Appendix G

Technical Reports for the Hydrology and Water Quality Chapter

College Park Site "A"
Preliminary Drainage Study
Rocklin, California

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Prepared For:

Cresleigh Homes Corporation

Prepared By

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
3301 C Street, Bldg. 100-B Tel: 916.341.7760
Sacramento, CA 95816 Fax: 916.341.7767

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1.0 Introduction

The College Park Site A Project is a proposed residential development of approximately 55.6 acres located in the City of Rocklin and situated east of Sierra College Boulevard and north of Rocklin Road. Development on this site will occur in two phases: phase 1 consists of 328 single family homes and phase 2 consists of 98 townhomes. The density of the single-family residences is approximately 7.5 units per acre and 10.4 acres of the final project site will remain open space. The development includes a park, recreation center, and a 1.5-acre parking lot. A project vicinity map is attached as Exhibit 1. *All of the calculations and sizing requirements in this report will be pertinent to Site A only.*

The College Park Site B Project (South side of the overall site) is a future mixed use development of approximately 15.8 acres.

This "Preliminary Drainage Report" provides recommendations and calculations for site "A" only. With the future development of Site "B", similar drainage design principals and methods will be utilized. The Site "B" drainage system will use underground and/ or above ground drainage basins as necessary.

This Preliminary Drainage Report intends to meet the requirements outlined in the Placer County Stormwater Management Manual for a Preliminary Plan of Development.

2.0 Criteria

The on-site system is designed to meet the requirements of the Placer County Stormwater Management Manual (SWMM) for flood control. The City of Rocklin Post-Construction Manual Design Guidance for Stormwater Treatment (RPCM) and West Placer Storm Water Quality Design Manual (WPSWQM) were used to determine proposed stormwater quality treatment measures.

Placer County drainage requirements to be met by this drainage system are:

- No inundation on private property in the 10-year event within the project boundary (SWMM – Section VI. B. 2.)
- 10-year flows shall be conveyed within the gutter, roadside ditches or swales, or underground within street areas. (SWMM – Section VI. – C. 1.)
- Maximum stormwater elevation is 4" above the top of curb and the storm and water flow cannot exceed 3 ft/sec during the 100-year event for continuous grade profiles (SWMM – Table 6-1).
- Stormwater is a minimum of one foot below building pads during the 100-year event at sag points. Ponding does not extend more than 120 feet from inlet (2 std. residential lot frontages) along any street segment. (SWMM – Table 6-1)

- The design HGL should be at least 6 inches below the gutter grade at the inlet to allow the inlet to function properly. The inlet should not be counted as accepting (additional) flow if there is a possibility the hydraulic grade will be above this level. (SWMM – Section VI. – D. 2. b. (4))
- The objective flow shall be taken as the estimated pre-development peak flow rate less 10 % of the difference between the estimated pre-development and post-development peak flow rates from the site for all standard design storms ranging in frequency from the 2-year and up to and including 100-year. In no case, however, shall the objective flow be less than 90 percent of the estimated pre-development flow (SWMM – Section VII. – D. 1. a. and Figure 7-1).

3.0 Existing Drainage Conditions

The existing site consists predominately of undeveloped meadows with some trees in the northern portion of the property, closer to Secret Ravine. Along East Sierra College Blvd, there are 2 adjacent parcels with existing residential buildings that will remain. Existing soils are classified as Hydrologic Soil Group B (Natural Resources Conservation Service – online soil survey), coarse sandy loam, which have moderate infiltration when wetted. Ground slopes throughout most of the project site range from 2-9 percent. Ground cover mostly consists of meadow grasslands. However, the northern quarter of the site includes woodland with approximately 50% canopy cover.

The available floodplain mapping in the vicinity of the project from the Federal Emergency Management Agency (FEMA) can be found online at https://msc.fema.gov/portal/home . An excerpt of FEMA's mapping information through their online mapping tools is provided on Exhibit 2. The lowest elevation of the proposed project terrain (discharge elevation) is at approximately 309 feet (North American Vertical Datum 1988) which is approximately seven feet higher than the adjacent maximum base flood elevation shown on Exhibit 2. With onsite mitigation proposed to reduce peak flow before reaching Secret Ravine, no detailed evaluation of flooding within Secret Ravine is contemplated.

There is a drainage divide in the southern portion of the project site, with most of the site draining northward directly to Secret Ravine. The remaining southern portion of the site flows to a small unnamed creek tributary to Secret Ravine. Existing watersheds were taken from the Update to the Dry Creek Watershed Flood Control Plan and are shown on Exhibit 3, in black. In order to compare proposed peak runoff with existing peak runoff, the existing watersheds were further subdivided to coincide with project site boundaries and allow for pre-project and post-project comparisons. The revised existing watersheds are shown on Exhibit 3.

Existing watersheds SE55L and SE56DB lie partially in the project area along the southern boundary of Site A, but were not further evaluated. These watersheds are not being developed and therefore do not need to be subdivided or further evaluated under post-project conditions. The portions of these watersheds that are within Site A will be redirected through the proposed vaulted detention storage area discharging along Sierra College Boulevard, while the remaining (remnant) existing watershed areas draining towards Rocklin Road will be smaller. Therefore, peak flow from these watersheds that will remain undeveloped will be reduced. The existing and revised (subdivided) existing watershed parameters are shown in Appendix 1.

When constructed, the onsite drainage system will convey offsite runoff from the watershed N_off through the project area. Under revised existing conditions the N_off watershed is routed through N_und and the hydrographs are combined at node Y_n. The existing and revised existing watersheds are shown in Exhibit 3. Peak flows for revised existing conditions at node Y_n and SE56C1 are shown in Table 1. The watershed parameters for the existing and revised watersheds are included in Appendix 1.

Table 1 – Existing hydrology peak flows

Location	Peak Flow, 2-year event (cfs)	Peak Flow, 10-year event (cfs)	Peak Flow, 25-year event (cfs)	Peak Flow, 100-year event (cfs)
Y_n	6.6	21.2	30.9	48.1
SE56C1	2.0	6.3	9.0	13.5

4.0 Proposed Drainage System

The proposed drainage conveyance system will be comprised of underground pipes and curbed-and-guttered streets and on-site detention storage. Only main trunk lines were modeled for this preliminary report for planning purposes and may change slightly during final design. Due to the moderate sloping terrain of the proposed development, adequate drainage can be achieved with storm drains ranging from 15” to 24” in diameter. The sizes and layout of the storm drain system are shown in Appendix 3 attached to this report.

The proposed grading and storm drain system will reroute portions of the existing watersheds to the north and west. These rerouted areas are roughly equal, such that watershed area draining across the boundary of the site will be approximately equal to existing conditions. The net effect is an extra 2.8 acres of drainage area flowing northward, which is mitigated by the detention basins to pre-project runoff conditions with smaller contributing areas. A portion of the northern watershed upstream of the site (watershed N_off) will be captured in the storm drain system and routed to DET2. The proposed drainage system and watersheds are shown in Exhibit 3.

The northern system will drain to two detention basins (DET1 and DET2) at the northern boundary of the project site. DET1 will have a capacity of 2.97 acre-ft and DET2 will have a capacity of 2.18 acre-ft. These detention facilities also act as a bioretention basin for stormwater quality treatment. The outlet for each basin is a 6-inch orifice for flood control and an underdrain for lower flows. For DET1 the outlet consists of: a 6-inch diameter perforated water quality underdrain beneath the bioretention (filtration) soil layer and a 6-inch diameter pipe placed 1.5 feet above the basin bottom (top of filtration soil layer) For DET2 the outlet consists of: a 6-inch diameter perforated water quality underdrain beneath the bioretention (filtration) soil layer and a 6-inch diameter pipe placed 2.5 feet above the basin bottom (top of filtration soil layer). The detention basins will drain directly to existing overland (offsite) flow paths to Secret Ravine. The outlets will be constructed with a standpipe configuration, allowing for flows greater than 100-year design flows to exit the basins through the top of the standpipe before overflowing the containment embankments.

The detention facilities are constrained and will treat an equivalent amount of runoff volume through bioretention at depths greater than recommended in the City's Post-Construction Manual. The methods follow WPSQM guidelines and are described in section IV.B.5 in Appendix 2.

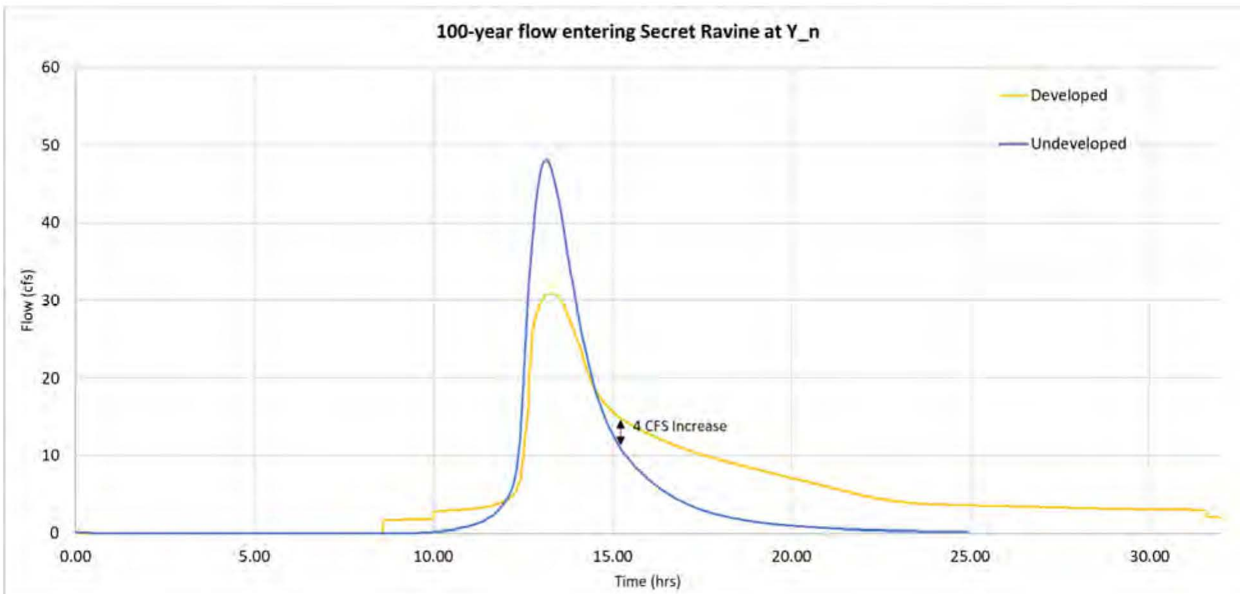
The southern system will drain to an underground vaulted detention basin. This detention basin will be tied into an existing 15-inch storm drain along East Sierra College Blvd. The outlet for this basin consists of a 4-inch diameter pipe at bottom elevation and a 6-inch diameter pipe at 2 feet above the bottom of the basin. Given that flood detention storage is below ground it is not feasible to construct a bioretention soil layer below the vault structure as it will not be maintainable. Therefore, the storm water quality treatment will be achieved in close coordination with local officials through a treatment vault structure, outfitted with acceptable filtration comparable to bioretention facilities, located downstream of the flood detention facility. Such a filtration configuration is assumed to treat low flows only, and have a high flow bypass to downstream, and no flood attenuation is assumed to occur within the treatment portion of the proposed system.

Runoff from the developed watersheds was calculated using the HEC-1 program and using the Dry Creek Desktop program and associated excel worksheet. Output hydrographs from HEC-1 were then used as input to an XPSWMM model to evaluate the storm drainage system and detention facilities. Analyzing only the storm drain trunklines with simplified watersheds was deemed sufficient for sizing detention and outlet portions of the storm drainage system.

5.0 Results (Site "A" Only)

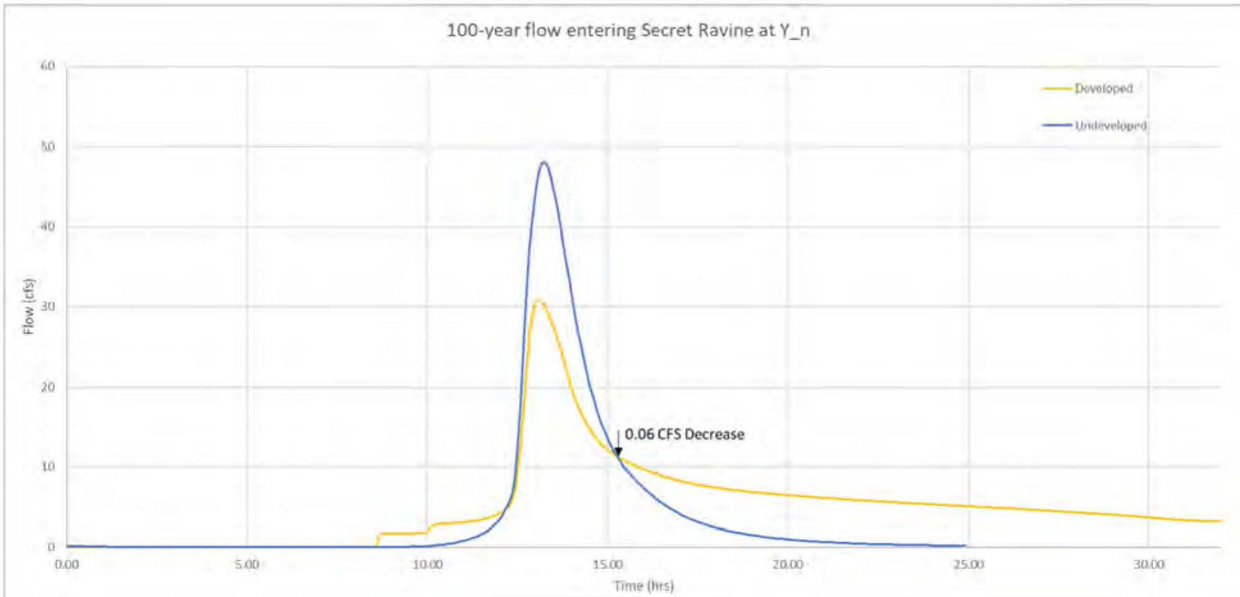
The impacts further downstream in Secret Ravine were analyzed to determine whether hydrograph timing would have any negative impact. The peak outflow from onsite developed conditions occurs at the same time (13.25 hours) as existing conditions. However, the developed condition flow is slightly larger when Secret Ravine is at peak flow, which is around 15.25 hours. At this time, the 100-year event peak flow increased by 4 cfs. See Figure 1 below. The peak flow in Secret Ravine is approximately 4,037 cfs. The hydraulic conditions were analyzed to determine if the 4 cfs could have an impact on the water surface elevation in Secret Ravine. A comparison was made in FlowMaster with the Secret Ravine cross section using pre-development peak flow (4,037 cfs) and developed peak flow (4,041 cfs). The analysis indicated that the impact to maximum water surface elevation in Secret Ravine would be less than 0.01 feet. See Appendix 4 for FlowMaster results.

Figure 1 – 100-year Hydrograph Comparison between Undeveloped and Developed Conditions



Upon review of these impacts, the City and Placer County directed the project to further reduce flow to mitigate any increase within Secret Ravine during peak flow conditions. To accomplish this reduction to the project's outflow the onsite detention storage must be modified to prevent release of additional runoff until after hour 15.25. In response to the City's request, Wood Rodgers determined that additional reduction can be achieved by diverting flow from DET2 to DET1 during peak onsite runoff conditions, further restricting the outlets of the detention basins, and storing more water in DET1. This diversion has been proposed at the manhole just upstream of DET2, as a 24-inch storm drain with an invert elevation of 319.5 feet, conveying higher flow to DET1. The new diversion pipe will drain west to east and flow beneath the proposed 18-inch storm drain flowing from south to north that drains the preserved tree grove area. Figure 2 shows the 100-year flow entering Secret Ravine at the Y_n location with the diversion and storage modifications.

Figure 2 – 100-year Hydrograph Comparison between Undeveloped and Developed Conditions



The resulting stage, storage and peak outflow for each detention basin is shown in Tables 2-5.

Table 2 – Detention Basin Results for 2-year storm event

Facility	Stage (ft), 2-year event	Storage (acre-ft), 2-year event	Peak Flow (cfs), 2-year event
DET1 (Northwest)	314.3	0.35	1.7
DET2 (Northeast)	317.5	0.99	1.8
DET3 (South)	348.6	0.69	0.8

Table 3 – Detention Basin Results for 10-year storm event

Facility	Stage (ft), 10-year event	Storage (acre-ft), 10-year event	Peak Flow (cfs), 10-year event
DET1 (Northwest)	315.4	0.82	2.2
DET2 (Northeast)	319.6	1.88	2.6
DET3 (South)	349.5	1.00	2.9

Table 4 – Detention Basin Results for 25-year storm event

Facility	Stage (ft), 25-year event	Storage (acre-ft), 25-year event	Peak Flow (cfs), 25-year event
DET1 (Northwest)	316.9	1.52	2.9
DET2 (Northeast)	319.9	2.03	2.7
DET3 (South)	349.9	1.13	4.5

Table 5 – Detention Basin Results for 100-year storm event

Facility	Stage (ft), 100-year event	Storage (acre-ft), 100-year event	Peak Flow (cfs), 100-year event
DET1 (Northwest)	319.5	2.97	3.7
DET2 (Northeast)	320.2	2.18	2.8
DET3 (South)	350.7	1.41	5.2

Comparisons were made between the northern and southern outfall points for pre-development and post-development drainage conditions. The drainage system meets Placer County requirements outlined in Section 2. Outflows from the detention basins are controlled so that downstream flows are reduced below target flow conditions in accordance with SWMM standards. See tables 6-7 for peak flow comparison results for the northern and southern development areas.

Table 6 – Peak flow comparison at Northern comparison location (Y_n/Yn)

Storm Event	Undeveloped Peak Flow (cfs)	Unmitigated Peak Flow (cfs)	Target Peak Flow (cfs)	Developed Peak Flow (cfs)	Difference (cfs)
2-year	6.6	15.05	5.94	5.4	-0.54
10-year	21.2	34.7	19.85	13.9	-5.95
25-year	30.9	48.5	29.14	19.8	-9.34
100-year	48.1	75.1	45.4	30.8	-14.6

Table 7 – Peak flow comparison at Southern comparison location (SE56C1/S_126)

Storm Event	Undeveloped Peak Flow (cfs)	Unmitigated Peak Flow (cfs)	Target Peak Flow (cfs)	Developed Peak Flow (cfs)	Difference (cfs)
2-year	2.0	5.6	1.8	1.6	-0.2
10-year	6.3	8.7	6.1	3.1	-3.0
25-year	9.0	9.0	9.0	4.0	-5.0
100-year	13.5	9.3	13.5	7.4	-6.1

The storm drain system was analyzed and the storm drain pipes meet SWMM requirements. The 10-year storm event was contained below gutter elevation and the 100-year storm event was contained below manhole rim elevation without including overland flow in streets. See the XPSWMM modeling files in Appendix 4 for the water surface elevation results.

The drainage system fully mitigates downstream impacts from the project site and complies SWMM design standards.

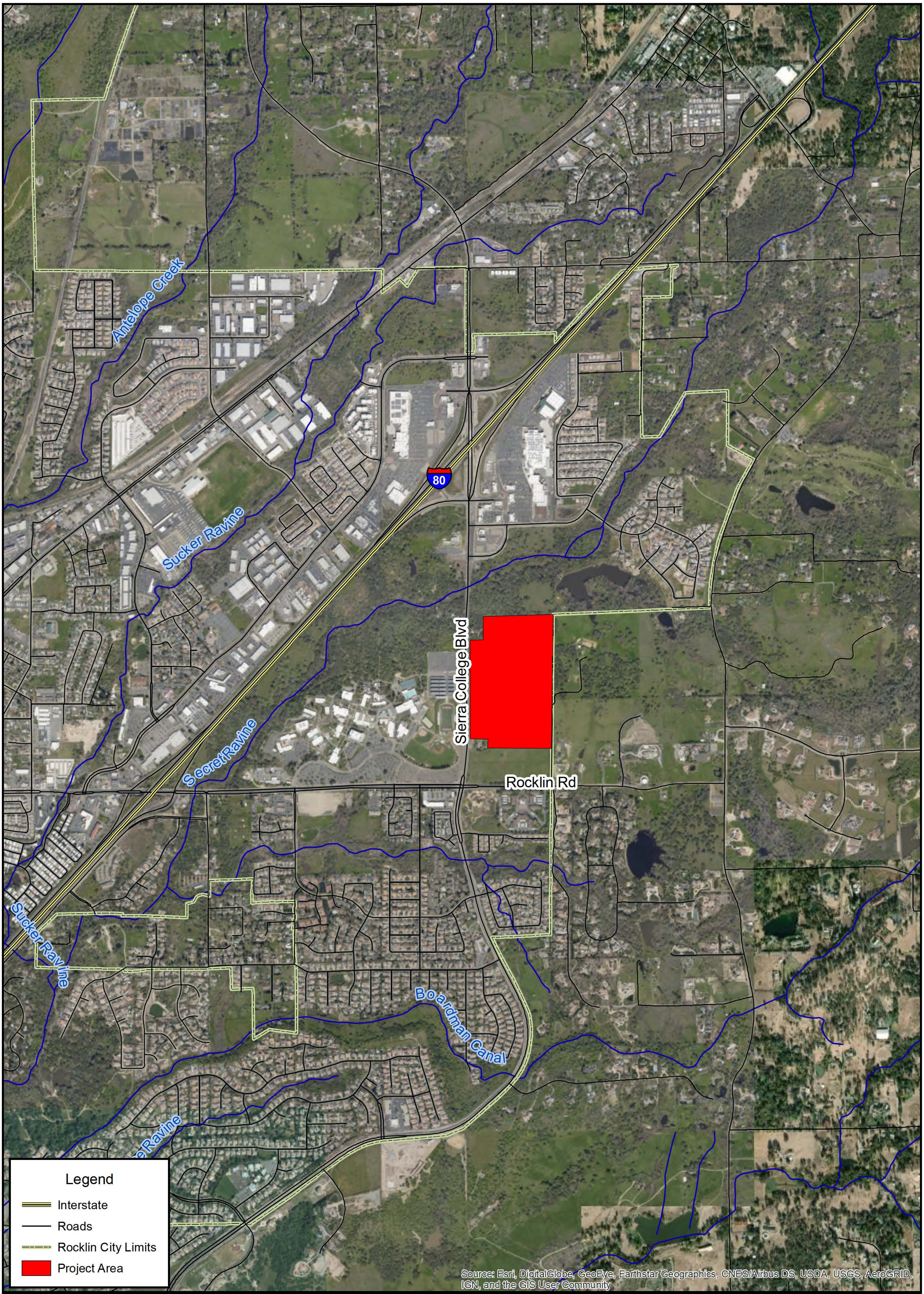


EXHIBIT 1 -
VICINITY MAP
SIERRA VILLAGE
ROCKLIN, CA
JANUARY 2021

NORTH

0 500 1,000
Feet

PRELIMINARY

WOOD RODGERS

EXHIBIT 2 - FEMA
FLOODPLAIN MAP

SIERRA VILLAGE

ROCKLIN, CA

JANUARY 2021

PRELIMINARY

WOOD RODGERS

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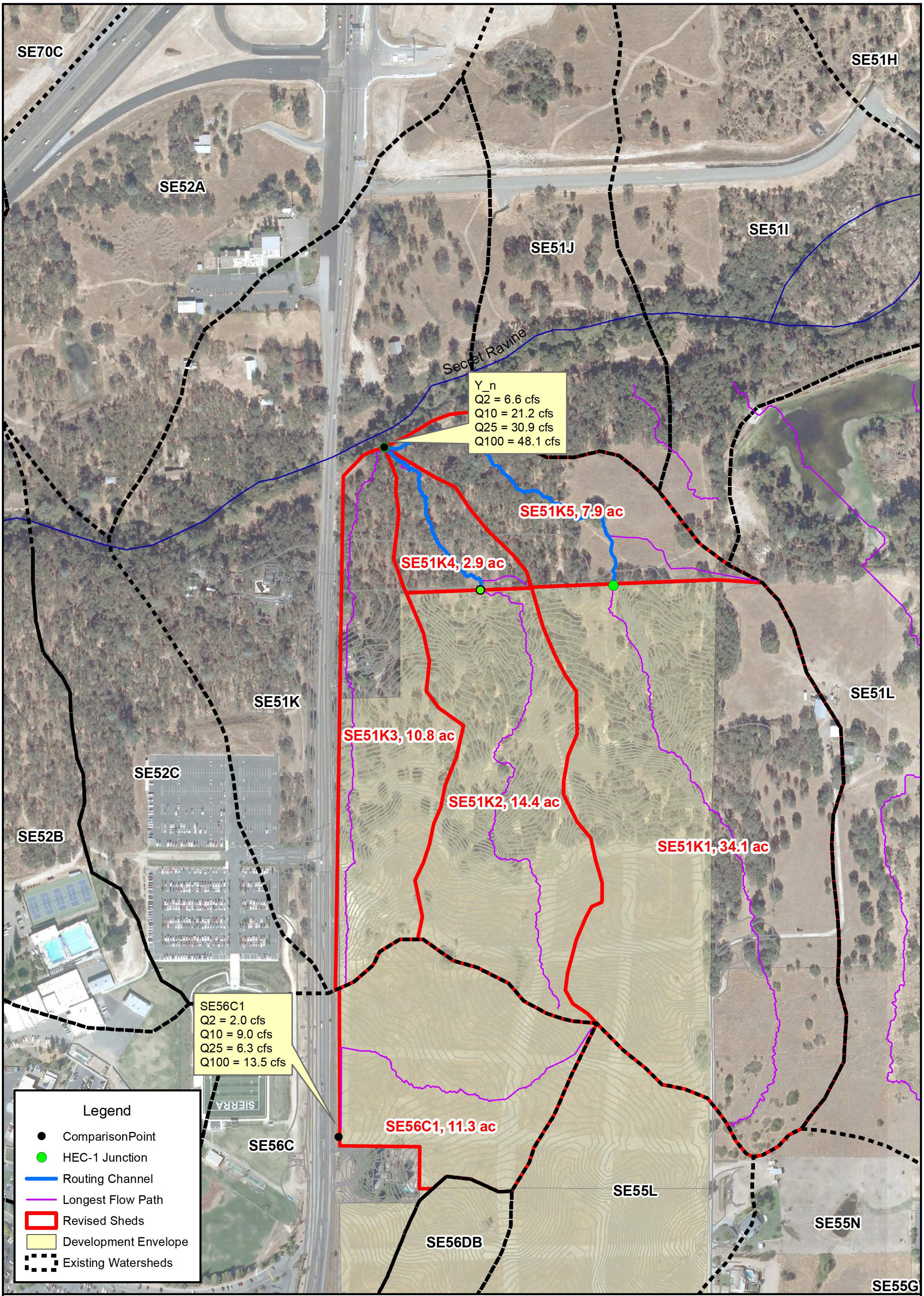

EXHIBIT 3 - REVISED
EXISTING HYDROLOGY

SIERRA VILLAGE
ROCKLIN, CA
JANUARY 2021

NORTH
0 100 200
Feet

Notes:
1) Existing watersheds were determined from the November 2011 Update to the Dry Creek Watershed Flood Control Plan

PRELIMINARY

WOOD RODGERS

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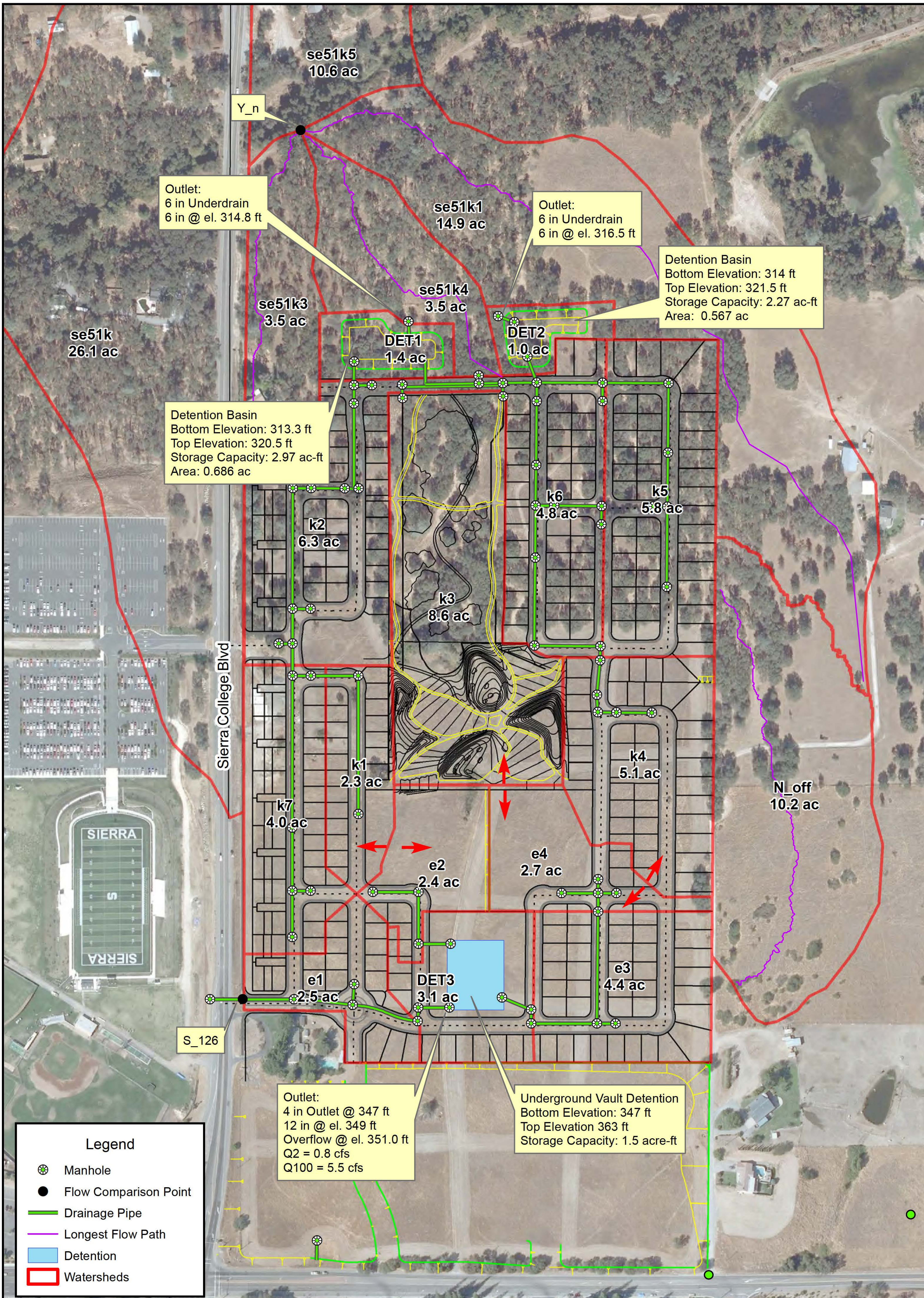

EXHIBIT 4 - PROPOSED DRAINAGE CONDITIONS
SIERRA VILLAGE
ROCKLIN, CA
APRIL 2021

NORTH
0 100 200
Feet

NOTES

PRELIMINARY

WOOD RODGERS

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EXHIBIT 4

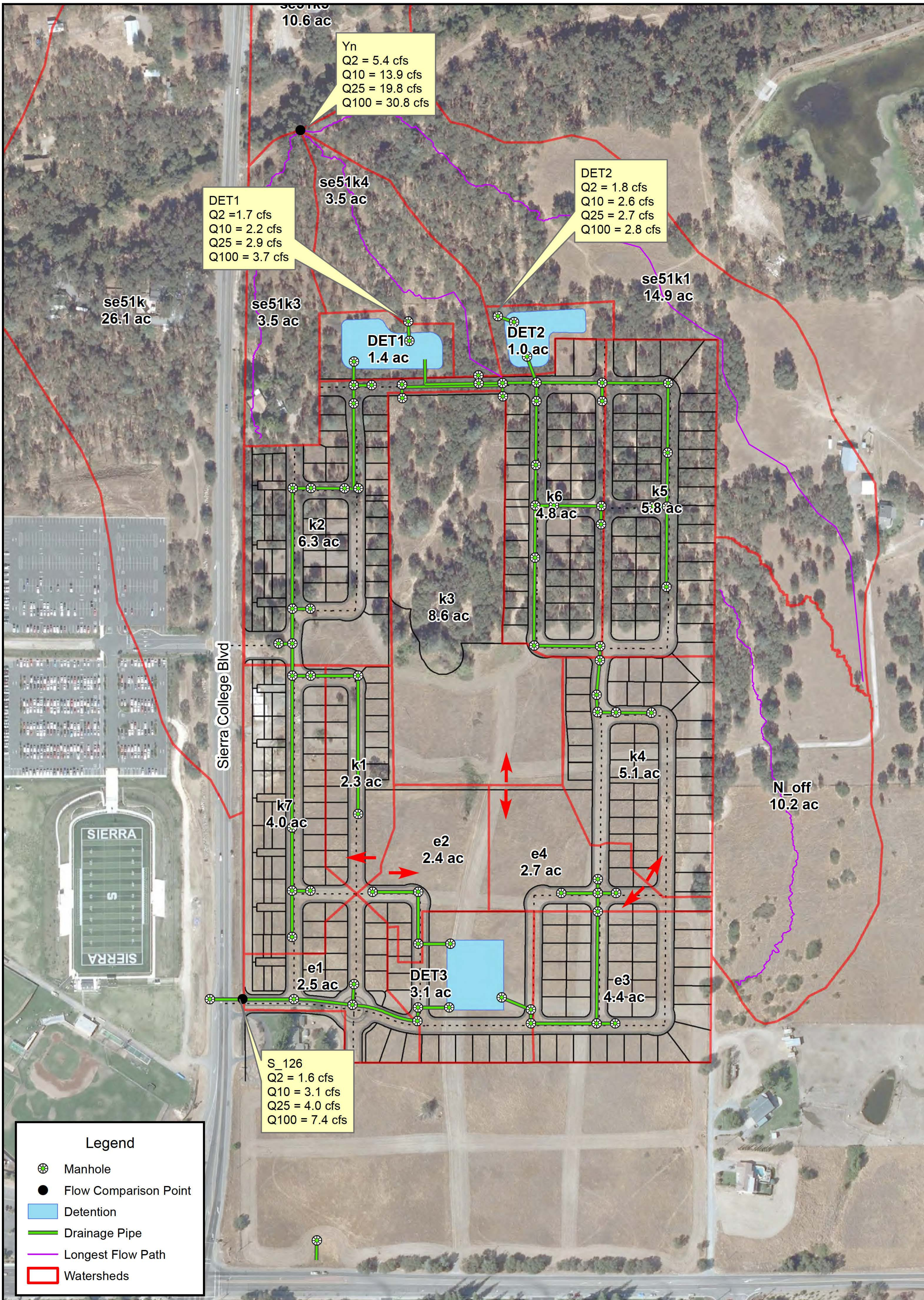

EXHIBIT 5 - DEVELOPED CONDITIONS RESULTS
SIERRA VILLAGE
ROCKLIN, CA
APRIL 2021

NORTH

0 100 200
Feet

NOTES

PRELIMINARY

WOOD RODGERS

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EXHIBIT 5

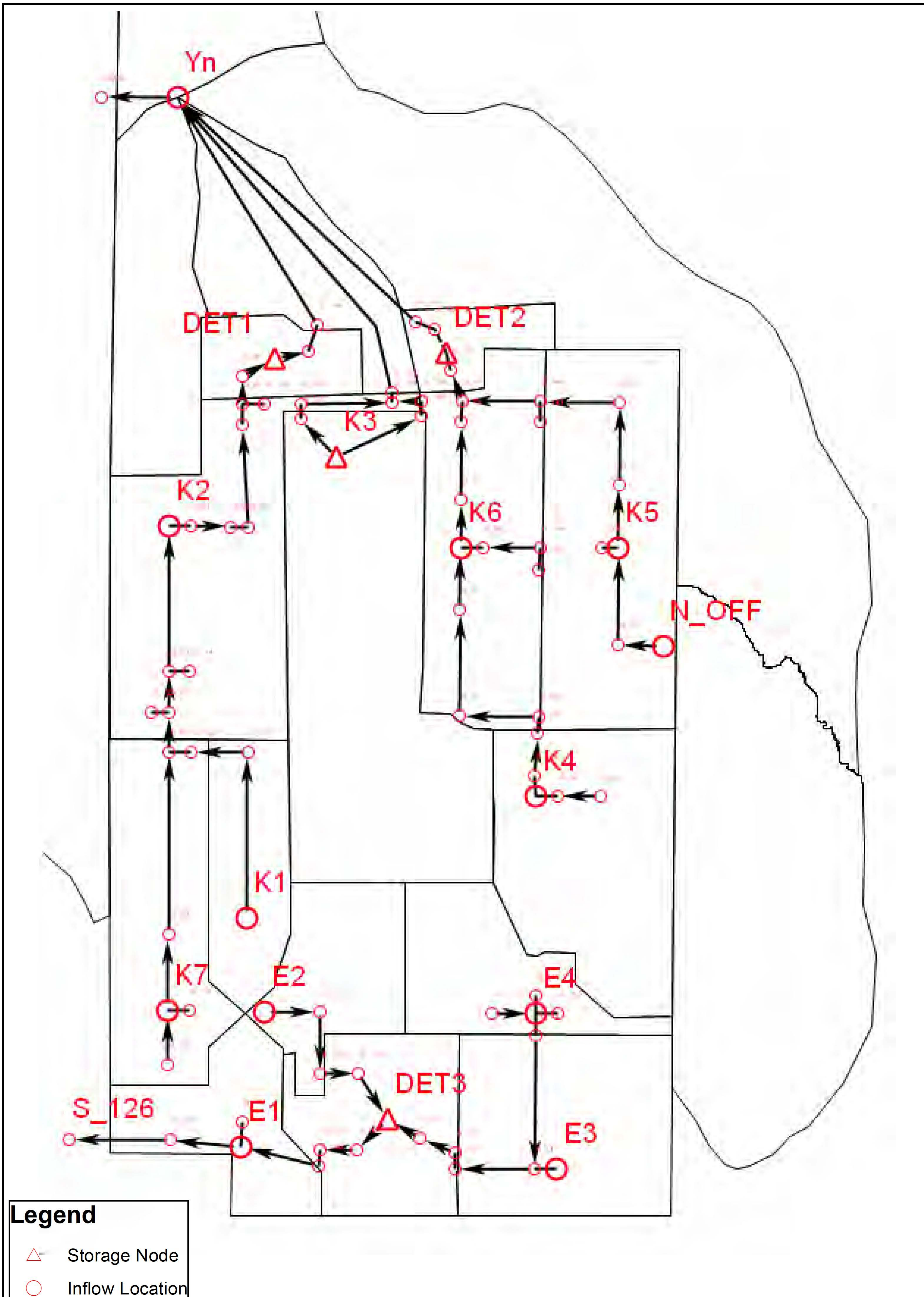

EXHIBIT 6 - PROPOSED
CONDITIONS ROUTING DIAGRAM
SIERRA VILLAGE
ROCKLIN, CA
JANUARY 2021

NORTH

0 100 200
Feet

NOTES

PRELIMINARY

WOOD RODGERS

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APPENDIX 1

APPENDIX 1: WATERSHED PARAMETERS

Existing

		LU CARDS								UK CARDS								RD1 CARD ITEMS						
		BA	PLANE 1			PLANE 2			PLANE 1				PLANE 2											
shed	DESCRIPTION	AREA MI^2	Init Abs	Const Infilt	% Imp	Init Abs	Const Infilt	% Imp	Length	Slope	'n' Value	% of Shed	Length	Slope	'n' Value	% of Shed	Length	Slope	'n' Value	Portion	TYPE	BW	SS
SE51K	SE51K 106.6ac	0.1666	0.1	0.1542	2.12	0.1	0.2466	73.56	402	0.001	0.4	87	77	0.0146	0.24	13	2424	0.0312	0.08	0	TRAP	2	20
SE56C	SE56C 59.1ac	0.0924	0.1	0.16	2	0.1	0.1901	58.77	497	0.001	0.4	33	92	0.0116	0.24	67	3475	0.0235	0.08	0	TRAP	2	20

Revised Existing

		LU CARDS							UK CARDS								RD1 CARD ITEMS						
		BA	PLANE 1			PLANE 2			PLANE 1				PLANE 2						0.08				20
shed	DESCRIPTION	AREA MI^2	Init Abs	Const Infilt	% Imp	Init Abs	Const Infilt	% Imp	Length	Slope	'n' Value	% of Shed	Length	Slope	'n' Value	% of Shed	Length	Slope	'n' Value	Portion	TYPE	BW	SS
SE51K1	SE51K1 34.1 ac	0.0532	0.1	0.1542	2.12	0.1	0.245	70	250	0.002	0.4	100	400	0.012	0.24	0	2438	0.0312	0.08	1	TRAP	2	20
SE51K2	SE51K2 14.4 ac	0.0225	0.1	0.1542	2.12	0.1	0.245	70	150.0	0.002	0.4	100	160.0	0.012	0.24	0.0	1800	0.0312	0.08	1	TRAP	2	20
SE51K3	SE51K3 10.8 ac	0.0169	0.1	0.1542	2.12	0.1	0.245	70	160.0	0.002	0.4	100	350.0	0.012	0.24	0.0	2100	0.0312	0.08	1	TRAP	2	20
SE51K4	SE51K4 2.9 ac	0.0045	0.1	0.1542	2.12	0.1	0.245	70	200.0	0.002	0.4	100	250.0	0.012	0.24	0.0	820	0.0312	0.08	1	TRAP	2	20
SE51K5	SE51K5 7.9 ac	0.0123	0.1	0.1542	2.12	0.1	0.245	70	210.0	0.002	0.4	100	200.0	0.012	0.24	0.0	1584	0.0312	0.08	1	TRAP	2	20
SE56C1	SE56C1 11.3 ac	0.0177	0.1	0.1454	2	0.1	0.245	70	130.0	0.002	0.4	100	130.0	0.0146	0.24	0.0	1385	0.0268	0.08	1	TRAP	2	20

Proposed

			LU CARDS						UK CARDS								RD1 CARD ITEMS						
			PLANE 1			PLANE 2			PLANE 1				PLANE 2										
Shed	DESCRIPTION	AREA MI^2	Init Abs	Const Infilt	% Imp	Init Abs	Const Infilt	% Imp	Length	Slope	'n' Value	% of Shed	Length	Slope	'n' Value	% of Shed	Length	Slope	'n' Value	Portion	TYPE	BW	SS
e3	PROPE3 11.7 ac	0.0182	0.1	0.1454	2.15	0.1	0.1454	80	50	0.001	0.4	17	50.0	0.012	0.24	83	1690	0.0268	0.015	1	TRAP	2	20
e1	PROPE1 1 ac	0.0015	0.1	0.1454	2.15	0.1	0.1454	80	40.0	0.001	0.4	0	40.0	0.0146	0.24	100.0	200	0.0268	0.015	1	TRAP	2	20
e2	PROPE2 0.8 ac	0.0013	0.1	0.1454	2.15	0.1	0.1454	80	30.0	0.001	0.4	10	30.0	0.0146	0.24	90.0	350	0.0268	0.015	1	TRAP	2	20
k1	PROPK1 5.7 ac	0.0089	0.1	0.1542	2.12	0.1	0.1542	70	80.0	0.001	0.4	0	80.0	0.012	0.24	100.0	700	0.0312	0.015	1	TRAP	2	20
k2	PROPK2 8.7 ac	0.0135	0.1	0.1542	2.12	0.1	0.1542	70	80.0	0.001	0.4	0	80.0	0.012	0.24	100.0	1500	0.0312	0.015	1	TRAP	2	20
k3	PROPK3 8.7 ac	0.0136	0.1	0.1542	2.12	0.1	0.1542	70	80.0	0.001	0.4	100	80.0	0.012	0.24	0.0	1000	0.0312	0.035	1	TRAP	2	20
k4	PROPK4 4.6 ac	0.0072	0.1	0.1542	2.12	0.1	0.1542	70	80.0	0.001	0.4	0	80.0	0.012	0.24	100.0	820	0.0312	0.015	1	TRAP	2	20
k5	PROPK5 6.2 ac	0.0097	0.1	0.1542	2.12	0.1	0.1542	70	80.0	0.001	0.4	0	80.0	0.012	0.24	100.0	750	0.0312	0.015	1	TRAP	2	20
k6	PROPK6 4.7 ac	0.0074	0.1	0.1542	2.12	0.1	0.1542	70	80.0	0.001	0.4	0	80.0	0.012	0.24	100.0	690	0.0312	0.015	1	TRAP	2	20
se51k	SE51K0 26.2 ac	0.0409	0.1	0.1454	1	0.1	0.1454	70	350	0.001	0.4	80	77.0	0.012	0.24	20	2000	0.0312	0.08	1	TRAP	2	20
N_off	NOFFS 10.2 ac	0.0159	0.1	0.1542	2.12	0.1	0.1542	70	250.0	0.001	0.4	100	250.0	0.012	0.24	0.0	1250	0.0312	0.08	1	TRAP	2	20
det	DET1 1.3 ac	0.0020	0.1	0.1542	2.12	0.1	0.1542	100	50.0	0.001	0.4	0	50.0	0.012	0.24	100.0	20	0.0312	0.035	1	TRAP	2	20
e_off	DET2 1 ac	0.0015	0.1	0.1542	2.12	0.1	0.1542	100	50.0	0.001	0.4	0	50.0	0.012	0.24	100.0	20	0.0312	0.015	1	TRAP	2	20
se51k1	E_OFF 1.6 ac	0.0024	0.1	0.1542	2.12	0.1	0.1542	40	35.0	0.001	0.4	0	35.0	0.012	0.24	100.0	500	0.0268	0.08	1	TRAP	2	20
se51k3	SE51K5 14.8 ac	0.0232	0.1	0.1542	1	0.1	0.1542	2.12	210.0	0.002	0.4	100	210.0	0.012	0.24	100.0	2565	0.0312	0.08	1	TRAP	2	20
se51k4	SE51K3 3.5 ac	0.0055	0.1	0.1542	1	0.1	0.1542	2.12	160.0	0.002	0.4	100	160.0	0.012	0.24	100.0	992	0.0312	0.08	1	TRAP	2	20

APPENDIX 2

Stormwater Control Plan
For a Regulated Project

College Park Site A

1/7/2021

Deana Ellis
Cresleigh Homes Corporation
3001 Douglas Boulevard, Suite 110
Roseville, CA 95661

Prepared by:

Wood Rodgers Inc.

3301 C Street, Building 100-B
Sacramento, CA 95816

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This Stormwater Control Plan was prepared using the template dated November 2014.

I. Project Data

Table 1. Project Data Form

Project Name/Number	Sierra Village "A"
Application Submittal Date	
Project Location	APN's 045-150-023, 048 and 052
Project Phase No.	Phase 1
Project Type and Description	Residential with 426 lots (single-family homes)
Total Project Site Area (acres)	55.6 acres
Total New and Replaced Impervious Surface Area	30.2 acres
Total Pre-Project Impervious Surface Area	0
Total Post-Project Impervious Surface Area	30.2 acres

II. Setting

II.A. Project Location and Description

The project site comprises 55.6 acres (APN's 045-150-023, 048 and 052), located east of Sierra College Boulevard and north of Rocklin Road. Development on this site will occur in two phases: phase 1 consists of 328 single family homes and phase 2 consists of 98 townhomes. The density of the single-family residences is approximately 7.5 units per acre. Approximately 10.4 acres of the final project site will remain open space. The development includes a park, recreation center, and a 1.5-acre parking lot. A project vicinity map is attached as **Exhibit 1**.

II.B. Existing Site Features and Conditions

The existing site consists predominately of undeveloped meadows. Along East Sierra College Blvd, there are 2 adjacent parcels with existing buildings. Existing soils are Type B, coarse sandy loam, which have moderate infiltration when wetted. Ground slopes throughout most of the project site range from 2-9 percent. Ground cover mostly consists of meadow grasslands. However, the northern quarter of the site includes woodland with approximately 50% canopy cover.

There is a drainage divide toward the southern end of the project site. Most of the site drains northward directly to Secret Ravine. The southern portion of the site flows to a natural stream tributary to Secrete Ravine.

II.C. Opportunities and Constraints for Stormwater Control

8.4 acres of open space is preserved in the northern center of the development where there are trees with approximately 50% canopy cover. A portion of flow from DMA 4 will be diverted into the open space via a curb cut to increase travel time and provide more bioretention. An additional 2 acres of open space is preserved in the south, where an underground vaulted detention basin will be constructed

III. Low Impact Development Design Strategies

III.A. Optimization of Site Layout

III.A.1. Limitation of development envelope

The development envelope is shown in **Exhibit 2**. The only natural barrier to development on this site is the presence of trees in the northern portion. Planned open space will preserve many of these trees.

III.A.2. Preservation of natural drainage features

Post-project peak outflow from the project site is reduced below existing peak runoff from the site. Only minor changes are made which alter natural site runoff routing. In DMA 3, 5 acres from existing watershed SE56E is re-routed northward. In The net effect is an extra 2.8 acres of drainage area flowing northward, which is mitigated by the detention basin. DMA 1, 2.2 acres from existing watershed SE51K is re-routed southward.

III.A.3. Setbacks from creeks, wetlands, and riparian habitats

The development is not within a setback area from streams, creeks, wetlands or riparian habitats.

The planned development is a residential zone. The standard lot size is 45' X 70'. The development adheres to R1-3.5 zoning requirements.

Setback Requirements for Zone R1-3.5	
Front	30'
Rear	25'
Interior Side	10'
Street Side	15'

III.A.4. Minimization of imperviousness
Permeable pavements were not chosen for this development. Where applicable building gutter flows will be buffered with landscaping/lawns before reaching the main conveyance system.

III.A.5. Use of drainage as a design element

III.B. Use of Permeable Pavements

Permeable pavements were not chosen for this development.

III.C. Dispersal of Runoff to Pervious Areas

Runoff will primarily be collected by curbed-and-guttered streets to an underground storm sewer system. Where applicable, building gutter flows will be buffered with landscaping/lawns before reaching the main conveyance system through the use of disconnected downspouts. The majority of the site will drain to two detention basins with a combined capacity of 5.6 acre-ft at the northern boundary of the site. The remainder will drain to an underground vault detention to the south. Additionally, DMA 4 will contain a curb cut to rout street runoff through open space.

III.D. Stormwater Control Measures

The majority of the site (43.7 acres) drains to detention basins at the northern boundary of the site, which include bioretention. The basins are designed to have a bottom area with the required 12" of gravel and 18" of a sandy top soil mixture. Cobbles will be placed at incoming pipes to prevent erosion from high velocities. A 6" diameter perforated pipe will drain the bioretention layer.

The remainder of the site flowing to the south is controlled by an underground vault. Water quality will be managed with media filtration at the outlet of the basin.

IV. Documentation of Drainage Design

IV.A. Descriptions of Each Drainage Management Area

Drainage Management areas are show on **Exhibit 3**

IV.A.1. Table of Drainage Management Areas

DMA Name	Surface Type	Area (square feet)
DMA 1	Residential / Open Space	519,900
DMA 2	Residential	82,800
DMA 3	Residential	604,500
DMA 4	Residential	219,200
DMA 5	Residential	475,800
DMA 6	Open Space / Landscape	365,300
DMA 7	Open Space / Detention	154,400

IV.A.2. Drainage Management Area Descriptions

DMA 1, totaling 519,900 square feet, drains residential lots, streets and parking. DMA 1 drains to Underground Detention.

DMA 2, totaling 82,800 square feet, drains residential lots and streets. DMA 2 drains to Underground Detention.

DMA 3, totaling 605,000 square feet, drains residential lots and streets. DMA 3 drains to the northern bioretention basin.

DMA 4, totaling 219,000 square feet, drains residential lots and streets. DMA 4 drains through DMA 5 to the northern bioretention basin. A portion of DMA 4 gutter flow will be routed through open space (DMA 6) by constructing a curb cut along the road.

DMA 5, totaling 476,000 square feet, drains residential lots and streets. DMA 5 drains to the northern bioretention basin.

DMA 6, totaling 365,000 square feet, drains a park and open space. DMA 6 drains to the northern bioretention basin.

DMA 7, totaling 154,000 square feet, drains open space and contains the main bioretention basin. DMA 7 drains in the bioretention basin or maintains natural overland runoff.

IV.B. Tabulation and Sizing Calculations

IV.B.1. Information Summary for Bioretention Facility Design

Total Project Area: 2,422,000	
DMA 1	519,900
DMA 2	82,800
DMA 3	604,500
DMA 4	219,200
DMA 5	475,800
DMA 6	365,300
DMA 7	154,400

IV.B.2. Self-Treating Areas

This project has no self-treating DMA's.

IV.B.3. Self-Retaining Areas

This project has no self-retaining DMA's.

IV.B.4. Areas Draining to Self-Retaining Areas

N/A

IV.B.5. Areas Draining to Bioretention Facilities

DMA Name	DMA Area (sq. ft.)	Post-project surface type	DMA Runoff factor[1]	DMA Area X runoff factor	Facility Name: North Bioretention Facilities		
DMA 2	82,800	Roofs and paving	.73	60,400			
DMA 3	604,500	Roofs and paving	.73	441,300			
DMA 4	219,200	Roofs and paving	.73	160,000			
DMA 5	475,800	Roofs and paving	.73	347,300			
DMA 6	365,300	Landscaped areas	.1	16,200	Sizing factor	Minimum Facility Size	Proposed Facility Size
Total>				1,025,300	0.04	41,000	41,000

1. Residential DMA areas including roofs and paving are considered 70% impervious and 30% landscaped based on development density. A weighted runoff factor (1*0.7 + 0.1*0.3) was used.

DMA Name	DMA Area (sq. ft.)	Post-project surface type	DMA Runoff factor	DMA Area X runoff factor[1]	Facility Name Southern Underground Filtration		
DMA 1-A	432,700	Roofs and paving	.73	315,900	Sizing factor	Minimum Facility Size	Proposed Facility Size
DMA 1-B	87,100	Roofs and paving	.1	8,700			
Total>				324,600	0.04	13,000	

1. Residential DMA areas including roofs and paving are considered 70% impervious and 30% landscaped based on development density. A weighted runoff factor (1*0.7 + 0.1*0.3) was used.

The minimum facility sizes are not possible in the constrained layout of the development. Increasing the footprint of these areas would require removal of old-growth wooded areas. These environmentally sensitive areas are best left preserved. Therefore, water quality treatment through bioretention will be achieved through a smaller footprint with additional ponding depth. The detention basins have additional capacity that can be allocated toward storing the water quality volume (WQV)in a greater depth than a typical bioretention basin. This was chosen as the preferred treatment method after discussion with the City of Rocklin drainage reviewer. The WQV was calculated according to the West Placer Stormwater Quality Manual (WPSQWM) standards.

The WQV was calculated using Fact Sheet TR-1 in the WPSWQM. See the tables below for the calculation. The WQV for DET1 is 23,900 cubic feet and the WQV for DET2 is 27,500 cubic feet. These volumes are in excess of storing 1-foot of depth over the Rocklin required bioretention area guidelines. DET1 will store the WQV up to a depth of 1.5 feet and DET2 will store the WQV up to a depth of 2.5 feet. Water stored up to these depths will entirely drain through the bioretention layer at the bottom of the detention basin. At depths greater than this, the detention basin will also drain through flood control outlets.

Northwest Basin (DET01)				
Name	Area	Runoff Coefficient	Unit Water Quality Volume	WQV
DMA 3	604,500	0.73	0.65	23,900
			Total WQV (ft3)	23,900
			Total WQV (ac-ft)	0.549

Northeast Basin (DET02)				
Name	Area	Runoff Coefficient	Unit Water Quality Volume	WQV
DMA 4	219,200	0.73	0.65	8,700
DMA 5	475,800	0.73	0.65	18,800
			Total WQV (ft3)	27,500
			Total WQV (ac-ft)	0.631

The Southern underground basin will provide equivalent water quality treatment through filtration as a 13,000 square foot bioretention facility.

V. Source Control Measures

V.A. Site activities and potential sources of pollutants

The site has potential pollutant sources typical of residential areas. This includes minor accidental spills, litter, debris, and home pesticides runoff.

V.B. Source Control Table

Potential source of runoff pollutants	Permanent source control BMPs	Operational source control BMPs
On-site storm drain inlets (unauthorized non- stormwater discharges and accidental spills or leaks)	Mark all inlets with the words —No Dumping! Flows to Creek‖	a. Maintain and periodically repaint or replace inlet markings. b. Provide stormwater pollution prevention information to new site owners, lessees, or operators. c. Include the following in lease agreements: —Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains.

Landscape/ Outdoor Pesticide Use/Building and Grounds Maintenance	The final landscape plans must accomplish the following: a. Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. b. Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. c. Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. d. Consider using pest-resistant plants, especially adjacent to hardscape. e. To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	a. Maintain landscaping using minimum or no pesticides. b. Follow operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/bmp- handbooks c. Provide IPM information to new owners, lessees and operators.
Plazas, sidewalks, and parking lots.		Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

V.C. Features, Materials, and Methods of Construction of Source Control BMPs

To mitigate accidental dumping, storm inlets will be clearly marked with "no dumping" signage. Signage will be periodically inspected by the operator. Language discouraging dumping and car washing will be added to homeowner's association or leasing agreements. The landscaping plan will address appropriate plants to reduce pesticide needs and promote infiltration. Regular sweeping of streets, sidewalks and parking lots will be added to the maintenance schedule.

VI. Stormwater Facility Maintenance

VI.A. Ownership and Responsibility for Maintenance in Perpetuity

The applicant accepts responsibility for interim operation and maintenance of stormwater treatment and flow-control facilities until such time as this responsibility is formally transferred to a subsequent owner.

VI.B. Summary of Maintenance Requirements for Each Stormwater Facility

The following activities will be added to the maintenance schedule:

- Removing vegetation, debris or other blockage from storm drain inlets.
- Pruning plants in bioretention to maintain plant health or prevent overgrowth along flow paths.
- Regular weed removal.
- Mulch replacement in bioretention basin to maintain 3” layer thickness.
- Maintain “No Dumping” signage at inlets.
- Inspect irrigation to ensure that there is no excess runoff.
- Warning to not use fertilizers or synthetic pesticides in the bioretention basin.

VII. Construction Checklist

[See the instructions beginning on page 3-7 of the *Post-Construction Manual.*]

SCP Page #	Source Control or Treatment Control Measure	See Plan Sheet #s
5	Mark all inlets with the words —No Dumping! Flows to Creek‖	
5	Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.	
5	interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	
5	refuse will be handled and provide supporting detail to what is shown on plans.	
6	signs will be posted on or near dumpsters with the words —Do not dump hazardous materials here or similar	

VIII. Certifications

The preliminary design of stormwater treatment facilities and other stormwater pollution control measures in this plan are in accordance with the current edition of the City of Rocklin *Post-Construction Manual.*

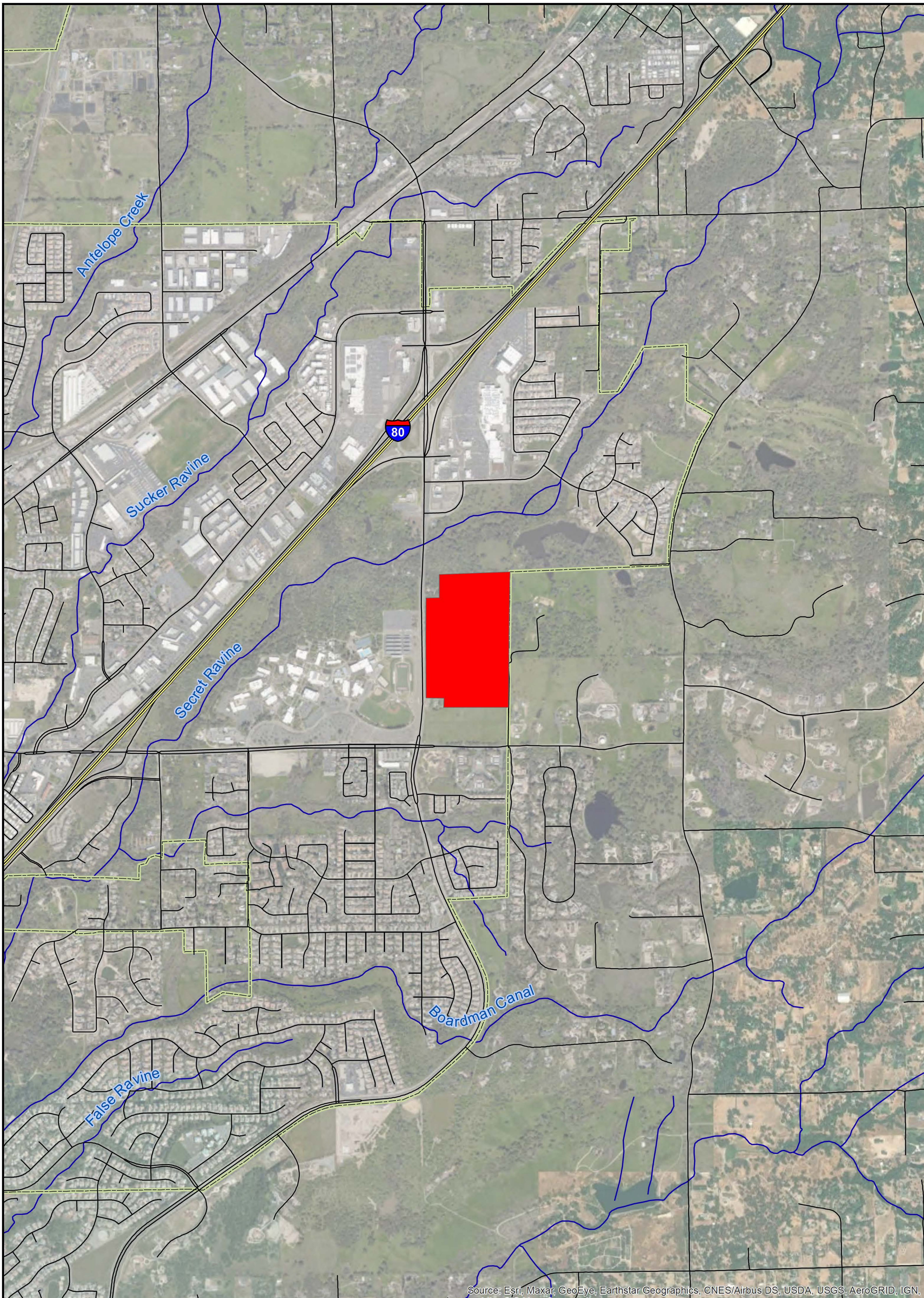

EXHIBIT 1 - PROJECT VICINITY MAP
SIERRA VILLAGE
ROCKLIN, CA
APRIL 2021

Legend
Interstate
Roads
Rocklin_Boundary_Line

PRELIMINARY

WOOD RODGERS

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EXHIBIT 1

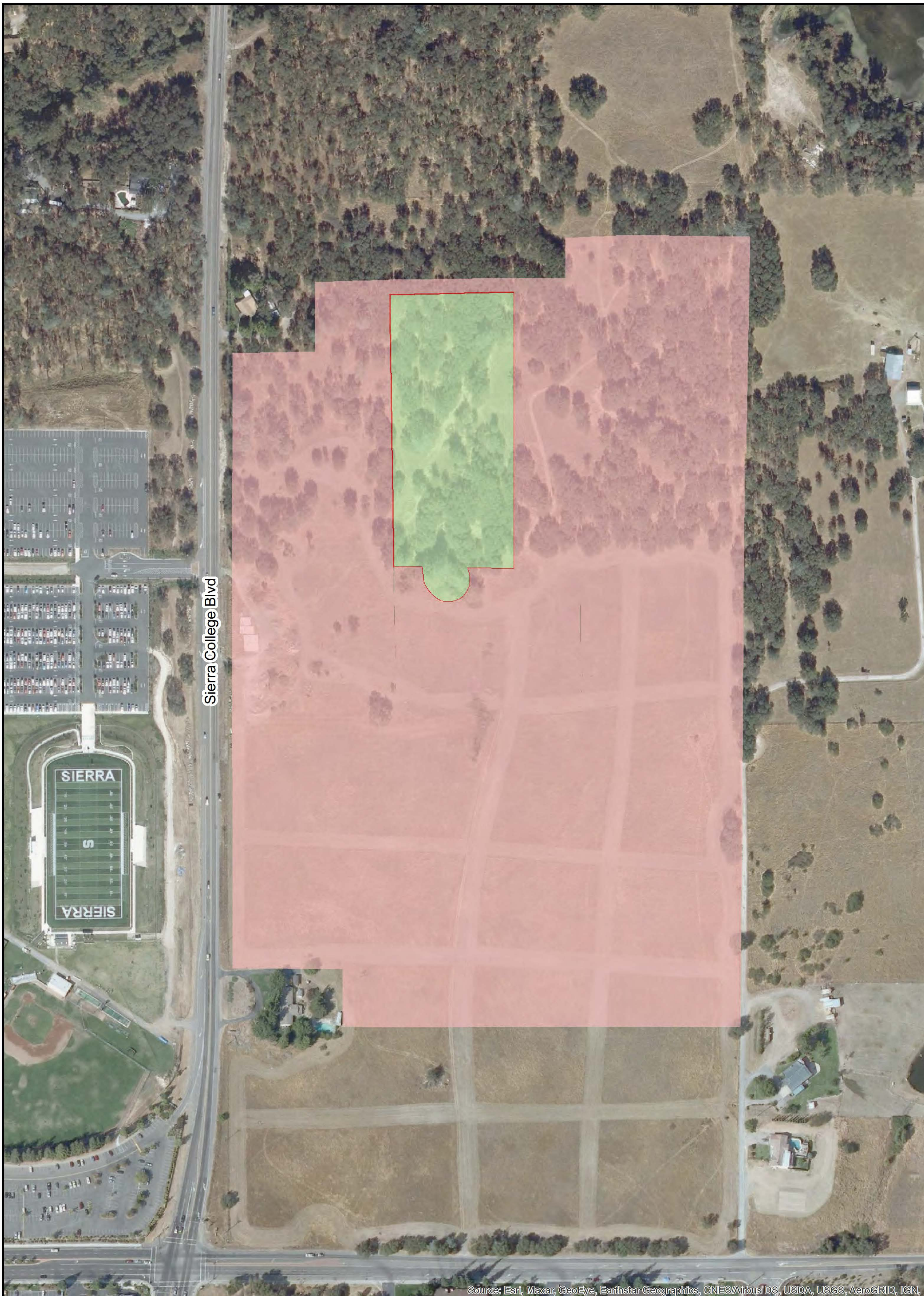

EXHIBIT 2 - DEVELOPMENT ENVELOPE

SIERRA VILLAGE

ROCKLIN, CA

APRIL 2021

Legend

DMA

Open Space

NORTH

0 100 200

Feet

NOTES

PRELIMINARY

WOOD RODGERS

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EXHIBIT 2

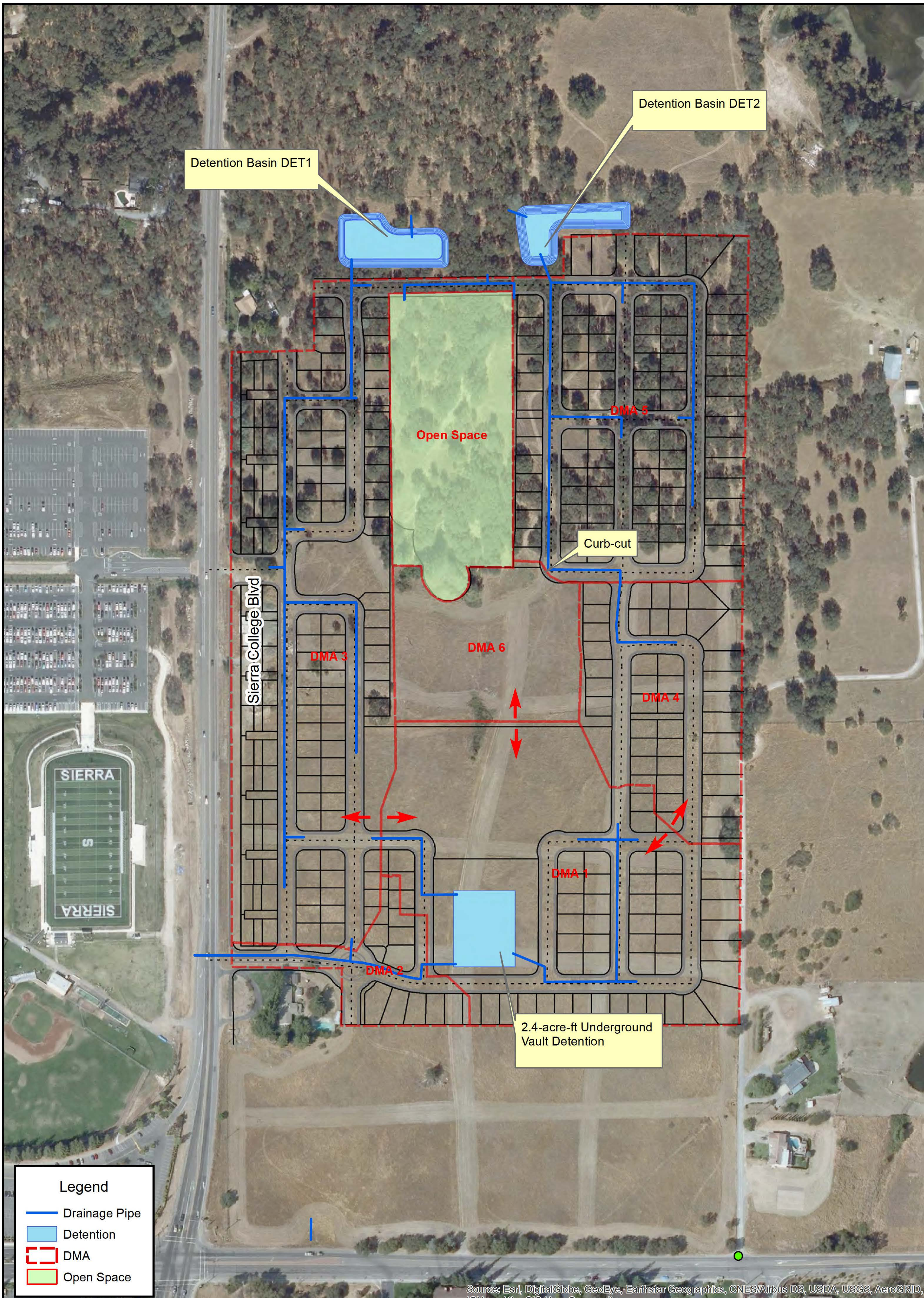

EXHIBIT 3 - DRAINAGE MANAGEMENT AREAS

SIERRA VILLAGE

ROCKLIN, CA

JANUARY 2021

NOTES

PRELIMINARY

WOOD RODGERS

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APPENDIX 3

PRELIMINARY GRADING AND DRAINAGE STUDY

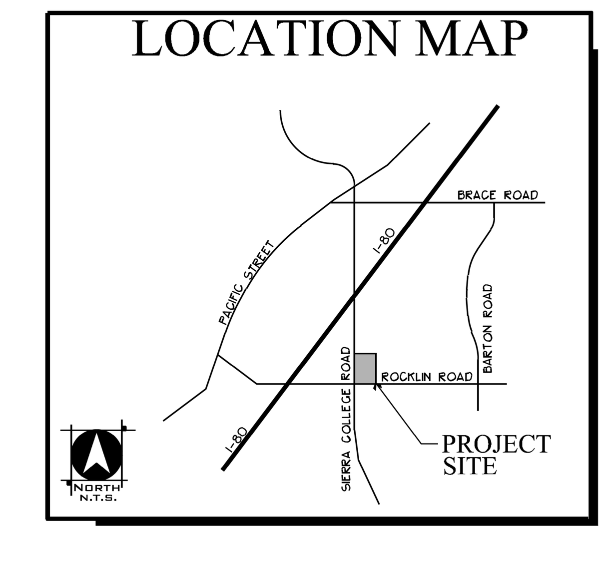
COLLEGE PARK NORTH

CITY OF ROCKLIN CALIFORNIA

SHEET 6 OF 8

APRIL 26, 2021

LOCATION MAP



LEGEND:

- PROJECT / UNIT BOUNDARY
- P= 20.0 PROPOSED MASS GRADING PAD ELEVATION
- XXX.X PROPOSED MASS GRADING STREET ELEVATION (SUBGRADE)
- PROPOSED OVERLAND RELEASE
- STORM DRAIN INLET
- 12"D STORM DRAIN
- STORM DRAIN MANHOLE
- TURNING MOVEMENTS

TOPOGRAPHY:

TOPOGRAPHICAL INFORMATION HAS BEEN PROVIDED BY OTHERS AND HAS NOT BEE FIELD VERIFIED BY WOOD RODGERS, INC. ALL TOPOGRAPHICAL FEATURES AND ELEVATIONS ARE FOR INFORMATIONAL PLANNING PURPOSE ONLY.

GRADING DESIGN

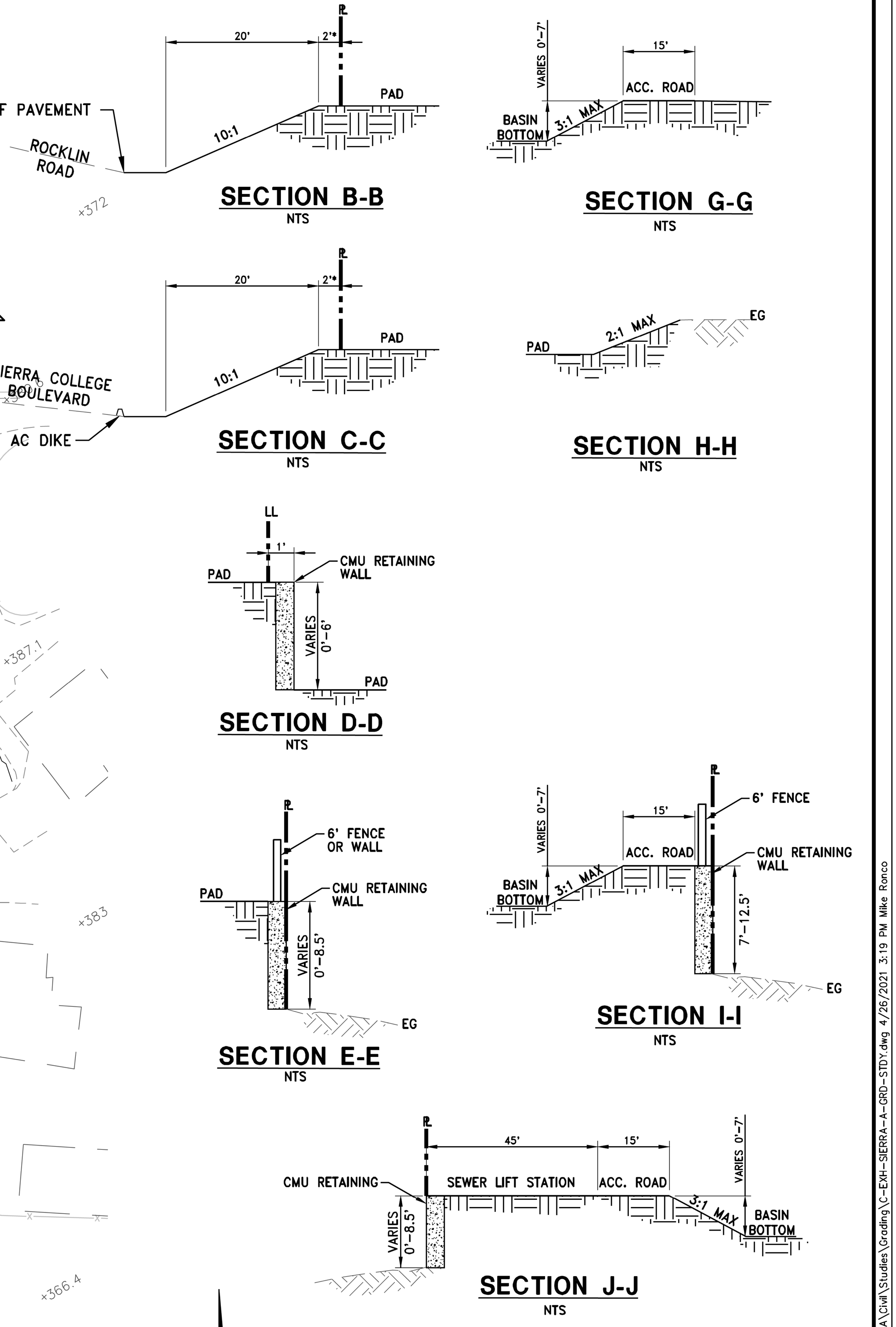
GRADING AND RETAINING WALLS SHOWN ARE PRELIMINARY. FINAL PAD ELEVATIONS AND WALL HEIGHTS SHALL BE DETERMINED WITH FINAL DESIGN.

EARTHWORK

CUT	239,000 CY
FILL	236,000 CY
NET	3,000 CY (CUT)

NOTE (DB WQ)

FINAL DETENTION BASIN/LID AND WATER QUALITY TREATMENT SHALL BE CALCULATED AND SIZED BASED UPON THE FINAL LAND USE PLAN.



SCALE: 1" = 60'

WOOD RODGERS
BUILDING RELATIONSHIPS ONE PROJECT AT A TIME
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Sacramento, CA 95816 Fax 916.341.7767

APPENDIX 4

(Included electronically with submittal)

College Park Sites “C-1”

Preliminary Drainage Study

Rocklin, California

December 2019
Revised January 2021

Prepared For:

College Park

Prepared By

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
3301 C Street, Bldg. 100-B Tel: 916.341.7760
Sacramento, CA 95816 Fax: 916.341.7767

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Exhibits

Exhibit 1 – Existing Watersheds
Exhibit 2 – Proposed Watersheds

Appendices

Appendix 1 – Watershed Parameters

Appendix 2 – FEMA Firmette

Appendix 3 – Grading Plan

Appendix 4 – Digital Modeling Files

1.0 Introduction

The College Park Site C-1 Project is a proposed residential development of approximately 4.9 acres located in the City of Rocklin and situated east of the intersection of El Don Drive and Corona Circle. Proposed development on this site consists of 26 single family homes. The density of the single-family residences is approximately 5 units per acre with 2.6 acres of the 7.6-acre project site remaining undeveloped. The undeveloped area is primarily dense tree canopy. *All of the calculations and sizing requirements in this report will be pertinent to Site C-1 only.*

This Preliminary Drainage Report intends to meet the requirements outlined in the Placer County Stormwater Management Manual for a Preliminary Plan of Development.

The College Park Site C-2 Project (North side of the overall site) is a future mixed use development of approximately 26.8 acres.

This "Preliminary Drainage Report" provides recommendations and calculations for site "C-1" only. With the future development of Site "C-2", similar drainage design principals and methods will be utilized.

2.0 References

1. Placer County Flood Control and Water Conservation District. Storm Water Management Manual. September 1990 (2004 revision).

2. City of Rocklin. Post-Construction Manual. June 2015.

3.0 Design Criteria

The on-site system is designed to meet the requirements of the Placer County Stormwater Management Manual (SWMM) as well as the City of Rocklin Post-Construction Manual Design Guidance for Stormwater Treatment (PCDM).

Placer County drainage requirements met by this drainage system are:

- No inundation on private property in the 10-year event within the Project boundary. (SWMM – Section VI. B. 2.)
- 10-year flows shall be conveyed within the gutter, roadside ditches or swales, or underground within street areas (SWMM – Section VI. – C. – 1.).
- Maximum stormwater elevation is 4" above the top of curb and the storm and water flow cannot exceed 3 ft/sec during the 100-year event for continuous grade profiles (SWMM – Table 6-1).
- Stormwater is a minimum of one foot below building pads during the 100-year event at sag points. Ponding does not extend more than 120 feet from inlet (2 std. residential lot frontages) along any street segment (SWMM – Table 6-1).

- The design HGL should be at least 6 inches below the gutter grade at the inlet to allow the inlet to function properly. The inlet should not be counted as accepting (additional) flow if there is a possibility the hydraulic grade will be above this level (SWMM – Section VI. – D. 2. b. (4)).
- The objective flow shall be taken as the estimated pre-development peak flow rate less 10 % of the difference between the estimated pre-development and post-development peak flow rates from the site for all standard design storms ranging in frequency from the 2-year and up to and including 100-year. In no case, however, shall the objective flow be less than 90 percent of the estimated pre-development flow (SWMM – Section VII. – D. 1. a. and Figure 7-1)

4.0 Existing Drainage Conditions

The existing site was subdivided into 3 watersheds. These watersheds are shown in **Exhibit 1**. Watersheds w1 and w3 sheet flow directly to the main creek. The w2 watershed partially drains through a low-lying area with dense vegetation. Runoff from the existing site was calculated using the HEC-1 program and using the Dry Creek Desktop program and associated excel worksheet. Runoff from watersheds w2 and w3 were routed and combined with shed w1, just above the bridge at El Don Drive through the creek corridor to estimate a combined peak flow. The existing peak runoff for the site is 11 cfs for the 100-year event. Watershed parameters are shown in **Appendix 1**.

Table 1 – Existing hydrology peak flows

Watershed	Peak Flow, 2-year event (cfs)	Peak Flow, 100-year event (cfs)
W1	.90	4.96
W2	.77	5.08
W3	.77	3.74
Comparison Point	1.9	11.0

The available floodplain mapping in the vicinity of the project from the Federal Emergency Management Agency (FEMA) is online at https://msc.fema.gov/portal/home. An excerpt of FEMA's mapping information through their online mapping tools is provided in **Appendix 2**. Along the western portion of the site, the lowest elevation of the proposed project development from our preliminary grading plan is at approximately 299 feet (North American Vertical Datum) which is approximately 9 feet higher than the adjacent maximum base flood elevation shown in Appendix 2. Along the eastern portion of the site the lowest preliminary pad grade is elevation 301.1 feet which is approximately 2.5 feet higher than the nearest base flood elevation. With the on-site mitigation proposed, no further hydrologic or hydraulic evaluation of flooding within this unnamed tributary to Secret Ravine is contemplated.

5.0 Proposed Drainage System

The proposed drainage conveyance is a system of underground pipes and curbed-and-guttered streets as shown in **Appendix 3**. The watersheds for the proposed project configuration are shown on **Exhibit 2**. Adequate drainage can be achieved with 15" diameter storm drains.

The post-development site was subdivided into 6 sheds. Two sheds which are undeveloped and four which capture the proposed storm drain network. Two detention basins are proposed to attenuate peak runoff and provide stormwater quality treatment. The first detention basin (Basin #1) is situated just east of El Don Drive and collects runoff from the majority of the site. The proposed bridge/roadway segment will convey drainage from the eastern cul-de-sac to combine with drainage from the lots west of the bridge. The bridge roadway segment will be configured to drain offsite flows from the existing development to the south under the roadway to the creek and the final sizing and vertical location will be determined during design. The detention basin is designed to be 5 feet deep (maximum) with a bioretention layer at the bottom. The northern boundary of the detention basin will be a vertical containment structure in order to achieve the required bottom area. The second detention basin (Basin #2) is situated between the eastern cul-de-sac and the creek. This basin will be bounded by a concrete containment structure to the northeast along a utility access road and graded along the southwest to lot elevations. This detention basin is designed to be a maximum of 4 feet deep with a bioretention soil/gravel layer at the bottom.

The outlet for each pond consists of a water quality underdrain below the biofiltration layer and a 12" gravity outlet pipe. The outlet pipe for Basin 1 is placed at a height of 15" above the bottom and the outlet pipe for Basin 2 is placed at a height of 12" above the bottom. Each of the basins will require the construction of a pipe outlet structure connecting outflow from the basins to the unnamed creek/channel beneath the existing elevated access road constructed along the deep wastewater sewer main alignment.

Runoff from the sheds were calculated using the HEC-1 program and the resulting hydrographs were input to XPSWMM to evaluate the detention basins. The estimated combined peak outflow being generated from the entire site reaching the El Don Drive crossing of the unnamed tributary stream is 10.6 cfs for the 100-year storm.

To comply with stormwater quality requirements, runoff must be routed through a bioretention basin having an area no less than 4 percent of the contributing impervious area. The required and provided bioretention areas for each basin are provided below.

Table 2 – Bioretention Basin Areas

Basin	Contributing Impervious Area (ft^2)	Required Bioretention Area (ft^2) – (4%)	Provided Bioretention Area (ft^2)
Basin 1	120,696	4,828	5,050
Basin 2	40,225	1,609	1,650

6.0 Results (Site "C-1" Only)

The analysis determined that the proposed drainage facilities adequately meet Placer County drainage requirements and City of Rocklin stormwater quality requirements.

The provided freeboard for each of the three basins exceeds the minimum requirement of 2 feet. The maximum 100-year storage volume for each basin is less than 2 acre-feet and therefore does not require an emergency spillway. See Tables 3-5 for detention basin results.

The 100-year hydraulic grade line for the storm drain system is below gutter elevation. See attached XPSWWM models for storm drain results.

Each basin provides adequate stormwater quality treatment through bioretention.

Using calculated target outflows from the Placer County formula, the target peak outflow rates at the downstream end of the project site are met. See Table 6 for the comparison between pre-developed and developed peak flow conditions.

Table 3 – Detention Basin Results for 2-year storm event

Facility	Stage (ft), 2-year event	Storage (cf), 2-year event	Peak Flow, 2-year event
Basin 1	291.5	5,165	0.6
Basin 2	292.5	1,797	0.2

Table 4 – Detention Basin Results for 10-year storm event

Facility	Stage (ft), 10-year event	Storage (cf), 10-year event	Peak Flow, 10-year event
Basin 1	292.3	9,468	1.2
Basin 2	293.0	2,658	0.7

Table 5 – Detention Basin Results for 25-year storm event

Facility	Stage (ft), 25-year event	Storage (cf), 25-year event	Peak Flow, 25-year event
Basin 1	292.5	10,869	1.8
Basin 2	293.2	3,046	1.2

Table 6 – Detention Basin Results for 100-year storm event

Facility	Stage (ft), 100-year event	Storage (cf), 100-year event	Peak Flow, 100-year event
Basin 1	293.0	13,536	3.2
Basin 2	293.5	3,672	2.0

Table 7 – Peak flow comparison

Storm Event	Undeveloped Peak Flow (cfs)	Unmitigated Peak Flow (cfs)	Target Peak Flow (cfs)	Developed Peak Flow (cfs)
2-year	1.9	3.8	1.7	1.5
10-year	5.4	8.1	5.1	2.5
25-year	7.5	10.6	7.2	4.2
100-year	11	14.8	10.6	7.0

EXISTING WATERSHEDS
COLLEGE PARK SITE C1
ROCKLIN, CA
JANUARY 2021

NORTH

0 100 200
Feet

Legend
- Flow Comparison Point
- longest_flow_path
- routing_channel
- Creek
- Watersheds
- 1-ft Elevation Contour

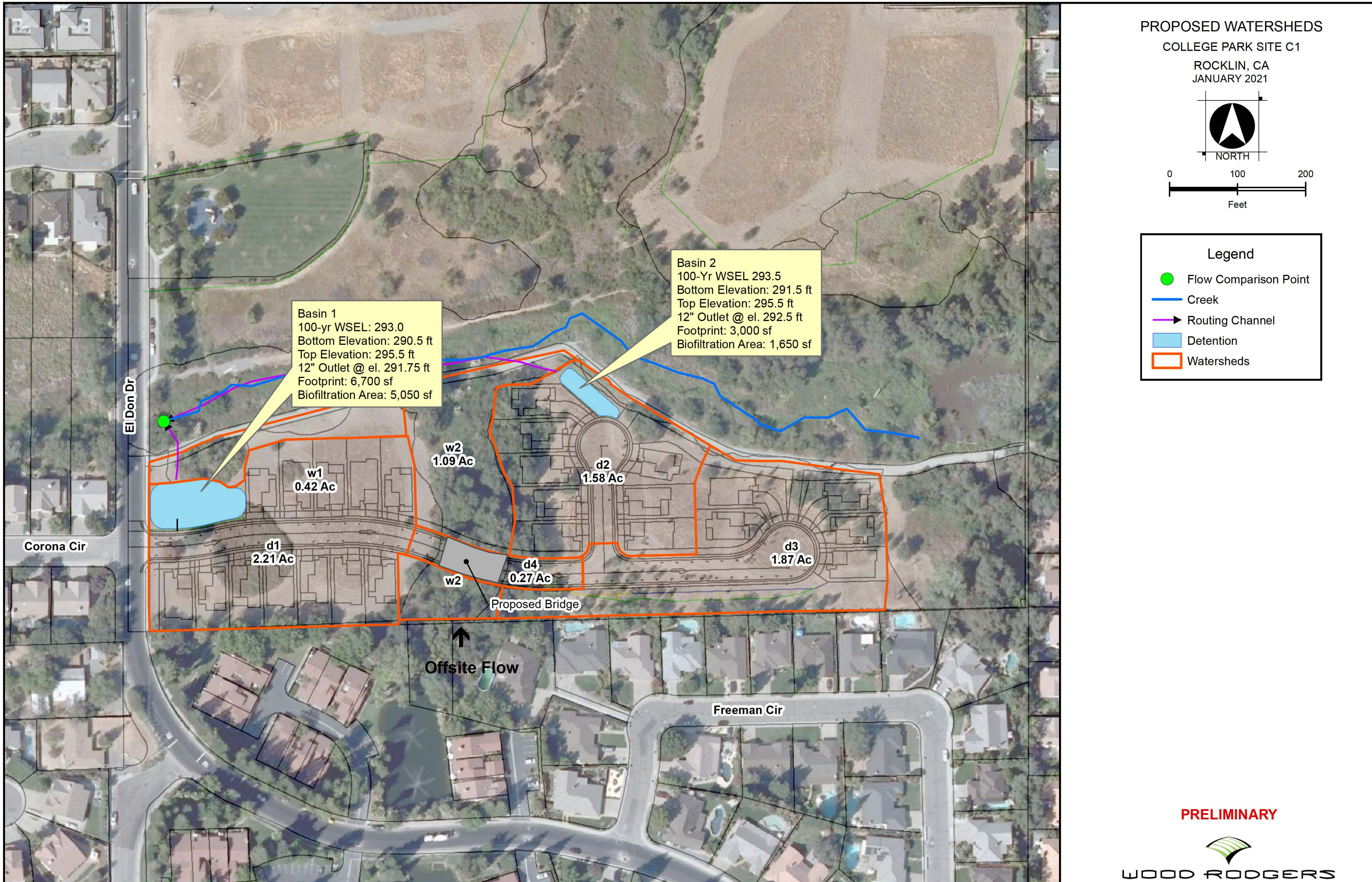
PRELIMINARY

WOOD RODGERS

J:\3000-s\3256_East Sierra\3256 East Sierra Site C\GIS\Tasks\Drainage\01-Existing Sheds.mxd 1/15/2021 10:17:04 AM mberggren

EXHIBIT 1

PROPOSED WATERSHEDS
COLLEGE PARK SITE C1
ROCKLIN, CA
JANUARY 2021



PRELIMINARY

WOOD RODGERS

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EXHIBIT 2

APPENDIX 1

APPENDIX 1: WATERSHED PARAMETERS

Existing

			LU CARDS						UK CARDS								RD1 CARD ITEMS						
		BA	PLANE 1	0.3108		PLANE 2	0.48		PLANE 1	0.005	0.4		PLANE 2						0.08				20
shed	DESCRIPTION	AREA MI^2	Init Abs	Const Infilt	% Imp	Init Abs	Const Infilt	% Imp	Length	Slope	'n' Value	% of Shed	Length	Slope	'n' Value	% of Shed	Length	Slope	'n' Value	Portion	TYPE	BW	SS
W1	W1 2.1 ac	0.003208	0.1	0.1529	2.13	0.1	0.249	0	170	0.05	0.4	100	94	0.05	0.24	0	75	0.01	0.08	0.0471	TRAP	2	20
W2	W2 3.5 ac	0.0054	0.1	0.1529	2.13	0.1	0.249	0	300	0.05	0.6	100	94	0.05	0.24	0	450	0.01	0.08	0.0471	TRAP	2	20
W3	W3 1.9 ac	0.002959	0.1	0.1412	2.09	0.1	0.249	0	240	0.09	0.4	100	90	0.09	0.24	0	860	0.01	0.08	0.0465	TRAP	2	20

Proposed

			LU CARDS						UK CARDS								RD1 CARD ITEMS						
		BA	PLANE 1	0.3108		PLANE 2	0.48		PLANE 1	0.005	0.4		PLANE 2						0.08				20
shed	DESCRIPTIONS	AREA MI^2	Init Abs	Const Infilt	% Imp	Init Abs	Const Infilt	% Imp	Length	Slope	'n' Value	% of Shed	Length	Slope	'n' Value	% of Shed	Length	Slope	'n' Value	Portion	TYPE	BW	SS
D1	D1 2.2 ac	0.0035	0.1	0.1529	70	0.1	0.249	70	90	0.05	0.4	100	90	0.05	0.24	0	250	0.001	0.025	0.047	TRAP	2	20
D2	D2 1.6 ac	0.0025	0.1	0.1529	70	0.1	0.249	70	90	0.05	0.4	100	90	0.05	0.24	0	250	0.001	0.025	0.047	TRAP	2	20
D3	D3 1.9 ac	0.0029	0.1	0.1412	70	0.1	0.249	70	90	0.09	0.4	100	90	0.09	0.24	0	350	0.001	0.025	0.047	TRAP	2	20
D4	D4 0.3 ac	0.0004	0.1	0.1412	70	0.1	0.249	70	90	0.09	0.4	100	90	0.09	0.24	0	250	0.001	0.025	0.047	TRAP		
W1	W1 0.4 ac	0.0007	0.1	0.1529	0	0.1	0.249	0	80	0.05	0.4	100	80	0.05	0.24	0	20	0.001	0.06	0.047	TRAP	2	20
W2	W2 1.1 ac	0.0017	0.1	0.1529	0	0.1	0.249	0	50	0.05	0.4	100	50	0.05	0.24	0	340	0.001	0.06	0.047	TRAP	2	20

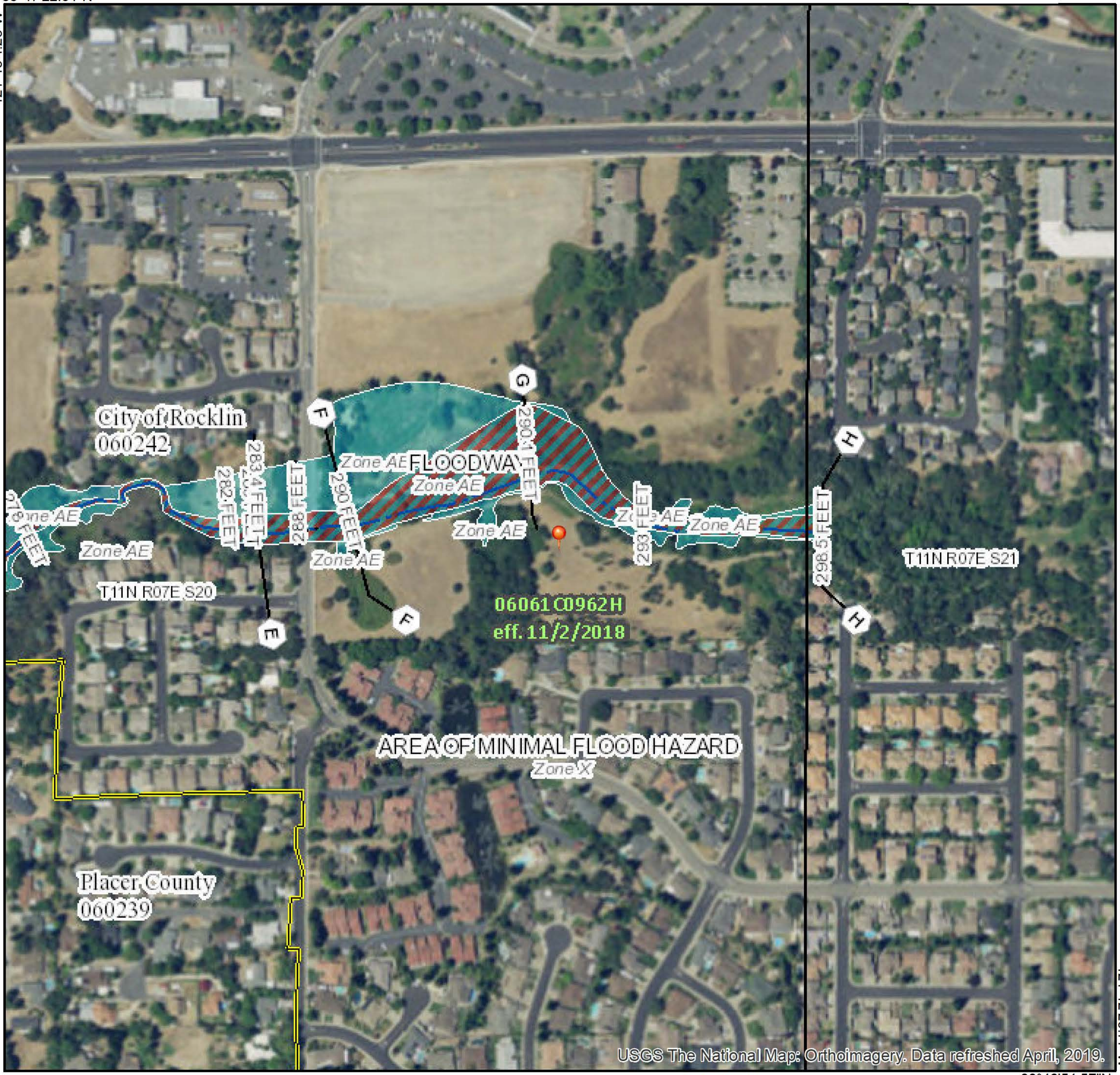
APPENDIX 2

National Flood Hazard Layer FIRMette

FEMA

38°47'22.61"N

121°13'34.23"W



121°12'26.77"W

38°46'54.57"N

Feet 0 250 500 1,000 1,500 2,000

1:6,000

Legend ATTACHMENT A

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
MAP PANELS	Digital Data Available
	No Digital Data Available
	Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/20/2019 at 6:14:45 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX 3

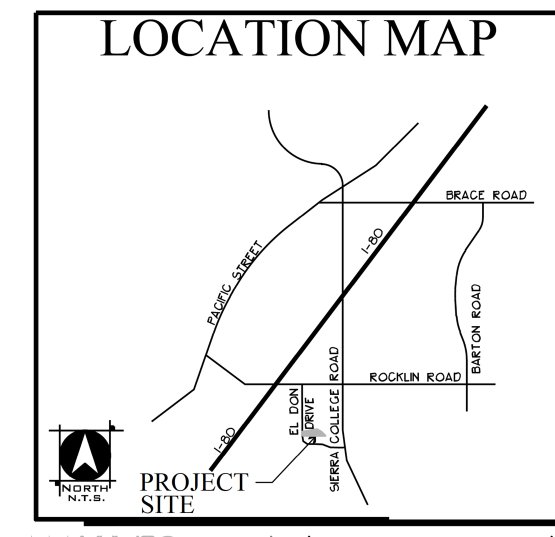
PRELIMINARY GRADING AND DRAINAGE

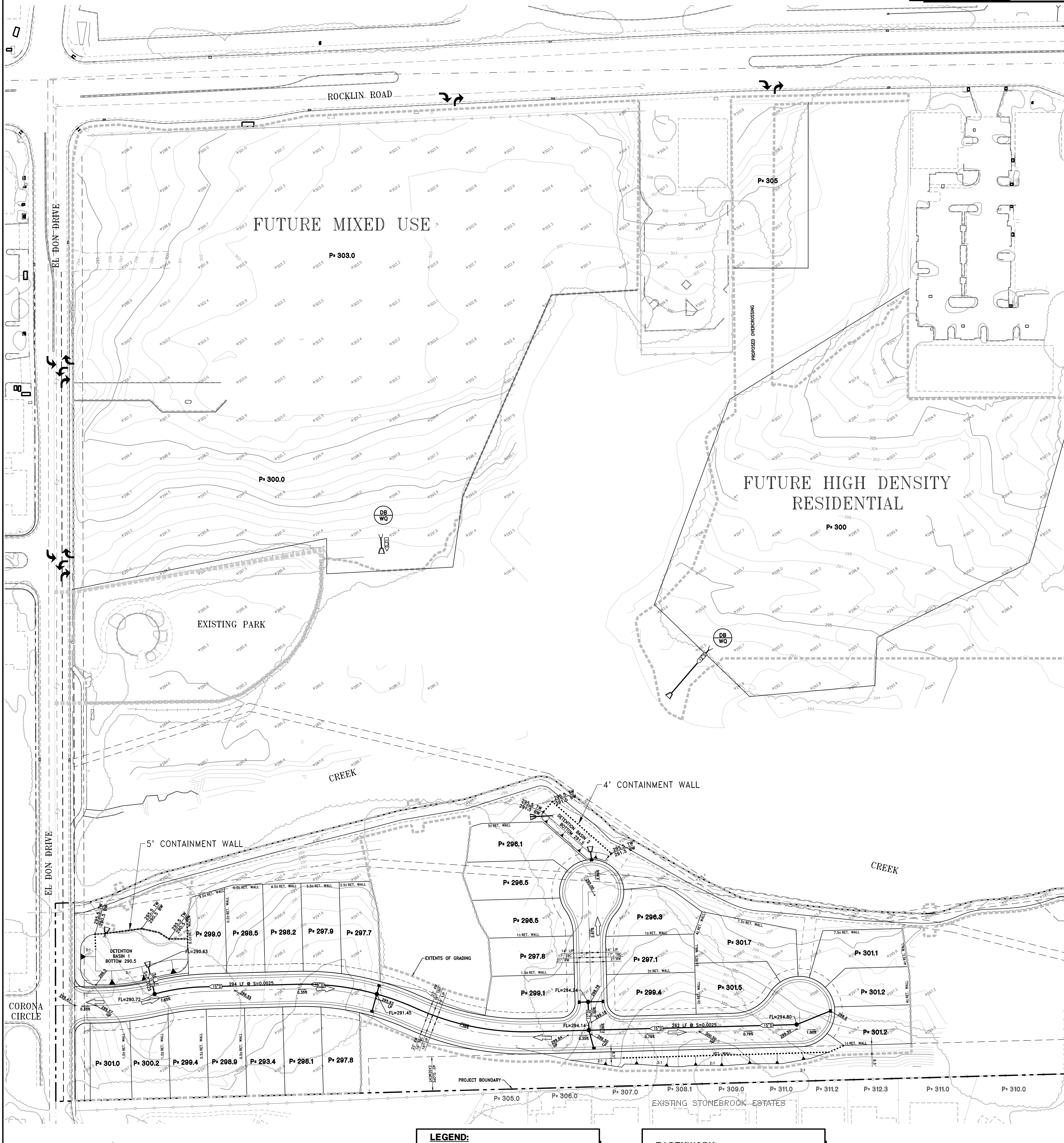
COLLEGE PARK - SOUTH

ROCKLIN CALIFORNIA

SHEET 5 OF 7

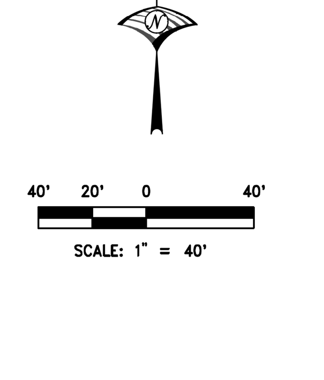
JANUARY 25, 2019
REVISED: MARCH 10, 2020
REVISED: JANUARY 12, 2021





NOTE (DB/WQ)

FINAL DETENTION BASIN/LID AND WATER QUALITY TREATMENT SHALL BE CALCULATED AND SIZED BASED UPON THE FINAL LAND USE PLAN.



LEGEND:

	PROJECT / UNIT BOUNDARY
P= 20.0	PROPOSED MASS GRADING PAD ELEVATION
XXX.X	PROPOSED MASS GRADING STREET ELEVATION
	PROPOSED OVERLAND RELEASE
	STORM DRAIN INLET
15"D	STORM DRAIN
	STORM DRAIN MANHOLE
	100 YR FLOODPLAIN
FW:300.5 TW:303.5	RETAINING WALL (FACE OF WALL, TOP OF WALL)
	TURNING MOVEMENTS

EARTHWORK

CUT	±14800 CY
FILL	±14800 CY
NET	±0 CY

GRADING DESIGN

GRADING AND RETAINING WALLS SHOWN ARE PRELIMINARY. FINAL PAD ELEVATIONS AND WALL HEIGHTS SHALL BE DETERMINED WITH FINAL DESIGN. GRADES AT LOT LINES ARE TOP BACK OF WALK UNLESS NOTED OTHERWISE

WOOD RODGERS
BUILDING RELATIONSHIPS ONE PROJECT AT A TIME
3301 C St, Bldg. 100-B Tel 916.341.7760
Sacramento, CA 95816 Fax 916.341.7767

APPENDIX 4

(Included with Electronic Submittal)

Geotechnical
Water Resources
Environmental and
Ecological Services

Technical Review

To: David Mohlenbrok; Lynn Toth

From: Chris Ferrari, PE, CFM

Date: July 25, 2021

Re: College Park/Sierra Villages Project Preliminary Drainage Study QC Review

INTRODUCTION

GEI has completed the review of the subject project and finds the current drainage design for the proposed project meets the City's and PCFCD drainage design criteria as well as the City's MS4 permit requirements. GEI also recommends that IF significant changes to the project drainage approach are made in the future, the drainage design should be reviewed to confirm the proper mitigation is maintained to city standards and conditions. As requested, attached are the previous GEI memos provided to the city which includes the comments and responses on the subject project.

GEI provided five overall quality control review memos submitted to the city based on submittals by Wood Rodgers. GEI provided the initial comment memo to the City on May 28th, 2020, with additional comment reviews submitted in June 2020, August 2020 March 2021 and the final approval in May 2021. The following is the best available data reviewed by GEI:

1. College Park Site A Preliminary Drainage Report. Site B was not included.
2. College Park Site C Preliminary Drainage Report.
3. GIS Data (Existing Topography, Proposed Berm Location, Soils)
4. CAD Grading Draft Plan
5. Hydrology Files (HEC-1) Models
6. XPSWMM Models

Contact Chris Ferrari at (916) 200-5119 if there are any questions with the following memos.

Geotechnical
Water Resources
Environmental and
Ecological Services

Technical Memorandum

To: David Mohlenbrok; Lynn Toth

From: Chris Ferrari, PE, CFM

Date: May 28, 2020 (Updated August 31, 2020)

Re: College Park Site "A" and "C" Preliminary Drainage Study – 2nd Quality Control Review

INTRODUCTION

GEI Consultants was contracted to provide one independent review for the preliminary College Park/Sierra Villages project located near the intersection of Rocklin Road and Sierra College Boulevard. The initial review comments were provided May 28th, but Wood Rodgers provided additional data on August 26th for Site "C". The documents provided to GEI for review included the following:

1. College Park Site A Preliminary Drainage Report dated Dec. 2019. Note: Email from Wood Rodgers Tom Makris dated May 27, 2020 indicated the proposed north basin includes a 15" drain pipe outlet and currently they do not have a plan for the property to the south so please hold off on that piece for now.
2. Site B was not included.
3. College Park Site C Preliminary Drainage Report dated Dec. 2019
4. GIS Data (Existing Topography, Proposed Berm Location, Soils)
5. CAD Grading Draft Plan
6. Hydrology Files (HEC-1) Models
7. XPSWMM Models
8. Site "C" drainage data provided August 26, 2020.

QUALITY CONTROL

The following are GEIs review comments and recommendations:

1. The project site is in the Secret Ravine watershed. Tributary to the Dry Creek watershed. Recommend the report include a pre- and post-project condition hydrologic model evaluation for the overall Secret Ravine watershed (see Placer County Flood Control website) to determine if the on-site detention basins are properly mitigating the 2-, 10-, 100-year flows. The goal is to determine if the post-development outflow hydrographs and timing from the proposed basins are close to pre-development conditions and will not adversely impact the overall watershed.

2. The target existing condition outflows for the 2-, 10-, 25- and 100-year for the proposed detention basins need to be discussed in the report. Review the Placer County Stormwater Management Manual to determine mitigation goals for the basin outflows and provide a summary table which includes a comparison for pre-, post with and without mitigation.

3. Input HEC-1 precipitation does not match Placer County Flood Control District Stormwater Management Manual (https://www.placer.ca.gov/DocumentCenter/View/1249/Stormwater-Management-Manual-PDF). For example, for 24-hour 100 Year precipitation, the Manual indicates 4.25 inches at an elevation of 150 ft, and this value will increase by 1.983 inches if elevation increases by every 1000 ft (Page V-A-2). Because the project site has an approximate elevation of 330 ft, it is expected its onsite 24-hour 100 Year precipitation will be a little more than 4.25 inches. However, HEC-1 model's 100 year 24-hour precipitation is 3.93 inch. Please clarify.

```
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* Centering Option OFF - Center at: NONE
* ANGLE will not be used -
ID DRY CREEK WATERSHED, PLACER COUNTY, CA
ID WATERSHED UPDATE MODELS - DRAFT ULT BUILDOUT
ID DRAFT MODEL FOR HYD ROUTING - DCTOOLBOX SOURCE
ID CESI/RBF 6/20/2019
ID
IT     5 13FEB08       0     300
IO     5               0
IN     5       0       0
*DIAGRAM
*
*
KK    e3
KM  e3  11.9 ac
BA0.0186
PB
* PI
*
*  Placer Design Precipitation -  depths in inches
*  Return period in years   100   Time interval in minutes     5
*  Elevation in feet          0   W of Crest
*  Duration in minutes     1500   Maximum depth at   750 minutes
*  Cloudburst 1-hr Factor  1.00
*
PI0.0048  0.0049  0.0049  0.0050  0.0051  0.0055  0.0052  0.0052  0.0052  0.0052
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```
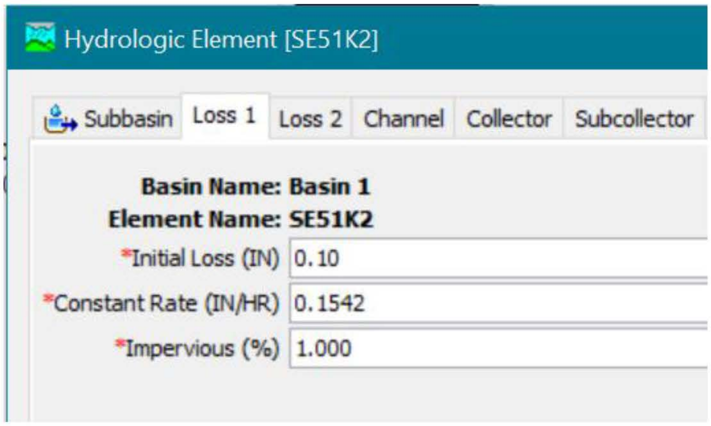
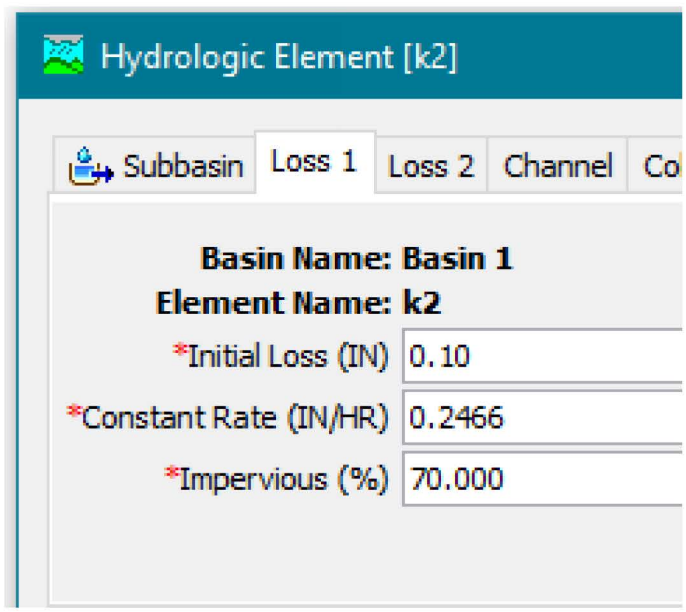

4. HEC-1 used Initial and Constant loss method to account for the precipitation loss on pervious surface. A constant loss rate of 0.1542 in/hr. was specified on undeveloped catchments,

whereas the loss rate increased to 0.2466 in/hr. on developed residential pervious area. Please conform.



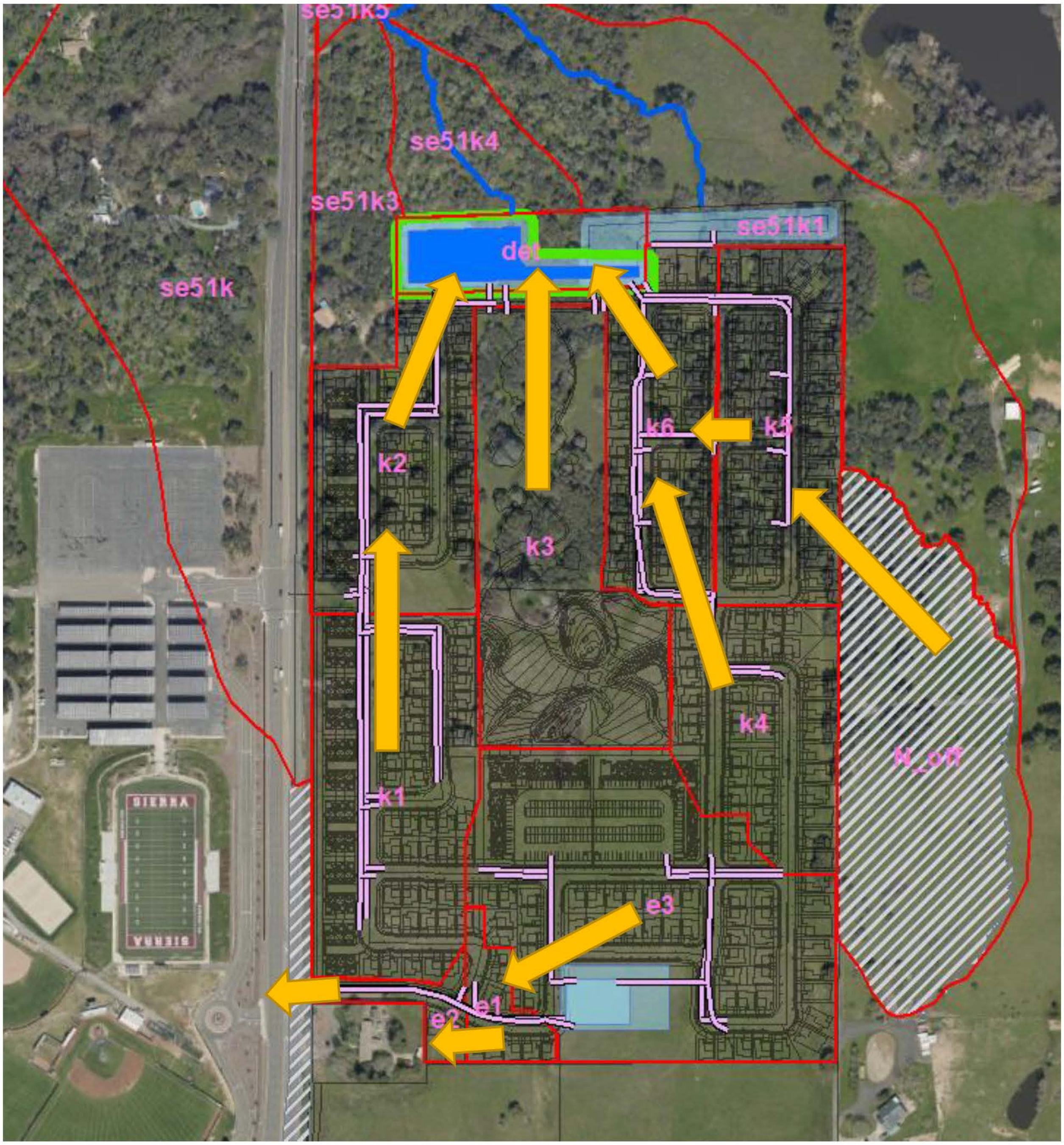


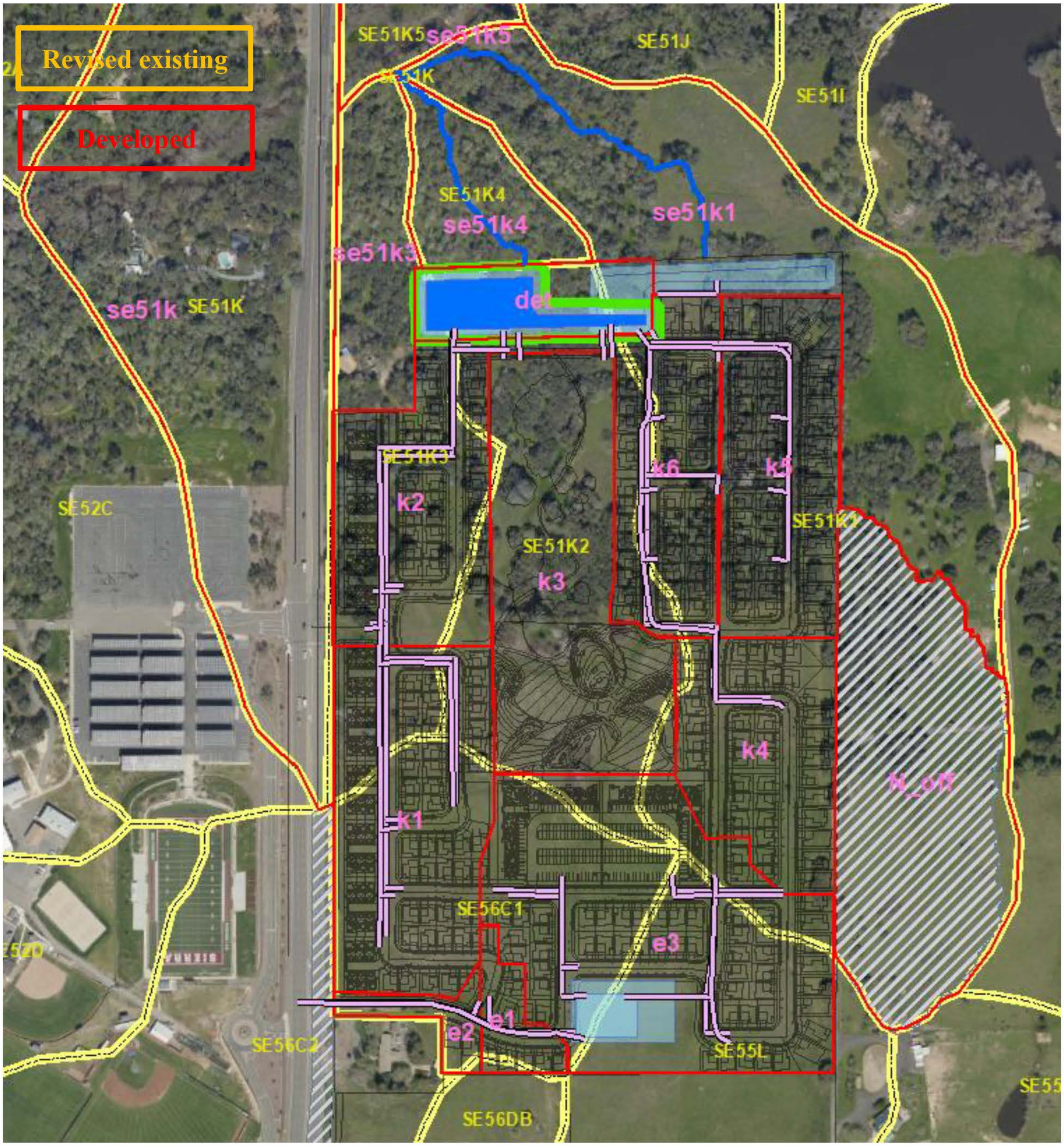
5. Channel Roughness on the RD record = 0.08. This Manning's n value seems high, but please confirm.

6. The runoff hydrographs from the HEC-1 models were utilized as lateral inflows to the nodes in the SWMM model. Review the previous comments to determine if the parameters in the HEC-1 files need to be adjusted and will affect the boundary condition hydrographs.

College Park Site "A" Draft Report Review:

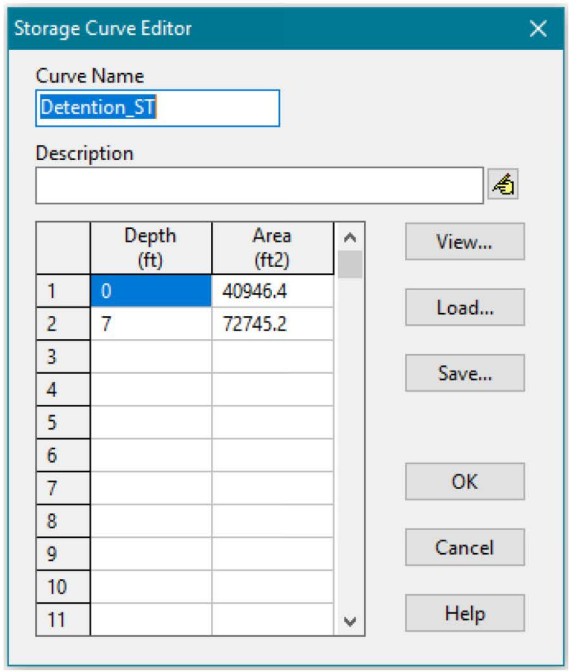
7. The routing diagrams for the SWMM model shown below should be discussed and included in the drainage reports. The comparison between revised existing catchments and developed catchments is shown below:




Revised existing
Developed
SE51K5
se51k5
SE51J
SE51K
SE51I
SE51K4
se51k4
se51k1
se51k3
se51k
SE51K
det
SE51K3
k6
k5
k2
SE52C
SE51K1
SE51K2
k3
k4
k1
N_off
SE56C1
e3
e2
e1
SE56C2
SE55L
SE56DB

8. There are several locations that the draft report does not match the SWMM model. Please confirm.

    - Report indicates a 5.6 acre-ft detention basin is placed on the northern boundary, but the SWMM potentially shows it is actually ~ 9 acre-ft. Please confirm.



    - Report indicates there are two 6'' diameter and one 12'' diameter pipes out of northern detention basin. But the SWMM model has different orifice dimensions (north_wq, north_low, north_high). Please correct the model or the report.

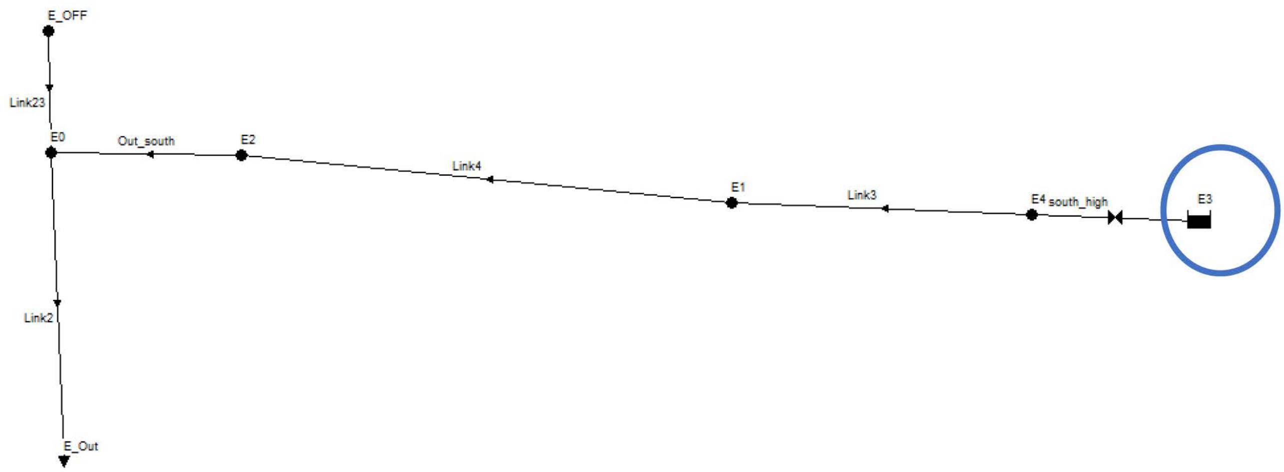
9. In Table 5 – Peak flow comparison in the report, Northern Basin Ex 100-year 13.68 cfs < Ex 10-year 13.8 cfs. Please review but should it be 5.75 cfs for SE51K2 in Table 1. Please correct.

10. If it is assumed the outlet of SE51K2 for existing condition was used to compare the peak flows against the detention basin orifice flows for developed condition, the total drainage areas contributed by k1, k2, k3, k4, k5, k6, N_off and det appear to be larger than SE51K2. Please review and select another location further downstream where both conditions have similar total drainage areas.

11. Reviewing the SWMM model, it appears the catchment selected for peak flow comparison for existing condition is SE56C1 and the location for the peak flow developed condition is

outlet e2. Reviewing the GIS map, it appears that SE56C1 partially covers e3, but also covers part of k1 which belongs to the northern system. Review and select another comparison location further downstream where both conditions have similar total drainage areas.

12. For the southern system, the entire catchment e3 was represented directly by a detention basin E3 in SWMM. Justify the routing for the e3 catchment. The Wood Rodgers email indicated that a plan for the south drainage still needs to be developed.



13. In the report, Table 3 does not match Table 5. Review and correct as needed. Also check the comparison outfall points for pre-development and post-development in the report, so that they are consistent with the SWMM models.

14. Overall the preliminary drainage report needs to be updated based on the listed comments to determine if the basins are adequately mitigating developed flows to existing conditions.

College Park Site "C" Draft Report Review provided August 28, 2020:

15. There are a number of places in the draft report which do not match the SWMM model. Please confirm and update drainage report.

- For example, the Grading Plan shows Detention Basin #3 has a bottom elevation = 292.5 ft. But the model shows this basin has an Invert El. = 296 ft. The inconsistency also applies to other two detention basins.
- The report concludes all the three basins have at least 2 ft of freeboard. In the model, Basin #2 d2 has an Invert EL. 290.0 ft and a Max Depth 4 ft. The calculated max depth in the basin is approximately 2.25 ft. Therefore, this would exceed the minimum 2ft freeboard requirement by 0.25ft. Please verify.

Geotechnical
Water Resources
Environmental and
Ecological Services

Technical Memorandum

To: David Mohlenbrok; Lynn Toth

From: Chris Ferrari, PE, CFM

Date: March 22, 2021

Re: College Park Site "A" and "C" Preliminary Drainage Study – 2nd Quality Control Review

INTRODUCTION

This memo provides the 2nd review of the preliminary College Park/Sierra Villages project comments located near the intersection of Rocklin Road and Sierra College Boulevard. The initial review comments were provided May 28th and additional data for Site "C" on August 26th. This TM provided GEIs review of the recent submittal. GEIs backcheck comments are in red below.

QUALITY CONTROL

The following are GEIs review comments:

1. Overall, the reports have been updated, but there are two comments in the report and model that should be confirmed:
    - *In the report "College Park Site "A" Preliminary Drainage Study", on Page 3, the second paragraph indicates the existing watershed SE55L is not being developed. However, Exhibit 4, it appears Residential houses is planned on the northern part of the watershed (i.e. e3).*
    - *On page 9, the Proposed Table, the second column DESCRIPTION, the drainage areas are not consistent with Exhibits 4/5.*
2. The project site is in the Secret Ravine watershed. Tributary to the Dry Creek watershed. Recommend the report include a pre- and post-project condition hydrologic model evaluation for the overall Secret Ravine watershed (see Placer County Flood Control website) to determine if the on-site detention basins are properly mitigating the 2-, 10-, 100-year flows. The goal is to determine if the post-development outflow hydrographs and timing from the proposed basins are close to pre-development conditions and will not adversely impact the overall watershed.

    The response to comment No.1 indicates the proposed north basin(s) placement will likely have a minor impact downstream in Secret Ravine. Agreed this could be a minor increase for this one project, but the detention design requirements should be reviewed to meet the Placer County Flood Control Stormwater Management Manual standards (PCSWMM) for minimizing potential downstream impacts. The Placer County Flood Control District can be *consulted to review and determine if the minimal increase as indicated will not be an impact to any downstream critical facility.*

3. The target existing condition outflows for the 2-, 10-, 25- and 100-year for the proposed detention basins need to be discussed in the report. Review the Placer County Stormwater Management Manual to determine mitigation goals for the basin outflows and provide a summary table which includes a comparison for pre-, post with and without mitigation.

The modeling shows the local impact is mitigated which is acceptable, but the Placer County Flood Control District will confirm if downstream impacts should be reviewed. See comment above for reviewing the PCSWMM standards.

4. Input HEC-1 precipitation does not match Placer County Flood Control District Stormwater Management Manual (https://www.placer.ca.gov/DocumentCenter/View/1249/Stormwater-Management-Manual-PDF). For example, for 24-hour 100 Year precipitation, the Manual indicates 4.25 inches at an elevation of 150 ft, and this value will increase by 1.983 inches if elevation increases by every 1000 ft (Page V-A-2). Because the project site has an approximate elevation of 330 ft, it is expected its onsite 24-hour 100 Year precipitation will be a little more than 4.25 inches. However, HEC-1 model's 100 year 24-hour precipitation is 3.93 inch. Please clarify.
The modeling impacts are corrected and is acceptable.

5. HEC-1 used Initial and Constant loss method to account for the precipitation loss on pervious surface. A constant loss rate of 0.1542 in/hr. was specified on undeveloped catchments, whereas the loss rate increased to 0.2466 in/hr. on developed residential pervious area. Please conform.
The modeling impacts are corrected and is acceptable.

6. Channel Roughness on the RD record = 0.08. This Manning's n value seems high, but please confirm.
The modeling was adjusted as requested.

7. The runoff hydrographs from the HEC-1 models were utilized as lateral inflows to the nodes in the SWMM model. Review the previous comments to determine if the parameters in the HEC-1 files need to be adjusted and will affect the boundary condition hydrographs. *The modeling impacts are corrected and acceptable.*

College Park Site "A" Draft Report Review:

8. The routing diagrams for the SWMM model shown below should be discussed and included in the drainage reports. The comparison between revised existing catchments and developed catchments is shown below:
Routing diagram is acceptable and is helpful to be included in the report.

9. There are several locations that the draft report does not match the SWMM model. Please confirm.

- Report indicates a 5.6 acre-ft detention basin is placed on the northern boundary, but the SWMM potentially shows it is actually ~ 9 acre-ft. Please confirm.
- Report indicates there are two 6'' diameter and one 12'' diameter pipes out of northern detention basin. But the SWMM model has different orifice dimensions (north_wq, north_low, north_high). Please correct the model or the report.

The basins in the model match the report and are acceptable.

10. In Table 5 – Peak flow comparison in the report, Northern Basin Ex 100-year 13.68 cfs < Ex 10-year 13.8 cfs. Please review but should it be 5.75 cfs for SE51K2 in Table 1. Please correct.

The modeling and tables were corrected and are acceptable.

11. If it is assumed the outlet of SE51K2 for existing condition was used to compare the peak flows against the detention basin orifice flows for developed condition, the total drainage areas contributed by k1, k2, k3, k4, k5, k6, N_off and det appear to be larger than SE51K2. Please review and select another location further downstream where both conditions have similar total drainage areas.

The modeling and tables were corrected but the results are showing minor increases. As discussed in the first comment, the PCFCWD should be consulted to determine if this could be a larger impact in the Dry Creek watershed.

12. Reviewing the SWMM model, it appears the catchment selected for peak flow comparison for existing condition is SE56C1 and the location for the peak flow developed condition is outlet e2. Reviewing the GIS map, it appears that SE56C1 partially covers e3, but also covers part of k1 which belongs to the northern system. Review and select another comparison location further downstream where both conditions have similar total drainage areas.

The model update is acceptable.

13. For the southern system, the entire catchment e3 was represented directly by a detention basin E3 in SWMM. Justify the routing for the e3 catchment. The Wood Rodgers email indicated that a plan for the south drainage still needs to be developed.

The model update is acceptable.

14. In the report, Table 3 does not match Table 5. Review and correct as needed. Also check the comparison outfall points for pre-development and post-development in the report, so that they are consistent with the SWMM models.

The model and documentation update are acceptable.

15. Overall, the preliminary drainage report needs to be updated based on the listed comments to determine if the basins are adequately mitigating developed flows to existing conditions. *As previously indicated the documentation is acceptable with a couple of clarifications.*

College Park Site "C" Draft Report Review provided August 28, 2020:

16. There are a number of places in the draft report which do not match the SWMM model. Please confirm and update drainage report.

- For example, the Grading Plan shows Detention Basin #3 has a bottom elevation = 292.5 ft. But the model shows this basin has an Invert El. = 296 ft. The inconsistency also applies to other two detention basins.
  The model update is acceptable.
- The report concludes all the three basins have at least 2 ft of freeboard. In the model, Basin #2 d2 has an Invert EL. 290.0 ft and a Max Depth 4 ft. The calculated max depth in the basin is approximately 2.25 ft. Therefore, this would exceed the minimum 2ft freeboard requirement by 0.25ft. Please verify.
  The model update is acceptable.

Geotechnical
Water Resources
Environmental and
Ecological Services

Technical Memorandum

To: David Mohlenbrok; Lynn Toth

From: Chris Ferrari, PE, CFM

Date: May 31, 2021

Re: College Park Site "A" Preliminary Drainage Study – 3rd Quality Control Review

INTRODUCTION

This memo provides the 3rd review of the preliminary College Park/Sierra Villages project comments located near the intersection of Rocklin Road and Sierra College Boulevard. The initial review comments were provided May 28th and additional data for Site "C" on August 26th. This TM provided GEIs review of the recent submittal by Wood Rodgers in April 2021. GEIs backcheck comments are in blue below.

QUALITY CONTROL

The following are GEIs review comments:

1. Overall, the report at this stage of planning is acceptable.

2. The project site is in the Secret Ravine watershed. Tributary to the Dry Creek watershed. Recommend the report include a pre- and post-project condition hydrologic model evaluation for the overall Secret Ravine watershed (see Placer County Flood Control website) to determine if the on-site detention basins are properly mitigating the 2-, 10-, 100-year flows. The goal is to determine if the post-development outflow hydrographs and timing from the proposed basins are close to pre-development conditions and will not adversely impact the overall watershed.

Previous Comments: The response to comment No.1 indicates the proposed north basin(s) placement will likely have a minor impact downstream in Secret Ravine. Agreed this could be a minor increase for this one project, but the detention design requirements should be reviewed to meet the Placer County Flood Control Stormwater Management Manual standards (PCSWMM) for minimizing potential downstream impacts. The Placer County Flood Control District can be consulted to review and determine if the minimal increase as indicated will not be an impact to any downstream critical facility.

New comment: The submittal dated April 2021 indicates detention storage was modified to prevent release of additional runoff after peak flow in Secret Ravine has passed. This approach is acceptable. However, Table 5 shows the DET1 storage under 100-year event is 2.97 ac-ft, *which is above the capacity of 2.3 ac-ft mentioned on page 3 (third paragraph under 4.0 Proposed Drainage System section). Please confirm DET1's new capacity that is require. This comment does not need additional review from GEI.*