DRAFT PACIFIC GATEWAY HYDROLOGY & HYDRAULICS REPORT

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1 Introduction

The Pacific Gateway Hydrology and Hydraulics Report reviews the existing drainage conditions and discusses modifications done for the proposed development at the project site. This report focuses on the hydrology and hydraulic conditions at the development area and adjacent drainages within the San Joaquin County (County). The development site is in the County jurisdiction outside of the City of Tracy. The area is bordered by open space to the west, orchards to the south and east, and quarries to the north. The development site is approximately 1,600 acres and currently mostly almond orchards.

The orchards will be converted to new commercial buildings, roadways, parking, and a college campus. 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 quantities the existing 10-year 48-hour and 100-year 24-hour hydrology and sizes potential infrastructure to mitigate the development impacts.

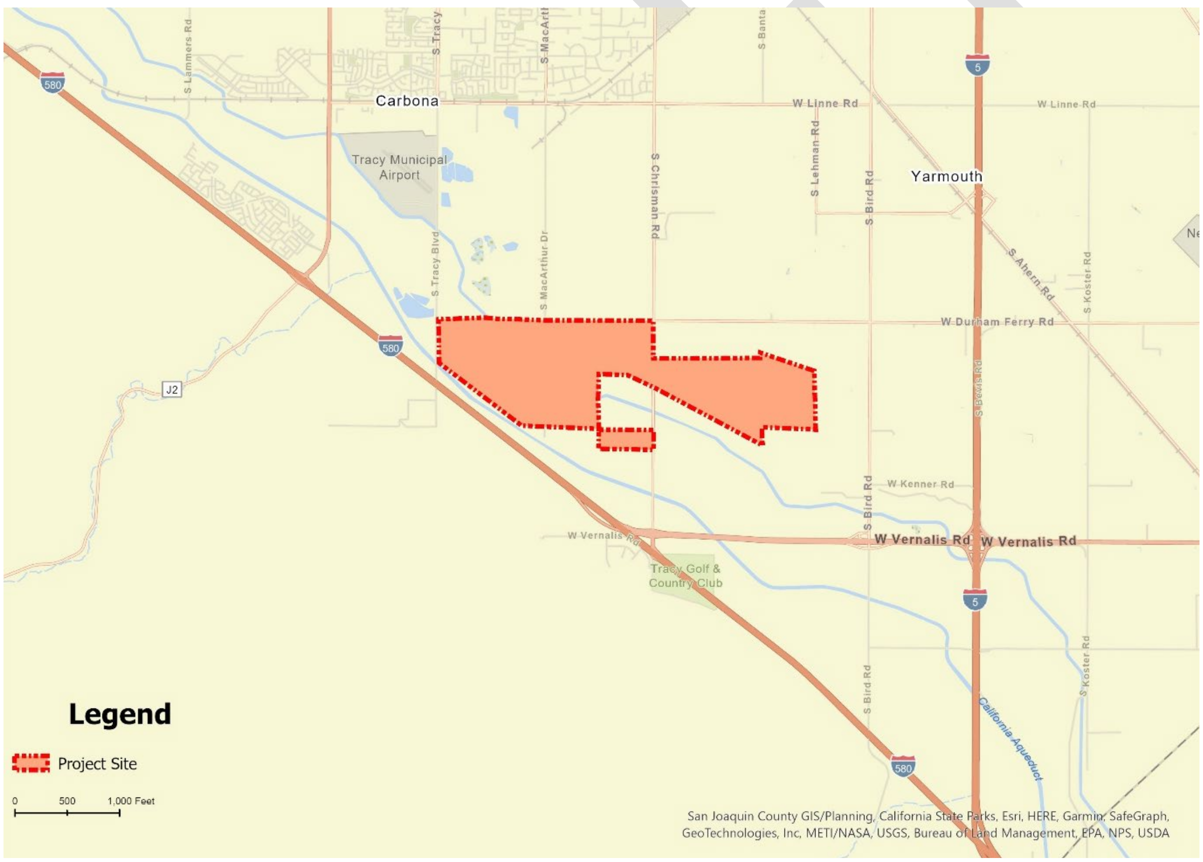

Figure 1-1: Project Location

2 Existing Conditions

There are no readily available reports of the watersheds intersecting the proposed development. Therefore, this study analyzes the exiting 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 the 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-hou rainfall patterns.

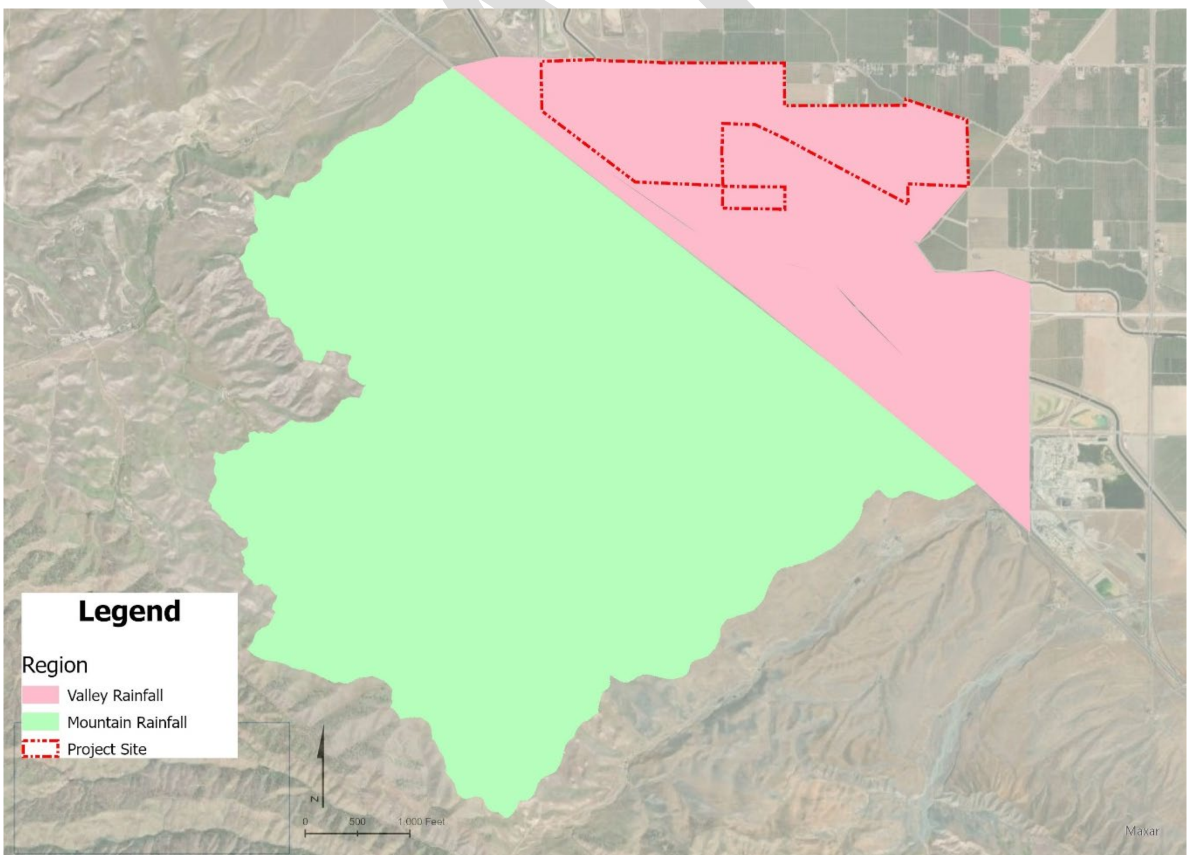

Figure 2-1: Rainfall Regions

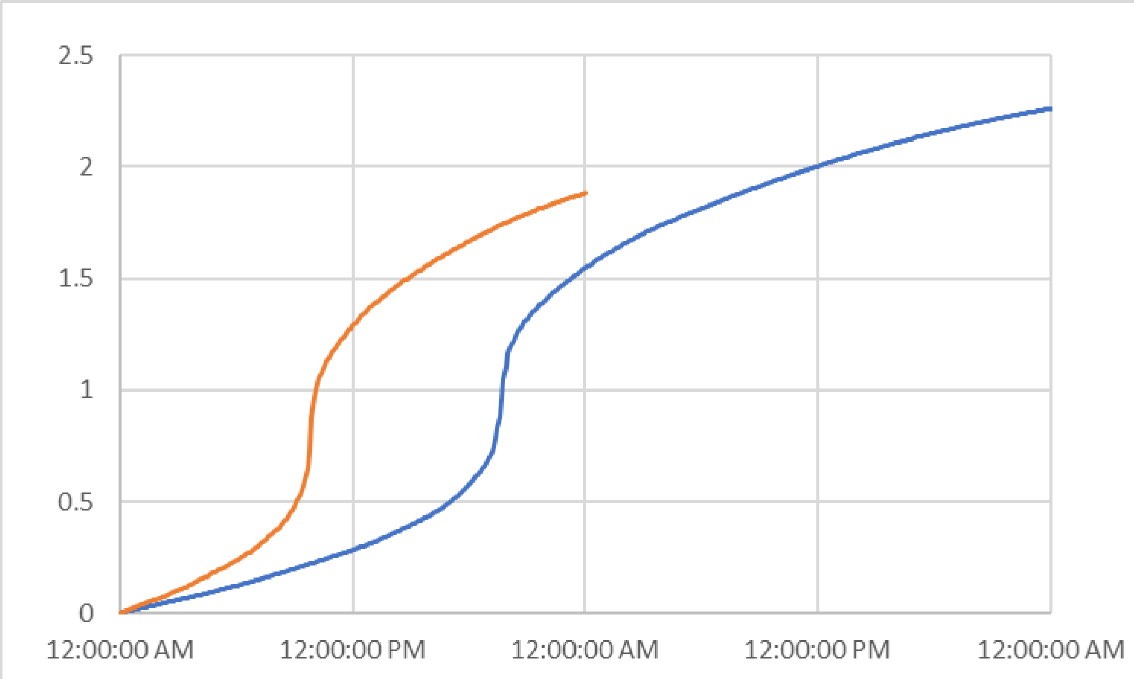

Figure 2-2: SCS Type I Rainfall Patterns

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. A Curve Number of 76 was used for the existing orchards (C Soils) with an AMC of II and a 2-percent impervious area.

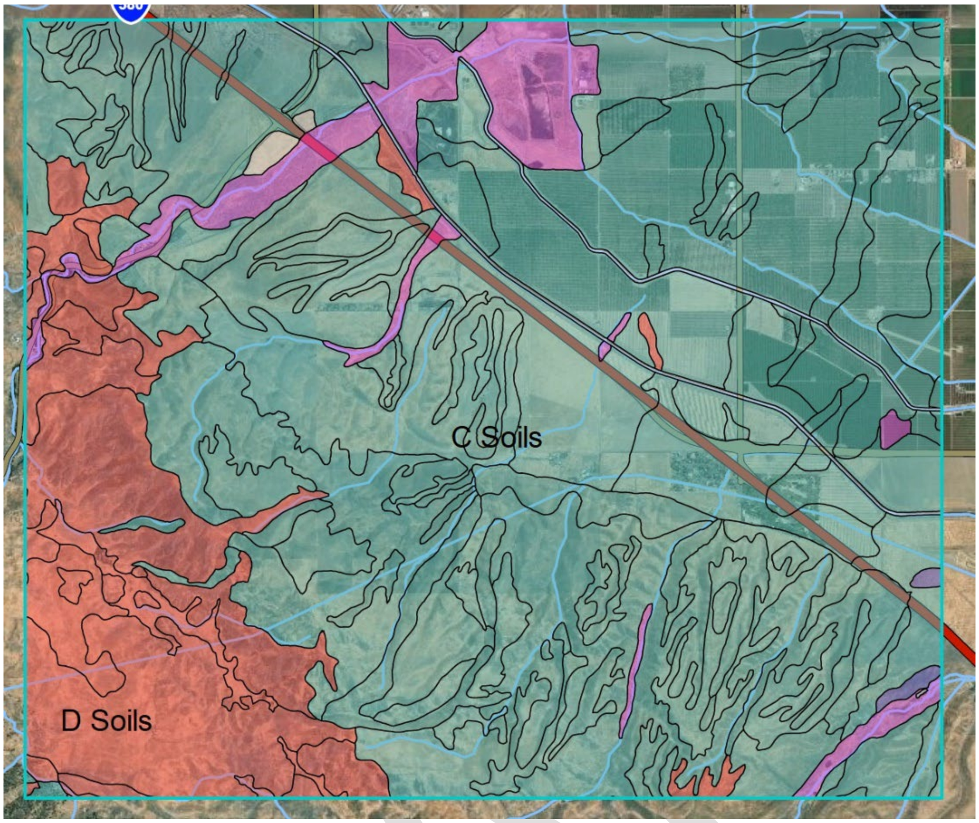

Figure 2-3: NRCS Hydrologic Soils Groups

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. Figure 2-4 shows the locations of significant culverts under roadways and canals or diversions directly into the Delta-Mendota Canal. 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 2-5 shows the watersheds and key flow points while Table 2-2 lists the peak 10-year and 100-year peak flows and runoff volumes. Table 2-3 lists the existing diversions to the Delta-Mendota Canal from the HEC-RAS models.

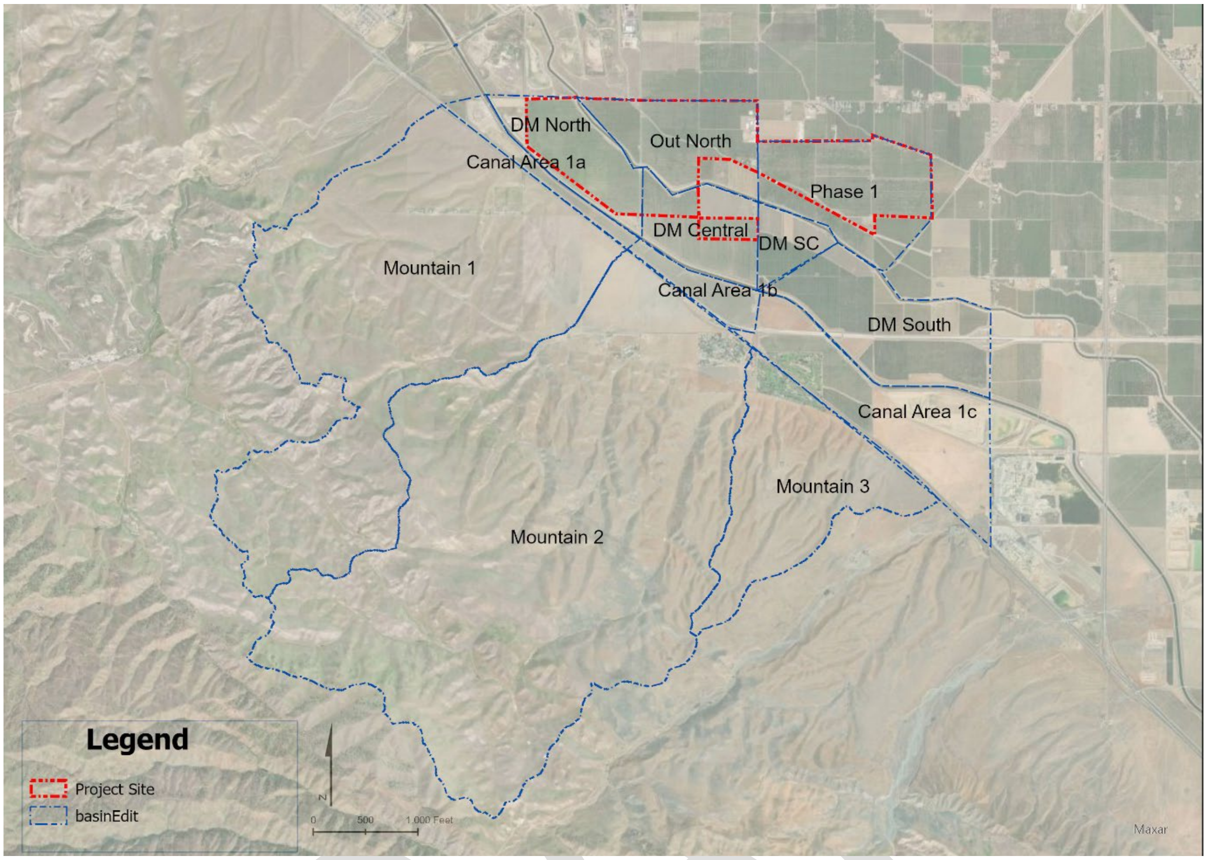

Figure 2-4: Existing Condition Catchment Areas

Table 2-2: Existing Hydrologic Model Results

Catchment	Size (acres)	10-year Peak Flow (cfs)	100-year Peak Flow (cfs)	10-year 48-hour Runoff Volume (acre-feet)	100-year 24-hour Runoff Volume (acre-feet)
Canal Area 1a	0.3	4	18	5	9
Canal Area 1b	0.3	4	18	5	9
Canal Area 1c	1.5	21	95	25	48
DM Central	1.8	25	110	28	55
DM North	0.8	11	48	12	24
DM SC	0.3	4	19	5	10
DM South	1.3	19	82	21	41
Mountain Area 1	6.8	75	254	139	273
Mountain Area 2	10.8	138	454	240	464
Mountain Area 3	2.0	25	95	39	78
Out North	1.0	14	61	16	31
Phase 1	1.2	28	94	24	43

Table 2-3: Model Diversions

Catchment	10-year Peak Flow (cfs)	100-year Peak Flow (cfs)	10-year 48-hour Runoff Volume (acre-feet)	100-year 24-hour Runoff Volume (acre-feet)
Delta Mendota North	24	96	60	192
Delta Mendota South	20	27	28	32

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.

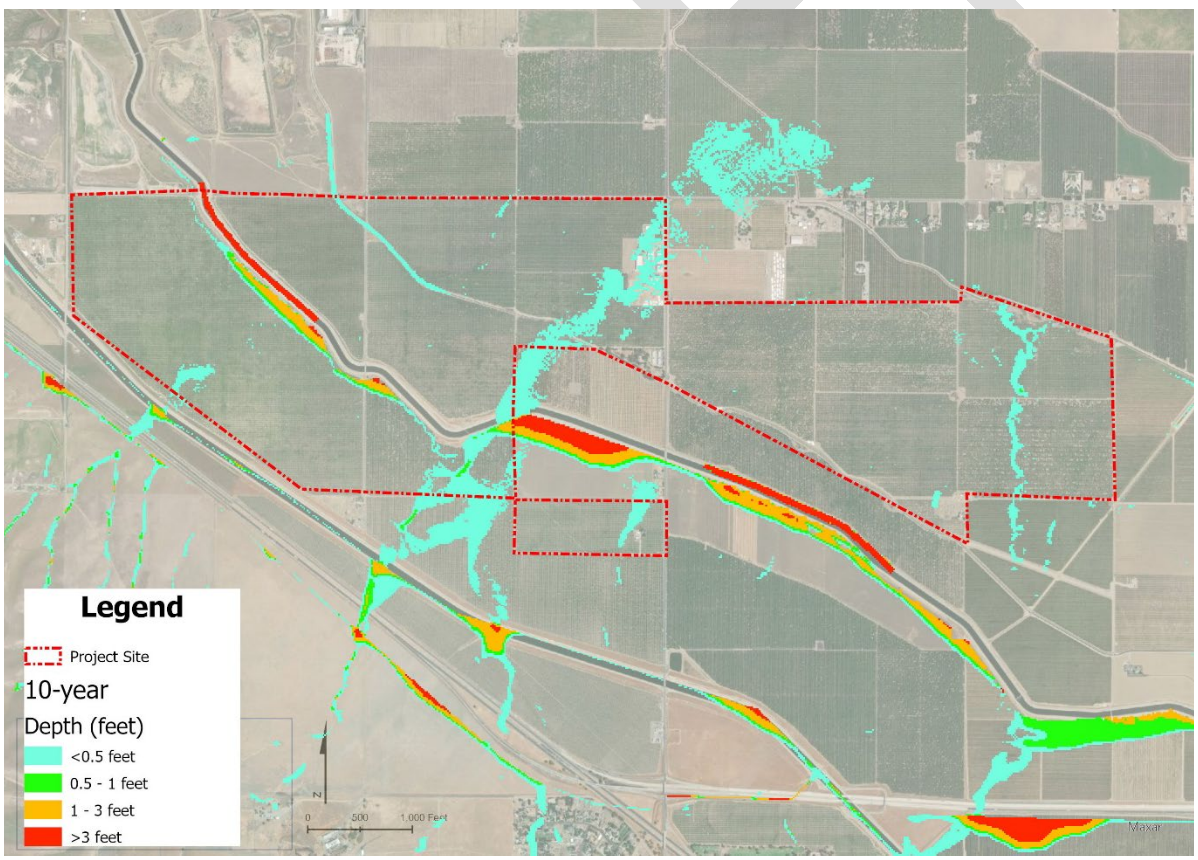

Figure 2-5: Existing 10-year Floodplain

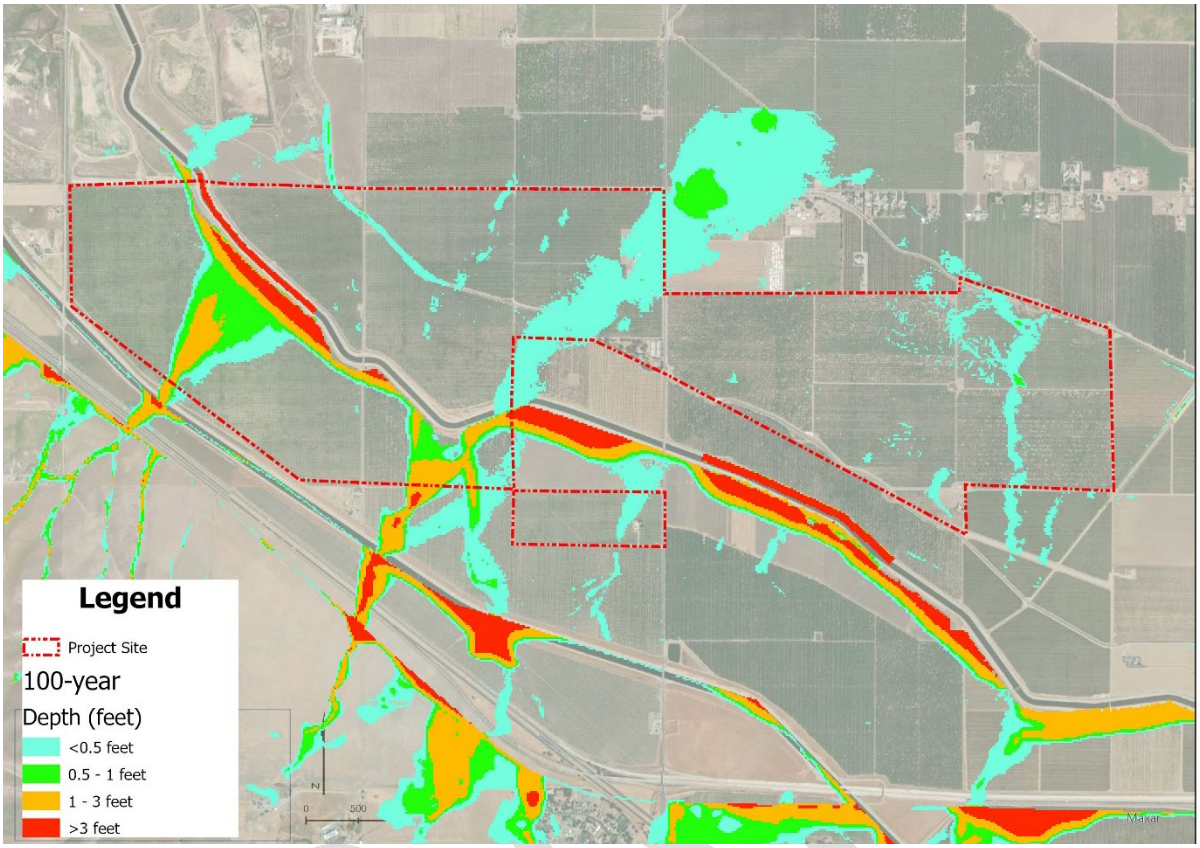

Figure 2-6: Exiting 100-year Floodplain

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 (Figure 3-1) 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 channel are not designed to convey these changes. Therefore, runoff will need to be stored in the proposed retention basins to mitigate the development.

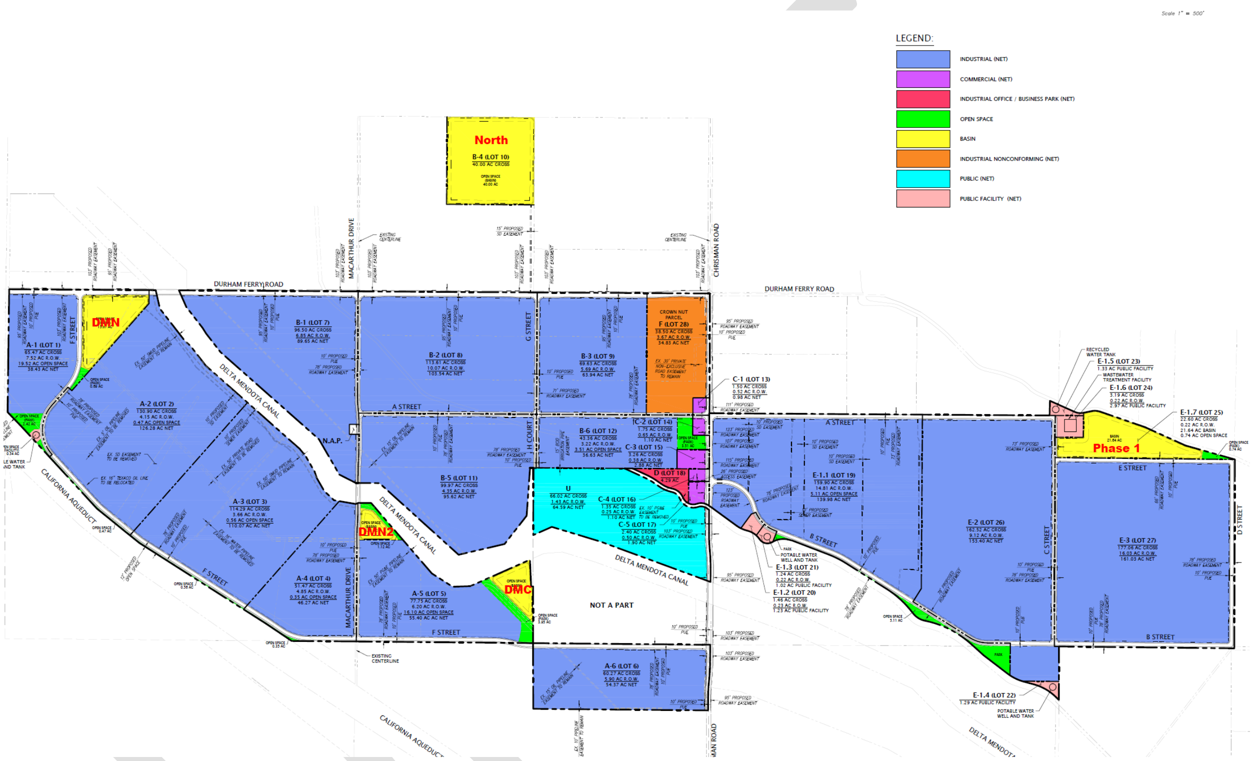

Figure 3-1: Proposed Industrial Development Areas

3.2 Proposed Hydraulic Changes

Schaaf & Wheeler recommends maintaining the existing culverts throughout the development area. The proposed design should continue to convey flows from west of the development through the region. The new drainage systems should continue to divert flows to the Delta-Mendota Canal and increase peak rates and volumes if permissible. 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 of freeboard. The 100-year 24-hour storm will be modeled to confirm the system does not spill. There is not enough information on downstream hydraulic conditions to determine if releasing flows from the basins is a viable option.

Schaaf & Wheeler has estimated a retention basin size for each development area. The conceptual basin sizes are listed in Table 3-1 and shown in Figure 3-2. Basins will be required to percolate in 10 days after a 10-year 48-hour event per County standards and within 72-hours per FAA regulations. As development plans progress, basin locations and sizing will likely be modified. Basins will discharge flows to the canals at the existing conditions rates. Discharges to canals and downstream areas are assumed to be at the same rates as existing conditions.

Table 3-1: Retention Basins

Retention Basin	Drainage Area (square miles)	Basin Area (acres)	Storage with Freeboard (acre-feet)	10-year Maximum Storage (acre-feet)	Minimum Percolation Rate (inch/Hour)	100-year Maximum Storage (acre-feet)
North	0.77	38	388	77	0.55	93
DMC	0.64	6	52	11	0.40	22
Phase 1	1.2	20	188	91	0.92	137
DMN	0.55	19	124	34	0.43	54
DMN2	0.28	3	24	11	0.85	18

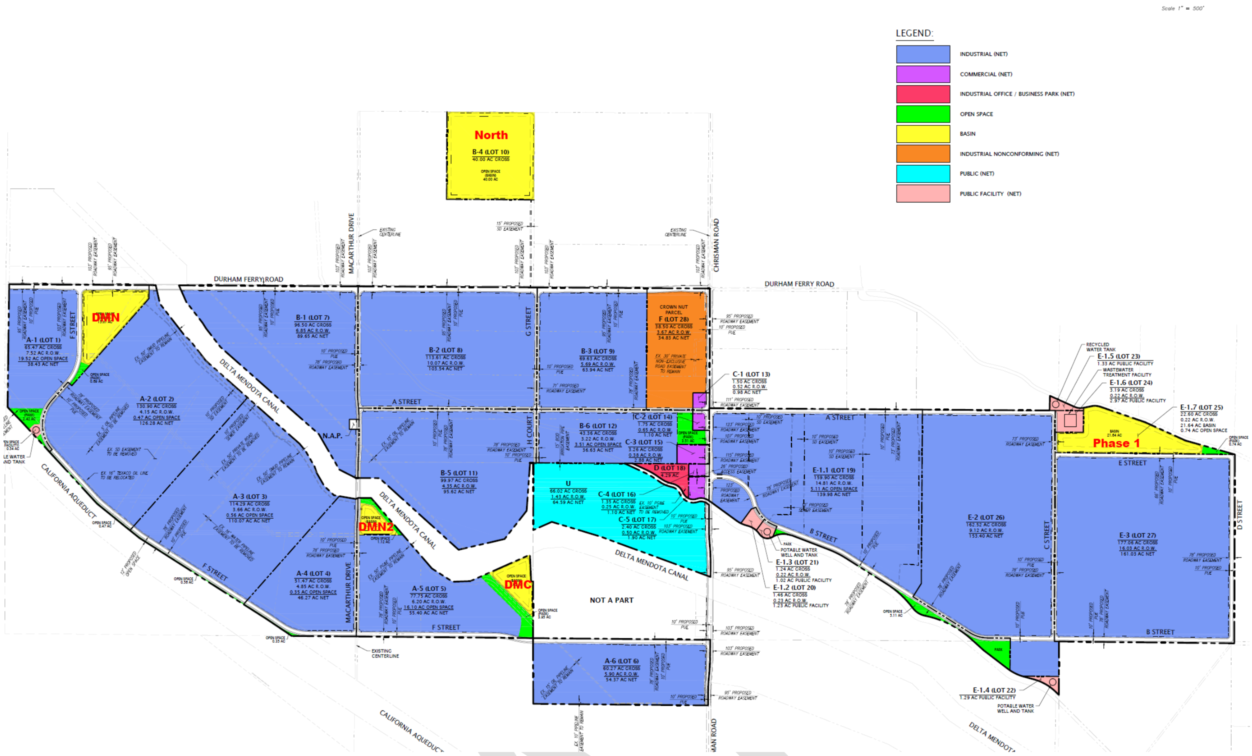

Figure 3-2: Proposed Retention Basins

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 exist orchard areas have minimal drainage infrastructure and 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. Percolation testing of each basin location is currently being performed in accordance with ASTM D3385.