Drainage Report for:

Blossom Ridge

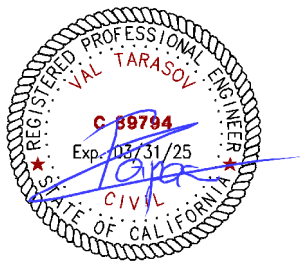
APN: 223-0091-002

Prepared by CNA Engineering Inc.

Vertical Datum NAVD 88

(Conversion factor to NGVD 29 = -2.549'

Per VertCon for BM #15-61)



DATE: 02-21-2023

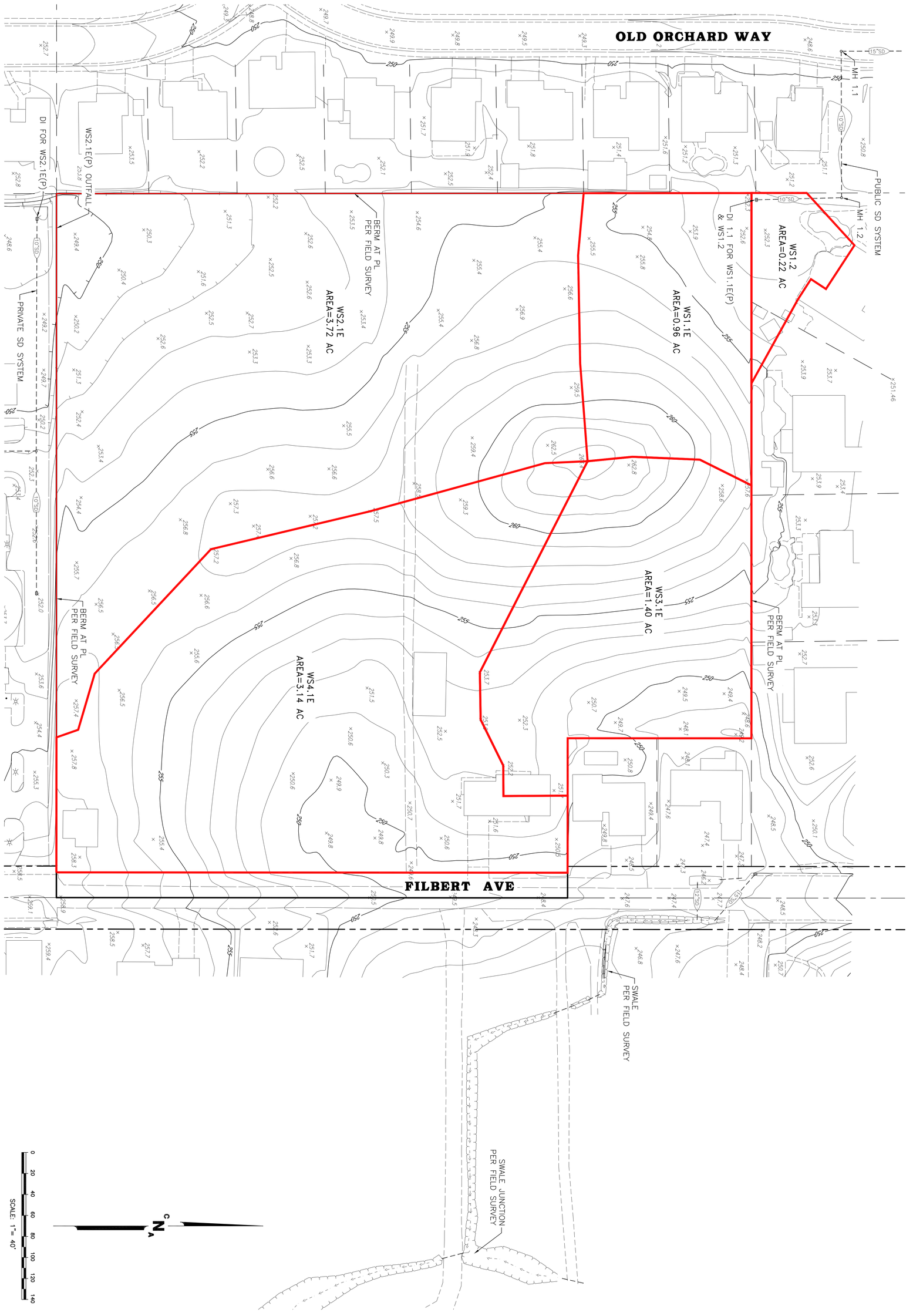
Introduction and background

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:

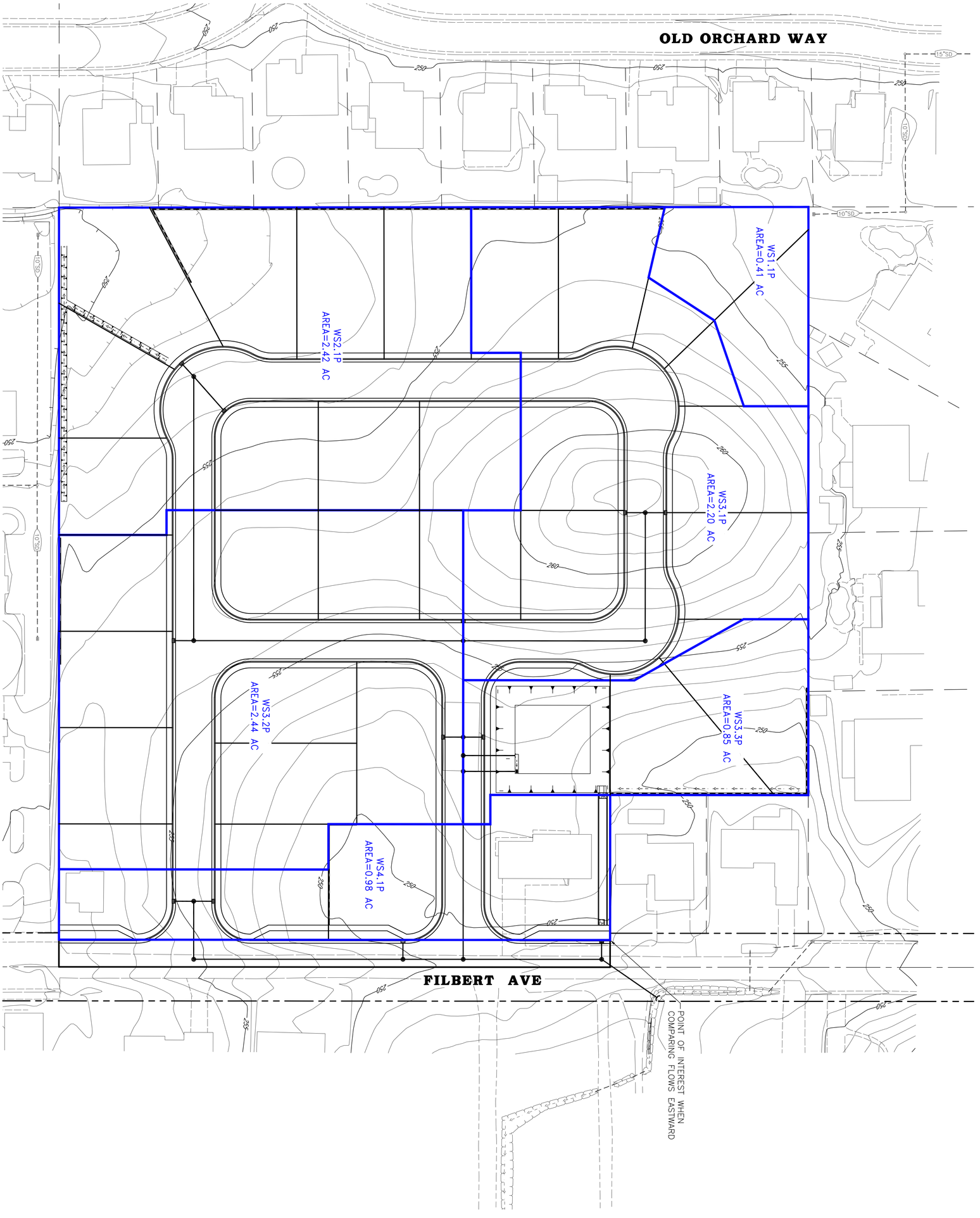
- 100-, 10- and 2-year post-development peak control to the pre- development level;
- Design public pipe system;
- Preliminary design Low Impact Development facilities.



SHEET X OF X SHEETS	DATE: 2/21/2023	**PRE-WATERSHED ON-SITE MAP FOR:** **BLOSSOM RIDGE** COUNTY OF SACRAMENTO STATE OF CALIFORNIA	SCALE: HORIZ.: 1"= 40' VERT.: N/A FLD BK.: N/A ASSESSOR'S PARCEL NO.: 223-0091-002
	FN.: 19144_11.DWG		PREPARED BY: DRAFTED BY: VAL T. DESIGNED BY: STEVE N. CHECKED BY: CHRIS O.

CNA ENGINEERING INC.
CIVIL ENGINEERING: LAND SURVEYING
PLANNING: STRUCTURAL DESIGN
PHONE: (916) 485-3746
2575 VALLEY ROAD
SACRAMENTO, CA 95821
cnaeng.com

REVISIONS	NO.	DESCRIPTION	APPROVED BY	DATE
	1			
	2			
	3			
	4			



SCALE: 1"= 40'

0 20 40 60 80 100 120 140

N

SHEET X OF X SHEETS

FN: 19144_T1.DWG

DATE: 2/21/2023

POST-WATERSHED ON-SITE MAP FOR:

BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

SCALE	PREPARED BY
HORIZ.: 1"= 40'	DRAFTED BY: VAL T.
VERT.: N/A	DESIGNED BY: STEVE N.
FLD BK.: N/A	CHECKED BY: CHRIS O.
ASSESSOR'S PARCEL NO.: 223-0091-002	

CNA ENGINEERING INC.

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REVISIONS

NO.	DESCRIPTION	APPROVED BY	DATE
1			
2			
3			
4			

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 post-development 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%;

Hydrologic Soils group B per USDA GIS Map.

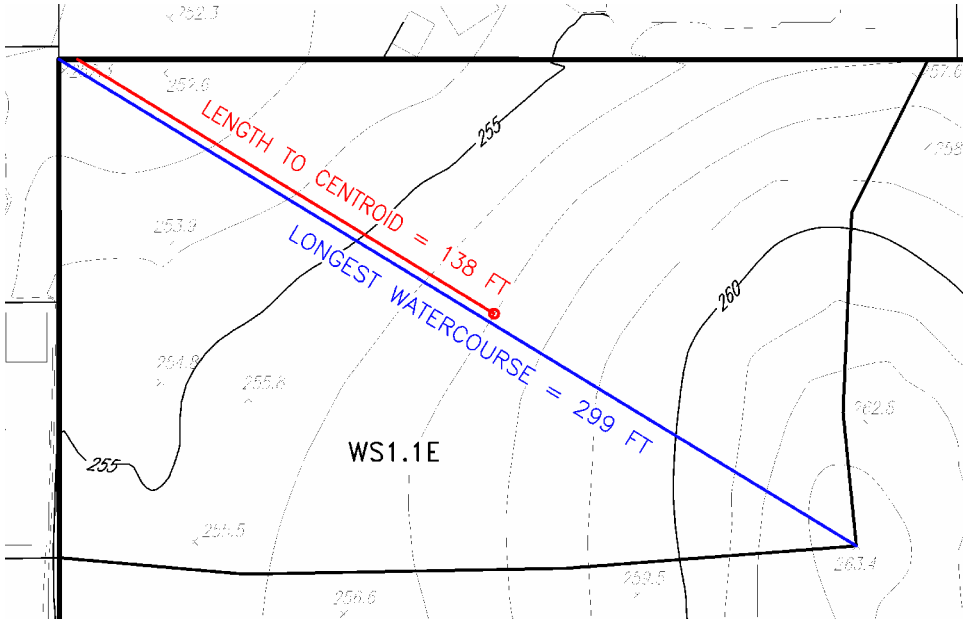


Figure 1 – WS1.1E Lengths.

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.

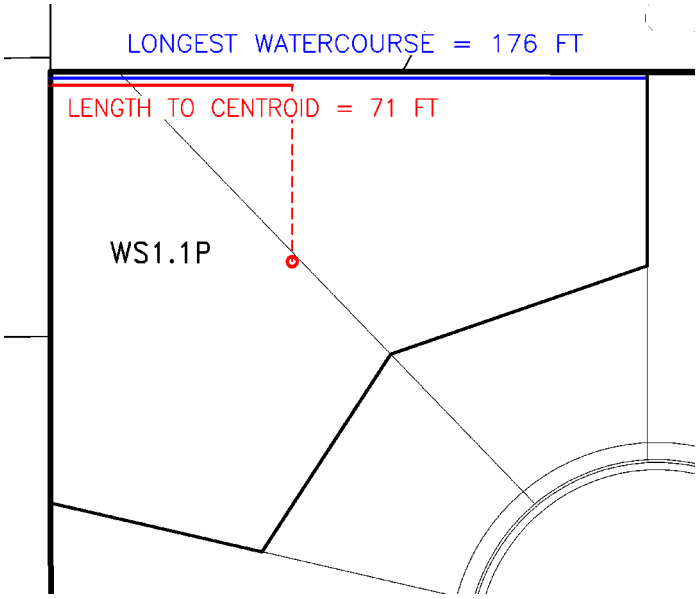


Figure 2 – WS1.1P Lengths.

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.

Sacramento method results
(Project: Blossom Ridge)
(100-year, 1-day rainfall)

ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
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)

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	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.

Nolte method results
(Project: 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

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).

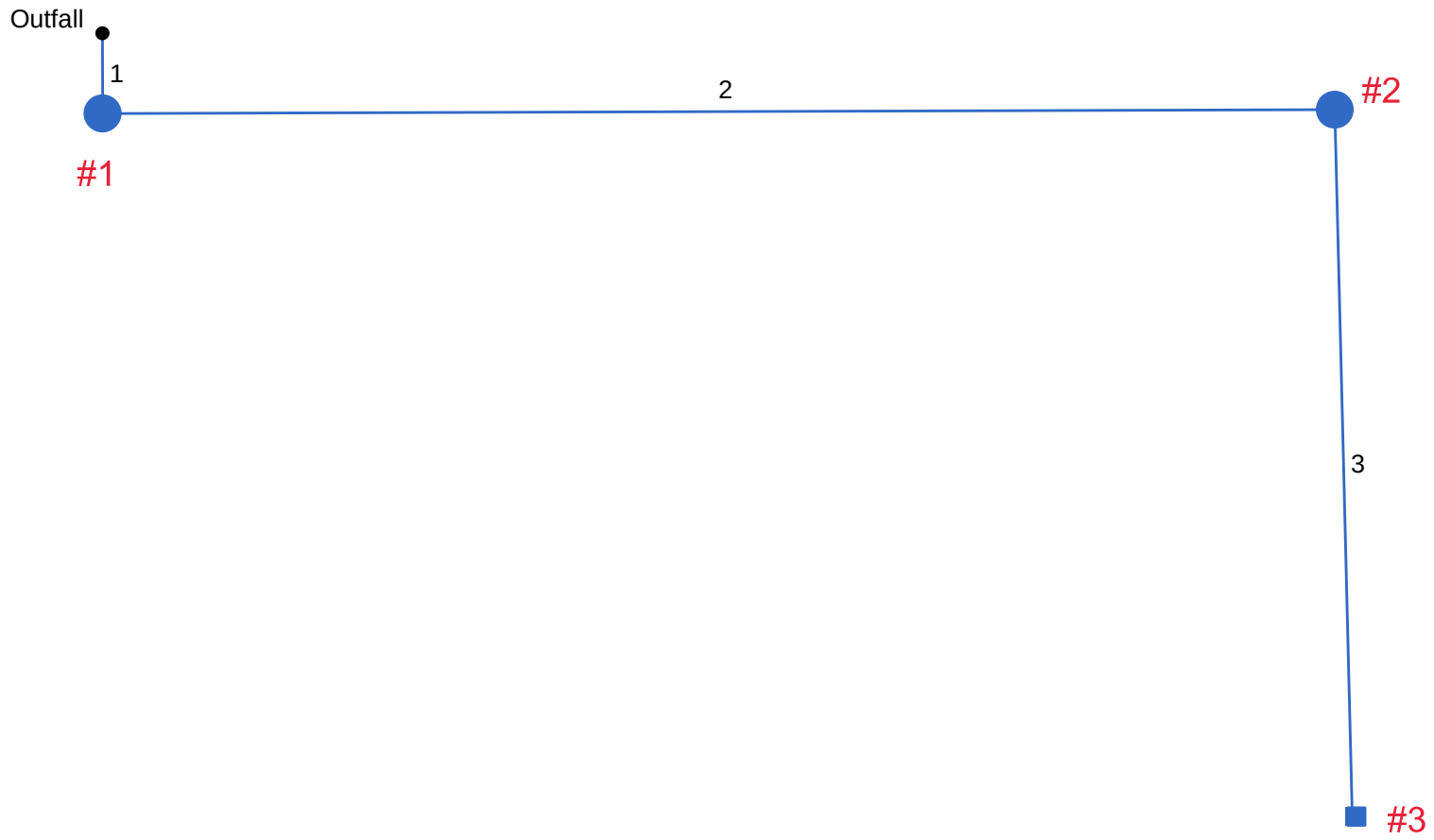
Pipes and nodes information is as follows (refer to the WS Map above). Existing SD facilities have been surveyed:

Structure #	*Structure ID*	*Rim Elevation*	*Invert (FL)*	*Pipe size and material (downstream)*	*Slope downstream*	*n-value*
1	MH 1.1	248.50	244.30 (out)	15", PVC	0.0100 (assumed)	0.015
2	MH 1.2	249.72	246.98 (out)	10", PVC	0.0192	0.015
3	DI 1.1 (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



Project File: North Pipe System_Proposed Flows.stm	Number of lines: 3	Date: 10-29-2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	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	MH	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 File: North Pipe System_Proposed Flows.stm | Number of lines: 3 | Date: 10-29-2020

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev. (ft)	Structure			Line Out			Line In		
				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 File: North Pipe System_Proposed Flows.stm | Number of Structures: 3 | Run Date: 10-29-2020

Storm Sewer Summary Report

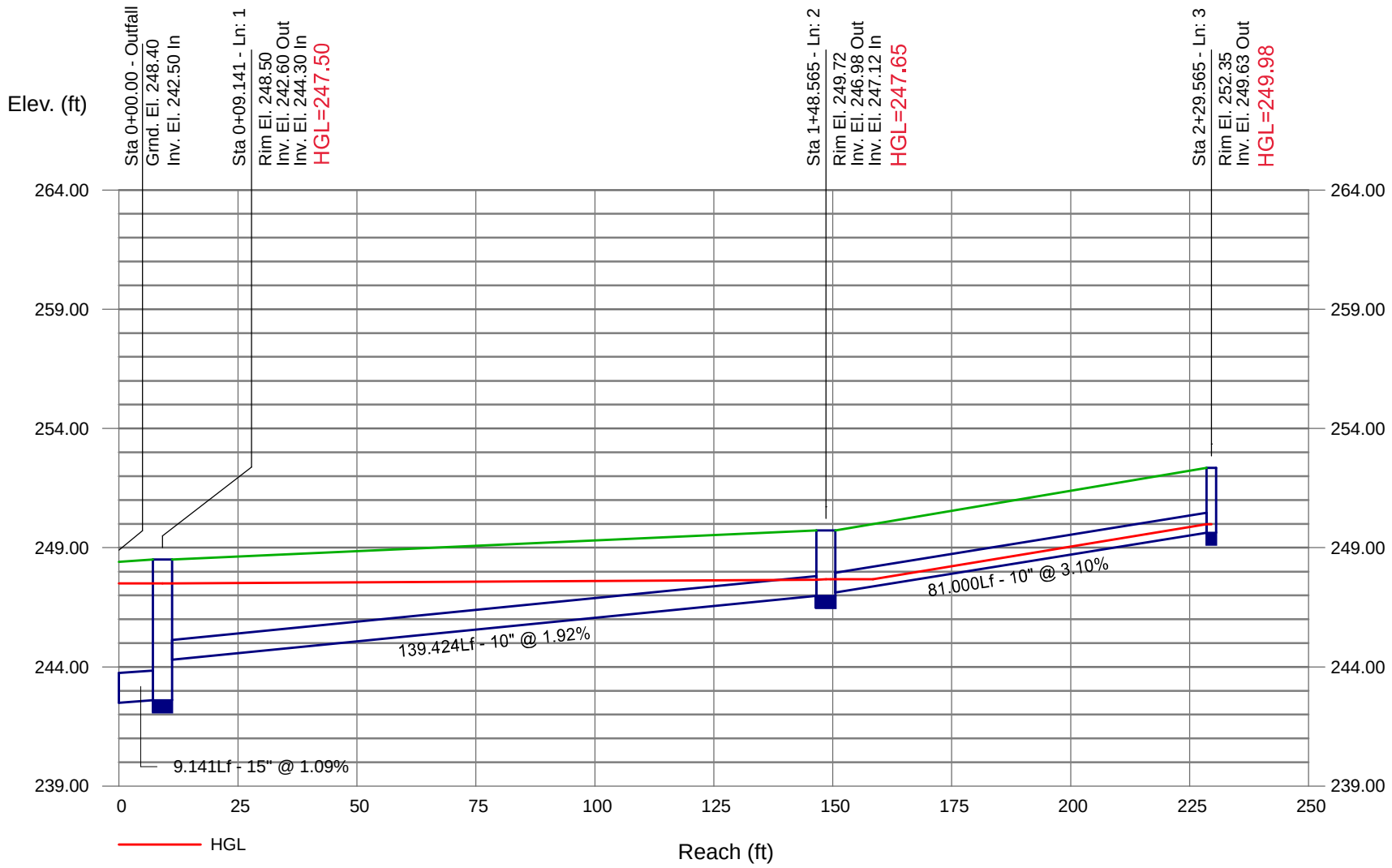
Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.	Junction Type
1		0.63	15	Cir	9.141	242.50	242.60	1.094	247.50*	247.50*	0.00	247.51	End	Manhole
2		0.63	10	Cir	139.424	244.30	246.98	1.922	247.51	247.65	0.03	247.68	1	Manhole
3		0.63	10	Cir	81.000	247.12	249.63	3.099	247.68	249.98	n/a	249.98 j	2	DropGrate

Project File: North Pipe System_Proposed Flows.stm | Number of lines: 3 | Run Date: 10-29-2020

NOTES: Known Qs only ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Profile

Proj. file: North Pipe System_Proposed Flows.stm



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%;

Hydrologic Soils group B per USDA GIS Map.

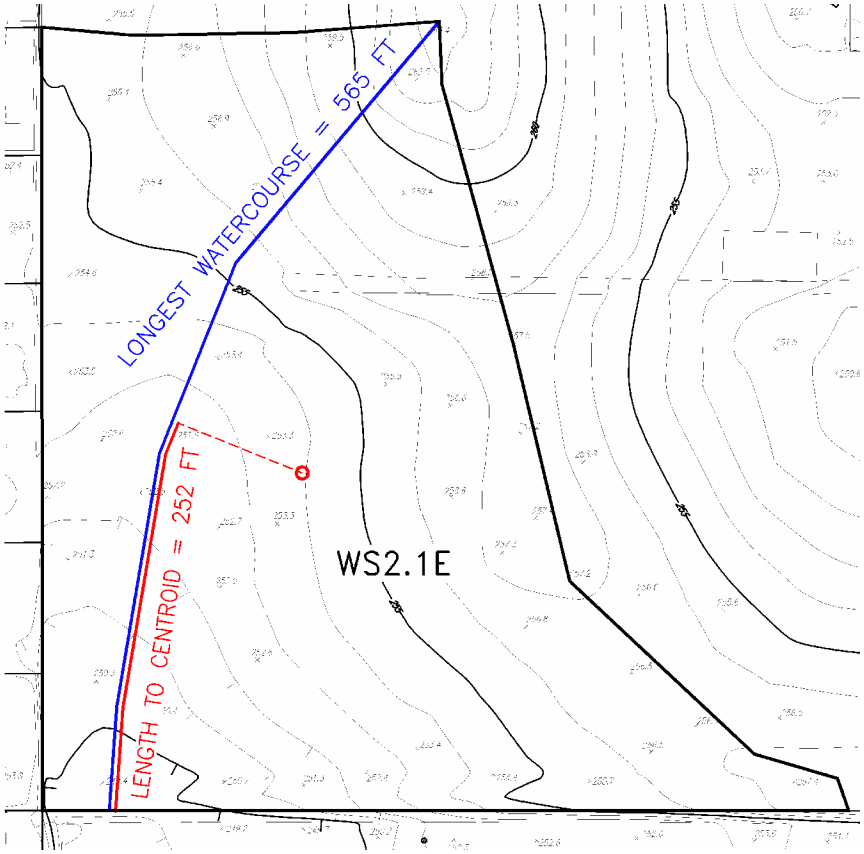


Figure 5 – WS2.1E Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

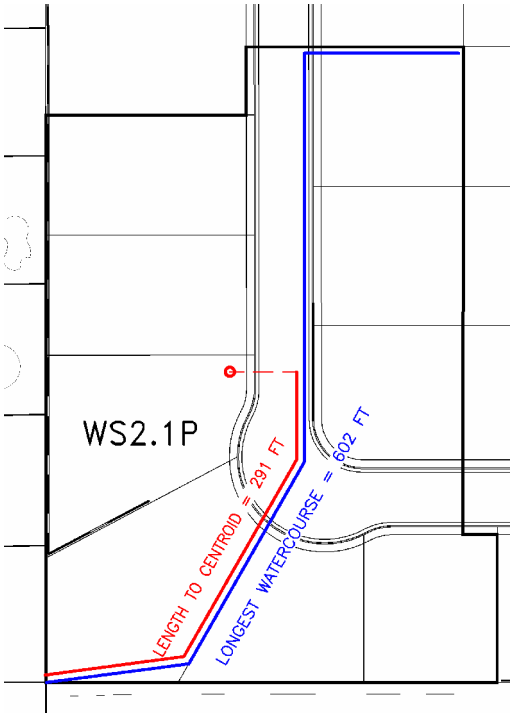


Figure 6 – WS2.1P Lengths.

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 post-development 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%;

Hydrologic Soils group B per USDA GIS Map.

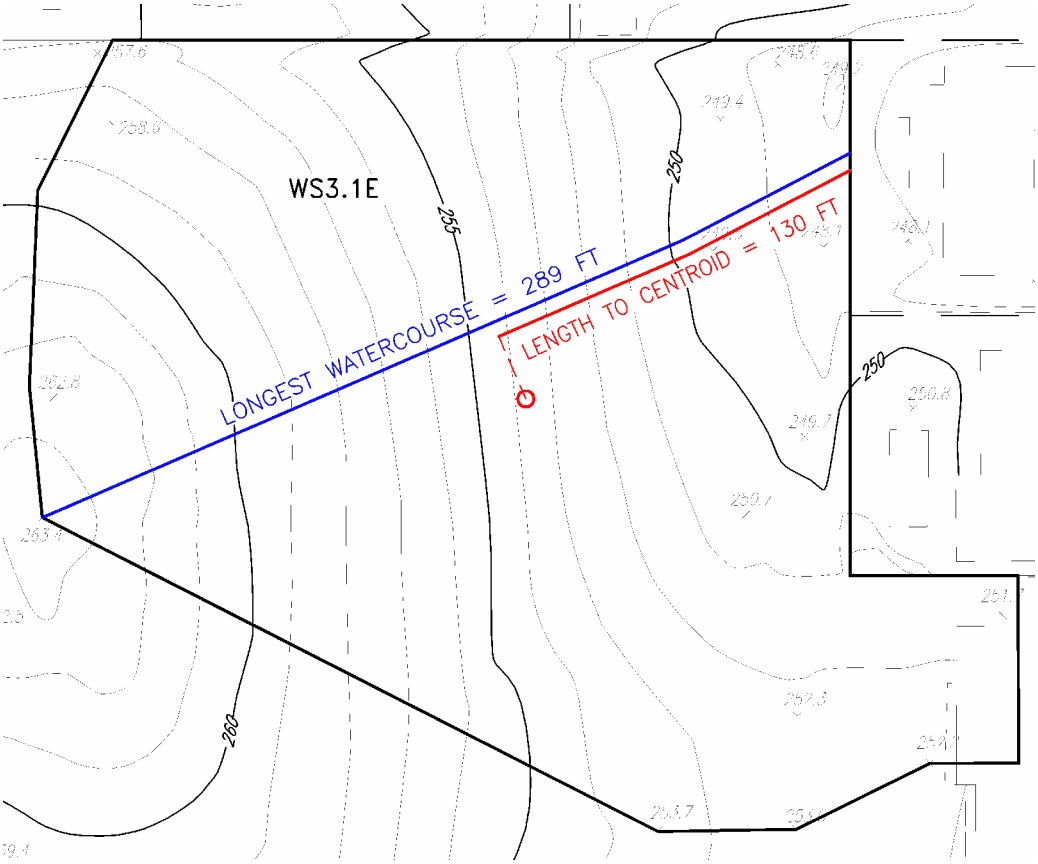


Figure 7 – WS3.1E Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

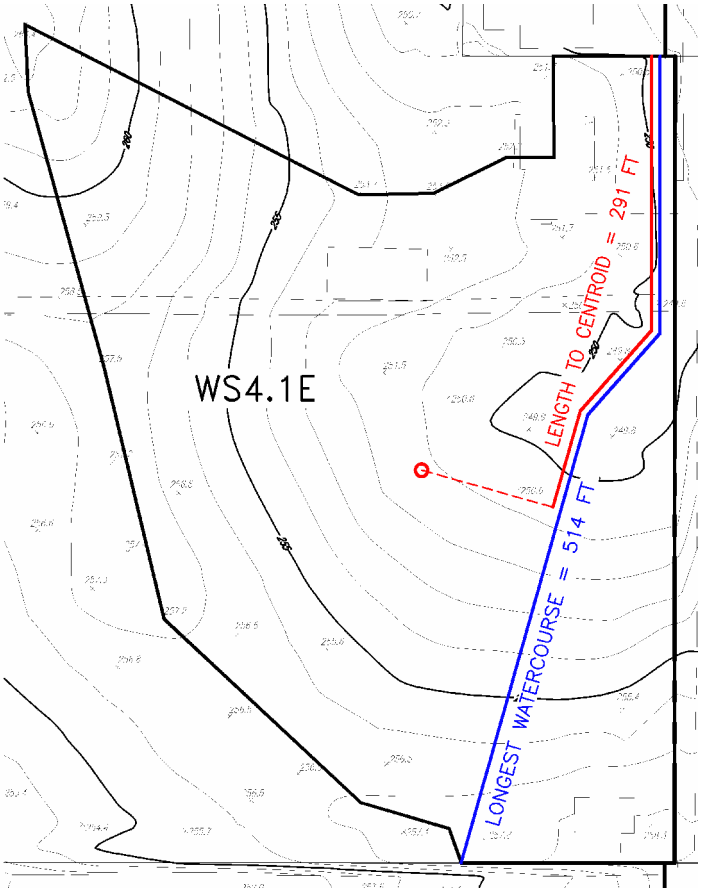


Figure 8 – WS4.1E Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

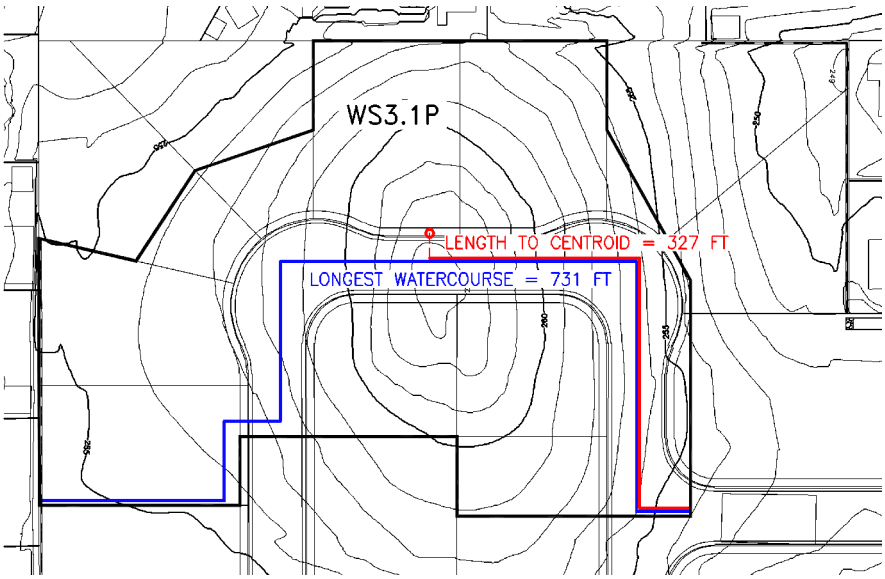


Figure 9 – WS3.1P Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

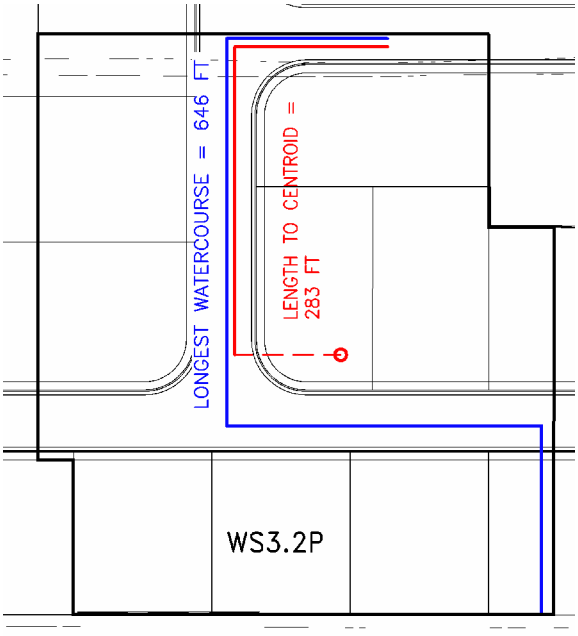


Figure 10 – WS3.2P Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

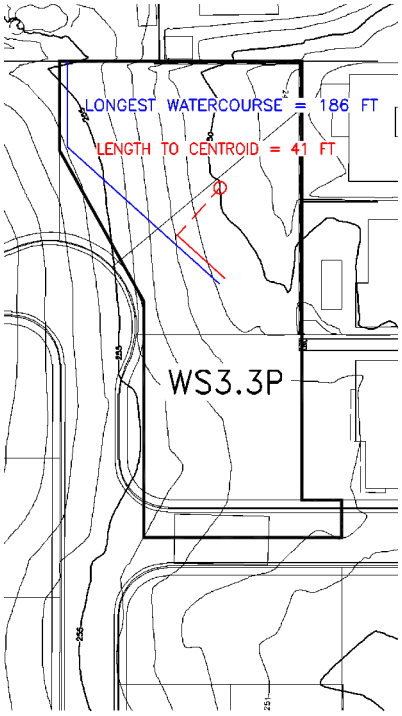


Figure 11 – WS3.3P Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

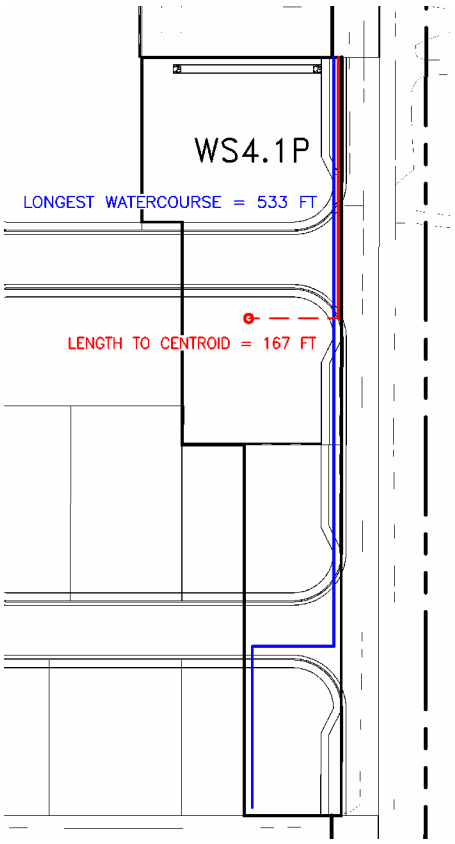


Figure 12 – WS4.1P Lengths.

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. Sunday, Dec 26 2021

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

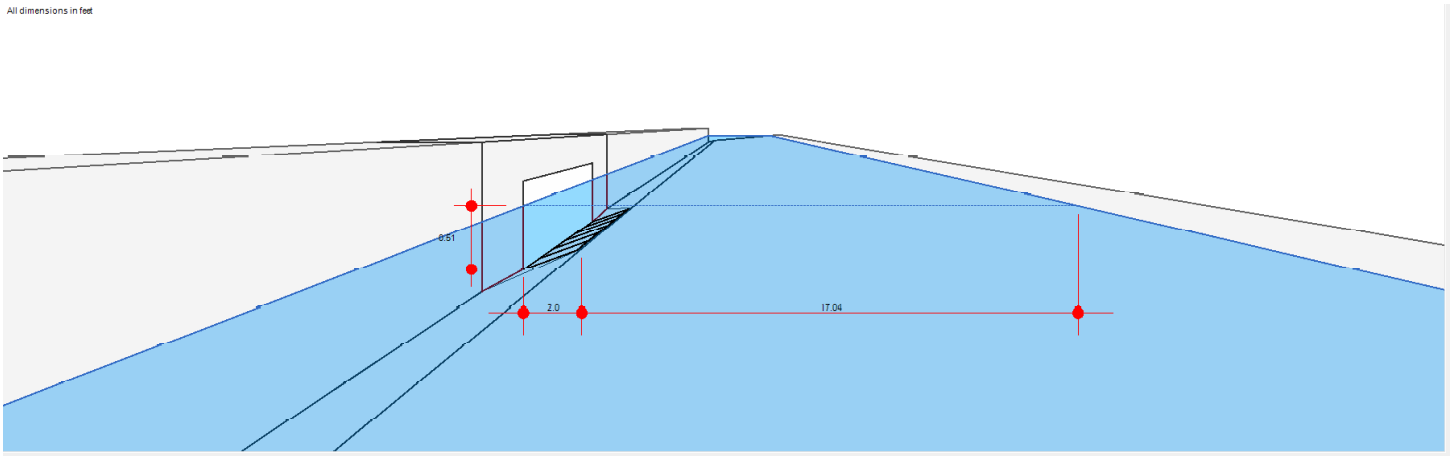
Slope, Sw (ft/ft)	= 0.062
Slope, Sx (ft/ft)	= 0.020
Local Depr (in)	= 0.49
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

Compute by:	Q vs Depth
Max Depth (in)	= 6

Highlighted

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

Lot 1 Overland Release

Rectangular

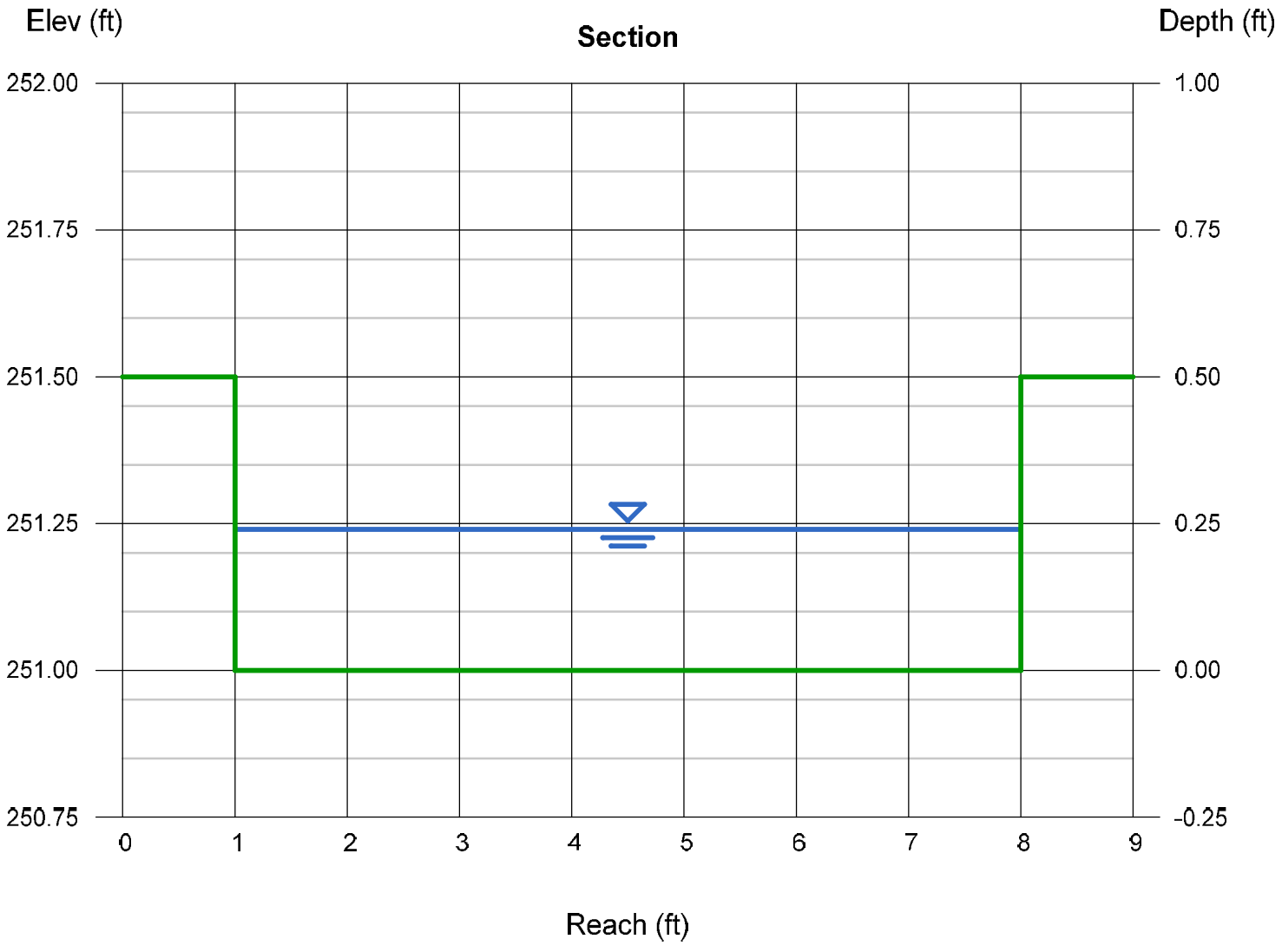
Bottom Width (ft)	= 7.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 251.00
Slope (%)	= 2.00
N-Value	= 0.016

Calculations

Compute by:	Known Q
Known Q (cfs)	= 8.00

Highlighted

Depth (ft)	= 0.24
Q (cfs)	= 8.000
Area (sqft)	= 1.68
Velocity (ft/s)	= 4.76
Wetted Perim (ft)	= 7.48
Crit Depth, Yc (ft)	= 0.35
Top Width (ft)	= 7.00
EGL (ft)	= 0.59



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Feb 2 2022

Lot 13 OR

Triangular

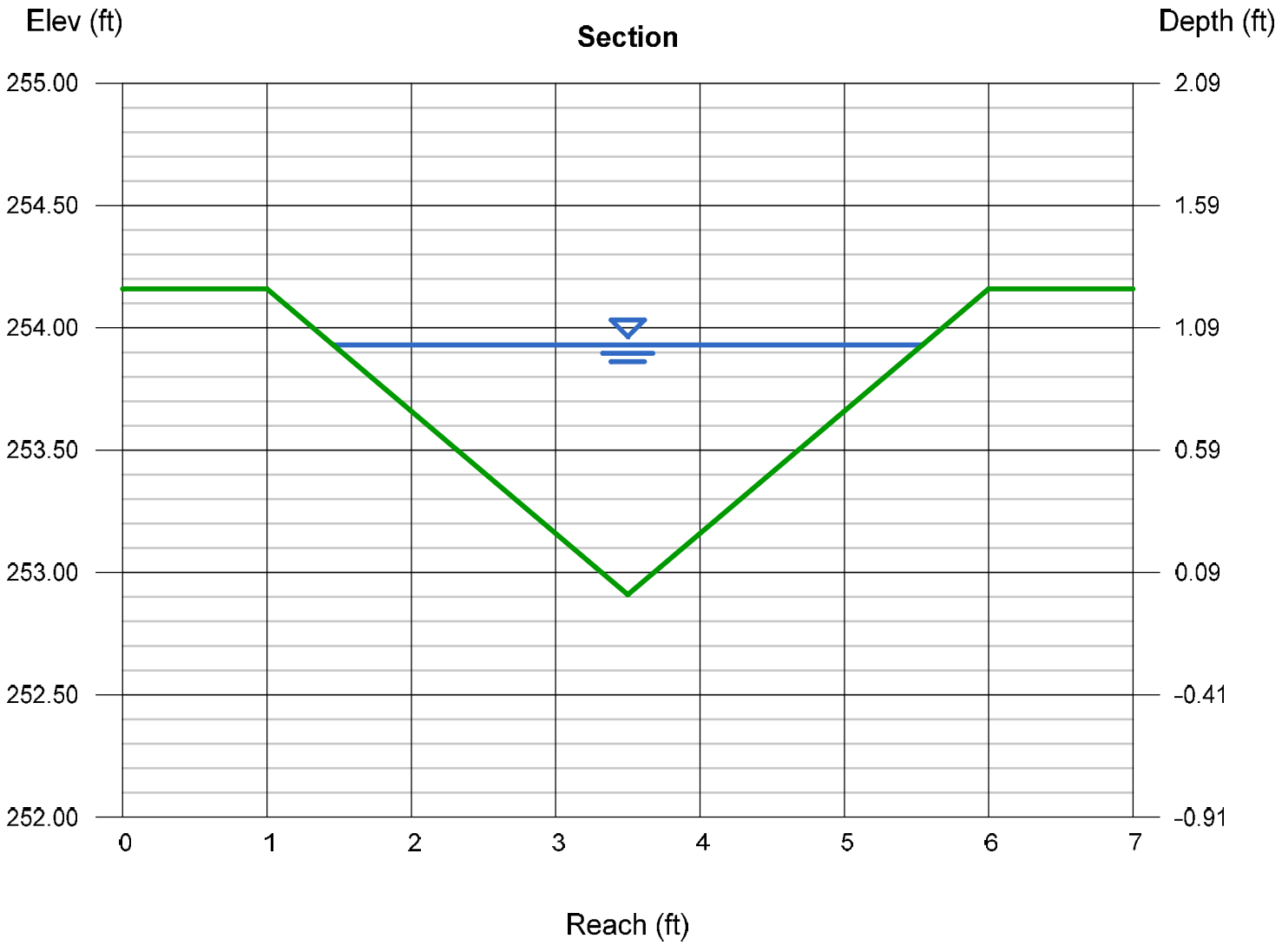
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.25
Invert Elev (ft)	= 252.91
Slope (%)	= 2.50
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.20

Highlighted

Depth (ft)	= 1.02
Q (cfs)	= 7.200
Area (sqft)	= 2.08
Velocity (ft/s)	= 3.46
Wetted Perim (ft)	= 4.56
Crit Depth, Yc (ft)	= 0.96
Top Width (ft)	= 4.08
EGL (ft)	= 1.21



3.5 Downstream Analysis

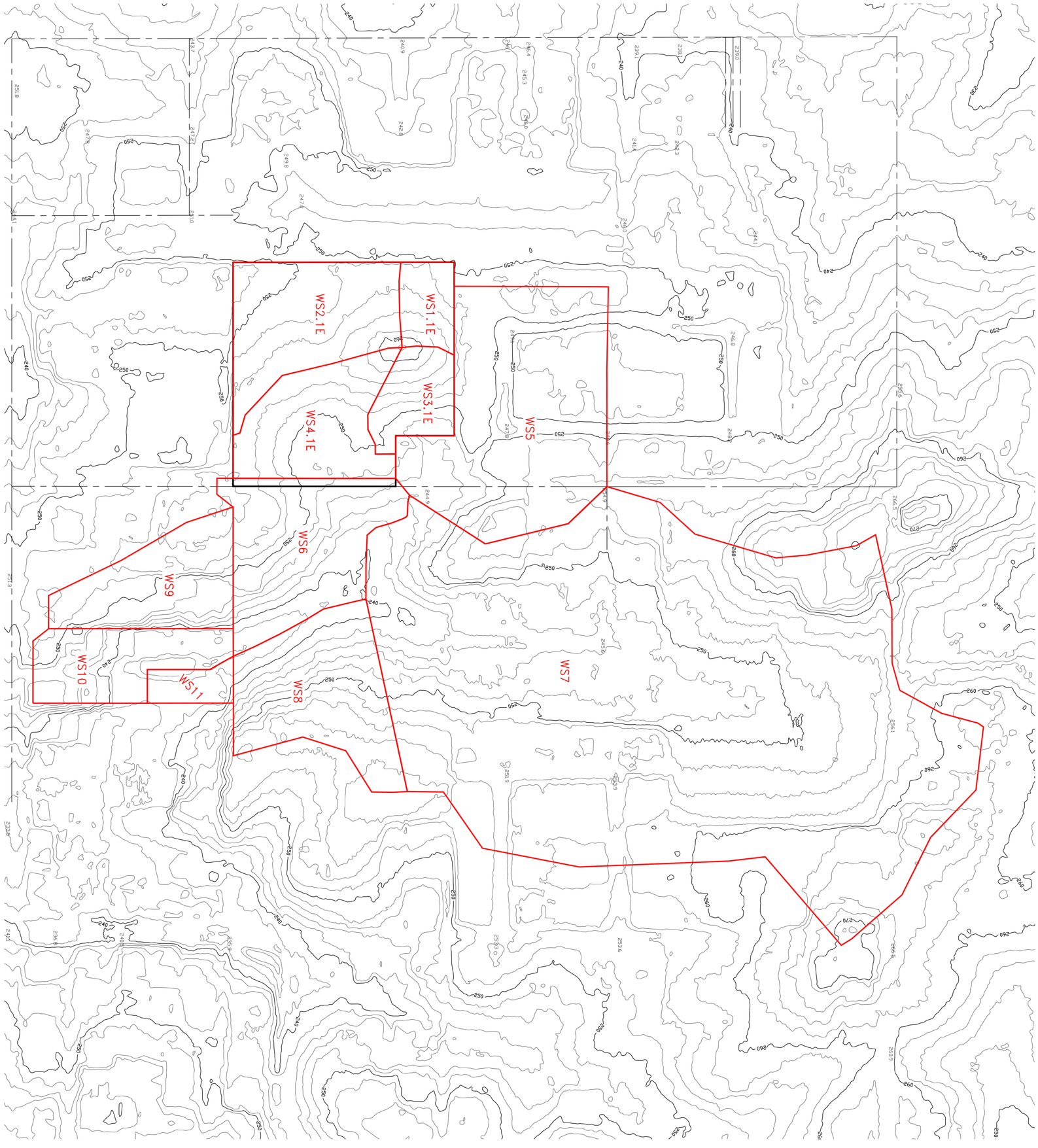
In order to evaluate the effect of the development downstream of the project Hec-Ras analysis has been performed. The goal of this analysis is to analyze the impact of the proposed development on the existing downstream developments and make sure that no adverse effect appear due to the development.

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.



SCALE: 1" = 140'

0 70 140 210 280 350 420 490

N

SHEET X OF X SHEETS	FN:NAD 27 GRID.DWG	DATE: 2/2/2022	

EXISTING WATERSHED MAP:

BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

SCALE	PREPARED BY
HORIZ.: 1"= 140'	DRAFTED BY: VAL T.
VERT.: N/A	DESIGNED BY: STEVE N.
FLD BK.: N/A	CHECKED BY: CHRIS O.
ASSESSOR'S PARCEL NO.: 223-0091-002	

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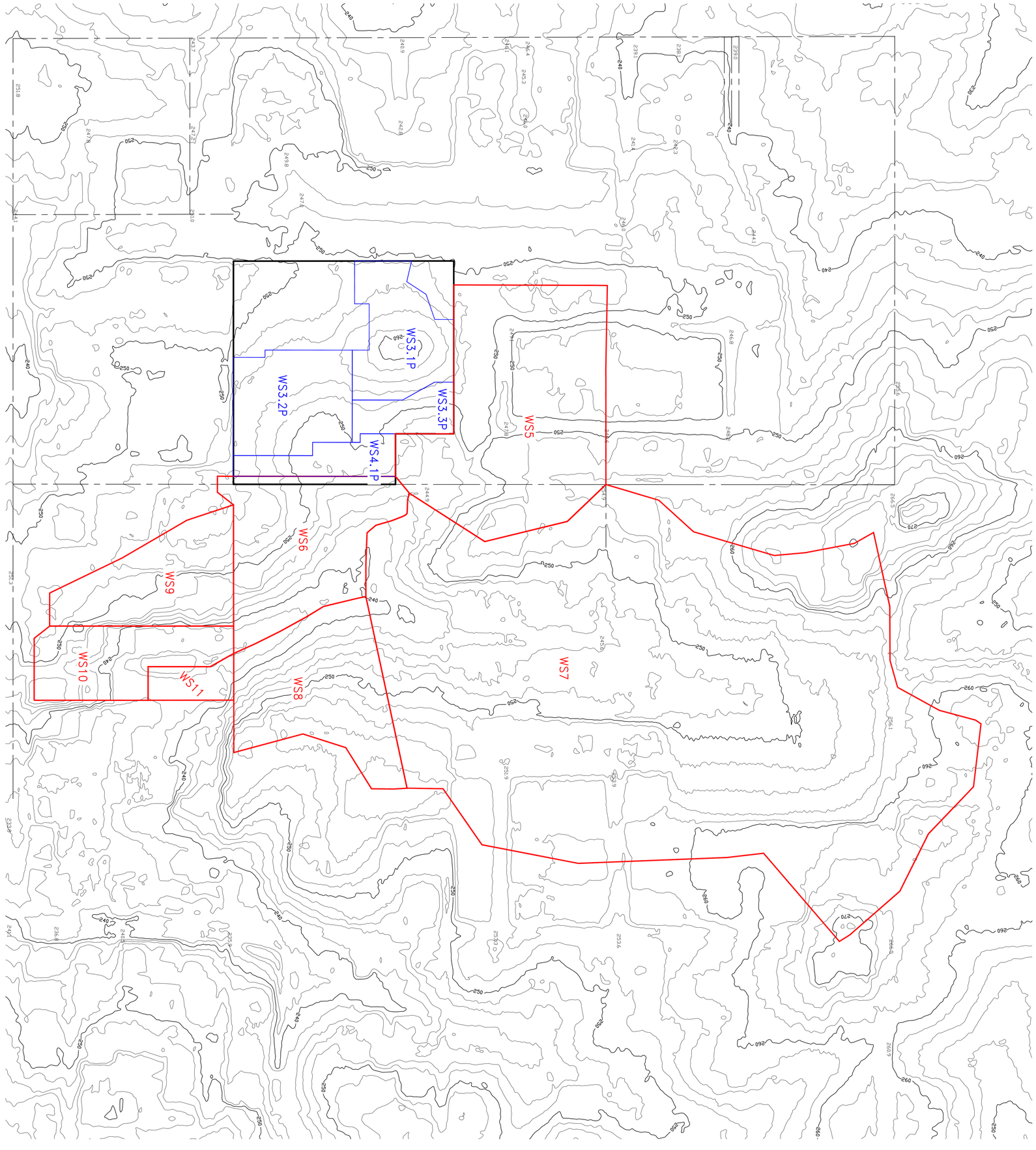

SCALE: 1" = 140'

0 70 140 210 280 350 420 490

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SHEET X OF X SHEETS

FN:NAD 27 GRID DWG

DATE: 2/2/2022

PROPOSED WATERSHED MAP:

BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

SCALE	PREPARED BY
HORIZ.: 1"= 140'	DRAFTED BY: VAL T.
VERT.: N/A	DESIGNED BY: STEVE N.
FLD BK.: N/A	CHECKED BY: CHRIS O.
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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%;

Hydrologic Soils group B per USDA GIS Map.

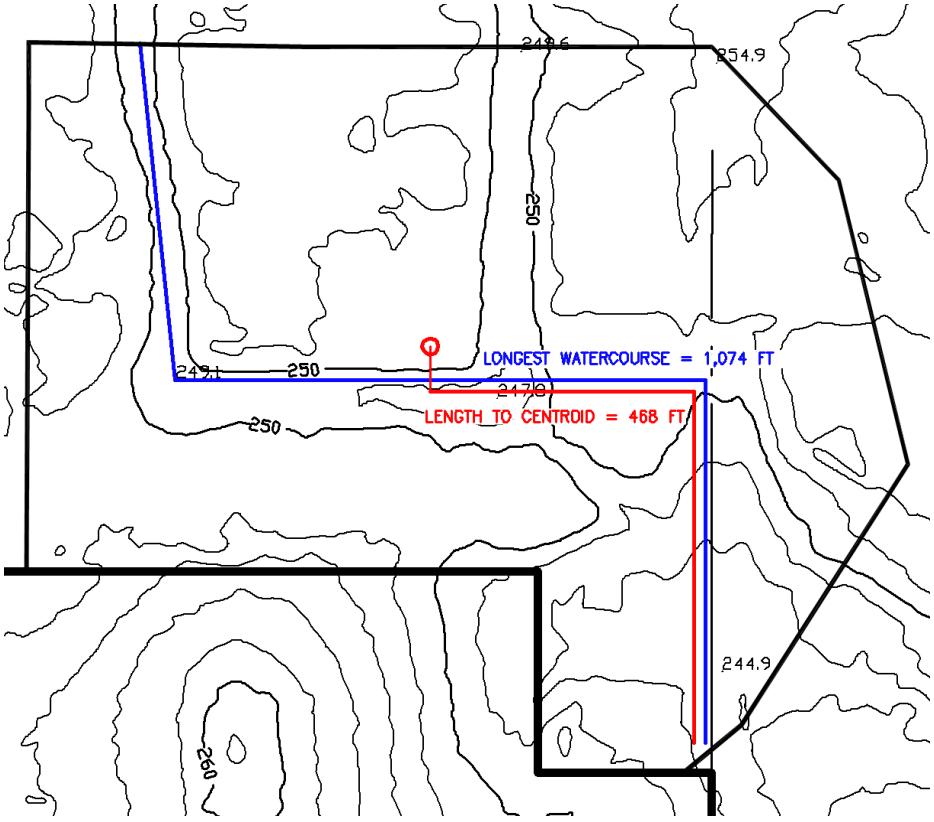


Figure 13 – WS5 Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

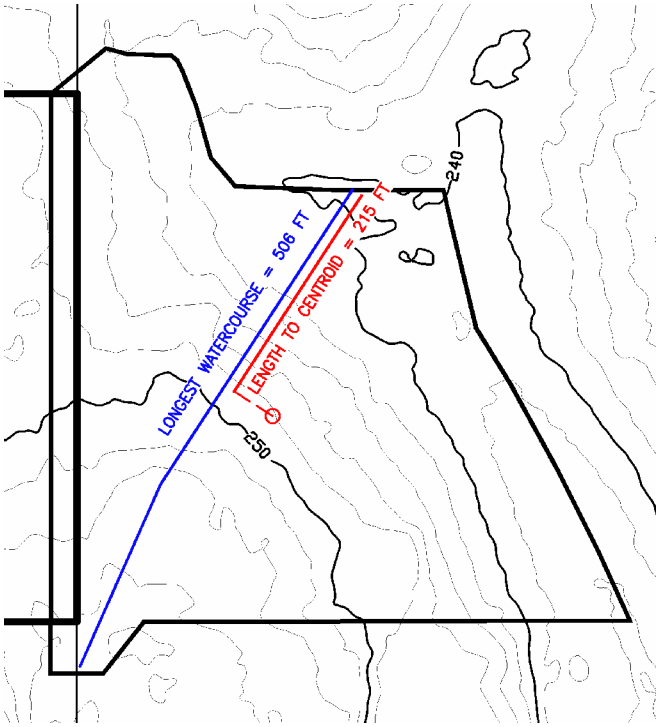


Figure 14 – WS6 Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

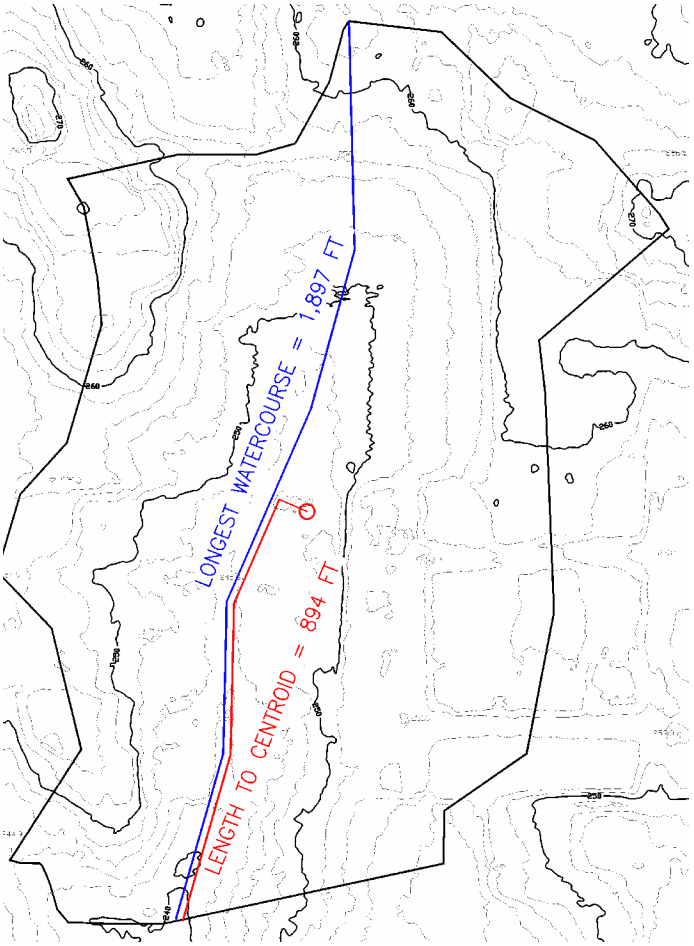


Figure 15 – WS7 Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

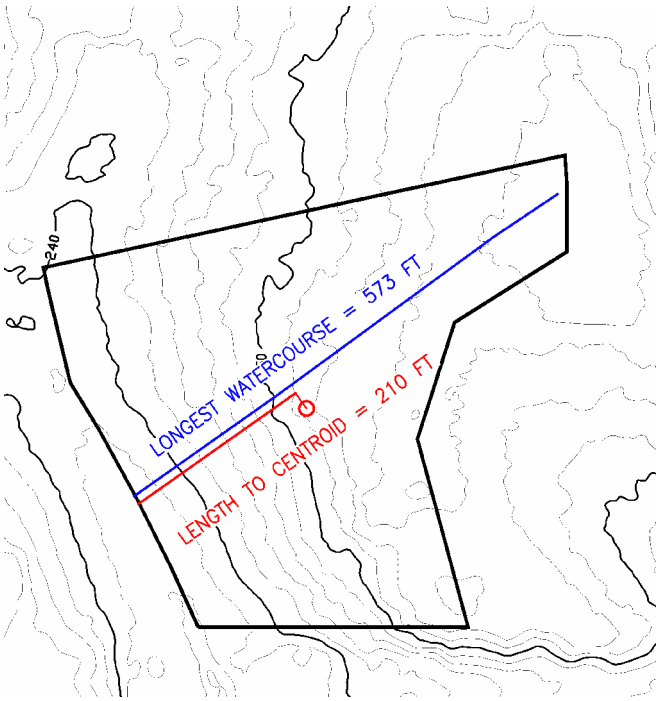


Figure 16 – WS8 Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

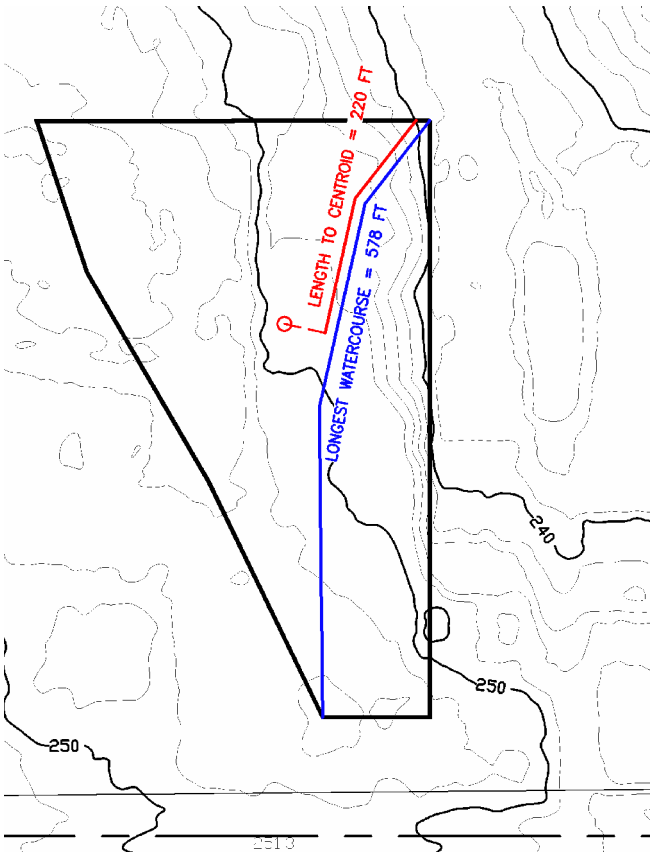


Figure 17 – WS9 Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

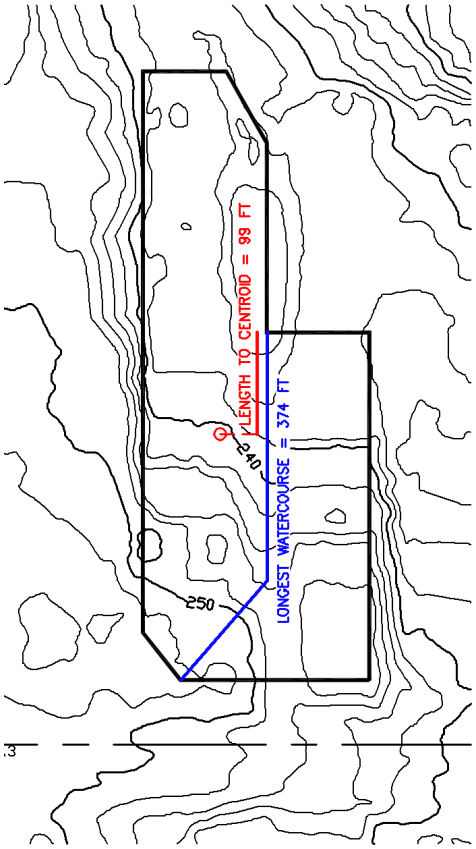


Figure 18 – WS10 Lengths.

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%;

Hydrologic Soils group B per USDA GIS Map.

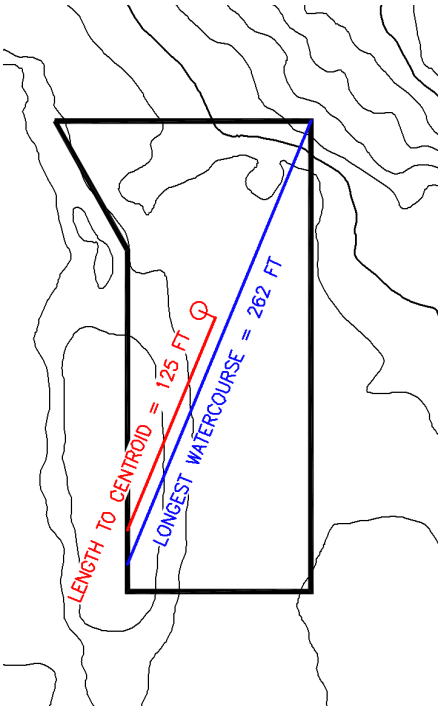


Figure 19 – WS11 Lengths.

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 / Section	100-year (pre.)	100-year (post.)	10-year (pre.)	10-year (post.)	2-year (pre.)	2-year (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.

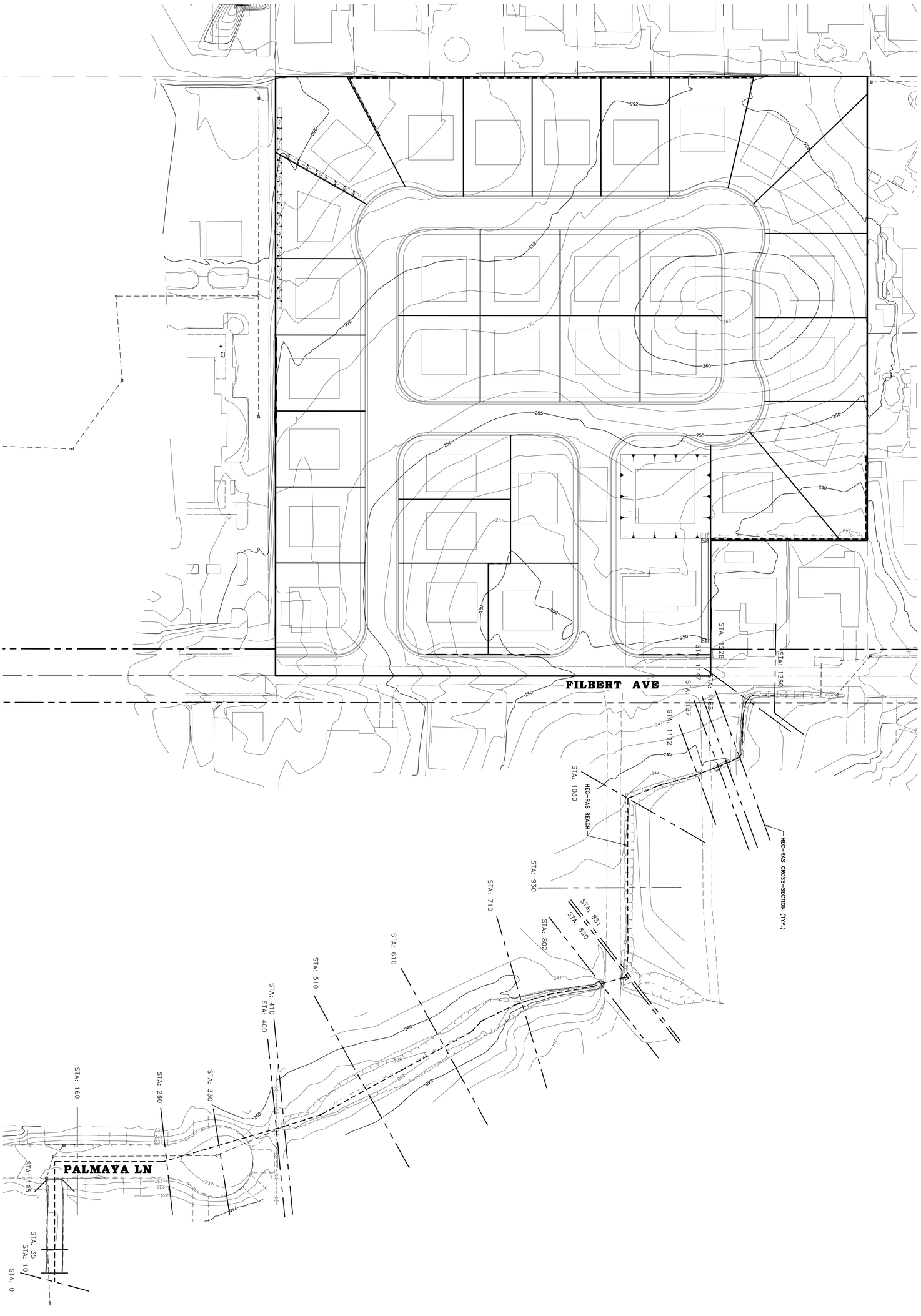
Offsite easements will not be required since the pipe outfall and appurtances, as discussed further, are located within the public Right-of-Way. Existing ditch downstream does not need to be engineered to convey design flows. This was communicated in the email with DWR on 12/8/2020.

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.



SHEET X OF X SHEETS

FN: 19144_T1.DWG

DATE: 2/21/2023

HEC-RAS PLAN FOR:

BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

SCALE	PREPARED BY
HORIZ.: 1"=50'	DRAFTED BY: VAL T.
VERT.: N/A	DESIGNED BY: STEVE N.
FLD BK.: N/A	CHECKED BY: CHRIS O.
ASSESSOR'S PARCEL NO.: 223-0091-002	

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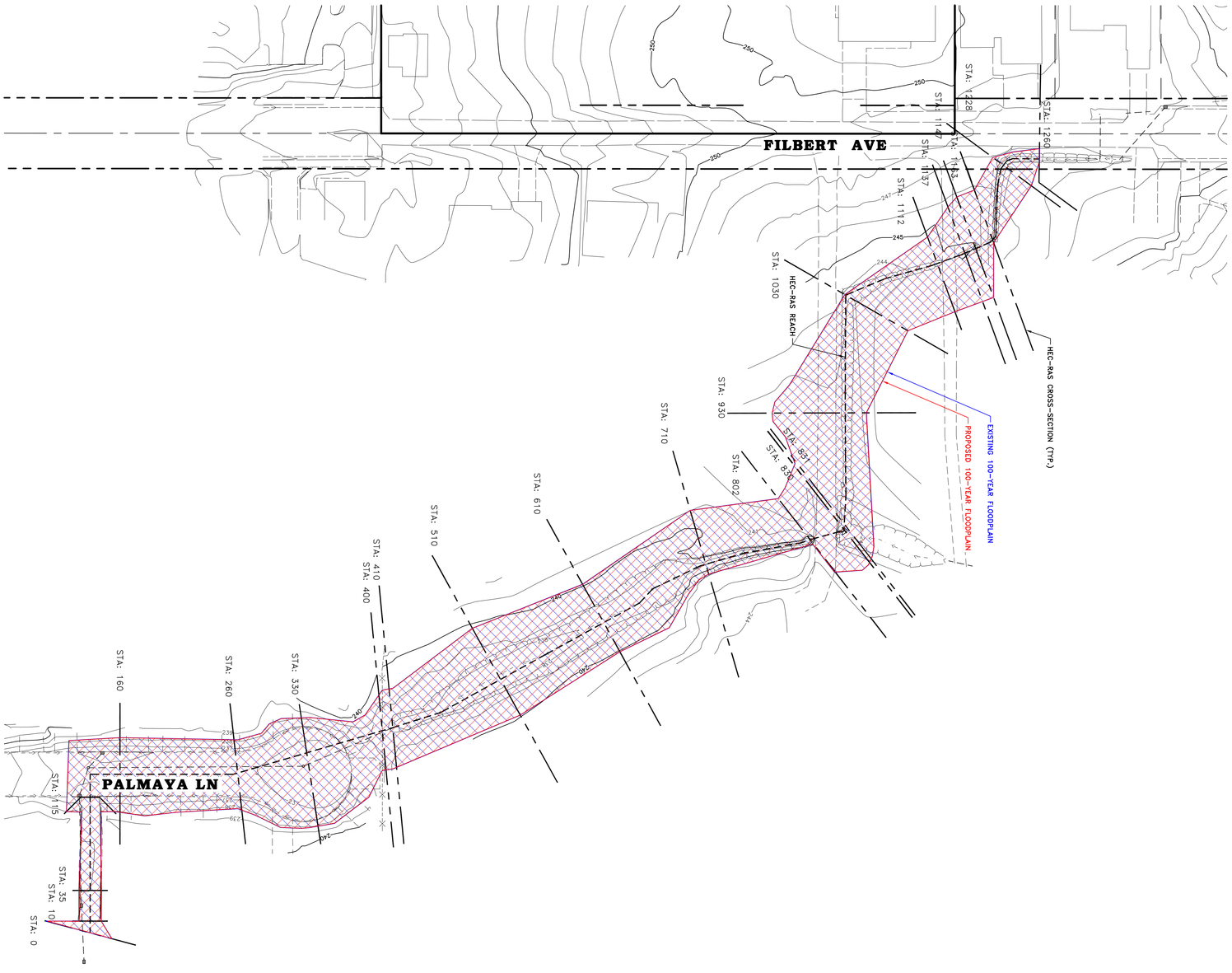

NOTE:

WHERE THE SURFACE ELEVATION DIFFERENCES ARE TOO SMALL TO BE PLOTTED ON THIS MAP, REFER TO THE SUMMARY TABLES COMPARING WATER SURFACE ELEVATIONS IN THE REPORT

EXISTING AND PROPOSED 100-YEAR FLOODPLAIN FOR: BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

SCALE	PREPARED BY
HORIZ.: 1"=50'	DRAFTED BY: VAL T.
VERT.: N/A	DESIGNED BY: STEVE N.
FLD BK.: N/A	CHECKED BY: CHRIS O.
ASSESSOR'S PARCEL NO.: 223-0091-002	

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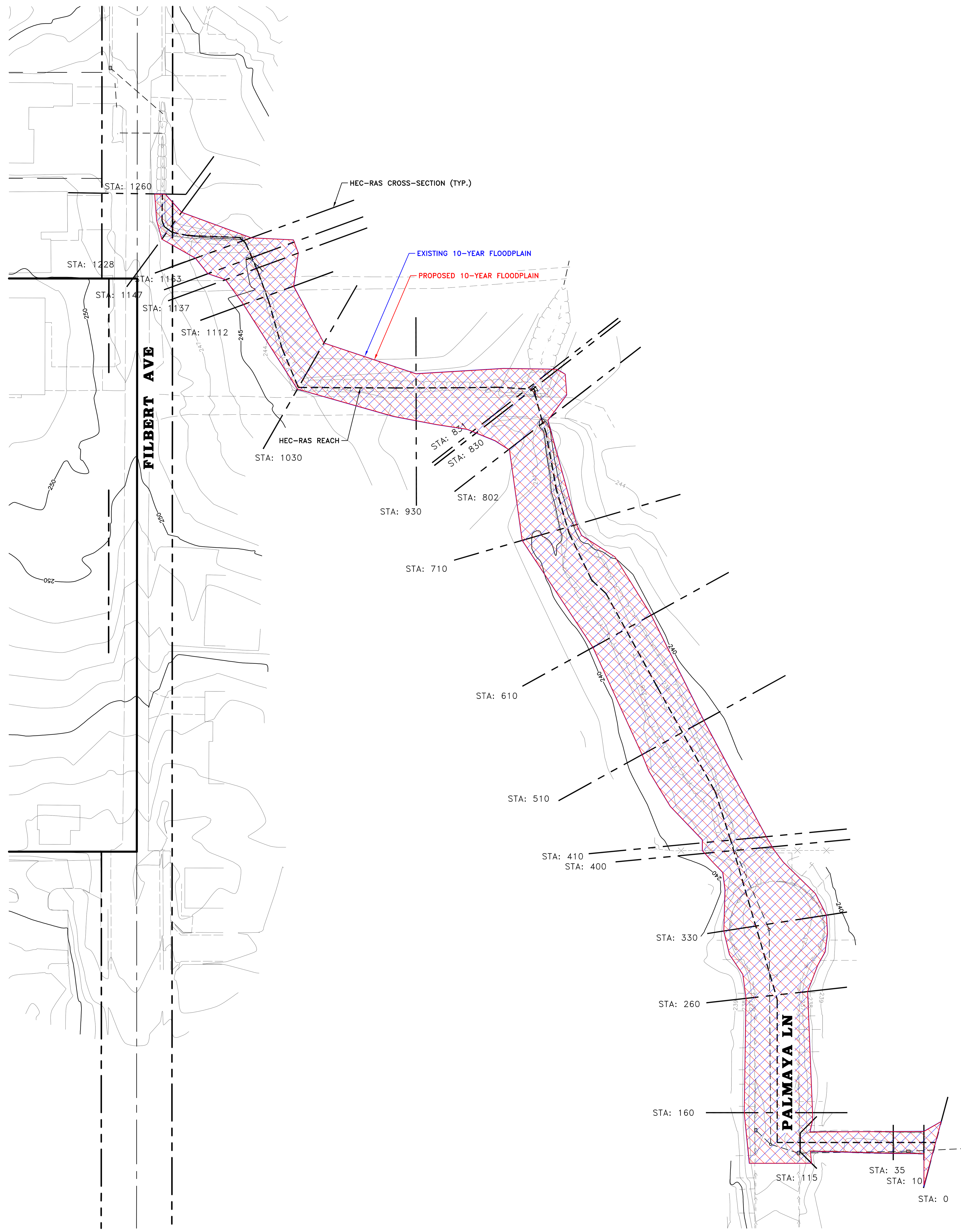
DATE: 2/21/2023



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.

NO.	DESCRIPTION	APPROVED BY	DATE
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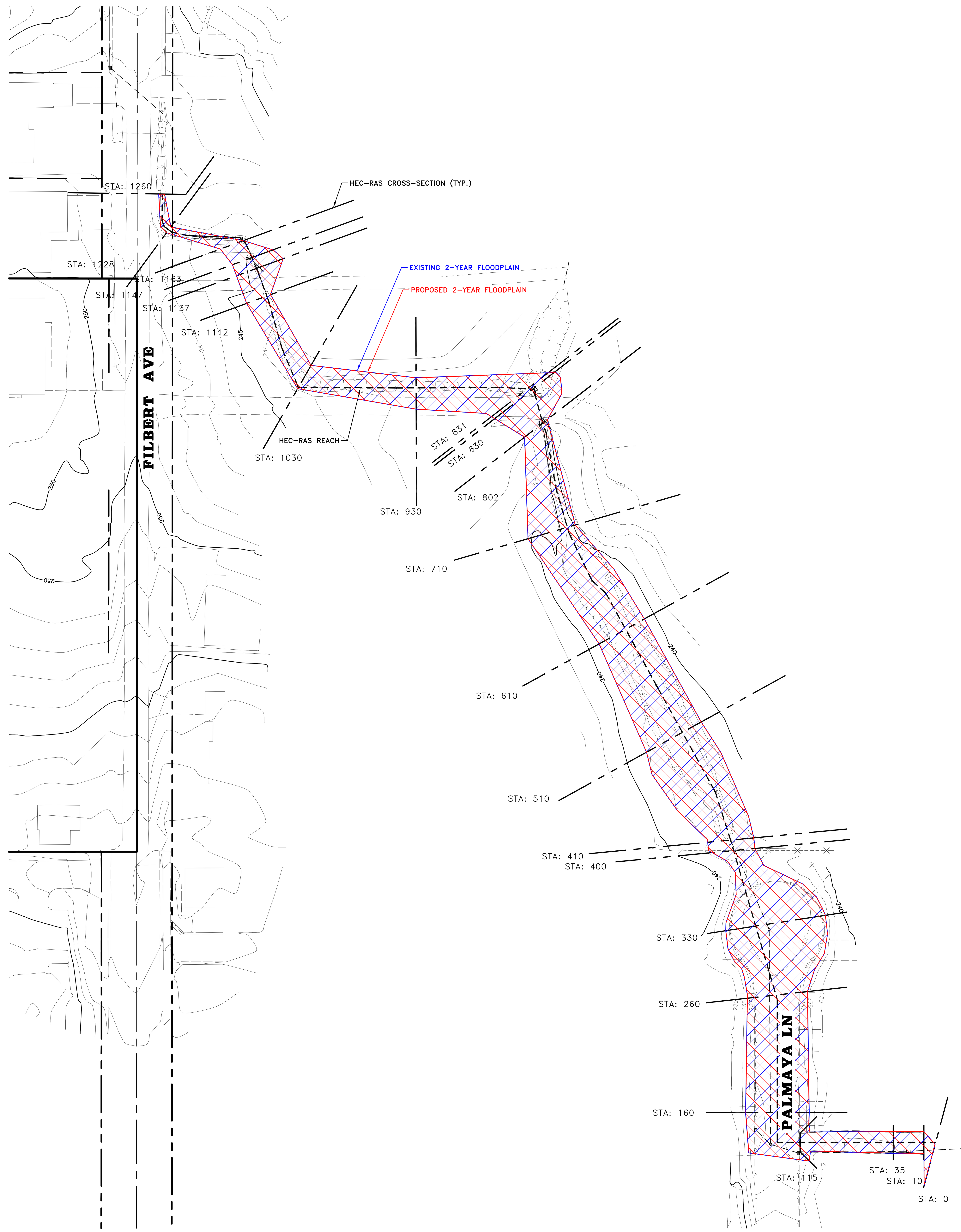
PREPARED BY
DRAFTED BY: VAL T.
DESIGNED BY: STEVE N.
CHECKED BY: CHRIS O.

SCALE
HORIZ.: 1"=50'
VERT.: N/A
FLD BK.: N/A
ASSESSOR'S PARCEL NO.: 223-0091-002

EXISTING AND PROPOSED 10-YEAR FLOODPLAIN FOR: BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 2/21/2023
FN.:19144_11.DWG
SHEET X OF X SHEETS



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.

NO.	DESCRIPTION	APPROVED BY	DATE
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PREPARED BY
DRAFTED BY: VAL T.
DESIGNED BY: STEVE N.
CHECKED BY: CHRIS O.

SCALE
HORIZ.: 1"=50'
VERT.: N/A
FLD BK.: N/A
ASSESSOR'S PARCEL NO.: 223-0091-002

EXISTING AND PROPOSED 2-YEAR FLOODPLAIN FOR:
BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 2/21/2023
FN.:19144_11.DWG

SHEET X OF X SHEETS

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%;

Hydrologic Soils group B per USDA GIS Map.

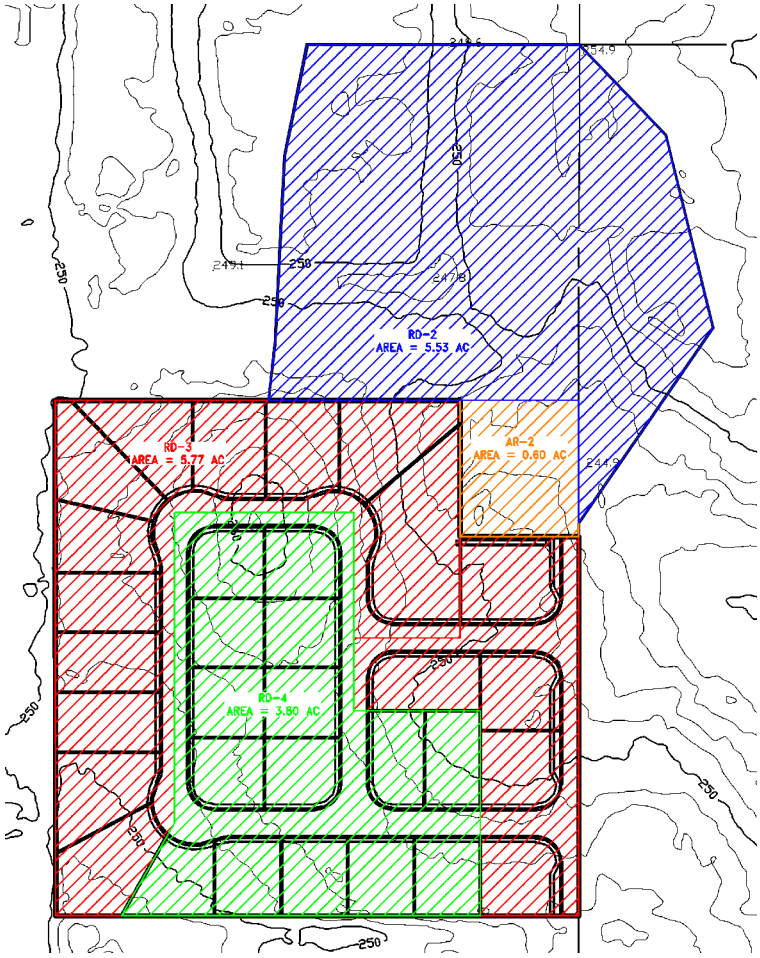


Figure 20 – WSC.1 Zoning.

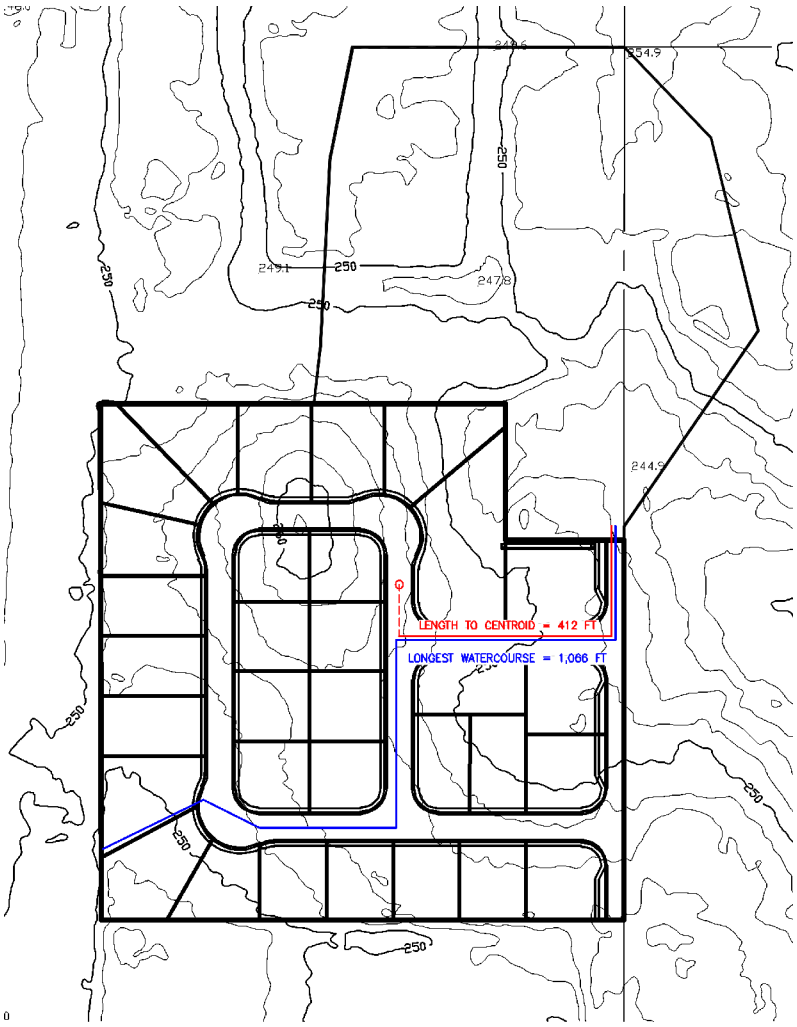
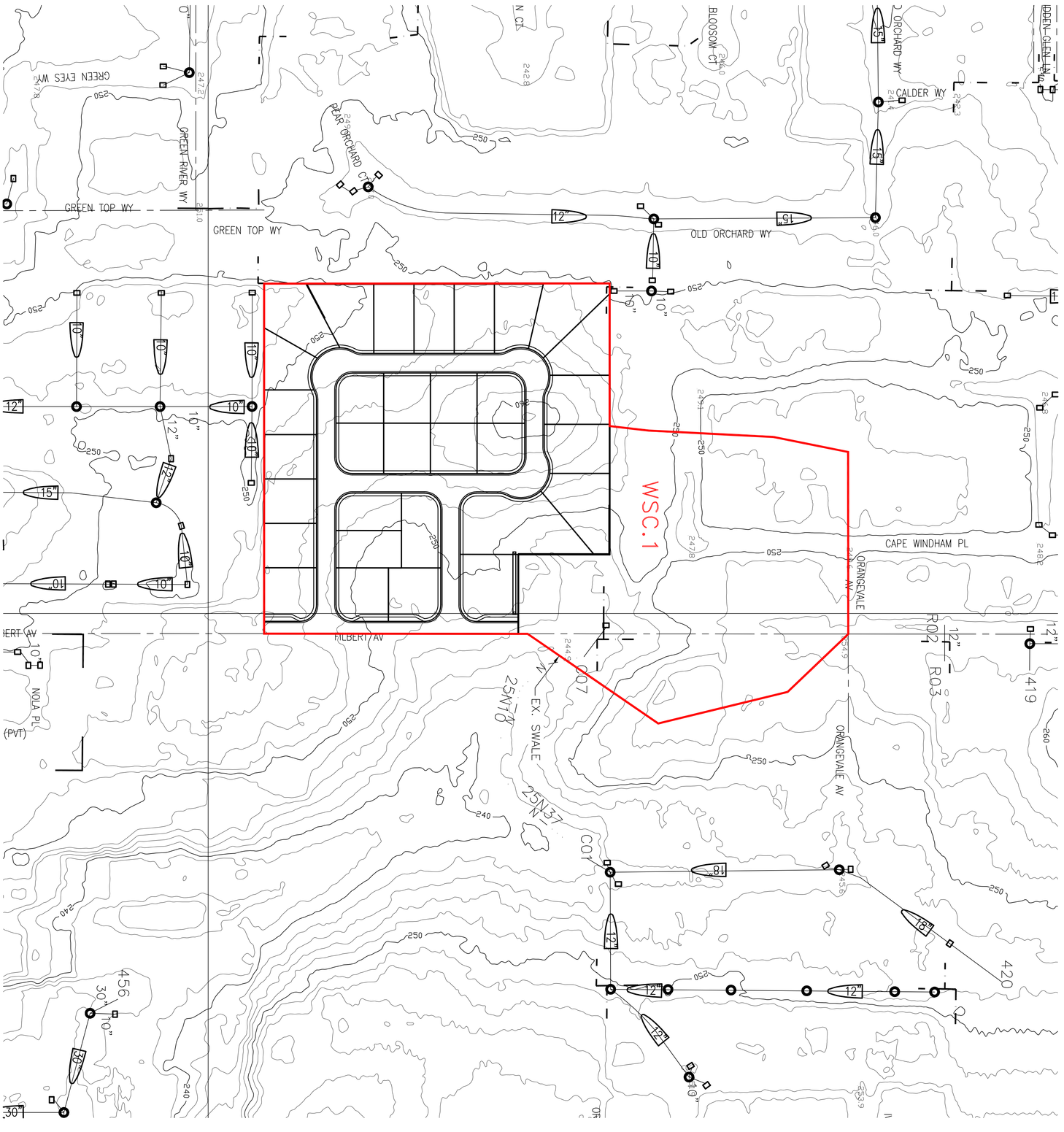


Figure 21 – WSC.1 Lengths.

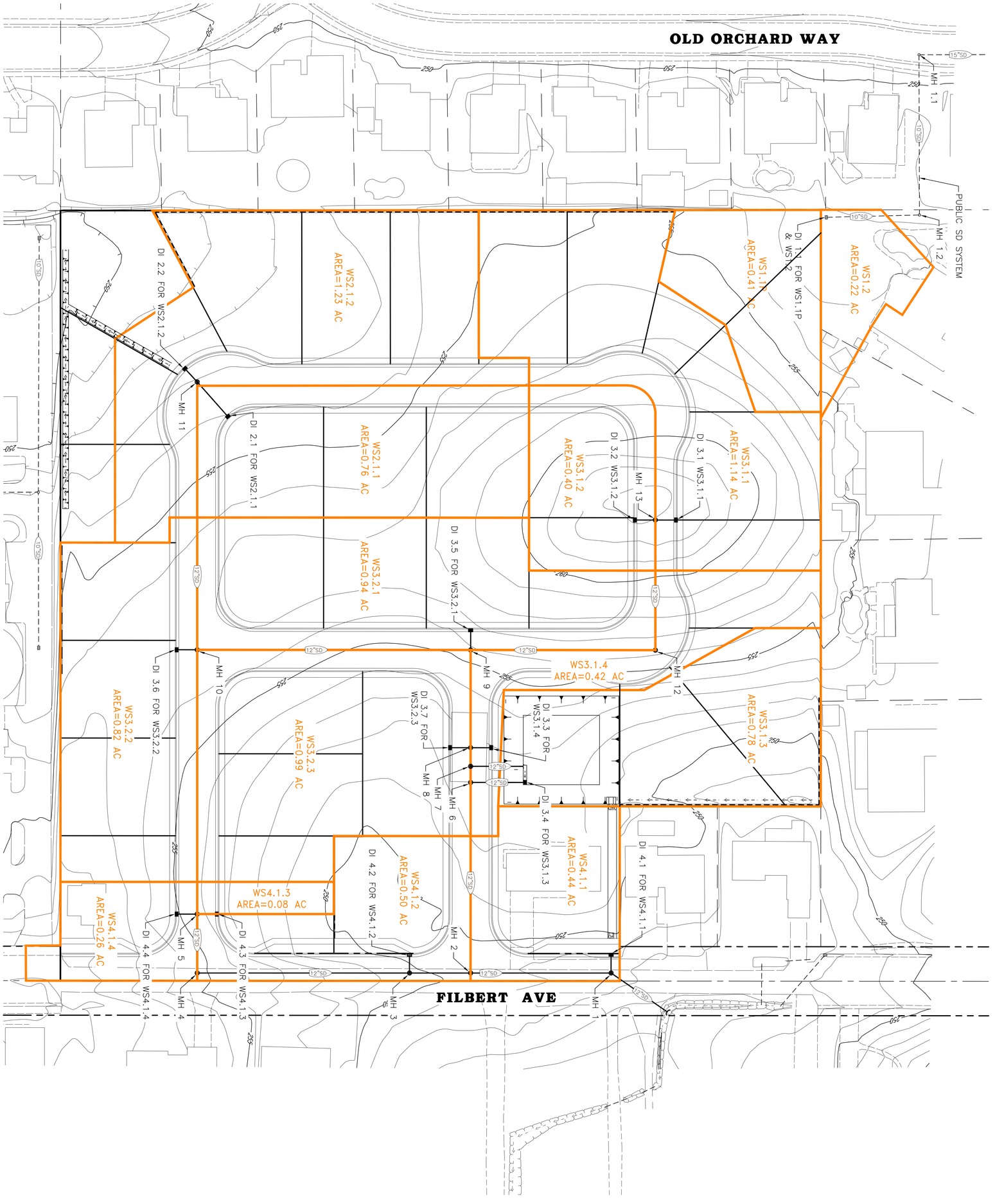


SCALE: 1" = 100'

0 50 100 150 200 250 300 350

N

SHEET X OF X SHEETS	FN:-NAD 27 GRID.DWG	DATE: 2/21/2023	**WATERSHED MAP FOR CREEK HGL:** **BLOSSOM RIDGE** COUNTY OF SACRAMENTO STATE OF CALIFORNIA	SCALE: HORIZ.: 1"= 100' VERT.: N/A FLD BK.: N/A ASSESSOR'S PARCEL NO.: 223-0091-002	PREPARED BY: DRAFTED BY: VAL T. DESIGNED BY: STEVE N. CHECKED BY: CHRIS O.	**CNA ENGINEERING INC.** CIVIL ENGINEERING: LAND SURVEYING PLANNING: STRUCTURAL DESIGN PHONE: (916) 485-3746 2575 VALLEY ROAD SACRAMENTO, CA 95821 cnaeng.com	REVISIONS NO. / DESCRIPTION / APPROVED BY / DATE: 1, 2, 3, 4



SHEET X / OF X SHEETS	FN:_19144_11.DWG	DATE: 2/21/2023	**WATERSHED MAP FOR PIPES FOR:** **BLOSSOM RIDGE** COUNTY OF SACRAMENTO STATE OF CALIFORNIA	SCALE: HORIZ.: 1"= 40' VERT.: N/A FLD BK.: N/A ASSESSOR'S PARCEL NO.: 223-0091-002	PREPARED BY: DRAFTED BY: VAL T. DESIGNED BY: STEVE N. CHECKED BY: CHRIS O.

CNA ENGINEERING INC.
CIVIL ENGINEERING: LAND SURVEYING
PLANNING: STRUCTURAL DESIGN
PHONE: (916) 485-3746
2575 VALLEY ROAD
SACRAMENTO, CA 95821
cnaeng.com

REVISIONS	NO.	DESCRIPTION	APPROVED BY	DATE
	1			
	2			
	3			
	4			

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):

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

Nolte method results
(Project: 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

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

Downstream Sub-system

Structure #	*Structure ID*	*Rim Elevation*	*Invert (FL)*	*Pipe size and material (downstream)*	*Slope downstream*	*n-value*
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

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

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

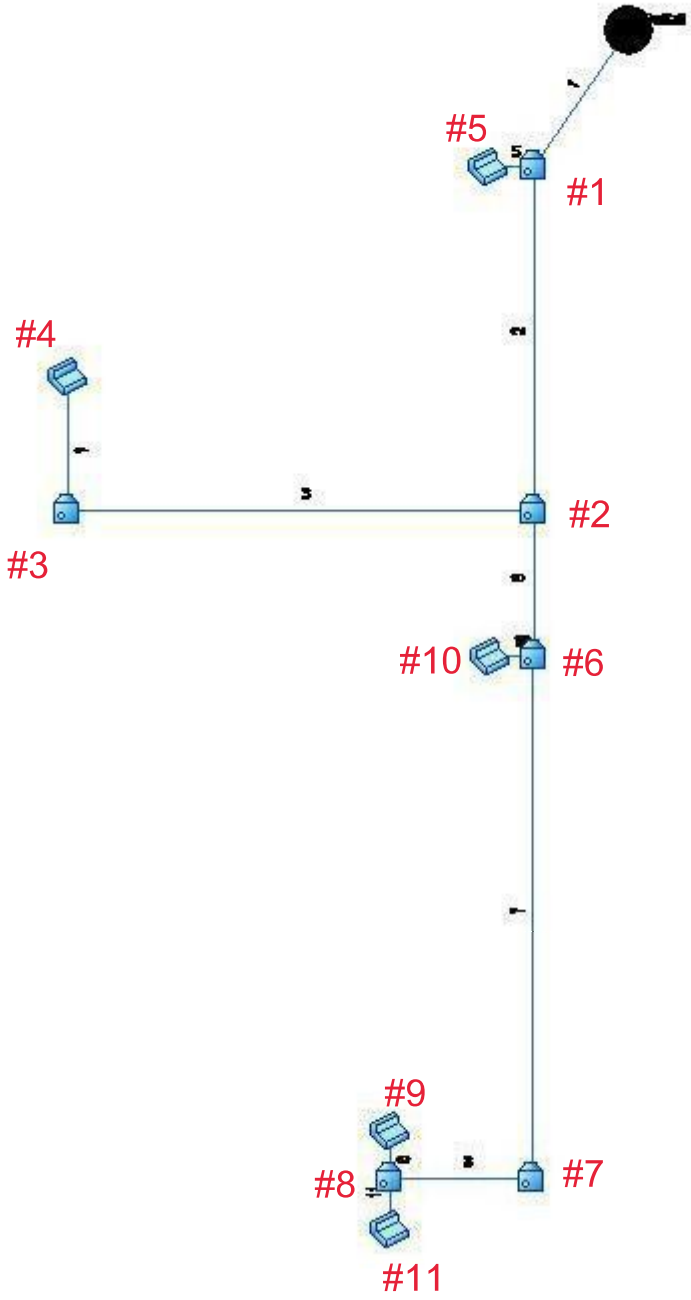
Results of the calculations are provided in the table below.

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

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.


#5
#1
#4
#2
#3
#10
#6
#9
#8
#7
#11

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	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	MH	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	MH	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	MH	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	MH	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	MH	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	MH	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	

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				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			

Storm Sewer Summary Report

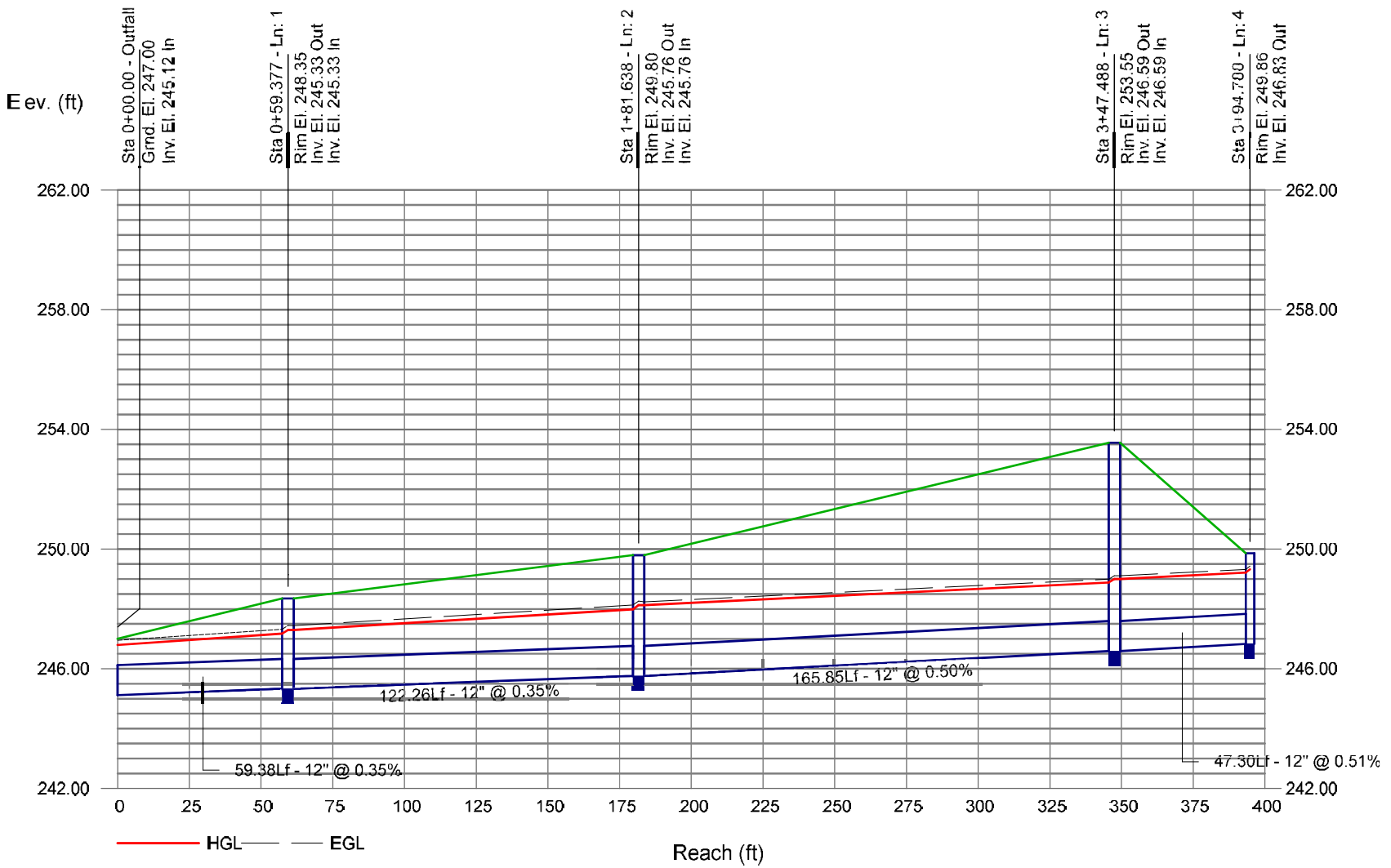
Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1		2.44	12	Cir	59.38	245.12	245.33	0.354	246.80*	247.17*	0.13	247.30	End	Manhole
2		2.32	12	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	3	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
8		0.09	12	Cir	51.24	249.65	250.17	1.015	249.77	250.29	0.04	250.29	7	Manhole
9		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_Down.stm | Number of lines: 11 | Run Date: 12/26/2021

NOTES: Known Qs only ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Profile

Proj. file: Main SD Pipe System_Down.stm



Storm Sewer Profile

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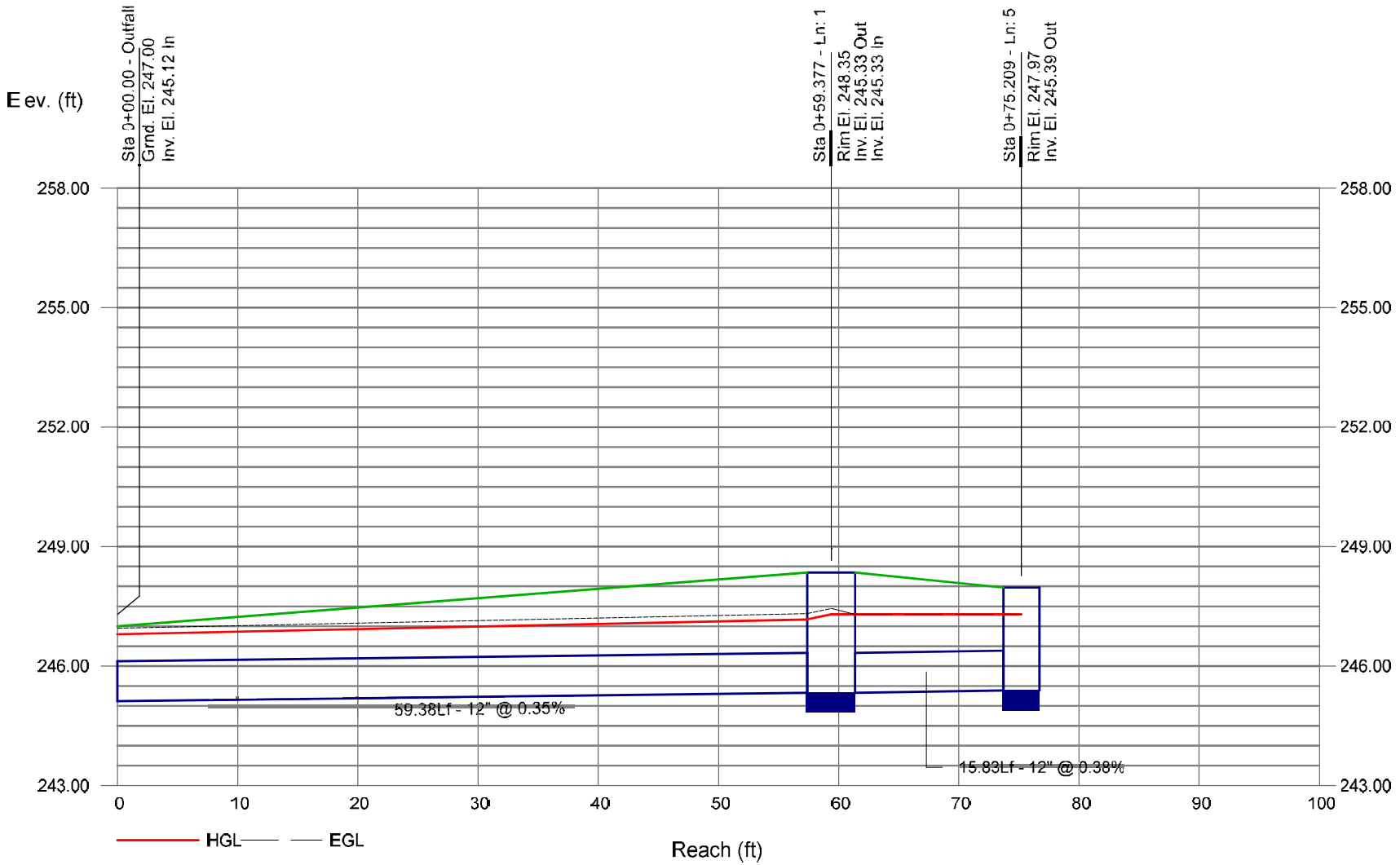

Storm Sewer Profile

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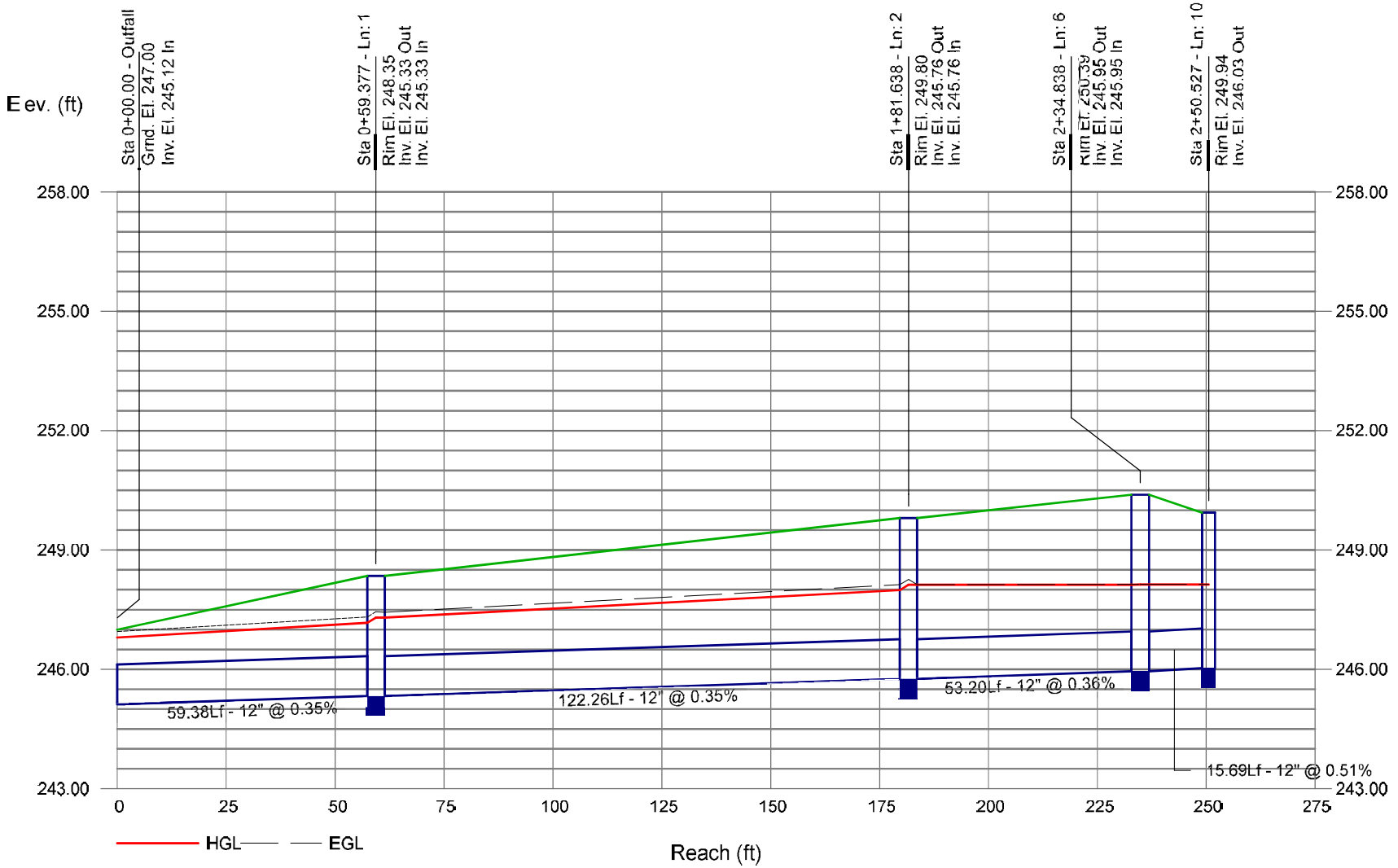
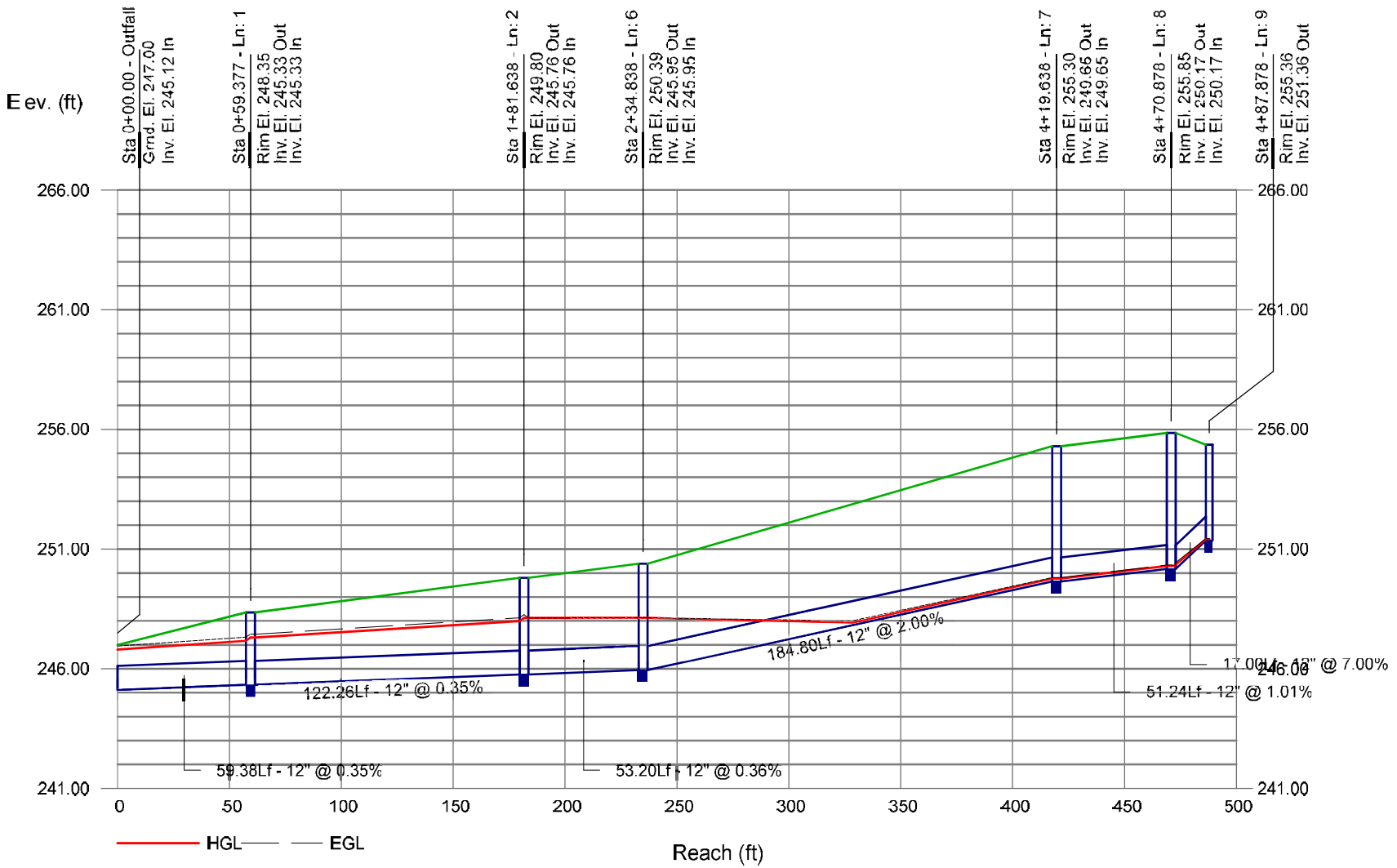


Storm Sewer Profile

Proj. file: Main SD Pipe System_Down.stm



Storm Sewer Profile

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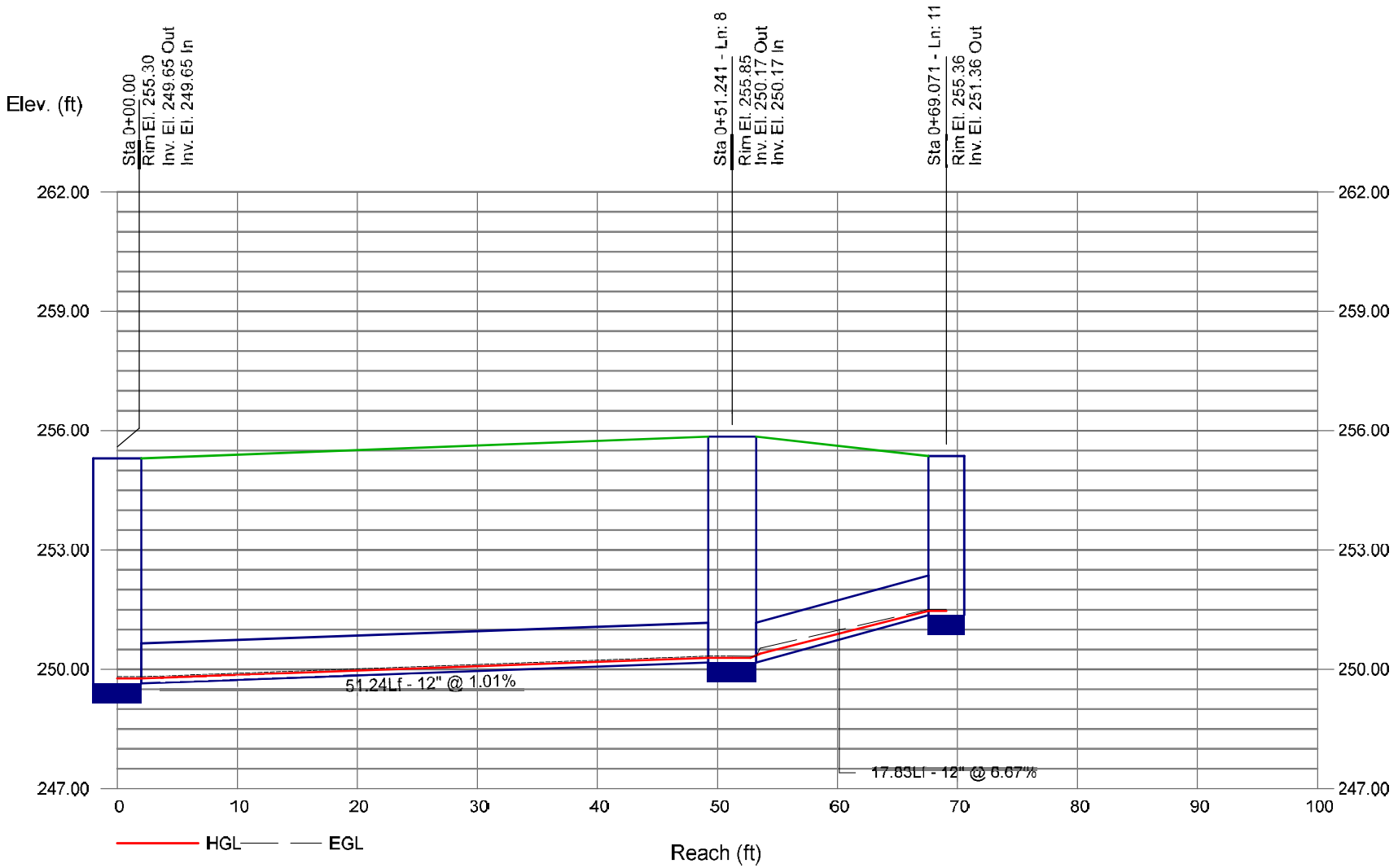


4.2.3.2 Upstream Sub-system

Upstream Sub-system

Structure #	*Structure ID*	*Rim Elevation*	*Invert (FL)*	*Pipe size and material (downstream)*	*Slope downstream*	*n-value*
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

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.

Results of the calculations are provided in the table below.

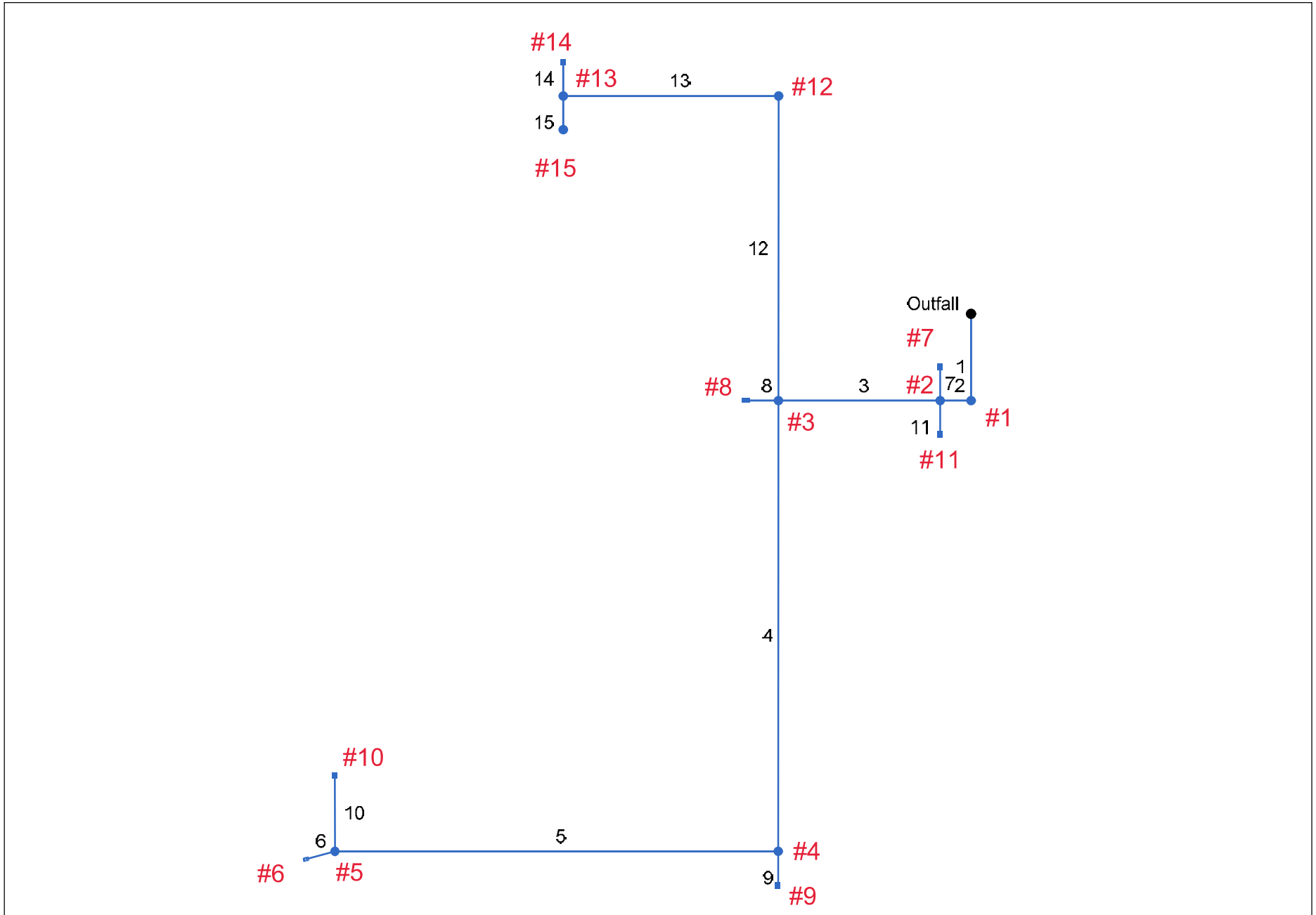
Structure #	*Structure ID*	*Rim Elevation*	*HGL*	*Rim – HGL*
1	MH 7	253.48	251.46	2.02
2	MH 8	253.38	251.60	1.78
3	MH 9	254.53	251.85	2.68
4	MH 10	255.74	252.02	3.72
5	MH 11	254.10	252.10	2.00
6	DI 2.2	253.57	252.11	1.46
7	DI 3.3	252.89	251.60	1.29
8	DI 3.5	254.04	251.85	2.19
9	DI 3.6	255.24	252.02	3.22
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

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



Project File: Main SD Pipe System_Up.stm	Number of lines: 15	Date: 12/26/2021

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	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	MH	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	MH	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	MH	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	MH	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	MH	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	MH	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	MH	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	

Project File: Main SD Pipe System_Up.stm | Number of lines: 15 | Date: 2/2/2022

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				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			

Storm Sewer Summary Report

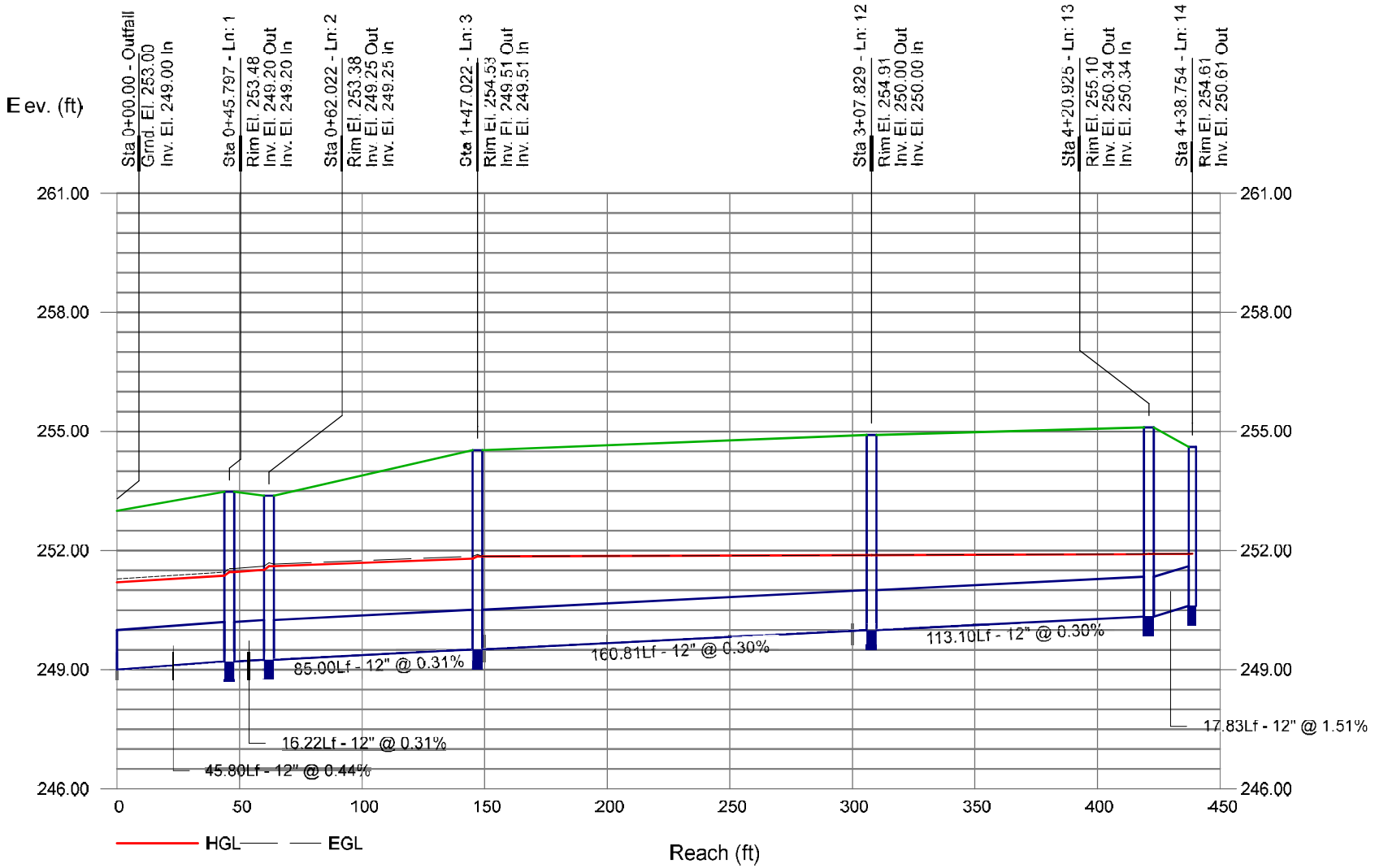
Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1		1.87	12	Cir	45.80	249.00	249.20	0.437	251.20*	251.37*	0.09	251.46	End	Manhole
2		1.87	12	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: Known Qs only ; *Surcharged (HGL above crown).

Storm Sewer Profile

Proj. file: Main SD Pipe System_Up.stm



Storm Sewer Profile

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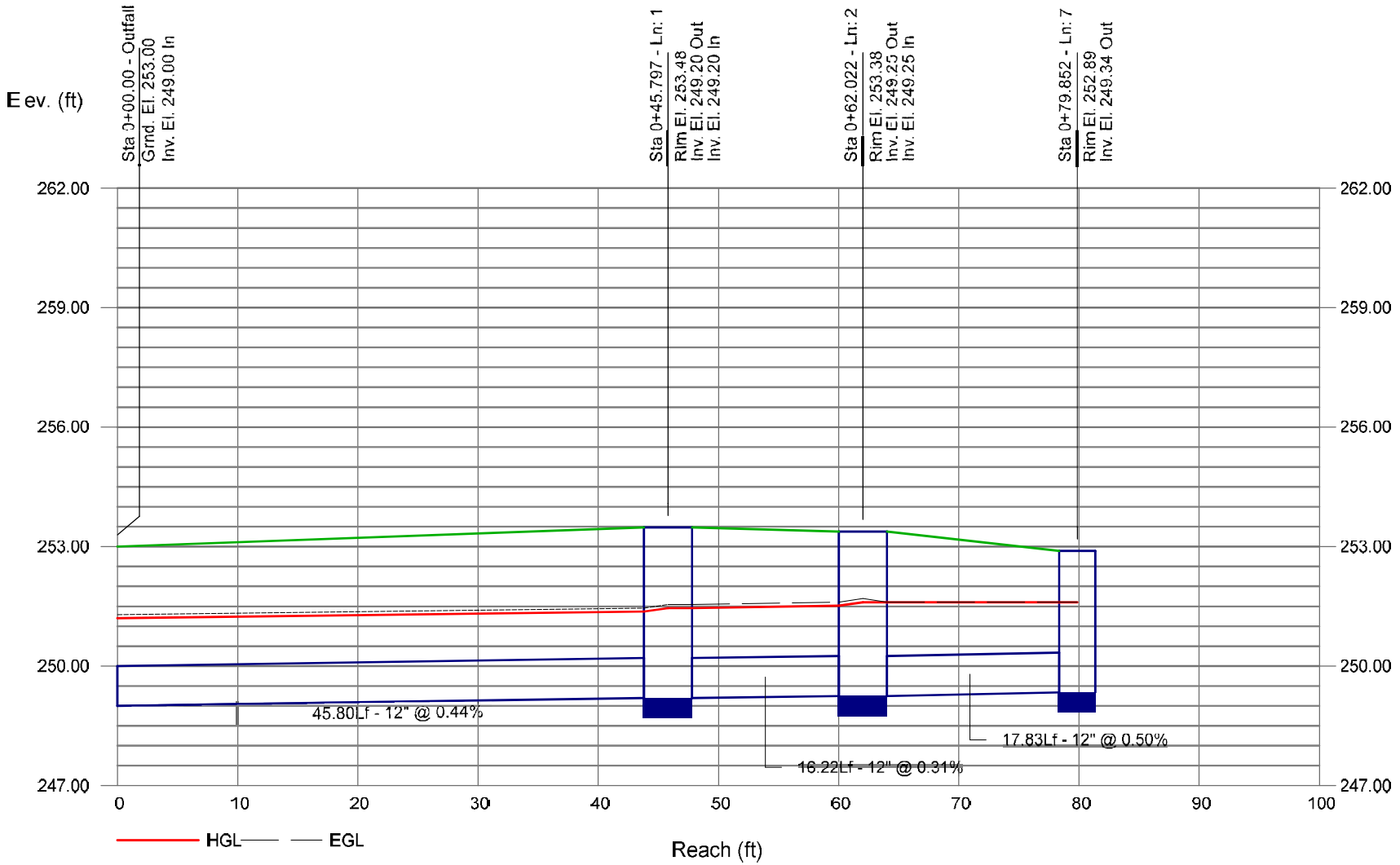

Storm Sewer Profile

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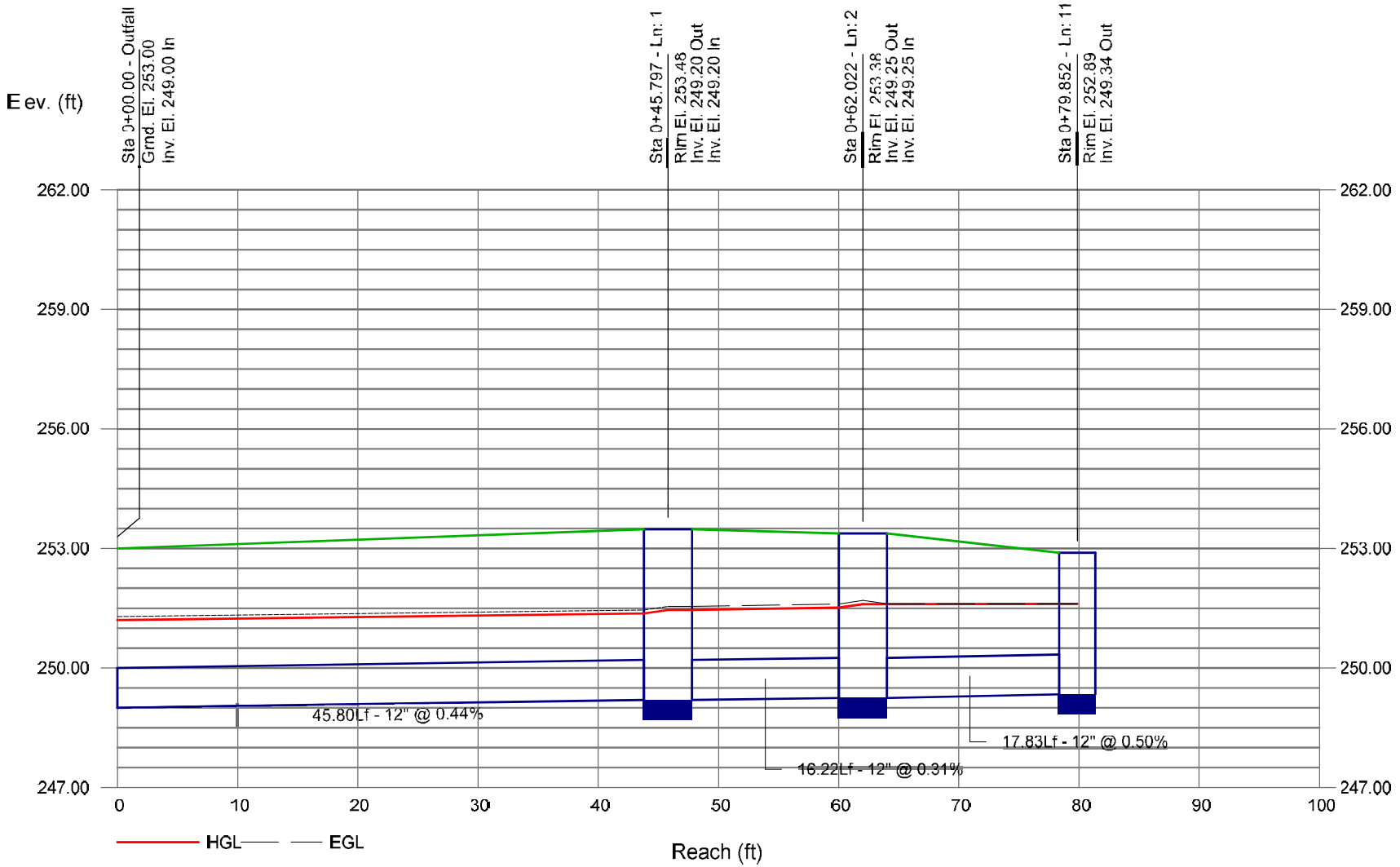

Storm Sewer Profile

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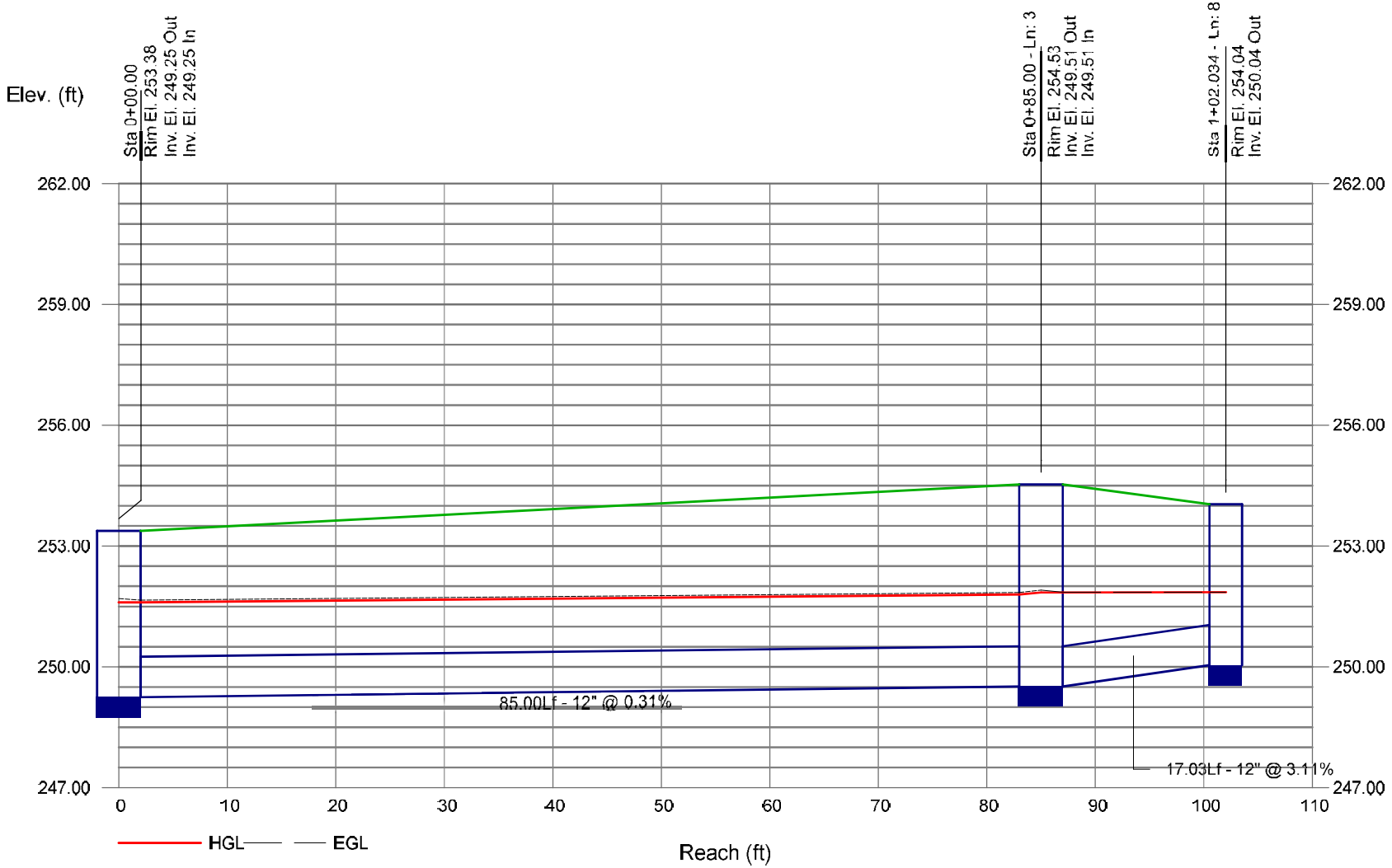

Storm Sewer Profile

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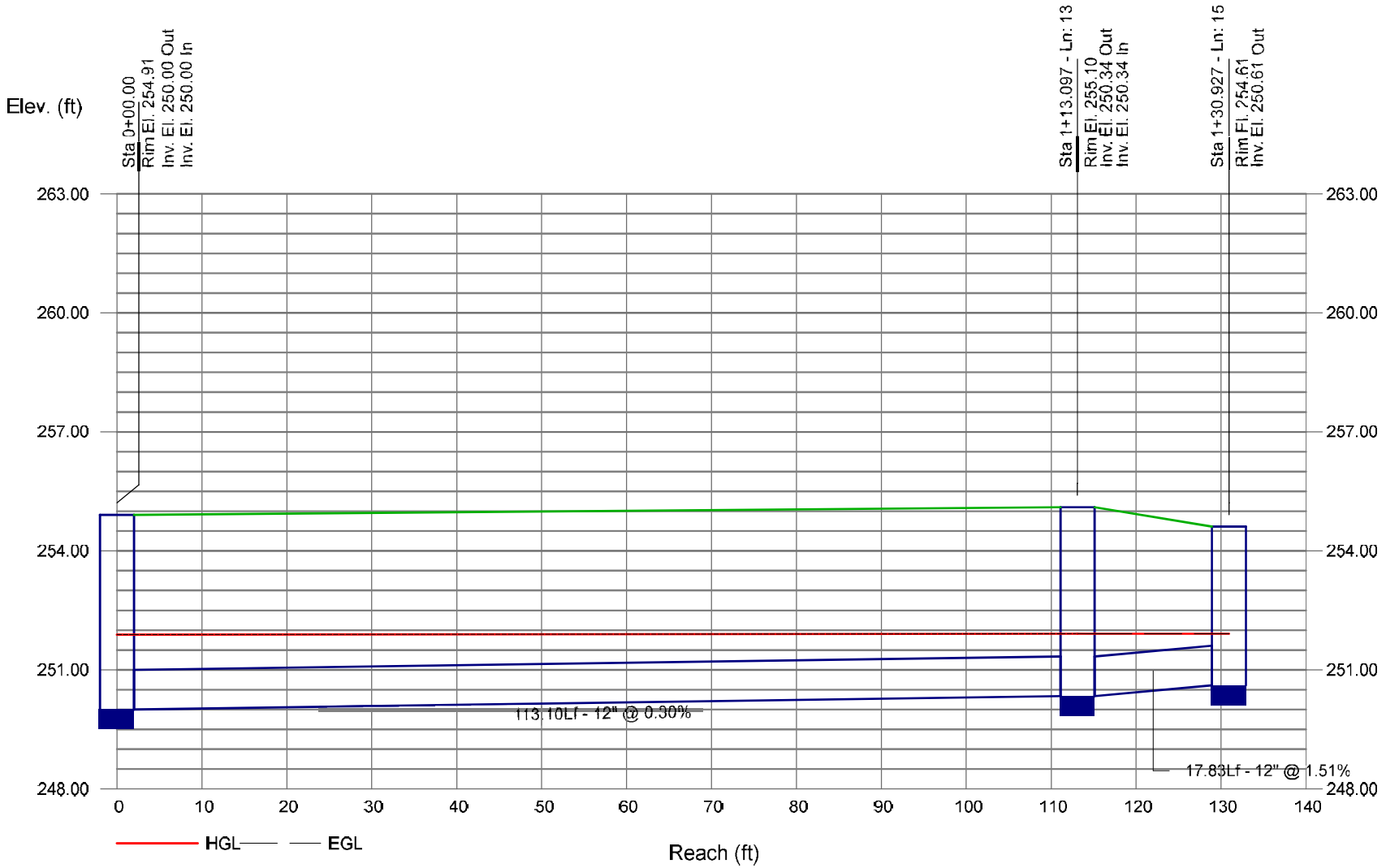
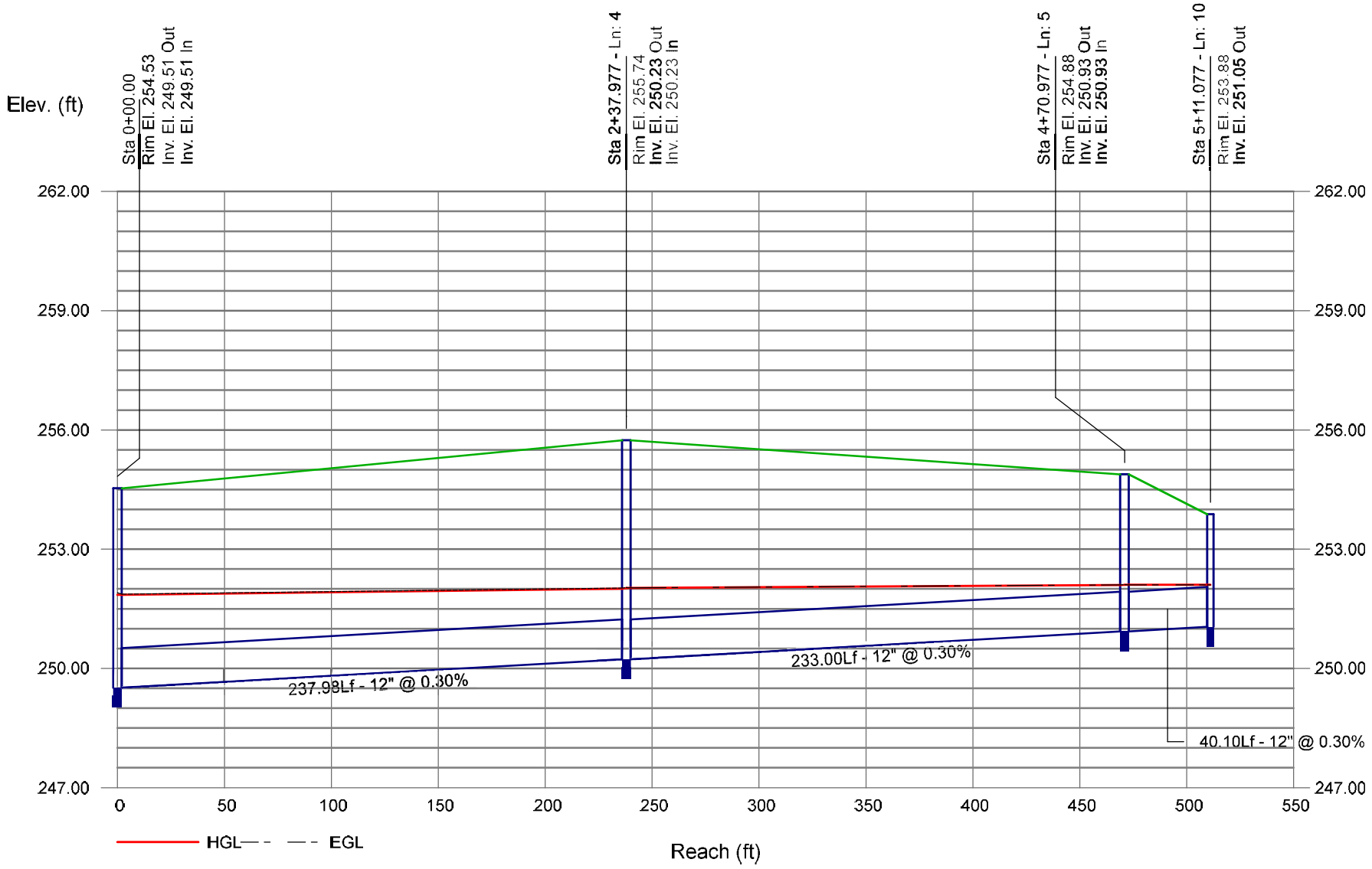


Storm Sewer Profile

Proj. file: Main SD Pipe System_Op.stm



Storm Sewer Profile

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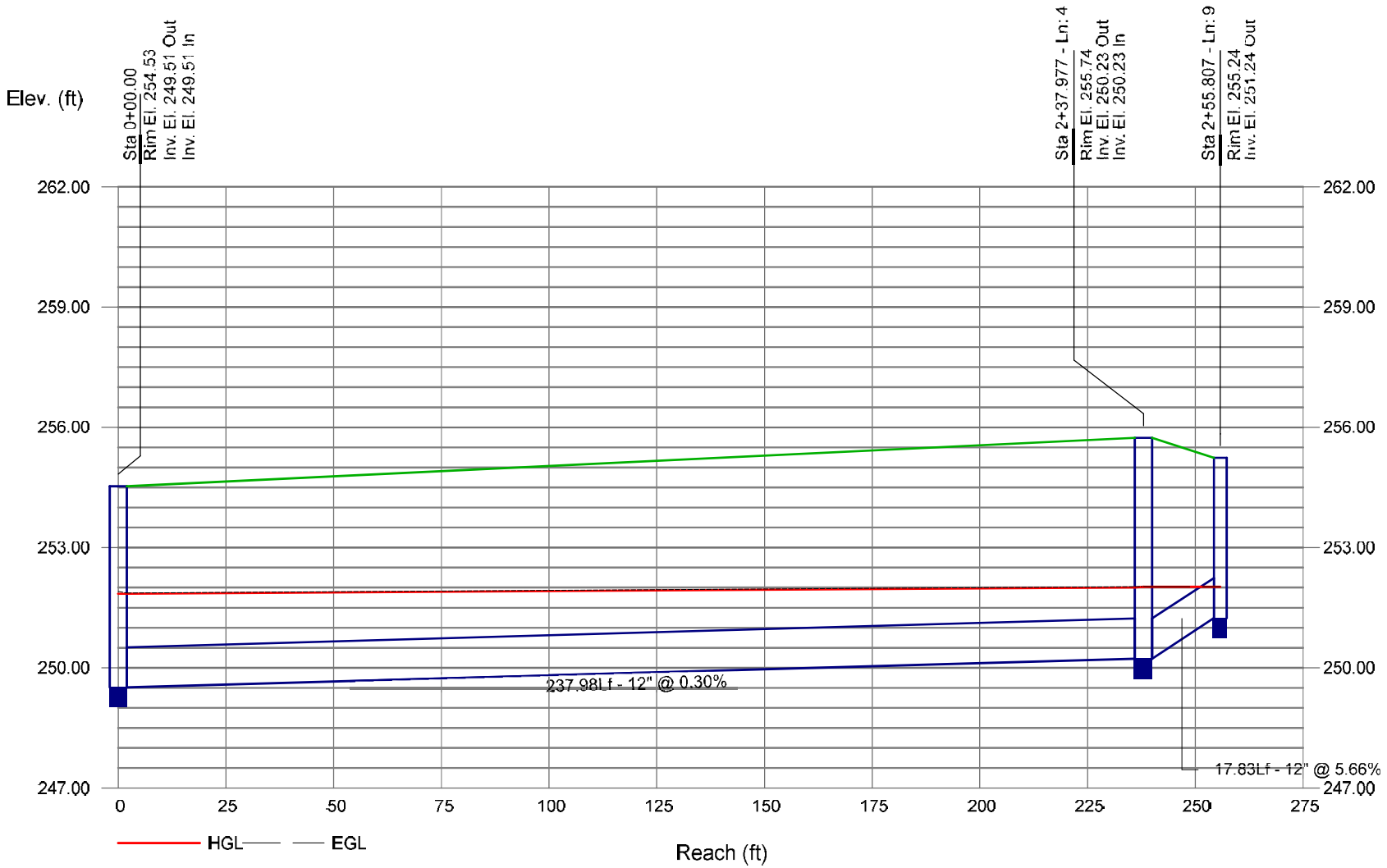

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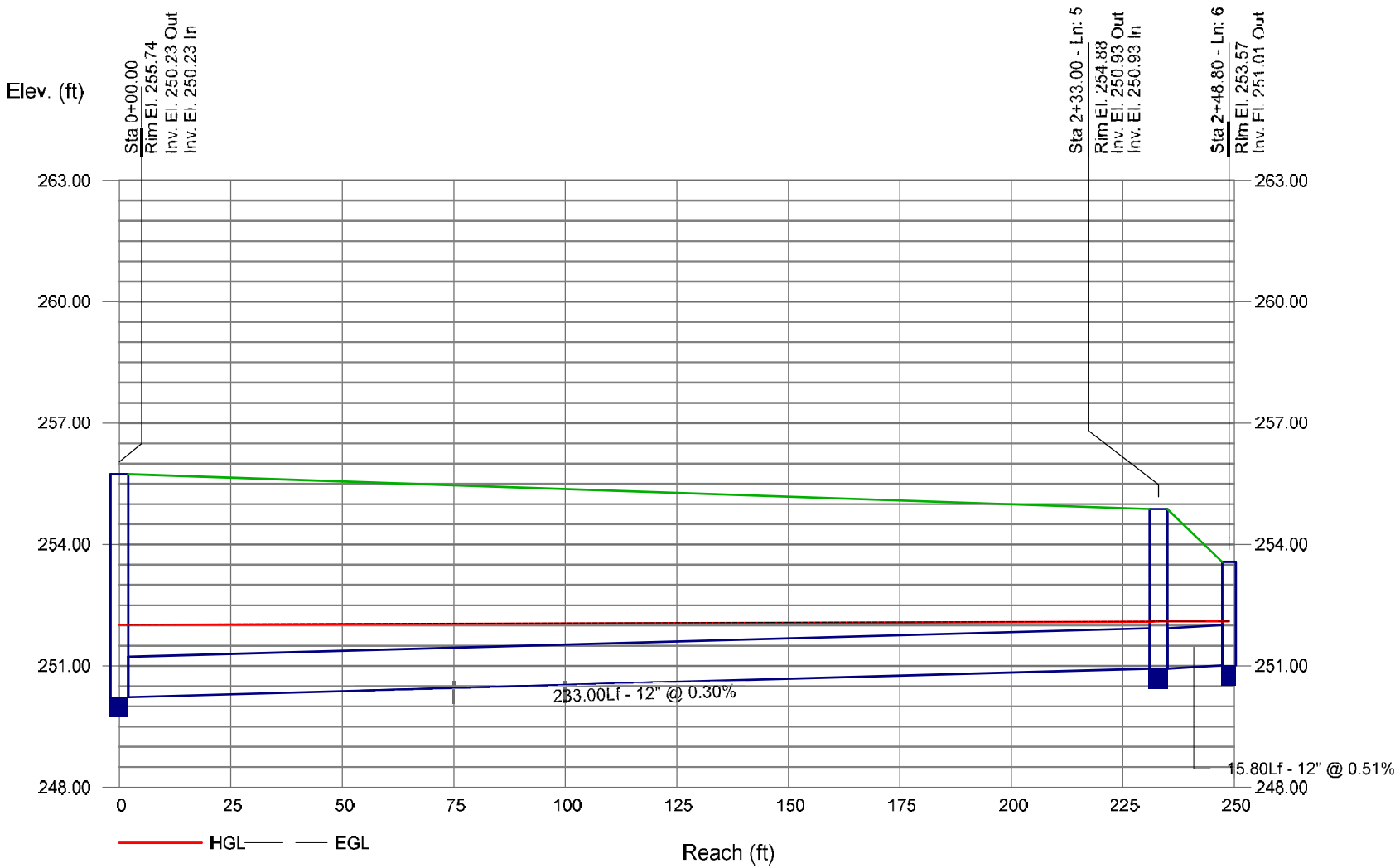


Velocity in the pipe system at the full flow is estimate by the minimum design pipe slope of 0.0030. As per report below, velocity is 2.15 ft/sec which exceeds the minimum 2.00 ft/sec value per Sacramento County stadards.

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Feb 2 2022

Full 12inch Pipe Capacity

Circular

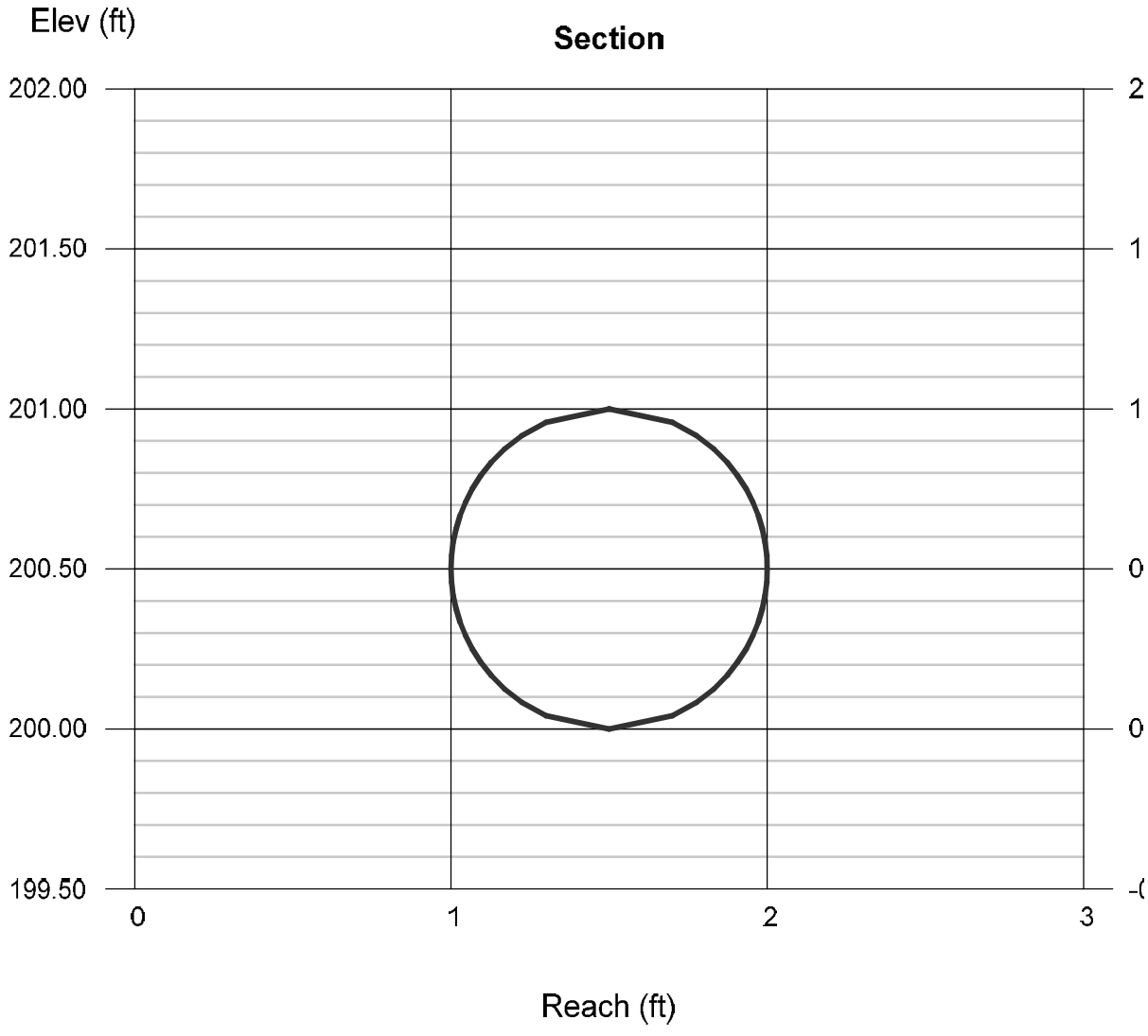
Diameter (ft)	= 1.00
Invert Elev (ft)	= 200.00
Slope (%)	= 0.30
N-Value	= 0.015

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.00

Highlighted

Depth (ft)	= 1.00
Q (cfs)	= 1.690
Area (sqft)	= 0.79
Velocity (ft/s)	= 2.15
Wetted Perim (ft)	= 3.14
Crit Depth, Yc (ft)	= 0.56
Top Width (ft)	= 0.00
EGL (ft)	= 1.07

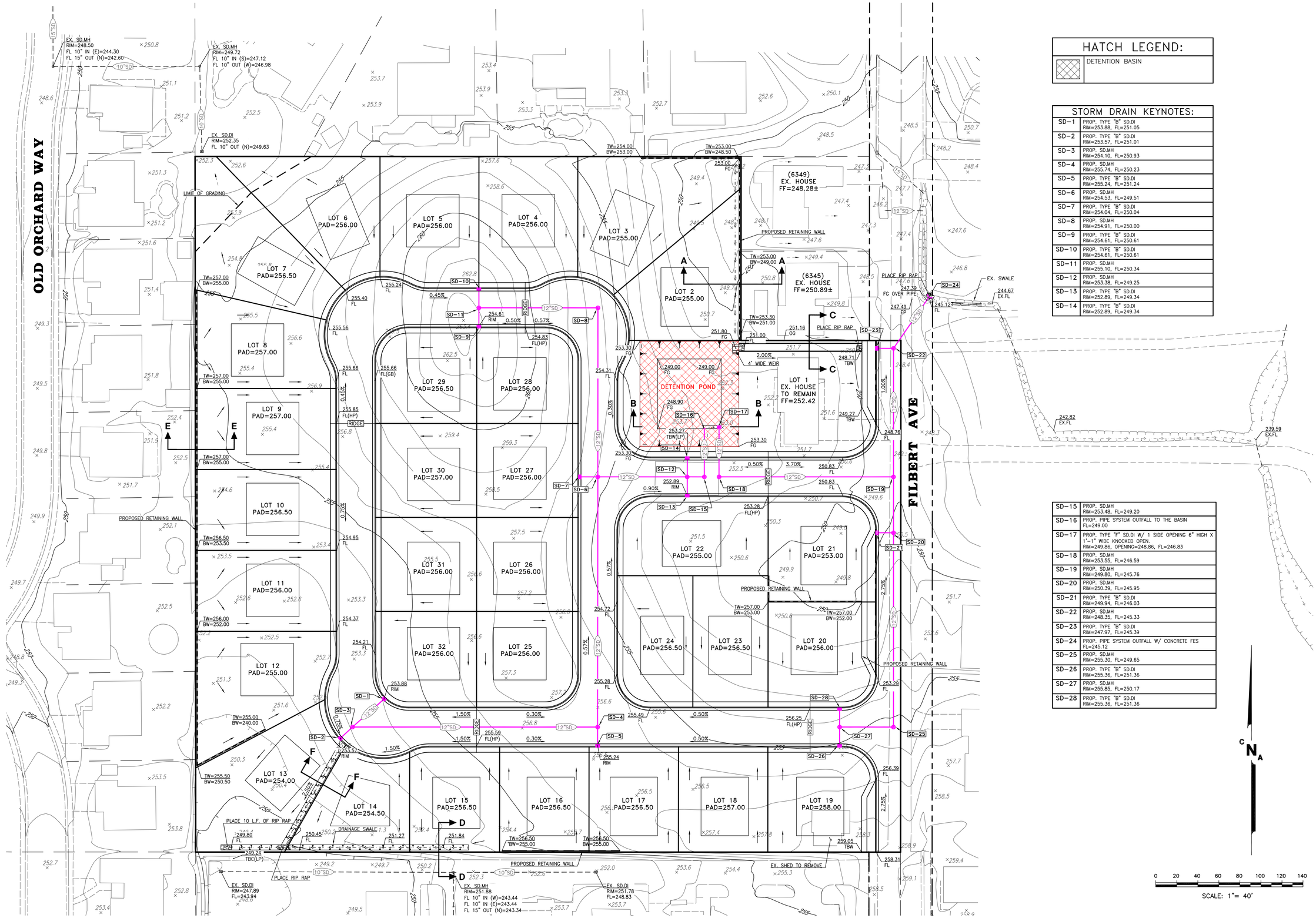


HATCH LEGEND:

	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
SD-6	PROP. SD.MH RIM=254.53, FL=249.51
SD-7	PROP. TYPE "B" SD.DI RIM=254.04, FL=250.04
SD-8	PROP. SD.MH 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 RIM=255.10, FL=250.34
SD-12	PROP. SD.MH RIM=253.38, FL=249.25
SD-13	PROP. TYPE "B" SD.DI RIM=252.89, FL=249.34
SD-14	PROP. TYPE "B" SD.DI RIM=252.89, FL=249.34
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 X 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
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 RIM=255.36, FL=251.36
SD-27	PROP. SD.MH RIM=255.85, FL=250.17
SD-28	PROP. TYPE "B" SD.DI RIM=255.36, FL=251.36



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 X 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
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 RIM=255.36, FL=251.36
SD-27	PROP. SD.MH RIM=255.85, FL=250.17
SD-28	PROP. TYPE "B" SD.DI RIM=255.36, FL=251.36

NO.	DESCRIPTION	APPROVED BY	DATE
1			
2			
3			
4			

REVISIONS

CNA ENGINEERING INC.
CIVIL ENGINEERING: LAND SURVEYING
PLANNING: STRUCTURAL DESIGN
PHONE: (916) 485-3746
2575 VALLEY ROAD
SACRAMENTO, CA 95821
cnaeng.com

PREPARED BY
DRAFTED BY: VAL T.
DESIGNED BY: STEVE N.
CHECKED BY: CHRIS O.

SCALE
HORIZ.: 1"= 40'
VERT.: N/A
FLD BK.: N/A

ASSESSOR'S PARCEL NO.: 223-0091-002

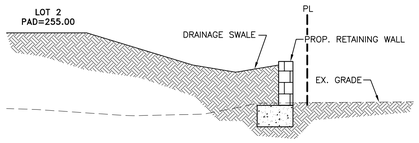
PRELIMINARY GRADING PLAN FOR:
BLOSSOM RIDGE

COUNTY OF SACRAMENTO — STATE OF CALIFORNIA

DATE : 2/21/2023

FN.:19144_11.DWG

SHEET X OF X SHEETS



SECTION A–A
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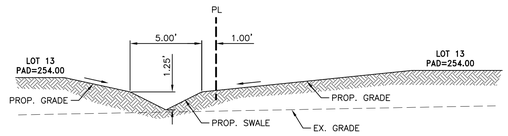

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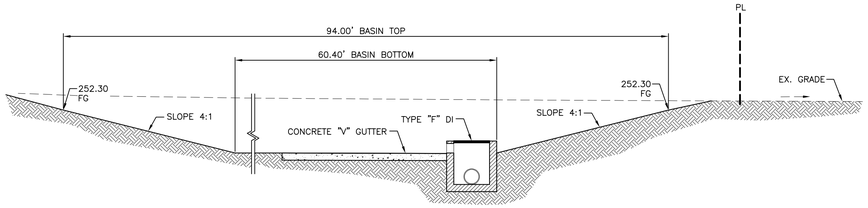

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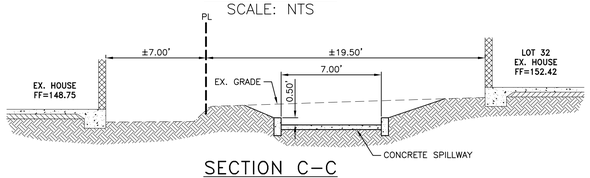

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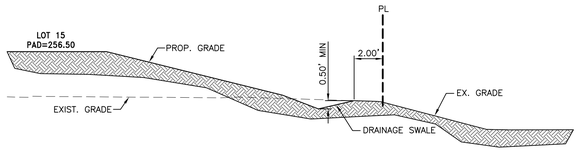

SECTION D–D
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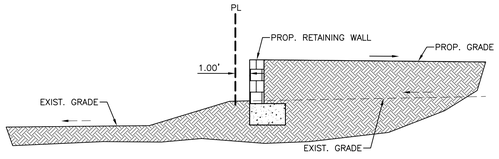


SECTION E–E
SCALE: NTS

NO.	DESCRIPTION	APPROVED BY	DATE
1			
2			
3			
4			

REVISIONS

CNA ENGINEERING INC.
CIVIL ENGINEERING: LAND SURVEYING
PLANNING: STRUCTURAL DESIGN
PHONE: (916) 485-3746
2575 VALLEY ROAD
SACRAMENTO, CA 95821
cnaeng.com

PREPARED BY	SCALE
DRAFTED BY: VAL T.	HORIZ.: N/A
DESIGNED BY: STEVE N.	VERT.: N/A
CHECKED BY: CHRIS O.	FLD BK.: N/A
ASSESSOR'S PARCEL NO.: 223-0091-002	

CROSS SECTIONS FOR:
BLOSSOM RIDGE
COUNTY OF SACRAMENTO
STATE OF CALIFORNIA

DATE : 2/21/2023

FN.:19144_11.DWG

SHEET
X OF X
SHEETS

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 = ±9,300 ft^2 = 0.21 acres.

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

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

D_{DR} = 0.64' for impervious area;

Ø = 0.35 - amended soil porosity;

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

A_{BMP} = 375 ft^2 - 25% of contributing impervious area – minimum BMP area; per LID calculator in order to achieve 100 points, Area of mulch bed is 1,150 ft^2.

A_i = 1,500 ft^2 – 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 Sizing Calculations

Name of Drainage Shed: Blossom Ridge Lot 7
Location of project: Sacramento

Fill in Blue Highlighted boxes

Step 1 - Open Space and Pervious Area Credits

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

1 a. Common Drainage Plan Area		acres	A_{CDP}	
Common Drainage Plan Open Space (Off-project)	0	acres	A_{OS}	**see area example below**
a. Natural storage reservoirs and drainage corridors	0	acres		
b. Buffer zones for natural water bodies	0	acres		
c. Natural areas including existing trees, other vegetation, and soil	0	acres		
d. Common landscape area/park	0	acres		
e. Regional Flood Control/Drainage basins	0	acres		
1 b. Project Drainage Shed Area (Total)	0.21	acres	A	
Project-Specific Open Space (In-project, communal)**	0.00	acres	A_{PSOS}	**see area example below**
a. Natural storage reservoirs and drainage corridors	0.00	acres		
b. Buffer zones for natural water bodies	0.00	acres		
c. Natural areas including existing trees, other vegetation, and soil	0.00	acres		
d. Landscape area/park	0.00	acres		
e. Flood Control/Drainage basins	0.00	acres		

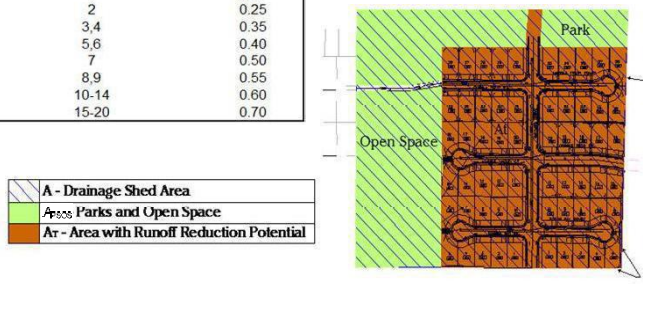
** Doesn't include impervious areas within individual lots and surrounding individual units. That is accounted for below using Form D-1a in Step 2.

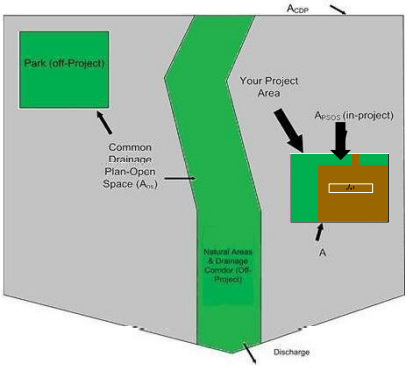
Area with Runoff Reduction Potential	$A - A_{PSOS}$ =	0.21	acres	A_T
Number of Units in A_T		1		
Number of units per acre in A_T	DU/A_T =	5	DUA	
Assumed Initial Impervious Fraction of A_T (determined using Table D-1a)		0.4	I	

Open Space & Pervious Area LID Credit (Step 1)
$(A_{OS}/A_{CDP}+A_{PSOS}/A)x100$ = 0 pts

Table D-1a

Dwelling units per acre	Imperviousness
1	0.17
2	0.25
3,4	0.35
5,6	0.40
7	0.50
8,9	0.55
10-14	0.60
15-20	0.70





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
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)	A_C	0.00	acres EAM

Runoff Reduction Credit (Step 2) $(A_C / A_T)*100$ = 0 pts

Form D-1a: Disconnected Roof Drains Worksheet

See Fact Sheet for more information regarding Disconnected Roof Drain credit guidelines

Effective Area Managed (A_C)

1. Determine efficiency Multiplier

Runoff is directed to a dispersal trench or dry well (Type A and B soils only)		1.00
Runoff is directed across landscaping, determine setback		
25 ft +	Use multiplier of	1.00
≥ 20 and < 25 ft	Use multiplier of	0.90
≥ 15 and < 20 ft	Use multiplier of	0.70
≥ 10 and < 15 ft	Use multiplier of	0.45
≥ 5 and < 10 ft	Use multiplier of	0.25

Efficiency Multiplier → [ ] Box J1

2. Determine percentage of roof drains disconnected → [ ] Box J2

3. Select project density in dwelling units per acre:

1	Use reduction factor of	0.08
2	Use reduction factor of	0.13
3,4	Use reduction factor of	0.19
5,6	Use reduction factor of	0.23
7	Use reduction factor of	0.29
8,9	Use reduction factor of	0.33
10-14	Use reduction factor of	0.37
15-20	Use reduction factor of	0.44

Reduction Factor → [0.23] Box J3

4. Determine Area Managed

Multiply Box J3 by A_T, and enter the result in Box J4 → [0.0] acres Box J4

5. Multiply Boxes J1, J2 and J4, and enter 60% of the Result in Box J → [0.0] acres Box J

This is the amount of area credit to enter into the "Disconnected Roof Drains" Box of Form D-1

Form D-1b: Disconnected Pavement Worksheet

See Fact Sheet for more information regarding NDC Pavement credit guidelines

Effective Area Managed (A_C)

Divided Sidewalks

1. Determine percentage of units with divided Sidewalks [ ] Box K1

Multiply Box K1, A_T, and 0.04 and enter 60% of the result in Box K → [0.00] acres Box K

This is the amount of area credit to enter into the "Disconnected Pavement" Box of Form D-1

Form D-1c: Interceptor Tree Worksheet

See Fact Sheet for more information regarding Interceptor Tree credit guidelines

Effective Area Managed (A_C)

New Evergreen Trees

1. Enter number of new evergreen trees that qualify as Interceptor Trees in Box L1. [ ] trees Box L1

2. Multiply Box L1 by 200 and enter result in Box L2 [0] sq. ft. Box L2

New Deciduous Trees

3. Enter number of new deciduous trees that qualify as Interceptor Trees in Box L3. [ ] trees Box L3

4. Multiply Box L3 by 100 and enter result in Box L4 [0] sq. ft. Box L4

Existing Tree Canopy

5. Enter square footage of existing tree canopy that qualifies as Existing Tree canopy in Box L5. [ ] sq. ft. Box L5

6. Multiply Box L5 by 0.5 and enter the result in Box L6 [0] sq. ft. Box L6

Total Interceptor Tree Credits

Add Boxes L2, L4, and L6 and enter it into Box L7 [0] sq. ft. Box L7

Divide Box L7 by 43,560 and multiply by 20% to get effective area managed 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 Driveway Design

See Fact Sheet for more information regarding Alternative Driveway Design credit guidelines

1. Select type of driveway

Pervious Driveway:	Multiplier:
Cobblestone Block P	0.40
Pervious Concrete/A	0.60
Modular Block Porous Pavement Porous Gravel	0.75
Not Directly-connected	1.00

[ ] Box M1

2. Determine percentage of units with 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 enter into the "Alternative Driveway Design" Box of Form D-1

Step 3 - Runoff Management Credits

Capture and Use Credits

Impervious Area Managed by Rain barrels, Cisterns, and automatically-emptied systems

(see Fact Sheet) ____ enter gallons, for simple rain barrels — 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 BMPs

(see Fact Sheet)

Bioretention Area ____ sq ft
Subdrain Elevation ____ inches
Ponding Depth, inches ____ inches — 0.00 acres

Impervious Area Managed by Infiltration BMPs

(see Fact Sheet)

Drawdown Time, hrs ____ drawdown_hrs_inf
Soil Infiltration Rate, in/hr ____ soil_inf_rate

Sizing Option 1: Capture Volume, acre-ft ____ capture_vol_inf — 0.00 acres

Sizing Option 2: Infiltration BMP surface area, sq ft ____ soil_surface_area — 0.00 acres

Basin or trench? Basin — approximate BMP depth 0.00 ft

Impervious Area Managed by Amended Soil or Mulch Beds

(see Fact Sheet) Mulched Infiltration Area, sq ft 1,150 mulch_area — 0.11 acres

Total Effective Area Managed by Capture-and-Use/Bioretention/Infiltration BMPs — 0.11 A_{LIDc}

Runoff Management Credit (Step 3) A_{LIDC}/A_T*200 = 100.6 pts

Total LID Credits (Step 1+2+3) LID compliant, check for treatment sizing in Step 4 — 100.6

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

Adjusted Area for Flow-Based, Non-LID Treatment $A_T - A_C - A_{LIDC}$ = 0.10 A_{AT}

Adjusted Impervious Fraction of A for Volume-Based, Non-LID Treatment $(A_T*I-A_C-A_{LIDC}) / A$ = 0.000 I_A

STOP: No additional treatment needed

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

Form D-1e

Calculate treatment flow (cfs): Flow = Runoff Coefficient x Rainfall Intensity x Adjusted Treatment Area

Determine C Factor using Table D-1b — C

Determine i using Table D-1c (Rainfall Intensity) — 0.18 — i

A_{AT} from Step 2 — 0.10 — A_{AT}

Flow = C * i * A_{AT} — 0.00 cfs

TABLE D-1b

Development Type	Runoff Coefficient (Rational), C
Single-family areas	0.50
Multi-units, detached	0.60
Apartment dwelling areas	0.70
Multi-units, attached	0.75
User Specified	0.00

Table D-1c

Rainfall Intensity			
Roseville	i =	0.20	in/hr
Sacramento	i =	0.18	in/hr
Folsom	i =	0.20	in/hr

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

Calculate water quality volume (Acre-Feet): WQV = Area x Maximized Detention Volume (P_0)

Obtain A from Step 1 — 0.21 — A — ____ hrs — Specified Draw Down time

Obtain P_0: Maximized Detention Volume from figures E-1 to 4 in Appendix E of this manual using I_A from Step 2. E= 0.00 — P_0

Calculate treatment volume (acre-ft):

Treatment volume = A x (P_0 / 12) — 0.00 Acre-Feet

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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 = ±5,000 ft^2 = 0.11 acres.

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

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

D_{DR} = 0.64' for impervious area;

Ø = 0.35 - amended soil porosity;

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

A_{BMP} = 300 ft^2 - 25% of contributing impervious area – minimum BMP area; per LID calculator in order to achieve 100 points, Area of mulch bed is 725 ft^2.

A_i = 1,200 ft^2 – 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 Sizing Calculations

Name of Drainage Shed: Blossom Ridge Lot 14
Location of project: Sacramento

Fill in Blue Highlighted boxes

Step 1 - Open Space and Pervious Area Credits

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

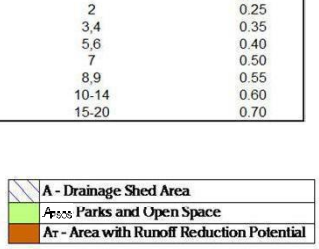
1 a. Common Drainage Plan Area		acres	A_{CDP}	
Common Drainage Plan Open Space (Off-project)	0	acres	A_{OS}	**see area example below**
a. Natural storage reservoirs and drainage corridors	0	acres		
b. Buffer zones for natural water bodies	0	acres		
c. Natural areas including existing trees, other vegetation, and soil	0	acres		
d. Common landscape area/park	0	acres		
e. Regional Flood Control/Drainage basins	0	acres		
1 b. Project Drainage Shed Area (Total)	0.11	acres	A	
Project-Specific Open Space (In-project, communal)**	0.00	acres	A_{PSOS}	**see area example below**
a. Natural storage reservoirs and drainage corridors	0.00	acres		
b. Buffer zones for natural water bodies	0.00	acres		
c. Natural areas including existing trees, other vegetation, and soil	0.00	acres		
d. Landscape area/park	0.00	acres		
e. Flood Control/Drainage basins	0.00	acres		

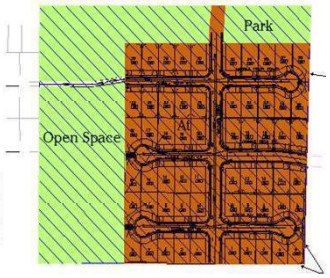
** Doesn't include impervious areas within individual lots and surrounding individual units. That is accounted for below using Form D-1a in Step 2.

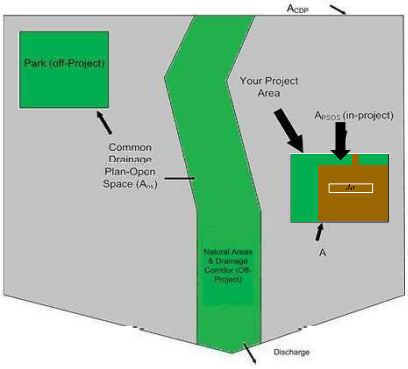
Area with Runoff Reduction Potential	$A - A_{PSOS}$ =	0.11	acres	A_T
Number of Units in A_T		1		
Number of units per acre in A_T	DU/A_T =	10	DUA	
Assumed Initial Impervious Fraction of A_T (determined using Table D-1a)		0.6	I	

Open Space & Pervious Area LID Credit (Step 1)
$(A_{OS}/A_{CDP}+A_{PSOS}/A)x100$ = 0 pts

Table D-1a	
Dwelling units per acre	Imperviousness
1	0.17
2	0.25
3,4	0.35
5,6	0.40
7	0.50
8,9	0.55
10-14	0.60
15-20	0.70







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	
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)	A_C	0.00	acres	EAM

Runoff Reduction Credit (Step 2) $(A_C / A_T)*100$ = 0 pts

Form D-1a: Disconnected Roof Drains Worksheet

See Fact Sheet for more information regarding Disconnected Roof Drain credit guidelines

Effective Area Managed (A_C)

1. Determine efficiency Multiplier

Runoff is directed to a dispersal trench or dry well (Type A and B soils only)		1.00
Runoff is directed across landscaping, determine setback		
25 ft +	Use multiplier of	1.00
≥ 20 and < 25 ft	Use multiplier of	0.90
≥ 15 and < 20 ft	Use multiplier of	0.70
≥ 10 and < 15 ft	Use multiplier of	0.45
≥ 5 and < 10 ft	Use multiplier of	0.25

Efficiency Multiplier → [ ] Box J1

2. Determine percentage of roof drains disconnected → [ ] Box J2

3. Select project density in dwelling units per acre:

1	Use reduction factor of	0.08
2	Use reduction factor of	0.13
3,4	Use reduction factor of	0.19
5,6	Use reduction factor of	0.23
7	Use reduction factor of	0.29
8,9	Use reduction factor of	0.33
10-14	Use reduction factor of	0.37
15-20	Use reduction factor of	0.44

Reduction Factor → [0.37] Box J3

4. Determine Area Managed

Multiply Box J3 by A_T, and enter the result in Box J4 [0.0] acres Box J4

5. Multiply Boxes J1, J2 and J4, and enter 60% of the Result in Box J [0.0] acres Box J

This is the amount of area credit to enter into the "Disconnected Roof Drains" Box of Form D-1

Form D-1b: Disconnected Pavement Worksheet

See Fact Sheet for more information regarding NDC Pavement credit guidelines

Effective Area Managed (A_C)

Divided Sidewalks

1. Determine percentage of units with divided Sidewalks [ ] Box K1

Multiply Box K1, A_T, and 0.04 and enter 60% of the result in Box K [0.00] acres Box K

This is the amount of area credit to enter into the "Disconnected Pavement" Box of Form D-1

Form D-1c: Interceptor Tree Worksheet

See Fact Sheet for more information regarding Interceptor Tree credit guidelines

Effective Area Managed (A_C)

New Evergreen Trees

1. Enter number of new evergreen trees that qualify as Interceptor Trees in Box L1. [ ] trees Box L1

2. Multiply Box L1 by 200 and enter result in Box L2 [0] sq. ft. Box L2

New Deciduous Trees

3. Enter number of new deciduous trees that qualify as Interceptor Trees in Box L3. [ ] trees Box L3

4. Multiply Box L3 by 100 and enter result in Box L4 [0] sq. ft. Box L4

Existing Tree Canopy

5. Enter square footage of existing tree canopy that qualifies as Existing Tree canopy in Box L5. [ ] sq. ft. Box L5

6. Multiply Box L5 by 0.5 and enter the result in Box L6 [0] sq. ft. Box L6

Total Interceptor Tree Credits

Add Boxes L2, L4, and L6 and enter it into Box L7 [0] sq. ft. Box L7

Divide Box L7 by 43,560 and multiply by 20% to get effective area managed 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 Driveway Design

See Fact Sheet for more information regarding Alternative Driveway Design credit guidelines

1. Select type of driveway

Pervious Driveway:	Multiplier:
Cobblestone Block P	0.40
Pervious Concrete/A	0.60
Modular Block Porous Pavement Porous Gravel	0.75
Not Directly-connected	1.00

[ ] Box M1

2. Determine percentage of units with 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 enter into the "Alternative Driveway Design" Box of Form D-1

Step 3 - Runoff Management Credits

Capture and Use Credits

Impervious Area Managed by Rain barrels, Cisterns, and automatically-emptied systems

(see Fact Sheet) ____ enter gallons, for simple rain barrels — 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 BMPs

(see Fact Sheet)

Bioretention Area ____ sq ft
Subdrain Elevation ____ inches
Ponding Depth, inches ____ inches — 0.00 acres

Impervious Area Managed by Infiltration BMPs

(see Fact Sheet)

Drawdown Time, hrs ____ drawdown_hrs_inf
Soil Infiltration Rate, in/hr ____ soil_inf_rate

Sizing Option 1: Capture Volume, acre-ft ____ capture_vol_inf — 0.00 acres

Sizing Option 2: Infiltration BMP surface area, sq ft ____ soil_surface_area — 0.00 acres

Basin or trench? Basin — approximate BMP depth 0.00 ft

Impervious Area Managed by Amended Soil or Mulch Beds

(see Fact Sheet) Mulched Infiltration Area, sq ft 725 mulch_area — 0.07 acres

Total Effective Area Managed by Capture-and-Use/Bioretention/Infiltration BMPs — 0.07 A_{LIDc}

Runoff Management Credit (Step 3) A_{LIDC}/A_T*200 = 121.0 pts

Total LID Credits (Step 1+2+3) LID compliant, check for treatment sizing in Step 4 — 121.0

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

Adjusted Area for Flow-Based, Non-LID Treatment $A_T - A_C - A_{LIDC}$ = 0.04 A_{AT}

Adjusted Impervious Fraction of A for Volume-Based, Non-LID Treatment $(A_T*I-A_C-A_{LIDC}) / A$ = 0.000 I_A

STOP: No additional treatment needed

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

Form D-1e

Calculate treatment flow (cfs): Flow = Runoff Coefficient x Rainfall Intensity x Adjusted Treatment Area

Determine C Factor using Table D-1b — C

Determine i using Table D-1c (Rainfall Intensity) — 0.18 — i

A_{AT} from Step 2 — 0.04 — A_{AT}

Flow = C * i * A_{AT} — 0.00 cfs

TABLE D-1b

Development Type	Runoff Coefficient (Rational), C
Single-family areas	0.50
Multi-units, detached	0.60
Apartment dwelling areas	0.70
Multi-units, attached	0.75
User Specified	0.00

Table D-1c

Rainfall Intensity			
Roseville	i =	0.20	in/hr
Sacramento	i =	0.18	in/hr
Folsom	i =	0.20	in/hr

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

Calculate water quality volume (Acre-Feet): WQV = Area x Maximized Detention Volume (P_0)

Obtain A from Step 1 — 0.11 — A — ____ hrs — Specified Draw Down time

Obtain P_0: Maximized Detention Volume from figures E-1 to 4 in Appendix E of this manual using I_A from Step 2. E: 0.00 — P_0

Calculate treatment volume (acre-ft):

Treatment volume = A x (P_0 / 12) — 0.00 Acre-Feet

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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 = ±10,300 ft^2 = 0.24 acres to the CL of proposed road.

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

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

D_{DR} = 0.64' for impervious area;

Ø = 0.35 - amended soil porosity;

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

A_{BMP} = 1,275 ft^2 - 25% of contributing impervious area – minimum BMP area; per LID calculator in order to achieve 100 points, Area of mulch bed is 1,350 ft^2.

A_i = 5,100 ft^2 – 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 BMP Sizing Calculations

Name of Drainage Shed: Blossom Ridge Lot 26
Location of project: Sacramento

Fill in Blue Highlighted boxes

Step 1 - Open Space and Pervious Area Credits

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

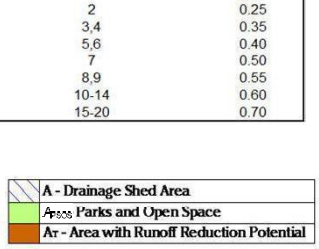
1 a. Common Drainage Plan Area		acres	A_{CDP}	
Common Drainage Plan Open Space (Off-project)	0	acres	A_{OS}	**see area example below**
a. Natural storage reservoirs and drainage corridors	0	acres		
b. Buffer zones for natural water bodies	0	acres		
c. Natural areas including existing trees, other vegetation, and soil	0	acres		
d. Common landscape area/park	0	acres		
e. Regional Flood Control/Drainage basins	0	acres		
1 b. Project Drainage Shed Area (Total)	0.24	acres	A	
Project-Specific Open Space (In-project, communal)**	0.00	acres	A_{PSOS}	**see area example below**
a. Natural storage reservoirs and drainage corridors	0.00	acres		
b. Buffer zones for natural water bodies	0.00	acres		
c. Natural areas including existing trees, other vegetation, and soil	0.00	acres		
d. Landscape area/park	0.00	acres		
e. Flood Control/Drainage basins	0.00	acres		

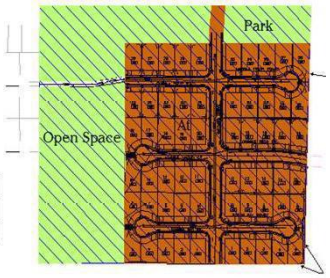
** Doesn't include impervious areas within individual lots and surrounding individual units. That is accounted for below using Form D-1a in Step 2.

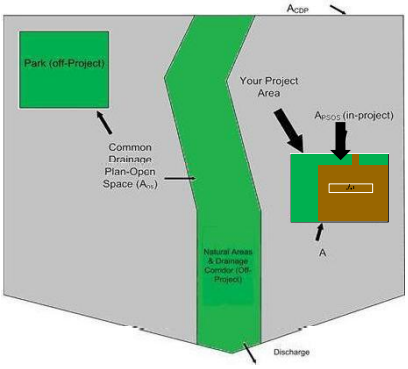
Area with Runoff Reduction Potential	$A - A_{PSOS}$ =	0.24	acres	A_T
Number of Units in A_T		1		
Number of units per acre in A_T	DU/A_T =	5	DUA	
Assumed Initial Impervious Fraction of A_T (determined using Table D-1a)		0.4	I	

Open Space & Pervious Area LID Credit (Step 1)
$(A_{OS}/A_{CDP}+A_{PSOS}/A)x100$ = 0 pts

Table D-1a	
Dwelling units per acre	Imperviousness
1	0.17
2	0.25
3,4	0.35
5,6	0.40
7	0.50
8,9	0.55
10-14	0.60
15-20	0.70







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
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)	A_C	0.00	acres EAM

Runoff Reduction Credit (Step 2) $(A_C / A_T)*100$ = 0 pts

Form D-1a: Disconnected Roof Drains Worksheet

See Fact Sheet for more information regarding Disconnected Roof Drain credit guidelines

Effective Area Managed (A_C)

1. Determine efficiency Multiplier

Runoff is directed to a dispersal trench or dry well (Type A and B soils only)		1.00
Runoff is directed across landscaping, determine setback		
25 ft +	Use multiplier of	1.00
≥ 20 and < 25 ft	Use multiplier of	0.90
≥ 15 and < 20 ft	Use multiplier of	0.70
≥ 10 and < 15 ft	Use multiplier of	0.45
≥ 5 and < 10 ft	Use multiplier of	0.25

Efficiency Multiplier → [ ] Box J1

2. Determine percentage of roof drains disconnected → [ ] Box J2

3. Select project density in dwelling units per acre:

1	Use reduction factor of	0.08
2	Use reduction factor of	0.13
3,4	Use reduction factor of	0.19
5,6	Use reduction factor of	0.23
7	Use reduction factor of	0.29
8,9	Use reduction factor of	0.33
10-14	Use reduction factor of	0.37
15-20	Use reduction factor of	0.44

Reduction Factor → [0.23] Box J3

4. Determine Area Managed

Multiply Box J3 by A_T, and enter the result in Box J4 [0.1] acres Box J4

5. Multiply Boxes J1, J2 and J4, and enter 60% of the Result in Box J [0.0] acres Box J

This is the amount of area credit to enter into the "Disconnected Roof Drains" Box of Form D-1

Form D-1b: Disconnected Pavement Worksheet

See Fact Sheet for more information regarding NDC Pavement credit guidelines

Effective Area Managed (A_C)

Divided Sidewalks

1. Determine percentage of units with divided Sidewalks [ ] Box K1

Multiply Box K1, A_T, and 0.04 and enter 60% of the result in Box K [0.00] acres Box K

This is the amount of area credit to enter into the "Disconnected Pavement" Box of Form D-1

Form D-1c: Interceptor Tree Worksheet

See Fact Sheet for more information regarding Interceptor Tree credit guidelines

Effective Area Managed (A_C)

New Evergreen Trees

1. Enter number of new evergreen trees that qualify as Interceptor Trees in Box L1. [ ] trees Box L1

2. Multiply Box L1 by 200 and enter result in Box L2 [0] sq. ft. Box L2

New Deciduous Trees

3. Enter number of new deciduous trees that qualify as Interceptor Trees in Box L3. [ ] trees Box L3

4. Multiply Box L3 by 100 and enter result in Box L4 [0] sq. ft. Box L4

Existing Tree Canopy

5. Enter square footage of existing tree canopy that qualifies as Existing Tree canopy in Box L5. [ ] sq. ft. Box L5

6. Multiply Box L5 by 0.5 and enter the result in Box L6 [0] sq. ft. Box L6

Total Interceptor Tree Credits

Add Boxes L2, L4, and L6 and enter it into Box L7 [0] sq. ft. Box L7

Divide Box L7 by 43,560 and multiply by 20% to get effective area managed 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 Driveway Design

See Fact Sheet for more information regarding Alternative Driveway Design credit guidelines

1. Select type of driveway

Pervious Driveway:	Multiplier:
Cobblestone Block P	0.40
Pervious Concrete/A	0.60
Modular Block Porous Pavement Porous Gravel	0.75
Not Directly-connected	1.00

[ ] Box M1

2. Determine percentage of units with 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 enter into the "Alternative Driveway Design" Box of Form D-1

Step 3 - Runoff Management Credits

Capture and Use Credits

Impervious Area Managed by Rain barrels, Cisterns, and automatically-emptied systems

(see Fact Sheet) ____ enter gallons, for simple rain barrels — 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 BMPs

(see Fact Sheet)

Bioretention Area ____ sq ft
Subdrain Elevation ____ inches
Ponding Depth, inches ____ inches — 0.00 acres

Impervious Area Managed by Infiltration BMPs

(see Fact Sheet)

Drawdown Time, hrs ____ drawdown_hrs_inf
Soil Infiltration Rate, in/hr ____ soil_inf_rate

Sizing Option 1: Capture Volume, acre-ft ____ capture_vol_inf — 0.00 acres

Sizing Option 2: Infiltration BMP surface area, sq ft ____ soil_surface_area — 0.00 acres

Basin or trench? Basin — approximate BMP depth 0.00 ft

Impervious Area Managed by Amended Soil or Mulch Beds

(see Fact Sheet) Mulched Infiltration Area, sq ft 1,350 mulch_area — 0.12 acres

Total Effective Area Managed by Capture-and-Use/Bioretention/Infiltration BMPs — 0.12 A_{LIDc}

Runoff Management Credit (Step 3) A_{LIDC}/A_T*200 = 103.3 pts

Total LID Credits (Step 1+2+3) LID compliant, check for treatment sizing in Step 4 — 103.3

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

Adjusted Area for Flow-Based, Non-LID Treatment $A_T - A_C - A_{LIDC}$ = 0.12 A_{AT}

Adjusted Impervious Fraction of A for Volume-Based, Non-LID Treatment $(A_T*I-A_C-A_{LIDC}) / A$ = 0.000 I_A

STOP: No additional treatment needed

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

Form D-1e

Calculate treatment flow (cfs): Flow = Runoff Coefficient x Rainfall Intensity x Adjusted Treatment Area

Determine C Factor using Table D-1b — C

Determine i using Table D-1c (Rainfall Intensity) — 0.18 — i

A_{AT} from Step 2 — 0.12 — A_{AT}

Flow = C * i * A_{AT} — 0.00 cfs

TABLE D-1b

Development Type	Runoff Coefficient (Rational), C
Single-family areas	0.50
Multi-units, detached	0.60
Apartment dwelling areas	0.70
Multi-units, attached	0.75
User Specified	0.00

Table D-1c

Rainfall Intensity			
Roseville	i =	0.20	in/hr
Sacramento	i =	0.18	in/hr
Folsom	i =	0.20	in/hr

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

Calculate water quality volume (Acre-Feet): WQV = Area x Maximized Detention Volume (P_0)

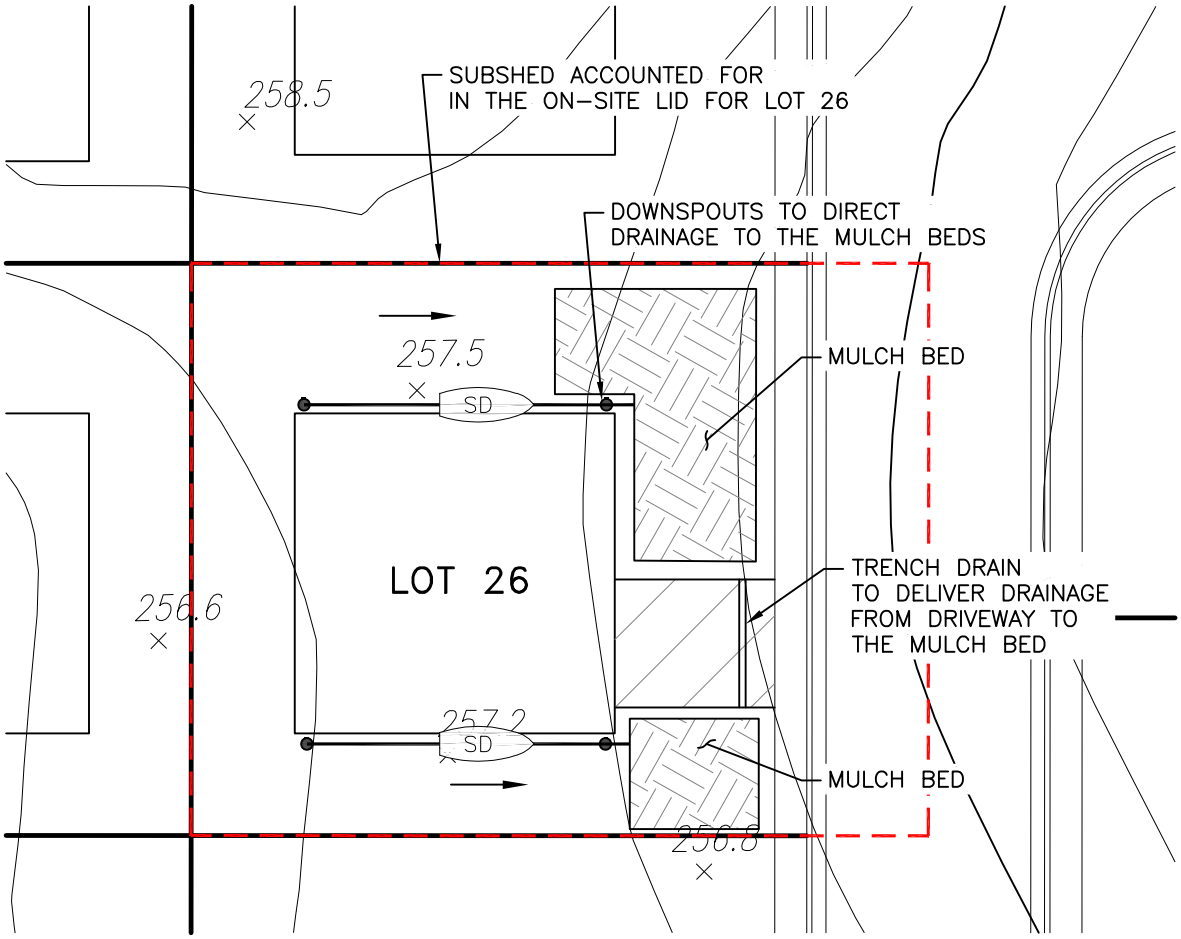
Obtain A from Step 1 — 0.24 — A — ____ hrs — Specified Draw Down time

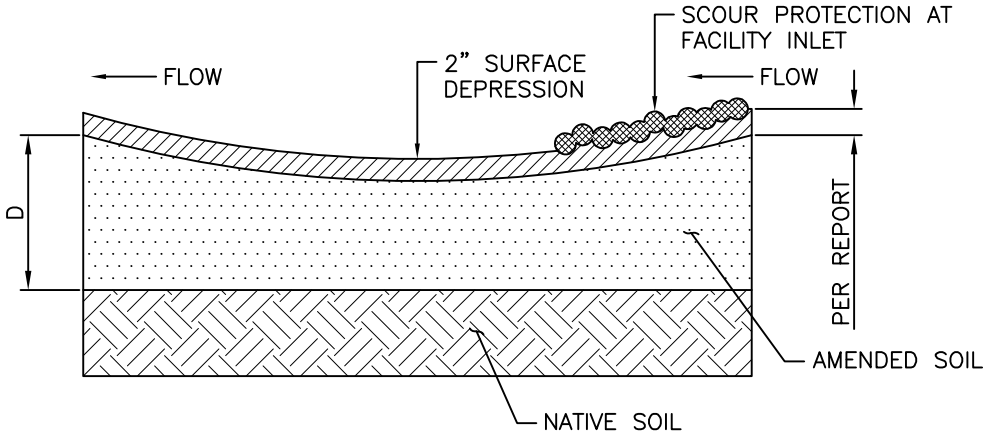
Obtain P_0: Maximized Detention Volume from figures E-1 to 4 in Appendix E of this manual using I_A from Step 2. E: 0.00 — P_0

Calculate treatment volume (acre-ft):

Treatment volume = A x (P_0 / 12) — 0.00 Acre-Feet

v06232012





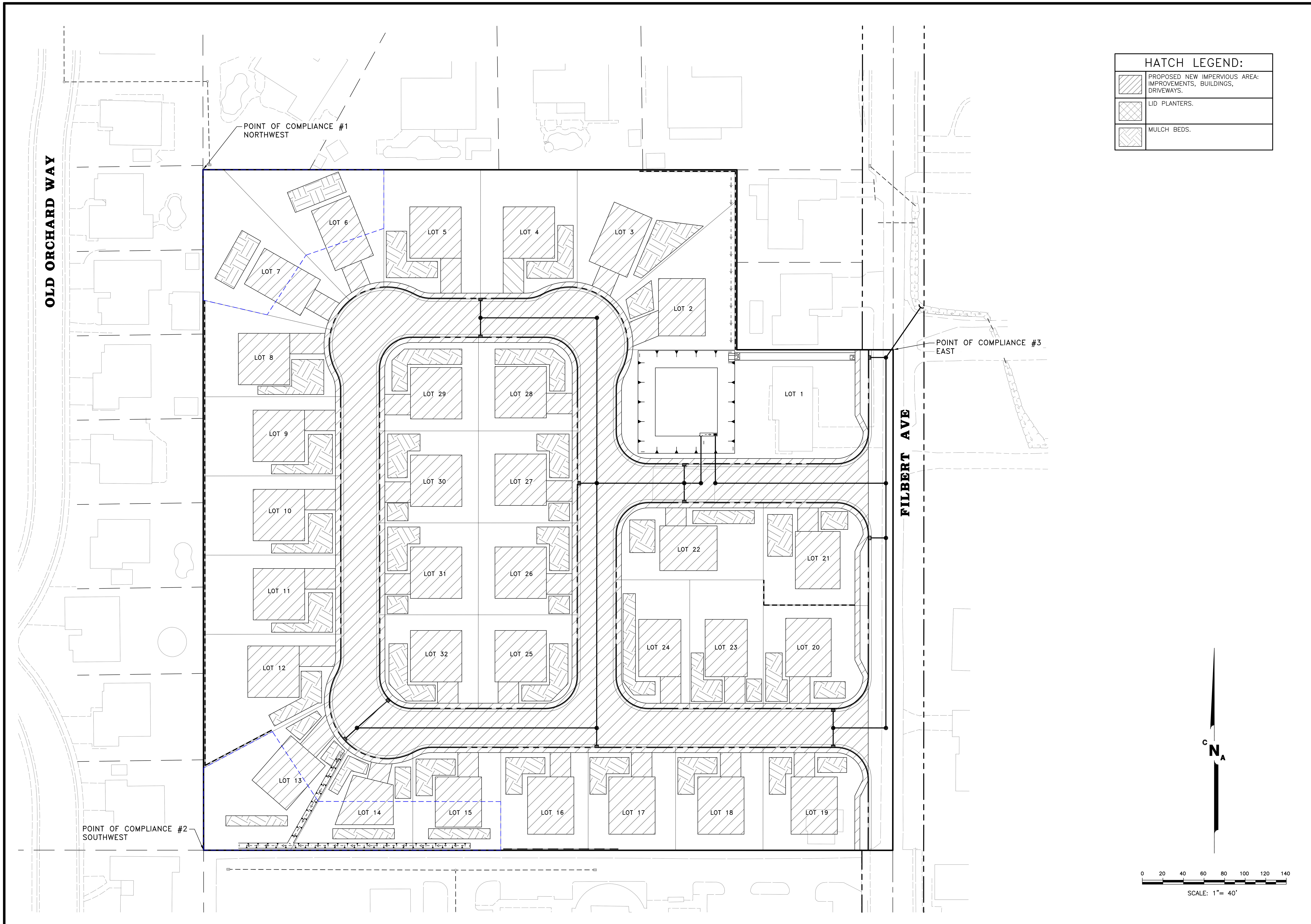
AMENDED SOIL WITH MULCH BED

N.T.S.

CNA ENGINEERING INC.
CIVIL ENGINEERING, LAND SURVEYING,
PLANNING, STRUCTURAL DESIGN
PHONE: (916) 485-3746
2575 VALLEY ROAD, SACRAMENTO, CA 95821
val@cnaeng.com

LOT 26 LID

SCALE: 1:30
DATE: 12/03/2021
FILE: 19144.DWG



NO.	DESCRIPTION	APPROVED BY	DATE
1			
2			
3			
4			

REVISIONS

CNA ENGINEERING INC.
CIVIL ENGINEERING: LAND SURVEYING
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PREPARED BY
DRAFTED BY: VAL T.
DESIGNED BY: STEVE N.
CHECKED BY: CHRIS O.

SCALE
HORIZ.: 1"= 40'
VERT.: N/A
FLD BK.: N/A
ASSESSOR'S PARCEL NO.: 223-0091-002

PRELIMINARY LID PLAN FOR:
BLOSSOM RIDGE
COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 2/21/2023
FN.:19144_11.DWG
SHEET X OF X SHEETS

Conclusions

1. The subdivision has been designed not to increase the peak flows during 100-, 10- and 2-year 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.
2. 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 (WS1.1E), cfs	Proposed Peak Flow (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 (WS2.1E), cfs	Proposed Peak Flow (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 (PRE), cfs	Proposed Peak Flow (POST), cfs
100-year	11.0	8.8
10-year	6.2	4.6
2-year	3.0	2.9