DRAFT PACIFIC GATEWAY HYDROLOGY & HYDRAULICS REPORT

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Table of Contents

Table of Figures

List of Tables

1 Introduction

The Pacific Gateway Hydrology and Hydraulics Report reviews the existing drainage conditions and discusses the proposed development at the project site. This report focuses on the hydrology and hydraulic conditions at the development area and adjacent drainages within South San Joaquin County (County).

This Revised Pacific Gateway Project ("Revised Project") remains a mixed-use development, now consisting of approximately 1,576.7 gross acres, in South San Joaquin County. The Revised Project is generally located south of the originally proposed Project and is bound by Route 132 to the south, Tracy Boulevard to the west, Bird Road to the east, and the Delta-Mendota Canal to the north, except for the University Campus, VFW, Industrial Park, and approximately 5.88 acres of General Commercial. The area is bordered by open space to the west, orchards to the south and east, and quarries to the north. The Revised Site is generally level and is currently developed with active agricultural uses, which include commercial scale almond and cherry orchards, as well as an agricultural processing and manufacturing facility, separately operated by A.B. FAB, Inc.

The development will reduce the pervious area and change runoff conditions. As part of the proposed project, several retention basins will be added to collect development runoff and infiltrate into native soils. Existing runoff passing through the site will be discharged into the Delta-Mendota Canal and other existing drainage facilities. The location of the development site and the adjacent drainages are shown in Figure 1-1. This study quantifies the existing 10-year 48-hour and 100-year 24-hour hydrology and sizes potential infrastructure to mitigate the development impacts.

Figure 1-1: Project Location

2 Existing Conditions

There are no readily available reports of the watersheds intersecting the proposed development. Therefore, this study analyzes the existing hydrology and hydraulics of the region. Schaaf & Wheeler used the 2014 San Joaquin Improvement Standards to develop runoff rates and analyze system performance for existing conditions.

2.1 Hydrology

Schaaf & Wheeler created an existing conditions hydrologic model (HEC-HMS) of the watersheds that potentially impact the development sites. Both the 10-year 48-hour and 100-year 24-hour events were modeled using the NRCS unit hydrograph methods.

2.1.1 Rainfall

The County standards require using a unit hydrograph method (TR-55) for areas over 200 acres. Schaaf & Wheeler applied the 10-year 48-hour and 100-year 24-hour total rainfall from NOAA Atlas 14 to the SCS Type I storm pattern to create design storms. The watershed was divided into two regions with varying rainfall characteristics: a Mountain Region west of Highway 580 and an Orchard Region east of the highway (Figure 2-1). Table 2-1 summarizes the rainfall totals and Figure 2-2 illustrates the 24-hour and 48-hour rainfall patterns.

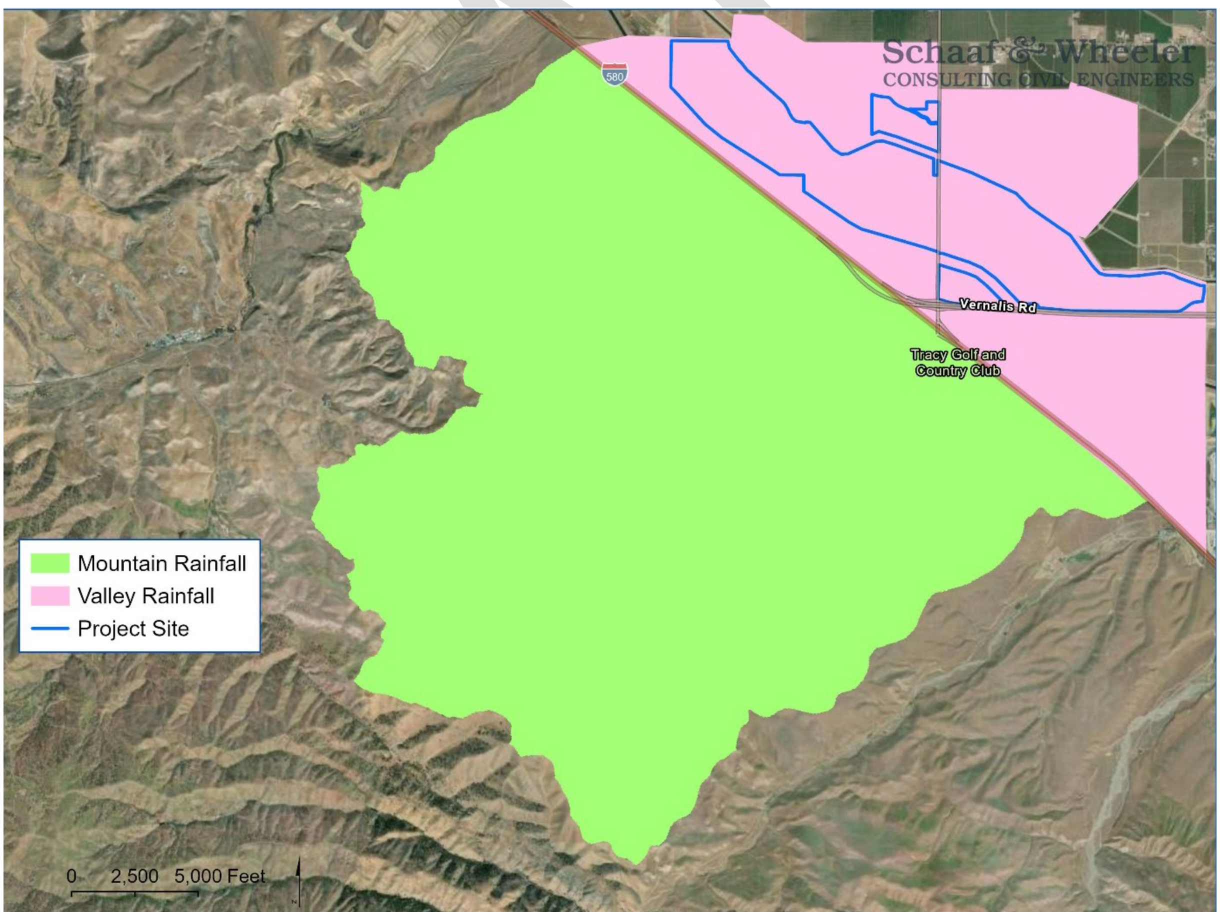

Figure 2-1: Rainfall Regions

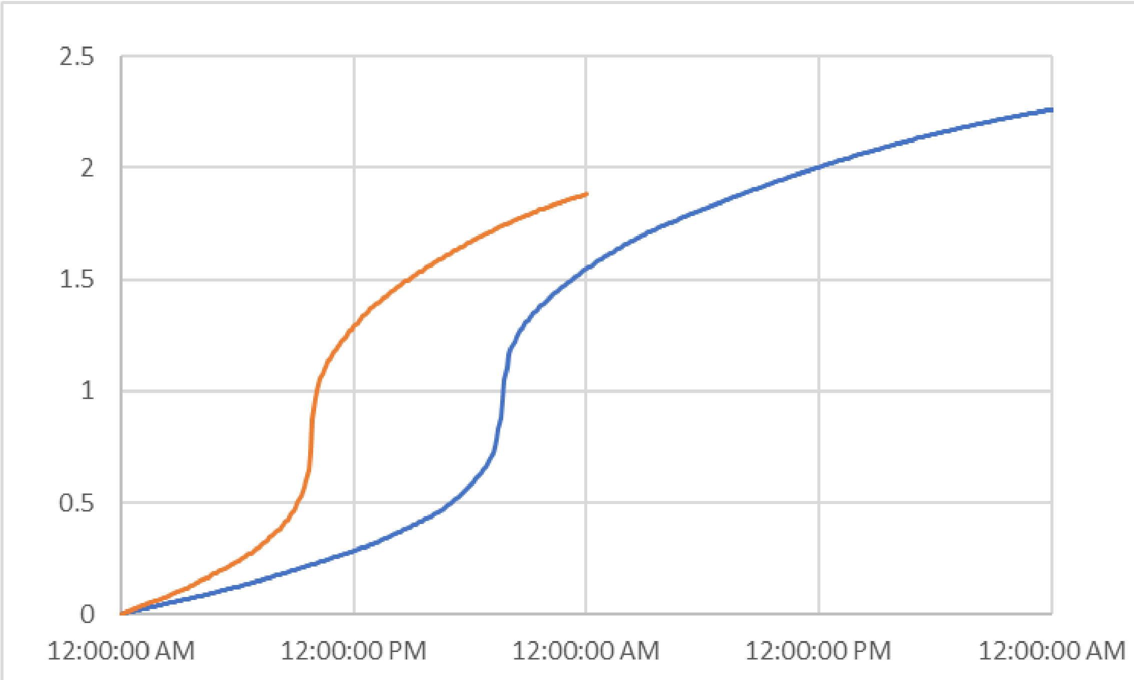

Figure 2-2: SCS Type I Rainfall Patterns

Table 2-1: 24-hour Rainfall Amounts

Location	10-year 48-hour (inches)	100-year 24-hour (inches)
Hills	2.26	2.98
Valley	2.06	2.67

2.1.2 Land Use and Soil Losses

The land use designations from TR-55 are reasonable and were used in this study for existing conditions. The Hydrologic Soils Group from the USDA Soil Resource Report provides soil groups for the watershed, which are a combination of Type D on the upper hillside and Type C on the lower hills and valley floor. Refer to Figure 2-3 for Hydrologic Soils Groups with the watershed. Schaaf & Wheeler calculated NRCS curve numbers to identify the hydrologic losses for the watersheds. Table 2-2 lists the curve numbers, percent impervious, and lag times used in the model.

Table 2-2: Curve Number, % Impervious, and Lag Times Utilized in the Model

Catchment	Curve Number	% Impervious	Lag Time (min.)
DMA 1A	70	90	20
DMA 1B	70	90	20
DMA 2	70	90	20
DMA 3A	70	90	20
DMA 3B	70	90	20
DMA 4	70	90	20
DMA 5	70	90	20
DMA 6	70	90	20
DMA 7	70	90	20
DMA 8	70	90	20
DMA 9	70	90	20
Canal Area 1a	70	2	20
Canal Area 1b	70	2	20
Canal Area 1c	70	18	20
Canal Area 1d	70	12	20
Canal Area 1e	70	15	20
Mountain Area 1	71	0.42	54
Mountain Area 2	72	0.45	63
Mountain Area 3a	70	16	20
Mountain Area 3b	70	4	20
Mountain Area 3c	70	0.44	44
DM South	70	6	20

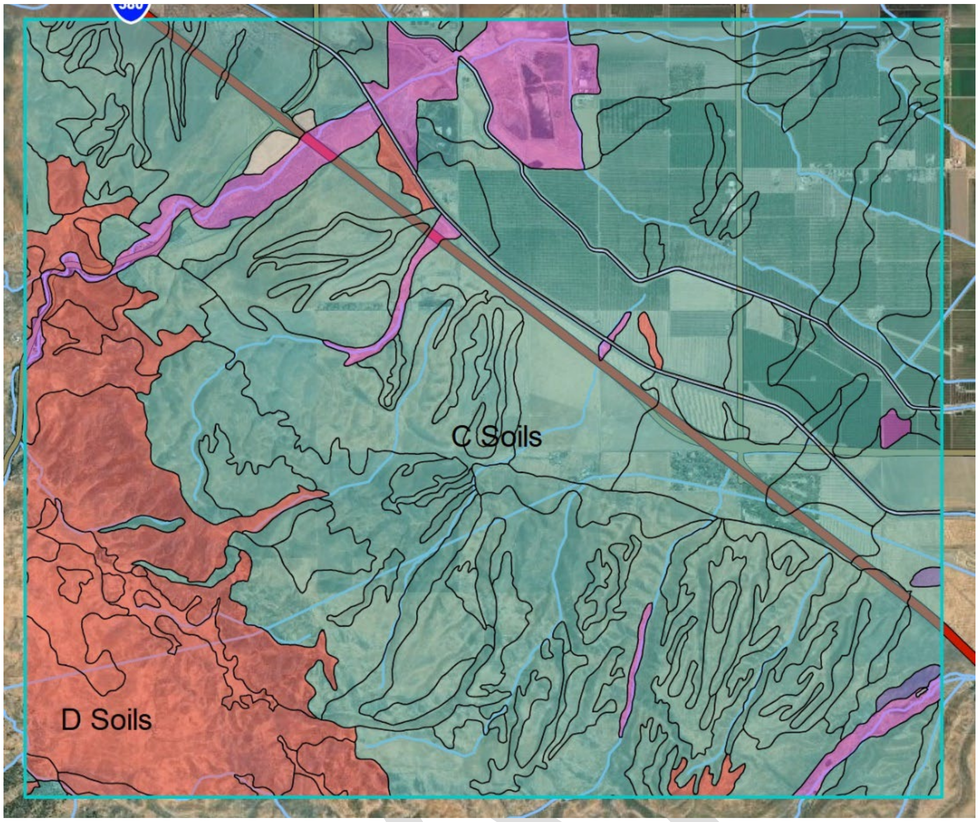

Figure 2-3: NRCS Hydrologic Soils Groups

2.1.3 Flow Routing

Runoff from each watershed either ponds in low-lying areas or is routed downstream. Hydraulic structures were field-verified by Schaaf & Wheeler and added to the HEC-HMS models using elevation-discharge curves developed in HEC-RAS. Digital elevation model (DEM) topographic data was available to develop stage-discharge and stage-storage curves. A course 2D HEC-RAS model was developed to determine existing flow paths and storage areas.

2.1.4 Peak Flows

The HEC-HMS models produce hydrographs for each watershed. Figure 2-4 shows the watersheds and key flow points. Figure 2-5 shows the model layout. Table 2-3 lists the peak 10-year and 100-year peak flows and runoff volumes. Table 2-4 lists the existing diversion to the Delta-Mendota Canal from the HEC-RAS models.

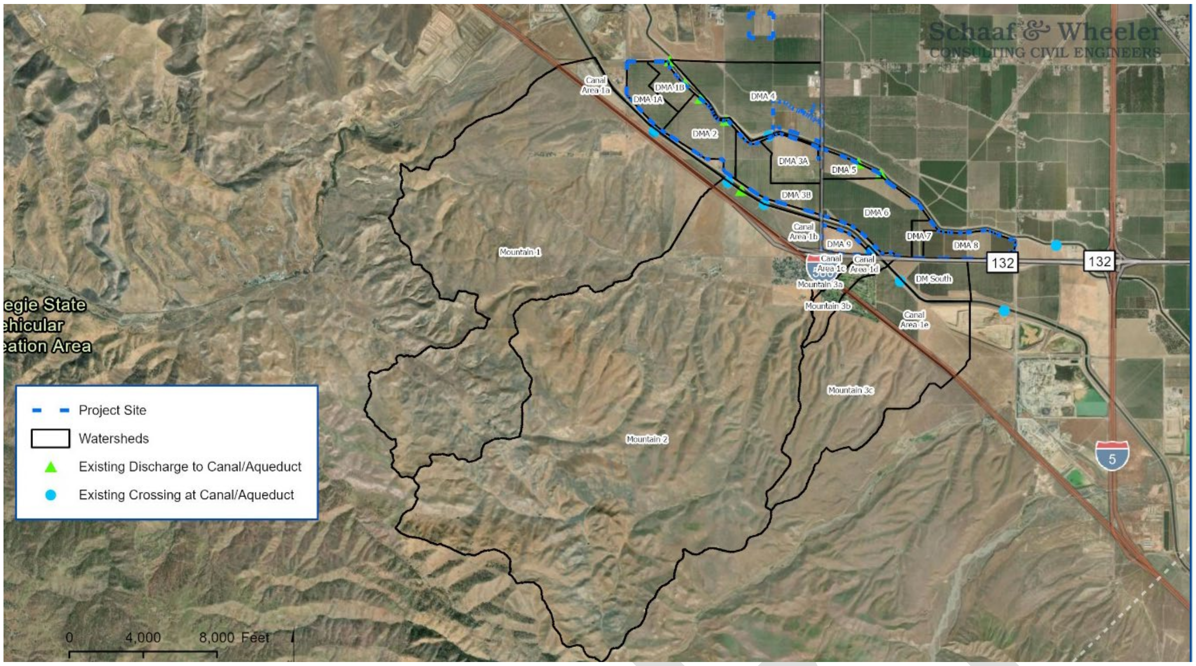

Figure 2-4: Existing Condition Catchment Areas. Existing culverts/crossings or discharges to the California Aqueduct and Delta Mendota Canal are also shown.

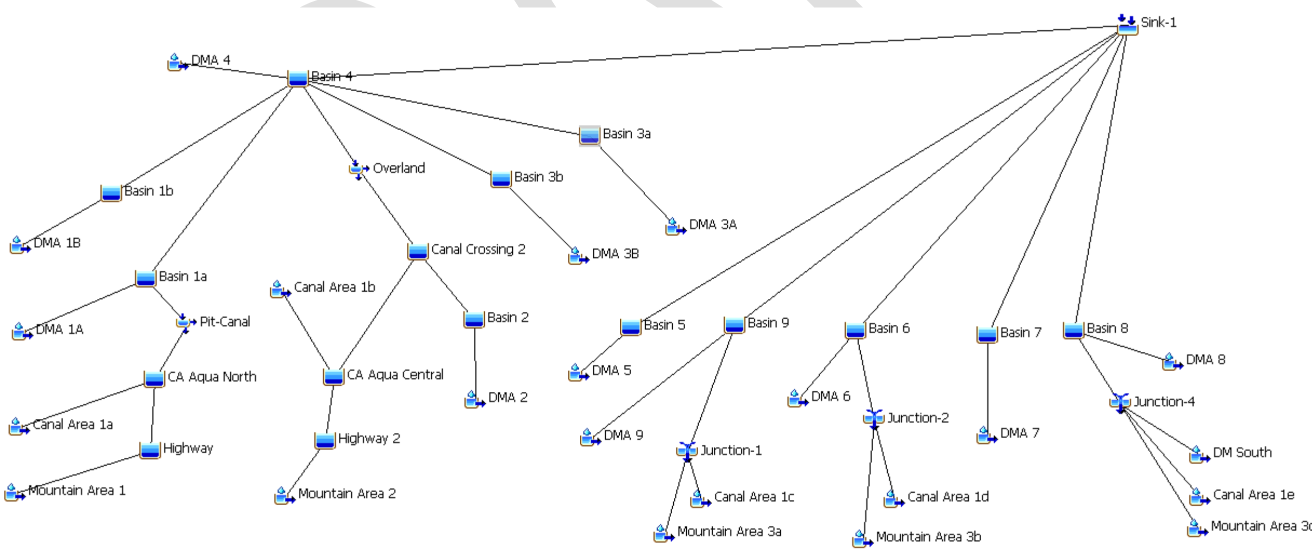

Figure 2-5: Existing Model Layout

Table 2-3: Existing Hydrologic Model Results

Catchment	Basin	Size (miles²)	Size (acres)	10-Year, 48-Hour Peak Flow (cfs)	100-Year, 24-Hour Peak Flow (cfs)	10-Year 48-Hour Runoff Volume (ac-ft)	100-Year 24-Hour Runoff Volume (ac-ft)
DMA 1A	1a	0.19	124	61	116	19	25
DMA 1B	1b	0.12	79	38	73	12	16
DMA 2	2	0.32	202	102	196	32	42
DMA 3A	3a	0.23	150	74	141	23	30
DMA 3B	3b	0.31	197	99	189	31	41
DMA 4	4	0.92	588	294	562	92	121
DMA 5	5	0.11	73	35	67	11	14
DMA 6	6	0.56	360	179	342	56	73
DMA 7	7	0.06	37	19	37	6	8
DMA 8	8	0.24	153	77	147	24	31
DMA 9	9	0.09	61	29	55	9	12
Canal Area 1a	-	0.29	187	6	27	5	9
Canal Area 1b	-	0.29	183	6	27	5	9
Canal Area 1c	9	0.09	55	2	8	1	3
Canal Area 1d	6	0.10	66	2	9	2	3
Canal Area 1e	8	0.65	418	12	60	10	20
Mountain Area 1	-	6.78	4,340	143	567	139	274
Mountain Area 2	-	10.84	6,935	255	922	241	466
Mountain Area 3a	9	0.04	23	3.2	9	1	2
Mountain Area 3b	6	0.12	78	5	18	3	5
Mountain Area 3c	8	1.70	1,089	32	143	32	65
DM South	8	0.30	192	9	34	6	11

Table 2-4: Model Diversions

Catchment	10-Year, 48-Hour Peak Flow (cfs)	100-Year, 24-Hour Peak Flow (cfs)	10-Year 48-Hour Runoff Volume (ac-ft)	100-Year 24-Hour Runoff Volume (ac-ft)
Delta Mendota North (Pit-Canal)	24	101	62	205

2.2 Hydraulics

The 10-year and 100-year runoff hydrographs from the HEC-HMS model were used for a hydraulic model (HEC-RAS) of the watershed. The channel and culvert network extends from the highway culverts to downstream of the development areas. The results from the hydraulic models show that runoff is both attenuated in the existing orchard areas and diverted into the canals. Flows are concentrated into shallow channels and metered under the canals at various locations. The delineations shown in Figure 2-5 and Figure 2-6 were used to develop flow paths, since FEMA has not studied this area. Development should take these zones into consideration. It is assumed the on-site drainage infrastructure will provide 100-year protection to the proposed buildings. The retention basins are designed to retain the 100-year, 24-hour peak flow from onsite and non-diverted upstream areas.

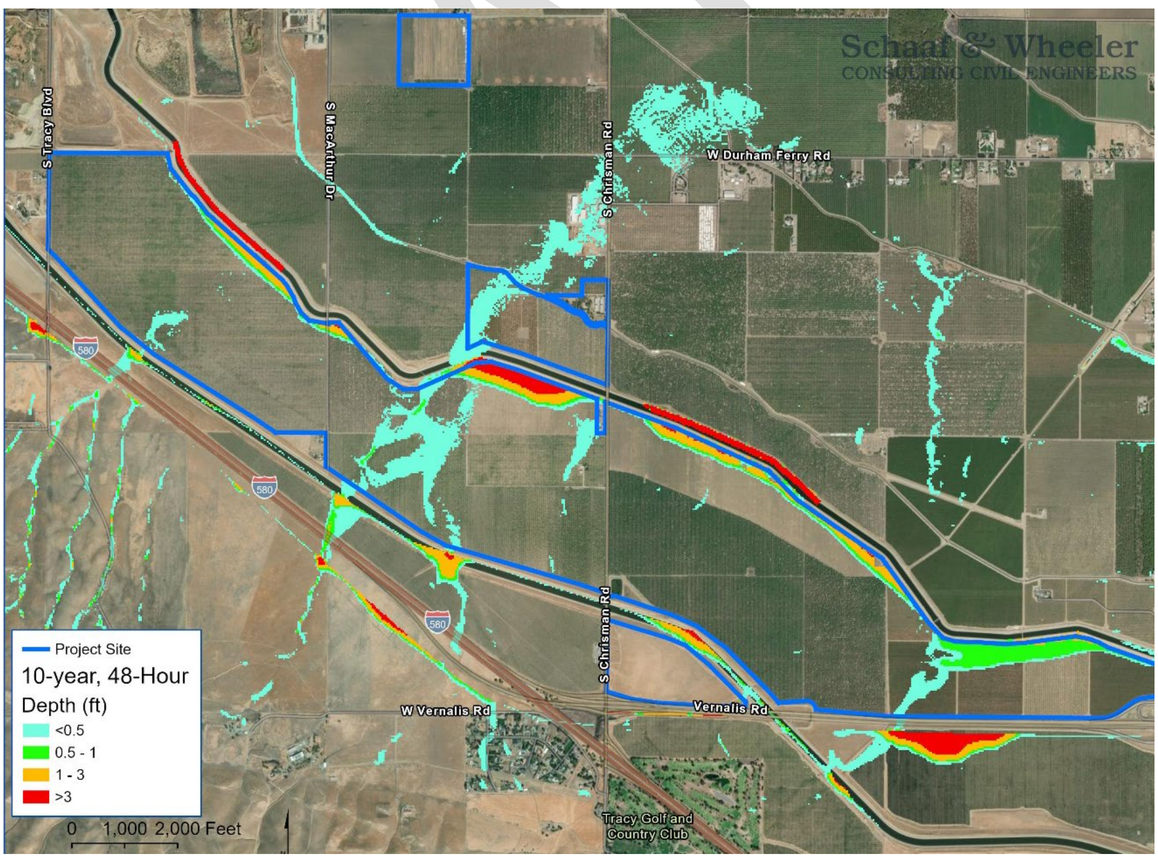

Figure 2-6: Existing 10-year Floodplain

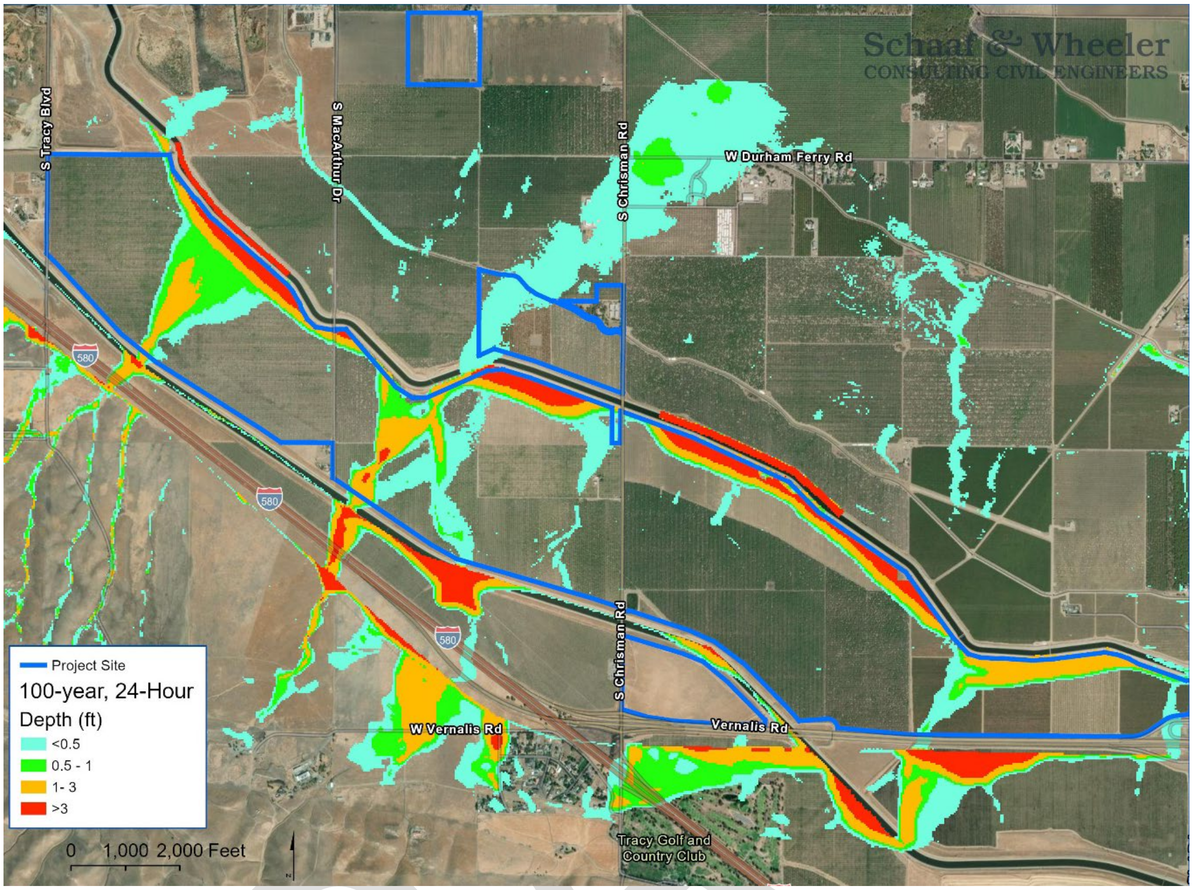

Figure 2-7: Existing 100-year Floodplain

3 Project Conditions

3.1 Hydrologic Changes

Currently, the orchards have minimal drainage infrastructure, which allows runoff to attenuate in low-lying areas. Developing these areas will modify much of that storage and decrease the hydrologic lag in each basin. This, along with the increased impervious surfaces, will increase the peak flows and volume of runoff from large storm events. The existing culverts and downstream infrastructure are likely not designed to convey these changes. Therefore, runoff will need to be stored in the proposed retention basins to mitigate the development.

3.2 Proposed Hydraulic Changes

Schaaf & Wheeler recommends maintaining the existing culverts throughout the development area. Flows from west of I-580 currently flow under the highway under the California Aqueduct and onto the project site, except for one location where water flows into the California Aqueduct. Those flow paths should continue. This analysis assumes the existing diversion rates and volumes are preserved. Any additional flow would be retained and infiltrated.

3.3 Proposed Retention Basins

Each phase of development will install necessary drainage networks to provide a 10-year 48-hour level-of-service to the development parcels. Each network will discharge to a retention basin that meets County standards. Retention means no surface discharges from the basins, only percolation. This study assumes the basins will be sized for the 10-year 48-hour capacity along with 25-percent freeboard. The 100-year 24-hour storm will be modeled to confirm that the system does not spill. Since not enough information is available on downstream hydraulic conditions, the basins will retain and percolate flows to prevent increases in downstream flows.

Schaaf & Wheeler has estimated a retention basin size for each development area. The basin dimensions (areas, elevations, depths, and volumes provided by Kier and Wright) are listed in Table 3-1.

Table 3-1. Retention Basin Dimensions, provided by K&W and Used in the Model

Basin	Basin Bottom Area (acres)	Basin Top Area (acres)	Basin Bottom Elevation (ft)	Basin Top Elevation (ft)	Basin Depth (ft)
1a	4.9	7.4	193.0	205.0	12
1b	2.9	4.8	181.5	193.5	12
2	1.9	3.5	182.5	194.5	12
3a	1.8	3.4	184.5	196.5	12
3b	0.8	2.3	184.5	196.5	12
4	29.8	35.0	130.0	142.0	12
5	1.3	2.7	174.0	189.0	15
6	6.1	8.9	173.0	189.0	16
7	2.1	3.5	173.0	189.0	16
8	10.7	14.9	171.0	189.0	18
9	1.8	3.3	234.0	249.0	15

Table 3-2 compares the maximum storage provided by the basins to the 10-year, 48-hour peak storage, and 100-year, 24-hour peak storage. The retention basin locations are shown in Figure 3-1. ENGEO conducted percolation tests. Basin sizes assume that percolation (from the rates provided by ENGEO) will occur along the side slopes and not along the bottom of the basins for basins 1-4. However, where the drain-down time was insufficient, an additional benched area was added along the perimeter of the basins to increase percolation; the dimensions of the percolation bench are included in Table 3-2. Basins 3, 4, 5, 6, and 7 will be required to percolate in 10 days after a 10-year 48-hour event per County standards. Basins 1 and 2 will be required to percolate in 2 days due to their proximity to the airport, per Federal Aviation Administration (FAA) regulations.

Basins 1a, 2, 3b, 5, 6, and 9 will pump to Basin 4 to the north at the pump rates listed in Table 3-2. As development plans progress, basin locations and sizing will likely be modified. The retention basins are only designed for onsite runoff and upstream non-diverted flows. The site currently receives offsite drainage from the mountain areas, which discharge to the canals or flow eastward. We assumed those flows will still be diverted or captured in the retention basins.

Table 3-2: Retention Basin Results

Basin	Drainage Area (mi^2)	Max. Percolation Rate (in./hr.)[1]	Pump Rate (cfs)	10-Year, 48-Hour Peak Storage (ac-ft)	100-Year, 24-Hour Peak Storage (ac-ft)	Max. Storage (ac-ft)	Size of Percolation Bench
1a	0.19	7.4	45.0	0.7	72.2	73.8	34' wide (93,000 SF)
1b	0.12	1.1	2.75	5.8	11.2	46.0	-
2	0.32	1.7	4.0	15.2	31.8	32.5	29' wide (35,000 SF)
3a	0.23	1.6	0.75	18.1	27.1	31.1	-
3b	0.31	1.6	13.0	7.7	17.9	18.7	-
4	0.92	80.9	-	174.9	320.2	388.4	-
5	0.11	0.15	0.5	8.3	13.0	29.5	-
6	0.78	0.05	2.5	49.3	75.9	119.9	-
7	0.06	0.75	-	1.9	4.7	45.0	-
8	2.89	0.70	-	46.9	111.4	230.3	-
9	0.22	0.15	0.25	9.8	15.8	38.1	-

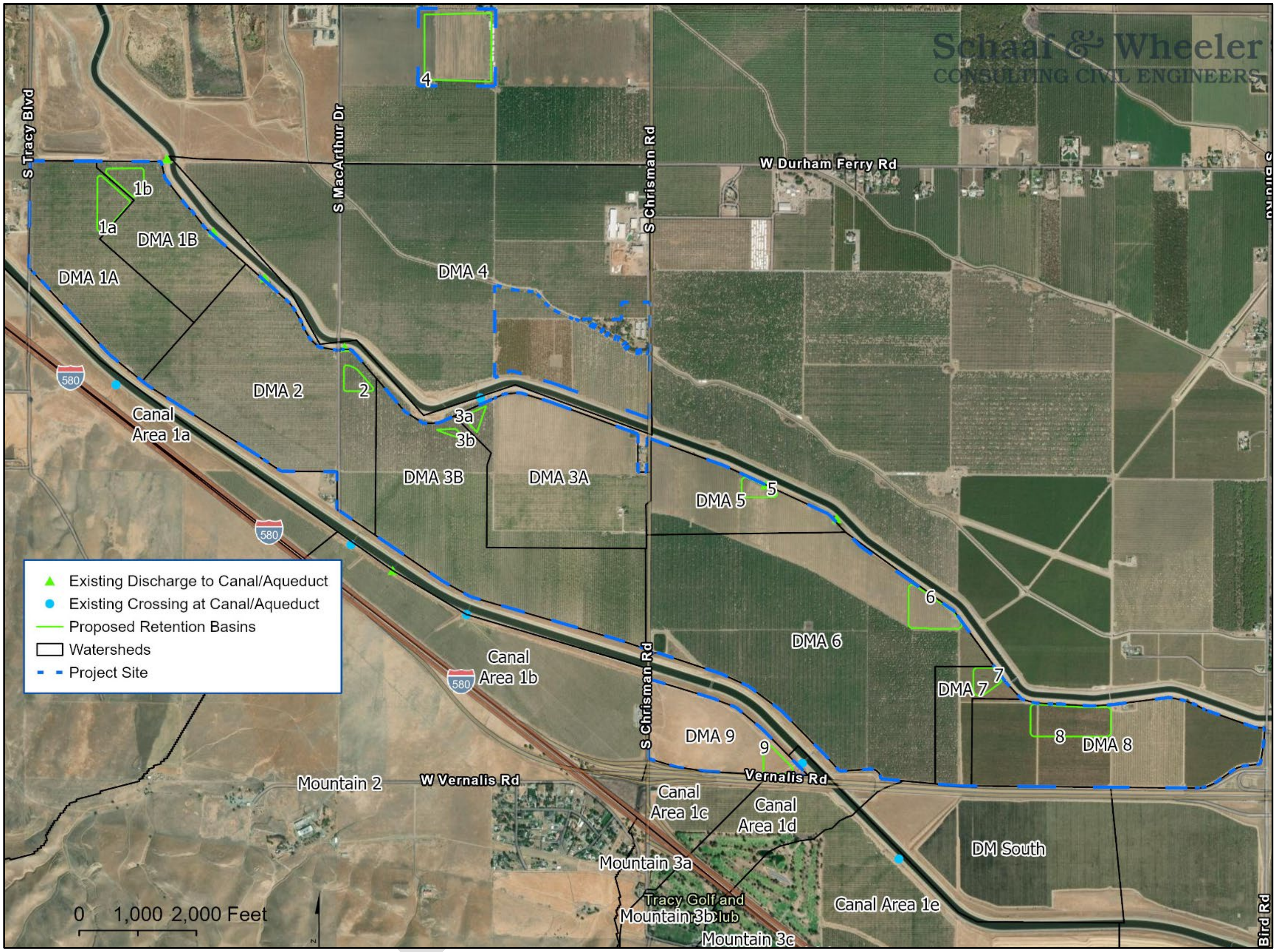

Figure 3-1: Proposed Retention Basins

4 Conclusion

This study provides a review of the existing and proposed hydrologic and hydraulic conditions for a commercial development along Highway 580 in San Joaquin County. The existing orchard areas have minimal drainage infrastructure. Runoff typically ponds in low-lying areas or is conveyed into or under the existing canals. The proposed development will greatly increase both the volume of runoff and peak flow rates during large storm events. These increases will need to be mitigated by using retention basins.

This report outlines the necessary retention basin sizing for each watershed. Basin location and sizes will likely change as development planning progresses.