Drainage Report for: Blossom Ridge

APN: 223-0091-002

Prepared by CNA Engineering Inc. *Vertical Datum NAVD 88* (Conversion factor to NGVD 29 = -2.549' Per VertCon for BM #15-61)



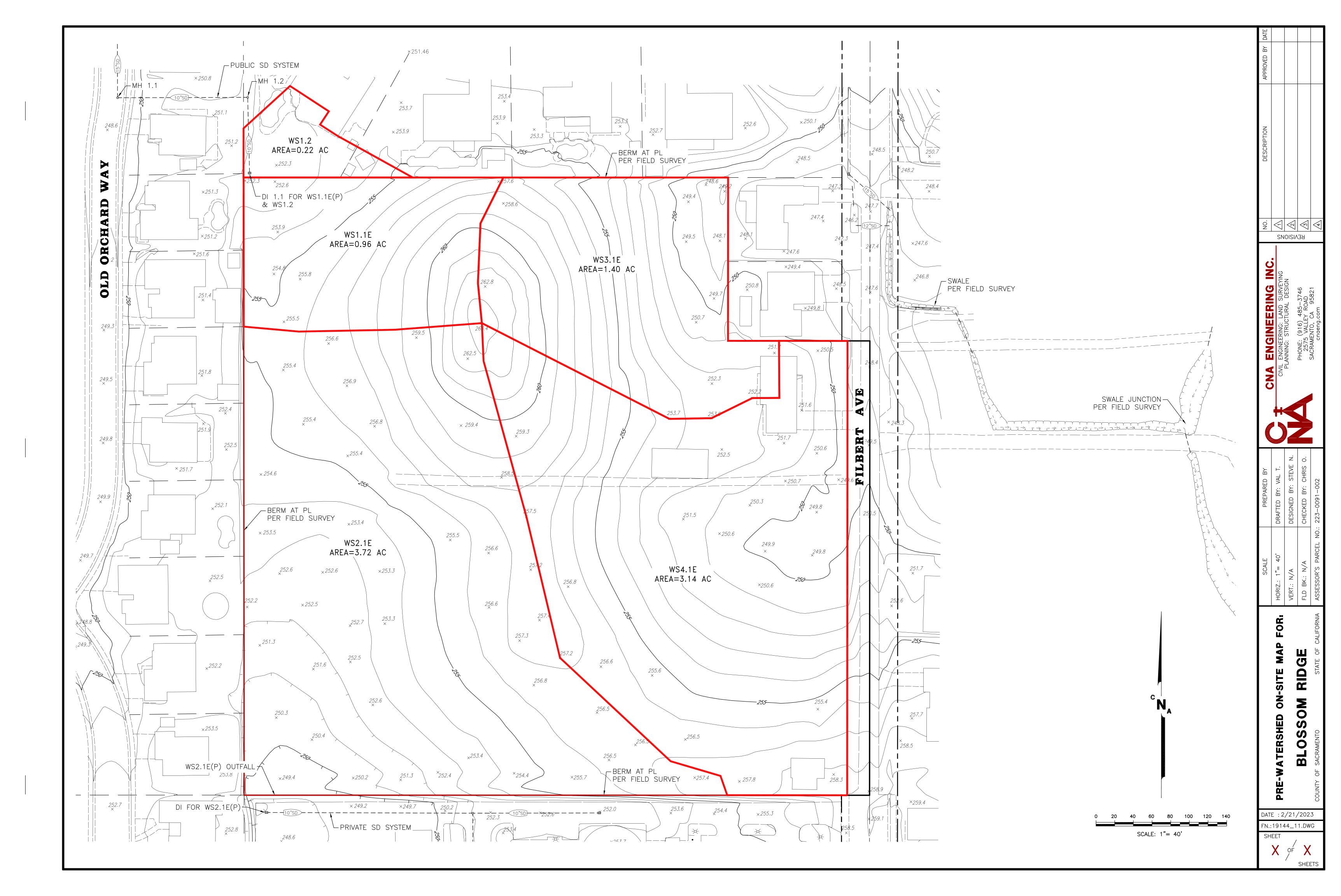
Introduction and background

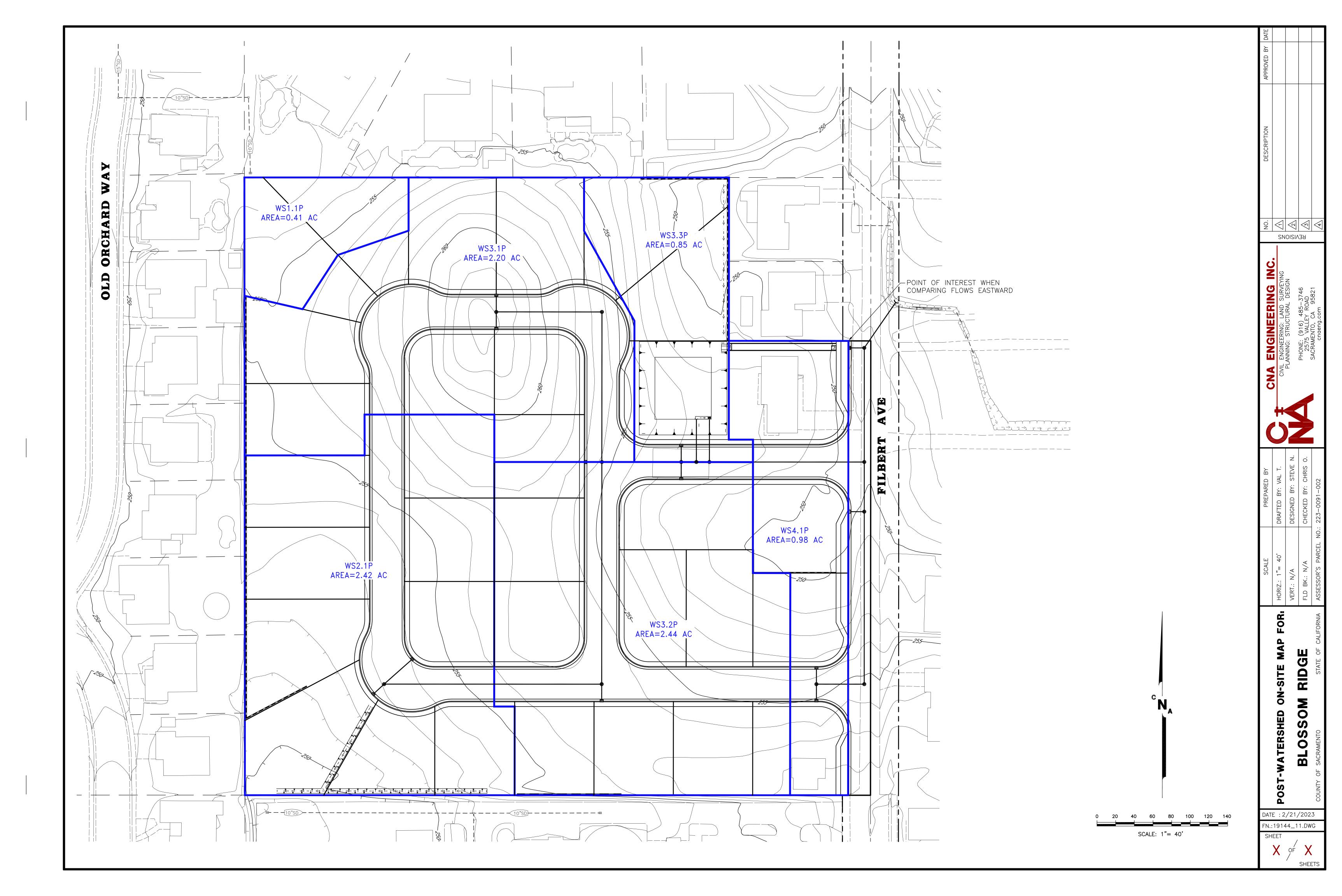
Project site is located on Filbert Avenue, north of the intersection with Greenback Lane.

The project drains to three directions. Each drainage direction is discussed separately in the following chapters.

The scope of this study includes:

- 100-, 10- and 2-year post-development peak control to the pre- development level;
- Design public pipe system;
- Preliminary design Low Impact Development facilities.





1. North-West Direction of Drainage

Watershed WS1.1E currently drains northwest to the backyard of the single-family residence. There is a public inlet located in the backyard that collects drainage and conveys it to Old Orchard Way. Per discussion with the Sacramento County Water Resources the proposed design should meet 2 criteria:

- Do not increase the 2-, 10- and 100-year flows in the historical direction;
- Make sure the existing pipe system is capable of conveying Nolte flows in the postdevelopment conditions. The system needs to be checked up to the Manhole MH13 (MH1.1) per DWR.

1.1 Watersheds Descriptions

Watershed WS1.1E conditions are:

Total shed area = 0.96 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 2% - open space grassland;

Length of longest watercourse – 299 ft [90% = 269.1 ft];

Length along longest watercourse to centroid – 156 ft;

Existing basin slope is 3.8%;

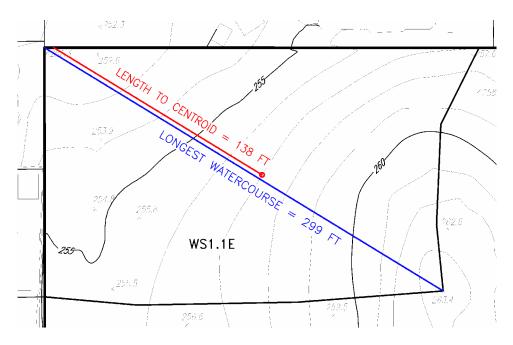


Figure 1 – WS1.1E Lengths.

Watershed WS1.1P conditions are:

Total shed area = 0.41 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 40% - RD-4.

Length of longest watercourse – 176 ft [90% = 158.4 ft];

Length along longest watercourse to centroid – 71 ft;

Basin slope is 3.8%;

Hydrologic Soils group B per USDA GIS Map.

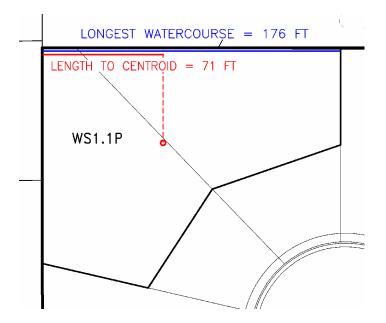


Figure 2 – WS1.1P Lengths.

Watershed WS1.2 – offsite (collected by the existing Type DI):

Total shed area = 0.22 acres;

Existing imperviousness = 50%.

1.2 SacCalc Analysis

Results are presented below.

		(P	<u>ramento meth</u> roject: Blosson 00-year, 1-day	n Ridge)		
ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
WS1-1E	2.7	12:05	.00			
WS2-1E	8.6	12:09	.01			
WS1-1P	1.5	12:02	.00			
WS3-1E	4.1	12:04	.00			
WS4-1E	7.3	12:08	.00			
PRE	11.	12:07	.01			
WS4-1P	3.3	12:03	.00			
WS3-1P	5.9	12:06	.00			
WS3-2P	6.9	12:05	.00			
WS2-1P	7.2	12:05	.00			
DV001	5.5	12:02	.00			.01
WS3-3P	3.1	12:02	.00			
JNC001	21.	12:05	.01			
POND	8.0	12:23	.01	3.3	.4	
POST	8.8	12:21	.01			
WSC-1	36.	12:09	.02			
WS5	20.	12:08	.01			
WS6	13.	12:04	.01			
WS7	68.	12:15	.06			
WS8	12.	12:05	.01			
WS9	11.	12:02	.00			
WS10	8.7	12:02	.00			
WS11	2.3	12:02	.00			

Figure 3 – SacCalc Results for 2-, 10-, and 100-year 24 hour storm events.

(10-year, 1-day rainfall)								
	Peak	Time of	Basin	Peak	Peak			
	flow	peak	area	stage	storage	Diversion volume		
ID	(cfs)	(hours)	(sq. mi)	(feet)	(ac-ft)	(ac-ft)		
WS1-1E	1.5	12:05	.00					
WS2-1E	4.9	12:09	.01					
WS1-1P	.8	12:02	.00					
WS3-1E	2.3	12:04	.00					
WS4-1E	4.2	12:08	.00					
PRE	6.2	12:07	.01					
WS4-1P	2.0	12:02	.00					
WS3-1P	3.8	12:04	.00					
WS3-2P	4.4	12:04	.00					
WS2-1P	4.6	12:03	.00					
DV001	4.6	12:03	.00			.00		
WS3-3P	1.8	12:02	.00					
JNC001	14.	12:03	.01					
POND	3.6	12:28	.01	2.2	.3	.00		
POST	4.6	12:03	.01					
WSC-1	24.	12:07	.02					
WS5	13.	12:06	.01					
WS6	8.0	12:04	.01					
WS7	44.	12:12	.06					
WS8	7.5	12:04	.01					
WS9	6.4	12:02	.00					
WS10	5.0	12:02	.00					
WS11	1.3	12:02	.00					

(2-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)
WS1-1E	.7	12:05	.00			
WS2-1E	2.4	12:09	.01			
WS1-1P	.4	12:02	.00			
WS3-1E	1.2	12:04	.00			
WS4-1E	2.1	12:08	.00			
PRE	3.0	12:07	.01			
WS4-1P	1.0	12:02	.00			
WS3-1P	2.0	12:04	.00			
WS3-2P	2.3	12:04	.00			
WS2-1P	2.4	12:03	.00			
DV001	2.4	12:03	.00			.00
WS3-3P	.9	12:02	.00			
JNC001	7.4	12:03	.01			
POND	2.5	12:21	.01	1.1	.1	
POST	2.9	12:07	.01			
WSC-1	12.	12:06	.02			
WS5	6.7	12:06	.01			
WS6	4.1	12:04	.01			
WS7	22.	12:12	.06			
WS8	3.8	12:04	.01			
WS9	3.4	12:02	.00			
WS10	2.6	12:02	.00			
WS11	.7	12:02	.00			

Figure 3 (continued) – SacCalc Results for 2-, 10-, and 100-year 24 hour storm events.

	Drainage area	(Hydrologic zone 1) Impervious area	Design Q
ID	(acres)	(%)	(cfs)
WS1-1E	0.96	20.00	0.27
WS1-2	0.22	50.00	0.06
WS2-1E	3.82	20.00	1.07
WS2-1P	2.39	40.00	0.67
WS1-1P	0.41	40.00	0.11
WS-411	0.44	40.00	0.12
WS-412	0.50	40.00	0.14
WS-413	0.08	40.00	0.02
WS-414	0.26	40.00	0.07
WS-211	0.76	40.00	0.21
WS-212	1.23	40.00	0.34
WS-311	1.14	40.00	0.32
WS-312	0.40	40.00	0.11
WS-313	0.78	40.00	0.22
WS-314	0.42	40.00	0.12
WS-321	0.94	40.00	0.26
WS-322	0.82	40.00	0.23
WS-323	0.99	40.00	0.28
JNC001	7.48	40.00	2.09

Nolte method results							
(Project:	Blossom	Ridge	Nolte)				
(Hy	drologic	zone 1)				

Figure 4 – SacCalc Results Nolte flows.

As can be seen from the results above, the development will not increase runoff offsite in the North-West Direction during 2-, 10- and 100-year events and for Nolte flows.

1.3 Hydraflow Pipe Analysis – Existing Off-site System

Flows from WS1.1P and WS1.2 are entered in the DI1.1 (Node #3) located offsite of the project.

Total flow entered is 0.22 + 0.41 = 0.63 cfs. (See Figure 4 above).

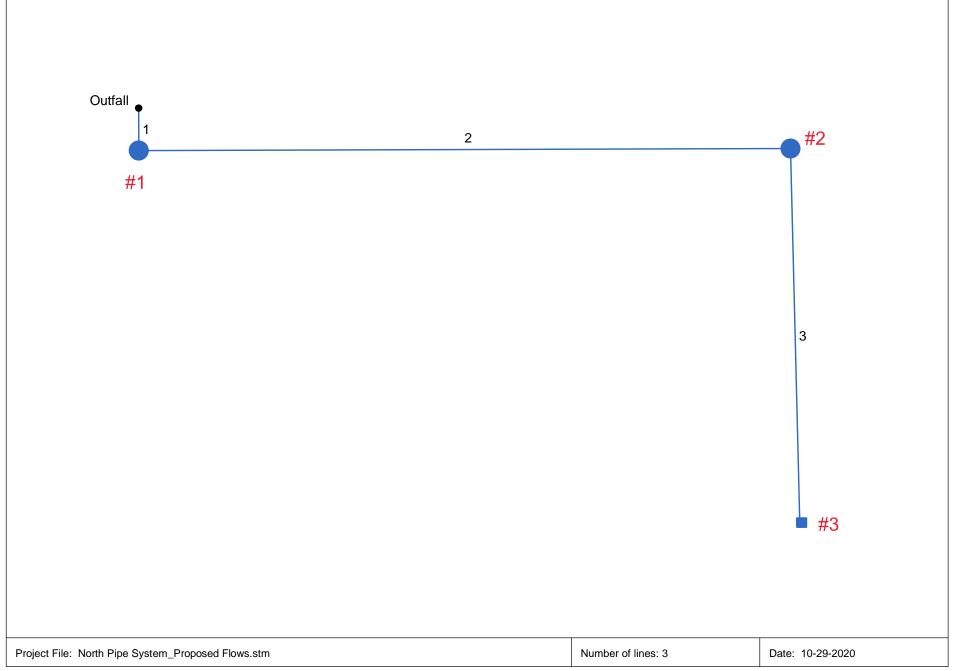
Pipes and nodes information is as follows (refer to the WS Map above). Existing SD facilities have been surveyed:

Structure	Structure	Rim	Invert	Pipe size and	Slope	n-value	
#	ID	Elevation	(FL)	material	downstream		
				(downstream)			
1	MH 1.1	248.50	244.30	15", PVC	0.0100	0.015	
		(out)		- ,	(assumed)		
2	MH 1.2	249.72	246.98	10", PVC	0.0192	0.015	
			(out)	- ,		01010	
	DI 1.1	050.05	0.40.60		0.004.0	0.015	
3	(WS1.1P & WS1.2)	252.35	249.63	10", PVC	0.0310	0.015	

Table 1 – Existing Storm Drain System Information.

As can be seen from the results below, HGL_{Nolte} for the system northwest of the project does not get closer than 12" below the rims of manholes and 6" below the rims of drop inlets. The system is considered to have sufficient capacity.

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan



Hydraflow Storm Sewers Extension v6.066

Storm Sewer Inventory Report

Line		Aligni	nent			Flow	Data					Physical Data					Line ID
No.	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	9.141	89.850	MH	0.00	0.00	0.00	0.0	242.50	1.09	242.60	15	Cir	0.015	1.00	248.50	
2	1	139.424	-90.028	МН	0.00	0.00	0.00	0.0	244.30	1.92	246.98	10	Cir	0.015	1.00	249.72	
3	2	81.000	88.765	DrGrt	0.63	0.00	0.00	0.0	247.12	3.10	249.63	10	Cir	0.015	1.00	252.35	
Project	Project File: North Pipe System_Proposed Flows.stm									Number o	f lines: 3			Date: 1	0-29-2020		

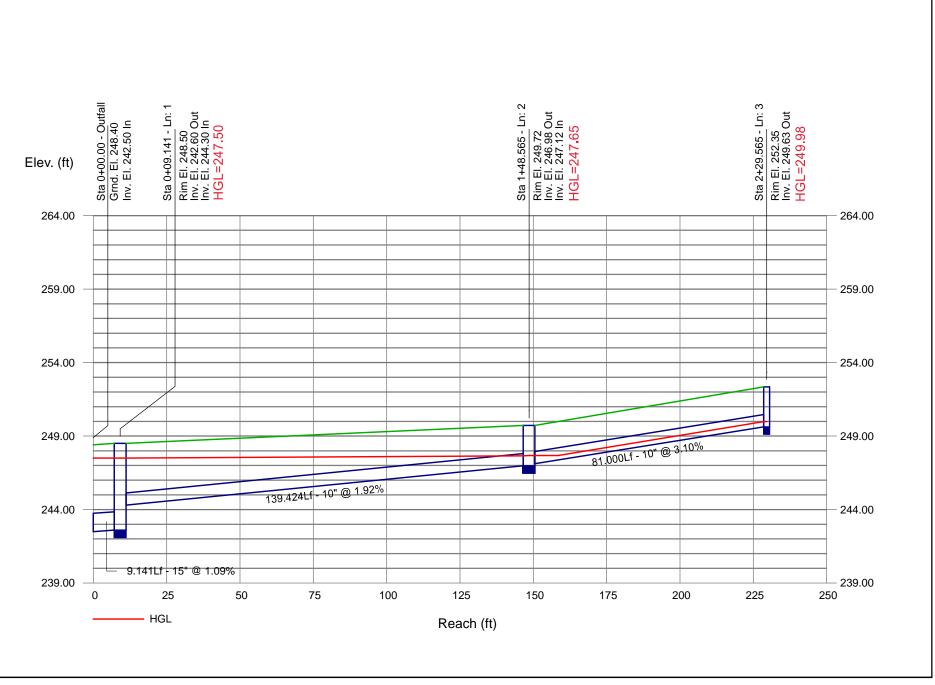
Structure Report

Struct No.	Structure ID	Junction	Rim Elev.		Structure			Line Out			Line In			
NO.		Туре	(ft)	Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)		
1		Manhole	248.50	Cir	4.00	4.00	15	Cir	242.60	10	Cir	244.30		
2		Manhole	249.72	Cir	4.00	4.00	10	Cir	246.98	10	Cir	247.12		
3		DropGrate	252.35	Rect	2.00	2.00	10	Cir	249.63					
Project	Project File: North Pipe System_Proposed Flows.stm								Number of Structures: 3			Run Date: 10-29-2020		

Hydraflow Storm Sewers Extension v6.066

Storm Sewer Summary Report

	0.63 0.63 0.63	15 10 10	Cir Cir Cir	9.141 139.424 81.000	242.50 244.30 247.12	242.60 246.98 249.63	1.094 1.922	247.50* 247.51	247.50* 247.65	0.00 0.03	247.51 247.68	End 1	Manhole
								247.51	247.65	0.03	247.68	1	Marchala
	0.63	10	Cir	81.000	247.12	240.62			1			'	Manhole
						243.00	3.099	247.68	249.98	n/a	249.98 j	2	DropGrate
roject		Project File: North Pipe System_Proposed Flows.stm Number of lines:											



2. South-West Direction of Drainage

Watershed WS2.1E currently drains southwest to the church property. The most of the watershed drainage is designed to be collected into the proposed pipe drainage system. The system will convey the flows to the detention basin and later off-site in the easterly direction. Per discussion with the Sacramento County Water Resources the proposed design should meet this criteria:

- Do not increase the 2-, 10- and 100-year flows in the historical direction. This direction is considered overland release path for this watershed.

Due to the proposed onsite storm drain system the portion of the street within shed WS2.1E would release overland in the southwest direction only during larger storm events.

2.1 Watersheds Descriptions

Watershed WS2.1E conditions are:

Total shed area = 3.82 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 2% - open space grassland;

Length of longest watercourse – 565 ft [90% = 508.5 ft];

Length along longest watercourse to centroid – 252 ft;

Existing basin slope is 2.5%;

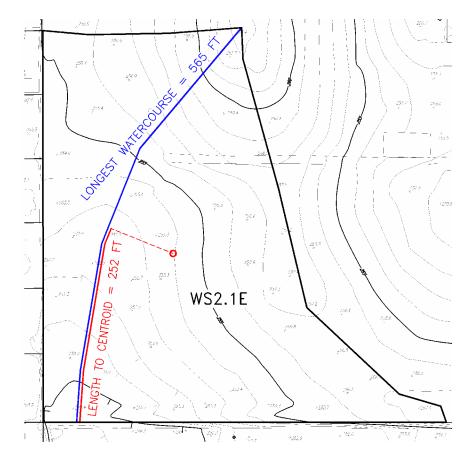


Figure 5 – WS2.1E Lengths.

Watershed WS2.1P conditions are:

Total shed area = 2.42 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – combined, based on proposed zoning area:

Imperviousness – 40% - RD-4.

Length of longest watercourse – 602 ft [90% = 541.8 ft];

Length along longest watercourse to centroid – 291 ft;

Proposed basin slope is 1.0%;

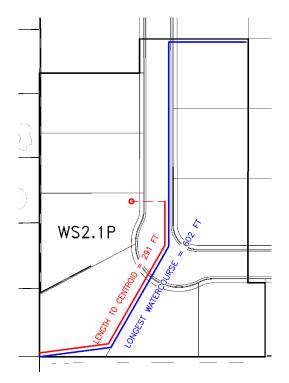


Figure 6 – WS2.1P Lengths.

2.2 SacCalc Analysis

As can be seen from the results in the Figure 3, the development will not increase runoff offsite in the South-West Direction during 2-, 10- and 100-year events. This is achieved by making the area contributing in this direction smaller: 3.72 acres of the existing undeveloped WS2.1E compared to the 2.42 acres of the developed WS2.1P.

3. East Direction of Drainage

Watershed WS3.1E currently drains northeast to the backyards of the single-family residences located on Filbert Avenue. Drainage fills up the front yards and finds its way across Filbert Avenue either via existing cross culvert or spilling over the sag of the roadway. Similarly, Watershed WS4.1E currently drains east towards Filbert Avenue, follows along the road and finds release in the same location. There is a drainage swale across Filbert Avenue that receives the drainage form the project site. This swale runs east towards the junction with another swale coming from the north direction. The swale junction has been surveyed and is located approximately 340 feet east of the Filbert centerline. Per discussion with the Sacramento County Water Resources the proposed design should meet the following criteria:

- Do not increase the 2-, 10- and 100-year flows in the historical direction;
- Design the pipe system that outfalls into the existing swale. If the tie-in location is in the Right-of-Way, no easement would be necessary;
- Design the proposed pipe system to be capable to convey Nolte flows in the postdevelopment conditions;
- Analyze downstream conditions.

3.1 Watersheds Descriptions

Watershed WS3.1E conditions are:

Total shed area = 1.40 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 2% - open space grassland;

Length of longest watercourse – 289 ft [90% = 260.1 ft];

Length along longest watercourse to centroid – 130 ft;

Existing basin slope is 5.5%;

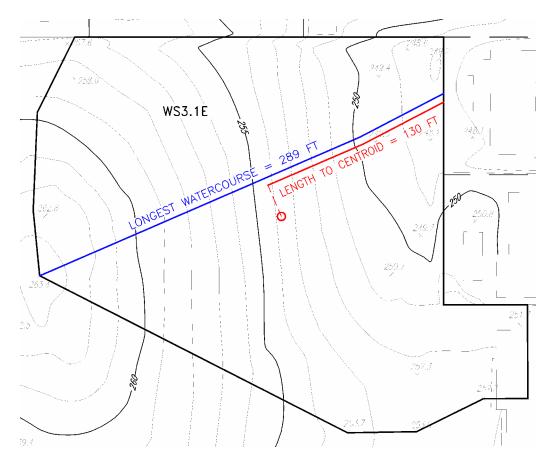


Figure 7 – WS3.1E Lengths.

Watershed WS4.1E conditions are:

Total shed area = 3.14 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 5% - open space with a few structures;

Length of longest watercourse – 514 ft [90% = 462.6 ft];

Length along longest watercourse to centroid – 291 ft;

Existing basin slope is 2.5%;

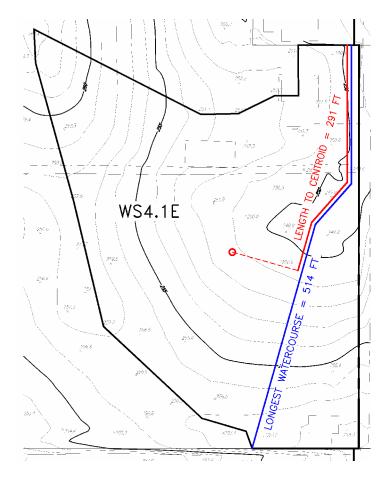


Figure 8 – WS4.1E Lengths.

Watershed WS3.1P conditions are:

Total shed area = 2.20 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – combined, based on proposed zoning area:

Imperviousness – 40% - RD-4.

Length of longest watercourse – 731 ft [90% = 657.9 ft];

Length along longest watercourse to centroid – 327 ft;

Proposed average basin slope is 0.5%;

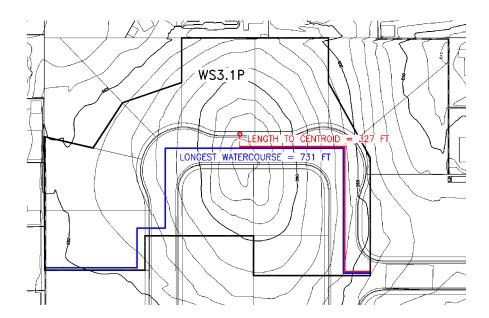


Figure 9 – WS3.1P Lengths.

Watershed WS3.2P conditions are:

Total shed area = 2.44 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – combined, based on proposed zoning area:

Imperviousness – 40% - RD-4.

Length of longest watercourse – 646 ft [90% = 581.4 ft];

Length along longest watercourse to centroid – 283 ft;

Proposed average basin slope is 0.5%;

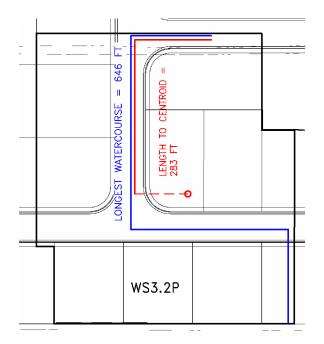


Figure 10 – WS3.2P Lengths.

Watershed WS3.3P conditions are:

Total shed area = 0.85 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – combined, based on proposed zoning area:

Imperviousness – 40% - RD-4.

Length of longest watercourse – 186 ft [90% = 167.4 ft];

Length along longest watercourse to centroid – 41 ft;

Proposed average basin slope is 1.0%;

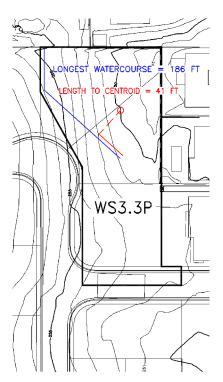


Figure 11 – WS3.3P Lengths.

Watershed WS4.1P conditions are:

Total shed area = 0.98 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 40% - RD-4.

Length of longest watercourse – 533 ft [90% = 479.7 ft];

Length along longest watercourse to centroid – 167 ft;

Proposed average basin slope is 2.0%;

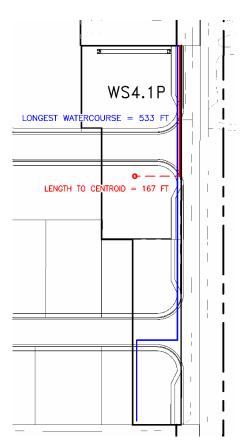


Figure 12 – WS4.1P Lengths.

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3.2 Peak Control

Due to the drainage issues downstream of the proposed development, the project is required not to increase the peak flows during 24 hour 2-, 10- and 100-year events. In order to satisfy this requirement a public detention basin on Lot 2 basin is proposed. On-site grades are design to allow the drainage to enter the basin by both: pipe system and overland flows. Flow restriction in the detention basin is proposed per detail in the Preliminary Grading Plan. Total depth of the basin is 3' with 3:1 side slopes. Watershed WS2.1P is connected to the basin via the drainage pipe system, but overland release of it follows the historical path south of the development.

3.3 SacCalc Analysis

As can be seen from the results in the Figure 3 – PRE and POST, the development will not increase runoff offsite in the East Direction during 2-, 10- and 100-year events. Watershed WS2.1P is connected to the basin using Diversion function. Inlet capacity as calculated in Hydraflow below is used as a diverted flow. Diverted flow is 5.50 cfs for 6" of head from the rim of the inlet to the top back of walk for the Type 1A rolled curb and gutter.

Inlet Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Type B DI Capacity

Combination Inlet

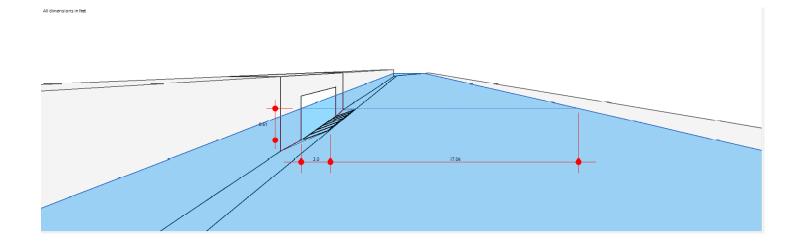
Location	=	Sag
Curb Length (ft)	=	3.00
Throat Height (in)	=	7.50
Grate Area (sqft)	=	5.49
Grate Width (ft)	=	1.83
Grate Length (ft)	=	3.00

Gutter

U ALUI	
Slope, Sw (ft/ft)	= 0.062
Slope, Sx (ft/ft)	= 0.020
Local Depr (in)	= 0.49
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= -Ō-
Gutter n-value	= -0-

Calculations Compute by: Max Depth (in)	Q vs Depth = 6
Highlighted Q Total (cfs)	= 5.50
Q Capt (cfs)	= 5.50

Q Total (cfs)	= 5.50
Q Capt (cfs)	= 5.50
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 6.07
Efficiency (%)	= 100
Gutter Spread (ft)	= 19.04
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



3.4 Overland Release

3.4.1 East Direction

Elevation of the sidewalk low point on the north access road adjacent to the basin is designed to be lower than the gutter flow line east of the basin in order to direct the overland flow into the basin. 4' wide weir and 5' wide concrete spillway is proposed on the north side of the existing house on Lot 1. Flow of 8.0 cfs as a post-developed condition at the outfall of the pond is used for the calculation.

The Report for the spillway is presented below. The detail is provided in the Preliminary Grading Plan.

3.4.2 South Direction

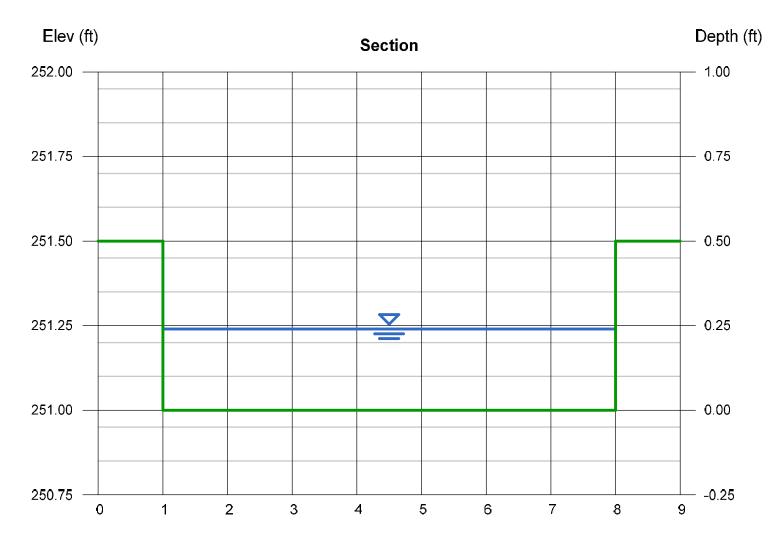
Additionally in the case of storm drain pipe system failing, Overland Release path has been designed on Lot 13. 100-year flow of WS-2.1.2P is 7.2 cfs. This has been used for calculations. See report below.

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Lot 1 Overland Release

Rectangular Highlighted Bottom Width (ft) = 7.00 Depth (ft) = 0.24 Total Depth (ft) = 0.50Q (cfs) = 8.000 Area (sqft) = 1.68 Velocity (ft/s) Invert Elev (ft) = 251.00= 4.76Slope (%) Wetted Perim (ft) = 7.48 = 2.00 N-Value = 0.016 Crit Depth, Yc (ft) = 0.35Top Width (ft) = 7.00**Calculations** EGL (ft) = 0.59Compute by: Known Q Known Q (cfs) = 8.00



Wednesday, Feb 2 2022

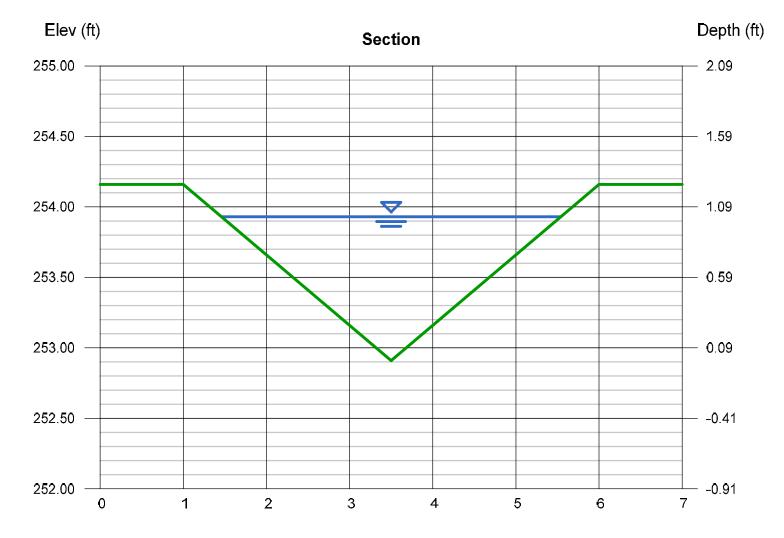
Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Wednesday, Feb 2 2022

Lot 13 OR

Triangular		Highlighted	
Side Slopes (z:1)	= 2.00, 2.00	Depth (ft)	= 1.02
Total Depth (ft)	= 1.25	Q (cfs)	= 7.200
		Arèa (sqft)	= 2.08
Invert Elev (ft)	= 252.91	Velocity (ft/s)	= 3.46
Slope (%)	= 2.50	Wetted Perim (ft)	= 4.56
N-Value	= 0.040	Crit Depth, Yc (ft)	= 0.96
		Top Width (ft)	= 4.08
Calculations		EGL (ft)	= 1.21
Compute by:	Known Q		
Known Q (cfs)	= 7.20		



Reach (ft)

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3.5 Downstream Analysis

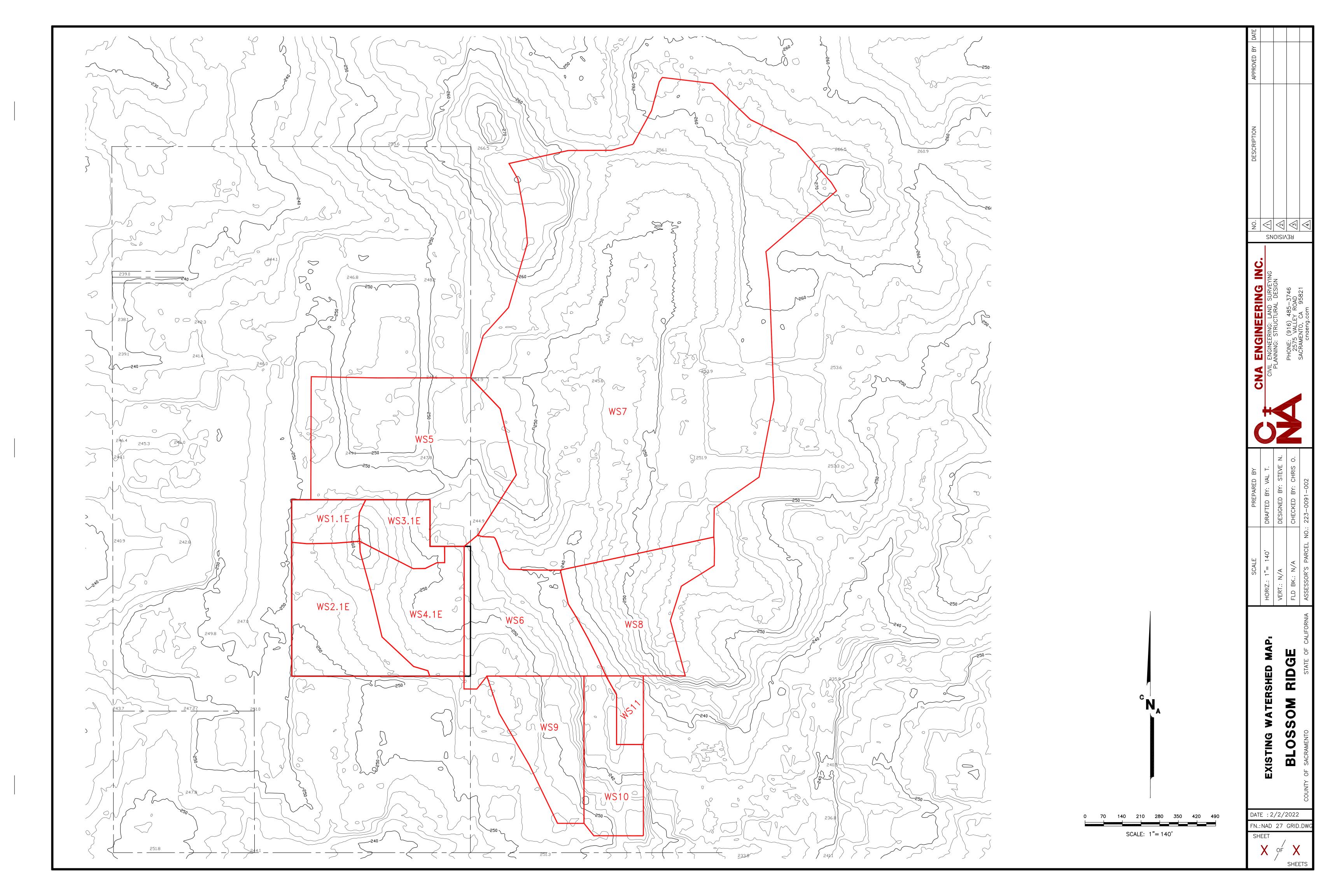
In order to evaluate the effect of the development downstream of the project Hec-Ras analysis has been performed. The goal of this analysis is to analyze the impact of the proposed development on the existing downstream developments and make sure that no adverse effect appear due to the development.

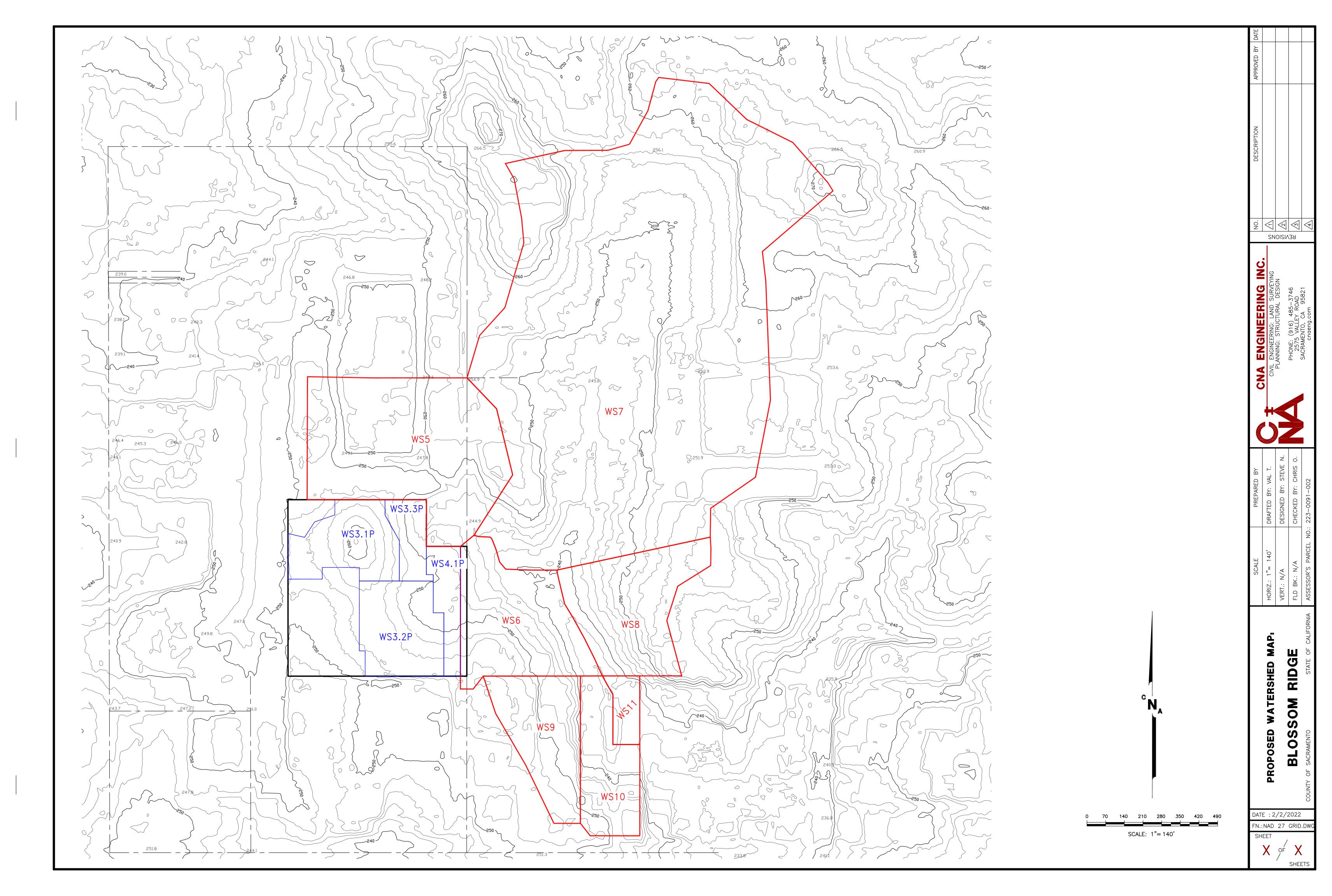
Exisitng conditions are as follows: onsite flows from WS3.1E & WS4.1E cross Filbert Avenue and fall into the swale. This swale alos conveys flows from WS5 as shonw on the Watershed Map. Further down flows from WS7 enter at the swales merging point. Flows from WS6 and WS7 enter the swale along its length. The Hec-Ras model is extended inside the subdivision to establish the proper downstream boundary conditions with a normal depth. At the Palms Subdivision northern boundary there is a CMP round inlet with 30" pipe that extends inside the subdivision pipe drain system. This pipe is disregarded in this floodplain analysis for simplicity of computations.

All drainage facilities and grades have been surveyed.

On-site watersheds have been described previously. Off-site watersheds are described below.

Existing house at 6349 Filbert Ave currently receives a large amount of drainage from the uphill portion of the project property. Additionally, existing property at 6345 Filbert Ave drains toward 6349 Filbert Ave and then 6349 conveys the drainage to the front towards the street. Proposed wall in the back of both 6345 nad 6349 will protect 6349 from receiving any project related direct drainage. However, drainage from 6345 will remain directed to 6349. Overall, it is estimated that the drainage situation for 6345 will improve due to re-routing of the direct drainage away from the property.





3.5.1 Off-site Watersheds Descriptions

Watershed WS5 conditions are:

Total shed area = 8.36 acres;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – 30% - RD-2;

Length of longest watercourse – 1,074 ft [90% = 966.6 ft];

Length along longest watercourse to centroid – 468 ft;

Existing basin slope is 1.0%;

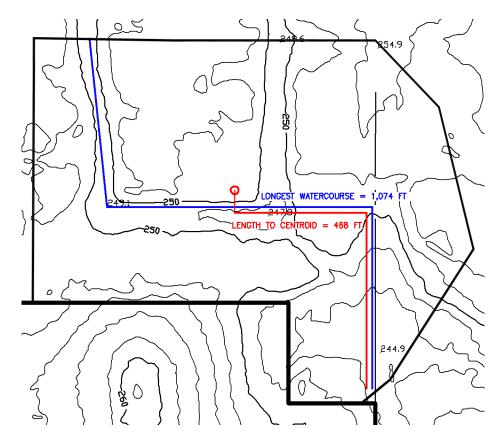


Figure 13 – WS5 Lengths.

Watershed WS6 conditions are:

Total shed area = 4.44 acres;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – 30% - RD-2;

Length of longest watercourse – 506 ft [90% = 455.4 ft];

Length along longest watercourse to centroid – 215 ft;

Existing basin slope is 3.0%;

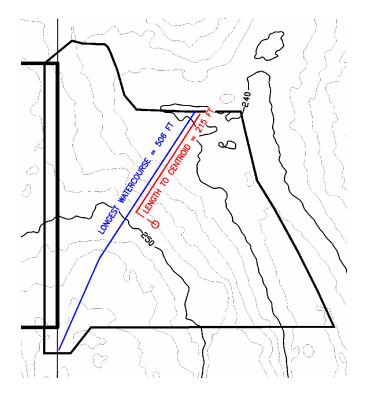


Figure 14 – WS6 Lengths.

Watershed WS7 conditions are:

Total shed area = 37.21 acres;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – 30% - RD-2;

Length of longest watercourse – 1,897 ft [90% = 1,707.3 ft];

Length along longest watercourse to centroid – 894 ft;

Existing basin slope is 1.0%;

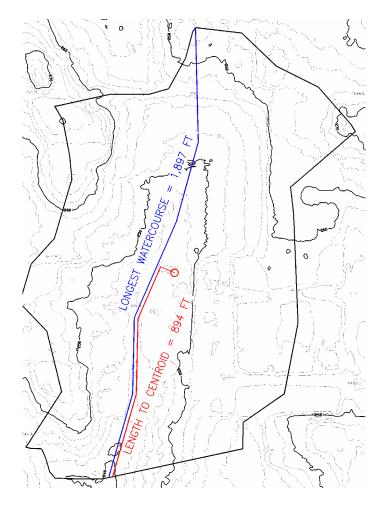


Figure 15 – WS7 Lengths.

Watershed WS8 conditions are:

Total shed area = 4.20 acres;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – 30% - RD-2;

Length of longest watercourse – 573 ft [90% = 515.7 ft];

Length along longest watercourse to centroid – 210 ft;

Existing basin slope is 3.0%;

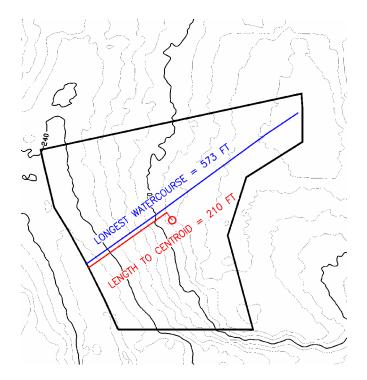


Figure 16 – WS8 Lengths.

Watershed WS9 conditions are:

Total shed area = 3.02 acres;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – 75% - MHP;

Length of longest watercourse – 578 ft [90% = 520.2 ft];

Length along longest watercourse to centroid – 220 ft;

Existing basin slope is 2.5%;

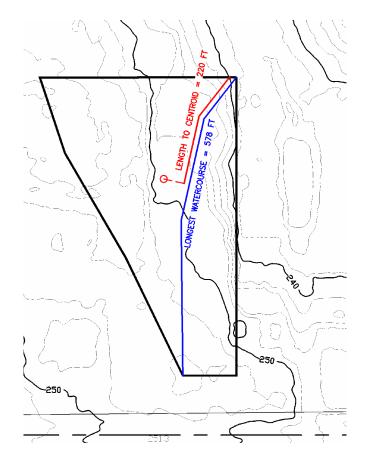


Figure 17 – WS9 Lengths.

Watershed WS10 conditions are:

Total shed area = 2.41 acres;

Mean Elevation – 240 ft;

Precipitation Zone – 3;

Imperviousness – 50% - SPA (RD-7);

Length of longest watercourse – 374 ft [90% = 336.6 ft];

Length along longest watercourse to centroid – 99 ft;

Existing basin slope is 5.5%;

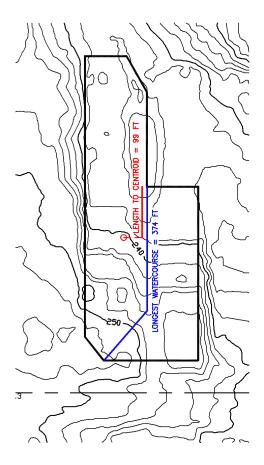


Figure 18 – WS10 Lengths.

Watershed WS11 conditions are:

Total shed area = 0.63 acres;

Mean Elevation – 240 ft;

Precipitation Zone – 3;

Imperviousness – 50% - SPA (RD-7);

Length of longest watercourse – 262 ft [90% = 235.8 ft];

Length along longest watercourse to centroid – 125 ft;

Existing basin slope is 2.5%;

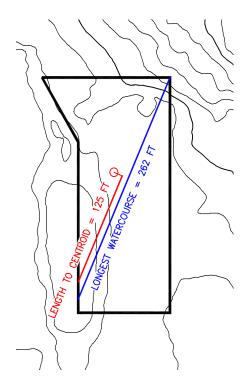


Figure 19 – WS11 Lengths.

3.5.2 HEC-RAS Analysis

Pre-Project and Post-Project conditions are analyzed in HEC-RAS.

- 1. Unsteady Flow Analysis has been performed in HEC-RAS. SacCalc results have been imported into HEC-RAS in the following locations for the Pre-Project conditions:
 - WS5 flow at section 1260;
 - WS3.1E & WS4.1 combined (PRE) flow at section 1228;
 - WS6 flow between sections 610 and 1030;
 - WS8 flow between sections 510 and 710;
 - WS7 flow at section 831;
 - WS9 flow at section 410;
 - WS10 flow between sections 10 and 400;
 - WS11 flow between sections 160 and 330.
- 2. Post-Project conditions:
 - WS5 flow at section 1260;
 - Pond flow at section 1228;
 - WS4.1P flow at section 1228;
 - WS6 flow between sections 610 and 1030;
 - WS8 flow between sections 510 and 710;
 - WS7 flow at section 831;
 - WS9 flow at section 410;
 - WS10 flow between sections 10 and 400;
 - WS11 flow between sections 160 and 330.

3 culverts have been inserted in locations per field survey.

At the end of the river normal depth of 0.005 has been applied to account for the slope of the parking of the apartments as determined per LiDAR.

Manning's n-value of 0.045 as for main channels with tall weeds and stones as well as flood plains with high grass has been used for the swale cross sections in HEC-RAS. Manning's n-value of 0.016 has been used for pavement between sections 0 and 330.

All the channel's bed sections were surveyed and LiDar information has been used to fill the gaps in field shots for some of the overbank data.

Simulation time of 10 seconds has been utilized in the HEC-RAS model provided attached for review.

3.5.3 Analysis of Results

WSE /	100-year	100-year	10-year	10-year	2-year	2-year
Section	(pre.)	(post.)	(pre.)	(post.)	(pre.)	(post.)
0	237.68	237.67	237.55	237.55	237.35	237.35
10	237.80	237.80	237.69	237.69	237.48	237.48
35	237.80	237.80	237.70	237.69	237.48	237.48
115	237.99	237.98	237.79	237.78	237.51	237.51
160	238.03	238.01	237.81	237.81	237.52	237.52
260	238.02	238.01	237.81	237.80	237.52	237.52
330	238.04	238.03	237.82	237.82	237.52	237.53
400	239.72	239.67	239.12	239.11	238.93	238.93
410	240.00	239.94	239.17	239.17	238.98	238.98
510	240.10	240.05	239.70	239.69	239.34	239.34
610	240.22	240.18	239.87	239.86	239.53	239.53
710	240.84	240.82	240.62	240.60	240.27	240.27
802	241.95	241.92	241.67	241.65	241.21	241.21
830	242.78	242.77	242.66	242.65	242.51	242.51
831	242.79	242.78	242.67	242.66	242.51	242.51
930	242.96	242.92	242.80	242.78	242.59	242.59
1030	243.82	243.76	243.68	243.66	243.52	243.52
1112	244.88	244.82	244.78	244.77	244.62	244.62
1137	245.32	245.30	245.26	245.23	245.13	245.13
1147	245.45	245.41	245.37	245.34	245.22	245.22
1163	245.70	245.59	245.55	245.54	245.47	245.47
1228	246.91	246.76	246.65	246.61	246.35	246.34
1260	247.00	246.91	246.78	246.75	246.50	246.49

 Table 2 – Water Surface Elevations.

As a result of the development flow rate and water surface elevations during 100-, 10-, & 2- year storm events do not increase, except for:

2-year WSE at section 330. This 0.01' increase is found to be insignificant and not impacting any existing dwelling. FF of the buildings at this location of The Palms 2 has been found at 240.13' – over 2' higher than 2-year WSE.

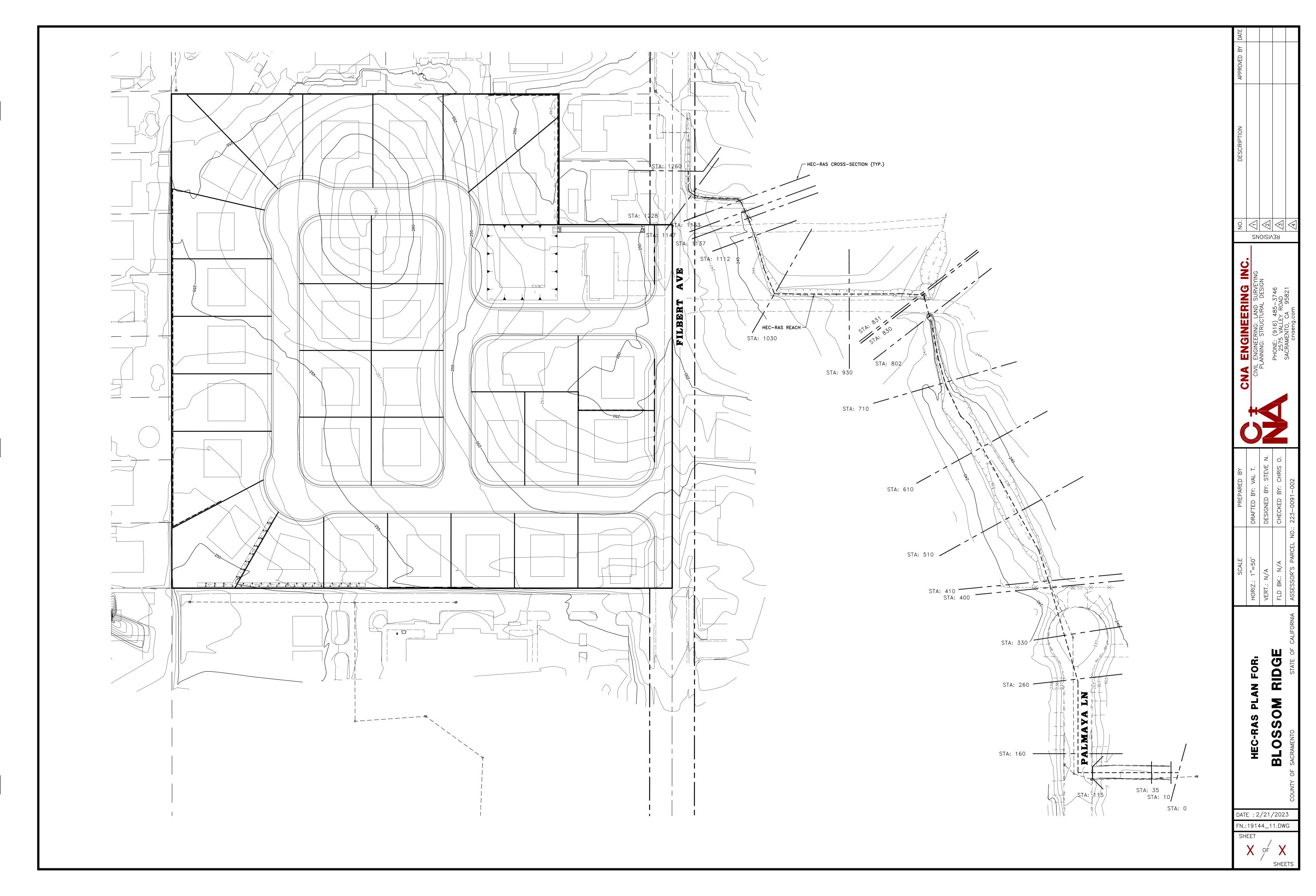
Offsite easements will not be required since the pipe outfall and appurtances, as discussed further, are located within the public Right-of-Way. Existing ditch downstream does not need to be engineered to convey design flows. This was communicated in the email with DWR on 12/8/2020.

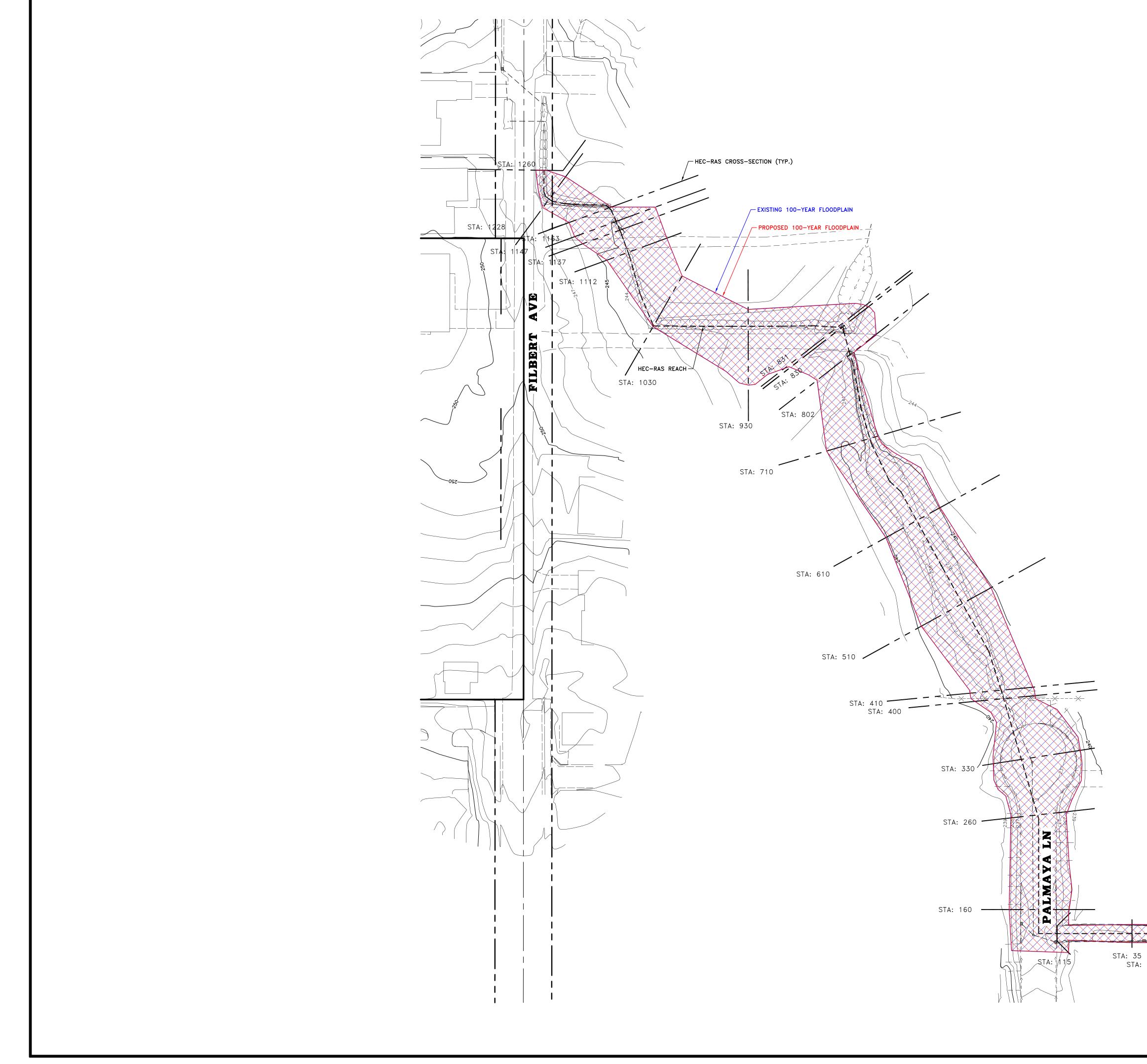
Existing driveways downstream of the development overtop as follows. Refer to the HEC-RAS plan below for the section numbering:

- Lowest portion of the driveway at section 1155 overtops at any of the discussed storm events. Maximum depth over the driveway lowest point is 0.43' in the existing conditions and 0.32' in the proposed conditions.

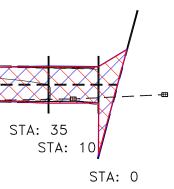
- Lowest portion of the driveway at section 1124.5 overtops at any of the discussed storm events. Maximum depth over the driveway lowest point is 0.50' in the existing conditions and 0.48' in the proposed conditions.

- Lowest portion of the driveway at section 816 overtops at any of the discussed storm events. Maximum depth over the driveway lowest point is 0.53' in the existing conditions and 0.52' in the proposed conditions.



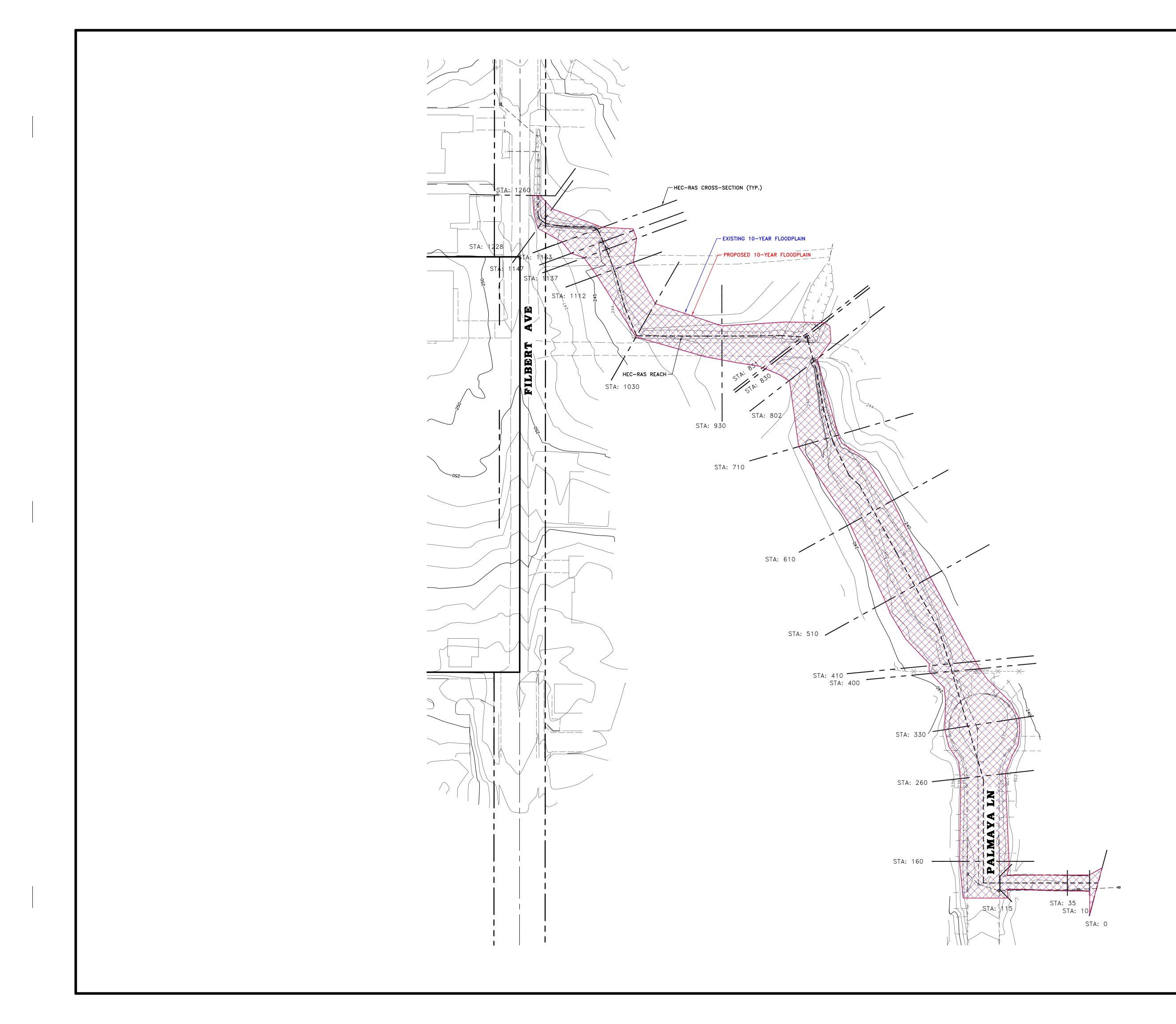


SH			SCALE	PREPARED BY	CNA FNGINFFRING INC	NO.	DESCRIPTION	APPROVED BY DATE
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		AND PROPOSED	HORIZ.: 1"=50'	DRAFTED BY: VAL T.	CIVIL ENGINEERING: LAND SURVEYING	SN		
OF	100-YEAR F	LOODPLAIN FOR.	VERT.: N/A	DESIGNED BY: STEVE N.	PLANNING: STRUCTURAL DESIGN			
SHEE	BLOSSO /202 1.DW	OM RIDGE	FLD BK.: N/A	CHECKED BY: CHRIS O.	PHONE: (916) 485–3746 2575 VALLEY ROAD	KE		
,		STATE OF CALIFORNIA	ASSESSOR'S PARCEL NO.: 223-0091-002	: 223-0091-002	SACRAMENIO, CA 95821 cnaeng.com	4		



NOTE:

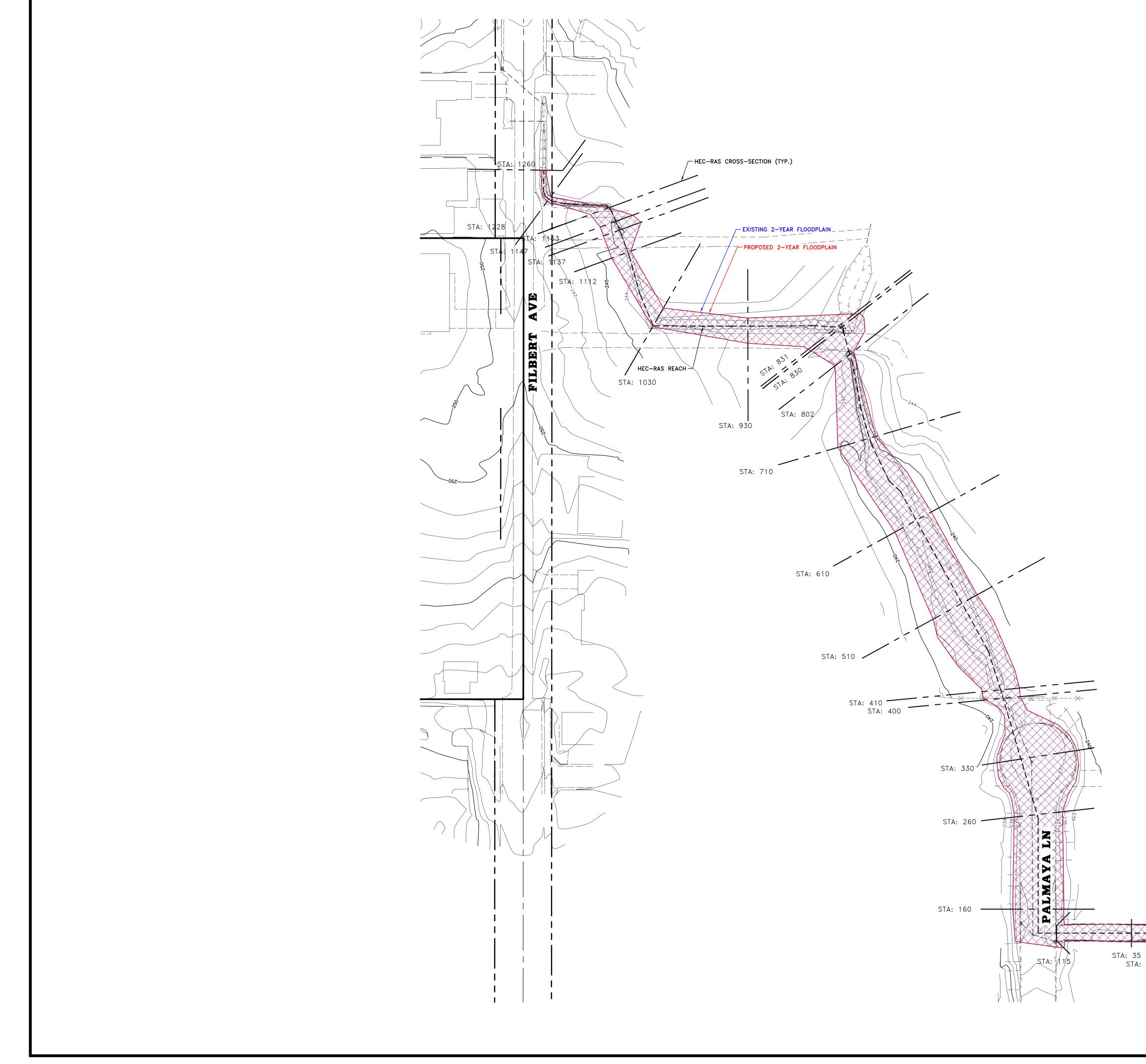
WATER SURFACE ELEVATIONS DIFFERENCES ARE TOO SMALL TO BE DEPICTED ON THIS MAP. REFER TO THE SUMMARY TABLES COMPARING WATER SURFACE ELEVATIONS IN THE REPORT.



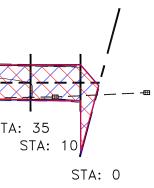
SH			SCALE	PREPARED BY	CNA FNGINFFRING INC	NO.	DESCRIPTION	APPROVED BY DATE
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,		STATE OF CALIFORNIA	ASSESSOR'S PARCEL NO.: 223-0091-002	: 223-0091-002	SAURAMENIO, CA 95821 cnaeng.com	4		

NOTE:

WATER SURFACE ELEVATIONS DIFFERENCES ARE TOO SMALL TO BE DEPICTED ON THIS MAP. REFER TO THE SUMMARY TABLES COMPARING WATER SURFACE ELEVATIONS IN THE REPORT.



FN.: SH			SCALE	PREPARED BY		CNA FNGINFFRING INC	NO.	DESCRIPTION	APPROVED BY	Υ DATE
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OF	2-YEAR FL	OODPLAIN FOR.	VERT.: N/A	DESIGNED BY: STEVE N.		PLANNING: STRUCTURAL DESIGN				
SHEE	RCOSSON /202	OM RIDGE	FLD BK.: N/A	CHECKED BY: CHRIS O.	J	PHONE: (916) 485–3746 2575 VALLEY ROAD	З К			
		STATE OF CALIFORNIA	ASSESSOR'S PARCEL NO.: 223-0091-002	: 223-0091-002		SACKAMENIO, CA 95821 cnaeng.com	4			



NOTE: WATER SURFACE ELEVAT

WATER SURFACE ELEVATIONS DIFFERENCES ARE TOO SMALL TO BE DEPICTED ON THIS MAP. REFER TO THE SUMMARY TABLES COMPARING WATER SURFACE ELEVATIONS IN THE REPORT.

4. Proposed Pipe Systems Analysis

The tie-in point for the System in Filbert Avenue is an existing swale in the Right-of-Way as described in Section 3 and shown in the Preliminary Grading Plan. Starting elevation for the HGL_{pipe} will is established as a 10-year HGL in the swale per Sacramento County Standards.

4.1 Initial HGL for Pipe System Analysis

Initial 10-year HGL in the pipe system is obtained from the downstream channel calculation.

4.1.1 Watershed Description

Watershed WSC.1 conditions are:

Total shed area = 15.60 acres – all the project area has been conservatively included as the most of the site will be collected by the proposed pipe system;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – combined, based on existing zoning areas:

RD-2 + AR-2 = 5.53 + 0.60 = 6.13 acres;

RD-3 = 5.77 acres;

RD-4 = 3.80 acres.

Length of longest watercourse – 1,066 ft [90% = 959.4 ft];

Length along longest watercourse to centroid – 412 ft;

Basin slope is 0.5%;

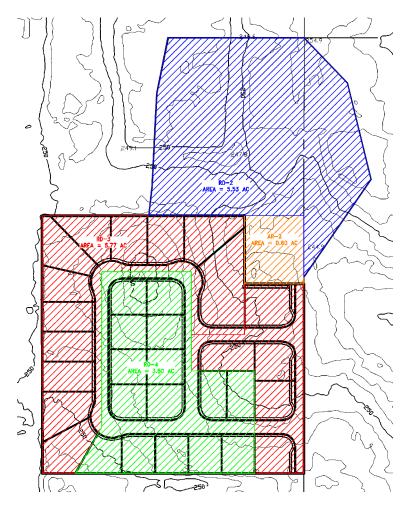


Figure 20 – WSC.1 Zoning.

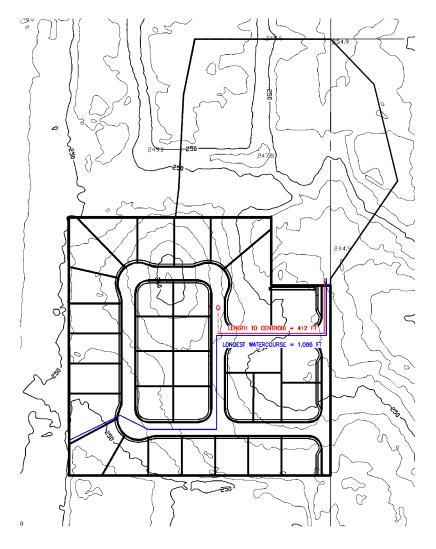
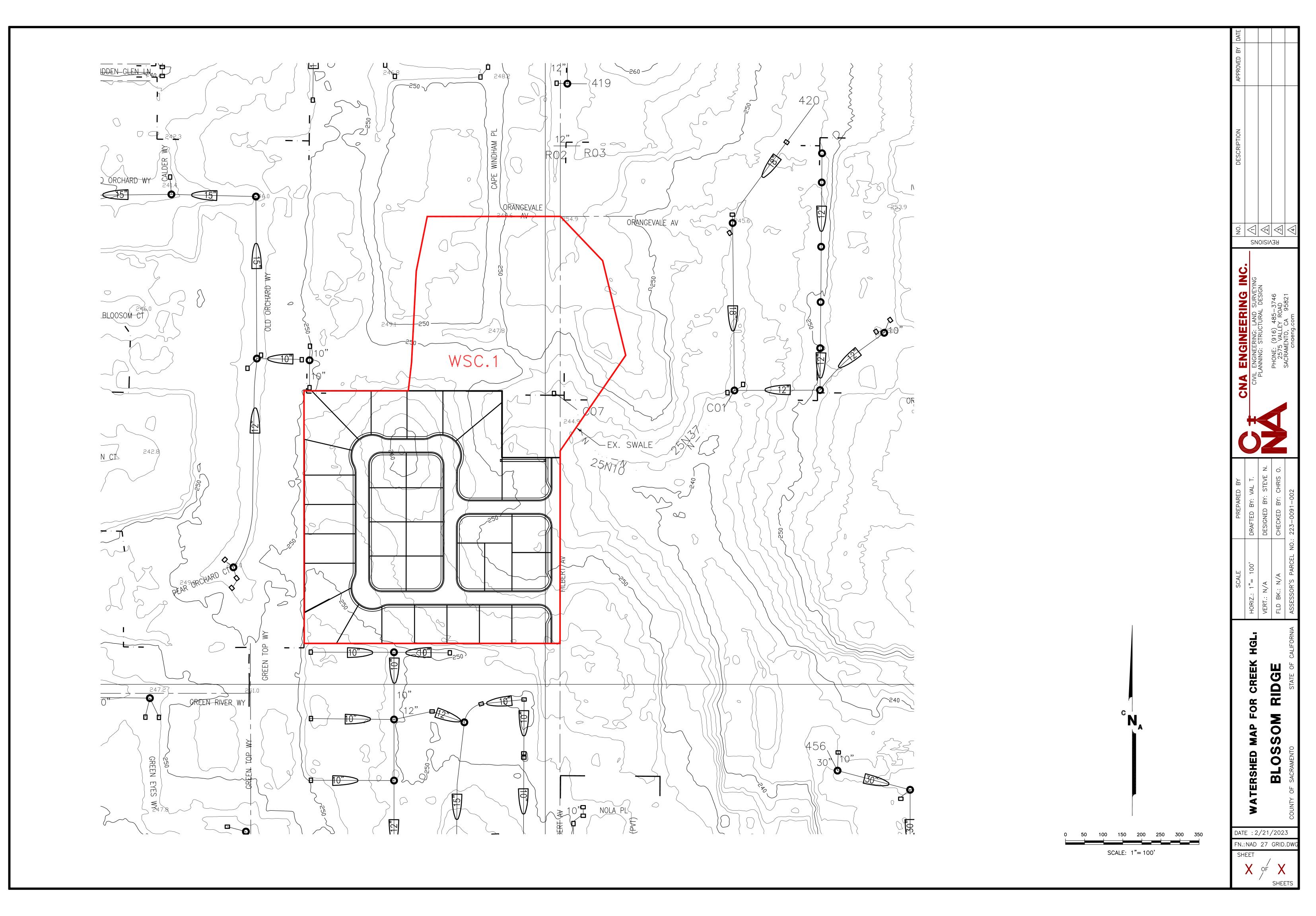
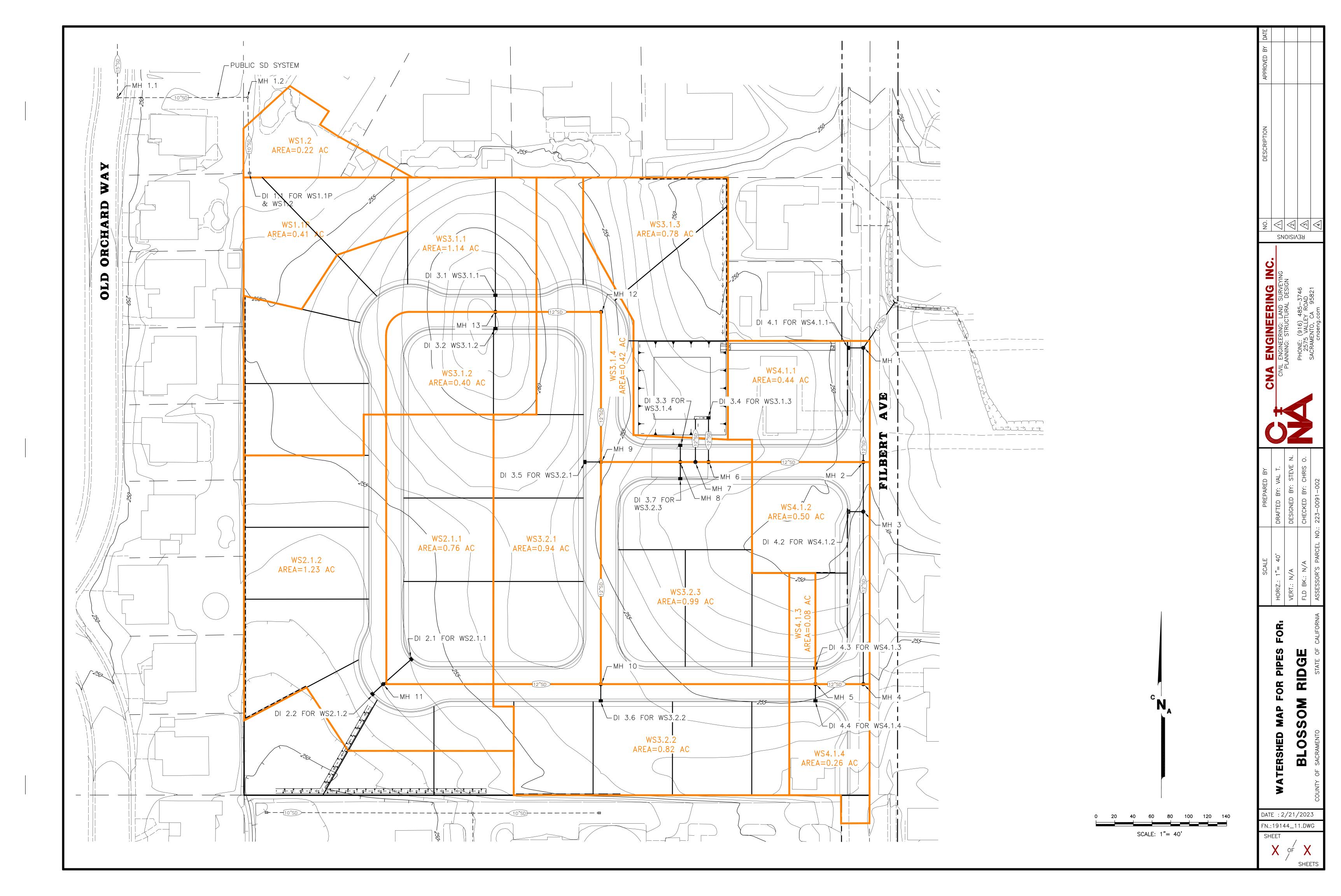


Figure 21 – WSC.1 Lengths.





CNA Engineering

4.1.2 SacCalc Analysis

Per SacCalc results for WSC.1 for 10-year event, peak flow is 24.0 cfs.

4.1.3 Hydraflow Channel Analysis

10-year 24-hour flow as calculated above for the watershed WSC.1 (24 cfs) has been run through the channel calculator. See report below. The geometry of the section has been obtained from the field work. N-value of 0.040 has been used for the earth channel with some weeds.

Water depth in the channel reaches 1.68' above the flow line which results in the WSE of **246.80**'. This elevation is taken as a boundary condition for the pipe system at the last node of the system.

4.2 Pipe Analysis

4.2.1 Watersheds Description

Areas and conditions for the purpose of calculations are assumed to be as follows:

- **WS2.1.1** (collected by the proposed type B DI):

Total shed area = 0.76 acres;

Proposed imperviousness = 40% - RD-4;

- *WS2.1.2* (collected by the proposed type B DI):

Total shed area = 1.23 acres;

Proposed imperviousness = 30% - RD-3;

- **WS3.1.1** (collected by the proposed type B DI):

Total shed area = 1.14 acres;

Proposed imperviousness = 30% - RD-3;

- *WS3.1.2* (collected by the proposed type B DI):

Total shed area = 0.40 acres;

Proposed imperviousness = 40% - RD-4;

- **WS3.1.3** (collected by the proposed type F DI in the pond):

Total shed area = 0.78 acres;

Proposed imperviousness = 40% - RD-4;

- **WS3.1.4** (collected by the proposed type J DI):

Total shed area = 0.42 acres;

Proposed imperviousness = 40% - RD-4;

- **WS3.2.1** (collected by the proposed type B DI):

Val Tarasov

Total shed area = 0.94 acres;

Proposed imperviousness = 40% - RD-4;

- **WS3.2.2** (collected by the proposed type B DI):

Total shed area = 0.82 acres;

Proposed imperviousness = 40% - RD-4;

- **WS3.2.3** (collected by the proposed type B DI):

Total shed area = 0.99 acres;

Proposed imperviousness = 40% - RD-4;

- **WS4.1.1** (collected by the proposed type B DI):

Total shed area = 0.44 acres;

Proposed imperviousness = 30% - RD-3;

- *WS4.1.2* (collected by the proposed type B DI):

Total shed area = 0.50 acres;

Proposed imperviousness = 30% - RD-3;

- **WS4.1.3** (collected by the proposed type B DI):

Total shed area = 0.08 acres;

Proposed imperviousness = 30% - RD-3;

- **WS4.1.4** (collected by the proposed type B DI):

Total shed area = 0.26 acres;

Proposed imperviousness = 30% - RD-3;

4.2.2 SacCalc Analysis

	(Proj	ect: Blossom Ridge_Nolte) (Hydrologic zone 1)	
ID	Drainage area (acres)	Impervious area (%)	Design Q (cfs)
WS1-1E	0.96	20.00	0.27
WS1-2	0.22	50.00	0.06
WS2-1E	3.82	20.00	1.07
WS2-1P	2.39	40.00	0.67
WS1-1P	0.41	40.00	0.11
WS-411	0.44	40.00	0.12
WS-412	0.50	40.00	0.14
WS-413	0.08	40.00	0.02
WS-414	0.26	40.00	0.07
WS-211	0.76	40.00	0.21
WS-212	1.23	40.00	0.34
WS-311	1.14	40.00	0.32
WS-312	0.40	40.00	0.11
WS-313	0.78	40.00	0.22
WS-314	0.42	40.00	0.12
WS-321	0.94	40.00	0.26
WS-322	0.82	40.00	0.23
WS-323	0.99	40.00	0.28
JNC001	7.48	40.00	2.09

<u>Nol</u>	te metho	d resul	ts
(Project:	Blossom	Ridge	Nolt

Figure 22 – SacCalc Nolte Results.

4.2.3 Hydraflow Analysis

Pipes and nodes information is as follows (refer to the WS Map above).

The system is split into 2 sub-systems upstream and downstream of the detention basin. Upstream watersheds are combined in junction as shown in SacCalc results above for the purpose of inputting into the downstream system.

4.2.3.1 Downstream Sub-system

Structure	Structure	Rim	Invert	Pipe size and	Slope	n-value
#	ID	Elevation	(FL)	material	downstream	
				(downstream)		
1	MH 1	248.35	245.33	12", RCP	0.0035	0.015
2	MH 2	249.80	245.76	12", RCP	0.0035	0.015
3	MH 6	253.55	246.59	12", PVC	0.0050	0.015
4	DI 3.4 (WS3.1.3)	249.86	246.83	12", PVC	0.0050	0.015
5	DI 4.1 (WS4.1.1)	247.97	245.39	12", PVC	0.0035	0.015
6	MH 3	250.39	245.95	12", PVC	0.0035	0.015
7	MH 4	255.30	249.65	12", PVC	0.0200	0.015
8	MH 5	255.85	250.17	12", PVC	0.0250	0.015
9	DI 4.3 (WS4.1.3)	255.36	251.36	12", PVC	0.0700	0.015
10	DI 4.2 (WS4.1.2)	249.94	246.03	12", PVC	0.0050	0.015
11	DI 4.4 (WS4.1.4)	255.36	251.36	12", PVC	0.0700	0.015

Downstream Sub-system

 Table 3 – Proposed Storm Drain System Information for Downstream Sub-system.

246.80' is used as downstream boundary condition as determined above.

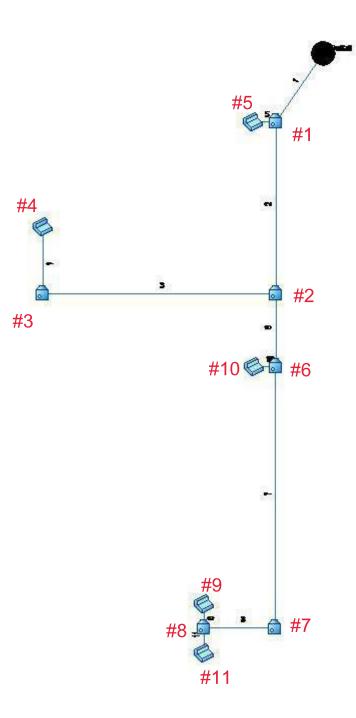
Structure #	Structure ID	Rim Elevation	HGL	Rim – HGL
1	MH 1	248.35	247.30	1.05
2	MH 2	249.80	248.13	1.67
3	MH 6	253.55	249.00	4.55
4	DI 3.4	249.86	249.32	0.54
5	DI 4.1	247.97	247.30	0.67
6	MH 3	250.39	248.13	2.26
7	MH 4	255.30	249.78	5.52
8	MH 5	255.85	250.29	5.56
9	DI 4.3	255.36	251.42	3.94
10	DI 4.2	249.94	248.13	1.81
11	DI 4.4	255.36	251.47	3.89

Results of the calculations are provided in the table below.

Table 4 – Summary of Nolte Results for Downstream Sub-system.

As can be seen from the results above, HGL_{Nolte} for the system does not get closer than 12" below the rims of manholes and 6" below the rims of drop inlets. The system is considered to have sufficient capacity to convey Nolte flows.

12" minimum cover is proposed over the outfall 12" RCP pipe as shown on the preliminary grading plan.



Storm Sewer Inventory Report

Line		Align	ment			Flow	/ Data					Physica	l Data				Line ID
No.	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	-
1	End	-59.38	124.66	мн	0.00	0.00	0.00	0.0	245.12	0.35	245.33	12	Cir	0.015	0.85	248.35	
2	1	122.26	-34.66	мн	0.00	0.00	0.00	0.0	245.33	0.35	245.76	12	Cir	0.015	1.00	249.80	
3	2	165.85	90.00	мн	0.00	0.00	0.00	0.0	245.76	0.50	246.59	12	Cir	0.015	1.00	253.55	
4	3	47.30	90.00	Grate	2.09	0.00	0.00	0.0	246.59	0.51	246.83	12	Cir	0.015	1.00	249.86	
5	1	15.83	55.34	Comb	0.12	0.00	0.00	0.0	245.33	0.38	245.39	12	Cir	0.015	1.00	247.97	
6	2	-53.20	0.00	мн	0.00	0.00	0.00	0.0	245.76	0.36	245.95	12	Cir	0.015	1.00	250.39	
7	6	184.80	0.00	мн	0.00	0.00	0.00	0.0	245.95	2.00	249.65	12	Cir	0.015	1.00	255.30	
8	7	.51.24	90.00	мн	0.00	0.00	0.00	0.0	249.65	1.01	250.17	12	Cir	0.015	1.00	255.85	
9	8	17.00	90.00	Comb	0.02	0.00	0.00	0.0	250.17	7.00	251.36	12	Cir	0.015	1.00	255.36	
10	6	15.69	90.00	Comb	0.14	0.00	0.00	0.0	245.95	0.51	246.03	12	Cir	0.015	1.00	249.94	
11	8	17.83	-90.00	Comb	0.07	0.00	0.00	0.0	250.17	6.67	251.36	12	Cir	0.015	1.00	255.36	
		in SD Pipe											of lines: 1				2/26/2021

Storm Sewers v2022.00

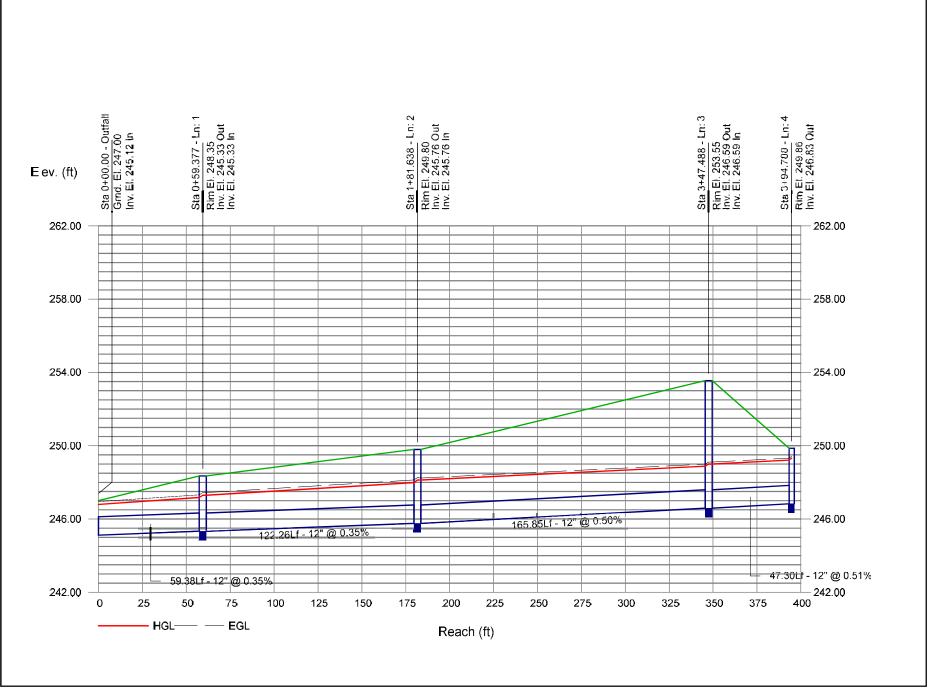
Structure Report

Struct No.	Structure ID	Junction	Rim Elev		Structure			Line Ou	it		Line In	
NO.		Туре	(ft)	Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1		Manhole	248.35	Cir	4.00	4.00	12	Cir	245.33	12 12	Cir Cir	245.33 245.33
2		Manhole	249.80	Cir	4.00	4.00	12	Cir	245.76	12 12	Cir Cir	245.76 245.76
3		Manhole	253.55	Cir	4.00	4.00	12	Cir	246.59	12	Cir	246.59
4		Grate	249.86	Rect	3.00	2.00	12	Cir	246.83			
5		Combination	247.97	Rect	3.00	2.00	12	Cir	245.39			
6		Manhole	250.39	Cir	4.00	4.00	12	Cir	245.95	12 12	Cir Cir	245.95 245.95
7		Manhole	255.30	Cir	4.00	4.00	12	Cir	249.65	12	Cir	249.65
8		Manhole	255.85	Cir	4.00	4.00	12	Cir	250.17	12 12	Cir Cir	250.17 250.17
9		Combination	255.36	Rect	3.00	2.00	12	Cir	251.36			
10		Combination	249.94	Rect	3.00	2.00	12	Cir	246.03			
11		Combination	255.36	Rect	3.00	2.00	12	Cir	251.36			
Project	File: Main SD Pipe Syste	m_Down.stm					N	lumber of Struc	tures: 11	Ru	n Date: 12/26/2	2021

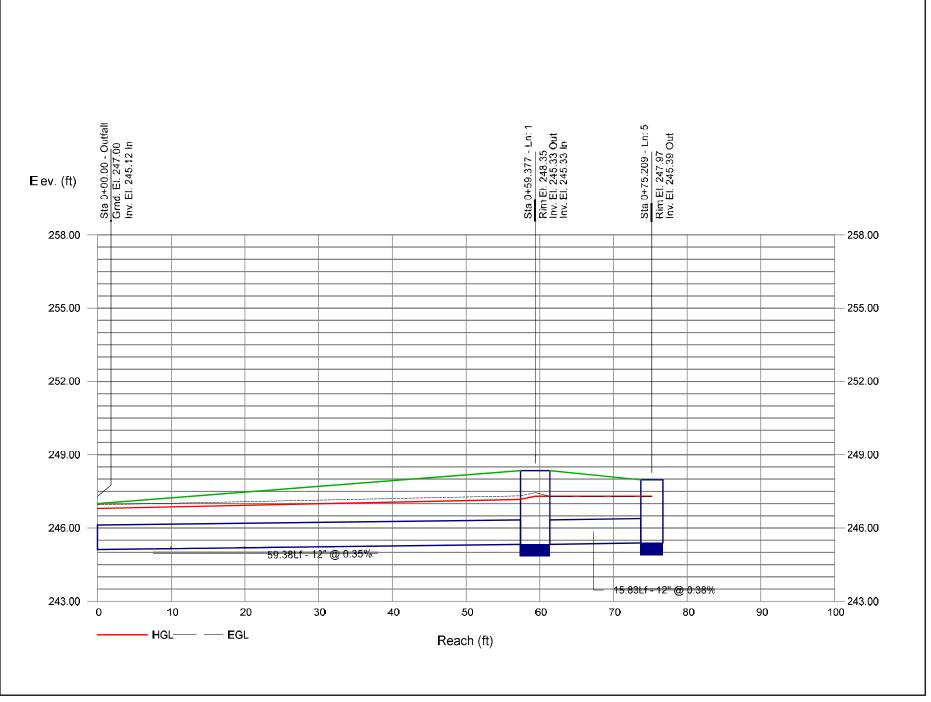
Storm Sewer Summary Report

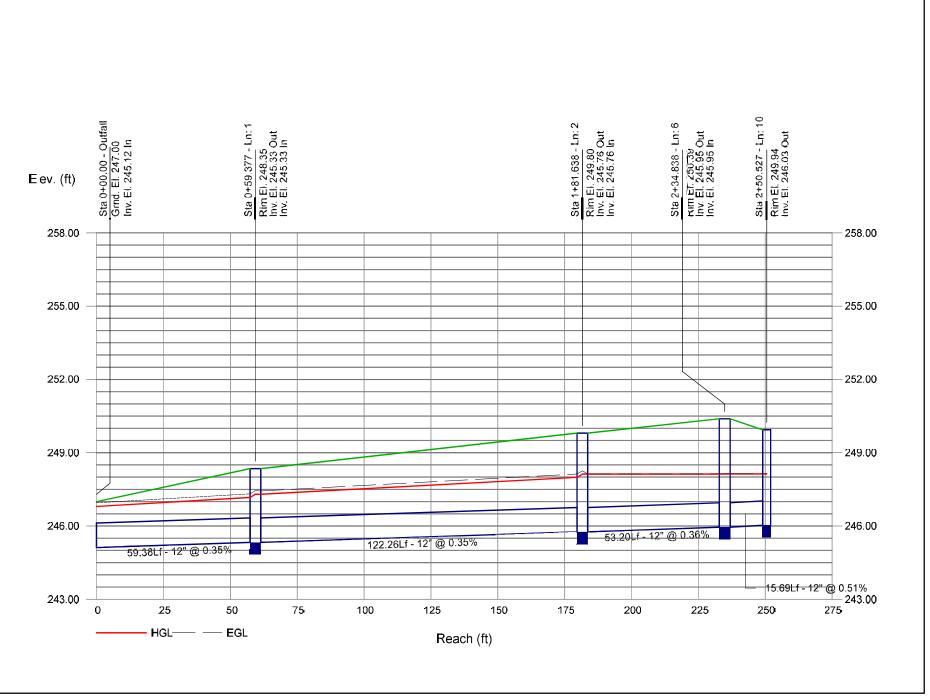
_ine No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor Ioss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1		2.44	12	Cir	59.38	245.12	245.33	0.354	246.80*	247.17*	0.13	247.30	End	Manhole
2		2.32	12	Cir	122.26	245.33	245.76	0.352	247.30*	247.99*	0.14	248.13	1	Manhole
3		2.09	12	Cir	165.85	245.76	246.59	0.500	248.13*	248.89*	0.11	249.00	2	Manhole
4		2.09	12	Cir	47.30	246.59	246.83	0.507	249.00*	249.21*	0.11	249.32	З	Grate
5		0.12	12	Cir	15.83	245.33	245.39	0.379	247.30*	247.30*	0.00	247.30	1	Combination
6		0.23	12	Cir	53.20	245.76	245.95	0.357	248.13*	248.13*	0.00	248.13	2	Manhole
7		0.09	12	Cir	184.80	245.95	249.65	2.002	248.13	249.77	n/a	249.77 j	6	Manhole
3		0.09	12	Cir	51.24	249.65	250.17	1.015	249.77	250.29	0.04	250.29	7	Manhole
Ð		0.02	12	Cir	17.00	250.17	251.36	7.000	250.29	251.42	n/a	251.42 j	-8	Combination
10		0.14	12	Cir	15.69	245.95	246.03	0.510	248.13*	248.13*	0.00	248.13	6	Combination
11		0.07	12	Cir	17.83	250.17	251.36	6.674	250.29	251.47	n/a	251.47 j	8	Combination
Project	File: Main SD Pipe System_Do	wn.stm	I	1	1	1	1		Number of	of lines: 11		Run	Date: 12/2	26/2021
NOTES	: Known Qs only ; *Surcharge	d (HGL aboy	ve crown) :		taine hvd	iumo								

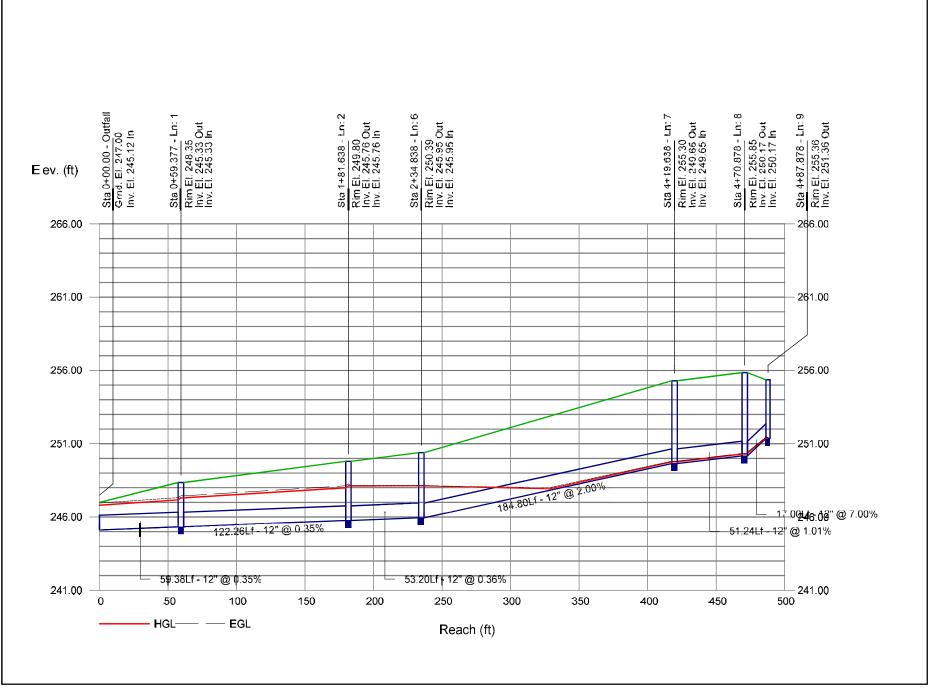
Storm Sewers v2022.00



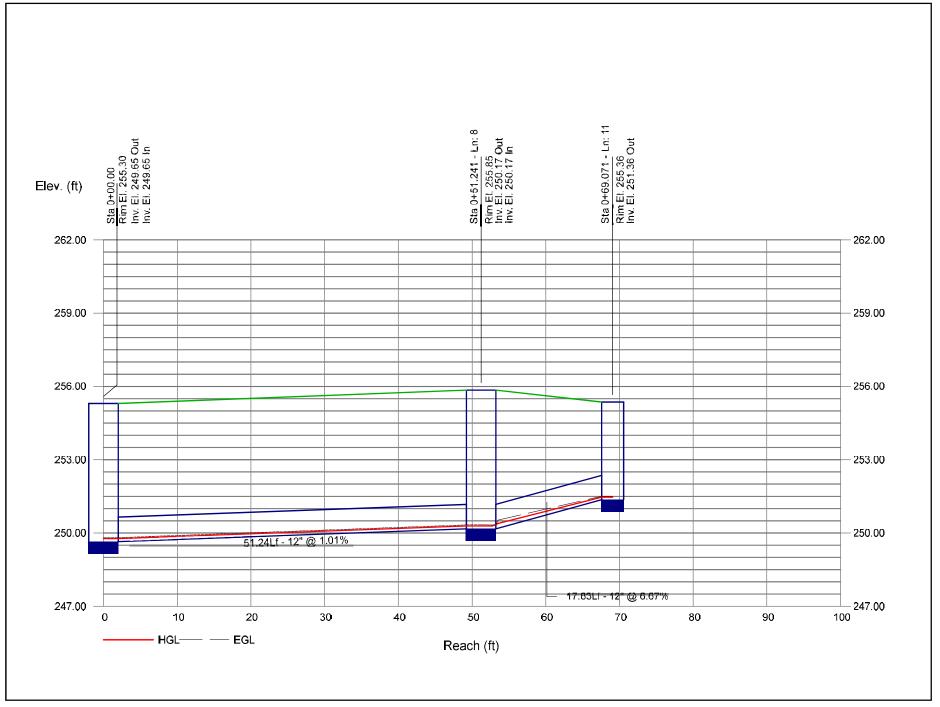
Storm Sewer Profile







Storm Sewer Profile



4.2.3.2 Upstream Sub-system

Structure	Structure	Rim	Invert	Pipe size and	Slope	n-value
#	ID	Elevation	(FL)	material	downstream	
				(downstream)		
1	MH 7	253.48	249.20	12", RCP	0.0044	0.015
2	MH 8	253.38	249.25	12", PVC	0.0030	0.015
3	MH 9	254.53	249.51	12", PVC	0.0030	0.015
4	MH 10	255.74	250.23	12", PVC	0.0030	0.015
5	MH 11	254.10	250.93	12", PVC	0.0030	0.015
6	DI 2.2 (WS2.1.2)	253.57	251.01	12", PVC	0.0050	0.015
7	DI 3.3 (WS3.1.4)	252.89	249.34	12", PVC	0.0050	0.015
8	DI 3.5 (WS3.2.1)	254.04	250.04	12", PVC	0.0311	0.015
9	DI 3.6 (WS3.2.2)	255.24	251.24	12", PVC	0.0566	0.015
10	DI 2.1 (WS2.1.1)	253.88	251.05	12", PVC	0.0030	0.015
11	DI 3.7 (WS3.2.3)	252.89	249.34	12", PVC	0.0050	0.015
12	MH 12	254.91	250.00	12", PVC	0.0030	0.015
13	MH 13	255.10	250.34	12", PVC	0.0030	0.015
14	DI 3.1 (WS3.1.1)	254.61	250.61	12", PVC	0.0151	0.015
15	DI 3.2 (WS3.1.2)	254.61	250.61	12", PVC	0.0151	0.015

Upstream Sub-system

 Table 5 – Proposed Storm Drain System Information for Upstream Sub-system.

Downstream boundary condition is established as a 10-year WSE in the detention pond. The elevation of water during 10-year storm event is 2.2' as shown in Figure 3. This gives the elevation of 251.20' to be used a downstream boundary condition.

Structure #	Structure ID	Rim Elevation	HGL	Rim – HGL
1	MH 7	253.48	251.46	2.02
2	MH 8	253.38	251.60	1.78
3	MH 9	254.53	251.85	2.68
4	MH 10	255.74	252.02	3.72
5	MH 11	254.10	252.10	2.00
6	DI 2.2	253.57	252.11	1.46
7	DI 3.3	252.89	251.60	1.29
8	DI 3.5	254.04	251.85	2.19
9	DI 3.6	255.24	252.02	3.22
10	DI 2.1	253.88	252.10	1.78
11	DI 3.7	252.89	251.61	1.28
12	MH 12	254.91	251.89	3.02
13	MH 13	255.10	251.91	3.19
14	DI 3.1	254.61	251.92	2.69
15	DI 3.2	254.61	251.91	2.70

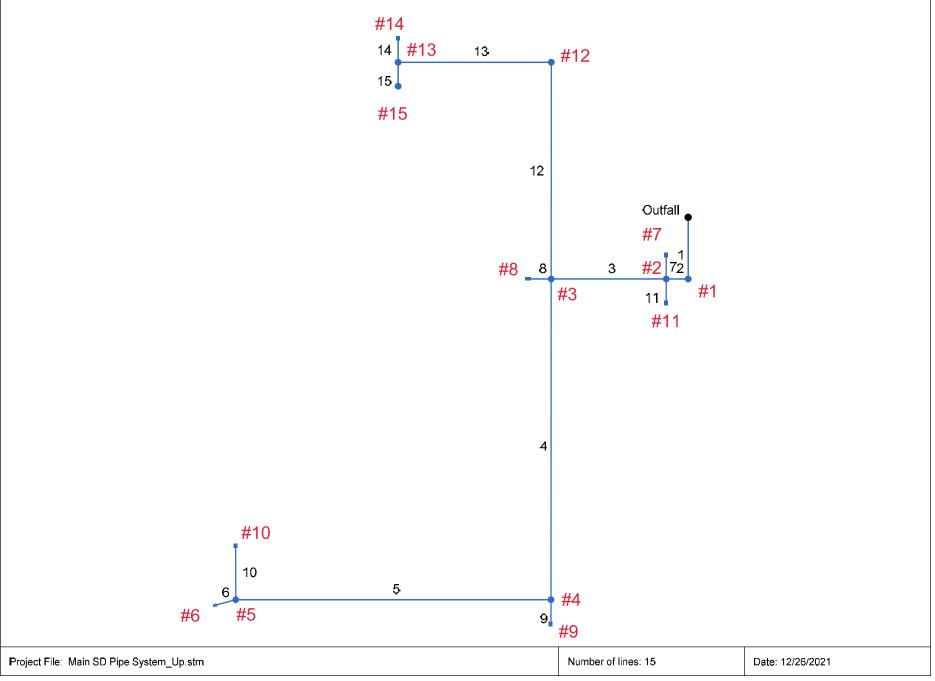
Results of the calculations are provided in the table below.

Table 6 – Summary of Nolte Results for Upstream Sub-system.

As can be seen from the results above, HGL_{Nolte} for the system does not get closer than 12" below the rims of manholes and 6" below the rims of drop inlets. The system is considered to have sufficient capacity to convey Nolte flows.

Offsite easements will not be required since the pipe outfall and appurtances are located within the public Right-of-Way. Existing ditch downstream does not need to be engineered to convey design flows. This was communicated in the email with DWR on 12/8/2020.

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Storm Sewers v2022.00

Storm Sewer Inventory Report

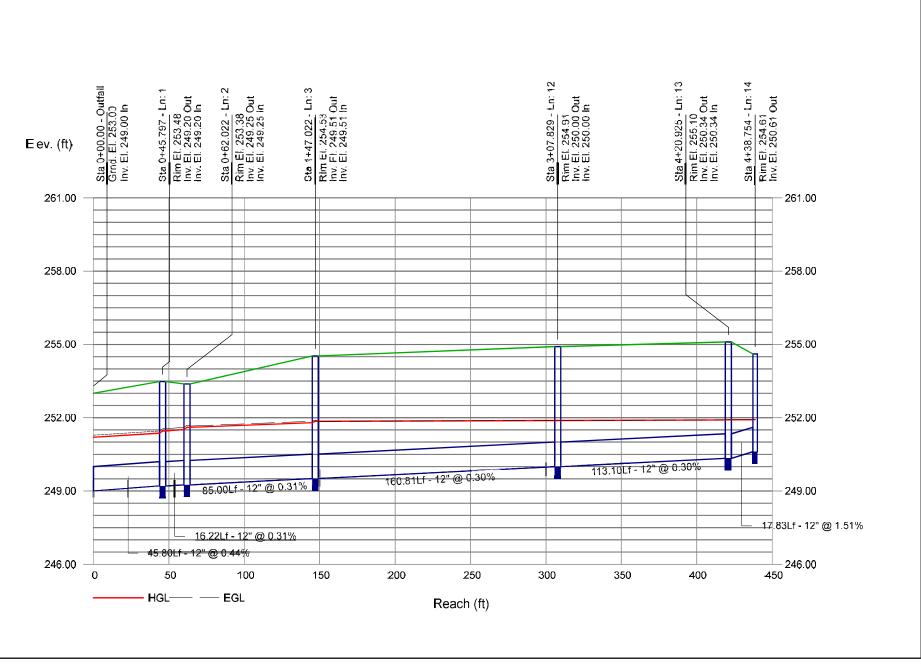
_ine		Align	ment			Flow	Data					Physica	l Data				Line ID
No.	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	45.80	90.00	мн	0.00	0.00	0.00	0.0	249.00	0.44	249.20	12	Cir	0.015	1.00	253.48	
2	1	16.22	90.00	мн	0.00	0.00	0.00	0.0	249.20	0.31	249.25	12	Cir	0.015	1.00	253.38	
3	2	85.00	-0.02	мн	0.00	0.00	0.00	0.0	249.25	0.31	249.51	12	Cir	0.015	1.00	254.53	
4	3	237.98	-89.95	мн	0.00	0.00	0.00	0.0	249.51	0.30	250.23	12	Cir	0.015	1.00	255.74	
5	4	233.00	89.96	мн	0.00	0.00	0.00	0.0	250.23	0.30	250.93	12	Cir	0.015	1.00	254.88	
6	5	15.80	-15.41	Comb	0.34	0.00	0.00	0.0	250.93	0.51	251.01	12	Cir	0.015	1.00	253.57	
7	2	17.83	89.97	Comb	0.12	0.00	0.00	0.0	249.25	0.50	249.34	12	Cir	0.015	1.00	252.89	
8	3	17.03	0.01	Comb	0.26	0.00	0.00	0.0	249.51	3.11	250.04	12	Cir	0.015	1.00	254.04	
9	4	17.83	0.00	Comb	0.23	0.00	0.00	0.0	250.23	5.66	251.24	12	Cir	0.015	1.00	255.24	
10	5	40.10	90.00	Comb	0.21	0.00	0.00	0.0	250.93	0.30	251.05	12	Cir	0.015	1.00	253.88	
11	2	17.83	-90.00	Comb	0.28	0.00	0.00	0.0	249.25	0.50	249.34	12	Cir	0.015	1.00	252.89	
12	3	160.81	90.02	МН	0.00	0.00	0.00	0.0	249.51	0.30	250.00	12	Cir	0.015	1.00	254.91	
13	12	113.10	-90.00	мн	0.00	0.00	0.00	0.0	250.00	0.30	250.34	12	Cir	0.015	1.00	255.10	
14	13	17.83	90.00	Comb	0.32	0.00	0.00	0.0	250.34	1.51	250.61	12	Cir	0.015	1.00	254.61	
15	13	17.83	-90.00	Comb	0.11	0.00	0.00	0.0	250.34	1.51	250.61	12	Cir	0.015	1.00	254.61	
Projec	t File: Ma	in SD Pipe	System_l	Jp.stm								Number	of lines: 15	i		Date: 2	/2/2022

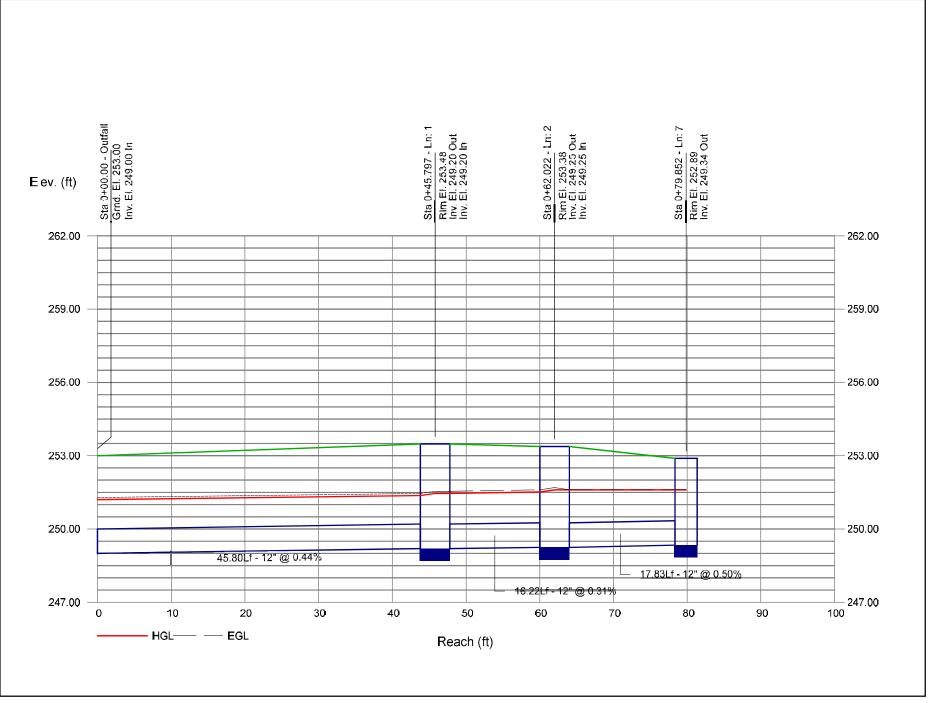
Structure Report

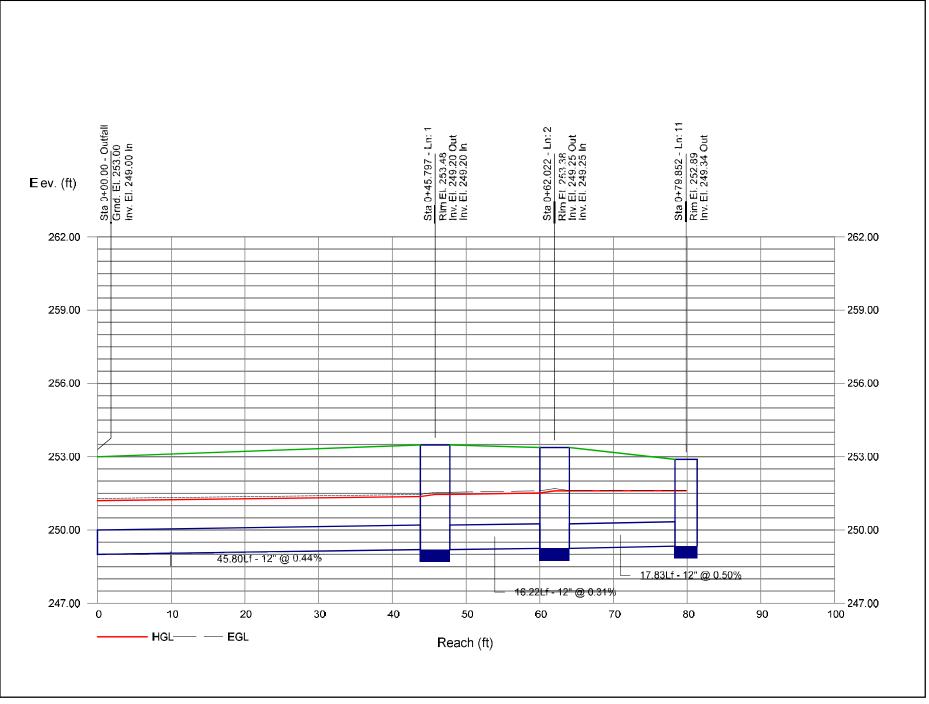
Struct No.	Structure ID	Junction	Rim Elev		Structure			Line Ou	t		Line In	
NO.		Туре	(ft)	Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1		Manhole	253.48	Cir	4.00	4.00	12	Cir	249.20	12	Cir	249.20
2		Manhole	253.38	Cir	4.00	4.00	12	Cir	249.25	12 12 12	Cir Cir Cir	249.25 249.25 249.25
3		Manhole	254.53	Cir	4.00	4.00	12	Cir	249.51	12 12 12	Cir Cir Cir	249.51 249.51 249.51
4		Manhole	255.74	Cir	4.00	4.00	12	Cir	250.23	12 12	Cir Cir	250.23 250.23
5		Manhole	254.88	Cir	4.00	4.00	12	Cir	250.93	12 12	Cir Cir	250.93 250.93
6		Combination	253.57	Rect	3.00	2.00	12	Cir	251.01			
7		Combination	252.89	Rect	3.00	2.00	12	Cir	249.34			
8		Combination	254.04	Rect	3.00	2.00	12	Cir	250.04			
9		Combination	255.24	Rect	3.00	2.00	12	Cir	251.24			
10		Combination	253.88	Rect	3.00	2.00	12	Cir	251.05			
11		Combination	252.89	Rect	3.00	2.00	12	Cir	249.34			
12		Manhole	254.91	Cir	4.00	4.00	12	Cir	250.00	12	Cir	250.00
13		Manhole	255.10	Cir	4.00	4.00	12	Cir	250.34	12 12	Cir Cir	250.34 250.34
14		Combination	254.61	Rect	3.00	2.00	12	Cir	250.61			
15		Combination	254.61	Cir	4.00	4.00	12	Cir	250.61			
Project	File: Main SD Pipe Syster	m_Up.stm					Nu	umber of Struc	tures: 15	Run	Date: 2/2/202	2

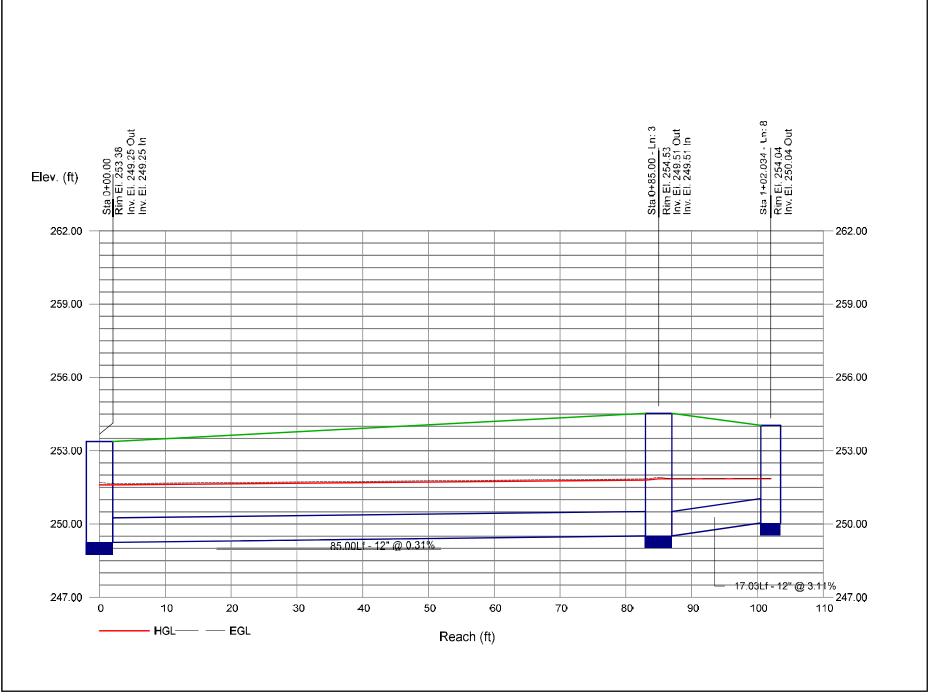
Storm Sewer Summary Report

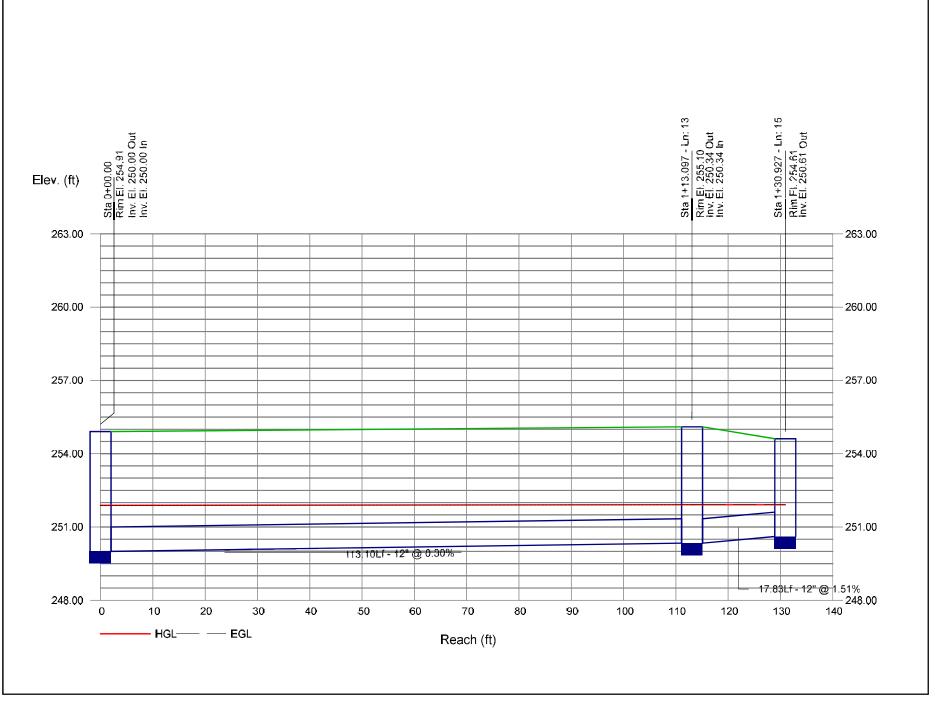
Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor Ioss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1		1.87	12	Cir	45.80	249.00	249.20	0.437	251.20*	251.37*	0.09	251.46	End	Manhole
2		1.87	12	Cir	16.22	249.20	249.25	0.308	251.46*	251.52*	0.09	251.60	1	Manhole
3		1.47	12	Cir	85.00	249.25	249.51	0.306	251.60*	251.80*	0.05	251.85	2	Manhole
4		0.78	12	Cir	237.98	249.51	250.23	0.303	251.85*	252.00*	0.02	252.02	3	Manhole
5		0.55	12	Cir	233.00	250.23	250.93	0.300	252.02*	252.09*	0.01	252.10	4	Manhole
6		0.34	12	Cir	15.80	250.93	251.01	0.506	252.10*	252.10*	0.00	252.11	5	Combination
7		0.12	12	Cir	17.83	249.25	249.34	0.505	251.60*	251.60*	0.00	251.60	2	Combination
8		0.26	12	Cir	17.03	249.51	250.04	3.111	251.85*	251.85*	0.00	251.85	3	Combination
9		0.23	12	Cir	17.83	250.23	251.24	5.665	252.02	252.02	0.00	252.02	4	Combination
10		0.21	12	Cir	40.10	250.93	251.05	0.299	252.10*	252.10*	0.00	252.10	5	Combination
11		0.28	12	Cir	17.83	249.25	249.34	0.505	251.60*	251.61*	0.00	251.61	2	Combination
12		0.43	12	Cir	160.81	249.51	250.00	0.305	251.85*	251.88*	0.00	251.89	3	Manhole
13		0.43	12	Cir	113.10	250.00	250.34	0.301	251.89*	251.91*	0.00	251.91	12	Manhole
14		0.32	12	Cir	17.83	250.34	250.61	1.514	251.91*	251.92*	0.00	251.92	13	Combination
15		0.11	12	Cir	17.83	250.34	250.61	1.514	251.91*	251.91*	0.00	251.91	13	Combination
Project	File: Main SD Pipe System_Up.	stm							Number	of lines: 15		Run	Date: 2/2/	2022
NOTES	S: Known Qs only ; *Surcharged	(HGL abov	ve crown).									I		

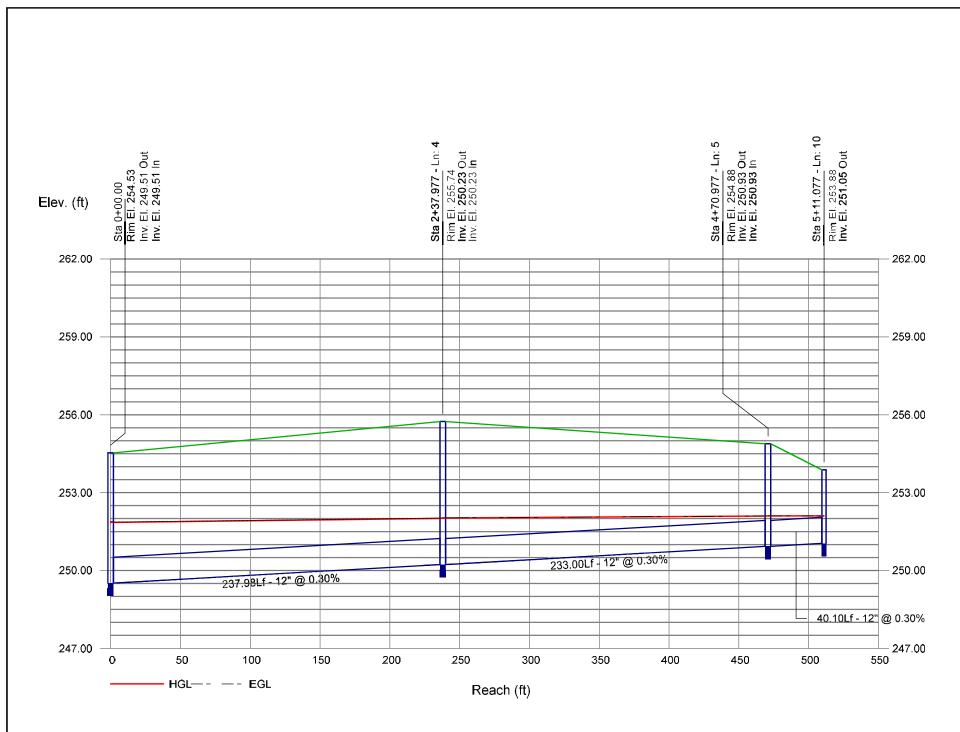


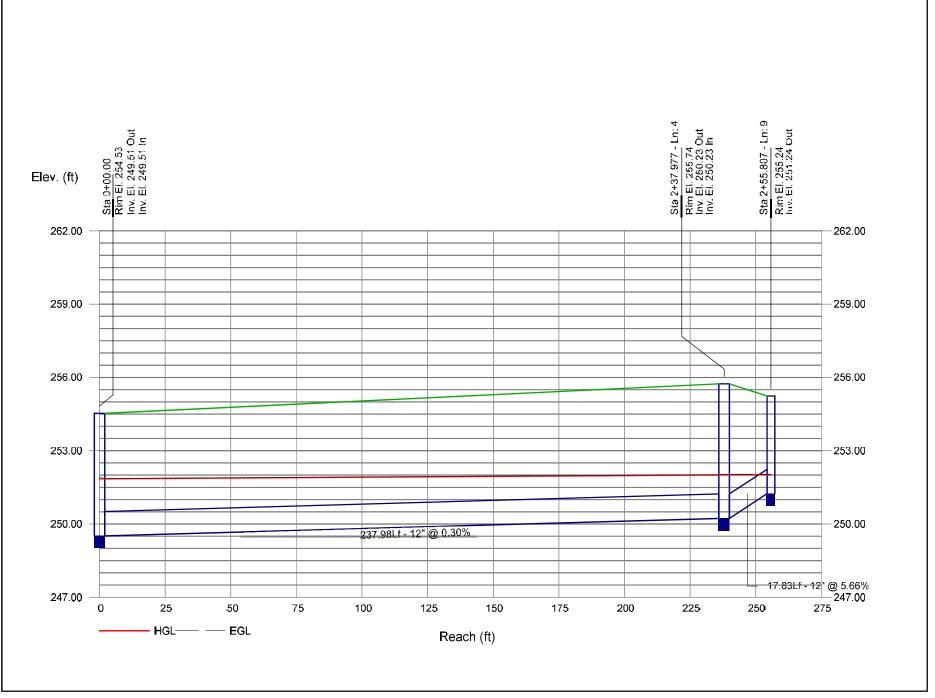


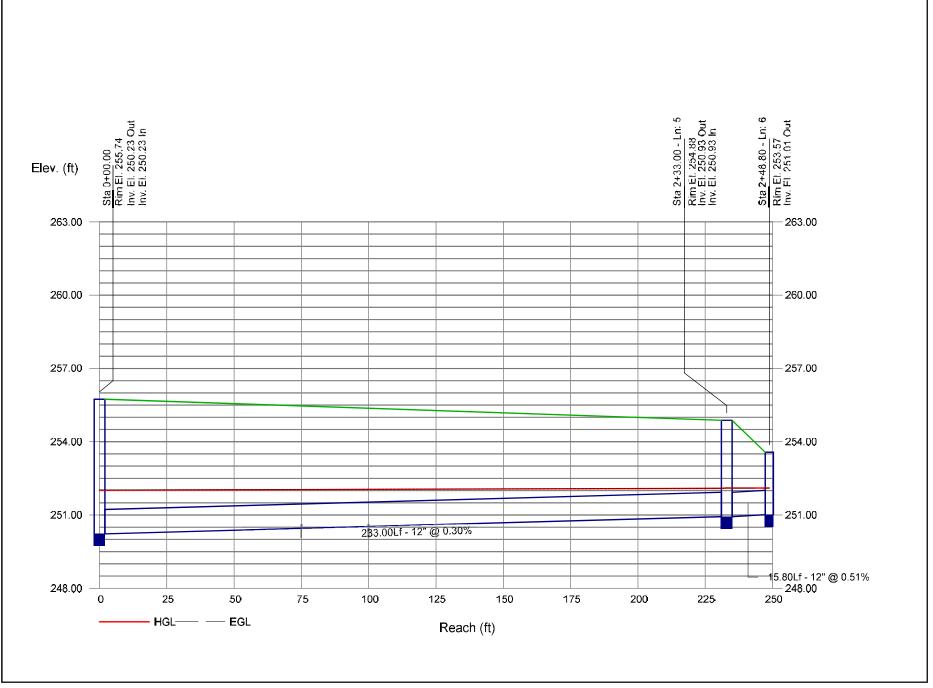












Velocity in the pipe system at the full flow is estimate by the minimum design pipe slope of 0.0030. As per report below, velocity is 2.15 ft/sec which exceeds the minimum 2.00 ft/sec value per Sacramento County stadards.

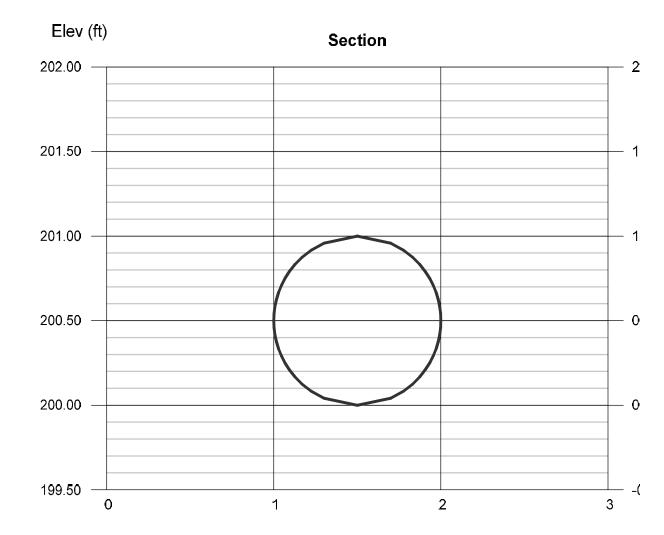
Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

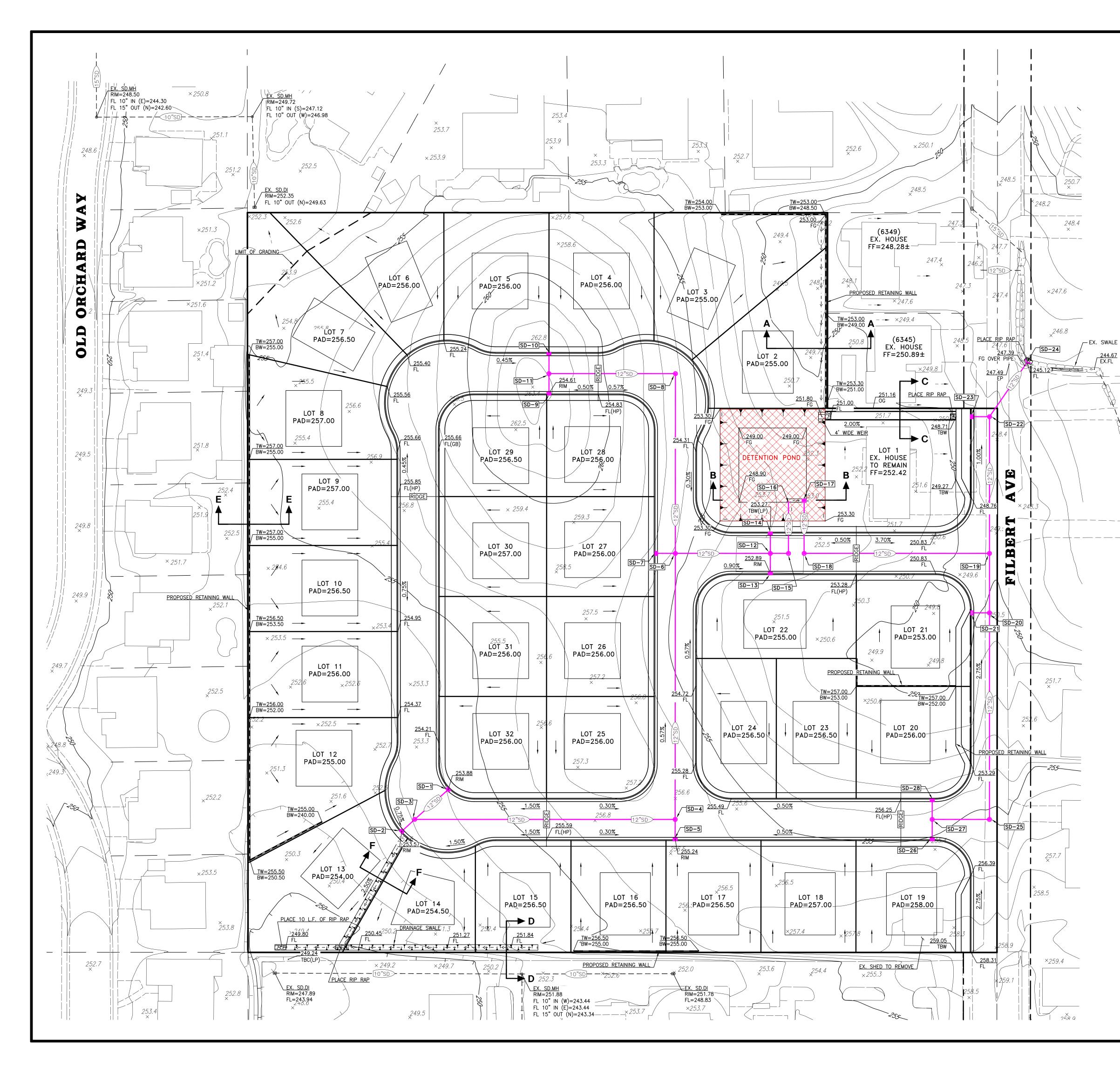
Wednesday, Feb 2 2022

Full 12inch Pipe Capacity

Circular		Highlighted	
Diameter (ft)	= 1.00	Depth (ft)	= 1.00
		Q (cfs)	= 1.690
		Arèa (sqft)	= 0.79
Invert Elev (ft)	= 200.00	Velocity (ft/s)	= 2.15
Slope (%)	= 0.30	Wetted Perim (ft)	= 3.14
N-Value	= 0.015	Crit Depth, Yc (ft)	= 0.56
		Top Width (ft)	= 0.00
Calculations		EĠL (ft)	= 1.07
Compute by:	Known Depth		
Known Depth (ft)	= 1.00		



Reach (ft)



HATCH LEGEND: DETENTION BASIN STORM DRAIN KEYNOTES: SD-1 PROP. TYPE "B" SD.DI RIM=253.88, FL=251.05 SD-2 PROP. TYPE "B" SD.DI RIM=253.57, FL=251.01 SD-3 PROP. SD.MH RIM=254.10, FL=250.93 SD-4 PROP. SD.MH RIM=255.74, FL=250.23 SD-5 PROP. TYPE "B" SD.DI RIM=255.24, FL=251.24 PROP. SD.MH RIM=254.53, FL=249.51 SD-6 SD-7 PROP. TYPE "B" SD.DI $\frac{1}{2} \boxed{2} \boxed{2} \boxed{2}$ RIM=254.04, FL=250.04 SD-8 PROP. SD.MH REVISIONS RIM=254.91, FL=250.00 SD-9 PROP. TYPE "B" SD.DI RIM=254.61, FL=250.61 SD-10 PROP. TYPE "B" SD.DI RIM=254.61, FL=250.61 SD-11 PROP. SD.MH Z RIM=255.10, FL=250.34 SD-12 PROP. SD.MH 5 RIM=253.38, FL=249.25 SD-13 PROP. TYPE "B" SD.DI 244.67 RIM=252.89, FL=249.34 SD-14 PROP. TYPE "B" SD.DI RIM=252.89, FL=249.34 ш GIN _6,≯± Z ()242.82 EX.FL 239.59 EX.FL SD-15 PROP. SD.MH RIM=253.48, FL=249.20 SD-16 PROP. PIPE SYSTEM OUTFALL TO THE BASIN FL=249.00 SD-17 PROP. TYPE "F" SD.DI W/ 1 SIDE OPENING 6" HIGH > 1'-1" WIDE KNOCKED OPEN. RIM=249.86, OPENING=248.86, FL=246.83 SD-18 PROP. SD.MH RIM=253.55, FL=246.59 SD-19 PROP. SD.MH RIM=249.80, FL=245.76 SD-20 PROP. SD.MH RIM=250.39, FL=245.95 SD-21 PROP. TYPE "B" SD.DI RIM=249.94, FL=246.03 J. SD-22 PROP. SD.MH RIM=248.35, FL=245.33 SD-23 PROP. TYPE "B" SD.DI RIM=247.97, FL=245.39 SD-24 PROP. PIPE SYSTEM OUTFALL W/ CONCRETE FES FL=245.12 SD-25 PROP. SD.MH RIM=255.30, FL=249.65 SD-26 PROP. TYPE "B" SD.DI Ō RIM=255.36, FL=251.36 SD-27 PROP. SD.MH RIM=255.85, FL=250.17 AN ш RIDGI SD-28 PROP. TYPE "B" SD.DI RIM=255.36, FL=251.36 μ U N N MO GR S ARY SO NIMI В Ľ ٩ DATE : 2/21/2023 60 80 100 120 140 40 FN.:19144_11.DWG

SCALE: 1"= 40'

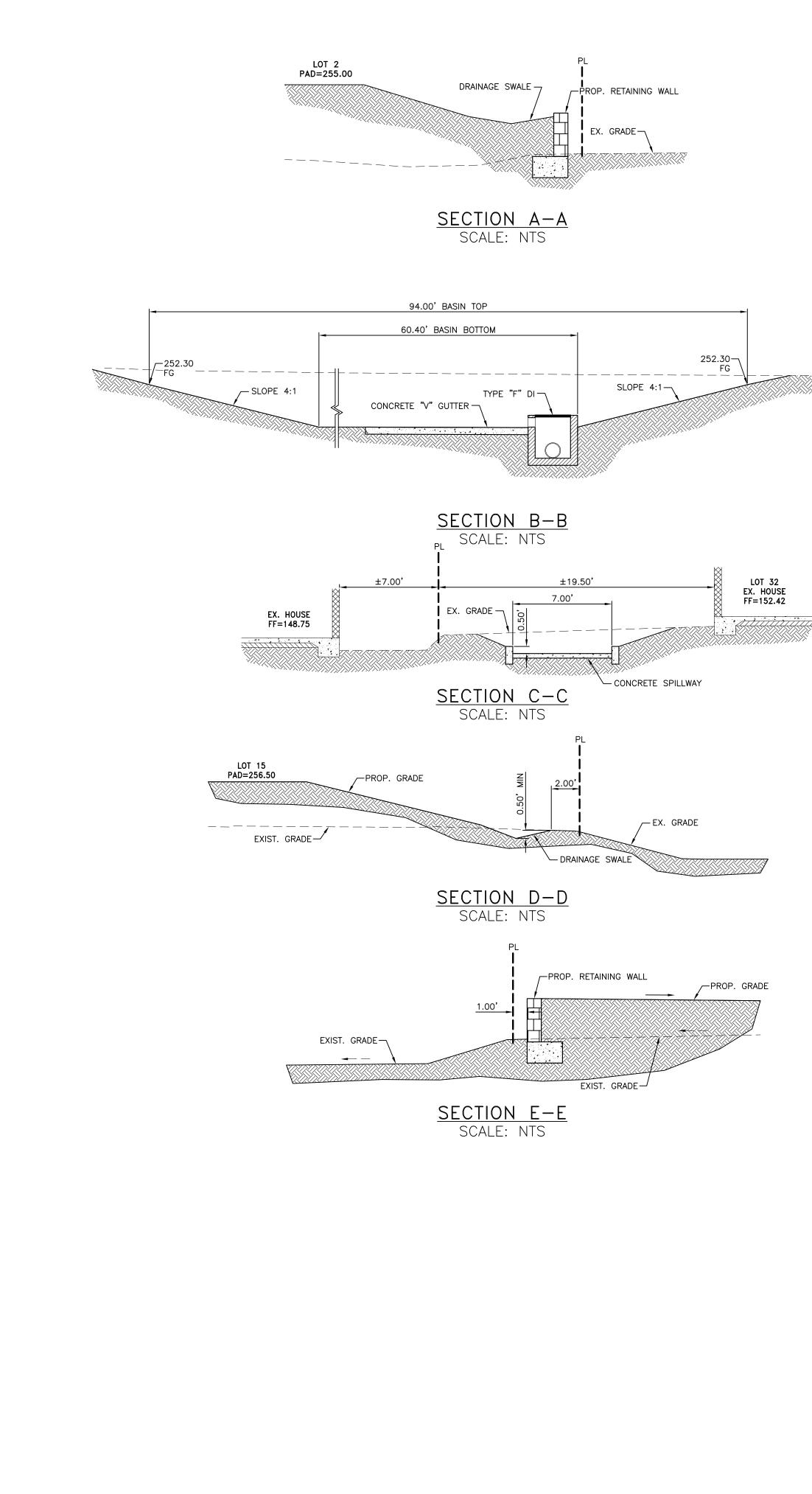
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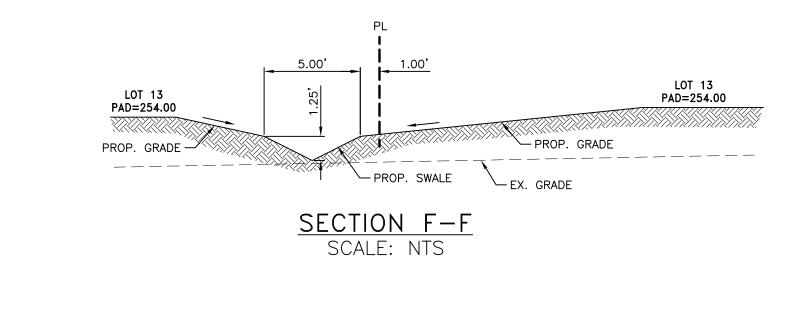
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SHEETS





EX. GRADE \neg

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FN.:	DAT		SCALE	PREPARED BY	CNA FNCINFFRING INC	NO.	DESCRIPTION	APPROVED BY DATE
1912 EET X	CROSS SECT	ECTIONS FOR.	HORIZ.: N/A	DRAFTED BY: VAL T.		SN SN		
			VERT.: N/A	DESIGNED BY: STEVE N.	CN			
	BLOSSOM		FLD BK.: N/A	CHECKED BY: CHRIS O.		к К		
G	COUNTY OF SACRAMENTO	STATE OF CALIFORNIA	ASSESSOR'S PARCEL NO.: 223-0091-002	: 223-0091-002	SACKAMENIO, CA 95821 cnaeng.com	4		

Low Impact Development Design

Residential LID Credits Worksheets are used to calculate the points for the project (see below). The required minimum for the project is 100 points. Information used is described below.

Total area = 9.31 acres to the Filbert Right-of Way;

Drainage Basin = 0.19 acres.

Number of Units = 32.

No new trees are counted in the calculations.

There are 3 discharges and, therefore, 3 points of compliance.

LID features will be constructed with building permits. Feasibility analysis is provided below with preliminary design and calculations. Final design will be provided at the time of building permit with each lot design or final Improvement plans.

Public road and frontage improvements have been accounted for by splitting of it's impact and oversizing the on-site LID features.

Northwest POC

Watershed WS1.1P constitutes the point of compliance. It consists of portions of lots 6 and 7.

To show future ability to comply with LID standards a sample lot has been reviewed. Lot 7 has been thoroughly reviewed and calculations are provided below.

Lot 7

30% Imperviousness is taken into account for proposed zoning RD-3.

Area of Lot 7 sloping northwest = $\pm 9,300$ ft² = 0.21 acres.

Mulch bed is proposed as LID feature for Lot 7. Depth of amended soil:

 $D_{BMP} = (D_{DR} * R_V) / (\emptyset * A_{BMP} / [A_{BMP} + A_i]) = (0.64 * 0.89) / (0.35 * 1,150 / [1,150 + 1,500]) = 3.75'' => 4'' is proposed.$

D_{DR} = 0.64' for impervious area;

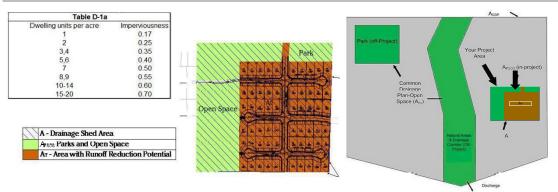
 $\emptyset = 0.35$ - amended soil porosity;

 $R_V = 0.89 - Volumetric Runoff coefficient for 100\%$ imperviousness per Stormwater Quality Design Manual;

 A_{BMP} = 375 ft² - 25% of contributing impervious area – minimum BMP area; per LID calculator in order to achieve 100 points, Area of mulch bed is 1,150 ft².

 A_i = 1,500 ft² – assumed portion of total impervious area sloping northwest – lot is split in two drainage directions.

Appendix D-1: Residential Sites: Low Impact Development (LID) Credits and Treatment BMP Sizi	ng Calculations
Name of Drainage Shed: Blossom Ridge Lot 7	Fill in Blue Highlighted boxes
Location of project: Sacramento	
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)	A _{os} see area example
a. Natural storage reservoirs and drainage corridors 0 acres	below
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) 0.21 acres	A
Project-Specific Open Space (In-project, communal**) 0.00 acres	A _{PSOS} see area example
a. Natural storage reservoirs and drainage corridors 0.00 acres	below
b. Buffer zones for natural water bodies 0.00 acres	bolow
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 usir	ng Form D-1a in Step 2.
Area with Runoff Reduction Potential A - A _{PSOS} = 0.21 acres	A _T
Number of Units in A	
Number of Units in A _T 1	
Number of units per acre in A _T DU/A _T = 5	DUA
Assumed Initial Impervious Fraction of A _T 0.4	1
(determined using Table D-1a)	
(uctermined using radie D-Td)	
Open Space & Pervious Area LID Credit (Step 1)	
$(A_{OS}/A_{CDP}+A_{PSOS}/A)x100 = 0 pts$	



Step 2 - Runoff Reduction Credits				
Runoff Reduction Measures			Effective Area Managed (A _C)	
Disconnected Roof Drains (see Fact Sheet)	use Form D-1a for credits		0.00	acres
(see Fact Sheet) Disconnected Pavement (see Fact Sheet)	use Form D-1b for credits		0.00	acres
Interceptor Trees (see Fact Sheet)	use Form D-1c for credits		0.00	acres
Alternative Driveway Design (see Fact Sheet)	use Form D-1d for credits		0.00	acres
Total Effective Area Managed (Credit Area)		Ac	0.00	acres EAM
Runoff Reduction Credit (Step 2)		(A _c / A _T)*100 =	0 pts	

Form D-1a: Disconnected Roof Drai See Fact Sheet for more information regarding D		it guidelines				
1. Determine efficiency Multiplier						Effective Area Managed (A _c)
Runoff is directed to a dispersal trench or dry	v well	1.00				
(Type A and B soils only)						
Runoff is directed across landscaping, detern 25 ft + Use m	mine setback nultiplier of	1.00				
		0.90 0.70				
		0.45				
<u>≥</u> 5 and < 10 ft Use m	nultiplier of	0.25		_		
	Efficiency Multip	lier	→	Box J1		
				7		
2. Determine percentage of roof drains disco	onnected		•	Box J2		
3. Select project density in dwelling units per		0.00				
1 Use reduction factor of 2 Use reduction factor of		0.08 0.13				
3,4 Use reduction factor of		0.19				
5,6 Use reduction factor of 7 Use reduction factor of		0.23				
7 Use reduction factor of 8,9 Use reduction factor of		0.29 0.33				
10-14 Use reduction factor of		0.37				
15-20 Use reduction factor of		0.44		7		
	Reduction Facto	r —	0.2	3 Box J3		
4. Determine Area Managed			-	-		
Multipl	ly Box J3 by A _T , and enter th	e result in Box J4	0.	0 acres Box J4		
5. Multiply Boxes J1, J2 and J4, and enter 60	0% of the Result in Box J					0.0 acres Box J
This is the amount of area credit to enter into	the "Disconnected Roof Dr	ains" Box of Form D-1				
Form D-1b: Disconnected Pavement	nt Worksheet					
See Fact Sheet for more information regarding N	NDC Pavement credit guidelin	es				
Divided Sidewalks						Effective Area Managed (A _C)
1. Determine percentage of units with divideo	d Sidewalks			Box K1		
Multiply Box K1, $A_{\rm T},$ and 0.04 and enter 60% σ	of the result in Box K					0.00 acres Box K
This is the amount of area credit to enter into	the "Disconnected Paveme	nt" Box of Form D-1				
Form D-1c: Interceptor Tree Works See Fact Sheet for more information regarding In		ies				
						Effective Area Managed (A _c)
New Evergreen Trees						
1. Enter number of new evergreen trees that	t qualify as Interceptor Trees	s in Box L1.				
-					trees	Box L1
2. Multiply Box L1 by 200 and enter result in	Box L2			<u> </u>	0 sq. ft.	Box L2
New Deciduous Trees						
3. Enter number of new deciduous trees that	t qualify as Interceptor Tree	in Boy I 2				
3. Enter number of new deciduous nees man	i quality as interceptor frees	S III DUX LO.			trees	Box L3
4. Multiply Box L3 by 100 and enter result in I	Box L4				0 sq. ft.	Box L4
Existing Tree Canopy						
5. Enter square footage of existing tree cano	ipy that qualities as Existing	Tree canopy in Box Lo.			sq. ft.	Box L5
				-		
6. Multiply Box L5 by 0.5 and enter the result	t in Box L6				0 sq. ft.	Box L6
Total Interceptor Tree Credits						
Add Boxes L2, L4, and L6 and enter it into Bo	ox L7				0 sq. ft.	Box L7
Divide Box L7 by 43,560 and multiply by 20%	to get effective area manag	and and enter the result	in Boy I 8		0.00 acres	Box L8
This is the amount of area credit to enter into			IT DOX LO	•	0.00	DOXED
Form D-1d: Alternative Driveway De						
See Fact Sheet for more information regarding A	Alternative Driveway Design ci	redit guidelines				
1. Select type of driveway Perviou	ous Driveway: Multipli	er:				
Cot	bblestone Block F	0.40				
	rvious Concrete/A odular Block	0.60				
Porous	is Pavement	0.75				
	rous Gravel irectly-connected	1.00				
				Box M1		
2. Determine percentage of units with Alterna	ative Driveways:			Box M2		
				JOA INC		
4. Multiply Boxes M1, M2, A _T and 0.04, and e	enter the result in Box M					0.00 acres
This is the amount of area credit to enter into		esign" Box of Form D-1				0.00

e water quality volume (Acre-Feet): WQV = Area x Maximized Detention Volume (P ₀) trom Step 1 0.2.1 A hrs Specified Draw Down time h ₀ : Maximized Detention Volume from figures E-1 to E 0.00 P ₀ endix E of this manual using I _A from Step 2. e treatment volume (acre-ft):					
insert in the standing of by Rinds tarrets, Claimer, and automatically employed the standing the standing of the standi	Capture and Use Credits				
Amount of the system 0.00 was Bit control of the system system system 0.00 was Bit control of the system system system 0.00 was Bit control of the system system system 0.00 was Bit control of the system system system 0.00 was Bit control of the system system system 0.00 was Bit control of the system system system system 0.00 was Bit control of the system	Impervious Area Managed by Rain barrels, Cister			0.00	00700
0.000 ave Determined integration Credit: Buffer Drives 0.000 ave Determined Drives Determined Drives Determined Drives Determined Drives Determine		enter gallons,	for simple rain barrels	0.00	acres
Impercision: Area Managed by discreterion BMP: Biosen: Discose		system)		0.00	acres
Image: Constant Section 2019 Descriptions, Image: Section 2019, Image: Sec					
Bit Prof. State Decker Prof. Prof. Bit Prof.	(See Fact Sheet)			0.00	acres
Wind Wind Wind Wind Wind Wind Wind Wind	Impervious Area Managed by Infiltration BMPs				
Staring Option 1: Capace Volume score Capace Volume score Capace Volume Score Copace Berling Option 2: Mathe of Mathe					
Skrig Option 2: interaction there in the series 0.000 arcs Bain or there in the series 0.000 arcs Impervious Area Managed by Capture-and-Use/Bioretention/Inititation BMFs 0.011 A.cs Total Effective Acea Managed by Capture-and-Use/Bioretention/Inititation BMFs 0.011 A.cs Rund Management Credit (Step 3) A.co/Ar/200 0.056 pts Total Effective Acea Managed by Capture-and-Use/Bioretention/Inititation BMFs 0.011 A.cs Rund Management Credit (Step 3) A.co/Ar/200 0.056 pts Total LD Credit (Step 1+24.3) LD compliant check to treatment step is Bes 4 10.05 Des project require hydromodification management? Fires, proceed to using SackManagement (Arit Arit Arit Arit (Arit Arit Arit (Arit (Arit Arit Arit (Arit (Arit Arit (Arit (Arit Arit (Arit				0.00	
Bain of therdit 1 table genome bill bill be get Derivational Assanged by Amended Soil of Mulch Beds 0.011 or mm Table Effective Area Managed by Capture and UseBioretentionMultitation Mare, still					
Total Effective Area Managed by Annoted Soil or Wulchel Based 1.150 muth, use 0.11 creat Total Effective Area Managed by Capture-and-Use/Bioretention/Initiration BMPs 0.11 Aure. Aure. Runoff Management Credit (Step 1) Aure. 100.000 pts Total Effective Area Managed by Capture-and-Use/Bioretention/Initiration BMPs 0.11 Aure. Runoff Management Credit (Step 1,2-42) Lib compliant, check for the treatment and the treatment of the tre	о.,				acres
tive First Sweig August			approximate binin depun		
Total Effective Area Managed by Capture-and-Use/Bioretention/Infitration BMPs 0.11 Acos Runoff Management Credit (Step 3) Augu/Art200 = 100.6 pts Total LD Credits (Step 1-22-3) LD complement, there have the the management storety on Step 4 100.8 Does project require hydromodification management? If yes, proceed to using SacHM. Art-Ac-Auge = 0.11 Acr. Adjusted Area for Flow-Based, Non-LD Treatment Art-Ac-Auge = 0.11 Acr. Adjusted Impervious Fraction of A for Volume-Based, Non-LD Treatment (Art-Ac-Auge = 0.10 Acr. Stop 4.1 Testiment Flow-Based (Rational Method) Testiment Flow-Based (Rational Method) Testiment Flow-Based (Rational Method) Testiment flow (drs): Pow = Runoff Coefficient x Rainfall Intensity x Adjusted Treatment Area Testiment flow (drs): Tes			1,150 mulch area	0.11	acres
Runoff Management Credit (Step 3) Auge/Ar 200 = 100.6 pts Total LD Credits (Step 14243) LD complant, duck for testment stern in Step 4 100.6 Dees project require hydromodification management? If yes, proceed to using Sterkti. Air Ac +Aoc = 0.10 Arr Adjusted Area for Flow-Based, Non-LD Treatment Ar +Ac +Aoc = 0.10 Arr Adjusted Impervious Fraction of A for Volume-Based, Non-LD Treatment (Ar + Ac +Aoc) / A = 0.000 In STOP: No additional treatment needed Step 4.1 Treatment - Flow-Based (Rational Method) In In In Caduate treatment flow (cfs): Flow = Runoff Coefficient x Rainfall Intensity x Adjusted Treatment Area In In In Determine Lusing Table D-10 C In In In In Arr 0.00 ch In In In In Arr 0.00 ch In <	(,				
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e water quality volume (Acre-Feet): WQV = Area x Maximized Detention Volume (P ₀) trom Step 1 0.21 A hrs Specified Draw Down time h/s: Maximized Detention Volume from figures E-1 to E 0.00 P ₀ endix E of this manual using I _A from Step 2. e treatment volume (acre-ft):	Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{xT} from Step 2 Flow = C * i * A TABLE D-1b Runoff Coeff Development Type Single-family areas Multi-units, detached Apartment dwelling areas Multi-units, attached	ат 0.00 fficient (Rational), C 0.50 0.60 0.75	C i A _{at}	Table Rainfall Roseville Sacramento	ntensity i = 0.20 in/hr i = 0.18 in/hr
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%: Maximized Detention Volume from figures E-1 to E 0.00 P ₀ endix E of this manual using Ι _λ from Step 2. e treatment volume (acre-ft):	Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{xT} from Step 2 Flow = C * i * A TABLE D-1b Runoff Coeff Development Type Single-family areas Multi-units, detached Apartment dwelling areas Multi-units, attached	ат 0.00 fficient (Rational), C 0.50 0.60 0.70 0.75 0.00	C i A _{AT} cfs	Table Rainfall Roseville Sacramento	ntensity i = 0.20 in/hr i = 0.18 in/hr
endix E of this manual using I _A from Step 2.	Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i * A TABLE D-1b Runoff Coel Development Type Single-family areas Multi-units, detached Apartment dwelling areas Multi-units, attached User Specified D Treatment - Volume-Based (ASCE-WEF) e water quality volume (Acre-Feet):	ат 0.00 fficient (Rational), C 0.50 0.60 0.75 0.00 WQV = Area x Maximized Detenti	C i A _{AT} cfs on Volume (P ₀)	Table Rainfall Roseville Sacramento Folsom	ntensity i = 0.20 in/hr i = 0.18 in/hr i = 0.20 in/hr
	Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i * A TABLE D-1b Runoff Coef Development Type Single-family areas Multi-units, attached Apartment dwelling areas Multi-units, attached User Specified D Treatment - Volume-Based (ASCE-WEF) e water quality volume (Acre-Feet): .from Step 1	ат 0.00 fficient (Rational), C 0.50 0.60 0.70 0.75 0.00 WQV = Area x Maximized Detenti	C i A _{AT} cfs	Table Rainfall Roseville Sacramento Folsom	ntensity i = 0.20 in/hr i = 0.18 in/hr i = 0.20 in/hr
	Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{xT} from Step 2 Flow = C * i * A TABLE D-1b Runoff Coel Development Type Single-family areas Multi-units, detached Apartment dwelling areas Multi-units, attached User Specified D Treatment - Volume-Based (ASCE-WEF) e water quality volume (Acre-Feet): .trom Step 1 to: Maximized Detention Volume from figures E-1 to E endix E of this manual using I _h from Step 2.	ат 0.00 fficient (Rational), C 0.50 0.60 0.70 0.75 0.00 WQV = Area x Maximized Detenti	C i A _{AT} cfs	Table Rainfall Roseville Sacramento Folsom	ntensity i = 0.20 in/hr i = 0.18 in/hr i = 0.20 in/hr
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Southwest POC

Southwest portion of Watershed WS2.1P constitutes the point of compliance. It consists of portions of lots 13, 14 & 15.

Lot 14 has been thoroughly reviewed and calculations are provided below.

Lot 14

40% Imperviousness is taken into account for proposed zoning RD-4.

Area of Lot 14 sloping southwest = $\pm 5,000$ ft² = 0.11 acres.

Mulch bed is proposed as LID feature for Lot 14. Depth of amended soil:

 $D_{BMP} = (D_{DR} * R_V) / (\emptyset * A_{BMP} / [A_{BMP} + A_i]) = (0.64 * 0.89) / (0.35 * 725 / [725 + 1,200]) = 4.32'' => 6'' is proposed.$

D_{DR} = 0.64' for impervious area;

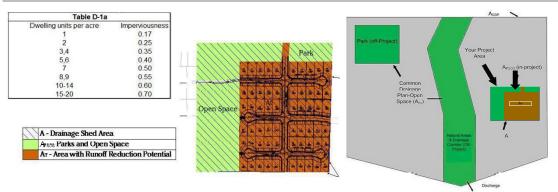
 $\emptyset = 0.35$ - amended soil porosity;

R_v = 0.89 – Volumetric Runoff coefficient for 100% imperviousness per Stormwater Quality Design Manual;

 A_{BMP} = 300 ft² - 25% of contributing impervious area – minimum BMP area; per LID calculator in order to achieve 100 points, Area of mulch bed is 725 ft².

A_i = 1,200 ft² – assumed portion of total impervious area sloping southwest – lot is split in two drainage directions.

Appendix D-1: Residential Sites: Low Impact Development (LID) Credits and Treatment BMP Siz	ing Calculations
Name of Drainage Shed: Blossom Ridge Lot 14	Fill in Blue Highlighted boxes
Location of project: Sacramento	
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)	A _{os} see area example
a. Natural storage reservoirs and drainage corridors 0 acres	See alea example
b. Buffer zones for natural water bodies 0 acres	below
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) 0.11 acres	А
Project-Specific Open Space (In-project, communal**) 0.00 acres	A _{PSOS}
a. Natural storage reservoirs and drainage corridors 0.00 acres	see area example below
b. Buffer zones for natural water bodies 0.00 acres	Delow
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 usi	ng Form D-1a in Step 2.
Area with Runoff Reduction Potential A - A _{PSOS} = 0.11 acres	A _T
Number of Units in A _T	
Number of units per sere in A	DUA
Number of units per acre in A_T DU/A _T = 10	DUA
Assumed Initial Impervious Fraction of A _T 0.6	- I
(determined using Table D-1a)	
On an One of Participant Area LID Conditi (Chan 4)	
Open Space & Pervious Area LID Credit (Step 1) (A _{OS} /A _{CDP} +A _{PSOS} /A)x100 = 0 pts	



Step 2 - Runoff Reduction Credits				
Runoff Reduction Measures			Effective Area Managed (A _C)	
Disconnected Roof Drains (see Fact Sheet)	use Form D-1a for credits		0.00	acres
(see Fact Sheet) Disconnected Pavement (see Fact Sheet)	use Form D-1b for credits		0.00	acres
Interceptor Trees (see Fact Sheet)	use Form D-1c for credits		0.00	acres
Alternative Driveway Design (see Fact Sheet)	use Form D-1d for credits		0.00	acres
Total Effective Area Managed (Credit Area)		Ac	0.00	acres EAM
Runoff Reduction Credit (Step 2)		(A _c / A _T)*100 =	0 pts	

						T (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)
1. Determine efficiency Multiplier						Effective Area Managed (A _c)
Runoff is directed to a dispersal tren	ch or drv well	1.00				
(Type A and B soils only)						
Runoff is directed across landscapin 25 ft +	Use multiplier of	1.00				
≥ 20 and < 25 ft ≥ 15 and < 20 ft	Use multiplier of Use multiplier of	0.90 0.70				
\ge 10 and < 15 ft	Use multiplier of	0.45				
≥ 5 and < 10 ft	Use multiplier of	0.25		_		
	Efficiency	/ Multiplier	•	Box J1		
0. Determine energiese of each de				7		
2. Determine percentage of roof dra	ains disconnected		•	Box J2		
 Select project density in dwelling Use reduction factor of 	units per acre:	0.08				
1 Use reduction factor of 2 Use reduction factor of		0.08				
3,4 Use reduction factor of		0.19				
5,6 Use reduction factor of 7 Use reduction factor of		0.23 0.29				
8,9 Use reduction factor of		0.33				
10-14 Use reduction factor of 15-20 Use reduction factor of		0.37 0.44				
	Reduction		→ 0.3	7 Box J3		
4. Determine Area Managed			0.3	<i>г</i> вох 33		
n. Botonnino nica managoa	Multiply Box J3 by A _T , and e	enter the result in Box J4	0.	0 acres Box J4		
			0.	acres		
5. Multiply Boxes J1, J2 and J4, and						0.0 acres Box J
This is the amount of area credit to e		Roof Drains" Box of Form D-1				
Form D-1b: Disconnected Pa						
See Fact Sheet for more information re	egarding NDC Pavement credit	guidelines				Effective Area Managed (A _c)
Divided Sidewalks						
1. Determine percentage of units wi	th divided Sidewalks			Box K1		
Multiply Box K1, A _T , and 0.04 and er						
This is the amount of area credit to e						0.00 acres Box K
Form D-1c: Interceptor Tree	Worksheet					
See Fact Sheet for more information re	egarding Interceptor Tree credit	guidelines				
						Effective Area Managed (A _C)
New Evergreen Trees						
1. Enter number of new evergreen t	rees that qualify as Intercepto	or Trees in Box L1.		1 m		
					trees	Box I 1
					trees	Box L1
2. Multiply Box L1 by 200 and enter	result in Box L2					
2. Multiply Box L1 by 200 and enter	result in Box L2				0 sq. ft.	Box L1 Box L2
2. Multiply Box L1 by 200 and enter New Deciduous Trees	result in Box L2					
-					0 sq. ft.	Box L2
New Deciduous Trees						
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New Deciduous Trees 3. Enter number of new deciduous 1 4. Multiply Box L3 by 100 and enter	trees that qualify as Intercepto				0 sq. ft.	Box L2 Box L3
New Deciduous Trees 3. Enter number of new deciduous t	trees that qualify as Intercepto				0 sq. ft.	Box L2 Box L3
New Deciduous Trees 3. Enter number of new deciduous 1 4. Multiply Box L3 by 100 and enter	rees that qualify as Intercepto	or Trees in Box L3.			0 sq. ft.	Box L2 Box L3 Box L4
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New Deciduous Trees 3. Enter number of new deciduous 1 4. Multiply Box L3 by 100 and enter Existing Tree Canopy 5. Enter square footage of existing to	rees that qualify as Intercepto result in Box L4 ree canopy that qualifies as E	or Trees in Box L3.			0 sq. ft.	Box L2 Box L3 Box L4 Box L5
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New Deciduous Trees 3. Enter number of new deciduous it 4. Multiply Box L3 by 100 and enter Existing Tree Canopy 5. Enter square footage of existing the 6. Multiply Box L5 by 0.5 and enter the Total Interceptor Tree Credits Add Boxes L2, L4, and L6 and enter Divide Box L7 by 43,560 and multiply This is the amount of area credit to of Form D-1d: Alternative Drive See Fact Sheet for more information ref	rees that qualify as Interceptor result in Box L4 ree canopy that qualifies as E he result in Box L6 it into Box L7 y by 20% to get effective area enter into the "Interceptor Tree way Design garding Alternative Driveway D Pervious Driveway: Cobblestone Block F Pervious Concrete/A Modular Block Porous Pavement Porous Gravel	or Trees in Box L3. xisting Tree canopy in Box L5. managed and enter the result i esign credit guidelines <u>Multiplier:</u> 0.40 0.60 0.75	n Box L8	Box M1	0 sq. ft. 0 sq. ft. 0 sq. ft. 0 sq. ft. 0 sq. ft.	Box L2 Box L3 Box L4 Box L5 Box L6 Box L7
New Deciduous Trees 3. Enter number of new deciduous it 4. Multiply Box L3 by 100 and enter Existing Tree Canopy 5. Enter square footage of existing the 6. Multiply Box L5 by 0.5 and enter the Total Interceptor Tree Credits Add Boxes L2, L4, and L6 and enter Divide Box L7 by 43,560 and multiply This is the amount of area credit to of Form D-1d: Alternative Drive See Fact Sheet for more information ref	rees that qualify as Interceptor result in Box L4 ree canopy that qualifies as E the result in Box L6 it into Box L7 y by 20% to get effective area enter into the "Interceptor Tree way Design sgarding Alternative Driveway D Pervious Driveway: Cobblestone Block F Pervious Concrete/A Modular Block Porous Pavement Porous Gravel Not Directly-connected	or Trees in Box L3. xisting Tree canopy in Box L5. managed and enter the result i esign credit guidelines <u>Multiplier:</u> 0.40 0.60 0.75	n Box L8	Eox M1 Box M2	0 sq. ft. 0 sq. ft. 0 sq. ft. 0 sq. ft. 0 sq. ft.	Box L2 Box L3 Box L4 Box L5 Box L6 Box L7
New Deciduous Trees 3. Enter number of new deciduous I 4. Multiply Box L3 by 100 and enter Existing Tree Canopy 5. Enter square footage of existing I 6. Multiply Box L5 by 0.5 and enter I Total Interceptor Tree Credits Add Boxes L2, L4, and L6 and enter Divide Box L7 by 43,560 and multipi This is the amount of area credit to e Form D-1d: Alternative Drive See Fact Sheet for more information re 1. Select type of driveway	rees that qualify as Interceptor result in Box L4 ree canopy that qualifies as E the result in Box L6 it into Box L7 y by 20% to get effective area enter into the "Interceptor Tree way Design sgarding Alternative Driveway D Pervious Driveway: Cobblestone Block F Pervious Concrete/A Modular Block Porous Pavement Porous Gravel Not Directly-connected	or Trees in Box L3. xisting Tree canopy in Box L5. managed and enter the result i esign credit guidelines <u>Multiplier:</u> 0.40 0.60 0.75	n Box L8		0 sq. ft. 0 sq. ft. 0 sq. ft. 0 sq. ft. 0 sq. ft.	Box L2 Box L3 Box L4 Box L5 Box L6 Box L7
New Deciduous Trees 3. Enter number of new deciduous I 4. Multiply Box L3 by 100 and enter Existing Tree Canopy 5. Enter square footage of existing I 6. Multiply Box L5 by 0.5 and enter I Total Interceptor Tree Credits Add Boxes L2, L4, and L6 and enter Divide Box L7 by 43,560 and multipi This is the amount of area credit to e Form D-1d: Alternative Drive See Fact Sheet for more information re 1. Select type of driveway	rees that qualify as Interceptor result in Box L4 ree canopy that qualifies as E the result in Box L6 it into Box L7 y by 20% to get effective area anter into the "Interceptor Tree way Design agarding Alternative Driveway D Pervious Driveway: Cobblestone Block F Pervious Concrete/A Modular Block Porous Pavement Pervious Gravel Not Directly-connected h Alternative Driveways: 04, and enter the result in Box	or Trees in Box L3.	n Box L8		0 sq. ft. 0 sq. ft. 0 sq. ft. 0 sq. ft. 0 sq. ft.	Box L2 Box L3 Box L4 Box L5 Box L6 Box L7

Step 3 - Runoff Management Credits Capture and Use Credits					
Impervious Area Managed by Rain barrels, Ci			0.00	1	
(see Fact Sheet)	enter gallor	s, for simple rain barrels	0.00	acres	
Automated-Control Capture and Use System (see Fact Sheet, then enter impervious area managed by	the system)		0.00	acres	
Bioretention/Infiltration Credits					
Impervious Area Managed by Bioretention BM (see Fact Sheet)					
(see Fact Sneet)	Subdrain Elevation Ponding Depth, inches		0.00	acres	
Impervious Area Managed by Infiltration BMP	-				
(see Fact Sheet)	Drawdown Time, hrs				
	Soil Infiltration Rate, in/hr	soil_inf_rate			
Sizing Optio			0.00	acres	
Sizing Optic			0.00 ft	acres	
Basin	or trench? Basin	approximate BMP depth	<u>5.00</u> ft		
Impervious Area Managed by Amended Soil o (see Fact Sheet)	r Mulch Beds Mulched Infiltration Area, sq ft	725 mulch_area	0.07	acres	
(See Faul Sheel)	wucheu minication Area, sq it	125 much_area	0.07	dues	
Total Effective Area Managed by Capture-and-U	Ise/Bioretention/Infiltration BMPs		0.07	A _{LIDc}	
Dura off Management Cradit (Ctar 2)		٨	_{IDC} /A _T *200 = 121.0		
Runoff Management Credit (Step 3)		A	$IDC/A_T 200 = 121.0$	pts	
Total LID Credits (Step 1+2+3) Does project require hydromodification manage		compliant, check for treatment : acHM.	sizing in Step 4 121.0		
Adjusted Area for Flow-Based, Non-LID Treatme	ent	,	$A_T - A_C - A_{LIDC} = 0.04$	A _{AT}	
Adjusted Impervious Fraction of A for Volume-B	ased, Non-LID Treatment	(A _T *I-	A _C -A _{LIDC}) / A = 0.000	I _A	
STOD: No additional treatment	noodod				
STOP: No additional treatment Step 4a Treatment - Flow-Based (Ration					
					_
Step 4a Treatment - Flow-Based (Ration	al Method)	at x Rainfall Intensity x Adjusted	Treatment Area		-
Step 4a Treatment - Flow-Based (Ration Form D-1e	al Method)	nt x Rainfall Intensity x Adjusted C	Treatment Area		-
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b	al Method) Flow = Runoff Coefficier	l	Treatment Area		
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs):	al Method)	l	Treatment Area		-
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b	al Method) Flow = Runoff Coefficier	l	Treatment Area		-
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity)	al Method) Flow = Runoff Coefficier 0.18	C	Treatment Area		-
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity)	al Method) Flow = Runoff Coefficier 0.18 0.04	C	Treatment Area		_
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Calculate treatment flow (cfs):	al Method) Flow = Runoff Coefficier 0.18 0.04	C i A _{AT}		Table D-1c	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2	al Method) Flow = Runoff Coefficier 0.18 0.04	C i A _{AT}		Table D-1c	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i TABLE D-1b	al Method) Flow = Runoff Coefficier 0.18 0.04 * A _{AT} 0.00	C i A _{AT}		Table D-1c	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i TABLE D-1b	al Method) Flow = Runoff Coefficier 0.18 0.04	C i A _{AT}		Table D-1c	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i TABLE D-1b Runoff C Development Type Single-family areas	al Method) Flow = Runoff Coefficier 0.18 0.04 A _{AT} 0.00 0efficient (Rational), C 0.50	C i A _{AT}	Roseville	iinfall Intensity i = 0.20 in/hr	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{xT} from Step 2 Flow = C * i TABLE D-1b Runoff C Deteologment Type Single-family areas Multi-units, detached	al Method) Flow = Runoff Coefficien 0.18 0.04 * A _{AT} 0.00 0efficient (Rational), C 0.50 0.60	C i A _{AT}	Roseville Sacramento	ninfall Intensity i = 0.20 in/hr i = 0.18 in/hr	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i TABLE D-1b Runoff C Development Type Single-family areas	al Method) Flow = Runoff Coefficier 0.18 0.04 A _{AT} 0.00 0efficient (Rational), C 0.50	C i A _{AT}	Roseville	iinfall Intensity i = 0.20 in/hr	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i TABLE D-1b Runoff C Development Type Single-family areas Multi-units, detached Apartment dwelling areas	al Method) Flow = Runoff Coefficier 0.18 0.04 A _{AT} 0.00 0efficient (Rational), C 0.50 0.60 0.70	C i A _{AT}	Roseville Sacramento	ninfall Intensity i = 0.20 in/hr i = 0.18 in/hr	
Step 4a Treatment - Flow-Based (Ration Flow - Based (Ration Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i TABLE D-1b Runoff C Development Type Single-family areas Multi-units, detached Apartment dwelling areas Multi-units, attached	al Method) Flow = Runoff Coefficier 0.18 0.04 * A _{kT} 0.00 0.60 0.70 0.75 0.00	C i A _{AT}	Roseville Sacramento	ninfall Intensity i = 0.20 in/hr i = 0.18 in/hr	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i TABLE D-1b Runoff C Development Type Single-family areas Multi-units, detached Apartment dwelling areas Multi-units, attached User Specified	al Method) Flow = Runoff Coefficier 0.18 0.04 * A _{kT} 0.00 0.60 0.70 0.75 0.00	C i A _{AT} cfs	Roseville Sacramento	ninfall Intensity i = 0.20 in/hr i = 0.18 in/hr	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i TABLE D-1b Runoff C Determine Type Single-family areas Multi-units, detached Apartment dwelling areas Multi-units, attached User Specified D Treatment - Volume-Based (ASCE-WEF	al Method) Flow = Runoff Coefficient 0.18 0.04 A _{AT} 0.00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	C i A _{AT} cfs	Roseville Sacramento	iinfall Intensity i = 0.20 in/hr i = 0.18 in/hr i = 0.20 in/hr	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i Development Type Single-family areas Multi-units, detached Apartment dwelling areas Multi-units, statached User Specified Treatment - Volume-Based (ASCE-WEF a water quality volume (Acre-Feet): from Step 1 g: Maximized Detention Volume from figures E-1 to	al Method) Flow = Runoff Coefficient 0.18 0.04 * A _{AT} 0.00 0.60 0.70 0.75 0.00 WQV = Area x Maximized Dete	C i A _{AT} cfs	Roseville Sacramento Folsom	iinfall Intensity i = 0.20 in/hr i = 0.18 in/hr i = 0.20 in/hr	
Step 4a Treatment - Flow-Based (Ration Form D-1e Calculate treatment flow (cfs): Determine C Factor using Table D-1b Determine i using Table D-1c (Rainfall Intensity) A _{AT} from Step 2 Flow = C * i TABLE D-1b Runoff C Development Type Single-family areas Multi-units, attached User Specified Treatment - Volume-Based (ASCE-WEF e water quality volume (Acre-Feet): from Step 1	al Method) Flow = Runoff Coefficier 0.18 0.04 A _{AT} 0.00 0efficient (Rational), C 0.50 0.60 0.70 0.75 0.00 WQV = Area x Maximized Dete 0.11	C i A _{AT} cfs ntion Volume (P ₀)	Roseville Sacramento Folsom	iinfall Intensity i = 0.20 in/hr i = 0.18 in/hr i = 0.20 in/hr	

East POC

The rest of the proposed lots contribute to the east point of compluiance. Proposed frontage improvements are also added to the impervious area.

Lot 26 has been thoroughly reviewed and calculations are provided below.

Lot 26

40% Imperviousness is taken into account for proposed zoning RD-4.

Area of Lot $26 = \pm 10,300$ ft² = 0.24 acres to the CL of proposed road.

Mulch bed is proposed as LID feature for Lot 26. Depth of amended soil:

 $D_{BMP} = (D_{DR} * R_V) / (\emptyset * A_{BMP} / [A_{BMP} + A_i]) = (0.64 * 0.89) / (0.35 * 1,350 / [1,350 + 5,100]) = 7.77'' => 8'' is proposed.$

D_{DR} = 0.64' for impervious area;

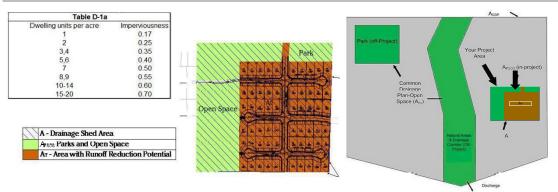
 $\emptyset = 0.35$ - amended soil porosity;

R_v = 0.89 – Volumetric Runoff coefficient for 100% imperviousness per Stormwater Quality Design Manual;

 A_{BMP} = 1,275 ft² - 25% of contributing impervious area – minimum BMP area; per LID calculator in order to achieve 100 points, Area of mulch bed is 1,350 ft².

 A_i = 5,100 ft² – assumed portion of total impervious area including a prtion of the proposed road to the centerline.

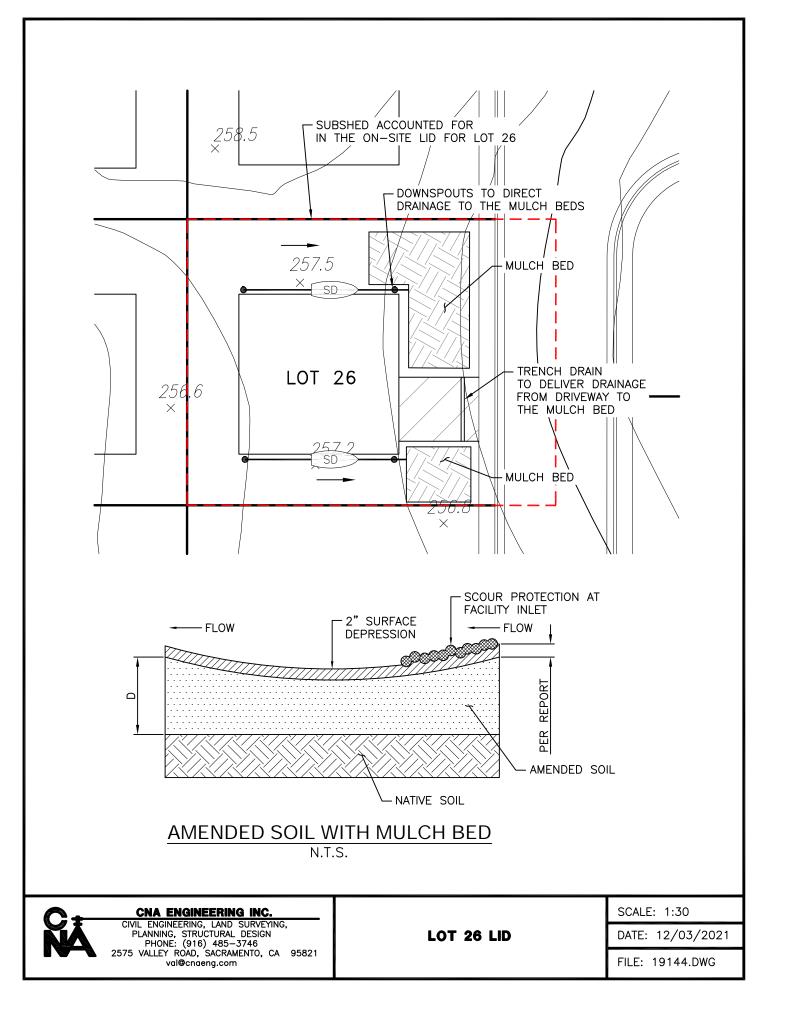
Appendix D-1: Residential Sites: Low Impact Development (LID) Credits and Treatment	t BMP Sizing	g Calculations	
Name of Drainage Shed: Blossom Ridge Lot 26		Fill in Blue Highlighted b	oxes
Location of project: Sacramento			
Step 1 - Open Space and Pervious Area Credits			
Is your project within the 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
a. Natural storage reservoirs and drainage corridors b. Buffer zones for natural water bodies	0 acres		below
c. Natural areas including existing trees, other vegetation, and soil	0 acres 0 acres		
d. Common landscape area/park	0 acres		
e. Regional Flood Control/Drainage basins	0 acres		
	olacies		
1 b. Project Drainage Shed Area (Total) 0.	.24 acres	A	
Project-Specific Open Space (In-project, communal**) 0.	.00 acres	A _{PSOS}	see area example
a. Natural storage reservoirs and drainage corridors 0.	.00 acres		below
b. Buffer zones for natural water bodies 0.	.00 acres		Delow
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		Form D-1a in Step 2.	
Area with Runoff Reduction Potential A - A _{PSOS} = 0.	.24 acres	A _T	
Number of Units in A _r			
		DUA	
Number of units per acre in A_T DU/ $A_T = 5$		DUA	
Assumed Initial Impervious Fraction of A _T 0.4		1	
(determined using Table D-1a)			
Once Carros & Demission Area LID Carrille (Char 4)			
Open Space & Pervious Area LID Credit (Step 1) (A _{OS} /A _{CDP} +A _{PSOS} /A)x100 =	0 pts		
(AOS/ACDP+APSOS/A)XIUU =	pis		

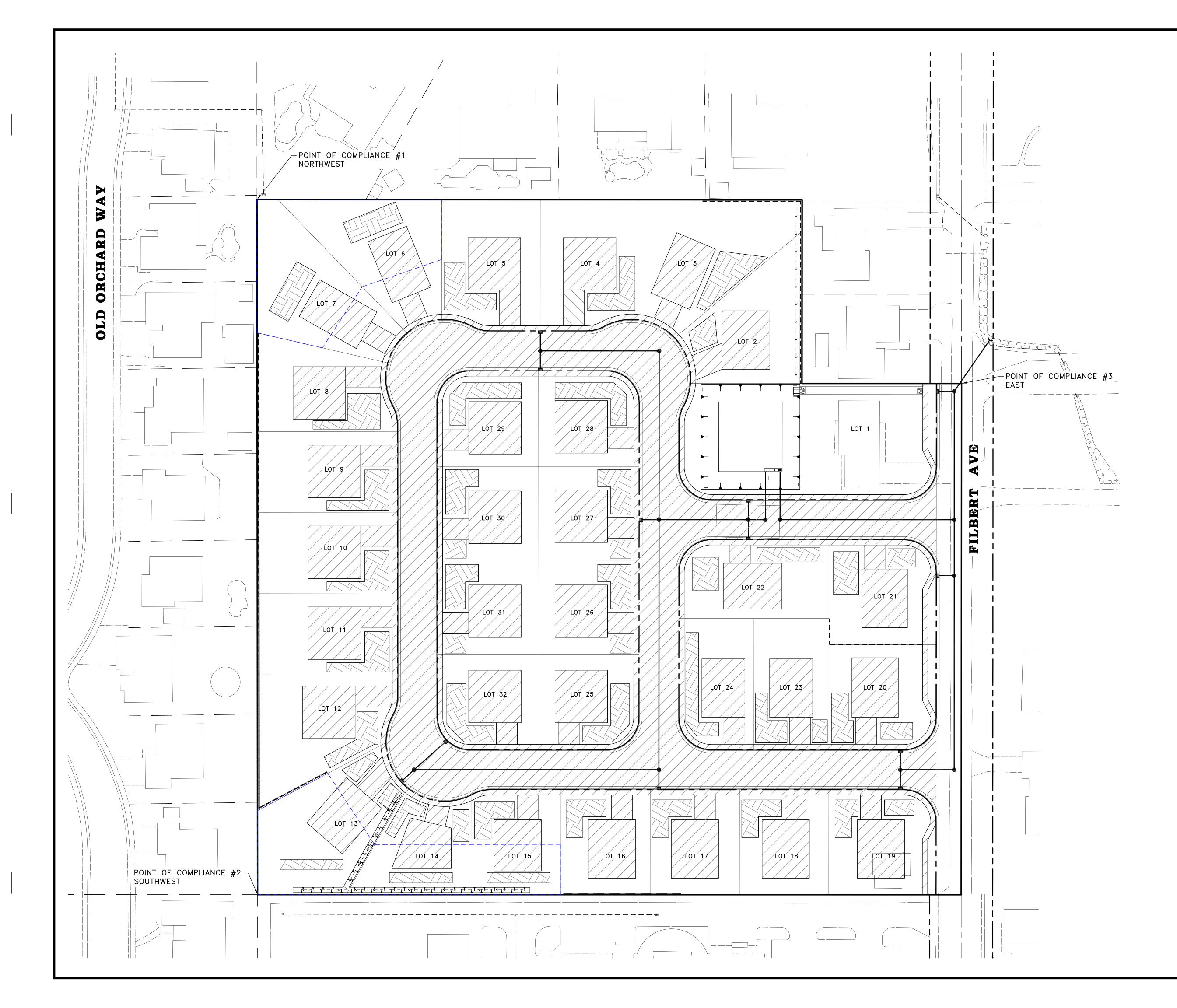


Step 2 - Runoff Reduction Credits				
Runoff Reduction Measures			Effective Area Managed (A _C)	
Disconnected Roof Drains (see Fact Sheet)	use Form D-1a for credits		0.00	acres
(see Fact Sheet) Disconnected Pavement (see Fact Sheet)	use Form D-1b for credits		0.00	acres
Interceptor Trees (see Fact Sheet)	use Form D-1c for credits		0.00	acres
Alternative Driveway Design (see Fact Sheet)	use Form D-1d for credits		0.00	acres
Total Effective Area Managed (Credit Area)		Ac	0.00	acres EAM
Runoff Reduction Credit (Step 2)		(A _C / A _T)*100 =	0 pts	

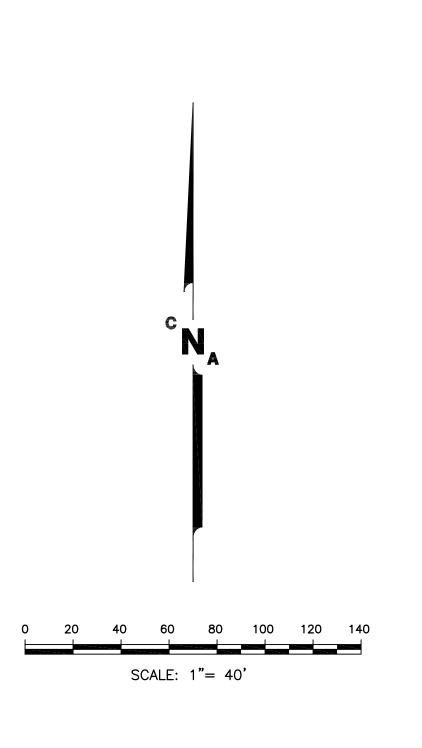
Form D-1a: Disconnected R See Fact Sheet for more information r		credit guidelines				
1. Determine efficiency Multiplier						Effective Area Managed (A _c)
Runoff is directed to a dispersal trer	nch or dry well	1.00				
(Type A and B soils only)						
Runoff is directed across landscapin 25 ft +	Use multiplier of	1.00				
≥ 20 and < 25 ft ≥ 15 and < 20 ft	Use multiplier of Use multiplier of	0.90 0.70				
\ge 10 and < 15 ft	Use multiplier of	0.45				
≥ 5 and < 10 ft	Use multiplier of	0.25		-		
	Efficiency M	ultiplier	→	Box J1		
2. Determine percentage of roof dr	rains disconnected		→ 	Box J2		
				B0x 32		
 Select project density in dwelling Use reduction factor of 	g units per acre:	0.08				
2 Use reduction factor of		0.13				
3,4 Use reduction factor of5,6 Use reduction factor of		0.19 0.23				
7 Use reduction factor of		0.29				
8,9 Use reduction factor of 10-14 Use reduction factor of		0.33 0.37				
15-20 Use reduction factor of		0.44		_		
	Reduction F	actor	→ 0.2	3 Box J3		
4. Determine Area Managed						
, i i i i i i i i i i i i i i i i i i i	Multiply Box J3 by A_T , and enter	er the result in Box J4	0.	1 acres Box J4		
5. Multiply Boxes J1, J2 and J4, and	d enter 60% of the Result in Box	J		_		0.0 acres Box J
This is the amount of area credit to						
Form D-1b: Disconnected P	avement Worksheet					
See Fact Sheet for more information r	regarding NDC Pavement credit guid	delines				
Divided Sidewalks						Effective Area Managed (A _C)
1. Determine percentage of units w	ith divided Sidewalks			Box K1		
Multiply Box K1, A_T , and 0.04 and end This is the amount of area credit to a_T		ement" Boy of Form D-1				0.00 acres Box K
		Binent Box of Form D-T				
Form D-1c: Interceptor Tree See Fact Sheet for more information r		delines				Effective Area Managed (A _c)
New Evergreen Trees						
1. Enter number of new evergreen	trees that qualify as Interceptor T	rees in Box L1.			_	
					trees	Box L1
2. Multiply Box L1 by 200 and enter	r result in Roy I 2				0 sq. ft.	Box L2
-	Tesuit III DOX L2				0 Sq. II.	BOX LZ
New Deciduous Trees						
3. Enter number of new deciduous	trees that qualify as Interceptor T	rees in Box L3.				David 2
					trees	Box L3
4. Multiply Box L3 by 100 and enter	r result in Box L4				0 sq. ft.	Box L4
Existing Tree Canopy						
5. Enter square footage of existing	tree canopy that qualifies as Exist	ing Tree canopy in Box L5.			sq. ft.	Box L5
6. Multiply Box L5 by 0.5 and enter	the result in Box L6				0 sq. ft.	Box L6
Total Interceptor Tree Credits						
Add Davies I.O. I.A. and I.C. and ante-	a it into David 7				0	David 7
Add Boxes L2, L4, and L6 and enter	r it into Box L7				0 sq. ft.	Box L7
Divide Box L7 by 43,560 and multipl	ly by 20% to get effective area ma	anaged and enter the result	in Box L8		0.00 acres	Box L8
This is the amount of area credit to	enter into the "Interceptor Trees"	Box of Form D-1				
Form D-1d: Alternative Drive	eway Design					
See Fact Sheet for more information r	egarding Alternative Driveway Desig	gn credit guidelines				
1. Select type of driveway	Pervious Driveway: Mu	Itiplier:				
	Cobblestone Block F	0.40				
	Pervious Concrete/A Modular Block	0.60				
	Porous Pavement	0.75				
	Porous Gravel Not Directly-connected	1.00				
				Box M1		
2. Determine percentage of units wi	ith Alternative Driveways:			Box M2		
4. Multiply Boxes M1, M2, A _T and 0.	.04, and enter the result in Box M					0.00 acres
This is the amount of area credit to						0.00

Big 3.1 Action Management Production	Capture and Use Credits				
market boom					
American Conjunction (line symple) 0.00 0.00 Bit control (line symple) 0.00 0.00 Bit co				0.00	20165
0.000 aus Displace instantial functions DBFs		enter galons,	for simple fair barrels	0.00	dules
Importion Area Managed by Bioretinion BMPs Reserve to a management of the first of		system)		0.00	acres
Build B	Bioretention/Infiltration Credits				
Imperiation of Andraged by Unification BMPs Imperiation of Andraged by Unification Andrage Andraged by					
exercise Decise The law Set of point Set of point </td <td>(see Fact Sheet)</td> <td></td> <td></td> <td>0.00</td> <td>acres</td>	(see Fact Sheet)			0.00	acres
Up field Steep Due to be into into into into into into into into					
Set Instants Runny	Impervious Area Managed by Infiltration BMPs (see Fact Sheet)	Drawdown Time, hrs	drawdown_hrs_inf		
Sin Q Quio 12: without BMP actions and a growth action and a growth action action of the origination of the origination action actio					
Basin or thermit? Basin genume there are body			capture_vol_inf		acres
Table Design of the Number of Solid of Muchine Bease (Sor Fars Orient) 0.13 sores Total Effective Area Managed by Capture-and Use BioretentionInfiltration BMPs 0.13 Auge Runooff Management Credit (Step 1) 0.00000000000000000000000000000000000					acres
Test Deep 1 Mutched Influence Area, sq. 1,130 mutch, uses 0.12 acros Test Is Effective Area Managed by Capture and UsesBioretemionAnilitation BMPs 0.12 Acros Runoff Management Credit (Step 1) L0 compliant, check for testment area in 1933 pts Total LID Credits (Step 1+2+3) L0 compliant, check for testment area in 1933 pts Des project require hydromodification management? If yes, proceed to using SachM. 103.3 Acr Adjusted Area for Flow-Based, Non-LD Treatment Ar. + Acj. Acc 0.13 Acr Adjusted Area for Flow-Based (Rational Method) Emm Def Emm Def Stop A. Treatment - Flow-Based (Rational Method) Emm Def Emm Def Calculate treatment flow (ds): Flow = Runoff Coefficient x Rainfall Intensity Acr Calculate treatment flow (ds): Flow = C + 1* Acr C Determine Using Table D-1c (Rainfall Intensity) 0.12 Acr Stright-family areas 0.50 Max Stright-family areas 0.50 Max Stright-family areas 0.50 Max Acr O.72 Acr Development Type	Basin or	trench? Basin	approximate BMP depth 0.00	ft	
Total Effective Area Managed by Capture-and-Use/Bioretention/Inflitration BMPs 0.12 Arice. Runoff Management Credit (Step 3) Arice. 103.3 pts Total LD Credits (Step 14.2-4.3) LD Compliant, check for teamers area in step. 4 103.3 pts Does project requires hydromodifications management PT types, proceed to using SacMM. Arice. 103.3 Arice. Adjusted Area for Flow-Based, Non-LD Treatment Ar AcAcAc Q Q Q Q Q Q Q	Impervious Area Managed by Amended Soil or M				
Runoff Management Credit (Step 3) Auxo/A+200 1033 pts Total LD Credits (Step 1+2+3) LD compliant, dues for treatment story in Step 4 103.3 Does project require hydromodification management? If yes, proceed to using SachM. Auxo/A+200 0.12 Arr. Adjusted Area for Flow-Based, Non-LD Treatment Arr. Ac. Aucol 0.12 Arr. Adjusted Impervious Fraction of A for Volume-Based, Non-LD Treatment (Ar+Ac.Aucol / A	(see Fact Sheet)	Mulched Infiltration Area, sq ft	1,350 mulch_area	0.12	acres
Runoff Management Credit (Step 3) Auxo/Ar 200 = 1023 pts Total LLD Credits (Step 14243) LD complant, check for treatment story in Step 4 103.3 Does project require hydromodification management? If yes, proceed to using SacHM. 103.3 103.3 Adjusted Area for Flow-Based, Non-LD Treatment Ar - Ac, -Auco = 0.12 Arr. Adjusted Area for Flow-Based, Non-LD Treatment (Ar + Ac, -Auco = 0.12 Arr. Adjusted Area for Flow-Based (Rational Method)				0.40	
Total LD Credits (Step 1+2+3) LD complexe, check for treatment sizing in Step 4 10.3 Does project require hydromodification management? Wyes, proceed to using SacHM. Ar +	Total Effective Area Managed by Capture-and-Use	/Bioretention/Infiltration BMPs		0.12	A _{LIDc}
Desproject require hydromodification management? If yes, proceed to using SacHM. Adjusted Area for Flow-Based, Non-LID Treatment Ar-Ac-Augor 0.12 Arr Adjusted Impervious Fraction of A for Volume-Based, Non-LID Treatment (Ari+Ac-Augor)/A 0.0000 IA STOP: No additional treatment needed Stop 4a Treatment - Flow-Based (Rational Method)	Runoff Management Credit (Step 3)		A _{LIDC} /A	A _T *200 = 103.3	pts
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HATCH LEGEND:
PROPOSED NEW IMPERVIOUS AREA: IMPROVEMENTS, BUILDINGS, DRIVEWAYS.
LID PLANTERS.
MULCH BEDS.



FN.:			SCALE	PREPARED BY		CNA FNGINFFRING INC	NO.	DESCRIPTION	APPROVED BY DATE
E : 2 1914 EET X	PRELIMINARY	LID PLAN FOR.	HORIZ.: 1"= 40'	DRAFTED BY: VAL T.			SZ SZ		
			VERT.: N/A	DESIGNED BY: STEVE N.		Z			
	BLOSSOM	RIDGE	FLD BK.: N/A	CHECKED BY: CHRIS O.	J		к К		
G	COUNTY OF SACRAMENTO	STATE OF CALIFORNIA	ASSESSOR'S PARCEL NO.: 223-0091-002	: 223-0091-002		SACRAMENIO, CA 93821 cnaeng.com	4		

CNA Engineering

Conclusions

- The subdivision has been designed not to increase the peak flows during 100-, 10- and 2year 24-hour events. Proposed design has incorporated the required grading to mitigate the increase of the flow during these storm events. Required drainage facilities have been incorporated into the preliminary design.
- Proposed on-site and off-site public storm drain systems have been designed to suffice for the purpose of conveying drainage considering Nolte flow. Freeboard requirements are met. Minimum velocity of 2 ft/sec at full flow is achieved.
- 3. Low Impact Development standards have been preliminary incorporated into the design of the subdivision. 100 points are achieved at every point of compliance.
- 4. The Palms 2 subdivision buildings will not be adversely impacted to the level of endangering the existing houses. There is a slight increase of the Water Surface Elevation during the 2-year event that has been found to be safe and not adversely impacting downstream properties.
- 5. Existing driveways downstream of the development overtop as follows:

- Lowest portion of the driveway at section 1155 overtops at any of the discussed storm events. Maximum depth over the driveway lowest point is 0.43' in the existing conditions and 0.32' in the proposed conditions.

- Lowest portion of the driveway at section 1124.5 overtops at any of the discussed storm events. Maximum depth over the driveway lowest point is 0.50' in the existing conditions and 0.48' in the proposed conditions.

- Lowest portion of the driveway at section 816 overtops at any of the discussed storm events. Maximum depth over the driveway lowest point is 0.53' in the existing conditions and 0.52' in the proposed conditions.

- 6. The project proposes no increase in the peak flows in 3 drainage discharge direction with the following results.
- Northwest direction:

	Existing Peak Flow	Proposed Peak Flow
	(WS1.1E), cfs	(WS1.1P), cfs
100-year	2.7	1.5
10-year	1.5	0.8
2-year	0.7	0.4

- Southwest direction:

	Existing Peak Flow	Proposed Peak Flow
	(WS2.1E), cfs	(WS2.1P), cfs
100-year	8.6	7.2
10-year	4.9	4.6
2-year	2.4	2.4

- East direction:

	Existing Peak Flow	Proposed Peak Flow
	(PRE), cfs	(POST), cfs
100-year	11.0	8.8
10-year	6.2	4.6
2-year	3.0	2.9