, other vegetation, and soil

0 acres

d. Common landscape area/park

0 acres

e. Regional Flood Control/Drainage basins

0 acres

1 b. Project Drainage Shed Area (Total)

21.12 acres

A

Project-Specific Open Space (In-project, communal**)

17.87 acres

A_{PSOS}

see area example below

a. Natural storage reservoirs and drainage corridors

0.00 acres

b. Buffer zones for natural water bodies

0.00 acres

c. Natural areas including existing trees, other vegetation, and soil

17.87 acres

d. Landscape area/park

0.00 acres

e. Flood Control/Drainage basins

0.00 acres

** Doesn't include impervious areas within individual lots and surrounding individual units. That is accounted for below using Form D-1a in Step 2.

Area with Runoff Reduction Potential

$A - A_{PSOS} =$

3.25 acres

A_T

Assumed Initial Impervious Fraction

$A_T / A =$

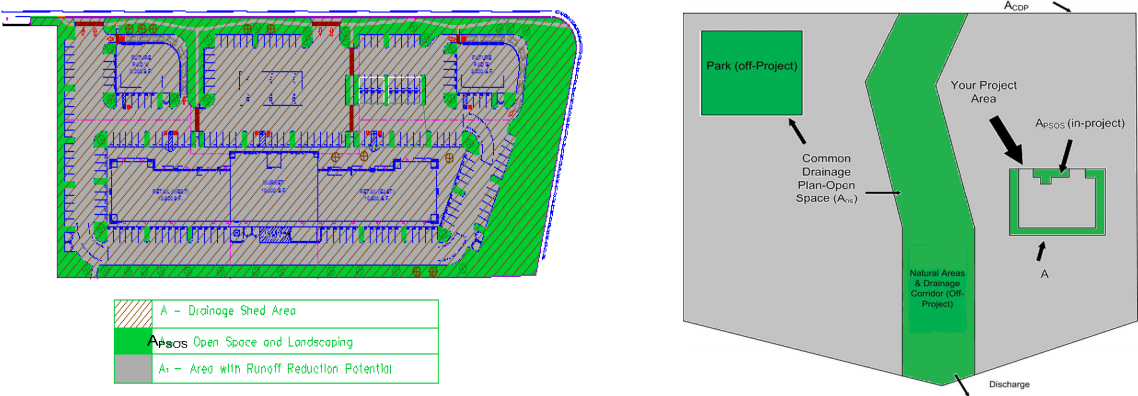
0.15

I

Open Space & Pervious Area LID Credit (Step 1)

$(A_{OS}/A_{CDP} + A_{PSOS}/A) \times 100 =$

85 pts



Step 2 - Runoff Reduction Credits

Runoff Reduction Treatments	Impervious Area Managed	Efficiency Factor	Effective Area Managed (A_c)
Porous Pavement:			
Option 1: Porous Pavement (see Fact Sheet, excludes porous pavement used in Option 2)	0 acres	x	0.000 acres
Option 2: Disconnected Pavement (see Fact Sheet, excludes porous pavement used in Option 1)	use Form D-2a for credits		0.00 acres
Landscaping used to Disconnect Pavement (see Fact Sheet)	3.2500 acres	=	3.25 acres
Disconnected Roof Drains (see Fact Sheet and/or Table D-2b for summary of requirements)	0 acres	=	0.00 acres
Ecoroof (see Fact Sheet)	0 acres	=	0.00 acres
Interceptor Trees (see Fact Sheet)	use Form D-2b for credits		0.00 acres
Total Effective Area Managed by Runoff Reduction Measures		A_c	3.25 acres
Runoff Reduction Credit (Step 2)		$(A_c / A_T) \times 100 =$	100 pts

Table D-2a

Porous Pavement Type	Efficiency Multiplier
Cobblestone Block Pavement	0.40
Pervious Concrete/Asphalt	0.60
Modular Block Pavement &	0.75
Reinforced Grass Pavement	1.00

Table D-2b

Maximum roof size	Minimum travel distance
≤ 3,500 sq ft	21 ft
≤ 5,000 sq ft	24 ft
≤ 7,500 sq ft	28 ft
≤ 10,000 sq ft	32 ft

Form D-2a: Disconnected Pavement Worksheet

See Fact Sheet for more information regarding Disconnected Pavement credit guidelines

Effective Area Managed (A_c)

Pavement Draining to Porous Pavement

2. Enter area draining onto Porous Pavement

0.00

acres

Box K1

3. Enter area of Receiving Porous Pavement

0.00

acres

Box K2

(excludes area entered in Step 2 under Porous Pavement)

4. Ratio of Areas (Box K1 / Box K2)

0.00

Box K3

5. Select multiplier using ratio from Box K3 and enter into Box K4

Ratio (Box D)

Multiplier

Ratio is ≤ 0.5

1.00

Ratio is > 0.5 and < 1.0

0.83

Ratio is > 1.0 and < 1.5

0.71

Ratio is > 1.5 and < 2.0

0.55

1

Box K4

6. Enter Efficiency of Porous Pavement (see table below)

Box K5

Porous Pavement Type	Efficiency Multiplier
Cobblestone Block Pavement	0.40
Pervious Concrete Asphalt Pavement	0.60
Modular Block Pavement	0.75
Porous Gravel Pavement	
Reinforced Grass Pavement	1.00

7. Multiply Box K2 by Box K5 and enter into Box K6

0.00

acres

Box K6

8. Multiply Boxes K1,K4, and K5 and enter the result in Box K7

0.00

acres

Box K7

9. Add Box K6 to Box K7 and multiply by 60%, and enter the Result in Box K8

0.00 acres

Box K8

This is the amount of area credit to enter into the "Disconnected Pavement" Box of Form D-2

Form D-2b: Interceptor Tree Worksheet

See Fact Sheet for more information regarding Interceptor Tree credit guidelines

New Evergreen Trees

1. Enter number of new evergreen trees that qualify as Interceptor Trees in Box L1. trees Box L1
2. Multiply Box L1 by 200 and enter result in Box L2 sq. ft. Box L2

New Deciduous Trees

3. Enter number of new deciduous trees that qualify as Interceptor Trees in Box L3. trees Box L3
4. Multiply Box L3 by 100 and enter result in Box L4 sq. ft. Box L4

Existing Tree Canopy

5. Enter square footage of existing tree canopy that qualifies as Existing Tree canopy in Box L5. sq. ft. Box L5
6. Multiply Box L5 by 0.5 and enter the result in Box L6 sq. ft. Box L6

Total Interceptor Tree EAM Credits

- Add Boxes L2, L4, and L6 and enter it into Box L7 sq. ft. Box L7
- Divide Box L7 by 43,560 and multiply by 20% to get effective area managed and enter result in Box L8 acres Box L8
- This is the amount of area credit to enter into the "Interceptor Trees" Box of Form D-2

Step 3 - Runoff Management Credits**Capture and Use Credits****Impervious Area Managed by Rain barrels, Cisterns, and automatically-emptied systems**(see Fact Sheet) enter gallons, for simple rain barrels acres**Automated-Control Capture and Use System**(see Fact Sheet, then enter impervious area managed by the system) acres**Bioretention/Infiltration Credits****Impervious Area Managed by Bioretention BMPs**(see Fact Sheet) Bioretention Area sq ft
Subdrain Elevation inches
Ponding Depth, inches inches acres**Impervious Area Managed by Infiltration BMPs**(see Fact Sheet) Drawdown Time, hrs drawdown_hrs_inf
Soil Infiltration Rate, in/hr soil_inf_rateSizing Option 1: Capture Volume, acre-ft capture_vol_inf acresSizing Option 2: Infiltration BMP surface area, sq ft soil_surface_area acresBasin or trench? approximate BMP depth ft**Impervious Area Managed by Amended Soil or Mulch Beds**(see Fact Sheet) Mulched Infiltration Area, sq ft mulch_area acres**Total Effective Area Managed by Capture-and-Use/Bioretention/Infiltration BMPs** A_{LIDc}**Runoff Management Credit (Step 3)**A_{LIDc}/A_T*200 = pts**Total LID Credits (Step 1+2+3)**

LID compliant, check for treatment sizing in Step 4

184.6

Does project require hydromodification management? If yes, proceed to using SachM.

Adjusted Area for Flow-Based, Non-LID TreatmentA_T - A_C - A_{LIDc} = A_{AT}**Adjusted Impervious Fraction of A for Volume-Based, Non-LID Treatment**A_{AT} / A = I_A**STOP: No additional treatment needed**

Step 4a Treatment - Flow-Based (Rational Method)

Calculate treatment flow (cfs):

Flow = Runoff Coefficient x Rainfall Intensity x Area

Look up value for i in Table D-2c (Rainfall Intensity)

0.18i

Obtain A_{AT} from Step 3

0.00A_{AT}

Use C = 0.95

0.95C

Flow = 0.95 * i * A_{AT}

0.00cfs

Table D-2c		
Rainfall Intensity		
Roseville	i =	0.20 in/hr
Sacramento	i =	0.18 in/hr
Folsom	i =	0.20 in/hr

Step 4b Treatment - Volume-Based (ASCE-WEF)

Calculate water quality volume (Acre-Feet):

WQV = Area x Maximized Detention Volume (P₀)

Obtain A from Step 1

21.12

A

hrs

Specified Draw Down time

Obtain P₀: Maximized Detention Volume from figures E-1 to E-4 in Appendix E of this manual using I_a from Step 2.

0.00

P₀

Calculate treatment volume (acre-ft):

Treatment volume = A x (P₀ / 12)

0.00

Acre-Feet

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EXHIBIT T:
COMMERCIAL SITE (LID) CREDITS FOR ONE PAD

Appendix D-2: Commercial Sites: Low Impact Development (LID) Credits and Treatment BMP Sizing Calculations

Name of Drainage Shed:Linda Creek

Location of project:Sacramento

Fill in Blue Highlighted boxes

Step 1 - Open Space and Pervious Area Credits

Is your project within the drainage area of a common drainage plan that includes open space? If not, skip to 1 b.

1 a. Common Drainage Plan Area

acres

A_{CDP}

Common Drainage Plan Open Space (Off-project)

0

acres

A_{OS}

see area example below

a. Natural storage reservoirs and drainage corridors

0

acres

b. Buffer zones for natural water bodies

0

acres

c. Natural areas including existing trees, other vegetation, and soil

0

acres

d. Common landscape area/park

0

acres

e. Regional Flood Control/Drainage basins

0

acres

1 b. Project Drainage Shed Area (Total)

0.34

acres

A

Project-Specific Open Space (In-project, communal**)

0.00

acres

A_{PSOS}

see area example below

a. Natural storage reservoirs and drainage corridors

0.00

acres

b. Buffer zones for natural water bodies

0.00

acres

c. Natural areas including existing trees, other vegetation, and soil

0.00

acres

d. Landscape area/park

0.00

acres

e. Flood Control/Drainage basins

0.00

acres

** Doesn't include impervious areas within individual lots and surrounding individual units. That is accounted for below using Form D-1a in Step 2.

Area with Runoff Reduction Potential

$A - A_{PSOS} =$

0.34

acres

A_T

Assumed Initial Impervious Fraction

$A_T / A =$

1.00

I

Open Space & Pervious Area LID Credit (Step 1)

$(A_{OS}/A_{CDP} + A_{PSOS}/A) \times 100 =$

0

pts

A - Drainage Shed Area

A_{PSOS} Open Space and Landscaping

A_T - Area with Runoff Reduction Potential

Park (off-Project)

Common Drainage Plan-Open Space (A_{OS})

Your Project Area

Natural Areas & Drainage Corridor (Off-Project)

A_{PSOS} (in-project)

A

Discharge

Step 2 - Runoff Reduction Credits

Runoff Reduction Treatments	Impervious Area Managed	Efficiency Factor	Effective Area Managed (A_C)
Porous Pavement:			
Option 1: Porous Pavement (see Fact Sheet, excludes porous pavement used in Option 2)	0 acres	x	0.000 acres
Option 2: Disconnected Pavement (see Fact Sheet, excludes porous pavement used in Option 1)	use Form D-2a for credits		0.00 acres
Landscaping used to Disconnect Pavement (see Fact Sheet)	0.0000 acres	=	0.00 acres
Disconnected Roof Drains (see Fact Sheet and/or Table D-2b for summary of requirements)	0 acres	=	0.00 acres
Ecoroof (see Fact Sheet)	0 acres	=	0.00 acres
Interceptor Trees (see Fact Sheet)	use Form D-2b for credits		0.00 acres
Total Effective Area Managed by Runoff Reduction Measures		A_C	0.00 acres
Runoff Reduction Credit (Step 2)		$(A_C / A_T) \times 100 =$	0 pts

Table D-2a

Porous Pavement Type	Efficiency Multiplier
Cobblestone Block Pavement	0.40
Pervious Concrete/Asphalt	0.60
Modular Block Pavement &	0.75
Reinforced Grass Pavement	1.00

Table D-2b

Maximum roof size	Minimum travel distance
≤ 3,500 sq ft	21 ft
≤ 5,000 sq ft	24 ft
≤ 7,500 sq ft	28 ft
≤ 10,000 sq ft	32 ft

Form D-2a: Disconnected Pavement Worksheet

See Fact Sheet for more information regarding Disconnected Pavement credit guidelines

Effective Area Managed (A_c)

Pavement Draining to Porous Pavement

2. Enter area draining onto Porous Pavement

0.00

acres

Box K1

3. Enter area of Receiving Porous Pavement
(excludes area entered in Step 2 under Porous Pavement)

0.00

acres

Box K2

4. Ratio of Areas (Box K1 / Box K2)

0.00

Box K3

5. Select multiplier using ratio from Box K3 and enter into Box K4

Ratio (Box D)	Multiplier
Ratio is ≤ 0.5	1.00
Ratio is > 0.5 and < 1.0	0.83
Ratio is > 1.0 and < 1.5	0.71
Ratio is > 1.5 and < 2.0	0.55

1

Box K4

6. Enter Efficiency of Porous Pavement (see table below)

Box K5

Porous Pavement Type	Efficiency Multiplier
Cobblestone Block Pavement	0.40
Pervious Concrete Asphalt Pavement	0.60
Modular Block Pavement	0.75
Porous Gravel Pavement	
Reinforced Grass Pavement	1.00

7. Multiply Box K2 by Box K5 and enter into Box K6

0.00

acres

Box K6

8. Multiply Boxes K1,K4, and K5 and enter the result in Box K7

0.00

acres

Box K7

9. Add Box K6 to Box K7 and multiply by 60%, and enter the Result in Box K8

0.00 acres

Box K8

This is the amount of area credit to enter into the "Disconnected Pavement" Box of Form D-2

Form D-2b: Interceptor Tree Worksheet

See Fact Sheet for more information regarding Interceptor Tree credit guidelines

New Evergreen Trees

1. Enter number of new evergreen trees that qualify as Interceptor Trees in Box L1. trees Box L1
2. Multiply Box L1 by 200 and enter result in Box L2 sq. ft. Box L2

New Deciduous Trees

3. Enter number of new deciduous trees that qualify as Interceptor Trees in Box L3. trees Box L3
4. Multiply Box L3 by 100 and enter result in Box L4 sq. ft. Box L4

Existing Tree Canopy

5. Enter square footage of existing tree canopy that qualifies as Existing Tree canopy in Box L5. sq. ft. Box L5
6. Multiply Box L5 by 0.5 and enter the result in Box L6 sq. ft. Box L6

Total Interceptor Tree EAM Credits

- Add Boxes L2, L4, and L6 and enter it into Box L7 sq. ft. Box L7
- Divide Box L7 by 43,560 and multiply by 20% to get effective area managed and enter result in Box L8 acres Box L8
- This is the amount of area credit to enter into the "Interceptor Trees" Box of Form D-2

Step 3 - Runoff Management Credits**Capture and Use Credits****Impervious Area Managed by Rain barrels, Cisterns, and automatically-emptied systems**(see Fact Sheet) enter gallons, for simple rain barrels acres**Automated-Control Capture and Use System**(see Fact Sheet, then enter impervious area managed by the system) acres**Bioretention/Infiltration Credits****Impervious Area Managed by Bioretention BMPs**

(see Fact Sheet)

Bioretention Area sq ft
Subdrain Elevation inches
Ponding Depth, inches inches acres**Impervious Area Managed by Infiltration BMPs**

(see Fact Sheet)

Drawdown Time, hrs drawdown_hrs_inf
Soil Infiltration Rate, in/hr soil_inf_rateSizing Option 1: Capture Volume, acre-ft capture_vol_inf acresSizing Option 2: Infiltration BMP surface area, sq ft soil_surface_area acresBasin or trench? approximate BMP depth ft**Impervious Area Managed by Amended Soil or Mulch Beds**

(see Fact Sheet)

Mulched Infiltration Area, sq ft mulch_area acres**Total Effective Area Managed by Capture-and-Use/Bioretention/Infiltration BMPs** A_{LIDc}**Runoff Management Credit (Step 3)**A_{LIDc}/A_T*200 = pts**Total LID Credits (Step 1+2+3)**

LID compliant, check for treatment sizing in Step 4

201.4

Does project require hydromodification management? If yes, proceed to using SachM.

Adjusted Area for Flow-Based, Non-LID TreatmentA_T - A_C - A_{LIDc} = A_{AT}**Adjusted Impervious Fraction of A for Volume-Based, Non-LID Treatment**A_{AT} / A = I_A**STOP: No additional treatment needed**

Step 4a Treatment - Flow-Based (Rational Method)

Calculate treatment flow (cfs):

Flow = Runoff Coefficient x Rainfall Intensity x Area

Look up value for i in Table D-2c (Rainfall Intensity)

0.18i

Obtain A_{AT} from Step 3

0.00A_{AT}

Use C = 0.95

0.95C

Flow = 0.95 * i * A_{AT}

0.00cfs

Table D-2c		
Rainfall Intensity		
Roseville	i =	0.20 in/hr
Sacramento	i =	0.18 in/hr
Folsom	i =	0.20 in/hr

Step 4b Treatment - Volume-Based (ASCE-WEF)

Calculate water quality volume (Acre-Feet):	WQV = Area x Maximized Detention Volume (P ₀)		
Obtain A from Step 1	0.34	A	hrs Specified Draw Down time
Obtain P ₀ : Maximized Detention Volume from figures E-1 to E-4 in Appendix E of this manual using I _a from Step 2.	0.00	P ₀	
Calculate treatment volume (acre-ft):			
Treatment volume = A x (P ₀ / 12)	0.00	Acre-Feet	

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EXHIBIT U:
COMMERCIAL SITES (LID) CREDITS WEIGHTED LID
TOTAL

Sub-Shed	Total Area		Existing Impervious		Existing Pervious		Proposed Impervious		Proposed Landscape		% Imperv.	Bio-Retention Planter	LID Points from Spreadsheet (max 200)	WQF	% of Site	Weighted LID Points
	(ft2)	(acres)	(ft2)	(acres)	(ft2)	(acres)	(ft2)	(acres)	(ft2)	(acres)		(ft2)		(ft3/s)		
PAD 1	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 2	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 3	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 4	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 5	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 6	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 7	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 8	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 9	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 10	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 11	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
PAD 12	14700.00	0.337	0.00	0.00	14700.00	0.34	14700.00	0.34	0.00	0.00	100%	2000.00	200.00	0.00	1.34%	2.68
TOTAL SITE AREA, MINUS PAD AREAS	919987.20	21.12	0.00	0.00	919987.20	21.12	141570.00	3.25	778417.20	17.87	15%	0.00	184.60	0.00	83.91%	154.90
Total	1096387.20	25.17	0.00	0.00	1096387.20	25.17	317970.00	7.30	778417.20	17.87	29%	24000.00	-	0.00	100%	187.08

*Note: PER Department of Water Resources recommendation Commercial LID was used for the LID Credits. As such Residential LID was not used.

*Note: TOTAL SITE AREA, MINUS PAD AREAS includes the proposed public road and the dirvieways