PREPARED FOR:

STORMWATER REPORT







LONG LEAD DOUBLE TRACK

PORT OF STOCKTON

FINAL DESIGN

AUGUST 31, 2026

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1. Introduction

In recent years, the Port of Stockton has experienced a significant increase in annual rail throughput, resulting in constrained rail access and switching capacity and reduced rail storage Port-wide. Additionally, the Port has identified several prospective tenants seeking new rail service, with a significant volume identified for the West Complex. Current access to the West Complex is only possible through the East Complex, over the existing San Joaquin River single-track rail bridge, and is heavily constrained by switching operations in the East Complex.

This stormwater report defines the major drainage design elements related to the proposed double lead track, and other associated improvements within the Port boundaries. The Port is also pursuing a track maintenance project to bolster the existing lead track, named 'Rail Hardening'. Several drainage improvements are proposed as part of both these projects that will occur in adjacent areas within similar timelines. Therefore, this stormwater report evaluates the proposed drainage improvements for both projects. A portion of the double lead track project lies in the BNSF ROW, covered in a separate stormwater report to address the drainage outside the Port property.

Lastly, this effort evaluates the proposed localized drainage improvements pertaining to improving drainage along the newly built tracks and ensuring that runoff is diverted away from these improvements. An area-wide drainage evaluation of the Port drainage system is outside the scope of this report.

1.1 Revisions

The following is a summary showing the revision tracking for the Drainage Report:

Table 1 – Revision Summary Table

Revision	**E**	**Previous Revisions**	
Date	08/31/2026	Rev	Date
Description	100% Stormwater Report	A	07/25/2023
Prepared By	Arkaprabha Ghosh, PE	B	08/30/2024
Checked By	Allene Rieger, PE	C	06/27/2025
Approved By	Jon Marshall, PE	D	06/29/2026

1.2 Project Location

The project is located at 2201 West Washington Street in Stockton, CA. The Port facility is located between MP 1123 and MP 1125 along the BNSF Stockton Subdivision. The Port of Stockton is the fourth largest Port in California by volume, shipping upwards of 4.7 million tons annually, and is the largest inland Port in California, occupying approximately 4,200 acres. The Port boundary is shown in **Figure 1** below.

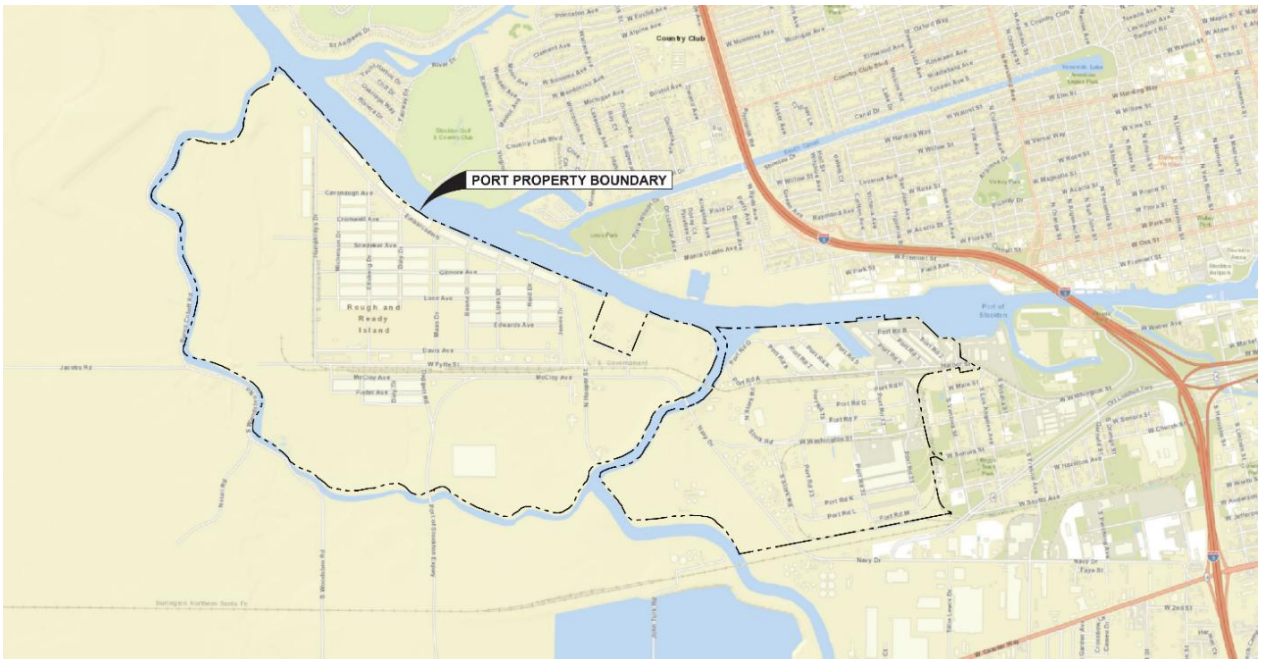


Figure 1 – Site Location Map

1.3 Project Stakeholders

List design team and agency stakeholders.

1.3.1 Design Team

Owner:	Port of Stockton, Jason Katindoy - Director of Facilities & Procurement
Railroad Operations:	CCTC, Ramiro Barba, General Manager
Prime Consultant/Bridge Engineer:	HDR, Inc., Matthew Archer, P.E. – Sr. Rail Engineer
Civil, Hydraulics, and Rail Engineer:	JMA Civil, Inc., Arka Ghosh, P.E. – Sr. Civil Engineer
Bridge Hydrology and Hydraulics Engineer:	HDR, Inc., Wana Chiu
Geotechnical Engineer:	Kleinfelder, Nathan L. Dahlen, P.E. – Sr Project Manager
Surveyor:	Cinquini and Passarino (C&P), Inc., Jim Dickey, P.L.S. – Principal Engineer
Environmental Engineer:	Anchor QEA, LLC, Marine Vie – Sr. Managing Environmental Planner

1.3.2 Agency Stakeholders

Port of Stockton

The Port of Stockton is the Owner of the project site and is responsible for leasing property to Port tenants. The Port manages all stormwater permitting and works collectively with the City of Stockton to issue all building permits.

Railroad

BNSF owns and operates the main line that serves the Port of Stockton. The Central California Traction Company (CCTC) is the Port's rail operator and is jointly owned by BNSF and UPRR. Both BNSF and UPRR serve tenants at the Port. All rail design at the Port is subject to approval from CCTC with input from BNSF and UPRR.

Local Agencies

The City of Stockton has permit jurisdiction adjacent to the BNSF ROW along Scotts Avenue and Fresno Avenue at the proposed underpass's location.

The Port maintains the levee system and has established an annual levee monitoring and inspection program to determine whether reinforcement of the perimeter levee's structural integrity is required. Levee monitoring occurs in collaboration with Reclamation Districts 403 and 404.

1.4 Applicable Codes and Standards

This report and the resulting design shall comply with the following standards: addenda, specifications, and recommended practices.

- BNSF Main Line Track Standards
- UPRR Industry Track Standards
- Port of Stockton Drainage Design Guidelines
- Caltrans Highway Design Manual (HDM)
- USDA/SCS TR-55 Urban Hydrology for Small Watersheds, June 1986

2. Records Review and Data Collection

2.1 Project Survey Datum

Ground survey was performed on 04/24/2023. The benchmark for the survey is city of Stockton benchmark number 305 stamped '10S-1' near entrance to the port of Stockton main offices. Horizontal coordinates are based on California state plane coordinate system zone #3, NAVD83. Vertical datum is based on NGVD88.

2.2 Flood Hazard Analysis

The project is located at 2201 West Washington Street in Stockton, CA. The Port facility is located between MP 1123 and MP 1125 along the BNSF Stockton Subdivision. Most of the project site is in a "Zone X Other Flood Area," which indicates an area with a 0.2% annual chance of flood or an area with a 1% annual chance of flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, as well as areas protected by levees from a 1% annual chance of flood.

The project lies in an area with reduced flood risk, as shown in the FEMA FIRM Map on **Attachment A.** A portion of the San Joaquin River is classified as a Regulatory Floodway. However, the risk of flooding is significantly reduced due to the levee system around both banks of the San Joaquin River and Burns Cutoff, which are maintained by the Reclamation Districts 403 and 404. The base flood elevations at the San Joaquin River vary from 10' at the north end of the Port to approximately 12.5 feet to the south at the BNSF mainline bridge.

2.3 SWPPP Risk Evaluation

The Contractor will prepare the SWPPP document for this project. However, an independent evaluation was performed to ascertain the level of risk for the project site based on the anticipated construction start and end dates. A Risk Level of 1 was deemed appropriate for both East and West Complex spanning the entire project footprint for an assumed duration starting March 2027 and ending in October 2028.

The NPDES risk worksheet was used to compute the three key risk factors using the GIS method. It was also verified through the Water Board portal that there were no high-risk receiving watersheds that the project footprint will discharge to. The receiving water bodies adjacent to the project site include 'Five Mile Slough' and Stockton Deepwater Channel and per 2022 Water Board data, neither of these water bodies are identified as having potential sedimentation risk. The results are summarized in **Table 2** below.

Table 2: SWPPP Analysis Summary

Attribute	Value
Rainfall Erosivity (R) Factor	40.72
Soil Erodibility (K) Factor	0.43
Length-Slope (LS) Factor	0.73
Watershed Erosion Estimate	6.48 tons/acre
Risk Level	1

3. Stormwater Analysis Approach

Civil3D's Storm and Sewer Analysis Package (SSA) was utilized to develop the stormwater model, which included the subbasins (drainage areas), storage nodes (retention/detention basins), inlets, and storm drains. The widely accepted SCS TR-55 method was utilized to compute peak runoffs. The 'Hydrodynamic' mode was utilized as the link routing method to obtain the most accurate results feasible. The software employs Manning's Equation to calculate capacity, velocity, and flow depth for open channel flow under uniform flow conditions. For closed conduit systems, Storm and Sanitary Analysis (SSA) applies open channel hydraulics (Manning's Equation) to partially full flow and utilizes the Hazen-Williams or Darcy-Weisbach equations to model full or pressurized flow. For surcharged conditions, dynamic wave routing is used to simulate unsteady flow behavior.

Flow capacity is reported based on the maximum flow rate a conduit or channel can convey under typical design conditions. Gradually varied flow is analyzed using the continuity and energy equations in conjunction with Manning's Equation. The model also accounts for minor losses throughout the system. In hydrodynamic routing mode, the full momentum equation is incorporated to simulate complex flow interactions. Additionally, storage curves are developed from elevation-area tables to determine the retention capacity of storage basins within the network.

4. Hydrologic Analysis

The following sections summarize the hydrologic analysis performed to quantify the peak flows and volumes for the return periods evaluated.

4.1 Rainfall Data

Rainfall intensity data for the evaluated return periods were obtained from NOAA Atlas 14, Volume 6, Version 2 and a copy of the data is included in **Attachment D**. Precipitation data was obtained for the 2-year, 50-year, and 100-year 24-hour storms.

Table 2: Project Site Precipitation Data

Point Precipitation Data (inches)			
Duration	Recurrence Interval (Years)		
	2-yr	50-yr	100-yr
24-hr	1.69	3.13	3.43
Point Precipitation Frequency Estimates (inches/hour)			
5-min	1.61	3.30	3.72

4.2 Rainfall-Runoff Losses

The Civil3D SSA software was used for the hydrologic calculations and to model the rainfall-runoff losses. The SCS Curve Number (CN) method was used as the rainfall loss method. The SCS CN method estimates total rainfall losses as function of cumulative precipitation, soil type and land use.

The SCS CN method requires the following inputs:

- **Curve Number (CN)**: The curve number that represents soil type and land use for the drainage area. A geotechnical report was prepared for this project by Kleinfelder, Inc., in June 2023, and an excerpt for the predominant soil type in the project area is included in **Attachment D**. According to the referenced geotechnical report, the soil type was identified and classified accordingly. Based on this classification, typical infiltration rates were estimated to range between 0.1 and 1.0 inches per hour. Given these values, the soil was determined to belong to Hydrologic Soil Group D, as defined in USDA Table 7-1, which is provided in **Appendix D**. The land use of the project area varies but can be described as a combination of open space with good condition, impervious areas with track roadbed and roadway pavement, based on Table 2-2a of the TR-55 manual which is included in **Attachment D.** Detailed curve number calculations for all drainage areas are provided in **Table 1** of **Attachments F and G**.
- **Initial Abstractions (I_a, inches)**: The amount of precipitation that falls before runoff begins. Detailed Initial Abstraction calculations for all drainage areas are provided in **Table 1** of **Attachment E**.
- **Impervious Area (%)**: The percentage of directly connected impervious area, defined as any impervious surface that is either directly connected to the drainage area discharge point or

flows directly into a pipe or impervious conduit to the discharge point. Detailed impervious area percentage calculations for all drainage areas are provided in **Table 1** of **Attachment E**.

- **Time of Concentration (Tc)/Lag**: Time of concentration is the time it takes run-off to travel from the hydraulically most distant point of the drainage area to the downstream element. Due to the small size of the individual drainage areas and for conservativeness, the minimum value of 5 minutes for a time of concentration was selected for all drainage areas, which results in a lag time of 3 minutes based on the following formula:
  Lag, L (min.) = Tc X 0.6 = 5 X 0.6 = 3 min.
  (Ref : National Engineering Handbook (NEH), Part 630 – Hydrology, Chapter 15: Time of Concentration, Washington, D.C., 2010.)

4.3 Runoff Data

The SCS TR55 Unit Hydrograph method determines the runoff data in SSA to transform point precipitation data into a design storm. This analysis is based on an SCS Type 1 storm, based on the project location per TR-55 Manual, Figure B-2. A copy of the rainfall distribution map is included in **Attachment D.** SSA output values for the peak run-off flow and corresponding volume for the 2-year, 50-year, and 100-year storms are included in **Tables 1** of **Attachment F** (Existing) and **Attachment G** (Proposed).

5. Existing Conditions

The Port of Stockton is divided into East and West Complex by the San Joaquin River, the main tributary within the project site. San Joaquin River is a major river in California, and the Port of Stockton is located on its downstream stretch before its confluence with the San Francisco Bay.

The East and West Complex have a complex network of drains and culverts that eventually drain into the San Joaquin River. In the East Complex, Port Rd A can be considered a divider; existing topography reflects that on the north side of Port Rd A, the water naturally drains towards the San Joaquin River. The water on the south side of Port Rd A is directed through a series of stormwater pipes and open channel earthen drainage ditches to a single pump-controlled discharge point on the west side of the East Complex. Drainage ditches on the East Complex are generally open, with culverts beneath road crossings or other developments. During years, when the retention basin reaches a high level of approximate elevation of 10.0, stormwater is pumped to the San Joaquin River. Stormwater falling in the replacement rail bridge and adjoining levees drains directly to the San Joaquin River. Despite the existing drainage system, several areas in East Complex demonstrate a localized tendency for standing water, particularly at the Port Yard and north of Washington Street, due to a lack of existing basins or stormwater outlets.

5.1 Tributary Areas

The project traverses multiple areas within the Port, and it is more convenient to break them down into separate regions to describe the drainage conditions. **Attachment B** shows the existing drainage map of all drainage regions described above, with pictures for illustration. The descoped areas have been marked in the attachment as well.

Port Yard

The Port Yard is flat with no apparent outfall locations or drainage ditches. It is separated from the San Joaquin River east approach by Stork Road, which separates the two regions. The northern limit of the drainage areas is defined by Port Road A, which is a natural high point in this area. The proposed project improvements lie exclusively south of Port Road A, which exhibits poor drainage conditions with frequent ponding on and adjacent to tracks during the wet season.

CCTC Wye

The drainage area boundaries in the CCTC Wye area are bound by Port Rd A, Port lead track, and Track 809, which are shaped by the numerous tracks in this area that serve as natural barriers to runoff. There are no apparent outfalls or drainage features in this area, and they also exhibit poor drainage in existing conditions. The existing lead track has been observed to have poor drainage conditions with visible spots of 'subgrade pumping'. The general terrain slopes south from the high point of Port Road A to the north. A natural low point east of Track 809 outside the Port property demonstrates significant flooding.

Washington Approaches

This region is largely flat with several low spots adjacent to the track that have been observed to pond, especially the northwest quadrant of the Washington at-grade crossing. No poor drainage conditions were observed on the Port lead track, although Track 847 serving Duraflame has been noted to be submerged under water during rainy weather. The Port's stormwater network has an outlet west of the Washington Street at-grade crossing, potentially tying into the City system east of the crossing.

State Route 4

This region underneath the SR-4 overpass is bound to the south by the BNSF mainline and Port lead track embankments and the Eco-Energy tracks to the west. The terrain slopes considerably to the north and east towards the existing retention pond in a vacant lot on a private property. The area bound by the Port lead and Eco-Energy tracks is largely flat but contains existing ditches and outfalls that tie into the Port stormwater network.

The existing drainage areas with outfall locations are summarized below in **Table 3**. The detailed results on peak flows for 2-year, 50-year, and 100-year storms are provided in Tables 1 and 5 of Attachment F.

Table 3 – Existing Drainage Areas

Drainage Area Name	Area (acres)	Downstream Element
Port Yard (EX-004 - Attachment B)		
EC-07EX	3.13	None
EC-08EX	0.92	None
EC-09EX	0.74	None
EC-10EX	0.90	None
CCTC Wye (EX-005 - Attachment B)		
EC-11EX	0.55	None

Drainage Area Name	Area (acres)	Downstream Element
EC-12EX	0.33	None
EC-13EX	2.92	None
EC-14EX	0.42	None
EC-15EX	0.14	None
Washington Approaches (EX-006 - Attachment B)		
EC-16EX	0.18	None
EC-17EX	0.50	None
EC-18EX	0.17	None
EC-19EX	0.18	None
EC-20EX	0.70	None
EC-21EX	0.23	None
EC-22EX	0.42	None
EC-23EX	0.25	None
EC-24EX	0.85	None
EC-25EX	0.38	None
EC-26EX	0.80	None
SR-4 Port Entrance (EX-007 - Attachment B)		
EC-27EX	1.39	Port storm drain network
EC-28EX	1.58	Port storm drain network
EC-29EX	0.66	SR4 Ditch 1
EC-30EX	1.19	SR4 Ditch 2
EC-31EX	1.39	SR4 Basin
EC-32EX	0.17	None

5.2 Runoff Analysis

Table 4 below summarizes the peak flow and total runoff volume for each drainage area analyzed for existing conditions.

Table 4 – Existing Runoff Data

Drainage Area	Area	Peak Outflow (cfs)			Total Runoff Volume (ac-ft)		
Name	(acres)	100 Year	50 Year	2 Year	100 Year	50 Year	2 Year
EC-07EX	3.13	6.75	6.03	2.60	8.36	7.45	3.22
EC-08EX	0.92	1.99	1.78	0.77	2.46	2.19	0.95
EC-09EX	0.74	1.42	1.25	0.47	1.75	1.54	0.61
EC-10EX	0.90	1.93	1.73	0.74	2.40	2.14	0.93
EC-11EX	0.55	1.19	1.06	0.46	1.47	1.31	0.57
EC-12EX	0.33	0.72	0.64	0.28	0.88	0.79	0.34

Drainage Area	Area	Peak Outflow (cfs)			Total Runoff Volume (ac-ft)		
Name	(acres)	100 Year	50 Year	2 Year	100 Year	50 Year	2 Year
EC-13EX	2.92	5.15	4.49	1.53	6.37	5.58	2.07
EC-14EX	0.42	0.63	0.54	0.15	0.80	0.70	0.23
EC-15EX	0.14	0.30	0.27	0.12	0.37	0.33	0.14
EC-16EX	0.18	0.39	0.35	0.15	0.48	0.43	0.19
EC-17EX	0.50	1.08	0.96	0.41	1.34	1.19	0.52
EC-18EX	0.17	0.36	0.32	0.14	0.45	0.40	0.18
EC-19EX	0.18	0.37	0.33	0.14	0.48	0.43	0.19
EC-20EX	0.70	1.16	1.00	0.32	1.45	1.26	0.45
EC-21EX	0.23	0.48	0.43	0.19	0.61	0.55	0.24
EC-22EX	0.42	0.90	0.80	0.35	1.12	1.00	0.43
EC-23EX	0.25	0.54	0.48	0.21	0.67	0.60	0.26
EC-24EX	0.85	1.32	1.13	0.33	1.66	1.44	0.48
EC-25EX	0.38	0.81	0.73	0.31	1.01	0.90	0.39
EC-26EX	0.80	1.74	1.55	0.67	2.14	1.90	0.82
EC-27EX	1.39	2.39	2.08	0.69	2.96	2.59	0.95
EC-28EX	1.58	2.60	2.25	0.71	3.24	2.83	1.00
EC-29EX	0.66	0.71	0.59	0.10	0.97	0.82	0.22
EC-30EX	1.19	1.87	1.61	0.48	2.36	2.05	0.70
EC-31EX	1.39	1.14	0.91	0.08	1.65	1.38	0.31
EC-32EX	0.17	0.37	0.33	0.14	0.45	0.40	0.18

6. Proposed Conditions

The general philosophy for this project has been to tie into existing ditches/retention basins wherever feasible. However, if no feasible facilities are available, we provide new retention ditches/basins to capture and hold stormwater runoff. Due to the space constraints placed by dense track and other infrastructure, it was not feasible to provide 10-foot wide ditches per UPRR's Main Line Design Guidelines. Therefore, we followed UPRR's Industry Track Guidelines to provide minimum 2-foot-wide and 2-foot-deep ditches and provided stormwater calculations to demonstrate that these ditches would be able to accommodate a storm event.

6.1 Tributary Areas

The tributary areas in the proposed condition had an increased percentage of impervious area due to the addition of a new track. However, the addition of new drainage features such as storm drain pipes and detention/retention basins also reshaped the boundaries and extents of these drainage areas, breaking them down into smaller areas. The following subsections discuss the proposed drainage conditions in each project region in greater detail. **Attachment C** shows the proposed

drainage map of all drainage regions described above. Figure 4 on Attachment E shows how the subbasins (tributary areas) were set up in SSA.

Port Yard

The Port Yard is a flat terrain with known ponding issues. Improving the area-wide stormwater system is beyond the scope of this project. The focus has been to ensure localized positive drainage for the track infrastructure. The new track added to the south of Port Yard (Track 7) lies within the leasehold of Metro Ports and is close to their existing access road. A retention basin was provided maximizing the area available without great site or lease impacts. Track underdrains were proposed for Track 7 as well as for the reconnected Tracks 845 and 846 that ultimately drain into the proposed ditch. There are no apparent storm drain networks or outfalls in this area, therefore, the proposed ditch would act as a retention basin with no outfalls nearby.

Table 7 below provides a summary of the proposed drainage conditions. The proposed drainage areas and outfalls are also shown in **Attachment C**.

Table 7: Port Yard Proposed Drainage

Drainage Area Name	Area (Acres)	Proposed Drainage	Outfall/ Tie-In
EC-06A	0.26	Prop. PortW_UD-B	None
EC-07	0.84	Prop. PortW_UD-A	None
EC-07A	0.32	Prop. PortW_UD-C	None
EC-08	1.59	None	None
EC-08A	1.03	Prop. Port Yard Ditch	Prop. Port Yard Ditch
EC-09	1.43	None	None
EC-09A	0.15	None	None
EC-10	0.89	Portyard-SD	Prop. Port Yard Ditch
EC-10A	0.29	Portyard-SD	Prop. Port Yard Ditch

CCTC Wye

The CCTC area has significant space constraints with a high density of tracks connecting the Port leads. Therefore, in order to minimize the footprint of the proposed improvements and reduce impacts, we have proposed a 15” and 12” underdrain between the two lead tracks at 20’ spacing. The subgrade grading will create a low point between the tracks, allowing the underdrain to collect the runoff from this area. Another potential issue with the existing conditions is an apparent lack of drainage outlets, which has demonstrated poor track drainage in this area. Furthermore, this has also resulted in runoff flowing southeast and flooding the adjacent private property of M&L. This runoff has also caused erosion of the track roadbed for Track 809 at several locations. We endeavored to avoid directing runoff to adjacent properties as part of this project, and therefore, the proposed solution in this area was a new retention basin (CCTC basin) south of the existing CCTC facility bound by the Port lead tracks to the west and Track 809 to the east. A segment of the underdrain proposed between the tracks will ultimately drain to the new CCTC retention basin. The size of this new basin was constrained by the existing CCTC track to the north.

As shown in **Attachment C,** a portion of the track underdrain between the two lead tracks is also sloped to discharge the runoff into the port yard ditch, through a series of underdrains. The new

track 811 connecting the Port Yard and CCTC shed with Track 811 will also have underdrains that will discharge into the existing storm drain pipes in the area.

Table 8 below provides a summary of the proposed drainage conditions. The proposed drainage areas and outfalls are also shown in **Attachment C**.

Table 8: CCTC Wye Proposed Drainage

Drainage Area Name	Area (Acres)	Proposed Drainage	Outfall/ Tie-In
EC-11	0.27	CCTC_UD-A	Prop. Port Yard Ditch
EC-11A	0.30	CCTC_UD-A	Prop. Port Yard Ditch
EC-12	0.78	811-UD-A, 811-SD	Prop. Port Yard Ditch
EC-12A	0.47	811-UD-B	Ex SD 811
EC-12B	0.16	811-UD-C	Ex SD 811
EC-13	2.92	Prop. CCT Basin	Prop. CCT Basin
EC-13A	0.76	CCT_UD-C	Prop. CCT Basin
EC-13C	0.19	CCT_UD-B	Prop. Port Yard Ditch
EC-18	0.80	None	Offsite
EC-18A	0.06	None	Offsite

Washington Approaches

In the north of the Washington street Washington basin will be proposed as part of Rail hardening project. The proposed Washington basin would take up the triangular real estate between the Port lead (LD01) and Track 807, just north of the Washington Street at-grade crossing. The basin extents are limited to the south by the presence of PG&E power poles and guy wire, which would not be impacted.
In the south of Washington street an underdrain is proposed next to the ECO track which carrier all the water to the SR-4 ditches and eventually drain into the existing storm drain network at the port entrance. . **Table 9** below provides a summary of the proposed drainage conditions. The proposed drainage areas and outfalls are also shown in **Attachment C**.

Table 9: Washington Approaches Proposed Drainage

Drainage Area Name	Area (Acres)	Proposed Drainage	Outfall/ Tie-In
EC-19	0.19	None	Offsite
EC-20	0.74	Prop. Washington Basin	Prop. Washington Basin
EC-21	0.23	None	None
EC-22	0.42	None	None
EC-23	0.25	None	Offsite
EC-24	0.85	ECO-UD, ECO_CV	Port Storm Drain Network
EC-25	0.38	None	None
EC-26	0.77	ECO-UD, ECO_CV	Port Storm Drain Network

State Route 4

There are constraints to the north of the existing lead track, especially from the right-of-way standpoint, as the proposed improvements fall within the private property to be acquired outside the Port ROW. Therefore, we have designed the track roadbed to minimize the ditch extents north of the improvements and the extent of property acquisition required. A short segment of a trapezoidal ditch (Boral Ditch) is proposed just south of the adjacent property Boral that will ultimately outfall into the proposed detention ditch (SR4 Ditch) as part of the Rail Hardening project through an equalizing culvert (Culv-2). This detention ditch is designed to provide retention capacity up to a water elevation matching the lowest top of the subgrade along the ditch. Any additional volume will be discharged through storm drains connecting to the existing storm drain network just east of the Eco-Energy facility. An existing retention pond (SR4 Basin) is just north of the SR4 crossing on a private property adjoining the Port ROW. However, since it is unclear whether a full property acquisition will be feasible, we have avoided directly draining into this pond. Nevertheless, the proposed track roadbed embankment will maintain the existing pattern of runoff sheet flowing from the BNSF and Port lead track embankment into this adjacent pond. There is another segment of ditch required just underneath SR-4, as it is not feasible to keep the top of the track subgrade above existing ground. We have proposed that this ditch ultimately outfall through a culvert (CR-6) daylighting the runoff away from the tracks into the adjacent property but not directly onto the existing retention pond.

Table 10 below provides a summary of the proposed drainage conditions. The proposed drainage areas and outfalls are also shown in **Attachment C**.

Table 10: State Route 4 Proposed Drainage

Drainage Area Name	Area (Acres)	Proposed Drainage	Outfall/ Tie-In
EC-27	1.01	None	Port Storm Drain Network
EC-27A	1.33	Prop. SR4 Ditch; Prop. Eco-SD	Port Storm Drain Network
EC-28	1.24	None	Port Storm Drain Network
EC-29	0.69	Prop. SR4 Ditch 2; Prop. Culv #2	Port Storm Drain Network
EC-30	0.41	None	None
EC-31	1.65	None	Ex. SR4 Basin

6.2 Runoff Analysis

Table 11 below summarizes the peak flow and total runoff volume for each drainage area analyzed for proposed conditions. As expected, the runoff in the proposed condition increases as compared to the existing conditions due to the impervious area added by the project.

Table 11 – Proposed Runoff Data

Drainage Area	Area (acres)	Peak Outflow (cfs)			Total Runoff Volume (inches)		
		100 Year	50 Year	2 Year	100 Year	50 Year	2 Year
EC-06A	0.26	0.53	0.48	0.43	2.57	2.28	2.07
EC-07	0.84	1.82	1.63	1.48	2.67	2.38	2.16
EC-07A	0.32	0.70	0.63	0.57	2.67	2.38	2.16
EC-08	1.59	3.44	3.07	2.79	2.67	2.38	2.16
EC-08A	1.03	1.90	1.67	1.49	2.29	2.02	1.81
EC-09	1.43	3.09	2.76	2.51	2.67	2.38	2.16
EC-09A	0.15	0.32	0.28	0.26	2.67	2.38	2.16
EC-10	0.89	1.93	1.73	1.57	2.67	2.38	2.16
EC-10A	0.29	0.62	0.56	0.50	2.67	2.38	2.16
EC-11	0.27	0.58	0.52	0.47	2.67	2.38	2.16
EC-11A	0.30	0.65	0.58	0.53	2.67	2.38	2.16
EC-12	0.78	1.55	1.38	1.24	2.45	2.17	1.96
EC-12A	0.47	0.95	0.84	0.76	2.48	2.19	1.98
EC-12B	0.16	0.35	0.31	0.28	2.67	2.38	2.16
EC-13	2.92	5.17	4.52	4.02	2.19	1.92	1.72
EC-13A	0.76	1.64	1.47	1.33	2.67	2.38	2.16
EC-13C	0.19	0.14	0.11	0.08	1.08	0.89	0.75
EC-18	0.80	1.73	1.54	1.40	2.67	2.38	2.16
EC-18A	0.06	0.12	0.11	0.10	2.66	2.37	2.14
EC-19	0.19	0.40	0.36	0.33	2.67	2.38	2.16
EC-20	0.74	1.44	1.27	1.14	2.38	2.10	1.89
EC-21	0.23	0.48	0.43	0.39	2.67	2.38	2.16
EC-22	0.42	0.90	0.80	0.73	2.67	2.38	2.16
EC-23	0.25	0.54	0.48	0.44	2.67	2.38	2.16
EC-24	0.85	1.01	0.85	0.72	1.57	1.34	1.17
EC-25	0.38	0.81	0.73	0.66	2.67	2.38	2.16
EC-26	0.77	1.66	1.48	1.35	2.67	2.38	2.16
EC-27	1.01	1.74	1.51	1.34	2.15	1.88	1.68
EC-27A	1.33	2.60	2.29	2.06	2.39	2.11	1.90
EC-28	1.24	2.04	1.77	1.56	2.06	1.80	1.60
EC-29	0.69	1.28	1.12	1.00	2.30	2.03	1.82
EC-30	0.41	0.35	0.28	0.23	1.22	1.02	0.87
EC-31	1.65	1.31	1.04	0.85	1.17	0.97	0.83

6.3 Terminal Drainage Conditions

A new terminal drainage facility is proposed south of the CCTC shed between the lead tracks and Track 809. This depression is already a natural drainage channel and can be used to collect track runoff from areas adjacent to the Port Road 13 crossing, where track pumping has been observed due to poor drainage. The final change in terminal drainage is at the northwestern corner of the Washington Street crossing. It is envisioned to function as a retention basin for the areas south of Washington. However, there is an opportunity to route additional runoff to the basin and have it outfall to the Port/City storm drain network along Washington Street if needed in the future.

7. Hydraulic Analysis

The Civil3D SSA software was used for the hydraulic calculations to determine whether the drainage elements of basins, ditches, and pipes had adequate capacity to accommodate the design storm event. Figures 6 and 7 in **Attachment E** show the schematic SSA project setup for both existing and proposed conditions.

7.1 Storm Drain Analysis

SSA utilizes Manning's equation to calculate the capacity of the proposed underdrains and existing storm drain pipes, to confirm that they have adequate capacity for the design flow rate resulting from a 100-year design storm. The flow is calculated as follows:

$$Q = \frac{1.49}{n} * A * R^{\left(\frac{2}{3}\right)} * S^{\left(\frac{1}{2}\right)}$$

Where:

Q or Q_{CAP} = Volumetric flow rate passing through the pipe in cfs.
A = Cross-sectional area of flow normal to the flow direction in ft^2
S = Bottom slope of the channel in ft/ft
n = Manning Roughness coefficient
R = Hydraulic Radius = A/P
P = Wetted perimeter in ft
Q_{REQ} = Peak flow for 100-year storm event

In Storm and Sanitary Analysis (SSA) (Autodesk), entrance losses, exit losses, and bend losses are accounted for in hydraulic calculations as minor losses due to flow transitions in the system. These losses represent energy dissipation from turbulence and flow disruption as water moves through various components like junctions, manholes, bends, and transitions between pipes or structures.

$$he = Ke \cdot \frac{v^2}{2g}$$

$$hx = Kx \cdot \frac{v^2}{2g}$$

$$hb = Kb \cdot \frac{v^2}{2g}$$

Where:

h_e = entrance head loss (ft or m)

h_x = exit head loss (ft or m)

h_b = bent head loss (ft or m)

K_e = entrance loss coefficient (typically ranges from 0.2 to 0.5)

K_x = exit loss coefficient (1.0 is typical unless otherwise modified)

K_e = bent loss coefficient (45° bend: Kb≈0.2, 90° bend: Kb≈0.3–0.5)

v = velocity of flow entering the structure (ft/s or m/s)

g = gravitational acceleration

For gradually varied conditions across manholes, transitions, or junctions, SSA uses a simplified energy balance approach:

$$H1 = H2 + hl$$

Where:

H_1, H_2 = total heads at upstream and downstream

h_l = head loss due to friction, entrance/exit/bend losses, etc.

SSA also incorporates hydrostatic pressure relationships and detailed channel geometry to support the calculation of gradually varied flow. Parameters such as top width, flow area, and hydraulic radius are derived from the conduit or channel cross-section geometry and are essential in computing conveyance and flow depth changes. By allowing for custom cross-sectional shapes, SSA can accurately model how depth and velocity evolve along the system, taking into account both geometric constraints and flow behavior.

Attachment E shows how the pipe links were set up in the SSA model. **Table 12** below summarizes the results for the existing pipe drains within the project under existing conditions during a 100-year storm event. The detailed results are presented in **Attachment F**.

Table 12 – Existing Pipe Capacity Summary in Existing Conditions for 100-Year Event

Name	Tributary Area(s)	Slope (%)	Dia. (in)	Manning's	Pipe Material	Capacity (cfs)	Peak Flow (cfs)	Velocity (ft/sec)	Surch-arge (min)	Flow Depth (ft)
	State Route 4 Port Entrance									
SD-7	EC-29EX	1.36	8	0.015	CMP	1.22	0.26	1.15	769	0.67
SD-8	EC-29EX; EC-30EX	2.60	14	0.015	PVC	7.51	0.00	0.00	0	0.00

Table 13 below summarizes the results for the proposed closed conduit flows, including storm drains, underdrains, and culverts under proposed conditions for the 100-year event. The flow patterns of the existing storm drains were identical under both existing and proposed conditions. Although all the pipes were designed to have adequate capacity for the anticipated 100-year peak flow, several of these pipes experience surcharge conditions. This is primarily due to the constraints of the tie-in elevations to existing outfalls or proposed basins.

Table 13 – Proposed Pipe Capacity Summary in Proposed Conditions for 100-Year Event

Element ID	Length	Slope	Dia.	Manning's	Capacity	Peak Flow	Velocity
	(ft)	(%)	(inches)		(cfs)	(cfs)	(ft/sec)
811-SD	15.00	0.2000	14.000	0.0200	1.56	1.42	1.91
811-UD-A	363.06	0.2000	14.000	0.0120	2.61	1.49	2.21
811-UD-B	238.00	0.2000	8.040	0.0120	0.59	0.95	2.72
811-UD-C	92.20	1.5900	8.040	0.0120	1.65	0.00	0.00
825_UD1	273.00	0.2000	9.960	0.0120	1.06	0.31	1.77
825_UD2	69.00	0.6100	8.040	0.0120	1.02	0.00	0.00
825_UD3	26.50	0.6000	9.960	0.0120	1.84	0.30	2.19
CCT_UD-B	100.00	0.2400	12.000	0.0120	1.73	0.13	0.27
CCT_UD-C	593.60	0.4900	9.960	0.0120	1.66	1.55	3.48
CCTC_UD-A	551.00	0.2000	15.000	0.0120	3.13	2.06	2.37
CCTC-SD	36.00	0.2500	15.000	0.0120	3.50	2.74	3.20
CCT-SD	18.00	0.5600	20.040	0.0200	6.74	1.53	2.65
CMP_Culv-1	236.00	0.4300	14.000	0.0200	2.30	2.27	2.71
CMP_Culv-2	65.00	0.4800	24.000	0.0200	10.15	1.25	1.71
ECO_CV	74.00	0.5100	12.000	0.0200	1.66	1.32	2.52
ECO-UD	1031.00	0.2000	15.000	0.0120	3.13	1.49	2.42
Portyard-SD	1466.00	0.2000	15.000	0.0120	3.11	2.10	2.87

7.2 Ditch Analysis

The existing and proposed ditches are modeled with a trapezoidal or triangular cross-section. When the ditch cross-section or slope varies, the most restrictive section and slope combination are used to calculate the drainage areas. These most restrictive sections do not take place at the end of the ditch where the flow rate is the highest, but they are sections determined to have the smallest area in each draining area; therefore, by using the most restrictive section for the calculation for the entire ditch, the result will be conservative. A summary of the existing ditch capacity versus the 100-year flow rates is provided in **Table 14** below. See **Attachment F** for detailed calculations.

Table 14 - Existing Ditch Capacities for Existing Conditions

Name	Slope	Geometry	Ditch Depth	Width	Manning's	Event	Peak Flow	Capacity	Velocity	Flow Depth
	(%)		(ft)	(ft)			(cfs)	(cfs)	(ft/sec)	(ft)
SR-4 Ditch 1	0.14	Trapezoidal	2.0	8.00	0.0220	100 Year	0.36	30.52	0.04	1.94
						50 Year	0.13		0.04	1.89
						2 Year	0.06		0.08	1.71
SR-4 Ditch 2	0.23	Trapezoidal	2.0	13.70	0.0270	100 Year	1.01	56.44	0.20	1.93
						50 Year	0.60		0.20	1.87
						2 Year	0.20		0.32	1.70

A summary of the existing ditch capacity versus the 100-year flow rates is provided in **Table 15** below. See **Attachment F** for detailed ditch flow calculations. All existing and proposed ditches have adequate capacities in both existing and proposed conditions. The peak flow and maximum flow depths of existing ditches reduces in the proposed condition despite the increase in impervious area due to the rerouting of runoff into other proposed drainage features, such as underdrains, new flow ditches, or new detention/retention areas.

The ditch capacity was determined by importing the ditch surface into Storm and Sanitary Analysis (SSA), where the volume was calculated based on the defined area and depth of the ditch. Additional factors such as initial water depth, evaporation, infiltration, and designated overflow paths were also incorporated to more accurately represent the ditch's storage capacity throughout the simulated storm event.

Table 15: Ditch Capacity Summary - Proposed Conditions

Name	Slope	Geometry	Ditch Depth	Width	Manning's	Event	Peak Flow	Capacity	Velocity	Flow Depth
	(%)		(ft)	(ft)			(cfs)	(cfs)	(ft/sec)	(ft)
EXISTING DITCHES										
SR-4 Ditch 1	0.14	Trapezoidal	2.0	8.0	0.022	100 Year	0.63		0.39	0.63
						50 Year	0.56	30.52	0.35	0.55
						2 Year	0.50		0.32	0.49
SR-4 Ditch 2	0.23	Trapezoidal	2.0	13.7	0.027	100 Year	2.56		0.40	0.63
						50 Year	2.58	56.44	0.46	0.55
						2 Year	1.92		0.47	0.48
PROPOSED DITCHES										
Prop.SR-4 Ditch	0.67	Trapezoidal	2.0	10.0	0.032	100 Year	1.15		0.55	0.66
						50 Year	1.00	46.39	0.51	0.63
						2 Year	0.36		0.48	0.38

7.3 Retention/ Detention Basin Analysis

The existing and proposed retention/detention basins/ditches were modeled in SSA as a storage node. The existing and finished grade surfaces were rendered in CAD, and elevation area tables were prepared, which were then entered into the SSA module to create storage curves for these nodes (**Attachment E**). The node's invert (FL) and top elevations (Rim) were specified in the model (**Attachment E**). Retention behavior was modeled in SSA by connecting the storage node to a 'dummy' outlet with a higher invert elevation than the basin's rim. The invert elevation was set higher than the basin's rim elevation to retain water within the ditches, allowing accurate modeling for the 100-year storm event. Detention behavior was modeled by linking a conveyance link (storm drain/culvert) connecting the storage node to the desired outlet (junction or another storage node).

The results for the analysis on retention storage volumes for the existing basins in existing conditions for a 100-year storm are provided below in **Table 16.** The detailed results are also shown in **Attachment F**.

Table 16: Existing Storage Basins/Ditches Analysis Summary - Existing Conditions

Name	Total Depth	Max Water Depth	Peak Inflow	Peak Outflow	Flooded Volume	Time Flooded
	(ft)	(ft)	(cfs)	(cfs)	(ac-inches)	(minutes)
SR 4 Basin	3.00	0.77	1.30	0.00	0.00	0.00

The results for the analysis on retention storage volumes for the existing and proposed basins in proposed conditions for a 100-year storm are provided below in **Table 17**. The detailed results are also shown in **Attachment F**.

The proposed Port yard ditch receives runoff from its own drainage area and adjacent areas through track underdrains. It is not feasible to grade a deeper or bigger ditch at this location since this lies in Metro Ports leasehold and the adjacent access road. The only feasible solution here is to provide an outfall that either sheet flows away from the area or connects to any adjacent network.

Table 17: Proposed Storage Basins/Ditches Analysis Summary - Proposed Conditions

Name	Total Depth	Max Water Depth	Peak Inflow	Peak Outflow	Flooded Volume	Time Flooded
	(ft)	(ft)	(cfs)	(cfs)	(ac-inches)	(minutes)
EXISTING STORAGE NODES						
SR4 Basin	3.00	0.77	1.30	0.00	0.00	0.00
PROPOSED STORAGE NODES						
Prop. CCT Basin	4.00	3.90	6.52	0.00	0.00	0.00
Prop Port Yard Ditch	3.12	1.91	3.35	0.00	0.00	0.00
PropSR4Ditch	4.76	2.01	4.74	3.68	0.00	0.00

According to the referenced geotechnical report, the soil type was identified, and based on this classification, typical infiltration rate is estimated to be 0.1 in/hr (0.2 ft/day) which will be used for drawdown calculation for the proposed ditches/basins based on the existing soil type. The results of the drawdown calculations for the 100-year storm event are presented in **Table 18**.

Table 18 - Drawdown Calculation Results Proposed Ditches

Ditch/Basin Name	Storage Depth 100-Year	Drawdown Time (Days) 100-Year	Storage Depth 10-Year	Drawdown Time (Days) 10-Year
Prop. CCT Basin	3.90	19.5	2.70	13.5
Prop. Port Yard Ditch	1.91	9.55	1.34	6.7
Prop. SR4 Ditch	2.01	10.05	1.69	8.45

Formulas:

- Storage Depth = High Water Elevation – Bottom Elevation
- Drainage Time = Storage Depth / Infiltration Rate

Based on the drawdown calculations, the basins appear to be inadequate to effectively manage back-to-back storm events and due to the site constraints, the basin size cannot be increased or made deeper. One potential recommendation is to remove 3 feet of the existing lean clay layer at the basin bottoms and replace it with an engineered soil mix to increase the infiltration capacity of the basins. However, this should be considered a temporary solution.

The long-term solution should focus on evaluating and improving the Port's overall stormwater management plan to enhance drainage within this area and provide a more sustainable approach to managing stormwater flows.

List of Attachments

Attachment A:	**FEMA Map**
Attachment B:	**Existing Drainage Maps**
Attachment C:	**Proposed Drainage Maps**
Attachment D:	**Hydrologic Data**
Attachment E:	**SSA Input Data**
Attachment F:	**SSA Model Results – Existing Conditions**
Attachment G:	**SSA Model Results – Proposed Conditions**

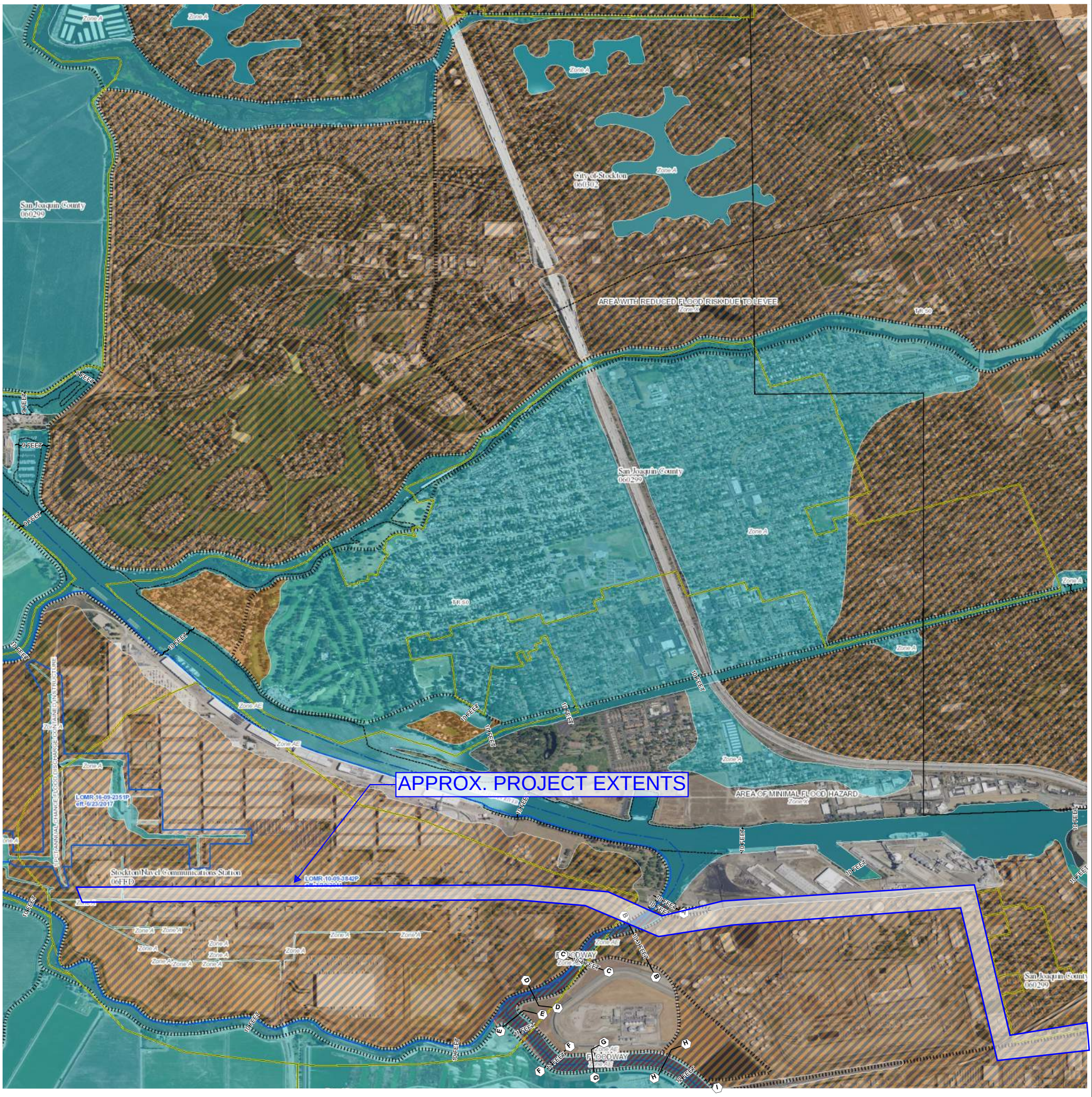
ATTACHMENT A

FEMA Map



38°0'13.37"N

121°22'31.03"W



121°18'44.02"W

USGS The National Map: Orthoimagery. Data refreshed April, 2019.

37°56'1.73"N

FLOOD HAZARD INFORMATION

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	20.2 Cross Sections with 1% Annual Chance
	17.5 Water Surface Elevation
	Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can beordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by USDA, Farm Service Agency (FSA). This information was derived from NAIP, dated April 11, 2018.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **6/9/2020 5:23:16 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. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

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

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.

ATTENTION: The levee, dike, or other structure that impacts flood hazards inside this boundary has not been shown to comply with Section 65.10 of the NFIP Regulations. As such, this FIRM panel will be revised at a later date to update the flood hazard information associated with this structure. The flood hazard data inside this boundary on the FIRM panel has been republished from the previous effective (historic) FIRM for this area, after being converted from NGVD 29 to NAVD 88.

SCALE

N

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88
For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map please see the Flood Insurance Study(FIS) Report for your community at https://msc.fema.gov

1 inch = 1,000 feet 1:12,000

0 500 1,000 2,000 3,000 4,000 Feet

0 105 210 420 630 840 Meters

FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

SAN JOAQUIN COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL **455** OF **835**

Panel Contains:

COMMUNITY	NUMBER	PANEL
STOCKTON NAVEL COMMUNICATIONS STATION CALIFORNIA	06FED	0455
CITY OF STOCKTON CALIFORNIA	060302	0455
SAN JOAQUIN COUNTY CALIFORNIA	060299	0455

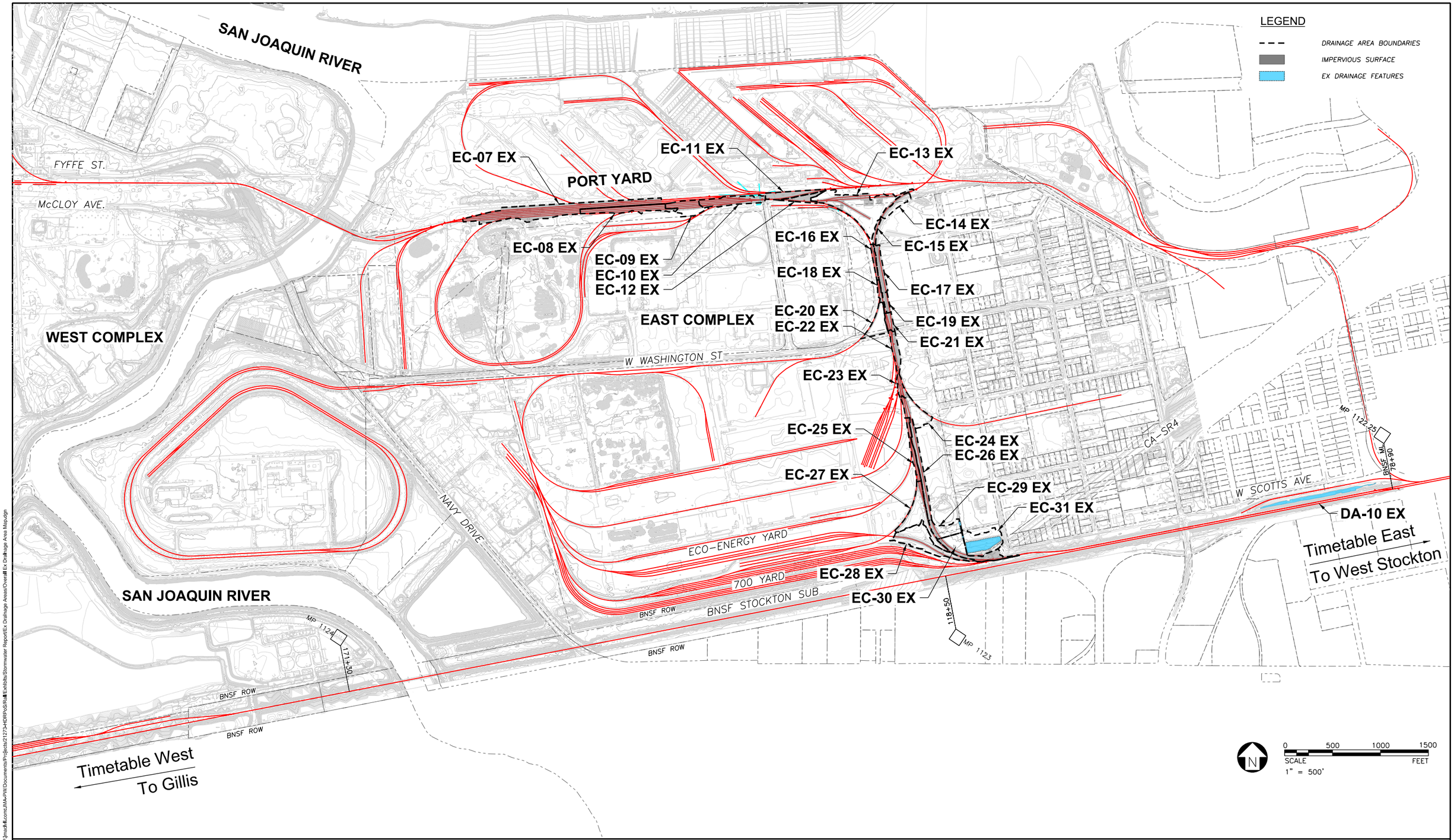
MAP NUMBER
06077C0455F
EFFECTIVE DATE
10/16/2009

Figure A-3: Stockton FEMA Flood Insurance Rate Map 2009

ATTACHMENT B

Existing Drainage Map





HammadSidiki
8/26/2026 - 1:50:20 PM - pw://JMA-PW-APP.jmacivil.com:JMA-PW/Documents/Projects/21273-HDR\Civil\Exhibits\Stormwater Report\Ex Drainage Areas\Overall Ex Drainage Area Map.dgn

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T: 925.400.4356
www.jmacivil.com

HDR
2379 Gateway Oaks, Ste. 200
Sacramento, CA 95833
T: 916.679.8700
www.hdrinc.com

ISSUED FOR BID
-
08/31/2026

MARK	DATE	DESCRIPTION
0	08/31/2026	ISSUED FOR BID
D	06/29/2026	REVISED 100% DESIGN
C	06/27/2025	100% DESIGN
B	08/30/2024	60% DESIGN
A	07/25/2023	30% DESIGN

PORT OF STOCKTON
LONG LEAD DOUBLE TRACK

315 W FYFFE STREET
STOCKTON, CA 95203

SHEET TITLE:
OVERALL EXISTING DRAINAGE AREA MAP EAST COMPLEX

PROJ NO: 21273	SHEET NO.
SCALE: AS NOTED	E-001
DATE: 08/31/2026	SHEET
DESIGNED BY: AG	

IF THIS DRAWING IS LESS THAN 22" X 34" IT IS A REDUCED SIZE DRAWING

PORT RD A

EC-06 EX

EC-07 EX

PORT LEAD

PORT YARD

EC-08 EX

MATCHLINE. SEE BELOW

H:12.0

H:10.2

L:10.0

L:9.8

H:10.4

H:12.3

L:8.4

H:11.3

H:10.7

H:10.8

INV=8.93
12" PIPE

INV=7.87
12" PIPE

TRK 829

TRK 828

TRK 827

TRK 845

TRK 846

TRK 806



Evidence of standing water along Port Rd A

VIEW 1

DIRECTION OF PIPE FLOW

DIRECTION OF FLOW

DRAINAGE AREA BOUNDARIES

IMPERVIOUS SURFACE

INV=8.05
10" PIPE

TRK 823

TRK 825

PORT RD A

PORT LEAD

EC-07 EX

EC-08 EX

PORT YARD

EC-10 EX

EC-09 EX

MATCHLINE. SEE ABOVE

H:12.0

H:12.3

H:12.9

H:13.2

H:13.5

L:12.1

L:11.5

H:12.6

H:12.6

INV=7.35
8" PIPE

TRK 828

TRK 827

TRK 806

VIEW 2

N

0 50 100 150
SCALE FEET
1" = 50'

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	JMA CIVIL 383 4th Street, Ste. 201 Oakland, CA 94607 T: 925.400.4356 www.jmacivil.com	HDR 2379 Gateway Oaks, Ste. 200 Sacramento, CA 95833 T: 916.679.8700 www.hdrinc.com		100% DESIGN NOT FOR CONSTRUCTION - 06/30/2025	MARK / DATE / DESCRIPTION D 06/30/2025 100% DESIGN C 03/10/2025 90% DESIGN B 08/30/2024 60% DESIGN A 07/25/2023 30% DESIGN	

PORT OF STOCKTON
RAIL & BRIDGE IMPROVEMENTS

2201 W. WASHINGTON STREET
STOCKTON, CA 95203

SHEET TITLE:
EX. DRAINAGE AREAS
PORT YARD

PROJ NO: 21273	SHEET NO. EX-003
SCALE: AS NOTED	
DATE: 03/10/2025	
DESIGNED BY: AG	SHEET 4 of 7

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6/12/2025 - 8:24:05 AM - pw://JMA-PW-APP-jmadvll.com:JMA-PW/Documents/Projects/21273-HDRPOS/Rail/Exhibits/Ex Drainage Areas/Drainage Exhibit - Port Yard.dgn

PORT RD A

PORT YARD

EC-10 EX

EC-11 EX

EC-12 EX

PORT RD 13

CCTC YARD

EC-13 EX

EC-14 EX

EC-15 EX

PORT LEAD

PORT LEAD

TRK 811

TRK 811X0

TRK 808

TRK 810

TRK 809

TRK 847

H:13.2

L:12.9

H:13.5

H:13.0

H:12.9

L:12.3

L:12.8

H:13.4

H:13.0

L:3.2

L:10.7

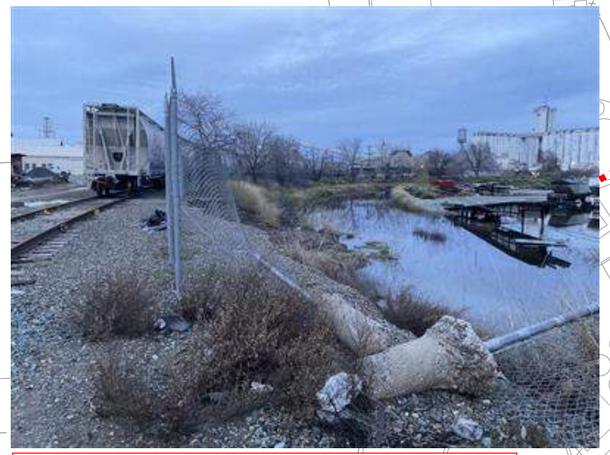
L:2.5

H:11.5

H:11.5



Evidence of poor drainage condition with discernible track pumping



Flooding at adjacent property east of Track 809 embankment

DIRECTION OF FLOW

DRAINAGE AREA BOUNDARIES

IMPERVIOUS SURFACE

0 50 100 150

SCALE 1" = 50' FEET

IF THIS DRAWING IS LESS THAN 22" X 34" IT IS A REDUCED SIZE DRAWING

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REVISIONS:

MARK	DATE	DESCRIPTION
D	06/30/2025	100% DESIGN
C	03/10/2025	90% DESIGN
B	08/30/2024	60% DESIGN
A	07/25/2023	30% DESIGN

PORT OF STOCKTON
RAIL & BRIDGE IMPROVEMENTS

2201 W. WASHINGTON STREET
STOCKTON, CA 95203

SHEET TITLE:
EX. DRAINAGE AREAS
CCTC WYE

PROJ NO: 21273	SHEET NO. EX-004
SCALE: AS NOTED	
DATE: 03/10/2025	SHEET 5 of 7
DESIGNED BY: AG	

EC-14 EX

EC-15 EX

CCTC FACILITY.
SEE EX-004

EC-13 EX

DURAFLAME

WASHINGTON ST

MATCHLINE. SEE BELOW

L:3.8

L:4.3

EC-17 EX

TRK 847

L:3.8

EC-19 EX

L:5.3

EC-21 EX

H:7.8

H:10.2

H:11.4

L:8.3

H:7.8

L:3.7

H:4.3

TRK 812

PORT LEAD

L:11.2

L:10.0

TRK 848

EC-16 EX

EC-18 EX

EC-20 EX

H:7.3

WESTWAY

H:8.0

TRK 807

H:7.0

VIEW 1

Evidence of ponding between track roadbed and adjacent building





Standing water adjacent to Washington St grade crossing

DIRECTION OF FLOW

DRAINAGE AREA BOUNDARIES

IMPERVIOUS SURFACE

WASHINGTON ST

MATCHLINE. SEE ABOVE

H:6.0

TRK 849

BORAL RESOURCES

H:6.0

L:5.0

12" CMP

FL=5.26

EC-22 EX

L:2.9

L:3.7

EC-23 EX

L:4.4

EC-24 EX

EC-26 EX

L:4.8

TRK 850

TRK 812

PORT LEAD

H:5.8

H:5.8

H:5.7

H:6.7

H:6.3

H:6.2

TRK 859

EC-25 EX

TRK 856

TRK 812

WESTWAY

BWC TRACKS

VIEW 2

0 50 100 150
SCALE
1" = 50'

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06/30/2025

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A	07/25/2023	30% DESIGN

PORT OF STOCKTON
RAIL & BRIDGE IMPROVEMENTS

2201 W. WASHINGTON STREET
STOCKTON, CA 95203

SHEET TITLE:
EX. DRAINAGE AREAS
WASHINGTON APPROACHES

PROJ NO: 21273	SHEET NO. EX-005
SCALE: AS NOTED	
DATE: 03/10/2025	
DESIGNED BY: AG	SHEET 6 of 7

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View of existing basin north of SR-4 on private property

H:7.4
L:4.4
L:5.3
TRK 859
EC-27 EX
PORT LEAD
TRK 860
SD-9; 14" HDPE
L:0.0
INV=0.05
H:8.2
H:5.6
L:2.0
SD-10; 24" HDPE
INV=2.36
EC-28 EX
L:4.9
SR4 DITCH 1
SD-7
INV=1.78
8" CMP
L:4.5
L:4.3
EC-29 EX
SD-7
INV=1.42
8" CMP
FL:1.8
L:1.6
L:4.9
SR4 DITCH 2
H:6.9
SD-8
INV=3.54
14" PVC
EC-31 EX
H:5.3
ECO-ENERGY LEAD
L:3.2
H:8.0
700 YARD
EC-30 EX
L:4.3
FL:2.7
SD-8
INV=3.28
14" PVC
SR4 BASIN
TOP=4.0
BTM=1.0
L:1.0
H:5.1
H:5.6
L:5.3
H:7.1
H:10.0
STATE ROUTE 4
SDMH
SD-13; 10" (S)
INV=-2.32
SD-12; 10" (N)
INV=-2.47
SDMH
SD-10, 11, 12; 10"
INV=-2.62
DA-01 EX
L:6.9
L:5.9
H:7.0
H:13.0
DA-02 EX
PORT LEAD
H:12.8
BNSF ROW
SDMH
SD-9; 24"
INV=-7.12
SD-10; 10"
INV=-2.58
BNSF STOCKTON SUBDIVISION

DIRECTION OF PIPE FLOW

DIRECTION OF FLOW

DRAINAGE AREA BOUNDARIES

IMPERVIOUS SURFACE

EX. DRAINAGE FEATURES

N

0 50 100 150
SCALE FEET
1" = 50'

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6/12/2025 - 8:21:26 AM - pw://JMA-PW-APP.jmadk.com:JMA-PW/Documents/Projects/21273-HDRPoS/Rail Exhibits/Ex Drainage Areas/Drainage Exhibit - Port Entrance.dgn

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PORT OF STOCKTON
RAIL & BRIDGE IMPROVEMENTS

2201 W. WASHINGTON STREET
STOCKTON, CA 95203

SHEET TITLE:
EX. DRAINAGE AREAS
STATE ROUTE 4

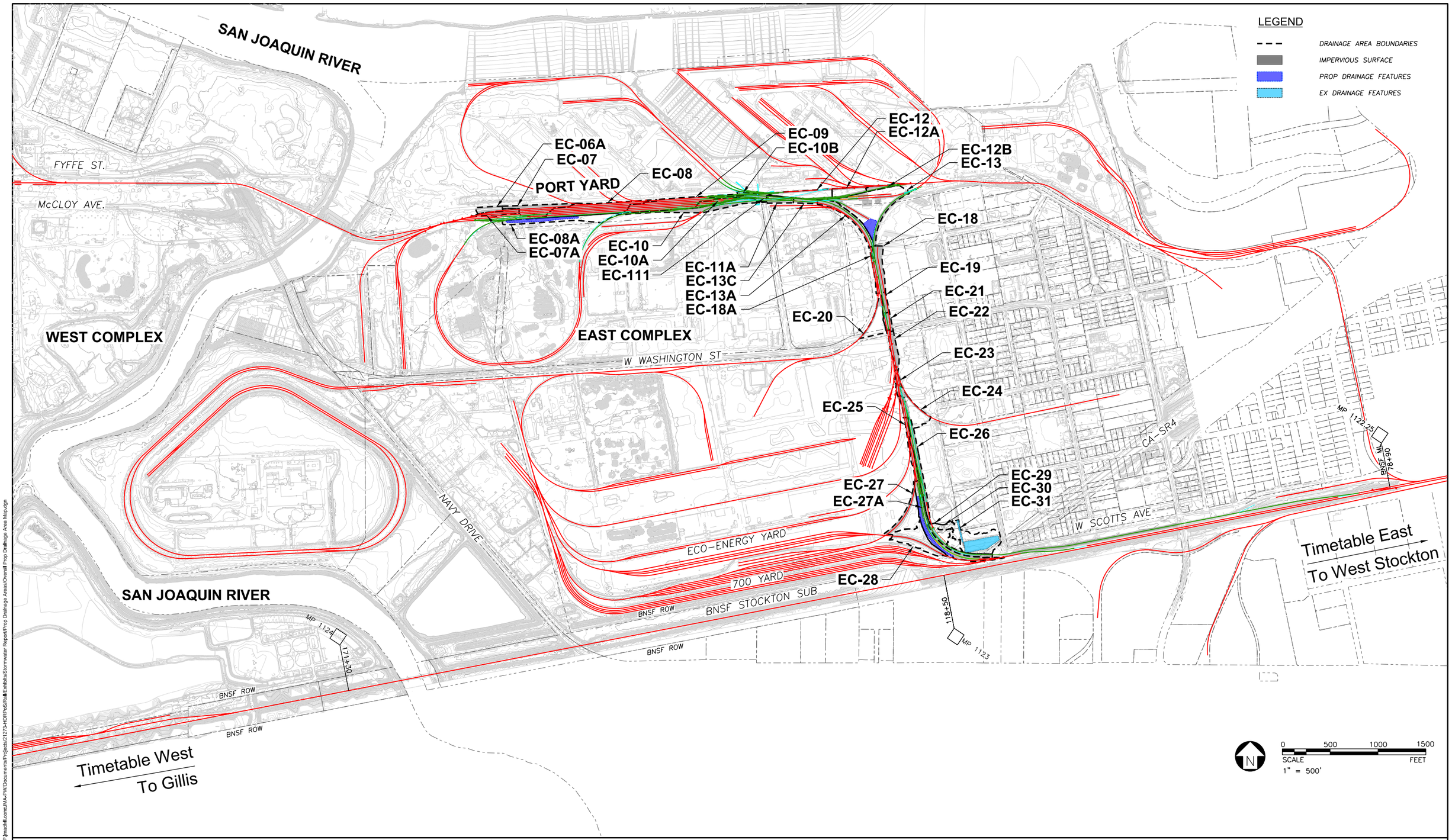
PROJ NO: 21273	SHEET NO. EX-006
SCALE: AS NOTED	
DATE: 03/10/2025	
DESIGNED BY: AG	SHEET 7 of 7

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ATTACHMENT C

Proposed Drainage Map





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8/26/2026 - 2:18:08 PM - pw://JMA-PW-APP.jmacivil.com:JMA-PW/Documents/Projects/21273-HDR\Pod5\Revit Exhibits\Stormwater Report\Prop Drainage Areas\Overall Prop Drainage Area Map.dgn

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A	07/25/2023	30% DESIGN

PORT OF STOCKTON
LONG LEAD DOUBLE TRACK

315 W FYFFE STREET
STOCKTON, CA 95203

SHEET TITLE:
OVERALL PROPOSED DRAINAGE AREA MAP EAST COMPLEX

PROJ NO: 21273	SHEET NO.
SCALE: AS NOTED	E-001
DATE: 08/31/2026	SHEET
DESIGNED BY: AG	

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EC-06

EC-06A

PORT RD A

EC-07

H:12.0

H:10.2

PORT LEAD

TRK 829

INV=8.93
12" PIPE

TRK 828

INV=7.87
12" PIEPE

TRK 827

EC-08

L:10.0

L:9.8

PORT YARD

H:11.3

EC-07A

H:10.7

PROP. 10" PortW_UD-C
U/S INV=6.82
D/S INV.=6.04

H:12.3

H:10.8

MATCHLINE. SEE BELOW

H:10.4

L:8.4

PROP. PORT YARD DITCH
TOP=8.0
BTM=6.0

EC-08A

DIRECTION OF PIPE FLOW

DIRECTION OF FLOW

DRAINAGE AREA BOUNDARIES

IMPERVIOUS SURFACE

PROP. DRAINAGE FEATURE

TRK 845

TRK 846

TRK 806

VIEW 1

TRK 828

TRK 827

PORT RD A

INV=8.05
10" PIPE

TRK 823

TRK 825

H:12.0

PORT LEAD

EC-09A

EC-09

H:13.2

H:12.3

H:13.5

PORT YARD

H:12.9

EC-10A

DA-17 EX

L:11.5

EC-11

L:12.1

H:12.6

EC-11A

MATCHLINE. SEE ABOVE

EC-10

DA-16 EX

H:12.6

TRK 806

INV=7.35
8" PIPE

VIEW 2

N

0 50 100 150
SCALE FEET
1" = 50'

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8/26/2026 - 2:29:16 PM - pw://JMA-PW-APP.jmacivil.com:JMA-PW/Documents/Projects/21273-HDRPortStockton/Exhibits/Stormwater Report/Prop Drainage Areas/Drainage Exhibit - Port Yard.dgn

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PORT OF STOCKTON
LONG LEAD DOUBLE TRACK

315 W FYFFE STREET
STOCKTON, CA 95203

SHEET TITLE:
PROP. DRAINAGE AREAS
PORT YARD

PROJ NO: 21273
SCALE: AS NOTED
DATE: 08/31/2026
DESIGNED BY: AG

SHEET NO.
EX-004
SHEET 4

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PORT RD A

EC-9A

EC-12

EC-12A

EC-12B

EC-11

EC-10

EC-11A

EC-13C

EC-13

EC-13A

EC-18A

EC-18

PORT YARD

CCTC YARD

PORT RD 13

PORT LEAD

TRK 811

TRK 811X0

TRK 808

TRK 810

TRK 809

TRK 847

H:13.2

H:13.5

H:13.0

H:12.9

L:12.9

L:12.8

L:12.3

L:3.2

L:10.7

L:2.5

H:11.5

H:11.5

TIE-IN TO EX.

TIE-IN TO EX.

TIE-IN TO EX.

PROP. CCTC BASIN
TOP=9.5
BTM=5.5

A

A

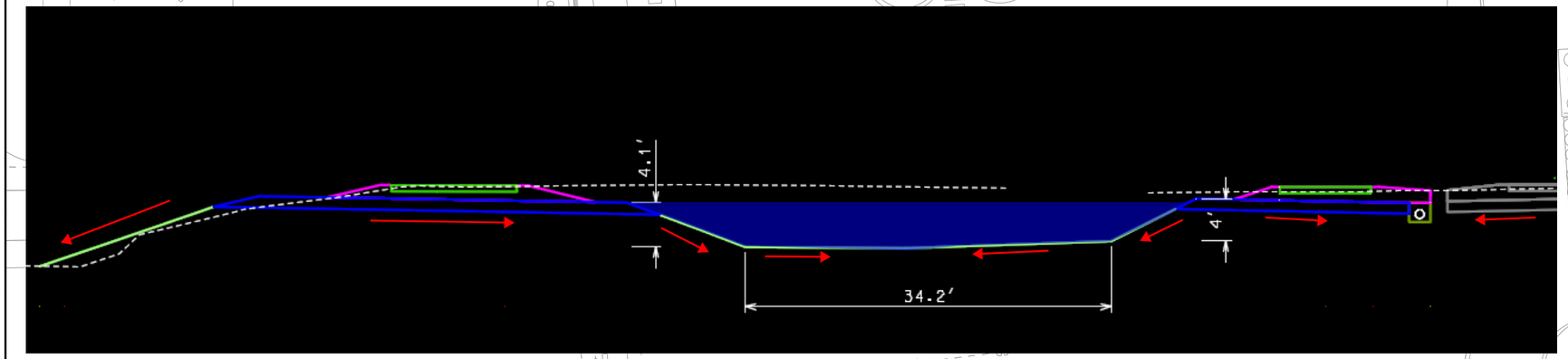
DIRECTION OF PIPE FLOW

DIRECTION OF FLOW

DRAINAGE AREA BOUNDARIES

IMPERVIOUS SURFACE

PROP. DRAINAGE FEATURE



SECTION A-A

0 50 100 150
SCALE FEET
1" = 50'

N

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PORT OF STOCKTON
RAIL & BRIDGE IMPROVEMENTS

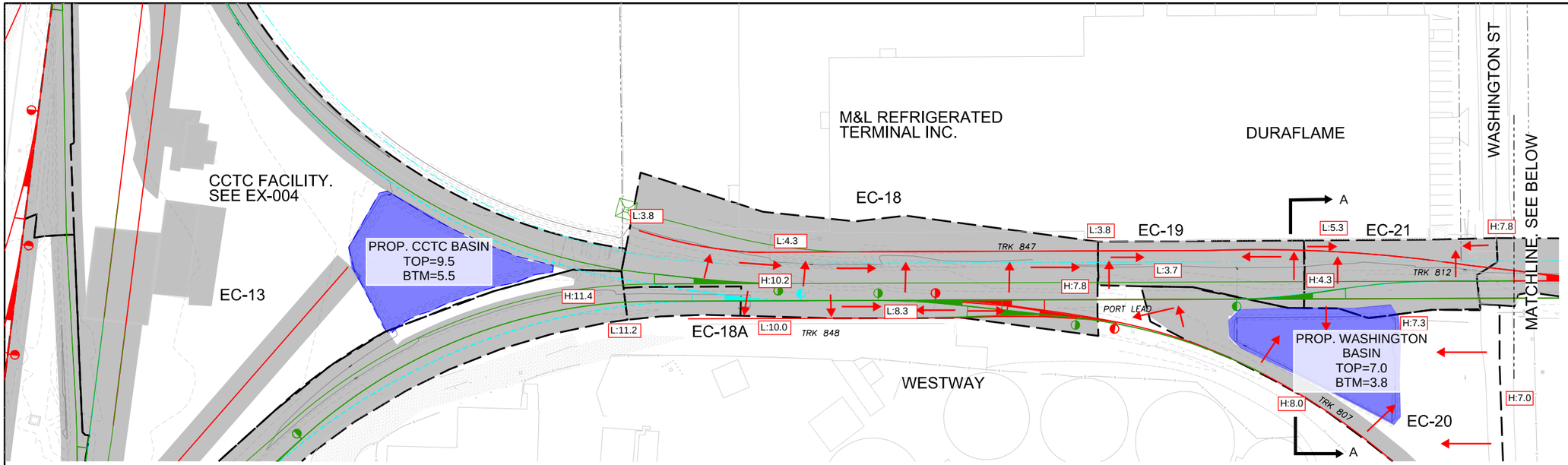
2201 W. WASHINGTON STREET
STOCKTON, CA 95203

SHEET TITLE:
PROP. DRAINAGE AREAS
CCTC WYE

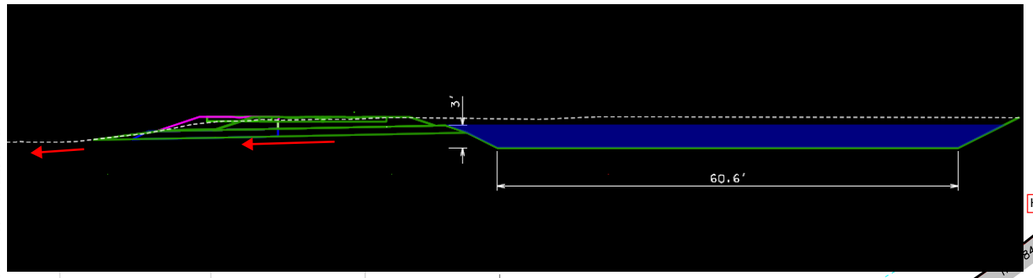
PROJ NO: 21273
SCALE: AS NOTED
DATE: 03/10/2025
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SHEET NO.
EX-005
SHEET 5 of 7

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VIEW 1



VIEW 2

DIRECTION OF FLOW

DRAINAGE AREA BOUNDARIES

IMPERVIOUS SURFACE

PROP. DRAINAGE FEATURE

N

0 50 100 150
SCALE FEET
1" = 50'

HammadSadiq
6/12/2025 - 11:44:00 AM pw://JMA-PW-APP.jmadvill.com:JMA-PW/Documents/Projects/21273-HDRPoSRail/Exhibits/Prop Drainage Areas/Drainage Exhibit - Washington.dgn

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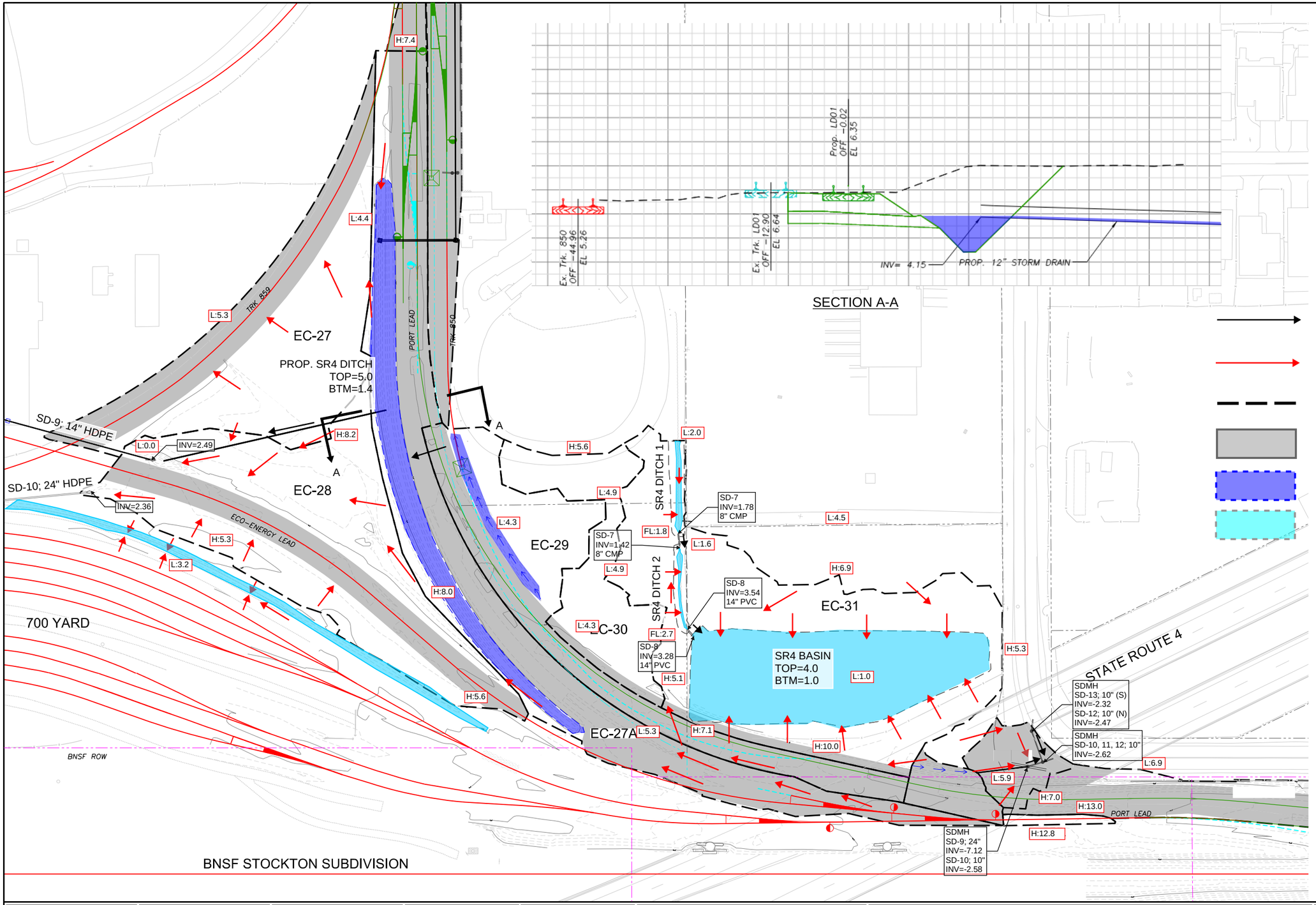
PORT OF STOCKTON
RAIL & BRIDGE IMPROVEMENTS

2201 W. WASHINGTON STREET
STOCKTON, CA 95203

SHEET TITLE:
PROP. DRAINAGE AREAS
WASHINGTON APPROACHES

PROJ NO: 21273	SHEET NO. EX-006
SCALE: AS NOTED	
DATE: 03/10/2025	
DESIGNED BY: AG	SHEET 6 of 7

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PORT OF STOCKTON
RAIL & BRIDGE IMPROVEMENTS

2201 W. WASHINGTON STREET
STOCKTON, CA 95203

SHEET TITLE:
EX. DRAINAGE AREAS
STATE ROUTE 4

PROJ NO: 21273	SHEET NO.
SCALE: AS NOTED	EX-006
DATE: 03/10/2025	SHEET 7 of 7
DESIGNED BY: AG	

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ATTACHMENT D

Hydrologic Data



NOAA Atlas 14, Volume 6, Version 2
Location name: Stockton, California, USA*
Latitude: 37.95°, Longitude: -121.2667°
Elevation: 23.43 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.107 (0.095-0.121)	0.134 (0.119-0.152)	0.170 (0.151-0.194)	0.200 (0.175-0.231)	0.242 (0.203-0.293)	0.275 (0.224-0.342)	0.310 (0.244-0.397)	0.346 (0.263-0.460)	0.396 (0.285-0.555)	0.436 (0.300-0.639)
10-min	0.153 (0.136-0.174)	0.192 (0.171-0.218)	0.244 (0.216-0.279)	0.287 (0.251-0.332)	0.347 (0.291-0.419)	0.395 (0.321-0.490)	0.444 (0.350-0.569)	0.496 (0.376-0.659)	0.567 (0.408-0.796)	0.624 (0.430-0.916)
15-min	0.185 (0.165-0.211)	0.232 (0.206-0.264)	0.295 (0.261-0.337)	0.347 (0.304-0.401)	0.420 (0.352-0.507)	0.477 (0.389-0.593)	0.537 (0.423-0.688)	0.599 (0.455-0.797)	0.686 (0.494-0.963)	0.755 (0.520-1.11)
30-min	0.251 (0.223-0.285)	0.314 (0.279-0.358)	0.399 (0.353-0.456)	0.470 (0.412-0.543)	0.569 (0.476-0.687)	0.646 (0.526-0.802)	0.727 (0.573-0.932)	0.812 (0.616-1.08)	0.929 (0.669-1.30)	1.02 (0.704-1.50)
60-min	0.350 (0.311-0.397)	0.438 (0.389-0.498)	0.556 (0.492-0.635)	0.655 (0.573-0.756)	0.792 (0.663-0.957)	0.900 (0.733-1.12)	1.01 (0.798-1.30)	1.13 (0.859-1.50)	1.29 (0.931-1.82)	1.42 (0.981-2.09)
2-hr	0.489 (0.435-0.555)	0.583 (0.518-0.664)	0.716 (0.634-0.818)	0.832 (0.728-0.960)	1.00 (0.837-1.21)	1.14 (0.928-1.42)	1.29 (1.02-1.66)	1.46 (1.11-1.94)	1.70 (1.22-2.38)	1.90 (1.31-2.78)
3-hr	0.577 (0.513-0.656)	0.680 (0.604-0.773)	0.826 (0.731-0.943)	0.954 (0.835-1.10)	1.14 (0.957-1.38)	1.30 (1.06-1.62)	1.48 (1.16-1.89)	1.67 (1.26-2.22)	1.95 (1.40-2.73)	2.18 (1.50-3.20)
6-hr	0.775 (0.690-0.881)	0.907 (0.805-1.03)	1.09 (0.967-1.25)	1.25 (1.10-1.45)	1.49 (1.25-1.80)	1.69 (1.37-2.09)	1.90 (1.50-2.43)	2.13 (1.62-2.83)	2.47 (1.78-3.46)	2.75 (1.90-4.04)
12-hr	1.00 (0.893-1.14)	1.20 (1.07-1.37)	1.47 (1.30-1.68)	1.69 (1.48-1.95)	1.99 (1.66-2.40)	2.22 (1.81-2.75)	2.46 (1.94-3.15)	2.70 (2.05-3.60)	3.04 (2.19-4.27)	3.31 (2.28-4.85)
24-hr	1.37 (1.23-1.55)	1.69 (1.52-1.91)	2.10 (1.88-2.38)	2.41 (2.15-2.76)	2.83 (2.45-3.33)	3.13 (2.67-3.75)	3.43 (2.86-4.20)	3.73 (3.03-4.67)	4.11 (3.22-5.35)	4.39 (3.34-5.90)
2-day	1.73 (1.56-1.95)	2.13 (1.92-2.41)	2.63 (2.37-2.99)	3.03 (2.70-3.46)	3.53 (3.06-4.16)	3.90 (3.32-4.68)	4.26 (3.55-5.22)	4.62 (3.76-5.79)	5.08 (3.98-6.61)	5.41 (4.12-7.26)
3-day	1.98 (1.79-2.24)	2.43 (2.19-2.75)	2.99 (2.69-3.40)	3.43 (3.06-3.92)	4.00 (3.47-4.71)	4.42 (3.76-5.30)	4.83 (4.02-5.91)	5.23 (4.25-6.56)	5.75 (4.51-7.48)	6.13 (4.66-8.23)
4-day	2.18 (1.97-2.47)	2.68 (2.41-3.03)	3.29 (2.96-3.73)	3.77 (3.37-4.31)	4.39 (3.81-5.17)	4.85 (4.13-5.81)	5.30 (4.42-6.49)	5.74 (4.67-7.20)	6.31 (4.95-8.22)	6.74 (5.12-9.04)
7-day	2.60 (2.35-2.95)	3.19 (2.87-3.61)	3.92 (3.53-4.45)	4.49 (4.01-5.14)	5.24 (4.54-6.16)	5.78 (4.93-6.93)	6.32 (5.27-7.73)	6.85 (5.57-8.59)	7.53 (5.90-9.80)	8.04 (6.11-10.8)
10-day	2.91 (2.63-3.29)	3.57 (3.22-4.05)	4.40 (3.96-5.00)	5.05 (4.51-5.77)	5.88 (5.10-6.92)	6.49 (5.53-7.78)	7.09 (5.91-8.67)	7.67 (6.24-9.63)	8.43 (6.61-11.0)	8.99 (6.84-12.1)
20-day	3.78 (3.41-4.28)	4.71 (4.24-5.33)	5.84 (5.25-6.63)	6.70 (5.98-7.66)	7.80 (6.76-9.17)	8.58 (7.30-10.3)	9.32 (7.77-11.4)	10.0 (8.17-12.6)	11.0 (8.59-14.3)	11.6 (8.84-15.6)
30-day	4.47 (4.03-5.06)	5.62 (5.07-6.37)	7.00 (6.30-7.95)	8.04 (7.18-9.19)	9.33 (8.09-11.0)	10.2 (8.71-12.3)	11.1 (9.24-13.6)	11.9 (9.67-14.9)	12.9 (10.1-16.8)	13.6 (10.4-18.3)
45-day	5.54 (5.00-6.27)	7.05 (6.35-7.98)	8.81 (7.92-10.0)	10.1 (9.03-11.6)	11.7 (10.1-13.8)	12.8 (10.9-15.3)	13.8 (11.5-16.9)	14.7 (12.0-18.5)	15.9 (12.4-20.6)	16.6 (12.7-22.3)
60-day	6.56 (5.91-7.42)	8.39 (7.56-9.50)	10.5 (9.44-11.9)	12.0 (10.7-13.8)	13.9 (12.0-16.3)	15.1 (12.9-18.1)	16.2 (13.5-19.9)	17.3 (14.1-21.7)	18.5 (14.5-24.1)	19.4 (14.7-26.0)

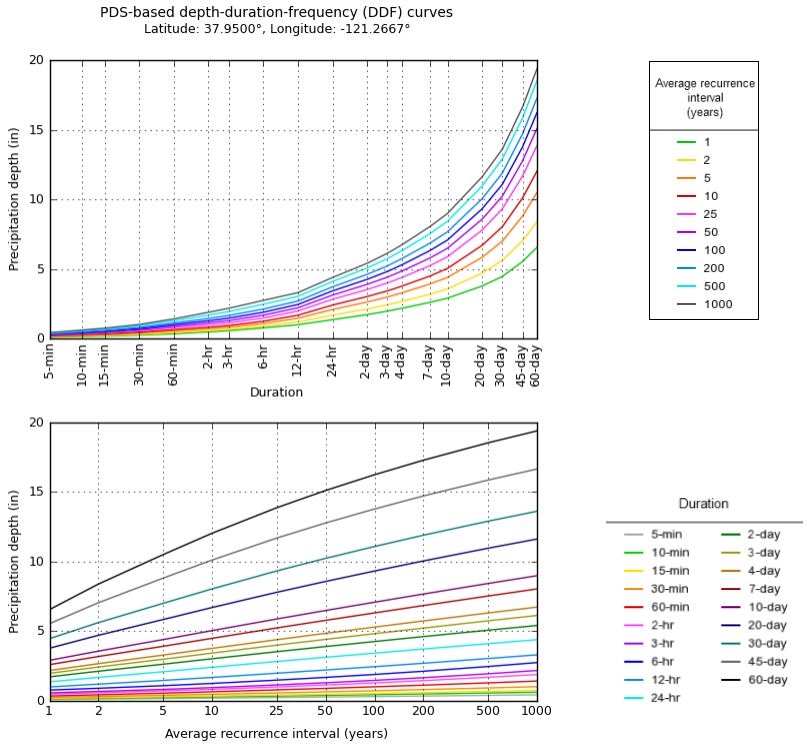
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

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PF graphical



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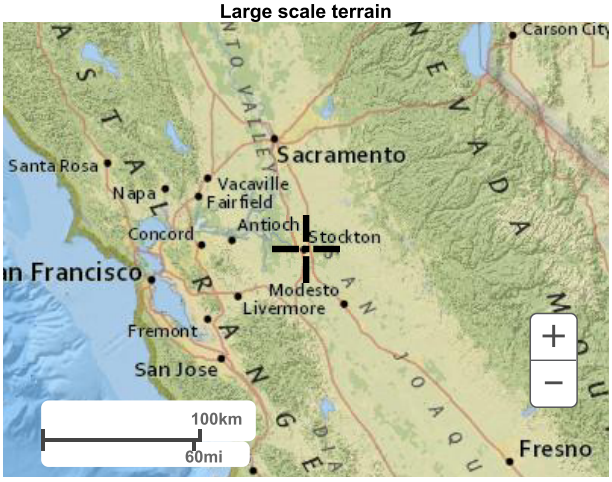
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Maps & aerials

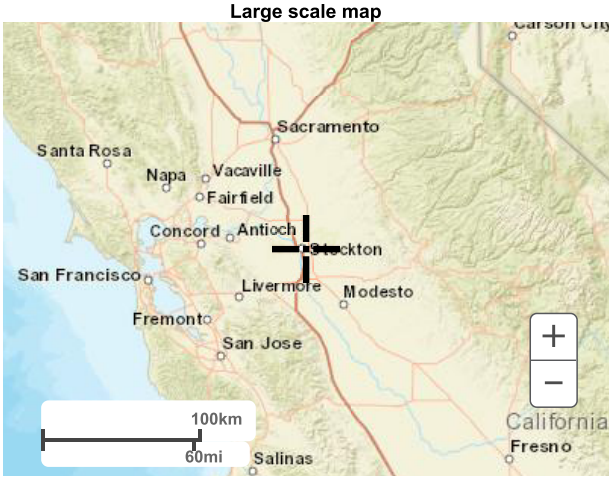
Small scale terrain



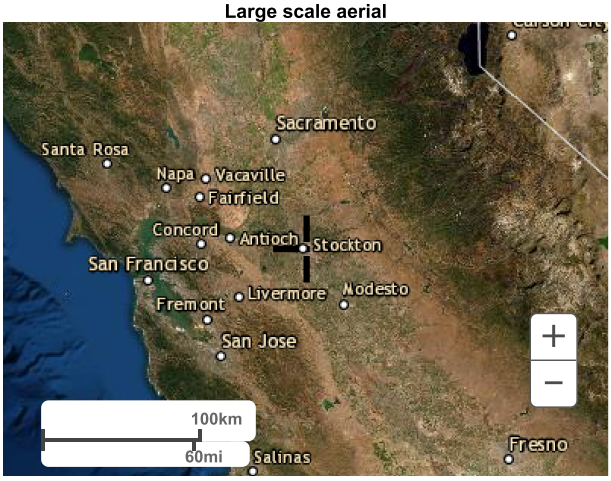
Large scale terrain



Large scale map



Large scale aerial



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NOAA Atlas 14, Volume 6, Version 2
Location name: Stockton, California, USA*
Latitude: 37.95°, Longitude: -121.2667°
Elevation: 23.43 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.28 (1.14-1.45)	1.61 (1.43-1.82)	2.04 (1.81-2.33)	2.40 (2.10-2.77)	2.90 (2.44-3.52)	3.30 (2.69-4.10)	3.72 (2.93-4.76)	4.15 (3.16-5.52)	4.75 (3.42-6.66)	5.23 (3.60-7.67)
10-min	0.918 (0.816-1.04)	1.15 (1.03-1.31)	1.46 (1.30-1.67)	1.72 (1.51-1.99)	2.08 (1.75-2.51)	2.37 (1.93-2.94)	2.66 (2.10-3.41)	2.98 (2.26-3.95)	3.40 (2.45-4.78)	3.74 (2.58-5.50)
15-min	0.740 (0.660-0.844)	0.928 (0.824-1.06)	1.18 (1.04-1.35)	1.39 (1.22-1.60)	1.68 (1.41-2.03)	1.91 (1.56-2.37)	2.15 (1.69-2.75)	2.40 (1.82-3.19)	2.74 (1.98-3.85)	3.02 (2.08-4.43)
30-min	0.502 (0.446-0.570)	0.628 (0.558-0.716)	0.798 (0.706-0.912)	0.940 (0.824-1.09)	1.14 (0.952-1.37)	1.29 (1.05-1.60)	1.45 (1.15-1.86)	1.62 (1.23-2.16)	1.86 (1.34-2.61)	2.04 (1.41-3.00)
60-min	0.350 (0.311-0.397)	0.438 (0.389-0.498)	0.556 (0.492-0.635)	0.655 (0.573-0.756)	0.792 (0.663-0.957)	0.900 (0.733-1.12)	1.01 (0.798-1.30)	1.13 (0.859-1.50)	1.29 (0.931-1.82)	1.42 (0.981-2.09)
2-hr	0.244 (0.218-0.278)	0.292 (0.259-0.332)	0.358 (0.317-0.409)	0.416 (0.364-0.480)	0.500 (0.418-0.604)	0.570 (0.464-0.708)	0.646 (0.508-0.828)	0.728 (0.553-0.968)	0.848 (0.610-1.19)	0.948 (0.653-1.39)
3-hr	0.192 (0.171-0.218)	0.226 (0.201-0.257)	0.275 (0.243-0.314)	0.318 (0.278-0.367)	0.381 (0.319-0.460)	0.434 (0.353-0.538)	0.491 (0.387-0.630)	0.555 (0.421-0.738)	0.648 (0.467-0.910)	0.727 (0.500-1.07)
6-hr	0.129 (0.115-0.147)	0.151 (0.134-0.172)	0.182 (0.161-0.208)	0.209 (0.183-0.242)	0.249 (0.208-0.301)	0.282 (0.229-0.350)	0.317 (0.250-0.406)	0.356 (0.270-0.473)	0.412 (0.297-0.578)	0.459 (0.316-0.674)
12-hr	0.083 (0.074-0.095)	0.100 (0.089-0.114)	0.122 (0.108-0.139)	0.140 (0.123-0.162)	0.165 (0.138-0.199)	0.184 (0.150-0.228)	0.204 (0.161-0.261)	0.224 (0.170-0.298)	0.252 (0.182-0.354)	0.274 (0.189-0.403)
24-hr	0.057 (0.051-0.064)	0.070 (0.063-0.080)	0.087 (0.079-0.099)	0.101 (0.090-0.115)	0.118 (0.102-0.139)	0.131 (0.111-0.156)	0.143 (0.119-0.175)	0.155 (0.126-0.195)	0.171 (0.134-0.223)	0.183 (0.139-0.246)
2-day	0.036 (0.032-0.041)	0.044 (0.040-0.050)	0.055 (0.049-0.062)	0.063 (0.056-0.072)	0.074 (0.064-0.087)	0.081 (0.069-0.097)	0.089 (0.074-0.109)	0.096 (0.078-0.121)	0.106 (0.083-0.138)	0.113 (0.086-0.151)
3-day	0.028 (0.025-0.031)	0.034 (0.030-0.038)	0.042 (0.037-0.047)	0.048 (0.043-0.054)	0.056 (0.048-0.065)	0.061 (0.052-0.074)	0.067 (0.056-0.082)	0.073 (0.059-0.091)	0.080 (0.063-0.104)	0.085 (0.065-0.114)
4-day	0.023 (0.021-0.026)	0.028 (0.025-0.032)	0.034 (0.031-0.039)	0.039 (0.035-0.045)	0.046 (0.040-0.054)	0.051 (0.043-0.061)	0.055 (0.046-0.068)	0.060 (0.049-0.075)	0.066 (0.052-0.086)	0.070 (0.053-0.094)
7-day	0.015 (0.014-0.018)	0.019 (0.017-0.021)	0.023 (0.021-0.026)	0.027 (0.024-0.031)	0.031 (0.027-0.037)	0.034 (0.029-0.041)	0.038 (0.031-0.046)	0.041 (0.033-0.051)	0.045 (0.035-0.058)	0.048 (0.036-0.064)
10-day	0.012 (0.011-0.014)	0.015 (0.013-0.017)	0.018 (0.016-0.021)	0.021 (0.019-0.024)	0.025 (0.021-0.029)	0.027 (0.023-0.032)	0.030 (0.025-0.036)	0.032 (0.026-0.040)	0.035 (0.028-0.046)	0.037 (0.028-0.050)
20-day	0.008 (0.007-0.009)	0.010 (0.009-0.011)	0.012 (0.011-0.014)	0.014 (0.012-0.016)	0.016 (0.014-0.019)	0.018 (0.015-0.021)	0.019 (0.016-0.024)	0.021 (0.017-0.026)	0.023 (0.018-0.030)	0.024 (0.018-0.032)
30-day	0.006 (0.006-0.007)	0.008 (0.007-0.009)	0.010 (0.009-0.011)	0.011 (0.010-0.013)	0.013 (0.011-0.015)	0.014 (0.012-0.017)	0.015 (0.013-0.019)	0.017 (0.013-0.021)	0.018 (0.014-0.023)	0.019 (0.014-0.025)
45-day	0.005 (0.005-0.006)	0.007 (0.006-0.007)	0.008 (0.007-0.009)	0.009 (0.008-0.011)	0.011 (0.009-0.013)	0.012 (0.010-0.014)	0.013 (0.011-0.016)	0.014 (0.011-0.017)	0.015 (0.012-0.019)	0.015 (0.012-0.021)
60-day	0.005 (0.004-0.005)	0.006 (0.005-0.007)	0.007 (0.007-0.008)	0.008 (0.007-0.010)	0.010 (0.008-0.011)	0.010 (0.009-0.013)	0.011 (0.009-0.014)	0.012 (0.010-0.015)	0.013 (0.010-0.017)	0.013 (0.010-0.018)

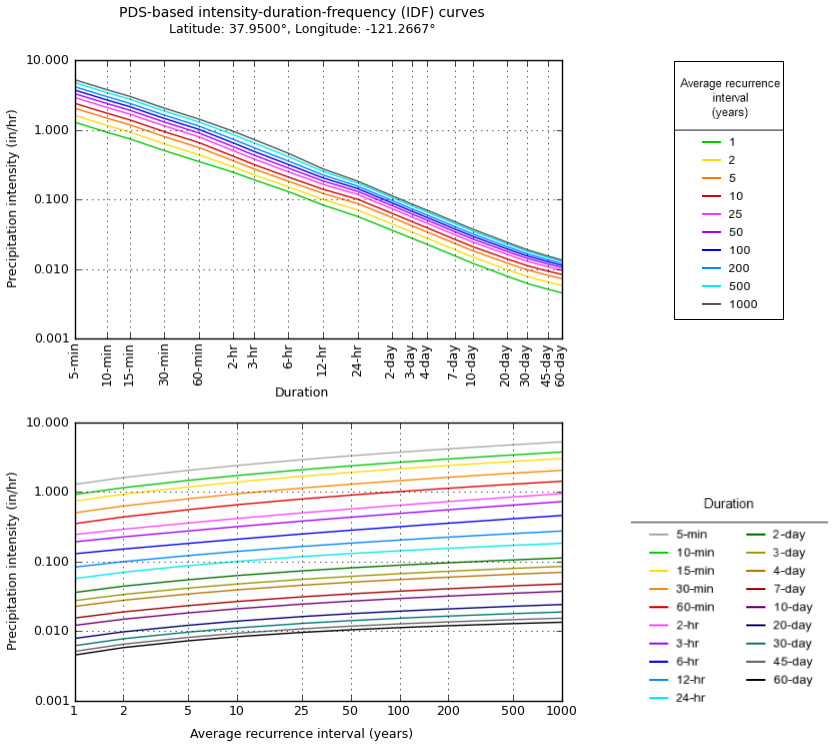
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

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PF graphical



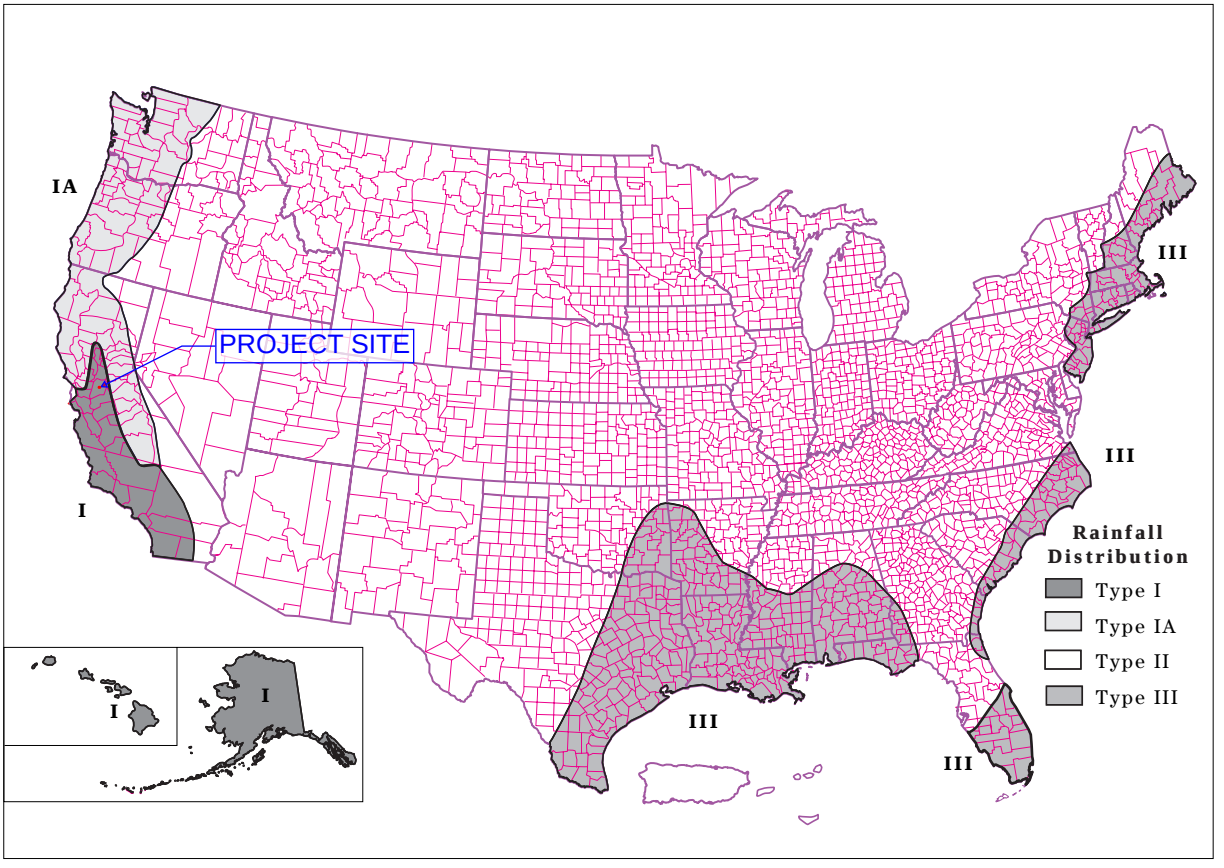
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Figure B-2 Approximate geographic boundaries for NRCS (SCS) rainfall distributions



Rainfall data sources

This section lists the most current 24-hour rainfall data published by the National Weather Service (NWS) for various parts of the country. Because NWS Technical Paper 40 (TP-40) is out of print, the 24-hour rainfall maps for areas east of the 105th meridian are included here as figures B-3 through B-8. For the area generally west of the 105th meridian, TP-40 has been superseded by NOAA Atlas 2, the Precipitation-Frequency Atlas of the Western United States, published by the National Ocean and Atmospheric Administration.

East of 105th meridian

Hershfield, D.M. 1961. Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 40. Washington, DC. 155 p.

West of 105th meridian

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. Precipitation-frequency atlas of the Western United States. Vol. I Montana; Vol. II, Wyoming; Vol III, Colorado; Vol. IV, New Mexico; Vol V, Idaho; Vol. VI, Utah; Vol. VII, Nevada; Vol. VIII, Arizona; Vol. IX, Washington; Vol. X, Oregon; Vol. XI, California. U.S. Dept. of Commerce, National Weather Service, NOAA Atlas 2. Silver Spring, MD.

Alaska

Miller, John F. 1963. Probable maximum precipitation and rainfall-frequency data for Alaska for areas to 400 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. of Commerce, Weather Bur. Tech. Pap. No. 47. Washington, DC. 69 p.

Hawaii

Weather Bureau. 1962. Rainfall-frequency atlas of the Hawaiian Islands for areas to 200 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 43. Washington, DC. 60 p.

Puerto Rico and Virgin Islands

Weather Bureau. 1961. Generalized estimates of probable maximum precipitation and rainfall-frequency data for Puerto Rico and Virgin Islands for areas to 400 square miles, durations to 24 hours, and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 42. Washington, DC. 94 P.

- **Artificial Fill (map symbol af) –** Unconsolidated sand and silt with lesser amounts of gravel and clay hydraulically emplaced from dredging of the San Joaquin River. Artificial fill may include organic materials.

- **Holocene Dos Palos Alluvium (map symbol Qdp) –** Unweathered, unconsolidated deposits of arkosic gravel, sand, silt, and clay covering the floodbasin of the lower San Joaquin River.

- **Late Pleistocene Modesto Formation (map symbol Qm) –** Represents glacial outwash from the core of Sierra Nevada and lesser local (not Sierran) sediment sources. Consists predominantly of sand and silt with lesser amounts of gravel and clay.

The Riverbank Formation is not exposed at the surface along the alignment but is interpreted to be located at a depth of about 45 to 60 feet below ground surface based on a significant increase in density and the presence of sandier deposits. The Riverbank Formation is described as follows:

- **Late Pleistocene Riverbank Formation (map symbol Qr) –** Arkosic sand forming terraces topographically at or above Modesto Formation level. Represents glacial outwash from core of Sierra Nevada and lesser locally sourced sediments.

A geologic map of the alignment, based on Wagner, et al. (1991) is presented on Figure 2.

3.3 EARTH MATERIALS

The following description provides a general summary of the subsurface conditions encountered during the field exploration and further validated by the laboratory testing program. For a more thorough description of the actual conditions encountered at specific boring locations, refer to the log of borings in Appendix A. All soils have been classified according to the Unified Soil Classification System (ASTM D2487).

Subsurface soils encountered during our investigation primarily consisted of soft to stiff clay, clay with sand, sandy clay, stiff to very stiff silt, loose to medium dense silty sands, clayey sands, poorly graded sands and soft to stiff cohesive soils in the upper 8 to 13 feet underlain by similar soils that are medium dense to dense and stiff to hard plus poorly graded sand with silt at depth below 40 ft.

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Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2/]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

San Joaquin East
San Joaquin West
BNSF ROW
SR-4 Northeast Areas
CCTC Wye
Areas adjacent to Stork Rd
Assumed for all impervious areas at Port including tracks and roadway
SR-4 Southwest Areas

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Appendix A Hydrologic Soil Groups

Soils are classified into hydrologic soil groups (HSG's) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSG's, which are A, B, C, and D, are one element used in determining runoff curve numbers (see chapter 2). For the convenience of TR-55 users, exhibit A-1 lists the HSG classification of United States soils.

The infiltration rate is the rate at which water enters the soil at the soil surface. It is controlled by surface conditions. HSG also indicates the transmission rate—the rate at which the water moves within the soil. This rate is controlled by the soil profile. Approximate numerical ranges for transmission rates shown in the HSG definitions were first published by Musgrave (USDA 1955). The four groups are defined by SCS soil scientists as follows:

Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr).

Group B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in/hr).

Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr).

Group D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr).

In exhibit A-1, some of the listed soils have an added modifier; for example, "Abrazo, gravelly." This refers to a gravelly phase of the Abrazo series that is found in SCS soil map legends.

Disturbed soil profiles

As a result of urbanization, the soil profile may be considerably altered and the listed group classification may no longer apply. In these circumstances, use the following to determine HSG according to the texture of the new surface soil, provided that significant compaction has not occurred (Brakensiek and Rawls 1983).

HSG	*Soil textures*
A	Sand, loamy sand, or sandy loam
B	Silt loam or loam
C	Sandy clay loam
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay

Drainage and group D soils

Some soils in the list are in group D because of a high water table that creates a drainage problem. Once these soils are effectively drained, they are placed in a different group. For example, Ackerman soil is classified as A/D. This indicates that the drained Ackerman soil is in group A and the undrained soil is in group D.

APPENDIX 19.A
Manning's Roughness Coefficient[a,b]
(design use)

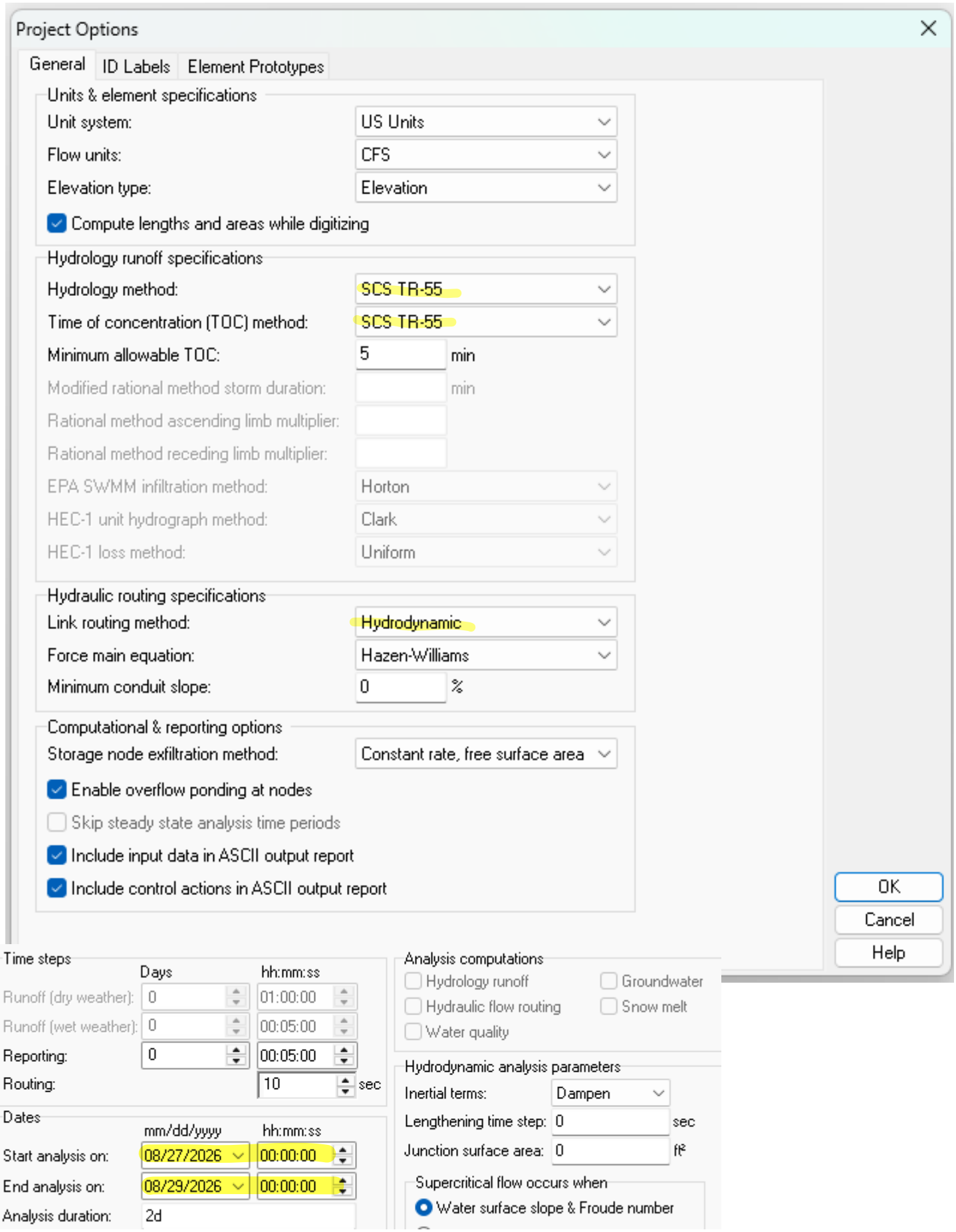
channel material	n
plastic (PVC and ABS)	0.009
clean, uncoated cast iron	0.013–0.015
clean, coated cast iron	0.012–0.014
dirty, tuberculated cast iron	0.015–0.035
riveted steel	0.015–0.017
lock-bar and welded steel pipe	0.012–0.013
galvanized iron	0.015–0.017
brass and glass	0.009–0.013
wood stave	
small diameter	0.011–0.012
large diameter	0.012–0.013
concrete	
average value used	0.013
typical commercial, ball and spigot rubber gasketed end connections	
– full (pressurized and wet)	0.010
– partially full	0.0085
with rough joints	0.016–0.017
dry mix, rough forms	0.015–0.016
wet mix, steel forms	0.012–0.014
very smooth, finished	0.011–0.012
vitrified sewer	0.013–0.015
common-clay drainage tile	0.012–0.014
asbestos	0.011
planed timber (flume)	0.012 (0.010–0.014)
canvas	0.012
unplaned timber (flume)	0.013 (0.011–0.015)
brick	0.016
rubble masonry	0.017
smooth earth	0.018
firm gravel	0.023
corrugated metal pipe (CMP)	0.022–0.033
natural channels, good condition	0.025
rip rap	0.035
natural channels with stones and weeds	0.035
very poor natural channels	0.060

[a]compiled from various sources
[b]Values outside these ranges have been observed, but these values are typical.

ATTACHMENT E

SSA Input Data




Project Options
General
ID Labels
Element Prototypes
Units & element specifications
Unit system:
US Units
Flow units:
CFS
Elevation type:
Elevation
Compute lengths and areas while digitizing
Hydrology runoff specifications
Hydrology method:
SCS TR-55
Time of concentration (TOC) method:
SCS TR-55
Minimum allowable TOC:
5
min
Modified rational method storm duration:
min
Rational method ascending limb multiplier:
Rational method receding limb multiplier:
EPA SWMM infiltration method:
Horton
HEC-1 unit hydrograph method:
Clark
HEC-1 loss method:
Uniform
Hydraulic routing specifications
Link routing method:
Hydrodynamic
Force main equation:
Hazen-Williams
Minimum conduit slope:
0
%
Computational & reporting options
Storage node exfiltration method:
Constant rate, free surface area
Enable overflow ponding at nodes
Skip steady state analysis time periods
Include input data in ASCII output report
Include control actions in ASCII output report
OK
Cancel
Help
Time steps
Days
hh:mm:ss
Runoff (dry weather):
0
01:00:00
Runoff (wet weather):
0
00:05:00
Reporting:
0
00:05:00
Routing:
10
sec
Dates
mm/dd/yyyy
hh:mm:ss
Start analysis on:
08/27/2026
00:00:00
End analysis on:
08/29/2026
00:00:00
Analysis duration:
2d
Analysis computations
Hydrology runoff
Groundwater
Hydraulic flow routing
Snow melt
Water quality
Hydrodynamic analysis parameters
Inertial terms:
Dampen
Lengthening time step:
0
sec
Junction surface area:
0
ft²
Supercritical flow occurs when
Water surface slope & Froude number

Time Series

General

Time series ID: TS-100 Year

Description: 100-year cumulative storm for San Joaquin (Stockton) County, California, with a total rainfall amount of 3.43 in using a SCS Type I 24-hr storm

Time series data

Data type

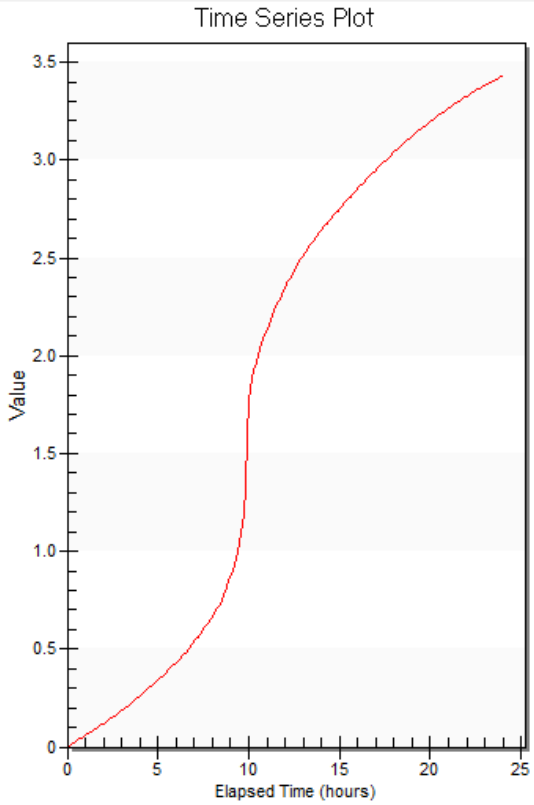
User defined

Standard rainfall Rainfall Designer...

Date (MM/DD/YYYY)	Time (H:MM)	Value
	0:00	0.00000
	0:06	0.00597
	0:12	0.01194
	0:18	0.01790
	0:24	0.02391
	0:30	0.02988
	0:36	0.03588

Time series curves

	ID	Number of Points	Description
1	TS-100 Year	241	100-year cumulative storm
2	TS-2 Year	241	2-year cumulative storm
3	TS-50 Year	241	50-year cumulative storm



Add
Delete
Load...
Save...
Close
Help

Time Series

General

Time series ID: TS-50 Year

Description: 50-year cumulative storm for San Joaquin (Stockton) County, California, with a total rainfall amount of 3.13 in using a SCS Type I 24-hr storm

Time series data

Data type

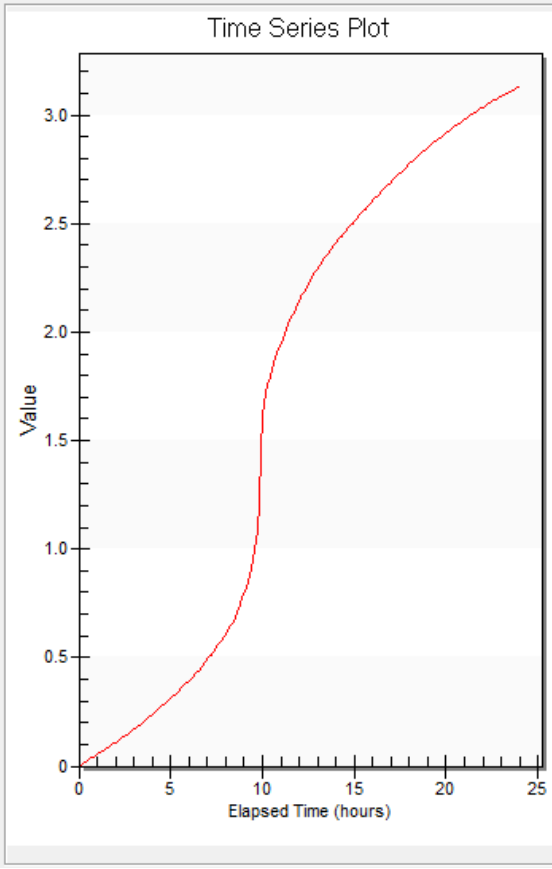
User defined

Standard rainfall Rainfall Designer...

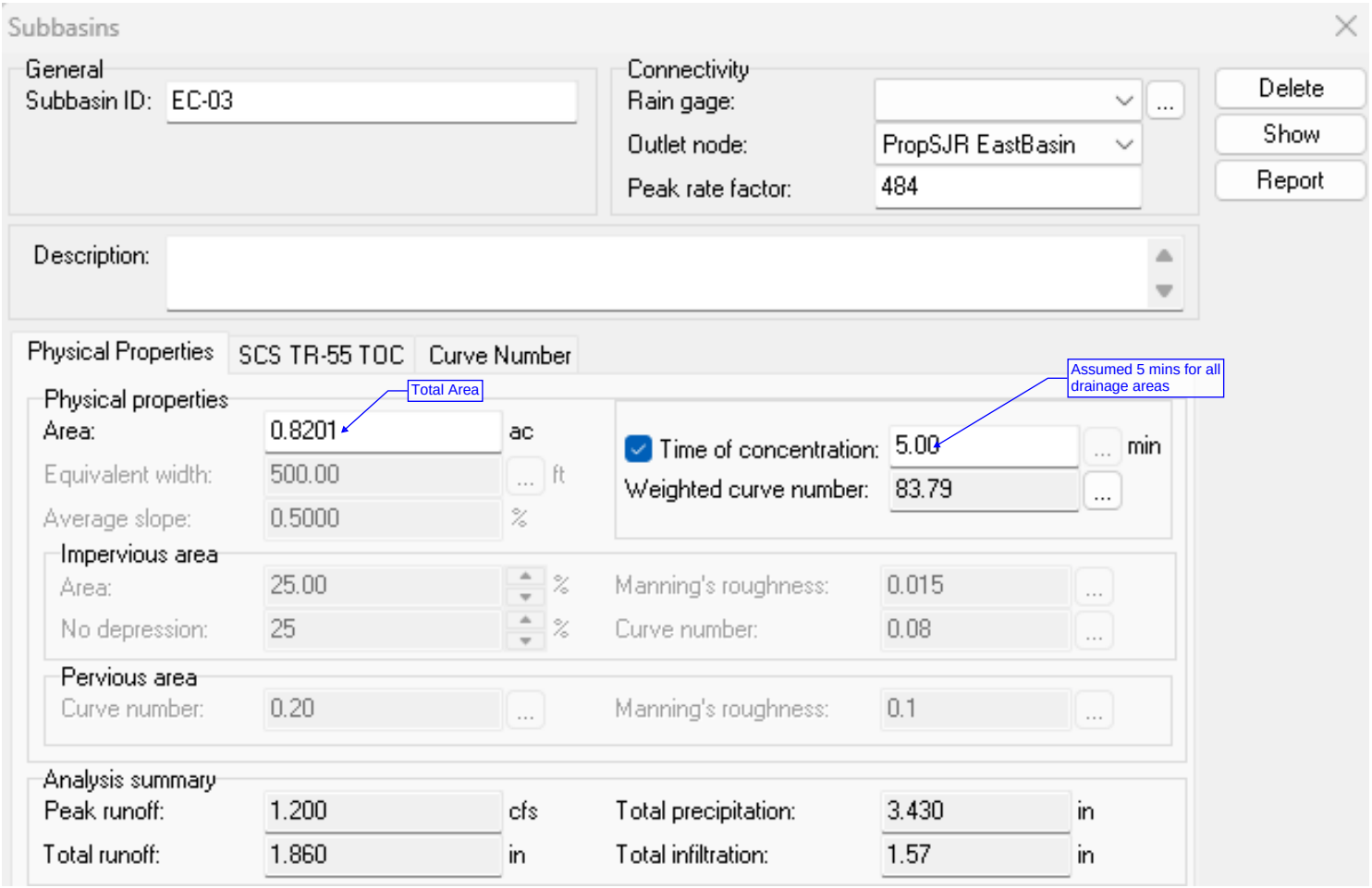
Date (MM/DD/YYYY)	Time (H:MM)	Value
	0:00	0.00000
	0:06	0.00545
	0:12	0.01089
	0:18	0.01634
	0:24	0.02182
	0:30	0.02726
	0:36	0.03274

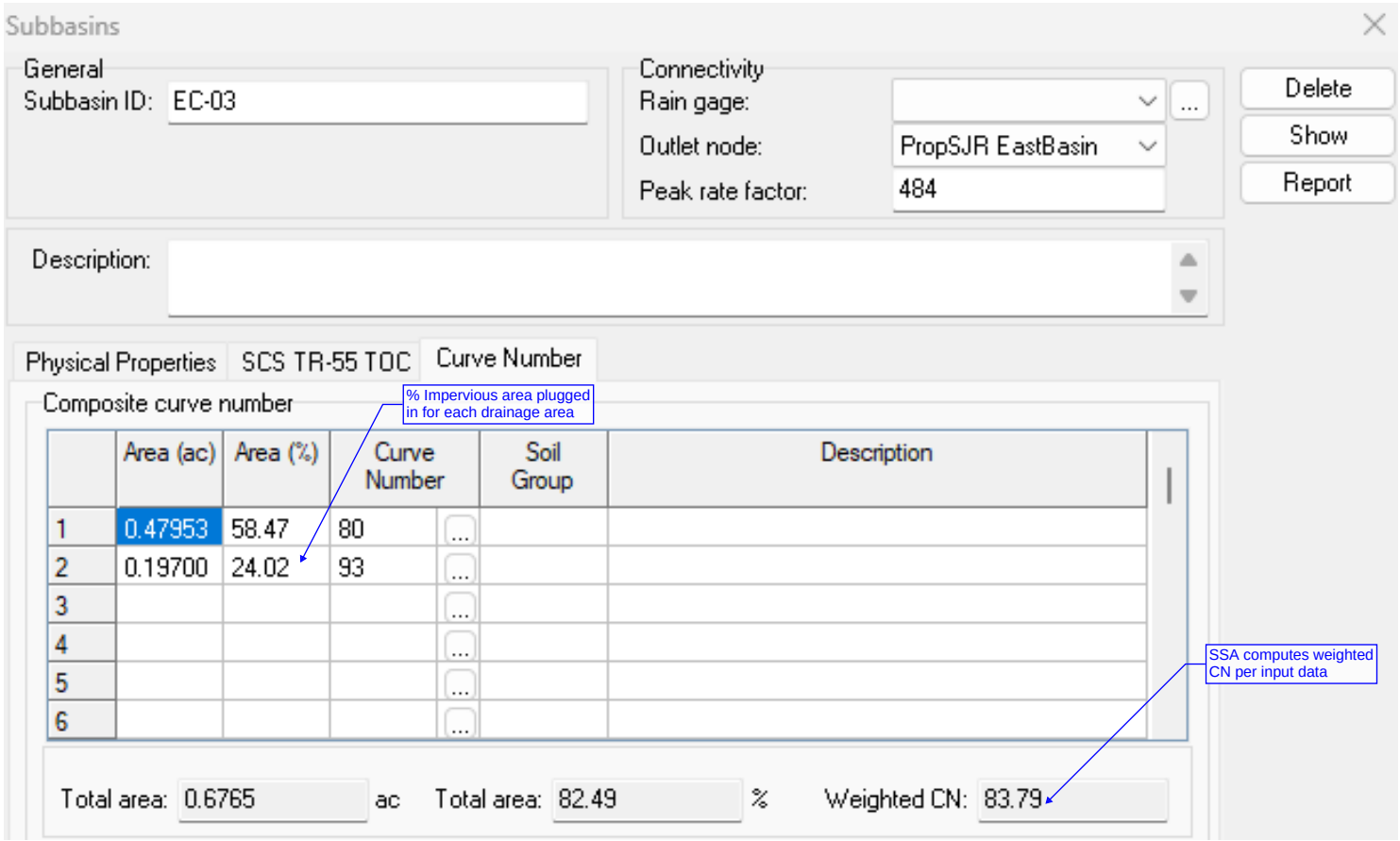
Time series curves

	ID	Number of Points	Description
1	TS-100 Year	241	100-year cumulative storm
2	TS-2 Year	241	2-year cumulative storm
3	TS-50 Year	241	50-year cumulative storm

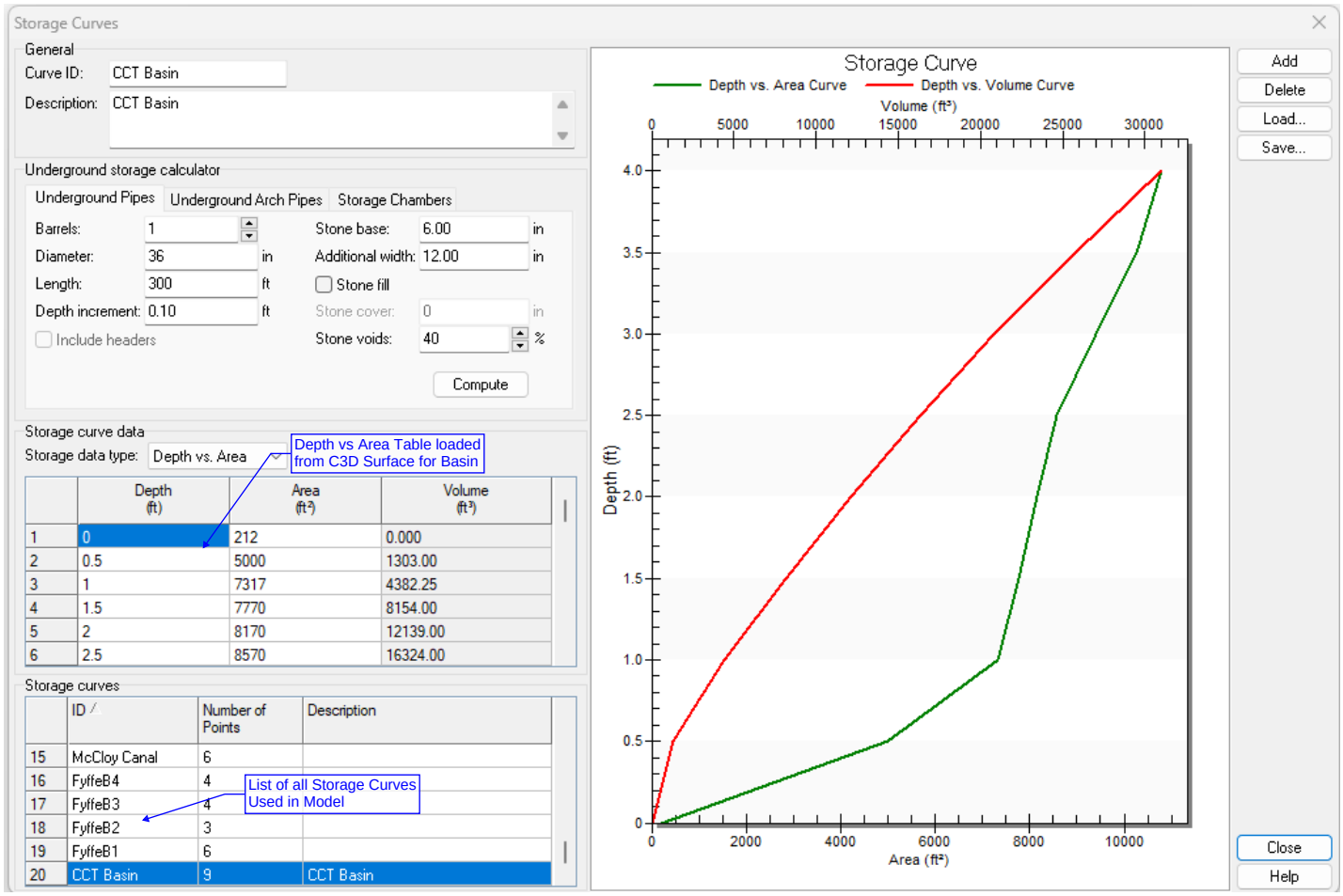


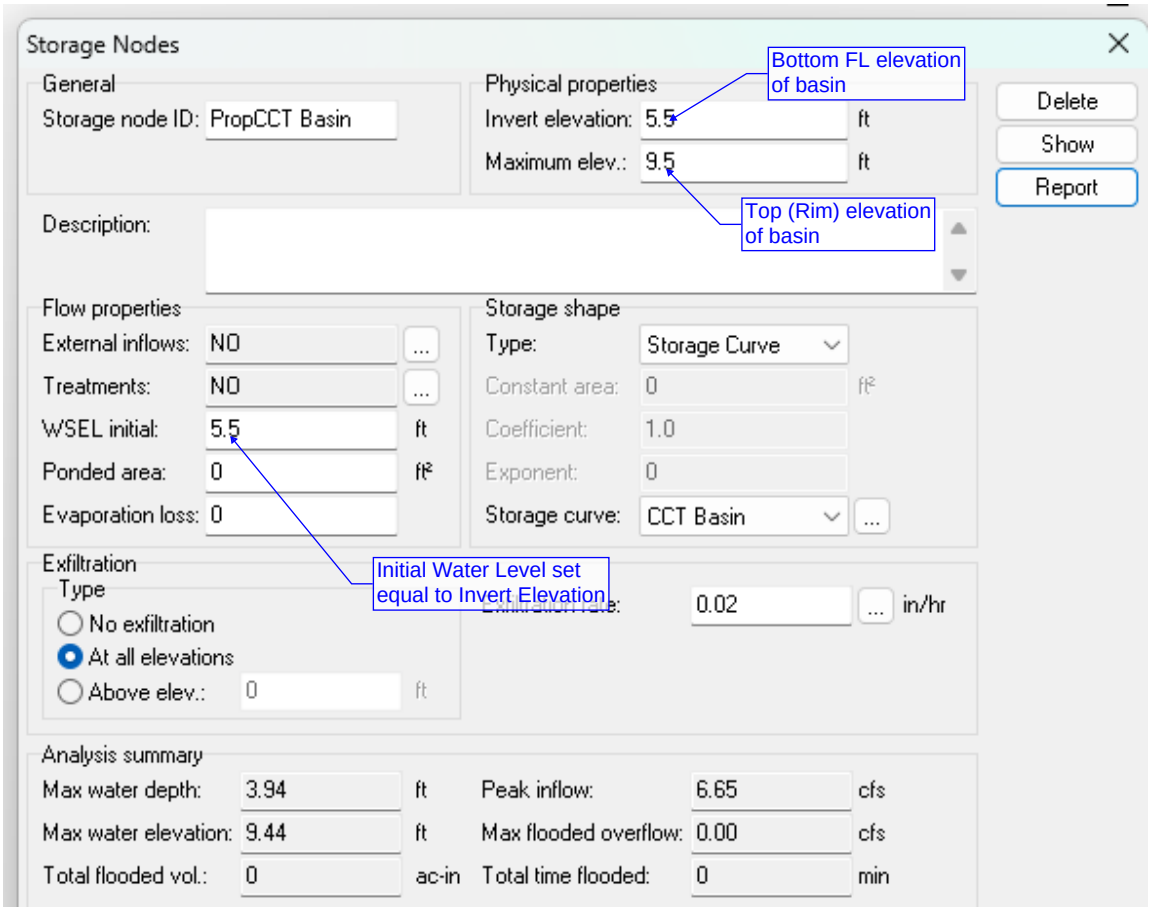
Add
Delete
Load...
Save...
Close
Help

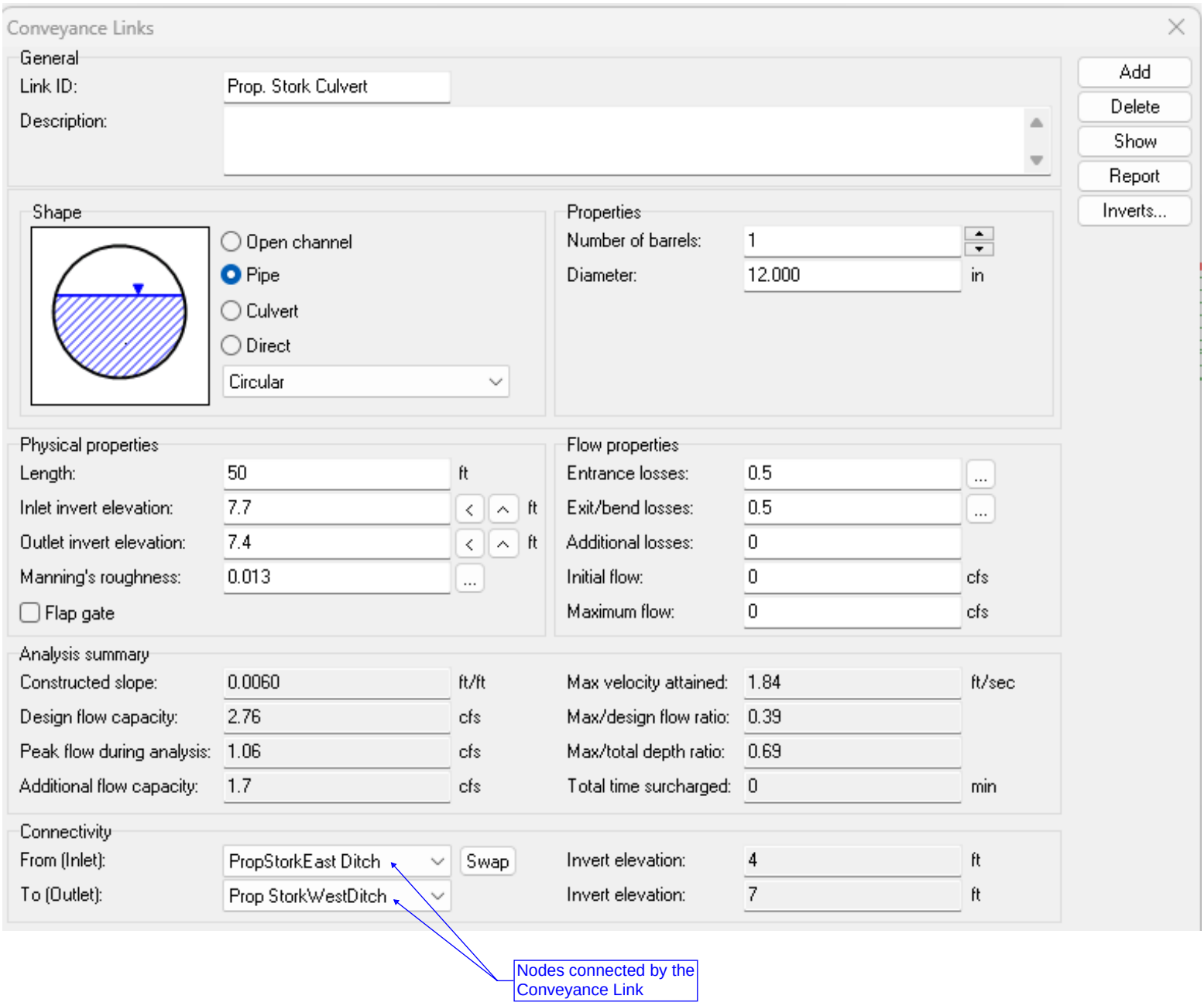

Subbasins
General
Subbasin ID: EC-03
Connectivity
Rain gage:
Outlet node: PropSJR EastBasin
Peak rate factor: 484
Delete
Show
Report
Description:
Physical Properties
SCS TR-55 TOC
Curve Number
Physical properties
Area: 0.8201 ac
Total Area
Equivalent width: 500.00 ft
Average slope: 0.5000 %
Assumed 5 mins for all drainage areas
Time of concentration: 5.00 min
Weighted curve number: 83.79
Impervious area
Area: 25.00 %
No depression: 25 %
Manning's roughness: 0.015
Curve number: 0.08
Pervious area
Curve number: 0.20
Manning's roughness: 0.1
Analysis summary
Peak runoff: 1.200 cfs
Total runoff: 1.860 in
Total precipitation: 3.430 in
Total infiltration: 1.57 in


Subbasins
General
Subbasin ID: EC-03
Connectivity
Rain gage:
Outlet node: PropSJR EastBasin
Peak rate factor: 484
Delete
Show
Report
Description:
Physical Properties
SCS TR-55 TOC
Curve Number
Composite curve number
% Impervious area plugged in for each drainage area
Area (ac) | Area (%) | Curve Number | Soil Group | Description
1 | 0.47953 | 58.47 | 80
2 | 0.19700 | 24.02 | 93
3
4
5
6
SSA computes weighted CN per input data
Total area: 0.6765 ac
Total area: 82.49 %
Weighted CN: 83.79

PORT OF STOCKTON
60% STORMWATER REPORT
ILLUSTRATION OF STORAGE CURVES FOR
RETENTION/DETENTION BASINS



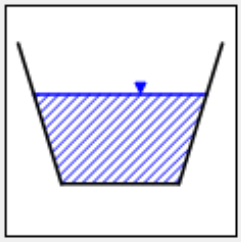



Conveyance Links
General
Link ID:
Prop. Stork Culvert
Description:
Add
Delete
Show
Report
Inverts...
Shape
Open channel
Pipe
Culvert
Direct
Circular
Properties
Number of barrels:
1
Diameter:
12.000
in
Physical properties
Length:
50
ft
Inlet invert elevation:
7.7
ft
Outlet invert elevation:
7.4
ft
Manning's roughness:
0.013
Flap gate
Flow properties
Entrance losses:
0.5
Exit/bend losses:
0.5
Additional losses:
0
Initial flow:
0
cfs
Maximum flow:
0
cfs
Analysis summary
Constructed slope:
0.0060
ft/ft
Design flow capacity:
2.76
cfs
Peak flow during analysis:
1.06
cfs
Additional flow capacity:
1.7
cfs
Max velocity attained:
1.84
ft/sec
Max/design flow ratio:
0.39
Max/total depth ratio:
0.69
Total time surcharged:
0
min
Connectivity
From (Inlet):
PropStorkEast Ditch
Swap
To (Outlet):
Prop StorkWestDitch
Invert elevation:
4
ft
Invert elevation:
7
ft
Nodes connected by the Conveyance Link

Conveyance Links

General
Link ID: Prop.SR-4_Ditch
Description:

Add
Delete
Show
Report
Inverts...

Shape

Open channel
Pipe
Culvert
Direct
Trapezoidal

Properties
Number of barrels: 1
Height: 2.000 ft
Bottom width: 2.000 ft
Left side slope: 1: 2 (V:H)
Right side slope: 1: 2 (V:H)

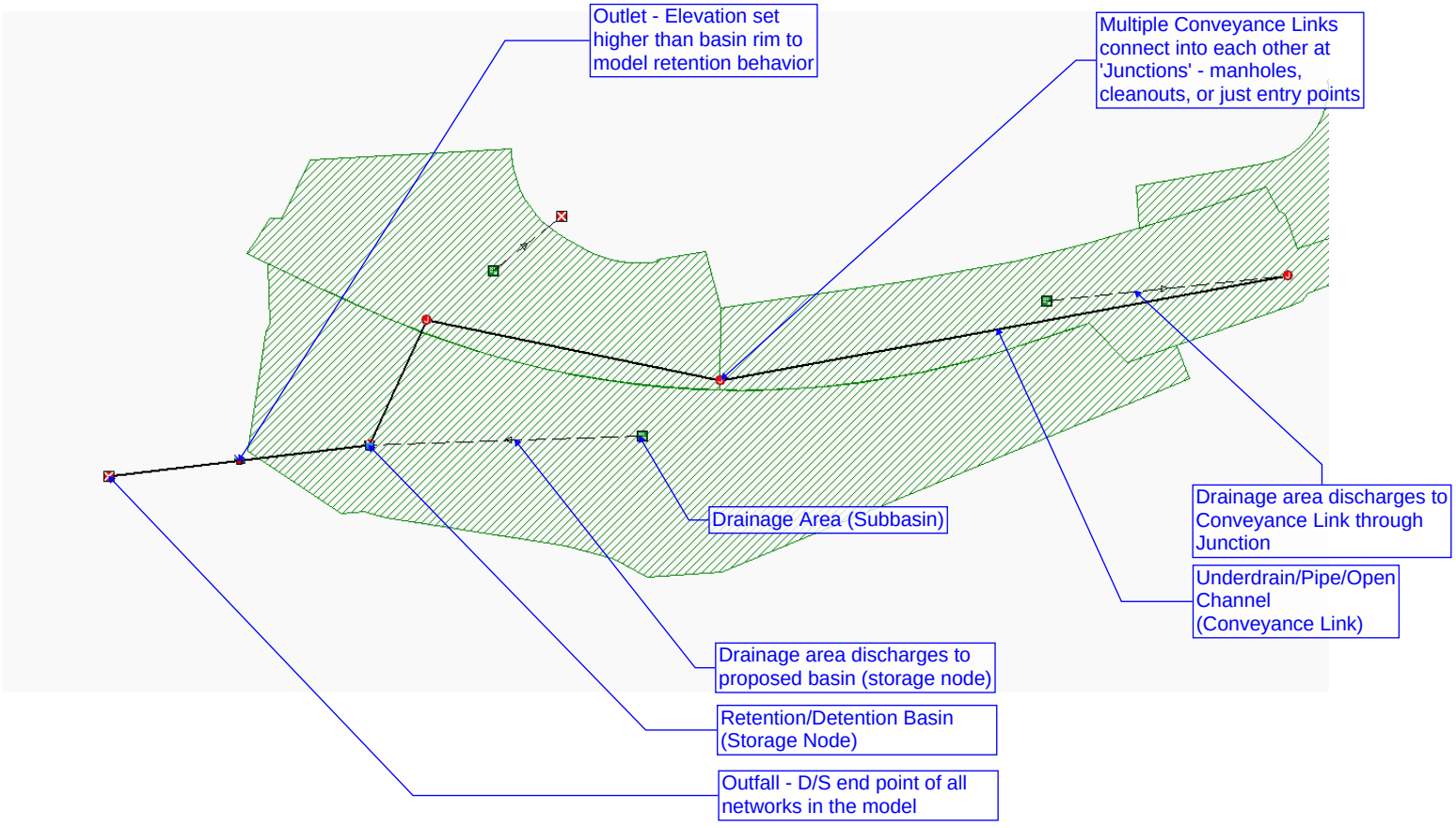
Physical properties
Length: 153.8 ft
Inlet invert elevation: 2.47 ft
Outlet invert elevation: 1.5 ft
Manning's roughness: 0.032
Flap gate

Flow properties
Entrance losses: 0.5
Exit/bend losses: 0.5
Additional losses: 0
Initial flow: 0 cfs
Maximum flow: 0 cfs

Analysis summary
Constructed slope: 0.0063 ft/ft
Design flow capacity: 47.03 cfs
Peak flow during analysis: 0.97 cfs
Additional flow capacity: 46.09 cfs
Max velocity attained: 0.18 ft/sec
Max/design flow ratio: 0.02
Max/total depth ratio: 0.96
Total time surcharged: 0 min

Connectivity
From (Inlet): JCT-81 Swap
To (Outlet): JCT-82
Invert elevation: 2.47 ft
Invert elevation: 1.5 ft

PORT OF STOCKTON
60% STORMWATER REPORT
ILLUSTRATION OF SETTING UP STORM DRAIN NETWORK



ATTACHMENT F

SSA Model Results Existing Conditions



PORT OF STOCKTON
100% STORM WATER REPORT
TABLE 1: PROPOSED DRAINAGE AREA SUMMARY

#	Element ID	Area (acres)	Drainage Outlet	Weighted Curve Number	100 Year Total Runoff (inches)	100 Year Peak Runoff (cfs)	50 Year Total Runoff (inches)	50 Year Peak Runoff (cfs)	2 Year Total Runoff (inches)	2 Year Peak Runoff (cfs)
1	EC-07EX	3.13	None	93.00	2.67	6.75	2.38	6.03	1.03	2.60
2	EC-08EX	0.92	None	93.00	2.67	1.99	2.38	1.78	1.03	0.77
3	EC-09EX	0.74	None	89.71	2.36	1.42	2.08	1.25	0.82	0.47
4	EC-10EX	0.9	None	93.00	2.67	1.93	2.38	1.73	1.03	0.74
5	EC-11EX	0.55	None	93.00	2.67	1.19	2.38	1.06	1.03	0.46
6	EC-12EX	0.33	None	93.00	2.67	0.72	2.38	0.64	1.03	0.28
7	EC-13EX	2.92	None	87.76	2.18	5.15	1.91	4.49	0.71	1.53
8	EC-14EX	0.42	None	84.45	1.91	0.63	1.66	0.54	0.55	0.15
9	EC-15EX	0.14	None	93.00	2.67	0.30	2.38	0.27	1.03	0.12
10	EC-16EX	0.18	None	93.00	2.67	0.39	2.38	0.35	1.03	0.15
11	EC-17EX	0.5	None	93.00	2.67	1.08	2.38	0.96	1.03	0.41
12	EC-18EX	0.17	None	93.00	2.67	0.36	2.38	0.32	1.03	0.14
13	EC-19EX	0.18	None	93.00	2.67	0.37	2.38	0.33	1.03	0.14
14	EC-20EX	0.7	None	86.35	2.07	1.16	1.80	1.00	0.64	0.32
15	EC-21EX	0.23	None	93.00	2.67	0.48	2.38	0.43	1.03	0.19
16	EC-22EX	0.42	None	93.00	2.67	0.90	2.38	0.80	1.03	0.35
17	EC-23EX	0.25	None	93.00	2.67	0.54	2.38	0.48	1.03	0.21
18	EC-24EX	0.85	None	84.89	1.95	1.32	1.69	1.13	0.57	0.33
19	EC-25EX	0.38	None	93.00	2.67	0.81	2.38	0.73	1.03	0.31
20	EC-26EX	0.8	None	93.00	2.67	1.74	2.38	1.55	1.03	0.67
21	EC-27EX	1.39	None	87.12	2.13	2.39	1.86	2.08	0.68	0.69
22	EC-28EX	1.58	None	86.16	2.05	2.60	1.79	2.25	0.63	0.71
23	EC-29EX	0.66	SR4 Ditch 1	78.34	1.47	0.71	1.24	0.59	0.33	0.10
24	EC-30EX	1.19	SR4 Ditch 2	85.32	1.98	1.87	1.72	1.61	0.59	0.48
25	EC-31EX	1.39	SR4 Basin	73.92	1.19	1.14	0.99	0.91	0.22	0.08

PORT OF STOCKTON
100% STORM WATER REPORT
TABLE 2: EXISTING NODES STORAGE ANALYSIS

#	Element ID	Invert Elevation (ft)	Max (Rim) Elevation (ft)	Top of Subgrade Elevation (ft)	Total Available Depth	Storm Event	Peak Inflow (cfs)	Peak Outflow (cfs)	Maximum HGL Depth Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Total Flooded Vol (ac-inches)	Total Time Flooded (minutes)
1	SR4Basin	1.00	4.00	7.00	3.00	100 Year	1.45	0.00	1.23	0.80	2 00:00	0.00	0.00
						50 Year	0.89	0.00	1.09	0.71	2 00:00	0.00	0.00
						2 Year	0.07	0.00	0.36	0.21	2 00:00	0.00	0.00

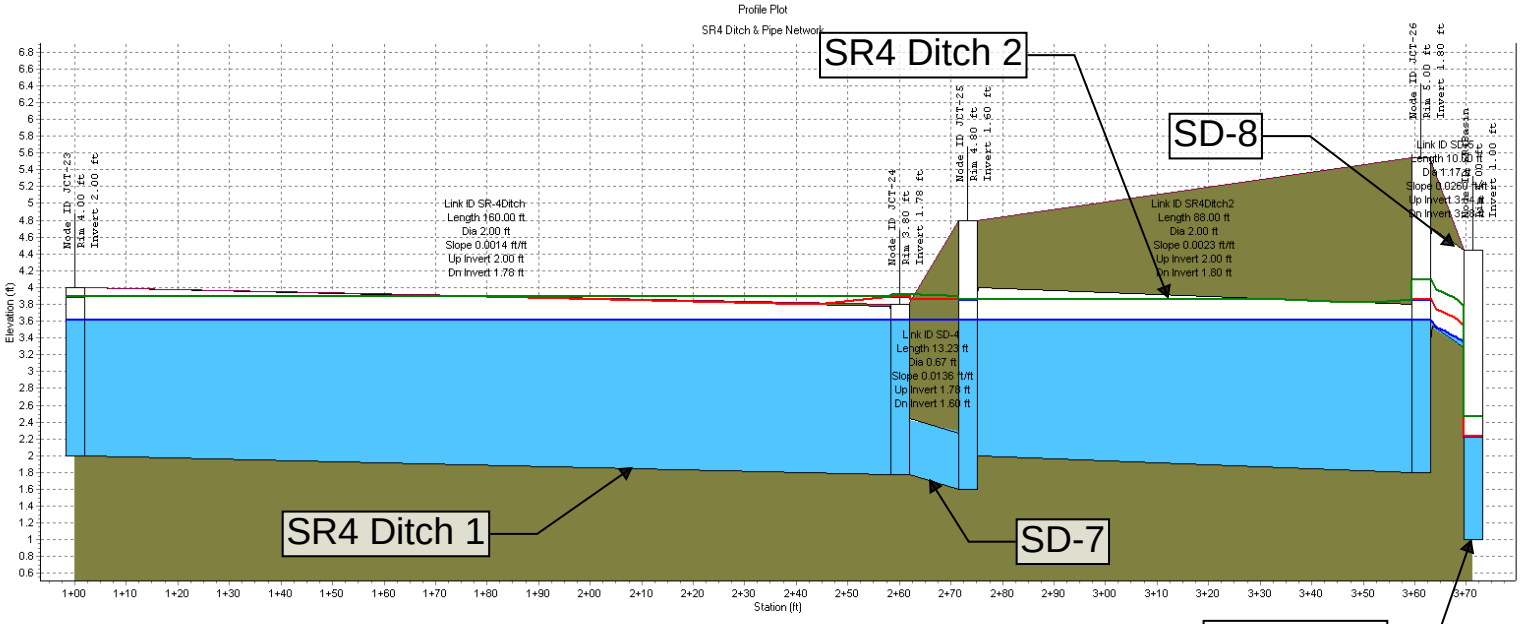
PORT OF STOCKTON
100% STORM WATER REPORT
TABLE 3: EXISTING PIPES/CULVERTS FLOW ANALYSIS

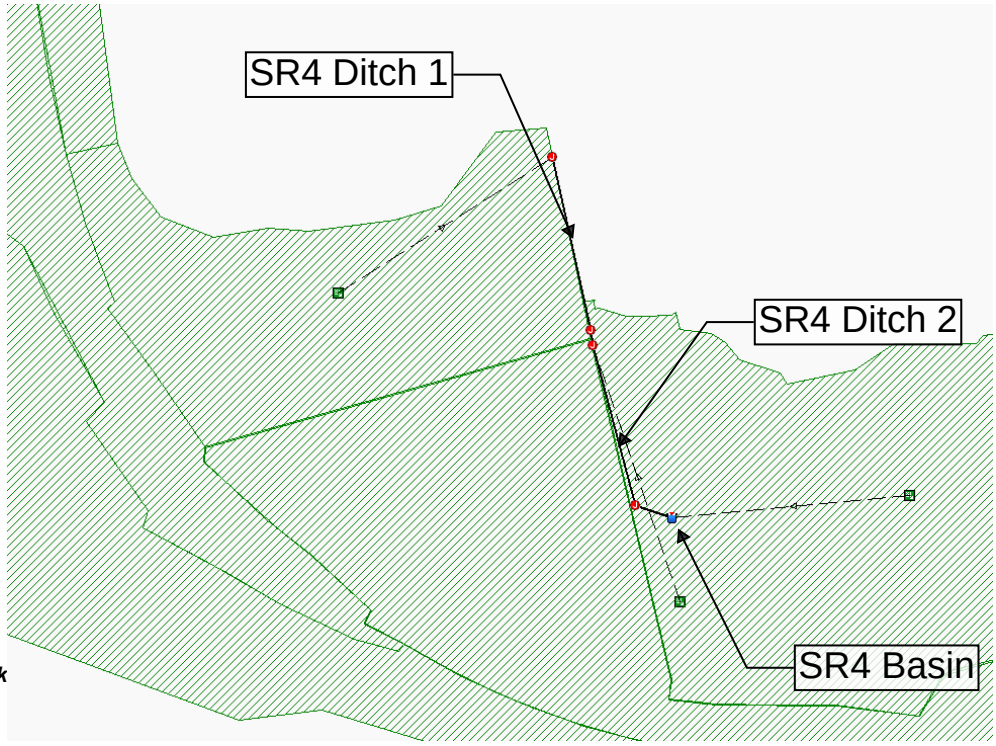
#	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Total Drop (ft)	Average Slope (%)	Pipe Diameter (inches)	Manning's Roughness	Storm Event	Peak Flow (cfs)	Design Flow Capacity (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Max/Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)	Reported Condition
1	SD-7	13.23	1.78	1.60	0.18	1.3600	8.040	0.0150	100 Year	0.26	1.22	0 10:00	1.15	0.21	1.00	769.00	0.67	SURCHARGED
									50 Year	0.24	1.22	0 10:04	1.07	0.20	1.00	710.00	0.67	SURCHARGED
									2 Year	0.20	1.22	0 10:04	0.92	0.16	1.00	641.00	0.67	SURCHARGED
2	SD-8	10.00	3.54	3.28	0.26	2.6000	14.040	0.0150	100 Year	0.00	7.51	0 00:00	0.00	0.00	0.00	0.00	0.00	Calculated
									50 Year	0.00	7.51	0 00:00	0.00	0.00	0.00	0.00	0.00	Calculated
									2 Year	0.00	7.51	0 00:00	0.00	0.00	0.00	0.00	0.00	Calculated

PORT OF STOCKTON
100% STORM WATER REPORT
TABLE 4: OPEN CHANNEL FLOW ANALYSIS

#	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Channel Type	Channel Height (ft)	Channel Width (ft)	Channel Manning's Roughness	Storm Event	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Max / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Max Flow Depth (ft)
1	SR-4 Ditch 1	160.00	2.00	1.78	0.1400	Trapezoidal	2.000	8.00	0.0220	100 Year	0.36		0 10:07	0.04	0.01	0.97	1.94
										50 Year	0.13	30.52	0 10:28	0.04	0.00	0.94	1.89
										2 Year	0.06		0 10:01	0.08	0.00	0.86	1.71
1	SR-4 Ditch 2	88.00	2.00	1.80	0.2300	Trapezoidal	2.000	13.70	0.0270	100 Year	1.01		0 10:08	0.20	0.02	0.97	1.93
										50 Year	0.60	56.44	0 10:00	0.20	0.01	0.93	1.87
										2 Year	0.20		0 095:55	0.32	0.00	0.85	1.70

PORT OF STOCKTON
100% STORMWATER REPORT
FIGURE 3: 100 YEAR PROFILE PLOT
EXISTING STATE ROUTE-4 DRAINAGE SYSTEM





ATTACHMENT G

SSA Model Results Proposed Conditions



PORT OF STOCKTON
100% STORM WATER REPORT
TABLE 1: PROPOSED DRAINAGE AREA SUMMARY

#	Element ID	Area (acres)	Drainage Outlet	Weighted Curve Number	100 Year Total Runoff (inches)	100 Year Peak Runoff (cfs)	50 Year Total Runoff (inches)	50 Year Peak Runoff (cfs)	2 Year Total Runoff (inches)	2 Year Peak Runoff (cfs)
8	EC-06A	0.26	JCT-72	92.01	2.57	0.53	2.28	0.48	2.07	0.43
9	EC-07	0.84	JCT-71	93.00	2.67	1.82	2.38	1.63	2.16	1.48
10	EC-07A	0.32	JCT-04	93.00	2.67	0.70	2.38	0.63	2.16	0.57
11	EC-08	1.59	Out-10	93.00	2.67	3.44	2.38	3.07	2.16	2.79
12	EC-08A	1.03	PropPortYard Ditch	89.00	2.29	1.90	2.02	1.67	1.81	1.49
13	EC-09	1.43	Out-11	93.00	2.67	3.09	2.38	2.76	2.16	2.51
14	EC-09A	0.15	Out-13	93.00	2.67	0.32	2.38	0.28	2.16	0.26
15	EC-10	0.89	JCT-24	93.00	2.67	1.93	2.38	1.73	2.16	1.57
16	EC-10A	0.29	Out-12	93.00	2.67	0.62	2.38	0.56	2.16	0.50
17	EC-11	0.27	JCT-31	93.00	2.67	0.58	2.38	0.52	2.16	0.47
18	EC-11A	0.30	JCT-30	93.00	2.67	0.65	2.38	0.58	2.16	0.53
19	EC-12	0.78	JCT-77	90.73	2.45	1.55	2.17	1.38	1.96	1.24
20	EC-12A	0.47	JCT-78	91.00	2.48	0.95	2.19	0.84	1.98	0.76
21	EC-12B	0.16	JCT-79	93.00	2.67	0.35	2.38	0.31	2.16	0.28
22	EC-13	2.92	PropCCT Basin	87.83	2.19	5.17	1.92	4.52	1.72	4.02
23	EC-13A	0.76	JCT-73	93.00	2.67	1.64	2.38	1.47	2.16	1.33
24	EC-13C	0.19	JCT-74	72.00	1.08	0.14	0.89	0.11	0.75	0.08
25	EC-18	0.80	Out-14	93.00	2.67	1.73	2.38	1.54	2.16	1.40
26	EC-18A	0.06	JCT-27	93.00	2.66	0.12	2.37	0.11	2.14	0.10
27	EC-19	0.19	Out-15	93.00	2.67	0.40	2.38	0.36	2.16	0.33
28	EC-20	0.74	PropWashingtonBasin	89.99	2.38	1.44	2.10	1.27	1.89	1.14
29	EC-21	0.23	Out-16	93.00	2.67	0.48	2.38	0.43	2.16	0.39
30	EC-22	0.42	Out-17	93.00	2.67	0.90	2.38	0.80	2.16	0.73
31	EC-23	0.25	Out-18	93.00	2.67	0.54	2.38	0.48	2.16	0.44
32	EC-24	0.85	Out-19	79.85	1.57	1.01	1.34	0.85	1.17	0.72
33	EC-25	0.38	Out-20	93.00	2.67	0.81	2.38	0.73	2.16	0.66
34	EC-26	0.77	Out-21	93.00	2.67	1.66	2.38	1.48	2.16	1.35
35	EC-27	1.01	Out-22	87.32	2.15	1.74	1.88	1.51	1.68	1.34
36	EC-27A	1.33	PropSR4Ditch	90.10	2.39	2.60	2.11	2.29	1.90	2.06
37	EC-28	1.24	Out-23	86.31	2.06	2.04	1.80	1.77	1.60	1.56
38	EC-29	0.69	JCT-81	89.09	2.30	1.28	2.03	1.12	1.82	1.00
39	EC-30	0.41	JCT-55	74.45	1.22	0.35	1.02	0.28	0.87	0.23
40	EC-31	1.65	SR4Basin	73.64	1.17	1.31	0.97	1.04	0.83	0.85

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TABLE 4: PROPOSED CONDITION EXISTING PIPES/CULVERTS FLOW ANALYSIS

#	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Total Drop (ft)	Average Slope (%)	Pipe Diameter (inches)	Manning's Roughness	Storm Event	Peak Flow (cfs)	Design Flow Capacity (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Max/Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)	Reported Condition
1	SD-7	13.23	1.78	1.60	0.18	1.3600	8.040	0.0150	100 Year	0.26	1.22	0 10:00	1.15	0.21	1.00	769.00	0.67	SURCHARGED
									50 Year	0.24	1.22	0 10:04	1.07	0.20	1.00	710.00	0.67	SURCHARGED
									2 Year	0.20	1.22	0 10:04	0.92	0.16	1.00	641.00	0.67	SURCHARGED
2	SD-8	10.00	3.54	3.28	0.26	2.6000	14.040	0.0150	100 Year	0.00	7.51	0 00:00	0.00	0.00	0.00	0.00	0.00	Calculated
									50 Year	0.00	7.51	0 00:00	0.00	0.00	0.00	0.00	0.00	Calculated
									2 Year	0.00	7.51	0 00:00	0.00	0.00	0.00	0.00	0.00	Calculated
3	Ex SD 811	10.00	8.74	8.63	0.11	1.1000	8.040	0.0150	100 Year	1.30	1.10	0 10:00	3.71	1.18	1.00	15.00	0.67	SURCHARGED
									50 Year	1.15	1.10	0 10:00	3.30	1.05	1.00	12.00	0.67	SURCHARGED
									2 Year	0.66	1.10	0 00:00	2.59	0.60	0.95	0.00	0.63	Calculated
4	Ex SD Pipe	155.00	0.05	-0.94	0.99	0.6400	14.040	0.0120	100 Year	3.67	4.65	0 10:09	4.49	0.79	0.72	0.00	0.83	Calculated
									50 Year	3.16	4.65	0 10:09	4.39	0.68	0.64	0.00	0.74	Calculated
									2 Year	1.05	4.65	0 10:11	3.39	0.23	0.33	0.00	0.39	Calculated

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TABLE 6: PROPOSED OPEN CHANNEL FLOW ANALYSIS

#	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Channel Type	Channel Height (ft)	Channel Width (ft)	Channel Manning's Roughness	Storm Event	Peak Flow (cfs)	Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)	Reported Condition
1	Prop.SR-4_Ditch	468.00	4.45	1.31	0.6700	Trapezoidal	2.000	10.00	0.0320	100 Year	1.15	0 10:02	0.55	14.19	46.39	0.02	0.33	0.00	0.66	Calculated
										50 Year	1.00	0 10:02	0.51	15.30	46.39	0.02	0.32	0.00	0.63	Calculated
										2 Year	0.36	0 10:03	0.48	16.26	46.39	0.01	0.19	0.00	0.38	Calculated

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TABLE 2: PROPOSED CONDITION EXISTING NODES STORAGE ANALYSIS

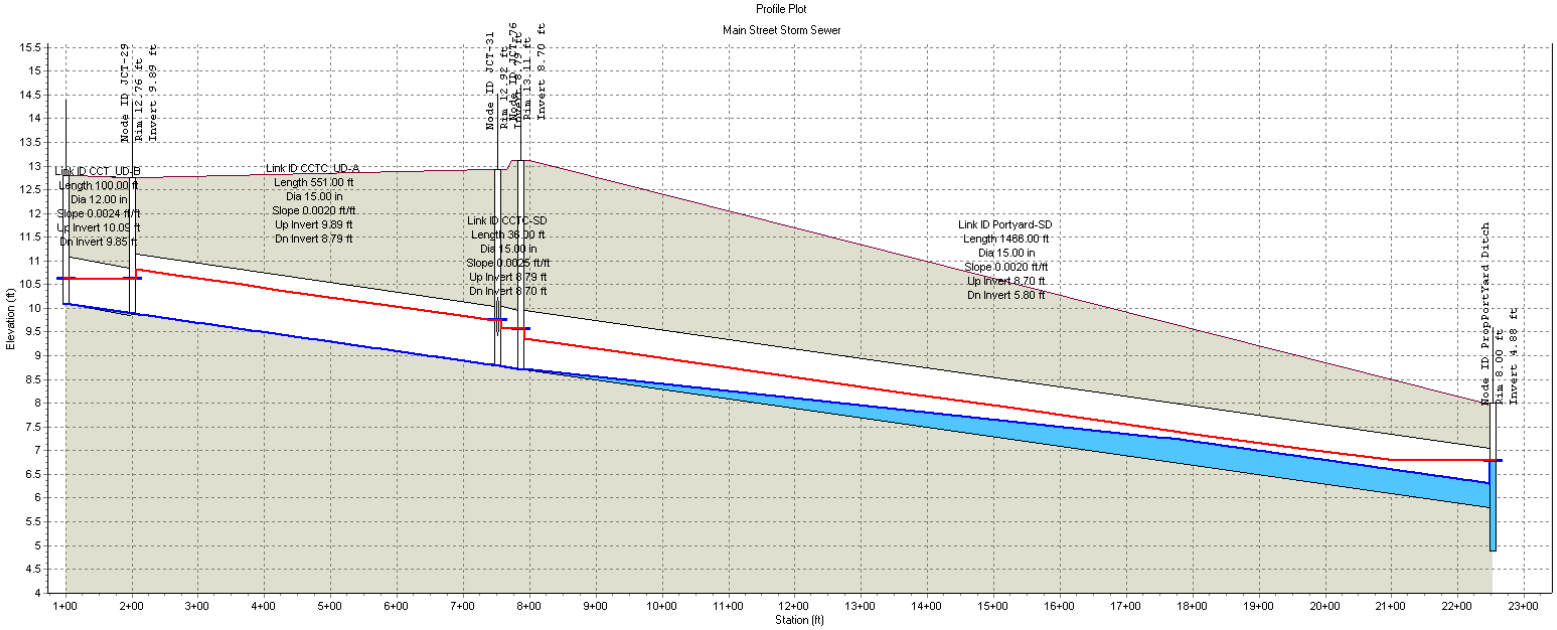
#	Element ID	Invert Elevation (ft)	Max (Rim) Elevation (ft)	Top of Subgrade Elevation (ft)	Total Available Depth	Storm Event	Peak Inflow (cfs)	Peak Outflow (cfs)	Maximum HGL Depth Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Total Flooded Vol (ac-inches)	Total Time Flooded (minutes)
1	SR4Basin	1.00	4.00		3.00	100 Year	1.30	0.00	0.77	0.48	1 00:00	0.00	0.00
						50 Year	1.03	0.00	0.69	0.43	1 00:00	0.00	0.00
						2 Year	0.83	0.00	0.63	0.39	1 00:00	0.00	0.00

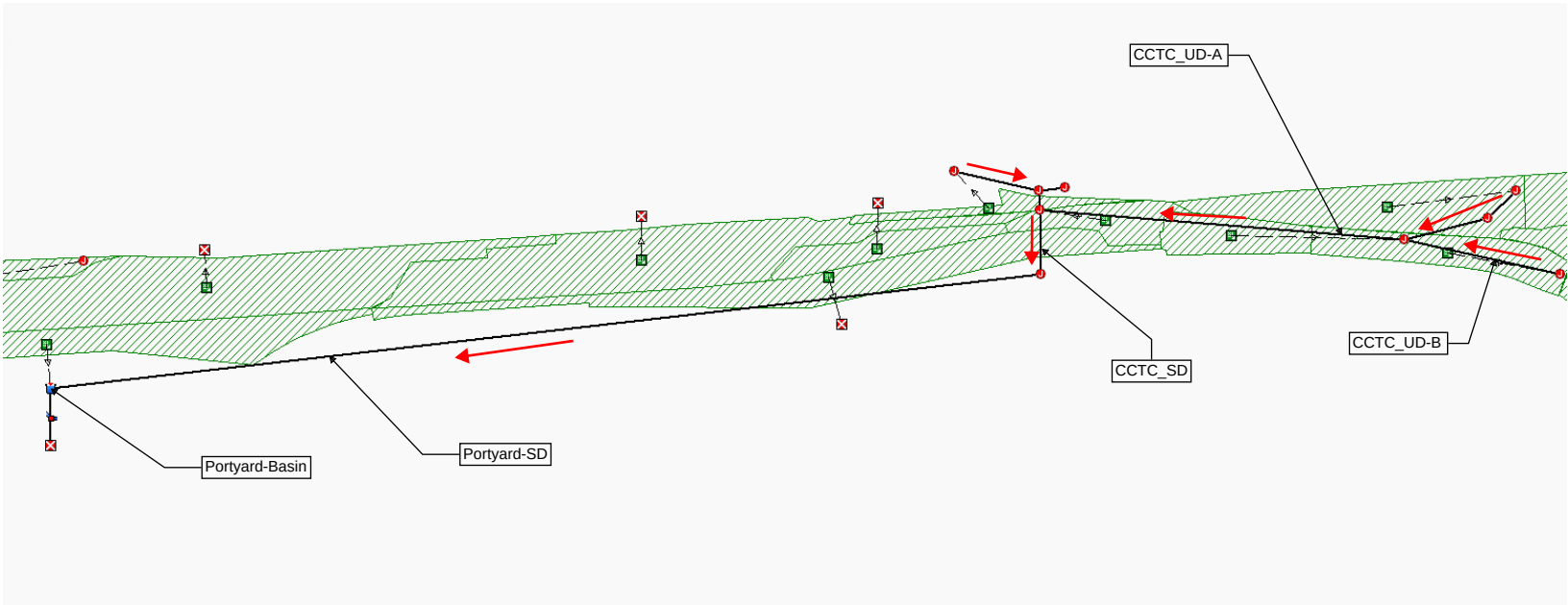
PORT OF STOCKTON
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TABLE 3: PROPOSED CONDITION PROPOSED NODES STORAGE ANALYSIS

#	Element ID	Invert Elevation (ft)	Max (Rim) Elevation (ft)	Total Available Depth	Storm Event	Peak Inflow (cfs)	Peak Outflow (cfs)	Maximum HGL Depth Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Total Flooded Vol (ac-inches)	Total Time Flooded (minutes)
1	PropCCT Basin	5.50	9.50	4.00	100 Year	6.52	0.00	3.90	2.64	1 00:21	0.00	0.00
					50 Year	5.71	0.00	3.56	2.35	1 00:21	0.00	0.00
					2 Year	2.02	0.00	1.76	1.18	1 00:23	0.00	0.00
2	PropPortYard Ditch	4.88	8.00	3.12	100 Year	3.35	0.00	1.91	1.28	2 00:00	0.00	0.00
					50 Year	2.93	0.00	1.74	1.15	2 00:00	0.00	0.00
					2 Year	1.00	0.00	0.92	0.62	1 08:50	0.00	0.00
3	PropSR4Ditch	0.24	5.00	4.76	100 Year	4.74	3.68	1.51	0.67	0 10:07	0.00	0.00
					50 Year	4.15	3.16	1.44	0.65	0 10:08	0.00	0.00
					2 Year	1.41	1.05	1.01	0.48	0 10:11	0 10:11	0.00

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TABLE 5: PROPOSED CONDITION PROPOSED PIPES/CULVERTS FLOW ANALYSIS

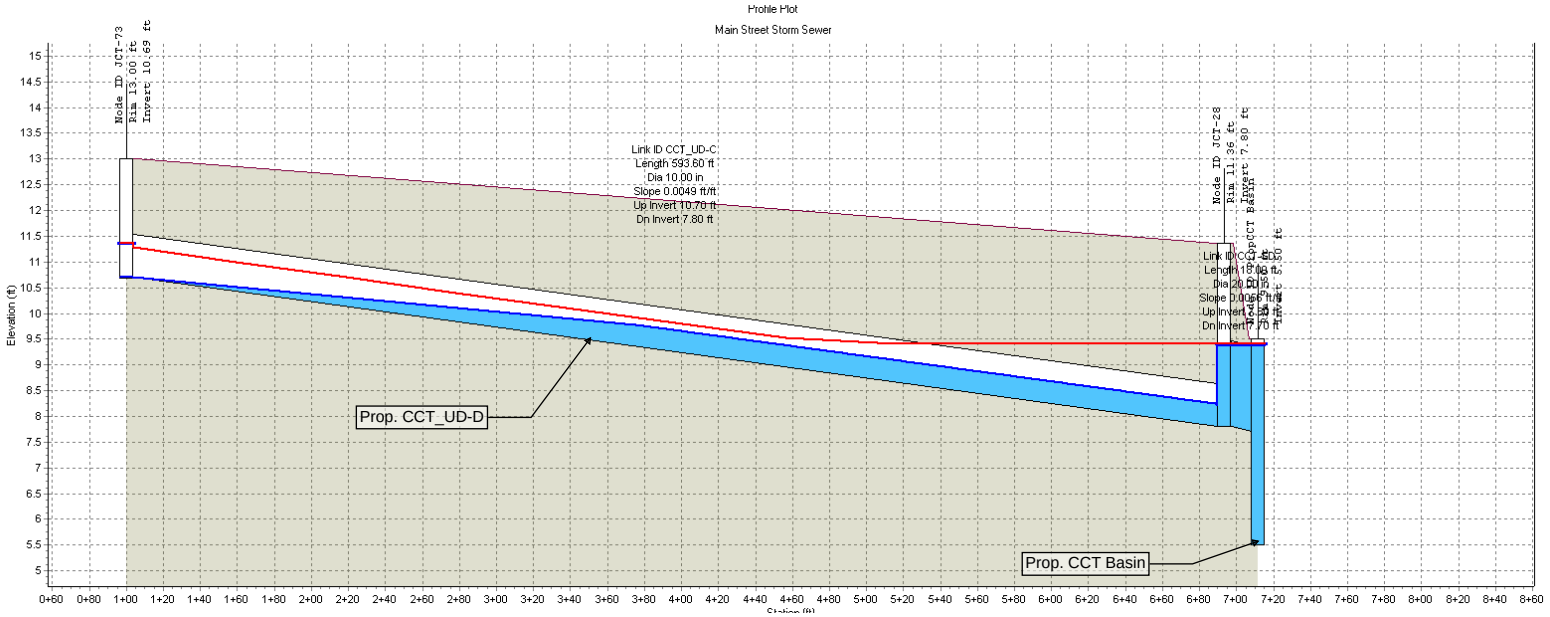
#	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Total Drop (ft)	Average Slope (%)	Pipe Diameter (inches)	Manning's Roughness	Storm Event	Peak Flow (cfs)	Design Flow Capacity (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Max/Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)	Reported Condition
1	811-SD	15.00	9.92	9.89	0.03	0.2000	14.000	0.0200	100 Year	1.42	1.56	0 10:02	1.91	0.91	0.67	0.00	0.77	Calculated
									50 Year	1.26	1.56	0 10:02	1.85	0.80	0.62	0.00	0.71	Calculated
									2 Year	0.48	1.56	0 10:03	1.43	0.31	0.36	0.00	0.42	Calculated
2	811-UD-A	363.06	10.65	9.92	0.73	0.2000	14.000	0.0120	100 Year	1.49	2.61	0 10:01	2.21	0.57	0.61	0.00	0.69	Calculated
									50 Year	1.32	2.61	0 10:01	2.14	0.50	0.57	0.00	0.64	Calculated
									2 Year	0.51	2.61	0 10:01	1.67	0.19	0.33	0.00	0.39	Calculated
3	811-UD-B	238.00	9.92	8.74	0.48	0.5000	8.000	0.0120	100 Year	0.92	0.92	0 10:00	2.63	1.00	1.00	4.00	0.64	SURCHARGED
									50 Year	0.80	0.92	0 10:01	2.47	0.87	0.88	0.00	0.58	SURCHARGED
									2 Year	0.32	0.92	0 10:00	1.33	0.35	0.65	0.00	0.43	Calculated
4	811-UD-C	92.20	10.21	8.74	1.47	1.5900	8.000	0.0120	100 Year	0.00	1.65	0 00:00	0.00	0.00	0.50	0.00	0.33	Calculated
									50 Year	0.00	1.65	0 00:00	0.00	0.00	0.50	0.00	0.33	Calculated
									2 Year	0.00	1.65	0 00:00	0.00	0.00	0.45	0.00	0.30	Calculated
5	825_UD1	273.00	10.10	9.56	0.54	0.2000	9.960	0.0120	100 Year	0.31	1.06	0 10:01	1.77	0.29	0.36	0.00	0.28	Calculated
									50 Year	0.27	1.06	0 10:01	1.72	0.26	0.33	0.00	0.27	Calculated
									2 Year	0.12	1.06	0 10:02	1.36	0.11	0.21	0.00	0.17	Calculated
6	825_UD2	69.00	9.98	9.56	0.42	0.6100	8.000	0.0120	100 Year	0.00	1.02	0 00:00	0.00	0.00	0.19	0.00	0.13	Calculated
									50 Year	0.00	1.02	0 00:00	0.00	0.00	0.18	0.00	0.12	Calculated
									2 Year	0.00	1.02	0 00:00	0.00	0.00	0.11	0.00	0.07	Calculated
7	825_UD3	26.50	9.56	9.40	0.16	0.6000	9.960	0.0120	100 Year	0.30	1.84	0 10:02	2.19	0.16	0.36	0.00	0.30	Calculated
									50 Year	0.26	1.84	0 10:02	2.20	0.14	0.30	0.00	0.25	Calculated
									2 Year	0.11	1.84	0 10:03	1.76	0.06	0.17	0.00	0.14	Calculated
8	CCT_UD-B	100.00	10.09	9.85	0.24	0.2400	12.000	0.0120	100 Year	0.13	1.73	0 10:05	0.27	0.07	0.64	0.00	0.64	Calculated
									50 Year	0.10	1.73	0 10:05	0.25	0.06	0.58	0.00	0.58	Calculated
									2 Year	0.02	1.73	0 10:00	0.13	0.01	0.29	0.00	0.29	Calculated
9	CCT_UD-C	593.60	10.70	7.80	2.90	0.4900	9.960	0.0120	100 Year	1.55	1.66	0 10:01	3.45	0.93	0.77	0.00	0.61	Calculated
									50 Year	1.39	1.66	0 10:01	3.39	0.84	0.71	0.00	0.56	Calculated
									2 Year	0.60	1.66	0 10:01	2.73	0.36	0.43	0.00	0.35	Calculated
10	CCTC_UD-A	551.00	9.89	8.79	1.10	0.2000	15.000	0.0120	100 Year	2.06	3.13	0 10:03	2.37	0.66	0.68	0.00	0.85	Calculated
									50 Year	1.81	3.13	0 10:03	2.29	0.58	0.62	0.00	0.78	Calculated
									2 Year	0.67	3.13	0 10:05	1.76	0.21	0.35	0.00	0.44	Calculated
11	CCTC-SD	36.00	8.79	8.70	0.09	0.2500	15.000	0.0120	100 Year	2.74	3.50	0 10:04	3.20	0.78	0.72	0.00	0.88	Calculated
									50 Year	2.42	3.50	0 10:04	3.12	0.69	0.66	0.00	0.81	Calculated
									2 Year	0.92	3.50	0 10:05	2.54	0.26	0.36	0.00	0.45	Calculated
12	CCT-SD	18.00	7.80	7.70	0.10	0.5600	20.000	0.0200	100 Year	1.53	6.10	0 10:02	2.59	0.25	0.98	0.00	1.63	Calculated
									50 Year	1.37	6.10	0 10:02	2.51	0.22	0.79	0.00	1.31	Calculated
									2 Year	0.58	6.10	0 10:03	1.97	0.10	0.19	0.00	0.32	Calculated
13	CMP_Culv-1	236.00	1.17	0.05	1.12	0.4700	14.000	0.0200	100 Year	2.40	2.41	0 10:11	2.79	1.00	0.75	0.00	0.87	Calculated
									50 Year	2.19	2.41	0 10:11	2.75	0.91	0.70	0.00	0.81	Calculated
									2 Year	0.70	2.41	0 10:18	2.12	0.29	0.35	0.00	0.41	Calculated
14	CMP_Culv-2	65.00	1.60	1.46	0.31	0.2200	24.000	0.0200	100 Year	0.64	6.82	0 10:09	1.03	0.09	0.37	0.00	0.75	Calculated
									50 Year	0.57	6.82	0 10:09	1.06	0.08	0.33	0.00	0.66	Calculated
									2 Year	0.21	6.82	0 10:13	1.06	0.03	0.11	0.00	0.23	Calculated
15	ECO_CV	74.00	1.58	1.20	0.38	0.5100	15.000	0.0200	100 Year	1.13	1.66	0 10:05	1.54	0.68	0.92	0.00	0.92	Calculated
									50 Year	1.04	1.66	0 10:06	1.53	0.63	0.86	0.00	0.86	Calculated
									2 Year	0.52	1.66	0 10:08	1.81	0.31	0.40	0.00	0.40	Calculated
16	ECO-UD	1031.00	3.64	1.58	2.06	0.2000	15.000	0.0120	100 Year	1.51	3.13	0 10:02	2.44	0.48	0.56	0.00	0.69	Calculated
									50 Year	1.37	3.13	0 10:01	2.40	0.44	0.51	0.00	0.63	Calculated
									2 Year	0.58	3.13	0 10:03	1.91	0.18	0.30	0.00	0.37	Calculated
17	Portyard-SD	1466.00	8.70	5.80	2.90	0.2000	15.000	0.0120	100 Year	2.10	3.11	0 10:09	2.87	0.67	0.58	0.00	0.72	Calculated
									50 Year	1.85	3.11	0 10:10	2.79	0.59	0.53	0.00	0.66	Calculated
									2 Year	0.67	3.11	0 10:12	2.15	0.21	0.30	0.00	0.37	Calculated

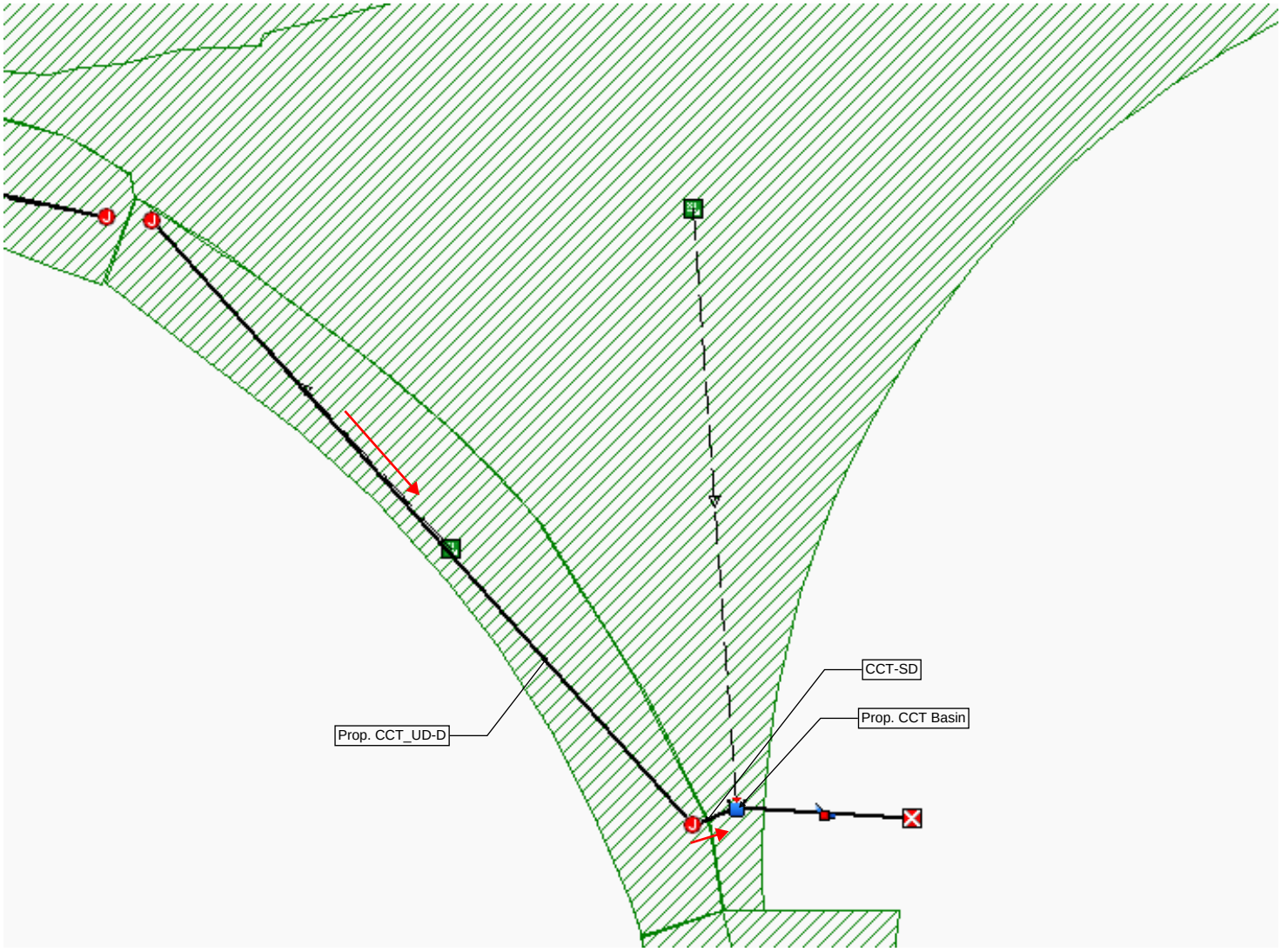




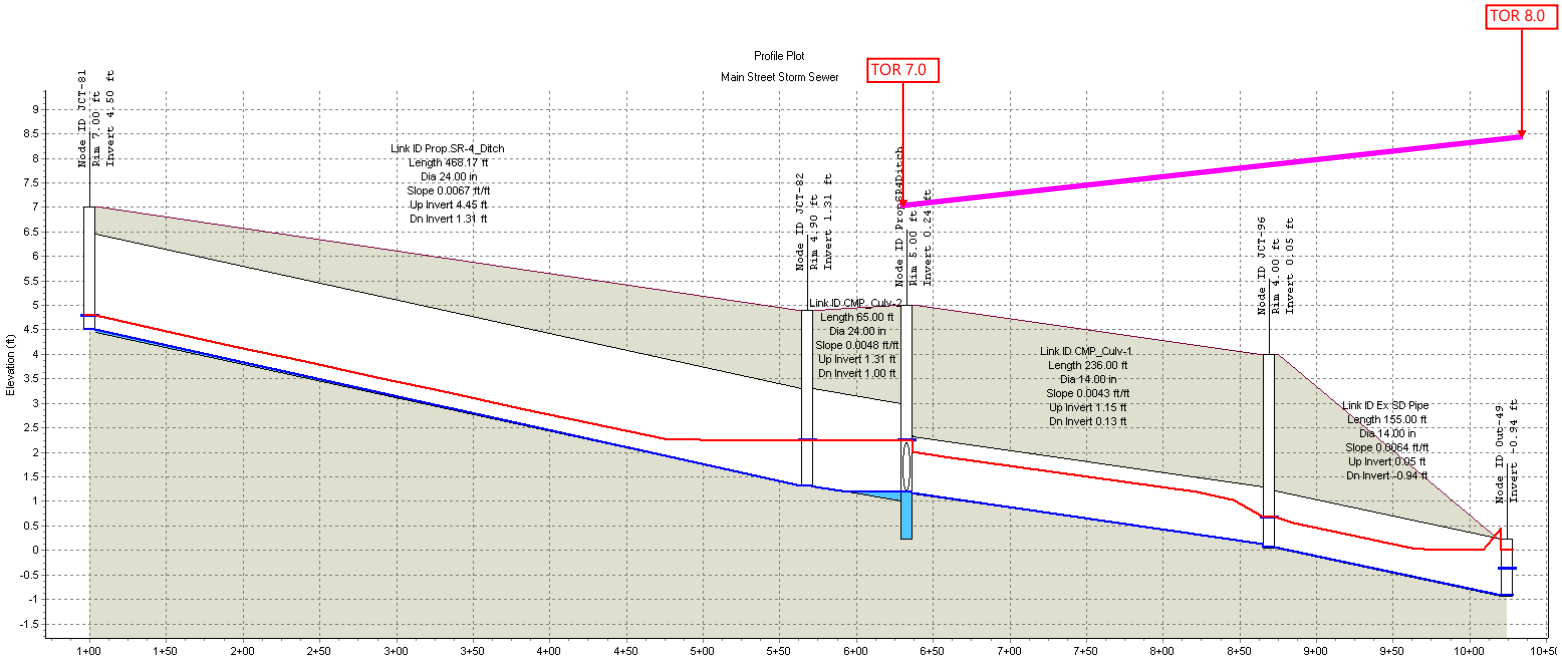
Autodesk Storm and Sanitary Analysis

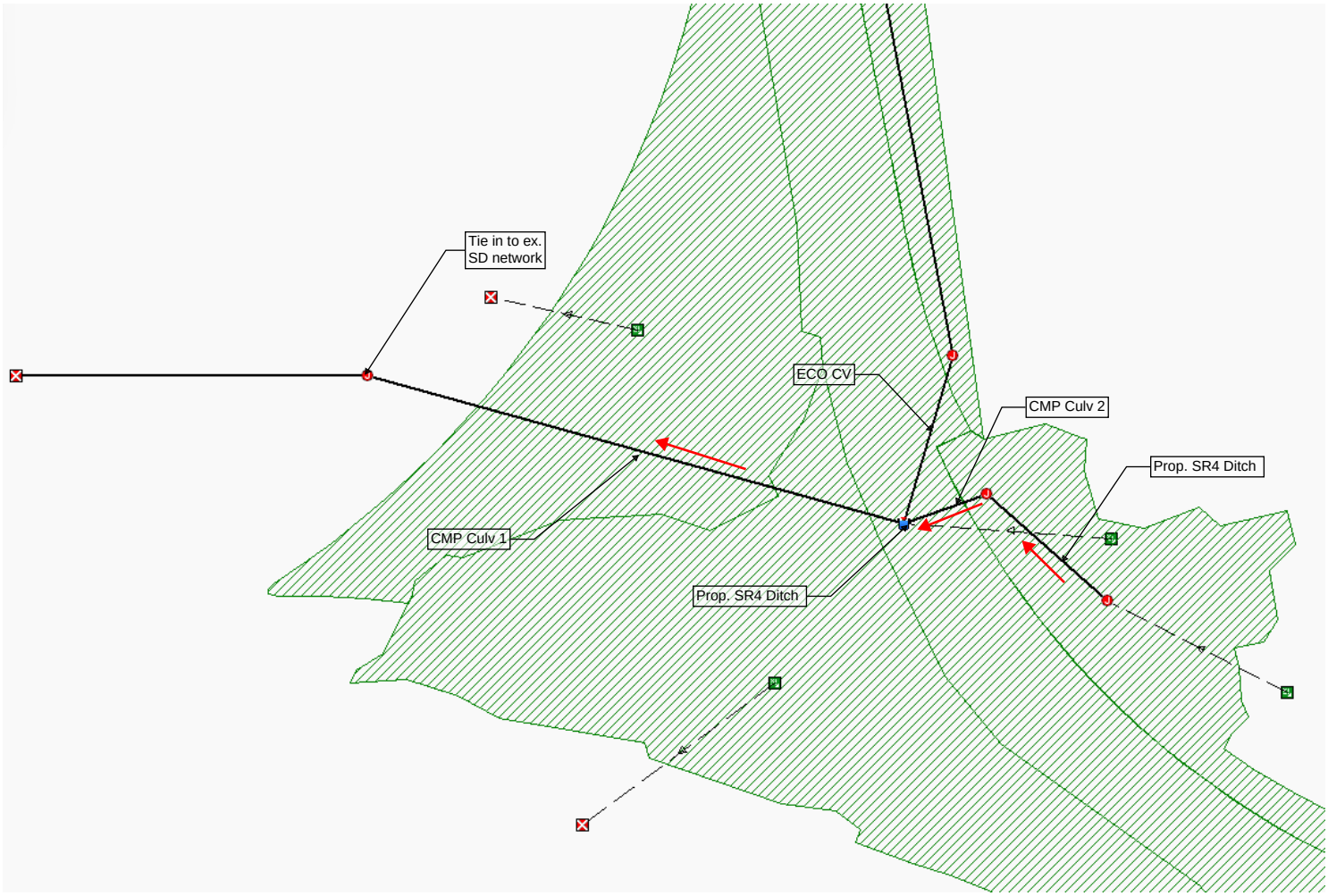
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FIGURE 7: 100 YEAR PROFILE PLOT
PROPOSED CCTC WYE DRAINAGE SYSTEM





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FIGURE 8: 100 YEAR PROFILE PLOT
PROPOSED PORT ENTRANCE DRAINAGE SYSTEM





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