

PREPARED FOR:



# STORMWATER REPORT



## MCCLOY RAIL YARD

PORT OF STOCKTON

FINAL DESIGN

AUGUST 31, 2026

PREPARED BY:



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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 a new rail service, with a significant volume identified for the West Complex. The McCloy Rail yard project addresses the need for additional railcar storage in West Complex due to the increased volumes.

This stormwater report defines the major drainage design elements related to the proposed McCloy rail yard, and other associated improvements. 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    | D                              | Previous Revisions |            |
|-------------|--------------------------------|--------------------|------------|
| Date        | 08/31/2026                     | Rev                | Date       |
| Description | Final Design Stormwater Report | A                  | 06/27/2025 |
| Prepared By | A. Ghosh                       | B                  | 12/22/2025 |
| Checked By  | A. Rieger                      | C                  | 06/22/2026 |
| Approved By | J. Marshall                    |                    |            |

## 1.2 Terms and Definitions

**Table 2: Terms and Definitions**

| Abbreviation | Full Form                                               |
|--------------|---------------------------------------------------------|
| AC-FT        | Acre- Feet                                              |
| BMP          | Best Management Practices                               |
| BNSF         | Burlington Northern Santa Fe Railway                    |
| CASQA        | California Stormwater Quality Association               |
| CCTC         | Central California Traction Company                     |
| CFS          | Cubic Feet per Second                                   |
| CMP          | Corrugated Metal Pipe                                   |
| CN           | Curve Number                                            |
| DMA          | Drainage Management Area                                |
| DSP          | Port of Stockton Storm Water Development Standards Plan |
| DTSC         | Department of Toxic Substances Control                  |
| FEMA         | Federal Emergency Management Agency                     |
| FIRM         | Flood Insurance Rate Map                                |
| HDPE         | High-Density Polyethylene                               |
| LID          | Low Impact Development                                  |
| NAVD         | North American Vertical Datum of 1988                   |
| NGVD         | National Geodetic Vertical Datum of 1929                |
| NOAA         | National Oceanic and Atmospheric Administration         |
| RAP          | Remedial Action Plan                                    |
| SCS          | Soil Conservative Service                               |
| SD           | Storm Drain                                             |
| SSA          | Storm and Sewer Analysis Package                        |
| UD           | Under Drain                                             |
| UPRR         | Union Pacific Railroad                                  |
| USDA         | United States Department of Agriculture                 |

### 1.3 Project Location

The project is located at 315 W Fyffe 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 proposed yard will be situated north of McCloy Avenue between the crossings of Humphreys Street and Hooper Street. This area is bound to the south by the Burns Cutoff River which flows into the San Joaquin River. Burns Cutoff also serves as the ultimate drainage outlet for the Port's West Complex through a network of ditches and culverts. The proposed project site, project outlet locations, and the ultimate downstream outfall into Burns Cutoff are shown in **Figure 1**.



**Figure 1: Site Location Map**

### 1.4 Project Stakeholders

#### 1.4.1 Design Team

|                                                |                                                                                 |
|------------------------------------------------|---------------------------------------------------------------------------------|
| Owner:                                         | Port of Stockton, Jason Katindoy - Deputy Port Director, Maritime & Real Estate |
| Railroad Operations:                           | CCTC, Jason Nalder, General Manager                                             |
| Prime Consultant/Bridge Engineer: Engineer     | HDR, Inc., Matthew Archer, P.E. – Sr. Rail                                      |
| Civil, Hydraulics, and Rail Engineer: Engineer | JMA Civil, Inc., Arka Ghosh, P.E. – Sr. Civil                                   |
| Geotechnical Engineer: Manager                 | Kleinfelder, Nathan L. Dahlen, P.E. – Sr Project                                |

|                         |                                                                                |
|-------------------------|--------------------------------------------------------------------------------|
| Surveyor:               | Cinquini and Passarino (C&P), Inc., Jim Dickey,<br>P.L.S. – Principal Engineer |
| Environmental Engineer: | Anchor QEA, LLC, Marine Vie – Sr. Managing<br>Environmental Planner            |
| Hazardous Materials:    | Geosyntec Consultants, Anju Wicke – Sr.<br>Principal Scientist                 |

#### 1.4.2 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. The Port has a Stormwater Development Standards Plan that outlines the necessary mitigation measures for new construction.

##### Railroad

CCTC is 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. CCTC does not have its own drainage standard. Rail projects at the Port comply with Port and UPRR/BNSF requirements.

##### California State Water Board

A portion of the project lies within Site 47 which is a regulated site by DTSC and California State Water Board. The project limits overlap with this site between the area bound by Track 946, McCloy Avenue and Port Expressway and is known to have arsenic contamination. Any proposed drainage features such as ditches are subject to evaluation by the Water Board specifically concerning potential groundwater contamination.

## 1.5 **Applicable Codes and Standards**

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

- Port of Stockton Storm Water DSP
- USDA/SCS TR-55 Urban Hydrology for Small Watersheds, June 1986
- UPRR Industry Track Standards

## 1.6 **Project Survey Datum**

A 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.

## 1.7 Flood Hazard Analysis

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 **Appendix 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.

## 1.8 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 3** below.

**Table 3: 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              |

## 1.9 Existing Facilities

The project site is bound by the existing railroad yard tracks leased out to Transload and Carry Transit to the north and McCloy Avenue to the south. The site is largely impervious consisting of track roadbed, roadway surface, and dirt access roads. Drainage is primarily provided by a series of WW-II era drainage ditches both to the north along Fyffe Avenue and to the south along McCloy

Avenue. These ditches are connected through equalizing culverts at crossing locations. **Figure 2** below depicts the tracks and the drainage ditches along McCloy Avenue.

The project also proposes stub-ended tracks in the area bound by Track 946 to the west and Port Expressway to the east. This area between the track and roadway is largely flat and drainage is provided by a shallow v-ditch that flows south into a culvert that crosses underneath Port Expressway into a series of ditches that ultimately convey runoff to the Burns Cutoff outlet. This area also falls under Site 47 which is regulated by DTSC and California Water Board. This site is known for arsenic contamination, and a RAP is in place as part of the adjacent Trammell Crow project on other side of Port Expressway to protect exposure to contaminated soil and groundwater contamination in this area. As part of the conditions in the RAP, the disturbed soil within this Site must not be relocated outside the site but instead be stored into a soil pile spread across the site. A summary of existing drainage areas, flow patterns and drainage facilities is provided in **Appendix B**.



**Figure 2: Existing Ditch along McCloy Avenue**

## 1.10 Nearby Tributaries

The Port's West Complex is an island bound by the Stockton Deepwater Channel to the north, San Joaquin River to the east and Burns Cutoff to the south and west. Burns Cutoff is the primary drainage outfall for the Port, and it ultimately flows into the San Joaquin River. San Joaquin River is a major riverine system in California's Central Valley and Stockton lies within the most downstream reaches of the river where it creates a delta region with Sacramento River.

## 2. Stormwater Analysis Approach

Civil3D's SSA was utilized to develop the stormwater model, which included the subbasins (drainage areas), storage nodes (retention/detention basins), inlets, storm drains, and ditches. 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, 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.

## 2.1 Design Principles

The stormwater analysis was conducted to satisfy the Port's DSP requirements. The Port's DSP does not specify a specific analysis methodology but outlines key objectives to be met for any future development at the Port. The main Port DSP objectives are as follows:

- Incorporate permanent control measures to mitigate pollutants in storm water
- Maintain post-development runoff rates as close to the pre-development rates as possible
- Implement mandatory and site-specific BMPs for any proposed development.

## 2.2 Return Periods

Three return periods were evaluated – 10-year, 50-year, and 100-year. The 10-year period is the prevalent local jurisdictional standard for sizing drainage features at this site. The 50-year and 100-year periods were also evaluated as they are the prevalent return periods used by BNSF and UPRR for their track roadbed analysis. The 50-year period is the recommended period for secondary or industry tracks while the 100-year period is the recommended period for areas in FEMA flood plains. This project falls under Port jurisdiction and subject to Port and local requirements.

## 3. Hydrologic Analysis

### 3.1 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 10-year, 50-year, and 100-year 24-hour storms. Table 4 below summarizes the total precipitation value determined for the Stockton area for this project for each return period.

**Table 4: Rainfall Data Summary**

| Design Storm   | Total Precipitation (inches) | Reference Document         |
|----------------|------------------------------|----------------------------|
| 10-Year 24-hr  | 2.41                         | Port DSP                   |
| 50-Year 24-hr  | 3.13                         | UPRR/BNSF Grade Separation |
| 100-Year 24-hr | 3.43                         | UPRR/BNSF Grade Separation |

### 3.2 Rainfall-Runoff Losses

The Civil3D SSA software was used for hydrologic calculations and to model the rainfall-runoff losses. The SCS 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 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 ( $T_c$ )/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:  
$$\text{Lag, } L \text{ (min.)} = T_c \times 0.6 = 5 \times 0.6 = 3 \text{ min.}$$
  
(Ref : National Engineering Handbook (NEH), Part 630 – Hydrology, Chapter 15: Time of Concentration, Washington, D.C., 2010.)

## 4. Existing Conditions Analysis

The ditches along Fyffe drain into the McCloy ditches through a culvert and the McCloy ditches in turn drain to the network of ditches west of Humphreys Street that convey runoff to the ultimate outfall location on Burns Cutoff. The area south of McCloy Avenue drains south through a v-ditch into an existing cross-culvert flowing east underneath Port Expressway.

Although the design intent for the ditches along McCloy Avenue is likely to drain west, topographic survey showed that all these ditches have negligible longitudinal slope and the ditch east of Track 946 only has culverts flowing into it with no apparent outfalls. Therefore, the McCloy Avenue and Fyffe Street ditches were modeled as storage nodes with culvert outfalls except for the ditch east of Track 946.

For the purposes of this project analysis, the culvert underneath Humphreys Street and the culvert underneath Port Expressway will be the two outlet locations that will receive runoff from the site area modified due to the project.

#### 4.1 Tributary Areas

The project site is divided into nine different drainage areas. The drainage areas are bound by the crown of McCloy Avenue to the south, and the track roadbed crowns to the north, which are high points. The drainage areas are also limited in the east-west direction by either crossing roadways such as Humphreys Street and Daggett Road or crossing tracks, such as Track 940 and Track 946. To the south of McCloy Avenue, the drainage area is defined by the crown of Port Expressway to the east and Track 946 roadbed and crown of Daggett Rd to the west. The drainage area map for the existing conditions is provided in **Appendix B**.

#### 4.2 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 10-year, 50-year, and 100-year storms are included in **Table 1** of **Attachment F**. **Table 5** summarizes the results in the existing condition.

**Table 5: Existing Runoff Data – 100-year**

| EXISTING CONDITIONS |           |                              |                              |                                    |
|---------------------|-----------|------------------------------|------------------------------|------------------------------------|
| Drainage Area Name  | Area (AC) | Peak Outflow, Q, 100YR (CFS) | Total Runoff 100 YR (inches) | Total Runoff Volume 100 YR (AC-FT) |
| Ex DMA-01           | 1.33      | 2.57                         | 2.38                         | 0.26                               |
| Ex DMA-02           | 1.49      | 2.11                         | 1.80                         | 0.22                               |
| Ex DMA-03           | 5.79      | 11.25                        | 2.39                         | 1.15                               |
| Ex DMA-04           | 4.00      | 8.62                         | 2.67                         | 0.89                               |
| Ex DMA-05           | 3.09      | 6.11                         | 2.44                         | 0.63                               |
| Ex DMA-06           | 0.69      | 1.49                         | 2.67                         | 0.15                               |
| Ex DMA-07           | 6.03      | 13.02                        | 2.67                         | 1.34                               |
| Ex DMA-08           | 6.56      | 12.76                        | 2.39                         | 1.31                               |

| EXISTING CONDITIONS |           |                              |                              |                                    |
|---------------------|-----------|------------------------------|------------------------------|------------------------------------|
| Drainage Area Name  | Area (AC) | Peak Outflow, Q, 100YR (CFS) | Total Runoff 100 YR (inches) | Total Runoff Volume 100 YR (AC-FT) |
| Ex DMA-09           | 5.83      | 8.23                         | 1.80                         | 0.87                               |
| <b>TOTAL</b>        | 34.81     | 66.16                        | 21.21                        | 6.83                               |

## 5. Proposed Condition Analysis

### West of McCloy Avenue At-Grade Crossing

The proposed project will significantly increase the impervious area and therefore, the peak runoff from the site due to the addition of four tracks and access roads. The track roadbed will also require the filling of most of the McCloy Yard ditches and capping of the connecting culverts. Drainage will be restored west of Track 946 by grading a new trapezoidal ditch just north of McCloy Avenue that continues to flow west to the Humphreys outfall.

### East of McCloy Avenue At-Grade Crossing

The addition of a fourth track east of Track 946 will not leave adequate width to grade a ditch without impacting McCloy Avenue. Therefore, an 18" storm drainpipe will be provided just north of McCloy Avenue fed by a series of storm drain catch basins collecting runoff. A detention pond was considered in the prior design between Track 946 and Port Expressway. However, this area has high arsenic levels and is a DTSC remedial site as part of Site 47. The grading and drainage design was changed to remove a detention basin in this area to alleviate potential concerns with groundwater contamination. Instead, the 18" storm drain will now have a high point at approx. Sta. 34+70. East of this station, the 18" pipe will drain east toward the proposed detention pond at the east limit of the yard north of McCloy Avenue. This detention basin will provide water quality treatment and flow attenuation through an outlet orifice control, before flowing through a proposed culvert underneath McCloy Avenue. This culvert will discharge runoff south into the recently constructed ditches south of McCloy Avenue for the Trammell Crow project.

### West of Port Expressway (Site 47)

West of the station 34+70, the pipe will drain west into a new ditch graded along Track 946. The approved RAP for Site 47 will cover the mitigation measures required for a shallow ditch that conveys runoff instead of holding standing water. The trackside ditches along Track 946 in Site 47 will flow into a new proposed culvert underneath Port Expressway that will drain into the recently constructed ditch east of Port Expressway for the Trammell Crow project. A new v-ditch will also be graded along the proposed roadway connection draining towards the v-ditch. A new culvert underneath the roadway will receive the runoff from the north and tie back to the existing v-ditch along Port Expressway to the south of the new roadway.

### North of the McCloy Yard Tracks

The project will create a low point north between the proposed tracks and the existing Port beltline. A series of perforated underdrain pipes will capture runoff entering the low points and route it

south into the proposed ditch or 18" storm drainpipe through a series of 7 track culverts spaced throughout the project.

## 5.1 Tributary Areas

The proposed improvements will increase the impervious area and weighted CN number but also break up the existing drainage areas into smaller management areas by creating a new highpoint due to the new track roadbed crown. The drainage areas south of the crown tend to be longer feeding directly to the proposed ditch or 18" storm drainpipe. The drainage areas between the crown and the Port beltline will be broken up into even smaller fragments, each draining to the series of proposed underdrains. South of McCloy Avenue, the area between Track 946 and Port Expressway will be broken into two smaller areas due to the introduction of a new roadway crown connecting Port Expressway and Daggett Road. The Site 47 area and the area east of McCloy Avenue at-grade crossing will ultimately drain to the recently completed Trammell Crow ditch that connects to the Port's drainage network feeding the ultimate outfall to Burns Cutoff. The area south of the new roadway will continue to drain southeast into the existing v-ditch along Port Expressway. The proposed drainage areas are shown in **Appendix C**.

## 5.2 Runoff Data

The results of the peak runoff and total runoff volume from the site drainage area for the proposed conditions for the 100-year storm are summarized in **Table 6**. A detailed report of the results is presented in **Table 1** of **Appendix G**. The proposed improvements increased total runoff volume by 0.31 AC-FT.

**Table 6: Proposed Runoff Data – 100-year**

| PROPOSED CONDITIONS |           |                              |                             |                                    |
|---------------------|-----------|------------------------------|-----------------------------|------------------------------------|
| Drainage Area Name  | Area (AC) | Peak Outflow, Q, 100YR (CFS) | Total Runoff 100YR (inches) | Total Runoff Volume 100 YR (AC-FT) |
| DMA-01              | 1.33      | 2.57                         | 2.38                        | 0.26                               |
| DMA-02              | 1.49      | 2.45                         | 2.05                        | 0.25                               |
| DMA-03              | 4.09      | 7.74                         | 2.33                        | 0.79                               |
| DMA-03A             | 1.04      | 2.25                         | 2.67                        | 0.23                               |
| DMA-03B             | 0.90      | 1.93                         | 2.67                        | 0.20                               |
| DMA-04              | 3.95      | 8.52                         | 2.67                        | 0.88                               |
| DMA-05              | 1.34      | 2.89                         | 2.67                        | 0.30                               |
| DMA-05A             | 1.29      | 2.79                         | 2.67                        | 0.29                               |
| DMA-06              | 0.56      | 1.20                         | 2.67                        | 0.12                               |
| DMA-07              | 6.03      | 13.02                        | 2.67                        | 1.34                               |
| DMA-08              | 1.13      | 2.43                         | 2.67                        | 0.25                               |
| DMA-08A             | 1.05      | 2.28                         | 2.67                        | 0.23                               |
| DMA-08B             | 0.59      | 1.28                         | 2.67                        | 0.13                               |
| DMA-08C             | 0.41      | 0.88                         | 2.67                        | 0.09                               |
| DMA-08D             | 0.51      | 1.10                         | 2.67                        | 0.11                               |
| DMA-08E             | 3.43      | 6.34                         | 2.28                        | 0.65                               |
| DMA-09              | 2.36      | 4.23                         | 2.21                        | 0.43                               |
| DMA-09A             | 2.36      | 3.42                         | 1.84                        | 0.36                               |
| DMA-09B             | 0.79      | 1.21                         | 1.92                        | 0.13                               |
| DMA-09C             | 0.38      | 0.65                         | 2.10                        | 0.07                               |
| <b>TOTAL</b>        | 35.03     | 69.18                        | 45.19                       | 7.14                               |

### 5.3 Terminal Drainage Conditions

Per **Figure 1**, the project footprint has two outfalls – west of Humphreys St. culvert and the other, east of the Port Expressway culvert. This work does not modify the terminal drainage conditions to the two outfall locations at the Humphreys Street culvert and the Port Expressway culvert. The project introduces a new terminal condition into the Trammell Crow ditch south of McCloy Avenue.

## 6. 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. **Attachment E** shows the schematic SSA project set up for existing and proposed conditions.

### 6.1 Storm Drain Analysis

SSA utilizes Manning's equation to calculate the capacity of the proposed HDPE 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<sub>CAP</sub> = Volumetric flow rate passing through the pipe in cfs.

A = Cross-sectional area of flow normal to the flow direction in ft<sup>2</sup>

S = Bottom slope of the channel in ft/ft

n = Manning Roughness coefficient. Manning's value is provided in SSA for the conduit type, size, and material. Typically, they are 0.010 for RCP pipes, and 0.011-0.015 for HDPE pipes

R = Hydraulic Radius = A/P

P = Wetted perimeter of the cross-sectional area of flow in ft.

Q<sub>REQ</sub> = Peak flow for 100-year storm event

In 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.

$$h_e = K_e \cdot \frac{v^2}{2g}$$

$$h_x = K_x \cdot \frac{v^2}{2g}$$

$$h_b = K_b \cdot \frac{v^2}{2g}$$

Where:

h<sub>e</sub> = entrance head loss (ft or m)

h<sub>x</sub> = exit head loss (ft or m)

h<sub>b</sub> = bent head loss (ft or m)

K<sub>e</sub> = entrance loss coefficient (typically ranges from 0.2 to 0.5)

K<sub>x</sub> = exit loss coefficient (1.0 is typical unless otherwise modified)

K<sub>b</sub> = bent loss coefficient (45° bend: K<sub>b</sub>≈0.2, 90° bend: K<sub>b</sub>≈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:

$$H_1 = H_2 + h_l$$

Where:

$H_1, H_2$  = total heads at upstream and downstream

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

**Table 7** summarizes the closed channel flow results in the proposed condition. All proposed pipe networks operate under capacity in the 100-year event. Detailed results for all storm events are provided in **Appendix G Tables 3, 4, and 5**.

**Table 7: Pipe Capacity Summary – 100-year**

| Pipe Name | Drainage Areas    | Peak flow 100 Year (cfs) | Dia. D (in) | Manning's (n) | Slope S (ft) | Flow Velocity (fps) | Capacity $Q_{CAP}$ (cfs) | $Q_{CAP} > Q_{REQ}$ |
|-----------|-------------------|--------------------------|-------------|---------------|--------------|---------------------|--------------------------|---------------------|
| Prop SD-1 | 08, 08B, 08C      | 1.73                     | 18.0        | 0.0100        | 0.20         | 0.98                | 5.15                     | Yes                 |
| Prop SD-2 | 08, 08B           | 1.94                     | 18.0        | 0.0100        | 0.20         | 1.34                | 5.09                     | Yes                 |
| Prop SD-3 | 08, 08B           | 2.01                     | 18.0        | 0.0100        | 0.20         | 2.50                | 5.09                     | Yes                 |
| Prop SD-4 | 08, 08A           | 3.75                     | 21.0        | 0.0100        | 0.20         | 3.40                | 8.17                     | Yes                 |
| Prop SD-5 | 08, 08B, 08C, 08D | 1.86                     | 21          | 0.012         | 0.31         | 0.77                | 5.99                     | Yes                 |
| Prop UD-1 | 08D               | 1.07                     | 10.0        | 0.0150        | 0.50         | 2.27                | 1.34                     | Yes                 |
| Prop UD-2 | 08C               | 0.86                     | 10.0        | 0.0120        | 0.50         | 2.70                | 1.68                     | Yes                 |
| Prop UD-3 | 08B               | 1.23                     | 10.0        | 0.0110        | 0.50         | 3.23                | 1.83                     | Yes                 |
| Prop UD-4 | 08A               | 2.24                     | 12.0        | 0.0110        | 0.48         | 3.72                | 2.92                     | Yes                 |
| Prop UD-5 | 05                | 2.64                     | 15.0        | 0.0120        | 0.17         | 2.51                | 2.92                     | Yes                 |
| Prop UD-6 | 03B               | 1.78                     | 15.0        | 0.0120        | 0.20         | 2.33                | 3.10                     | Yes                 |
| Prop UD-7 | 03A               | 2.25                     | 15.0        | 0.0120        | 0.20         | 1.83                | 3.13                     | Yes                 |

## 6.2 Culvert Analysis

The project proposed 7 track culverts to drain the north underdrains to the south ditch and 18" storm drain alongside McCloy Avenue. Additionally, a culvert is also proposed underneath the new roadway draining the detention pond to the existing v-ditch. All culverts are proposed to be CMP per railroad standards and vary in size from 12" in diameter to 24". The Manning's values were typically 0.011-0.015 for CMP culverts with higher values for bigger sizes. SSA utilizes a similar method to computing flow through culverts as closed pipes except the losses at the entrance and exit sections. All culverts were modeled as projecting out into the ditch. **Table 8** below summarizes the 100-year results for all proposed culverts. Detailed results for all design storms are provided in **Appendix G Tables 3, 4, and 5**.

**Table 8: Culvert Capacity Summary – 100-year**

| Pipe Name            | Drainage Areas         | Peak flow 100 Year (cfs) | D (in) | Manning's (n) | Slope S (ft) | Flow Velocity (fps) | Capacity Q <sub>CAP</sub> (cfs) | Q <sub>CAP</sub> > Q <sub>REQ</sub> |
|----------------------|------------------------|--------------------------|--------|---------------|--------------|---------------------|---------------------------------|-------------------------------------|
| Prop Culv #1         | 08D                    | 1.08                     | 12.0   | 0.0110        | 0.55         | 1.80                | 3.12                            | Yes                                 |
| Prop Culv #2         | 08C                    | 0.88                     | 12.0   | 0.0110        | 1.00         | 1.14                | 4.21                            | Yes                                 |
| Prop Culv #3         | 08B                    | 1.29                     | 12.0   | 0.0110        | 1.00         | 1.65                | 4.21                            | Yes                                 |
| Prop Culv #4         | 08A                    | 2.38                     | 12.0   | 0.0110        | 1.50         | 3.03                | 5.16                            | Yes                                 |
| Prop Culv #5         | 05                     | 2.48                     | 18.0   | 0.0140        | 0.27         | 1.66                | 5.07                            | Yes                                 |
| Prop Culv #6         | 03B                    | 1.43                     | 21.0   | 0.0140        | 0.27         | 1.12                | 7.63                            | Yes                                 |
| Prop Culv #7         | 03A                    | 0.05                     | 24.0   | 0.0150        | 0.55         | 0.04                | 14.54                           | Yes                                 |
| Prop. McCloy Culvert | 08, 08B, 08C, 08D 08E, | 0.41                     | 15.0   | 0.0150        | 1.6          | 1.91                | 4.0                             | Yes                                 |
| Prop. 946 Culvert    | 08, 08B, 09            | 6.44                     | 18.0   | 0.0150        | 0.5          | 5.58                | 6.44                            | Yes                                 |

## 6.3 Ditch Analysis

The project proposed a new trapezoidal ditch south of the tracks flowing west into the Humphreys Street canal starting just west of the new Track 946 crossing. This ditch receives runoff from a series of culverts that capture runoff from the north underdrains. The ditch was sized per UPRR specifications for an industrial track roadbed with a 2' minimum bottom width and minimum 2' depth from the top of subgrade. The ditch gets deeper and wider as it approaches west and ties back into the existing historic ditch. From an SSA analysis standpoint, this ditch was modeled as multiple ditch segments, as shown in **Table 9** to simulate the progressively increasing flows that this ditch receives from the cross-culverts as we move west.

A v-ditch is also proposed just south of Track 946 that will convey runoff from the 18" storm drains to the proposed detention basin.

SSA 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.

**Table 9** below summarizes the 100-year results for all open-channels. Detailed results for all design storms are provided in **Appendix G Table 6**.

**Table 9: Open Channel Capacity Summary – 100-year**

| Pipe Name            | Drainage Areas        | Peak flow 100 Year (cfs) | Manning's (n) | Slope S (ft) | Flow Velocity (fps) | Capacity Q <sub>CAP</sub> (cfs) | Q <sub>CAP</sub> > Q <sub>REQ</sub> |
|----------------------|-----------------------|--------------------------|---------------|--------------|---------------------|---------------------------------|-------------------------------------|
| McCloy Ditch 1       | 05A                   | 1.50                     | 0.0250        | 0.10         | 0.51                | 24.18                           | Yes                                 |
| McCloy Ditch 2       | 05, 05A               | 4.42                     | 0.0250        | 0.10         | 0.80                | 23.80                           | Yes                                 |
| McCloy Ditch 3       | 03, 05, 05A           | 9.73                     | 0.0250        | 0.10         | 1.69                | 24.18                           | Yes                                 |
| McCloy Ditch 4       | 03, 03B, 05, 05A      | 8.45                     | 0.0250        | 0.10         | 1.04                | 52.34                           | Yes                                 |
| McCloy Ditch 5       | 03, 03A, 03B, 05, 05A | 6.23                     | 0.0250        | 0.03         | 0.29                | 38.96                           | Yes                                 |
| Port Roadway V-Ditch | 09C                   | 0.63                     | 0.016         | 0.34         | 1.35                | 12.36                           | Yes                                 |
| Trk 946 Ditch        | 08, 08A, 08B, 09      | 6.38                     | 0.016         | 0.12         | 1.10                | 27.11                           | Yes                                 |

## 6.4 Detention Basin Analysis

A detention basin typically allows a temporary storm water impoundment depth of one to three feet, have an outlet that allows a slow discharge of water to the discharge point, and is typically dry between storm events. The benefits of an extended detention basin include the settling of particulate matter, reduction of the peak storm water runoff volume for flood control and water quality enhancements, reduction of runoff velocity, and promotion of biofiltering and conversion of pollutants.

The proposed detention basin north of McCloy Avenue at the eastern limit of the new yard was sized to accommodate a 100-year storm event with a culvert outlet draining to the trapezoidal ditch south of McCloy Avenue that was recently constructed for the Trammell Crow development. A 3" orifice was proposed at the outlet to control the peak outflow and promote flow attenuation. The basin demonstrated adequate capacity to store a 100-year event as shown in **Table 10** below, and it also satisfies the volume-based design criteria outlined in the CASQA BMP Handbook per Port DSP

requirements. As shown in Exhibit D of Attachment G, the required 'water quality' retention volume for the detention pond is approximately 5,800 cu. ft., which is being met for the lowest storm evaluated – 10-year.

Detailed analysis results are provided in **Attachment G Table 2 and Figure 1**. Please note that the existing Fyffe ditches demonstrate flooding in the 100-year storm. That is likely due to their design criteria being the CASQA requirements. The project scope does not include improving or adding capacity to drainage features not impacted by the proposed developments.

**Table 10: Detention Basin Analysis Summary – 100-year**

| Basin/ Storage     | Storage Depth (ft) | Max Depth (ft) | Min Freeboard (ft) | Total Flooded Volume (ac-inches) | Total Time Flooded (mins) |
|--------------------|--------------------|----------------|--------------------|----------------------------------|---------------------------|
| Ex. Fyffe Ditch #1 | 2.50               | 2.28           | 0.22               | 0.00                             | 0.00                      |
| Ex. Fyffe Ditch #2 | 1.00               | 1.00           | 0.00               | 0.28                             | 20.00                     |
| Ex. Fyffe Ditch #3 | 2.00               | 1.54           | 0.46               | 0.00                             | 0.00                      |
| Ex. McCloy Canal   | 2.50               | 0.86           | 1.64               | 0.00                             | 0.00                      |
| Prop. McCloy Basin | 3.5                | 2.36           | 1.14               | 0.00                             | 0.00                      |

## 7. Stormwater Quality Evaluation

### 7.1 Project Specific Requirements

Port's DSP lists the following BMPs that apply to this project.

- Demonstrate how potential pollutants that may infiltrate into the soil and groundwater will be kept from being discharged to the infiltration BMP; and
- Propose and commit to a monitoring program to periodically verify that pollutants in the surface water are not impacting the soil and groundwater.

The Port also recommends one of several LIDs be implemented. The following LID treatment was adopted for this project:

- Extended Detention Basin (TC-22)

### 7.2 Treatment Controls

Based on Port's DSP Section 3, which outlines the mandatory minimum BMPs and specific BMPs for West Complex, the following BMPs are proposed to be adopted for this project.

- **Label all storm drain inlets (SD-13)** that only storm water is allowed and drain flows to delta per CASQA requirements.
- **Conserve Natural Areas (SD-10):** The grading of the project has been limited to the greatest extent feasible to conserve as much of the historic ditches along McCloy Avenue as possible.

Drainage along the portion of the ditch that will be filled up due to the track roadbed will be maintained through subsurface drainage systems that convey runoff to a new proposed detention basin west of Port Expressway.

- **Extended Detention Basin (TC-22):** As described in **Section 5.4**.
- **No Net Increase in Runoff Volume or Peak Rate (POS-02):** The increase in impervious area and peak runoff has been mitigated by proposing a new detention basin north of McCloy Avenue. The project site in the proposed condition has three main outfall locations that ultimately convey runoff to the Burns Cutoff pump. The portion of the site north of McCloy Avenue drains west through the existing culvert across Humphreys Street that receives runoff from the McCloy Avenue ditches. The portion of the site south of McCloy Avenue adjacent to Port Expressway drains south through a culvert conveying runoff into the Trammell Crow ditch.

The new detention basin will store runoff from the proposed project site between Carry Transit and McCloy Avenue and after a certain attenuation is achieved, will drain through a proposed orifice structure and culvert underneath McCloy Avenue discharging to the Trammell Crow ditches south of McCloy Avenue. As demonstrated in **Table 11** below, the detention pond provides adequate retention for a 100-year storm, therefore, the 100-year peak flow through the McCloy Ave outfall is 0.41 cfs in the proposed condition.

The peak outflow through the outfall just east of Port Expressway is also reduced because a majority of the drainage area previously contributing to the runoff in this area is being rerouted through the series of 18-inch storm drains into the detention pond.

The peak flow through the Humphreys Culvert will largely stay the same in the proposed condition despite the addition of the impervious area, as shown in **Table 11**. This is because the existing drainage pattern will be altered so that the area east of the McCloy Avenue crossing with Track 946 is rerouted to drain south to the new Trammell Crow ditches instead of flowing west.

**Table 11: Outfall Peak Runoff Values**

| Outfall         | Location                             | Peak Flow (cfs) |              |              |              |              |              |
|-----------------|--------------------------------------|-----------------|--------------|--------------|--------------|--------------|--------------|
|                 |                                      | Ex 10-yr        | Prop 10-yr   | Ex 50-yr     | Prop 50-yr   | Ex 100-yr    | Prop 100-yr  |
| Burns Cutoff    | West of Humphreys Street             | 35.59           | 28.31        | 51.32        | 40.32        | 57.93        | 45.36        |
| Port Expressway | Culvert underneath Port Expressway   | 4.10            | 5.79         | 6.98         | 8.72         | 8.21         | 10.17        |
| McCloy Ave      | New Culvert underneath McCloy Avenue | 0.0             | 0.32         | 0.0          | 0.38         | 0.0          | 0.41         |
| <b>TOTAL:</b>   |                                      | <b>39.69</b>    | <b>34.42</b> | <b>58.30</b> | <b>49.42</b> | <b>66.14</b> | <b>55.94</b> |



## List of Appendices

- Appendix A: FEMA Maps**
- Appendix B: Existing Drainage Area Maps**
- Appendix C: Proposed Drainage Area Maps**
- Appendix D: Hydrologic Data**
- Appendix E: SSA Input Data**
- Appendix F: Existing Drainage Calculations**
- Appendix G: Proposed Drainage Calculations**

## Appendix A: FEMA Maps



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)<br>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                                                                                                                                                   |
| GENERAL STRUCTURES          |  | Area of Undetermined Flood Hazard Zone D                                                                                                                          |
|                             |  | Channel, Culvert, or Storm Sewer                                                                                                                                  |
| OTHER FEATURES              |  | Levee, Dike, or Floodwall                                                                                                                                         |
|                             |  | 20.2 Cross Sections with 1% Annual Chance Water Surface Elevation                                                                                                 |
|                             |  | 17.5 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 be ordered 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 1-800-636-6620.

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, 2016.

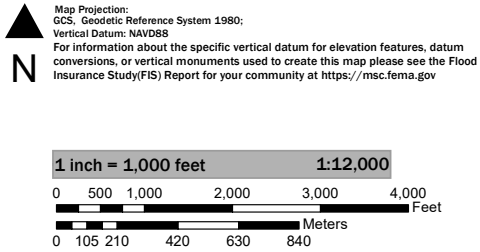
This map was exported from FEMA's National Flood Hazard Layer (NFHL) on 6/9/2020 5:23:16 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the 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



NATIONAL FLOOD INSURANCE PROGRAM  
FLOOD INSURANCE RATE MAP

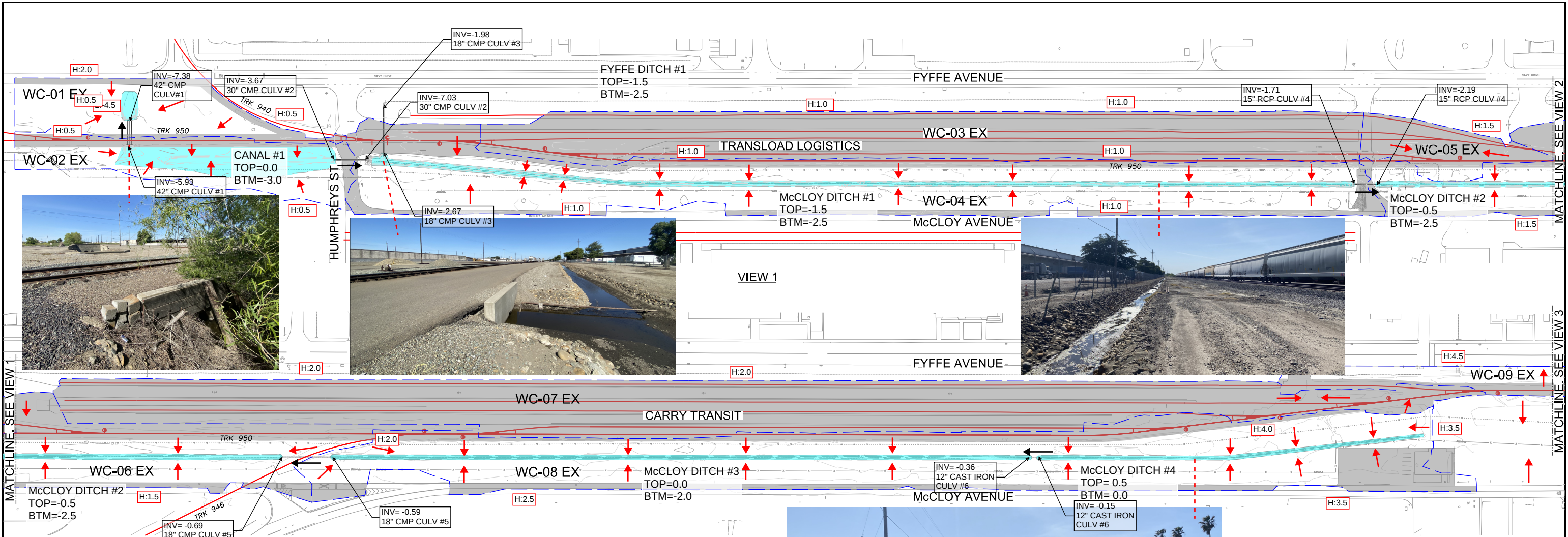
SAN JOAQUIN COUNTY, CALIFORNIA  
AND INCORPORATED AREAS  
PANEL 455 OF 835

|                                                  |        |       |
|--------------------------------------------------|--------|-------|
| Panel Contains:                                  | NUMBER | PANEL |
| COMMUNITY                                        |        |       |
| STOCKTON NAVAL 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

## Appendix B: Existing Drainage Area Maps



The ditches along Fyffe drain into the McCloy ditches through a culvert and the McCloy ditches in turn drain to the network of ditches west of Humphreys Street that convey runoff to the ultimate outfall location on Burns Cutoff.

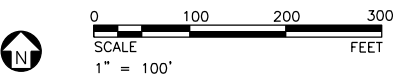
Topo survey show that McCloy ditches have negligible longitudinal slope and the ditch east of Track 946 only has culverts flowing into it with no apparent outfalls. Hence, the McCloy Avenue and Fyffe Street ditches were modeled as storage nodes with culvert outfalls except for the ditch east of Track 946. For the purposes of this project analysis, the culvert underneath Humphreys Street and the culvert underneath Port Expressway will be the two outlet locations that will receive runoff from the site area modified due to the project.

The project site is divided into nine different drainage areas. The drainage areas are bound by the crown of McCloy Avenue to the south, and the track roadbed crowns to the north, which are high points. The drainage areas are also limited in the east-west direction by either crossing roadways such as Humphreys Street and Daggett Road or crossing tracks, such as Track 940 and Track 946. To the south of McCloy Avenue, the drainage area is defined by the crown of Port Expressway to the east and Track 946 roadbed and crown of Daggett Rd to the west.

VIEW 1

VIEW 2

- DIRECTION OF PIPE FLOW
- DIRECTION OF FLOW
- DRAINAGE AREA BOUNDARIES
- IMPERVIOUS SURFACE
- EX. DRAINAGE FEATURES



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CONSTRUCTION

07/25/2023

REVISIONS:

| MARK | DATE       | DESCRIPTION |
|------|------------|-------------|
| A    | 07/25/2023 | 30% DESIGN  |

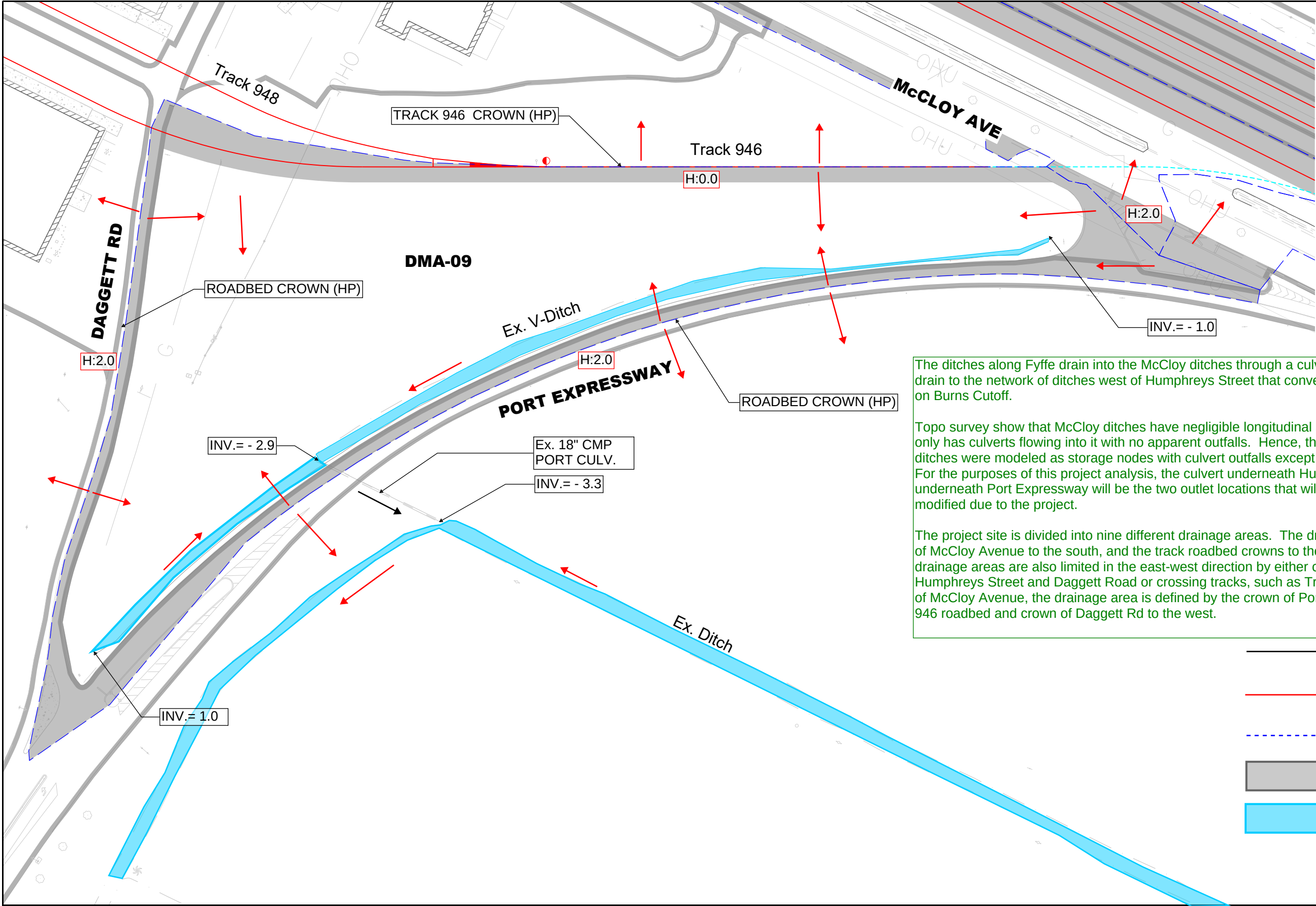
PORT OF STOCKTON  
RAIL CAPACITY IMPROVEMENTS

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STOCKTON, CA 95203

SHEET TITLE:  
EX. DRAINAGE AREAS  
WEST COMPLEX

PROJ NO: 21273  
SCALE: AS NOTED  
DATE: 07/25/2023  
DESIGNED BY: AG

SHEET NO.  
EX-001  
SHEET 7 OF 87



The ditches along Fyffe drain into the McCloy ditches through a culvert and the McCloy ditches in turn drain to the network of ditches west of Humphreys Street that convey runoff to the ultimate outfall location on Burns Cutoff.

Topo survey show that McCloy ditches have negligible longitudinal slope and the ditch east of Track 946 only has culverts flowing into it with no apparent outfalls. Hence, the McCloy Avenue and Fyffe Street ditches were modeled as storage nodes with culvert outfalls except for the ditch east of Track 946. For the purposes of this project analysis, the culvert underneath Humphreys Street and the culvert underneath Port Expressway will be the two outlet locations that will receive runoff from the site area modified due to the project.

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DIRECTION OF PIPE FLOW

DIRECTION OF FLOW

DRAINAGE AREA BOUNDARIES

IMPERVIOUS SURFACE

EX. DRAINAGE FEATURES

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SCALE  
1" = 50'  
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| MARK | DATE     | DESCRIPTION                        |
|------|----------|------------------------------------|
| C    | 06/27/25 | 100% DESIGN                        |
| B    | 08/16/23 | 15% DESIGN - ALTERNATIVES ANALYSIS |
| A    | 04/13/21 | 15% DESIGN                         |

PORT OF STOCKTON  
McCLOY RAIL YARD

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STOCKTON, CA 95203

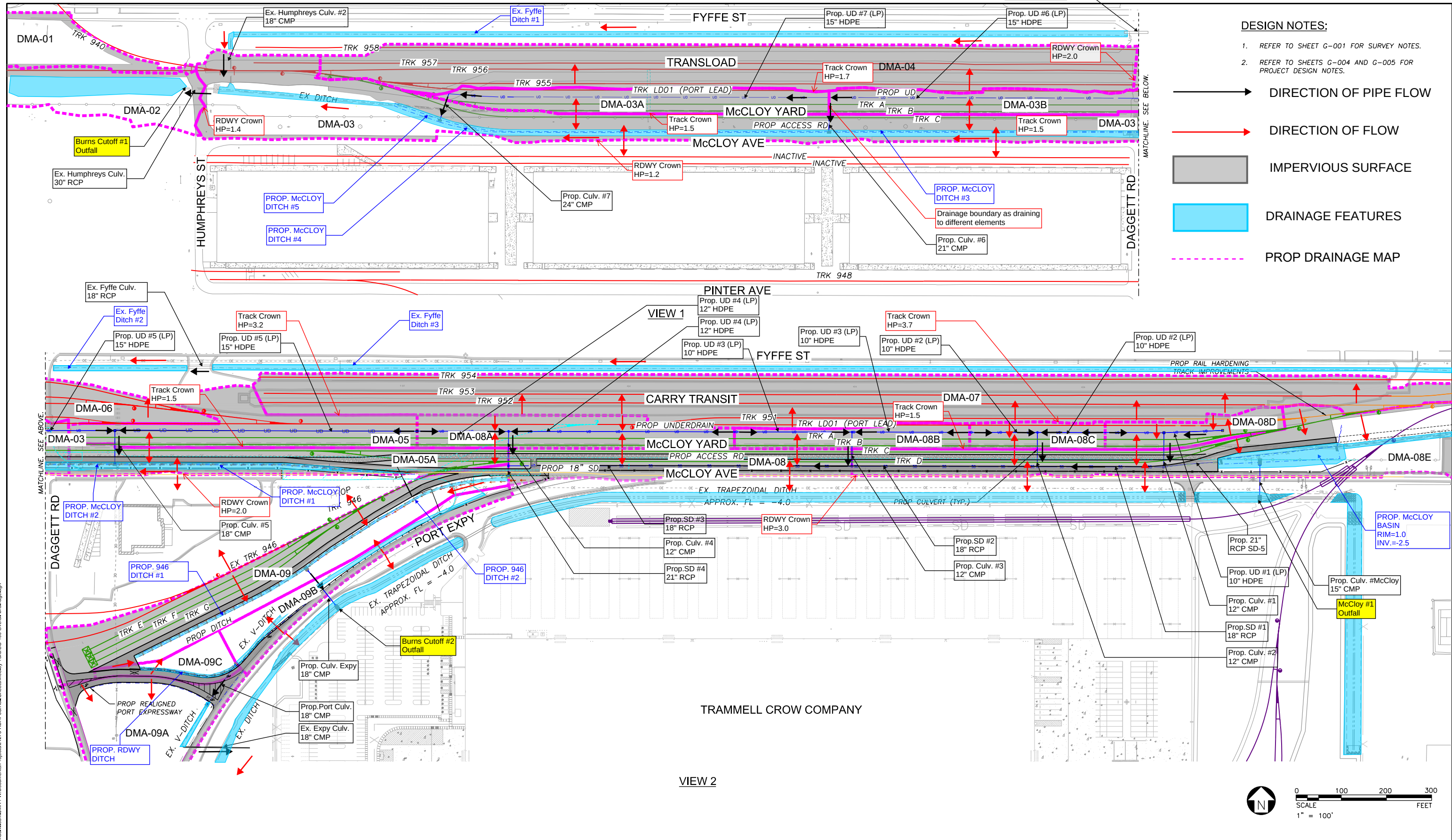
SHEET TITLE:  
EX. DRAINAGE AREA  
PORT EXPRESSWAY

PROJ NO: 21273  
SCALE: AS NOTED  
DATE: 06/27/2025  
DESIGNED BY: AG

SHEET NO.  
EX-002  
SHEET OF 73

## Appendix C: Proposed Drainage Area Maps

12/18/2025 - 2:38:42 PM - p:\2\JMA-PV-APP\JMA-PV\Documents\Projects\21273-HDR\Pos\Rail\Sheets\McCloy Yard\CG-100 Overall Drainage.dgn



- DESIGN NOTES:**
- REFER TO SHEET G-001 FOR SURVEY NOTES.
  - REFER TO SHEETS G-004 AND G-005 FOR PROJECT DESIGN NOTES.
- DIRECTION OF PIPE FLOW
- DIRECTION OF FLOW
- IMPERVIOUS SURFACE
- DRAINAGE FEATURES
- PROP DRAINAGE MAP

| <b>JMA CIVIL</b><br>383 4th Street, Ste. 201<br>Oakland, CA 94607<br>T: 925.400.4356<br>www.jmacivil.com |          | <b>HDR</b><br>2379 Gateway Oaks, Ste. 200<br>Sacramento, CA 95833<br>T: 916.679.8700<br>www.hdrinc.com |  | 100% DESIGN<br><br>12/22/2025 |  | REVISIONS:<br><table><tr><th>MARK</th><th>DATE</th><th>DESCRIPTION</th></tr><tr><td>D</td><td>12/22/25</td><td>100% DESIGN - GRADING CHANGES</td></tr><tr><td>C</td><td>06/27/25</td><td>100% DESIGN</td></tr><tr><td>B</td><td>08/16/23</td><td>15% DESIGN - ALTERNATIVES ANALYSIS</td></tr><tr><td>A</td><td>04/13/21</td><td>15% DESIGN</td></tr></table> |  | MARK | DATE | DESCRIPTION | D | 12/22/25 | 100% DESIGN - GRADING CHANGES | C | 06/27/25 | 100% DESIGN | B | 08/16/23 | 15% DESIGN - ALTERNATIVES ANALYSIS | A | 04/13/21 | 15% DESIGN |  <b>PORT OF STOCKTON</b><br>McCLOY RAIL YARD<br><br>315 WEST FYFFE STREET<br>STOCKTON, CA 95203 |  | SHEET TITLE:<br><b>OVERALL GRADING &amp; DRAINAGE<br/>PLAN<br/>McCLOY YARD</b><br><br>PROJ NO: 21273<br>SCALE: AS NOTED<br>DATE: 12/22/2025<br>DESIGNED BY: AG |  | SHEET NO.<br><b>CG-100</b><br>SHEET OF 72 |  |
|----------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------|--|-------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|------|-------------|---|----------|-------------------------------|---|----------|-------------|---|----------|------------------------------------|---|----------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------|--|
| MARK                                                                                                     | DATE     | DESCRIPTION                                                                                            |  |                               |  |                                                                                                                                                                                                                                                                                                                                                              |  |      |      |             |   |          |                               |   |          |             |   |          |                                    |   |          |            |                                                                                                                                                                                      |  |                                                                                                                                                                |  |                                           |  |
| D                                                                                                        | 12/22/25 | 100% DESIGN - GRADING CHANGES                                                                          |  |                               |  |                                                                                                                                                                                                                                                                                                                                                              |  |      |      |             |   |          |                               |   |          |             |   |          |                                    |   |          |            |                                                                                                                                                                                      |  |                                                                                                                                                                |  |                                           |  |
| C                                                                                                        | 06/27/25 | 100% DESIGN                                                                                            |  |                               |  |                                                                                                                                                                                                                                                                                                                                                              |  |      |      |             |   |          |                               |   |          |             |   |          |                                    |   |          |            |                                                                                                                                                                                      |  |                                                                                                                                                                |  |                                           |  |
| B                                                                                                        | 08/16/23 | 15% DESIGN - ALTERNATIVES ANALYSIS                                                                     |  |                               |  |                                                                                                                                                                                                                                                                                                                                                              |  |      |      |             |   |          |                               |   |          |             |   |          |                                    |   |          |            |                                                                                                                                                                                      |  |                                                                                                                                                                |  |                                           |  |
| A                                                                                                        | 04/13/21 | 15% DESIGN                                                                                             |  |                               |  |                                                                                                                                                                                                                                                                                                                                                              |  |      |      |             |   |          |                               |   |          |             |   |          |                                    |   |          |            |                                                                                                                                                                                      |  |                                                                                                                                                                |  |                                           |  |

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

## Appendix D: Hydrologic Data



## POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishant Roy, Carl Trypsak, Dale Uhrh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bommil, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoon

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps\\_&\\_aerials](#)

### PF tabular

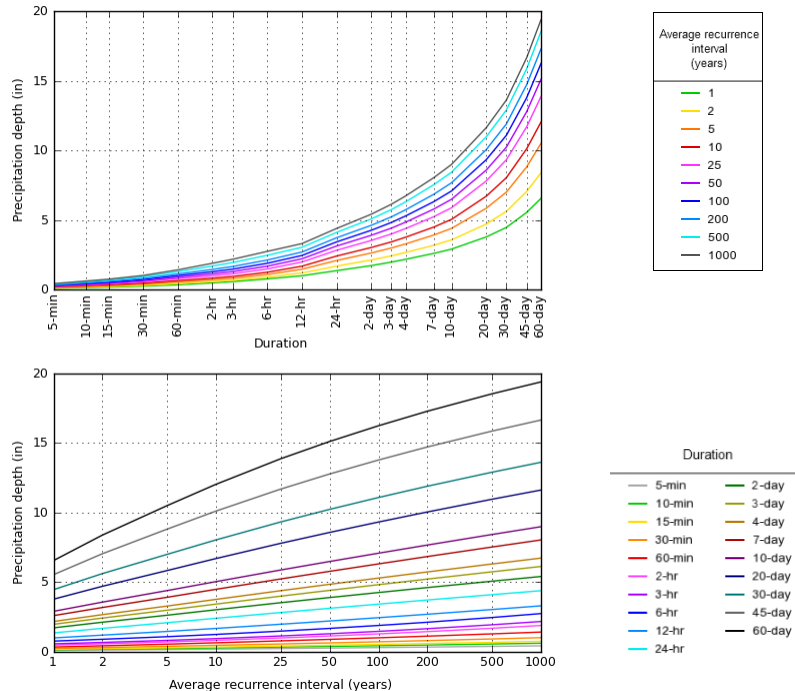
| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup> |                                     |                        |                        |                        |                        |                        |                        |                        |                        |                        |
|----------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Duration                                                                                                 | Average recurrence interval (years) |                        |                        |                        |                        |                        |                        |                        |                        |                        |
|                                                                                                          | 1                                   | 2                      | 5                      | 10                     | 25                     | 50                     | 100                    | 200                    | 500                    | 1000                   |
| 5-min                                                                                                    | 0.107<br>(0.095-0.121)              | 0.134<br>(0.119-0.152) | 0.170<br>(0.151-0.194) | 0.200<br>(0.175-0.231) | 0.242<br>(0.203-0.293) | 0.275<br>(0.224-0.342) | 0.310<br>(0.244-0.397) | 0.346<br>(0.263-0.460) | 0.396<br>(0.285-0.555) | 0.436<br>(0.300-0.639) |
| 10-min                                                                                                   | 0.153<br>(0.136-0.174)              | 0.192<br>(0.171-0.218) | 0.244<br>(0.216-0.279) | 0.287<br>(0.251-0.332) | 0.347<br>(0.291-0.419) | 0.395<br>(0.321-0.490) | 0.444<br>(0.350-0.569) | 0.496<br>(0.376-0.659) | 0.567<br>(0.408-0.796) | 0.624<br>(0.430-0.916) |
| 15-min                                                                                                   | 0.185<br>(0.165-0.211)              | 0.232<br>(0.206-0.264) | 0.295<br>(0.261-0.337) | 0.347<br>(0.304-0.401) | 0.420<br>(0.352-0.507) | 0.477<br>(0.389-0.593) | 0.537<br>(0.423-0.688) | 0.599<br>(0.455-0.797) | 0.686<br>(0.494-0.963) | 0.755<br>(0.520-1.11)  |
| 30-min                                                                                                   | 0.251<br>(0.223-0.285)              | 0.314<br>(0.279-0.358) | 0.399<br>(0.353-0.456) | 0.470<br>(0.412-0.543) | 0.569<br>(0.476-0.687) | 0.646<br>(0.526-0.802) | 0.727<br>(0.573-0.932) | 0.812<br>(0.616-1.08)  | 0.929<br>(0.669-1.30)  | 1.02<br>(0.704-1.50)   |
| 60-min                                                                                                   | 0.350<br>(0.311-0.397)              | 0.438<br>(0.389-0.498) | 0.556<br>(0.492-0.635) | 0.655<br>(0.573-0.756) | 0.792<br>(0.663-0.957) | 0.900<br>(0.733-1.12)  | 1.01<br>(0.798-1.30)   | 1.13<br>(0.859-1.50)   | 1.29<br>(0.931-1.82)   | 1.42<br>(0.981-2.09)   |
| 2-hr                                                                                                     | 0.489<br>(0.435-0.555)              | 0.583<br>(0.518-0.664) | 0.716<br>(0.634-0.818) | 0.832<br>(0.728-0.960) | 1.00<br>(0.837-1.21)   | 1.14<br>(0.928-1.42)   | 1.29<br>(1.02-1.66)    | 1.46<br>(1.11-1.94)    | 1.70<br>(1.22-2.38)    | 1.90<br>(1.31-2.78)    |
| 3-hr                                                                                                     | 0.577<br>(0.513-0.656)              | 0.680<br>(0.604-0.773) | 0.826<br>(0.731-0.943) | 0.954<br>(0.835-1.10)  | 1.14<br>(0.957-1.38)   | 1.30<br>(1.06-1.62)    | 1.48<br>(1.16-1.89)    | 1.67<br>(1.26-2.22)    | 1.95<br>(1.40-2.73)    | 2.18<br>(1.50-3.20)    |
| 6-hr                                                                                                     | 0.775<br>(0.690-0.881)              | 0.907<br>(0.805-1.03)  | 1.09<br>(0.967-1.25)   | 1.25<br>(1.10-1.45)    | 1.49<br>(1.25-1.80)    | 1.69<br>(1.37-2.09)    | 1.90<br>(1.50-2.43)    | 2.13<br>(1.62-2.83)    | 2.47<br>(1.78-3.46)    | 2.75<br>(1.90-4.04)    |
| 12-hr                                                                                                    | 1.00<br>(0.893-1.14)                | 1.20<br>(1.07-1.37)    | 1.47<br>(1.30-1.68)    | 1.69<br>(1.48-1.95)    | 1.99<br>(1.66-2.40)    | 2.22<br>(1.81-2.75)    | 2.46<br>(1.94-3.15)    | 2.70<br>(2.05-3.60)    | 3.04<br>(2.19-4.27)    | 3.31<br>(2.28-4.85)    |
| 24-hr                                                                                                    | 1.37<br>(1.23-1.55)                 | 1.69<br>(1.52-1.91)    | 2.10<br>(1.88-2.38)    | 2.41<br>(2.15-2.76)    | 2.83<br>(2.45-3.33)    | 3.13<br>(2.67-3.75)    | 3.43<br>(2.86-4.20)    | 3.73<br>(3.03-4.67)    | 4.11<br>(3.22-5.35)    | 4.39<br>(3.34-5.90)    |
| 2-day                                                                                                    | 1.73<br>(1.56-1.95)                 | 2.13<br>(1.92-2.41)    | 2.63<br>(2.37-2.99)    | 3.03<br>(2.70-3.46)    | 3.53<br>(3.06-4.16)    | 3.90<br>(3.32-4.68)    | 4.26<br>(3.55-5.22)    | 4.62<br>(3.76-5.79)    | 5.08<br>(3.98-6.61)    | 5.41<br>(4.12-7.26)    |
| 3-day                                                                                                    | 1.98<br>(1.79-2.47)                 | 2.43<br>(2.19-2.75)    | 2.99<br>(2.69-3.40)    | 3.43<br>(3.06-3.92)    | 4.00<br>(3.47-4.71)    | 4.42<br>(3.76-5.30)    | 4.83<br>(4.02-5.91)    | 5.23<br>(4.25-6.56)    | 5.75<br>(4.51-7.48)    | 6.13<br>(4.66-8.23)    |
| 4-day                                                                                                    | 2.18<br>(1.97-2.47)                 | 2.68<br>(2.41-3.03)    | 3.29<br>(2.96-3.73)    | 3.77<br>(3.37-4.31)    | 4.39<br>(3.81-5.17)    | 4.85<br>(4.13-5.81)    | 5.30<br>(4.42-6.49)    | 5.74<br>(4.67-7.20)    | 6.31<br>(4.95-8.22)    | 6.74<br>(5.12-9.04)    |
| 7-day                                                                                                    | 2.60<br>(2.35-2.95)                 | 3.19<br>(2.87-3.61)    | 3.92<br>(3.53-4.45)    | 4.49<br>(4.01-5.14)    | 5.24<br>(4.54-6.16)    | 5.78<br>(4.93-6.93)    | 6.32<br>(5.27-7.73)    | 6.85<br>(5.57-8.59)    | 7.53<br>(5.90-9.80)    | 8.04<br>(6.11-10.8)    |
| 10-day                                                                                                   | 2.91<br>(2.63-3.29)                 | 3.57<br>(3.22-4.05)    | 4.40<br>(3.96-5.00)    | 5.05<br>(4.51-5.77)    | 5.88<br>(5.10-6.92)    | 6.49<br>(5.53-7.78)    | 7.09<br>(5.91-8.67)    | 7.67<br>(6.24-9.63)    | 8.43<br>(6.61-11.0)    | 8.99<br>(6.84-12.1)    |
| 20-day                                                                                                   | 3.78<br>(3.41-4.28)                 | 4.71<br>(4.24-5.33)    | 5.84<br>(5.25-6.63)    | 6.70<br>(5.98-7.66)    | 7.80<br>(6.76-9.17)    | 8.58<br>(7.30-10.3)    | 9.32<br>(7.77-11.4)    | 10.0<br>(8.17-12.6)    | 11.0<br>(8.59-14.3)    | 11.6<br>(8.84-15.6)    |
| 30-day                                                                                                   | 4.47<br>(4.03-5.06)                 | 5.62<br>(5.07-6.37)    | 7.00<br>(6.30-7.95)    | 8.04<br>(7.18-9.19)    | 9.33<br>(8.09-11.0)    | 10.2<br>(8.71-12.3)    | 11.1<br>(9.24-13.6)    | 11.9<br>(9.67-14.9)    | 12.9<br>(10.1-16.8)    | 13.6<br>(10.4-18.3)    |
| 45-day                                                                                                   | 5.54<br>(5.00-6.27)                 | 7.05<br>(6.35-7.98)    | 8.81<br>(7.92-10.0)    | 10.1<br>(9.03-11.6)    | 11.7<br>(10.1-13.8)    | 12.8<br>(10.9-15.3)    | 13.8<br>(11.5-16.9)    | 14.7<br>(12.0-18.5)    | 15.9<br>(12.4-20.6)    | 16.6<br>(12.7-22.3)    |
| 60-day                                                                                                   | 6.56<br>(5.91-7.42)                 | 8.39<br>(7.56-9.50)    | 10.5<br>(9.44-11.9)    | 12.0<br>(10.7-13.8)    | 13.9<br>(12.0-16.3)    | 15.1<br>(12.9-18.1)    | 16.2<br>(13.5-19.9)    | 17.3<br>(14.1-21.7)    | 18.5<br>(14.5-24.1)    | 19.4<br>(14.7-26.0)    |

<sup>1</sup> 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.  
Please refer to NOAA Atlas 14 document for more information.

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### PF graphical

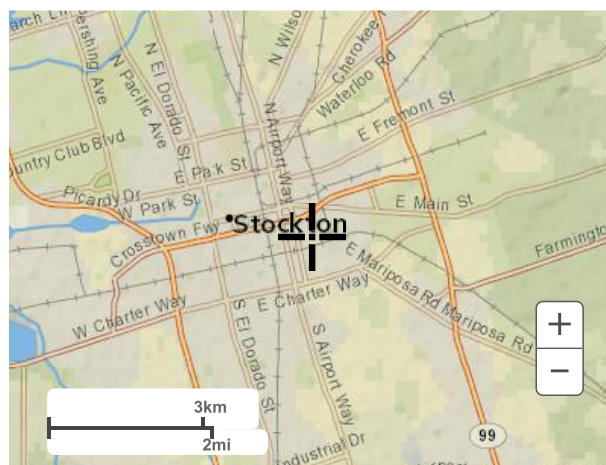
PDS-based depth-duration-frequency (DDF) curves  
Latitude: 37.9500°, Longitude: -121.2667°



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### Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)



## POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps\\_&\\_aerials](#)

### PF tabular

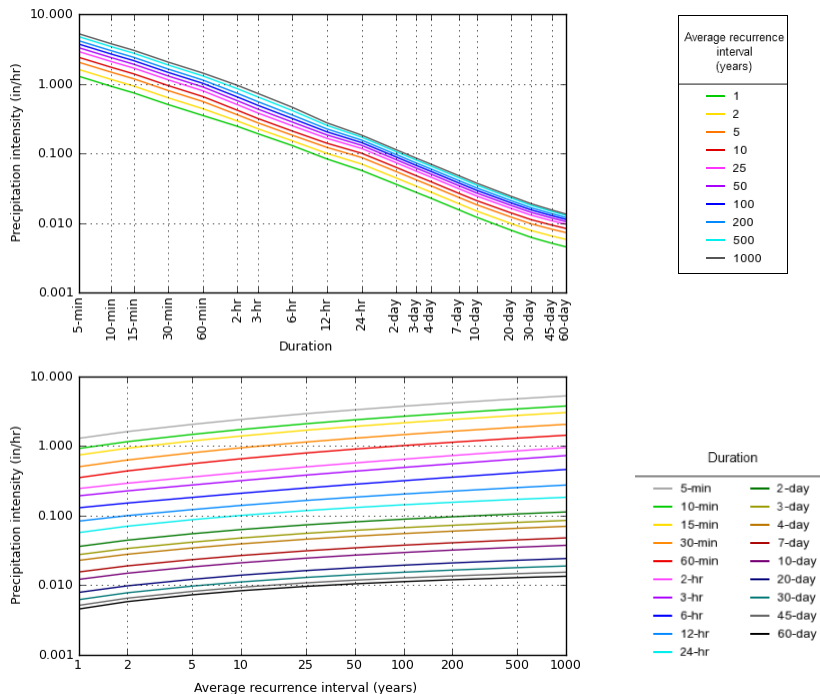
| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) <sup>1</sup> |                                     |                        |                        |                        |                        |                        |                        |                        |                        |                        |
|---------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Duration                                                                                                      | Average recurrence interval (years) |                        |                        |                        |                        |                        |                        |                        |                        |                        |
|                                                                                                               | 1                                   | 2                      | 5                      | 10                     | 25                     | 50                     | 100                    | 200                    | 500                    | 1000                   |
| 5-min                                                                                                         | 1.28<br>(1.14-1.45)                 | 1.61<br>(1.43-1.82)    | 2.04<br>(1.81-2.33)    | 2.40<br>(2.10-2.77)    | 2.90<br>(2.44-3.52)    | 3.30<br>(2.69-4.10)    | 3.72<br>(2.93-4.76)    | 4.15<br>(3.16-5.52)    | 4.75<br>(3.42-6.66)    | 5.23<br>(3.60-7.67)    |
| 10-min                                                                                                        | 0.918<br>(0.816-1.04)               | 1.15<br>(1.03-1.31)    | 1.46<br>(1.30-1.67)    | 1.72<br>(1.51-1.99)    | 2.08<br>(1.75-2.51)    | 2.37<br>(1.93-2.94)    | 2.66<br>(2.10-3.41)    | 2.98<br>(2.26-3.95)    | 3.40<br>(2.45-4.78)    | 3.74<br>(2.58-5.50)    |
| 15-min                                                                                                        | 0.740<br>(0.660-0.844)              | 0.928<br>(0.824-1.06)  | 1.18<br>(1.04-1.35)    | 1.39<br>(1.22-1.60)    | 1.68<br>(1.41-2.03)    | 1.91<br>(1.56-2.37)    | 2.15<br>(1.69-2.75)    | 2.40<br>(1.82-3.19)    | 2.74<br>(1.98-3.85)    | 3.02<br>(2.08-4.43)    |
| 30-min                                                                                                        | 0.502<br>(0.446-0.570)              | 0.628<br>(0.558-0.716) | 0.798<br>(0.706-0.912) | 0.940<br>(0.824-1.09)  | 1.14<br>(0.952-1.37)   | 1.29<br>(1.05-1.60)    | 1.45<br>(1.15-1.86)    | 1.62<br>(1.23-2.16)    | 1.86<br>(1.34-2.61)    | 2.04<br>(1.41-3.00)    |
| 60-min                                                                                                        | 0.350<br>(0.311-0.397)              | 0.438<br>(0.389-0.498) | 0.556<br>(0.492-0.635) | 0.655<br>(0.573-0.756) | 0.792<br>(0.663-0.957) | 0.900<br>(0.733-1.12)  | 1.01<br>(0.798-1.30)   | 1.13<br>(0.859-1.50)   | 1.29<br>(0.931-1.82)   | 1.42<br>(0.981-2.09)   |
| 2-hr                                                                                                          | 0.244<br>(0.218-0.278)              | 0.292<br>(0.259-0.332) | 0.358<br>(0.317-0.409) | 0.416<br>(0.364-0.480) | 0.500<br>(0.418-0.604) | 0.570<br>(0.464-0.708) | 0.646<br>(0.508-0.828) | 0.728<br>(0.553-0.968) | 0.848<br>(0.610-1.19)  | 0.948<br>(0.653-1.39)  |
| 3-hr                                                                                                          | 0.192<br>(0.171-0.218)              | 0.226<br>(0.201-0.257) | 0.275<br>(0.243-0.314) | 0.318<br>(0.278-0.367) | 0.381<br>(0.319-0.460) | 0.434<br>(0.353-0.538) | 0.491<br>(0.387-0.630) | 0.555<br>(0.421-0.738) | 0.648<br>(0.467-0.910) | 0.727<br>(0.500-1.07)  |
| 6-hr                                                                                                          | 0.129<br>(0.115-0.147)              | 0.151<br>(0.134-0.172) | 0.182<br>(0.161-0.208) | 0.209<br>(0.183-0.242) | 0.249<br>(0.208-0.301) | 0.282<br>(0.229-0.350) | 0.317<br>(0.250-0.406) | 0.356<br>(0.270-0.473) | 0.412<br>(0.297-0.578) | 0.459<br>(0.316-0.674) |
| 12-hr                                                                                                         | 0.083<br>(0.074-0.095)              | 0.100<br>(0.089-0.114) | 0.122<br>(0.108-0.139) | 0.140<br>(0.123-0.162) | 0.165<br>(0.138-0.199) | 0.184<br>(0.150-0.228) | 0.204<br>(0.161-0.261) | 0.224<br>(0.170-0.298) | 0.252<br>(0.182-0.354) | 0.274<br>(0.189-0.403) |
| 24-hr                                                                                                         | 0.057<br>(0.051-0.064)              | 0.070<br>(0.063-0.080) | 0.087<br>(0.079-0.099) | 0.101<br>(0.090-0.115) | 0.118<br>(0.102-0.139) | 0.131<br>(0.111-0.156) | 0.143<br>(0.119-0.175) | 0.155<br>(0.126-0.195) | 0.171<br>(0.134-0.223) | 0.183<br>(0.139-0.246) |
| 2-day                                                                                                         | 0.036<br>(0.032-0.041)              | 0.044<br>(0.040-0.050) | 0.055<br>(0.049-0.062) | 0.063<br>(0.056-0.072) | 0.074<br>(0.064-0.087) | 0.081<br>(0.069-0.097) | 0.089<br>(0.074-0.109) | 0.096<br>(0.078-0.121) | 0.106<br>(0.083-0.138) | 0.113<br>(0.086-0.151) |
| 3-day                                                                                                         | 0.028<br>(0.025-0.031)              | 0.034<br>(0.030-0.038) | 0.042<br>(0.037-0.047) | 0.048<br>(0.043-0.054) | 0.056<br>(0.048-0.065) | 0.061<br>(0.052-0.074) | 0.067<br>(0.056-0.082) | 0.073<br>(0.059-0.091) | 0.080<br>(0.063-0.104) | 0.085<br>(0.058-0.114) |
| 4-day                                                                                                         | 0.023<br>(0.021-0.026)              | 0.028<br>(0.025-0.032) | 0.034<br>(0.031-0.039) | 0.039<br>(0.035-0.045) | 0.046<br>(0.040-0.054) | 0.051<br>(0.043-0.061) | 0.055<br>(0.046-0.068) | 0.060<br>(0.049-0.075) | 0.066<br>(0.052-0.086) | 0.070<br>(0.053-0.094) |
| 7-day                                                                                                         | 0.015<br>(0.014-0.018)              | 0.019<br>(0.017-0.021) | 0.023<br>(0.021-0.026) | 0.027<br>(0.024-0.031) | 0.031<br>(0.027-0.037) | 0.034<br>(0.029-0.041) | 0.038<br>(0.031-0.046) | 0.041<br>(0.033-0.051) | 0.045<br>(0.035-0.058) | 0.048<br>(0.028-0.064) |
| 10-day                                                                                                        | 0.012<br>(0.011-0.014)              | 0.015<br>(0.013-0.017) | 0.018<br>(0.016-0.021) | 0.021<br>(0.019-0.024) | 0.025<br>(0.021-0.029) | 0.027<br>(0.023-0.032) | 0.030<br>(0.025-0.036) | 0.032<br>(0.026-0.040) | 0.035<br>(0.028-0.046) | 0.037<br>(0.028-0.050) |
| 20-day                                                                                                        | 0.008<br>(0.007-0.009)              | 0.010<br>(0.009-0.011) | 0.012<br>(0.011-0.014) | 0.014<br>(0.012-0.016) | 0.016<br>(0.014-0.019) | 0.018<br>(0.015-0.021) | 0.019<br>(0.016-0.024) | 0.021<br>(0.017-0.026) | 0.023<br>(0.018-0.030) | 0.024<br>(0.018-0.032) |
| 30-day                                                                                                        | 0.006<br>(0.006-0.007)              | 0.008<br>(0.007-0.009) | 0.010<br>(0.009-0.011) | 0.011<br>(0.010-0.013) | 0.013<br>(0.011-0.015) | 0.014<br>(0.012-0.017) | 0.015<br>(0.013-0.019) | 0.017<br>(0.013-0.021) | 0.018<br>(0.014-0.023) | 0.019<br>(0.014-0.025) |
| 45-day                                                                                                        | 0.005<br>(0.005-0.006)              | 0.007<br>(0.006-0.007) | 0.008<br>(0.007-0.009) | 0.009<br>(0.008-0.011) | 0.011<br>(0.009-0.013) | 0.012<br>(0.010-0.014) | 0.013<br>(0.011-0.016) | 0.014<br>(0.011-0.017) | 0.015<br>(0.012-0.019) | 0.015<br>(0.012-0.021) |
| 60-day                                                                                                        | 0.005<br>(0.004-0.005)              | 0.006<br>(0.005-0.007) | 0.007<br>(0.007-0.008) | 0.008<br>(0.007-0.010) | 0.010<br>(0.008-0.011) | 0.010<br>(0.009-0.013) | 0.011<br>(0.009-0.014) | 0.012<br>(0.010-0.015) | 0.013<br>(0.010-0.017) | 0.013<br>(0.010-0.018) |

<sup>1</sup> 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.  
Please refer to NOAA Atlas 14 document for more information.

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### PF graphical

PDS-based intensity-duration-frequency (IDF) curves  
Latitude: 37.9500°, Longitude: -121.2667°

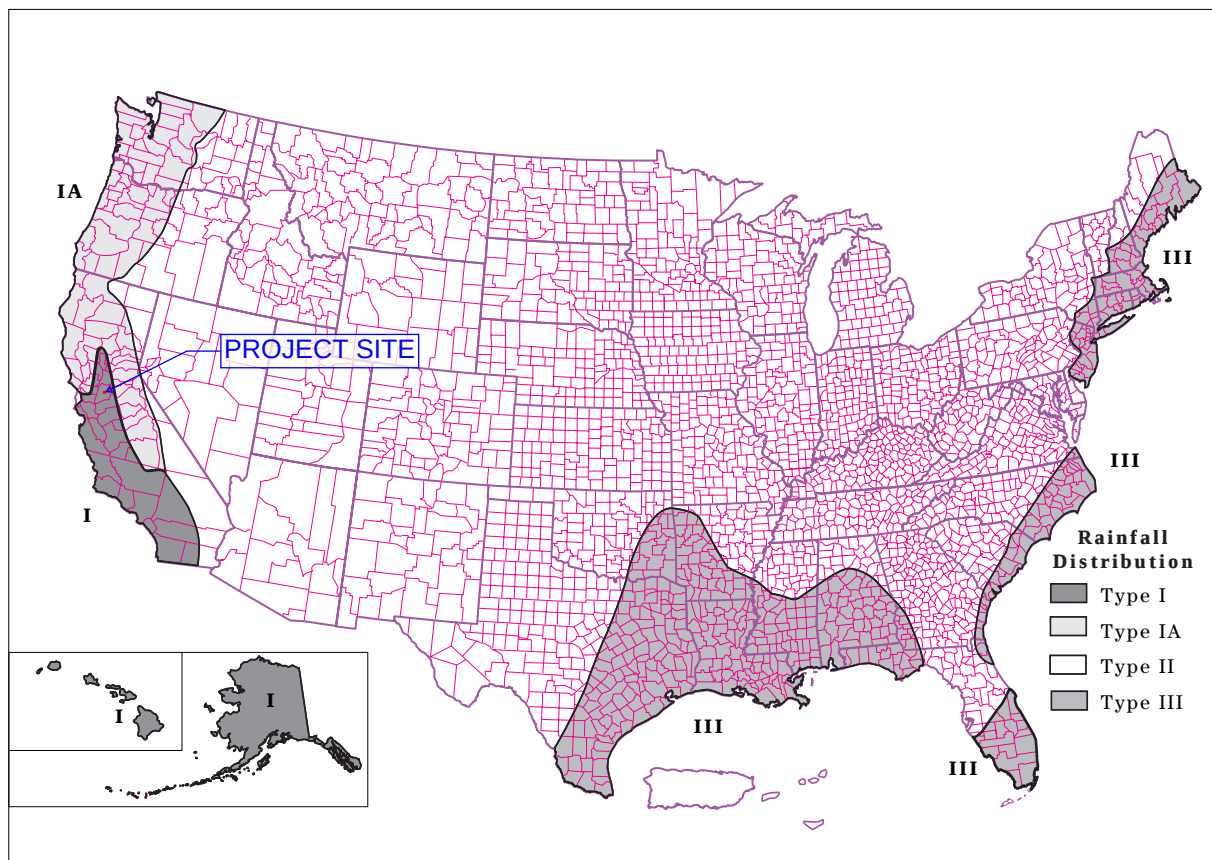


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### Maps & aerials

Small scale terrain

**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.

**Table 2-2a** Runoff curve numbers for urban areas <sup>1/</sup>

| Cover description                                                                                                                    |                                               | Curve numbers for hydrologic soil group |    |    |    |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------|----|----|----|
| Cover type and hydrologic condition                                                                                                  | Average percent impervious area <sup>2/</sup> | A                                       | B  | C  | D  |
| <i>Fully developed urban areas (vegetation established)</i>                                                                          |                                               |                                         |    |    |    |
| Open space (lawns, parks, golf courses, cemeteries, etc.) <sup>3/</sup> :                                                            |                                               |                                         |    |    |    |
| 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) <sup>4/</sup> .....                                                                 |                                               | 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 |
| <i>Developing urban areas</i>                                                                                                        |                                               |                                         |    |    |    |
| Newly graded areas                                                                                                                   |                                               |                                         |    |    |    |
| (pervious areas only, no vegetation) <sup>5/</sup> .....                                                                             |                                               | 77                                      | 86 | 91 | 94 |
| Idle lands (CN's are determined using cover types similar to those in table 2-2c).                                                   |                                               |                                         |    |    |    |

<sup>1</sup> Average runoff condition, and  $I_a = 0.2S$ .<sup>2</sup> 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.<sup>3</sup> CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.<sup>4</sup> 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.<sup>5</sup> 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<sup>a,b</sup>  
(design use)

| channel material                       | <i>n</i>            |
|----------------------------------------|---------------------|
| 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               |

<sup>a</sup>compiled from various sources

<sup>b</sup>Values outside these ranges have been observed, but these values are typical.

## Appendix E: SSA Input Data

McCLOY YARD  
100% STORMWATER REPORT  
SSA MODEL SETUP

Project Options

GeneralID LabelsElement 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:5min

Modified rational method storm duration:

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

Analysis Options

GeneralStorm Selection

Time steps

Dayshh:mm:ss

Runoff (dry weather):001:00:00

Runoff (wet weather):000:05:00

Reporting:000:05:00

Routing:30sec

Dates

mm/dd/yyyyhh:mm:ss

Start analysis on:06/18/202500:00:00

End analysis on:06/20/202500:00:00

Analysis duration:2d

Analysis computations

☐ Hydrology runoff☐ Groundwater

☐ Hydraulic flow routing☐ Snow melt

☐ Water quality

Hydrodynamic analysis parameters

Inertial terms:Dampen

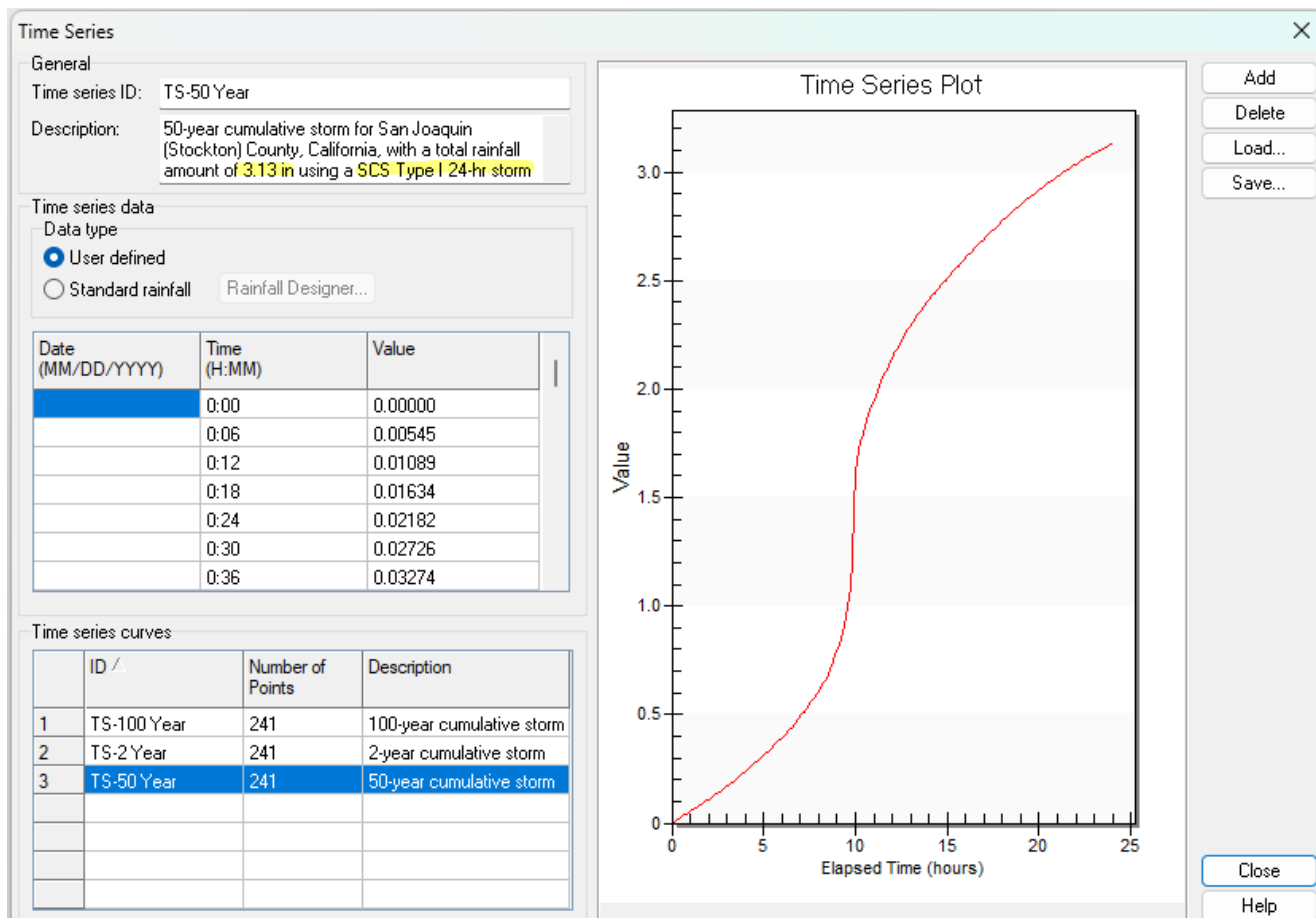
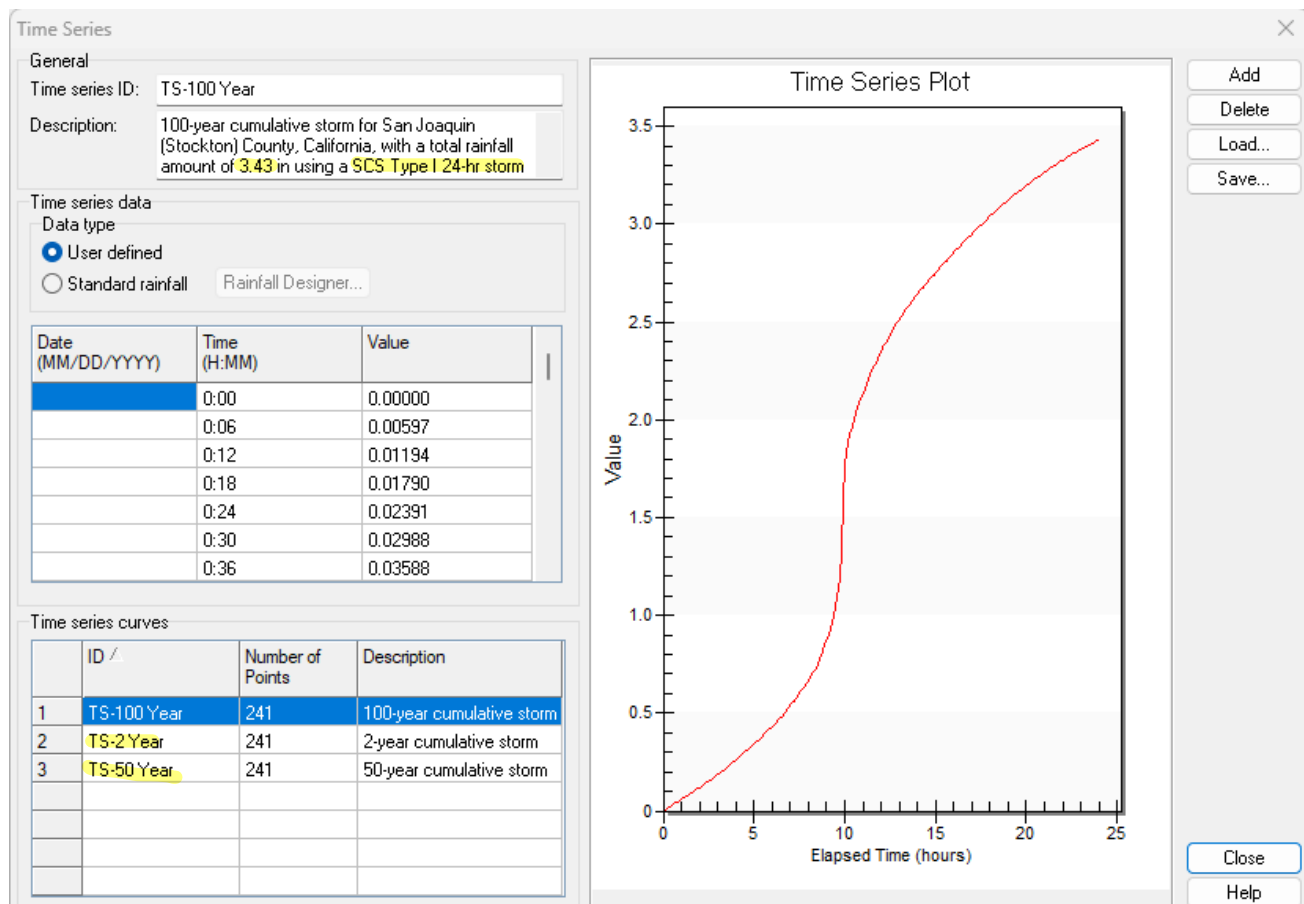
Lengthening time step:0sec

Junction surface area:0ft²

Supercritical flow occurs when

☒ Water surface slope & Froude number

# McCLOY YARD 100% STORMWATER REPORT DESIGN RAINFALL EVENTS



# McCLOY YARD 100% STORMWATER REPORT SETUP OF SUBBASINS

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

Equivalent width: 500.00 ft

Average slope: 0.5000 %

Impervious area

Area: 25.00 %

No depression: 25 %

Pervious area

Curve number: 0.20

Manning's roughness: 0.015

Curve number: 0.08

Manning's roughness: 0.1

Analysis summary

Peak runoff: 1.200 cfs

Total precipitation: 3.430 in

Total runoff: 1.860 in

Total infiltration: 1.57 in

Total Area

Assumed 5 mins for all drainage areas

Time of concentration: 5.00 min

Weighted curve number: 83.79

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 |           |          |              | ...        |             |

Total area: 0.6765 ac

Total area: 82.49 %

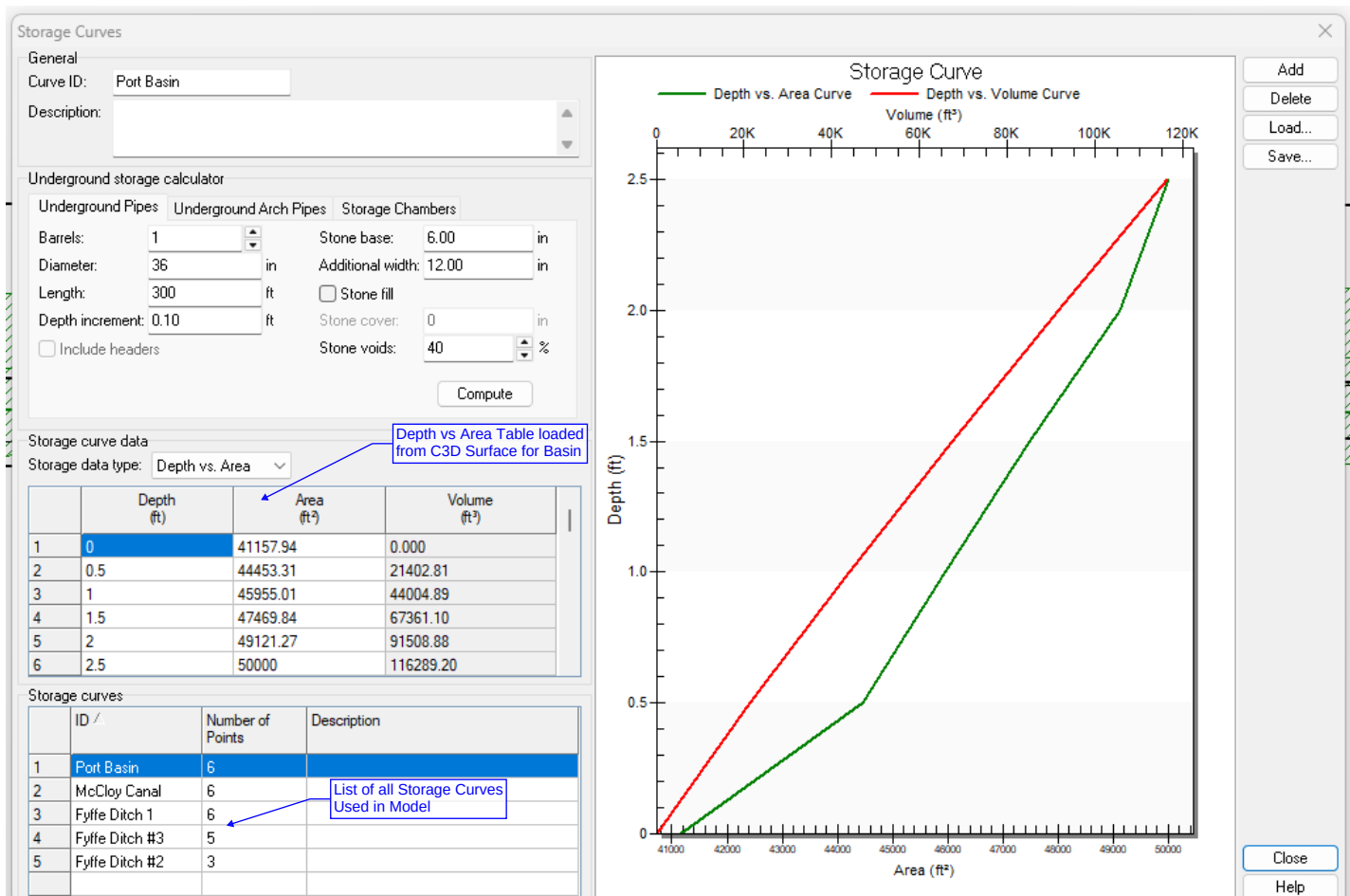
Weighted CN: 83.79

SSA computes weighted CN per input data

# McCLOY YARD

## 100% STORMWATER REPORT

### ILLUSTRATION OF STORAGE CURVES FOR RETENTION/DETENTION BASINS



Storage Nodes

General  
Storage node ID: Port Basin  
Description:

Physical properties  
Invert elevation: -4.5 ft  
Maximum elev.: -2 ft  
Delete  
Show  
Report

Flow properties  
External inflows: NO  
Treatments: NO  
WSEL initial: -4.5 ft  
Ponded area: 0 ft<sup>2</sup>  
Evaporation loss: 0

Storage shape  
Type: Storage Curve  
Constant area: 0 ft<sup>2</sup>  
Coefficient: 1.0  
Exponent: 0  
Storage curve: Port Basin

Exfiltration  
Type  
☒ No exfiltration  
☐ At all elevations  
☐ Above elev.: 0 ft

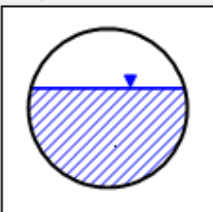
Initial Water Level set equal to Invert Elevation

Analysis summary  
Max water depth: N/A ft  
Max water elevation: N/A ft  
Total flooded vol.: N/A ac-in  
Peak inflow: N/A cfs  
Max flooded overflow: N/A cfs  
Total time flooded: N/A min

**McCLOY YARD**  
**100% STORMWATER REPORT**  
**SET UP CONVEYANCE LINKS (PIPES/CULVERTS/OPEN CHANNEL)**

Conveyance Links
✕

**General**  
Link ID:   
Description:

**Shape**  


☐ Open channel  
☐ Pipe  
☒ Culvert  
☐ Direct  

Circular

**Properties**  
Number of barrels: 

1

  
Culvert type: 

Corrugated Metal Pipe C

  
Culvert entrance: 

Projecting

  
Diameter: 

18.000

 in

**Physical properties**  
Length: 

74.128

 ft  
Inlet invert elevation: 

-0.98

 ft  
Outlet invert elevation: 

-1.18

 ft  
Manning's roughness: 

0.014

  
☐ 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: 

0.0027

 ft/ft  
Design flow capacity: 

5.07

 cfs  
Peak flow during analysis: 

N/A

 cfs  
Additional flow capacity: 

N/A

 cfs

Max velocity attained: 

N/A

 ft/sec  
Max/design flow ratio: 

N/A

  
Max/total depth ratio: 

N/A

  
Total time surcharged: 

N/A

 min

**Connectivity**  

From (Inlet): 

SN-867

▼ Swap  
To (Outlet): 

Out-1 {Network-SN-868}

▼

Invert elevation: 

-0.98

 ft  
Invert elevation: 

-1.18

 ft

Add

Delete

Show

Report

Inverts...

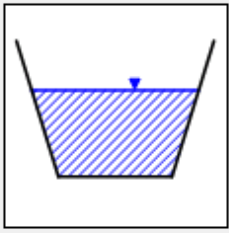
Nodes connected by the  
Conveyance Link

E-6

**McCLOY YARD**  
**100% STORMWATER REPORT**  
**SET UP CONVEYANCE LINKS (PIPES/CULVERTS/OPEN CHANNEL)**

Conveyance Links
✕

**General**  
Link ID:   
Description:

**Shape**  


☒ Open channel  
☐ Pipe  
☐ Culvert  
☐ Direct  

Trapezoidal

**Properties**  
Number of barrels: 

1

  
Height: 

2.800

 ft  
Bottom width: 

2.000

 ft  
Left side slope: 

1: 2

 (V:H)  
Right side slope: 

1: 2

 (V:H)

**Physical properties**  
Length: 

853.33

 ft  
Inlet invert elevation: 

-2.031

< ^

 ft  
Outlet invert elevation: 

-2.909

< ^

 ft  
Manning's roughness: 

0.025

 ...  
☐ 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: 

0.0010

 ft/ft  
Design flow capacity: 

51.60

 cfs  
Peak flow during analysis: 

N/A

 cfs  
Additional flow capacity: 

N/A

 cfs

Max velocity attained: 

N/A

 ft/sec  
Max/design flow ratio: 

N/A

  
Max/total depth ratio: 

N/A

  
Total time surcharged: 

N/A

 min

**Connectivity**  
From (Inlet): 

Out-1{Network-SN-866}

v

Swap

  
To (Outlet): 

Out-1{Network-SN-862}

v

Invert elevation: 

-2.031

 ft  
Invert elevation: 

-2.909

 ft

Add

Delete

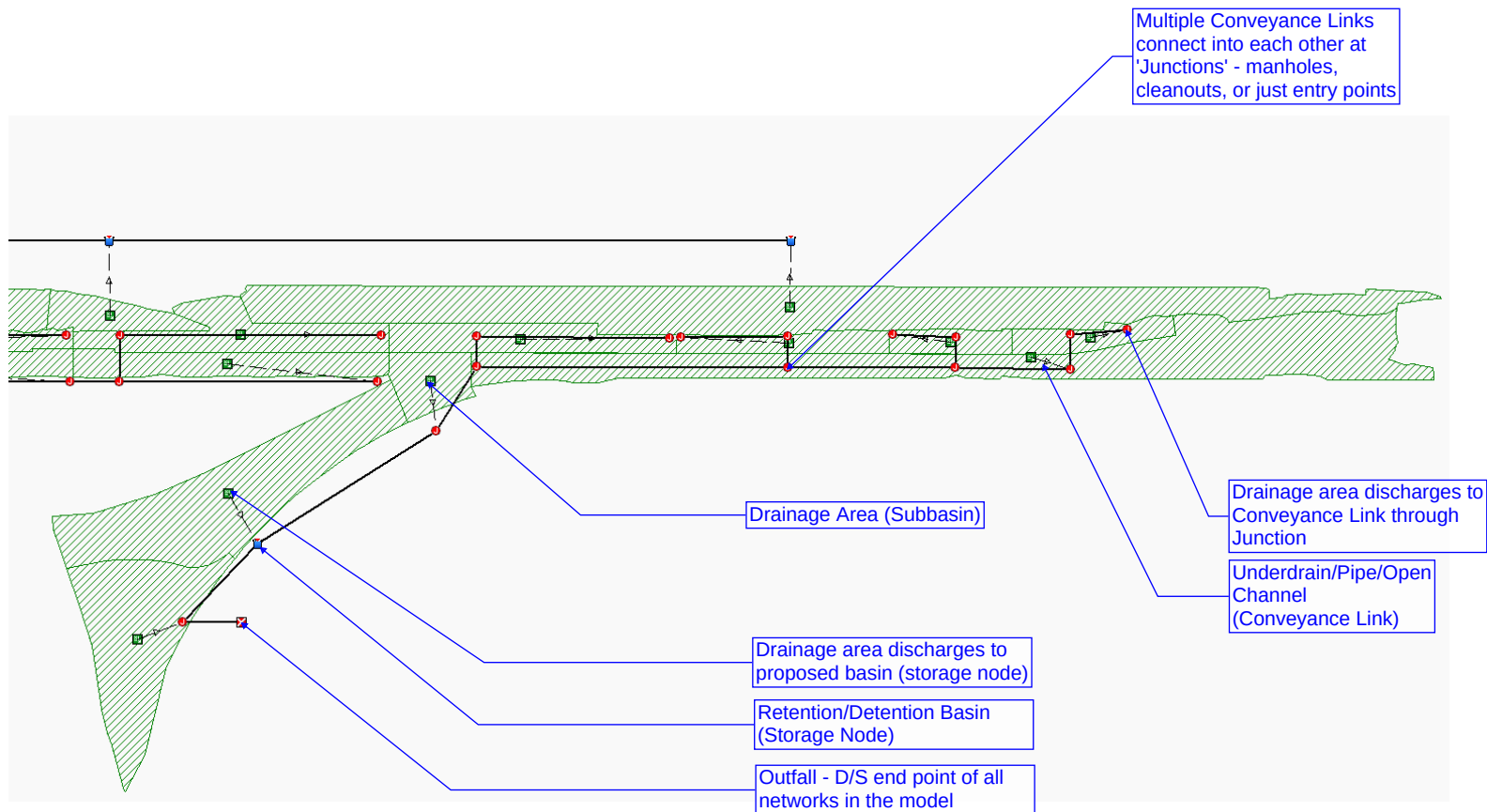
Show

Report

Inverts...

E-7

McCLOY YARD  
60% STORMWATER REPORT  
ILLUSTRATION OF SETTING UP STORM DRAIN NETWORK



## Appendix F: Existing Drainage Calculations

McCloy Rail Yard  
100% Stormwater Report  
Table 1: Existing Drainage Area Summary

| SN | Drainage  | Area    | Drainage        | Weighted | 100-Year                           |                             |                         | 50-Year                            |                             |                         | 10-Year                            |                             |                         |
|----|-----------|---------|-----------------|----------|------------------------------------|-----------------------------|-------------------------|------------------------------------|-----------------------------|-------------------------|------------------------------------|-----------------------------|-------------------------|
|    | Area      | (acres) | Outlet          | CN       | Total<br>Precipitation<br>(inches) | Total<br>Runoff<br>(inches) | Peak<br>Runoff<br>(cfs) | Total<br>Precipitation<br>(inches) | Total<br>Runoff<br>(inches) | Peak<br>Runoff<br>(cfs) | Total<br>Precipitation<br>(inches) | Total<br>Runoff<br>(inches) | Peak<br>Runoff<br>(cfs) |
| 1  | EX DMA-01 | 1.33    | Burns Cutoff #1 | 89.95    | 3.43                               | 2.38                        | 2.57                    | 3.13                               | 2.10                        | 2.27                    | 2.41                               | 1.45                        | 1.55                    |
| 2  | EX DMA-02 | 1.49    | McCloy Canal    | 83.06    | 3.43                               | 1.80                        | 2.11                    | 3.13                               | 1.56                        | 1.80                    | 2.41                               | 0.99                        | 1.09                    |
| 3  | EX DMA-03 | 5.79    | McCloy Ditch #1 | 90.09    | 3.43                               | 2.39                        | 11.25                   | 3.13                               | 2.11                        | 9.92                    | 2.41                               | 1.46                        | 6.78                    |
| 4  | EX DMA-04 | 4.00    | Fyffe Ditch #1  | 93.00    | 3.43                               | 2.67                        | 8.62                    | 3.13                               | 2.38                        | 7.70                    | 2.41                               | 1.70                        | 5.50                    |
| 5  | EX DMA-05 | 3.09    | McCloy Ditch #2 | 90.58    | 3.43                               | 2.44                        | 6.11                    | 3.13                               | 2.16                        | 5.41                    | 2.41                               | 1.50                        | 3.72                    |
| 6  | EX DMA-06 | 0.69    | Fyffe Ditch #2  | 93.00    | 3.43                               | 2.67                        | 1.49                    | 3.13                               | 2.38                        | 1.33                    | 2.41                               | 1.70                        | 0.95                    |
| 7  | EX DMA-07 | 6.03    | Fyffe Ditch #3  | 93.00    | 3.43                               | 2.67                        | 13.02                   | 3.13                               | 2.38                        | 11.63                   | 2.41                               | 1.70                        | 8.31                    |
| 8  | EX DMA-08 | 6.56    | McCloy Ditch #4 | 90.11    | 3.43                               | 2.39                        | 12.76                   | 3.13                               | 2.11                        | 11.26                   | 2.41                               | 1.46                        | 7.69                    |
| 9  | EX DMA-09 | 5.83    | Expy Culvert    | 83.01    | 3.43                               | 1.80                        | 8.23                    | 3.13                               | 1.55                        | 7.01                    | 2.41                               | 0.99                        | 4.24                    |

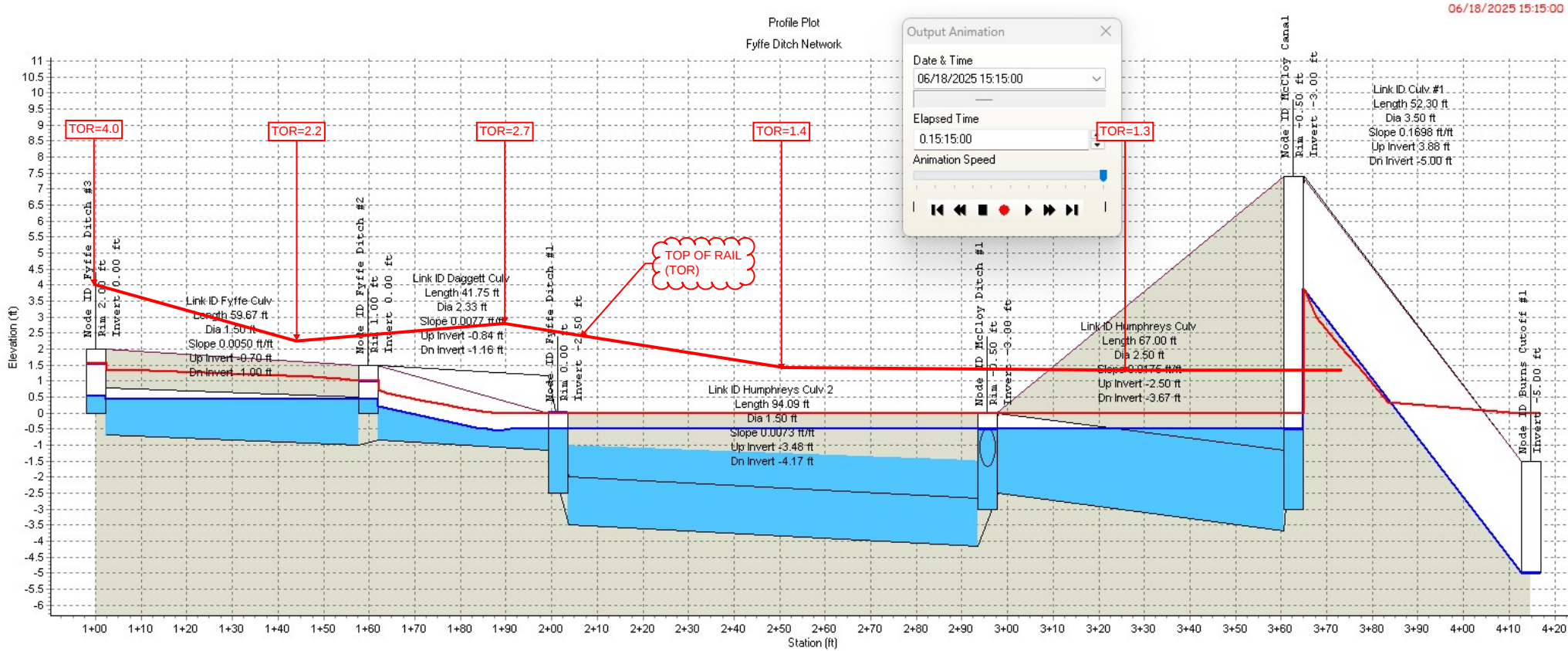
McCloy Rail Yard  
100% Stormwater Report  
Table 2: Existing Storage Node Analysis

| SN              | Basin/ Storage  | Invert<br>(ft) | Rim<br>(ft) | Peak<br>Inflow<br>(cfs) | Peak<br>Outflow<br>(cfs) | Storage<br>Depth<br>(ft) | Max<br>Depth<br>(ft) | Average<br>Depth<br>(ft) | Time of Max Depth<br>Occurrence<br>(days hh:mm) | Total<br>Flooded<br>(ac-inches) | Total Time<br>Flooded<br>(minutes) |
|-----------------|-----------------|----------------|-------------|-------------------------|--------------------------|--------------------------|----------------------|--------------------------|-------------------------------------------------|---------------------------------|------------------------------------|
| <b>100-Year</b> |                 |                |             |                         |                          |                          |                      |                          |                                                 |                                 |                                    |
| 1               | Fyffe Ditch #1  | -2.50          | 0.00        | 13.40                   | 5.56                     | 2.50                     | 2.50                 | 1.84                     | 0 10:03                                         | 1.07                            | 36.00                              |
| 2               | Fyffe Ditch #2  | 0.00           | 1.00        | 6.61                    | 5.77                     | 1.00                     | 1.00                 | 0.41                     | 0 10:03                                         | 0.35                            | 23.00                              |
| 3               | Fyffe Ditch #3  | 0.00           | 2.00        | 13.01                   | 5.72                     | 2.00                     | 1.54                 | 0.54                     | 0 10:09                                         | 0.00                            | 0.00                               |
| 4               | McCloy Canal    | -3.00          | -0.50       | 3.11                    | 0.00                     | 2.50                     | 2.50                 | 2.26                     | 0 10:03                                         | 2.54                            | 1242.00                            |
| 5               | McCloy Ditch #1 | -3.00          | -0.50       | 18.00                   | 1.06                     | 2.50                     | 2.50                 | 2.27                     | 0 10:03                                         | 29.31                           | 1258.00                            |
| 6               | McCloy Ditch #2 | -2.50          | -0.50       | 7.53                    | 2.04                     | 2.00                     | 2.00                 | 1.77                     | 0 10:00                                         | 17.64                           | 1427.00                            |
| 7               | McCloy Ditch #3 | -2.00          | 0.50        | 3.58                    | 2.61                     | 2.50                     | 2.44                 | 1.82                     | 0 10:37                                         | 0.00                            | 0.00                               |
| 8               | McCloy Ditch #4 | 0.00           | 1.00        | 12.74                   | 3.58                     | 1.00                     | 1.00                 | 0.32                     | 0 09:54                                         | 1.59                            | 19.00                              |
| <b>50-Year</b>  |                 |                |             |                         |                          |                          |                      |                          |                                                 |                                 |                                    |
| 1               | Fyffe Ditch #1  | -2.50          | 0.00        | 11.94                   | 5.68                     | 2.50                     | 2.50                 | 1.83                     | 0 10:08                                         | 0.45                            | 24.00                              |
| 2               | Fyffe Ditch #2  | 0.00           | 1.00        | 6.01                    | 5.77                     | 1.00                     | 1.00                 | 0.39                     | 0 10:07                                         | 0.09                            | 11.00                              |
| 3               | Fyffe Ditch #3  | 0.00           | 2.00        | 11.63                   | 5.21                     | 2.00                     | 1.47                 | 0.51                     | 0 10:09                                         | 0.00                            | 0.00                               |
| 4               | McCloy Canal    | -3.00          | -0.50       | 3.05                    | 0.00                     | 2.50                     | 2.50                 | 2.25                     | 0 10:09                                         | 2.18                            | 1142.00                            |
| 5               | McCloy Ditch #1 | -3.00          | -0.50       | 15.73                   | 1.29                     | 2.50                     | 2.50                 | 2.26                     | 0 10:09                                         | 25.46                           | 1245.00                            |
| 6               | McCloy Ditch #2 | -2.50          | -0.50       | 6.54                    | 1.93                     | 2.00                     | 2.00                 | 1.76                     | 0 10:06                                         | 15.37                           | 1414.00                            |
| 7               | McCloy Ditch #3 | -2.00          | 0.50        | 3.58                    | 2.41                     | 2.50                     | 2.40                 | 1.79                     | 0 10:36                                         | 0.00                            | 0.00                               |
| 8               | McCloy Ditch #4 | 0.00           | 1.00        | 11.25                   | 3.58                     | 1.00                     | 1.00                 | 0.30                     | 0 09:56                                         | 1.17                            | 16.00                              |
| <b>10-Year</b>  |                 |                |             |                         |                          |                          |                      |                          |                                                 |                                 |                                    |
| 1               | Fyffe Ditch #1  | -2.50          | 0.00        | 8.95                    | 4.45                     | 2.50                     | 2.14                 | 1.79                     | 0 10:45                                         | 0.00                            | 0.00                               |
| 2               | Fyffe Ditch #2  | 0.00           | 1.00        | 4.79                    | 4.38                     | 1.00                     | 0.86                 | 0.34                     | 0 10:10                                         | 0.00                            | 0.00                               |
| 3               | Fyffe Ditch #3  | 0.00           | 2.00        | 8.30                    | 4.08                     | 2.00                     | 1.26                 | 0.44                     | 0 10:08                                         | 0.00                            | 0.00                               |
| 4               | McCloy Canal    | -3.00          | -0.50       | 2.69                    | 0.00                     | 2.50                     | 2.50                 | 2.25                     | 0 10:46                                         | 1.43                            | 1146.00                            |
| 5               | McCloy Ditch #1 | -3.00          | -0.50       | 10.87                   | 1.63                     | 2.50                     | 2.50                 | 2.26                     | 0 10:46                                         | 14.91                           | 1187.00                            |
| 6               | McCloy Ditch #2 | -2.50          | -0.50       | 4.11                    | 1.09                     | 2.00                     | 2.00                 | 1.76                     | 0 10:43                                         | 9.81                            | 1358.00                            |
| 7               | McCloy Ditch #3 | -2.00          | 0.50        | 3.58                    | 1.70                     | 2.50                     | 2.24                 | 1.71                     | 0 10:36                                         | 0.00                            | 0.00                               |
| 8               | McCloy Ditch #4 | 0.00           | 1.00        | 7.68                    | 3.58                     | 1.00                     | 1.00                 | 0.26                     | 0 10:00                                         | 0.31                            | 8.00                               |

**McCloy Rail Yard**  
**100% Stormwater Report**  
**Table 3: Existing Condition Closed Pipes Analysis**

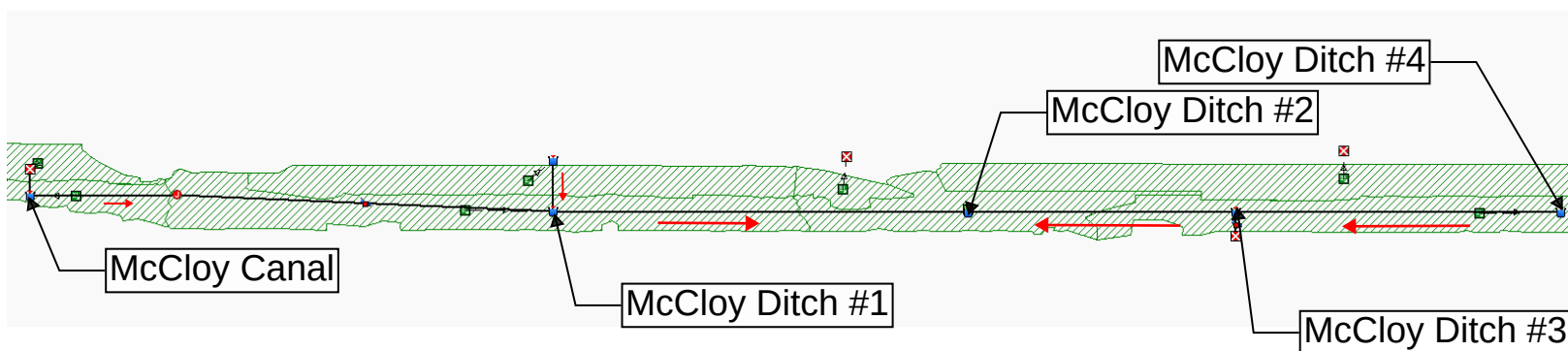
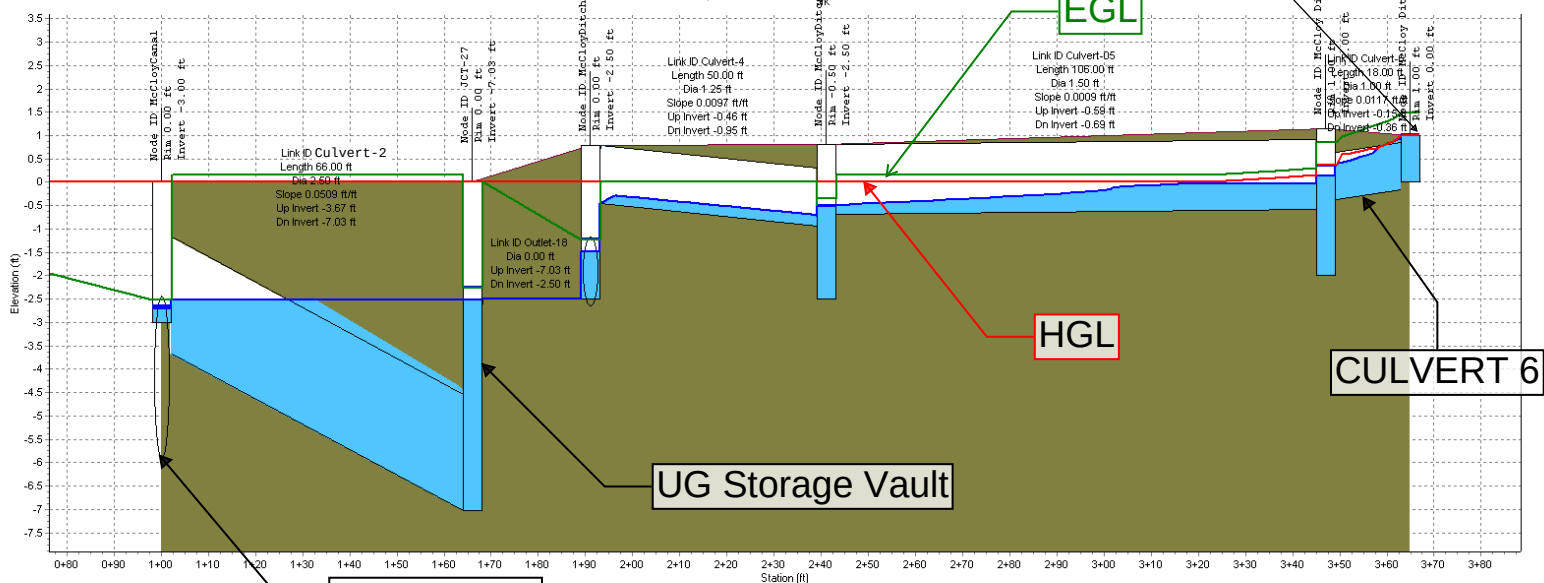
| SN              | Drainage Pipe/ Culv. | Inlet           | Outlet          | Length<br>(ft) | Slope<br>(%) | Dia.<br>(inches) | Manning's | Max<br>Velocity<br>(ft/sec) | Design<br>Capacity<br>(cfs) | Peak Flow<br>(cfs) | Max<br>Design/Capacity | Max Flow<br>Depth<br>(ft) | Max<br>Depth/ Dia | Time of Peak<br>Occurrence<br>(days hh:mm) | Total Time<br>Surcharged<br>(min) | Reported<br>Condition |
|-----------------|----------------------|-----------------|-----------------|----------------|--------------|------------------|-----------|-----------------------------|-----------------------------|--------------------|------------------------|---------------------------|-------------------|--------------------------------------------|-----------------------------------|-----------------------|
| <b>100-Year</b> |                      |                 |                 |                |              |                  |           |                             |                             |                    |                        |                           |                   |                                            |                                   |                       |
| 1               | Expy Culv.           | -               | Burns Cutoff #2 | 143.31         | 0.28         | 18.00            | 0.0150    | 5.03                        | 4.81                        | 8.21               | 1.71                   | 1.30                      | 0.87              | 0 10:00                                    | 0.00                              | > CAPACITY            |
| 2               | Culv #1              | McCloy Canal    | Burns Cutoff #1 | 52.30          | 16.98        | 42.00            | 0.0150    | 0.00                        | 7.63                        | 0.00               | 0.00                   | 0.00                      | 0.00              | 0 00:00                                    | 0.00                              |                       |
| 3               | Daggett Culv         | Fyffe Ditch #2  | Fyffe Ditch #1  | 41.75          | 0.77         | 27.96            | 0.0180    | 3.89                        | 41.08                       | 5.77               | 0.14                   | 1.08                      | 0.46              | 0 10:26                                    | 0.00                              |                       |
| 4               | Fyffe Culv           | Fyffe Ditch #3  | Fyffe Ditch #2  | 59.67          | 0.50         | 18.00            | 0.0140    | 3.64                        | 0.40                        | 5.72               | 14.32                  | 1.25                      | 0.83              | 0 10:09                                    | 0.00                              | > CAPACITY            |
| 5               | Humphreys Culv       | McCloy Ditch #1 | McCloy Canal    | 67.00          | 1.75         | 30.00            | 0.0170    | 0.38                        | 27.10                       | 1.06               | 0.04                   | 2.25                      | 0.90              | 0 09:57                                    | 0.00                              |                       |
| 6               | Humphreys Culv 2     | Fyffe Ditch #1  | McCloy Ditch #1 | 94.09          | 0.73         | 18.00            | 0.0150    | 3.15                        | 6.64                        | 5.56               | 0.84                   | 1.50                      | 1.00              | 0 10:03                                    | 2302.00                           | SURCHARGED            |
| 7               | McCloy Culv          | McCloy Ditch #4 | McCloy Ditch #3 | 17.60          | 1.19         | 12.00            | 0.0150    | 5.21                        | 4.42                        | 3.58               | 0.81                   | 0.86                      | 0.86              | 0 09:54                                    | 0.00                              |                       |
| 8               | McCloy Culv 1        | McCloy Ditch #1 | McCloy Ditch #2 | 49.00          | 0.78         | 15.00            | 0.0110    | 1.69                        | 6.72                        | 2.04               | 0.30                   | 1.23                      | 0.98              | 0 10:00                                    | 0.00                              |                       |
| 9               | McCloy Culv 2        | McCloy Ditch #2 | McCloy Ditch #3 | 105.99         | 0.09         | 18.00            | 0.0140    | 2.45                        | 3.00                        | 2.61               | 0.87                   | 0.87                      | 0.58              | 0 10:37                                    | 0.00                              |                       |
| <b>50-Year</b>  |                      |                 |                 |                |              |                  |           |                             |                             |                    |                        |                           |                   |                                            |                                   |                       |
| 1               | Expy Culv.           | -               | Burns Cutoff #2 | 143.31         | 0.28         | 18.00            | 0.0150    | 4.40                        | 4.81                        | 6.98               | 1.45                   | 1.26                      | 0.84              | 0 10:00                                    | 0.00                              | > CAPACITY            |
| 2               | Culv #1              | McCloy Canal    | Burns Cutoff #1 | 52.30          | 16.98        | 42.00            | 0.0150    | 0.00                        | 7.63                        | 0.00               | 0.00                   | 0.00                      | 0.00              | 0 00:00                                    | 0.00                              |                       |
| 3               | Daggett Culv         | Fyffe Ditch #2  | Fyffe Ditch #1  | 41.75          | 0.77         | 27.96            | 0.0180    | 4.15                        | 41.08                       | 5.77               | 0.14                   | 1.08                      | 0.46              | 0 10:07                                    | 0.00                              |                       |
| 4               | Fyffe Culv           | Fyffe Ditch #3  | Fyffe Ditch #2  | 59.67          | 0.50         | 18.00            | 0.0140    | 3.35                        | 0.40                        | 5.21               | 13.05                  | 1.23                      | 0.82              | 0 10:09                                    | 0.00                              | > CAPACITY            |
| 5               | Humphreys Culv       | McCloy Ditch #1 | McCloy Canal    | 67.00          | 1.75         | 30.00            | 0.0170    | 0.38                        | 27.10                       | 1.29               | 0.05                   | 2.25                      | 0.90              | 0 09:58                                    | 0.00                              |                       |
| 6               | Humphreys Culv 2     | Fyffe Ditch #1  | McCloy Ditch #1 | 94.09          | 0.73         | 18.00            | 0.0150    | 3.21                        | 6.64                        | 5.68               | 0.86                   | 1.50                      | 1.00              | 0 10:08                                    | 2293.00                           | SURCHARGED            |
| 7               | McCloy Culv          | McCloy Ditch #4 | McCloy Ditch #3 | 17.60          | 1.19         | 12.00            | 0.0150    | 5.21                        | 4.42                        | 3.58               | 0.81                   | 0.84                      | 0.84              | 0 10:15                                    | 0.00                              |                       |
| 8               | McCloy Culv 1        | McCloy Ditch #1 | McCloy Ditch #2 | 49.00          | 0.78         | 15.00            | 0.0110    | 1.60                        | 6.72                        | 1.93               | 0.29                   | 1.23                      | 0.98              | 0 10:06                                    | 0.00                              |                       |
| 9               | McCloy Culv 2        | McCloy Ditch #2 | McCloy Ditch #3 | 105.99         | 0.09         | 18.00            | 0.0140    | 2.37                        | 3.00                        | 2.41               | 0.80                   | 0.84                      | 0.56              | 0 10:36                                    | 0.00                              |                       |
| <b>10-Year</b>  |                      |                 |                 |                |              |                  |           |                             |                             |                    |                        |                           |                   |                                            |                                   |                       |
| 1               | Expy Culv.           | -               | Burns Cutoff #2 | 143.31         | 0.28         | 18.00            | 0.0150    | 3.43                        | 4.81                        | 4.10               | 0.85                   | 0.94                      | 0.64              | 0 10:00                                    | 0.00                              |                       |
| 2               | Culv #1              | McCloy Canal    | Burns Cutoff #1 | 52.30          | 16.98        | 42.00            | 0.0150    | 0.00                        | 7.63                        | 0.00               | 0.00                   | 0.00                      | 0.00              | 0 00:00                                    | 0.00                              |                       |
| 3               | Daggett Culv         | Fyffe Ditch #2  | Fyffe Ditch #1  | 41.75          | 0.77         | 27.96            | 0.0180    | 4.42                        | 41.08                       | 4.38               | 0.11                   | 0.77                      | 0.33              | 0 10:10                                    | 0.00                              |                       |
| 4               | Fyffe Culv           | Fyffe Ditch #3  | Fyffe Ditch #2  | 59.67          | 0.50         | 18.00            | 0.0140    | 3.18                        | 0.40                        | 4.08               | 10.21                  | 1.06                      | 0.70              | 0 10:08                                    | 0.00                              | > CAPACITY            |
| 5               | Humphreys Culv       | McCloy Ditch #1 | McCloy Canal    | 67.00          | 1.75         | 30.00            | 0.0170    | 0.50                        | 27.10                       | 1.63               | 0.06                   | 2.25                      | 0.90              | 0 10:01                                    | 0.00                              |                       |
| 6               | Humphreys Culv 2     | Fyffe Ditch #1  | McCloy Ditch #1 | 94.09          | 0.73         | 18.00            | 0.0150    | 2.52                        | 6.64                        | 4.45               | 0.67                   | 1.50                      | 1.00              | 0 10:10                                    | 2281.00                           | SURCHARGED            |
| 7               | McCloy Culv          | McCloy Ditch #4 | McCloy Ditch #3 | 17.60          | 1.19         | 12.00            | 0.0150    | 5.22                        | 4.42                        | 3.58               | 0.81                   | 0.84                      | 0.84              | 0 10:11                                    | 0.00                              |                       |
| 8               | McCloy Culv 1        | McCloy Ditch #1 | McCloy Ditch #2 | 49.00          | 0.78         | 15.00            | 0.0110    | 1.20                        | 6.72                        | 1.09               | 0.16                   | 1.23                      | 0.98              | 0 10:43                                    | 0.00                              |                       |
| 9               | McCloy Culv 2        | McCloy Ditch #2 | McCloy Ditch #3 | 105.99         | 0.09         | 18.00            | 0.0140    | 2.07                        | 3.00                        | 1.70               | 0.57                   | 0.71                      | 0.47              | 0 10:36                                    | 0.00                              |                       |

McCloy Rail Yard  
100% Stormwater Report  
Figure 1: Fyffe Avenue Ditch Network Profile Plot  
100-Year Peak Flow



# McCloy Rail Yard 100% Stormwater Report

## 100-Year Peak Flow



## Appendix G: Proposed Drainage Calculations

McCloy Rail Yard  
100% Stormwater Report  
Table 1: Proposed Drainage Area Summary

| SN | Drainage Area | Area<br>(acres) | Weighted<br>CN | 100-Year                           |                          |                      | 50-Year                            |                          |                      | 10-Year                            |                          |                      |
|----|---------------|-----------------|----------------|------------------------------------|--------------------------|----------------------|------------------------------------|--------------------------|----------------------|------------------------------------|--------------------------|----------------------|
|    |               |                 |                | Total<br>Precipitation<br>(inches) | Total Runoff<br>(inches) | Peak Runoff<br>(cfs) | Total<br>Precipitation<br>(inches) | Total Runoff<br>(inches) | Peak Runoff<br>(cfs) | Total<br>Precipitation<br>(inches) | Total Runoff<br>(inches) | Peak Runoff<br>(cfs) |
| 1  | DMA-01        | 1.33            | 89.96          | 3.43                               | 2.38                     | 2.57                 | 3.13                               | 2.10                     | 2.27                 | 2.41                               | 1.45                     | 1.55                 |
| 2  | DMA-02        | 1.49            | 86.12          | 3.43                               | 2.05                     | 2.45                 | 3.13                               | 1.78                     | 2.12                 | 2.41                               | 1.18                     | 1.35                 |
| 3  | DMA-03        | 4.09            | 89.42          | 3.43                               | 2.33                     | 7.74                 | 3.13                               | 2.05                     | 6.81                 | 2.41                               | 1.41                     | 4.61                 |
| 4  | DMA-03A       | 1.04            | 93.00          | 3.43                               | 2.67                     | 2.25                 | 3.13                               | 2.38                     | 2.01                 | 2.41                               | 1.70                     | 1.44                 |
| 5  | DMA-03B       | 0.90            | 93.00          | 3.43                               | 2.67                     | 1.93                 | 3.13                               | 2.38                     | 1.73                 | 2.41                               | 1.70                     | 1.23                 |
| 6  | DMA-04        | 3.95            | 93.00          | 3.43                               | 2.67                     | 8.52                 | 3.13                               | 2.38                     | 7.61                 | 2.41                               | 1.70                     | 5.43                 |
| 7  | DMA-05        | 1.34            | 93.00          | 3.43                               | 2.67                     | 2.89                 | 3.13                               | 2.38                     | 2.58                 | 2.41                               | 1.70                     | 1.84                 |
| 8  | DMA-05A       | 1.29            | 93.00          | 3.43                               | 2.67                     | 2.79                 | 3.13                               | 2.38                     | 2.49                 | 2.41                               | 1.70                     | 1.78                 |
| 9  | DMA-06        | 0.56            | 93.00          | 3.43                               | 2.67                     | 1.20                 | 3.13                               | 2.38                     | 1.07                 | 2.41                               | 1.70                     | 0.77                 |
| 10 | DMA-07        | 6.03            | 93.00          | 3.43                               | 2.67                     | 13.02                | 3.13                               | 2.38                     | 11.63                | 2.41                               | 1.70                     | 8.31                 |
| 11 | DMA-08        | 1.13            | 93.00          | 3.43                               | 2.67                     | 2.43                 | 3.13                               | 2.38                     | 2.17                 | 2.41                               | 1.70                     | 1.55                 |
| 12 | DMA-08A       | 1.05            | 93.00          | 3.43                               | 2.67                     | 2.28                 | 3.13                               | 2.38                     | 2.04                 | 2.41                               | 1.70                     | 1.45                 |
| 13 | DMA-08B       | 0.59            | 93.00          | 3.43                               | 2.67                     | 1.28                 | 3.13                               | 2.38                     | 1.15                 | 2.41                               | 1.70                     | 0.82                 |
| 14 | DMA-08C       | 0.41            | 93.00          | 3.43                               | 2.67                     | 0.88                 | 3.13                               | 2.38                     | 0.79                 | 2.41                               | 1.69                     | 0.56                 |
| 15 | DMA-08D       | 0.51            | 93.00          | 3.43                               | 2.67                     | 1.10                 | 3.13                               | 2.38                     | 0.99                 | 2.41                               | 1.70                     | 0.70                 |
| 16 | DMA-08E       | 3.43            | 88.87          | 3.43                               | 2.28                     | 6.34                 | 3.13                               | 2.01                     | 5.56                 | 2.41                               | 1.37                     | 3.73                 |
| 17 | DMA-09        | 2.36            | 88.10          | 3.43                               | 2.21                     | 4.23                 | 3.13                               | 1.94                     | 3.69                 | 2.41                               | 1.31                     | 2.44                 |
| 18 | DMA-09A       | 2.36            | 83.52          | 3.43                               | 1.84                     | 3.42                 | 3.13                               | 1.59                     | 2.92                 | 2.41                               | 1.02                     | 1.78                 |
| 19 | DMA-09B       | 0.79            | 84.58          | 3.43                               | 1.92                     | 1.21                 | 3.13                               | 1.67                     | 1.04                 | 2.41                               | 1.08                     | 0.65                 |
| 20 | DMA-09C       | 0.38            | 86.77          | 3.43                               | 2.10                     | 0.65                 | 3.13                               | 1.83                     | 0.56                 | 2.41                               | 1.22                     | 0.36                 |

McCloy Rail Yard  
100% Stormwater Report  
Table 2: Proposed Condition Storage Node Analysis

| SN              | Basin/ Storage     | Invert<br>(ft) | Rim<br>(ft) | Peak<br>Inflow<br>(cfs) | Peak<br>Outflow<br>(cfs) | Storage<br>Depth<br>(ft) | Max<br>Depth<br>(ft) | Min<br>Freeboard<br>(ft) | Average<br>Depth<br>(ft) | Time of Max Depth<br>Occurrence<br>(days hh:mm) | Total Flooded<br>Volume<br>(ac-inches) | Total Time<br>Flooded<br>(minutes) |
|-----------------|--------------------|----------------|-------------|-------------------------|--------------------------|--------------------------|----------------------|--------------------------|--------------------------|-------------------------------------------------|----------------------------------------|------------------------------------|
| <b>100-year</b> |                    |                |             |                         |                          |                          |                      |                          |                          |                                                 |                                        |                                    |
| 1               | Ex. Fyffe Ditch #1 | -2.50          | 0.00        | 13.03                   | 6.41                     | 2.50                     | 2.28                 | 0.22                     | 0.58                     | 0 10:29                                         | 0.00                                   | 0.00                               |
| 2               | Ex. Fyffe Ditch #2 | 0.00           | 1.00        | 6.39                    | 5.77                     | 1.00                     | 1.00                 | 0.00                     | 0.31                     | 0 10:04                                         | 0.28                                   | 20.00                              |
| 3               | Ex. Fyffe Ditch #3 | 0.00           | 2.00        | 13.01                   | 5.71                     | 2.00                     | 1.54                 | 0.46                     | 0.41                     | 0 10:09                                         | 0.00                                   | 0.00                               |
| 4               | Ex. McCloy Canal   | -3.00          | -0.50       | 12.41                   | 13.17                    | 2.50                     | 0.86                 | 1.64                     | 0.32                     | 0 10:27                                         | 0.00                                   | 0.00                               |
| 5               | Prop. McCloy Basin | -2.50          | 1.00        | 8.19                    | 1.81                     | 3.50                     | 2.36                 | 1.14                     | 0.95                     | 0 10:14                                         | 0.00                                   | 0.00                               |
| <b>50-year</b>  |                    |                |             |                         |                          |                          |                      |                          |                          |                                                 |                                        |                                    |
| 1               | Ex. Fyffe Ditch #1 | -2.50          | 0.00        | 11.69                   | 7.61                     | 2.50                     | 2.15                 | 0.35                     | 0.54                     | 0 10:27                                         | 0.00                                   | 0.00                               |
| 2               | Ex. Fyffe Ditch #2 | 0.00           | 1.00        | 5.84                    | 1.07                     | 1.00                     | 0.99                 | 0.01                     | 0.29                     | 0 10:09                                         | 0.00                                   | 0.00                               |
| 3               | Ex. Fyffe Ditch #3 | 0.00           | 2.00        | 11.63                   | 11.63                    | 2.00                     | 1.46                 | 0.54                     | 0.38                     | 0 10:09                                         | 0.00                                   | 0.00                               |
| 4               | Ex. McCloy Canal   | -3.00          | -0.50       | 11.41                   | 1.79                     | 2.50                     | 0.86                 | 1.64                     | 0.30                     | 0 10:52                                         | 0.00                                   | 0.00                               |
| 5               | Prop. McCloy Basin | -2.50          | 1.00        | 7.71                    | 1.47                     | 3.50                     | 2.16                 | 1.34                     | 0.91                     | 0 10:16                                         | 0.00                                   | 0.00                               |
| <b>10-year</b>  |                    |                |             |                         |                          |                          |                      |                          |                          |                                                 |                                        |                                    |
| 1               | Ex. Fyffe Ditch #1 | -2.50          | 0.00        | 8.77                    | 5.43                     | 2.50                     | 1.67                 | 0.83                     | 0.43                     | 0 10:30                                         | 0.00                                   | 0.00                               |
| 2               | Ex. Fyffe Ditch #2 | 0.00           | 1.00        | 4.67                    | 0.77                     | 1.00                     | 0.85                 | 0.15                     | 0.23                     | 0 10:10                                         | 0.00                                   | 0.00                               |
| 3               | Ex. Fyffe Ditch #3 | 0.00           | 2.00        | 8.30                    | 8.30                     | 2.00                     | 1.25                 | 0.75                     | 0.31                     | 0 10:08                                         | 0.00                                   | 0.00                               |
| 4               | Ex. McCloy Canal   | -3.00          | -0.50       | 9.06                    | 1.08                     | 2.50                     | 0.78                 | 1.72                     | 0.24                     | 0 10:36                                         | 0.00                                   | 0.00                               |
| 5               | Prop. McCloy Basin | -2.50          | 1.00        | 5.13                    | 0.61                     | 3.50                     | 1.71                 | 1.79                     | 0.81                     | 0 10:38                                         | 0.00                                   | 0.00                               |

# Exhibit D - Port's DSP

Project Name: \_\_\_\_\_  
 Site Specific DSP  
 Page 7 of 8

## Volume Based Sizing Calculation:

### Formulas:

Stormwater Quality Design Volume (SQDV) =

Unit Basin Storage Volume for 80% Annual Capture ( $V_{unit}$ ) x Total Area ( $A_{total}$ )

Where  $V_{unit}$  is derived from Figure 2 using the effective imperviousness ( $I_{wq}$ )

and  $I_{wq}$  is derived from Figure 1 using the percentage of impervious area of the project.

Percentage of impervious area = (area impervious)/ $A_{total}$  x 100

1. Determine total drainage area ( $A_{total}$ )
2. Determine the percentage of impervious area ( $I_a$ ):  

$$I_a = (\text{Impervious area} / A_{total}) \times 100$$
3. Determine the Effective imperviousness ( $I_{wq}$ ) using **Figure 1**<sup>3</sup>.
4. Determine the appropriate drawdown period for the selected BMP.
5. Determine the unit basin storage volume ( $V_u$ ) using **Figure 2**<sup>4</sup>.
6. Calculate SQDV

$$\begin{aligned} \text{SQDV} &= V_u \times A_{total} \\ &= (V_u \text{ "inches"}) \times (1 \text{ ft}/12 \text{ inches}) \times \\ &\quad (A_{total} \text{ "acres"}) \times (43,560 \text{ ft}^2/\text{acre}) \\ &= \text{ft}^3 \end{aligned}$$

$$\begin{aligned} &0.32 \text{ inches} \times (1 \text{ ft}/12 \text{ inches}) \times \\ &5 \text{ acres} \times (43,560 \text{ sq. ft./acre}) \\ &= 5,808 \text{ cu. ft.} \end{aligned}$$

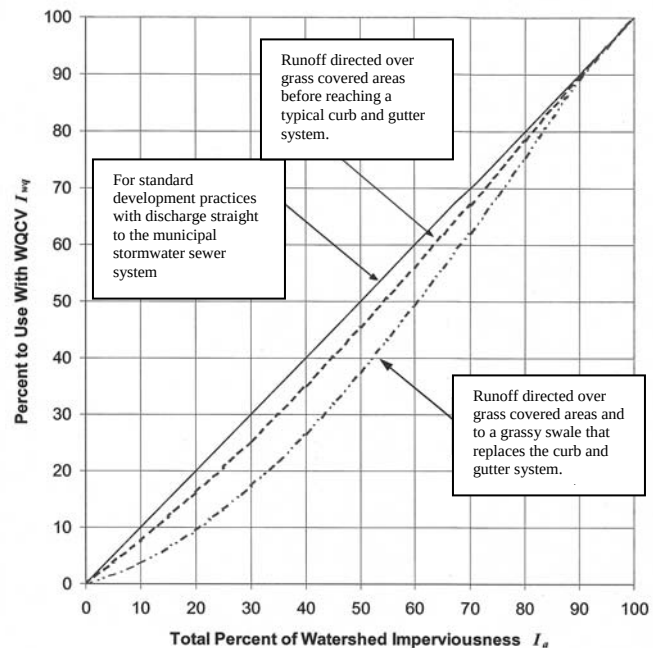


**Figure 1**<sup>3</sup>

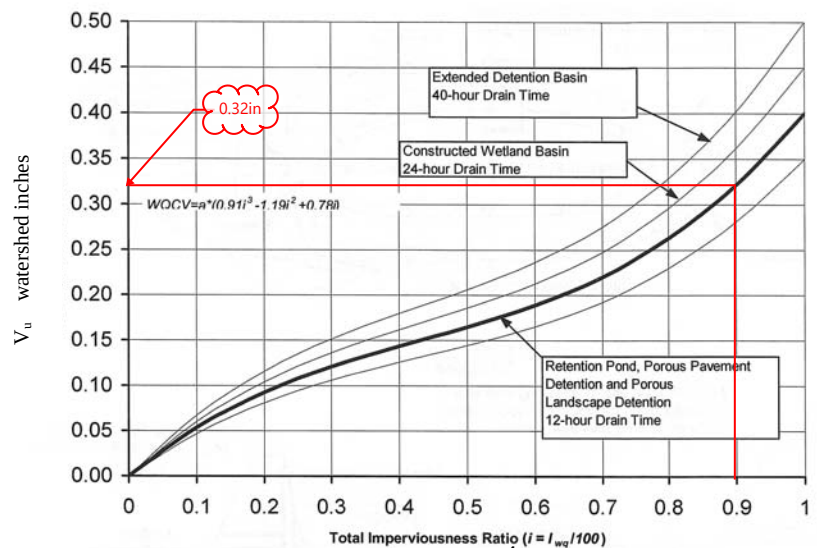
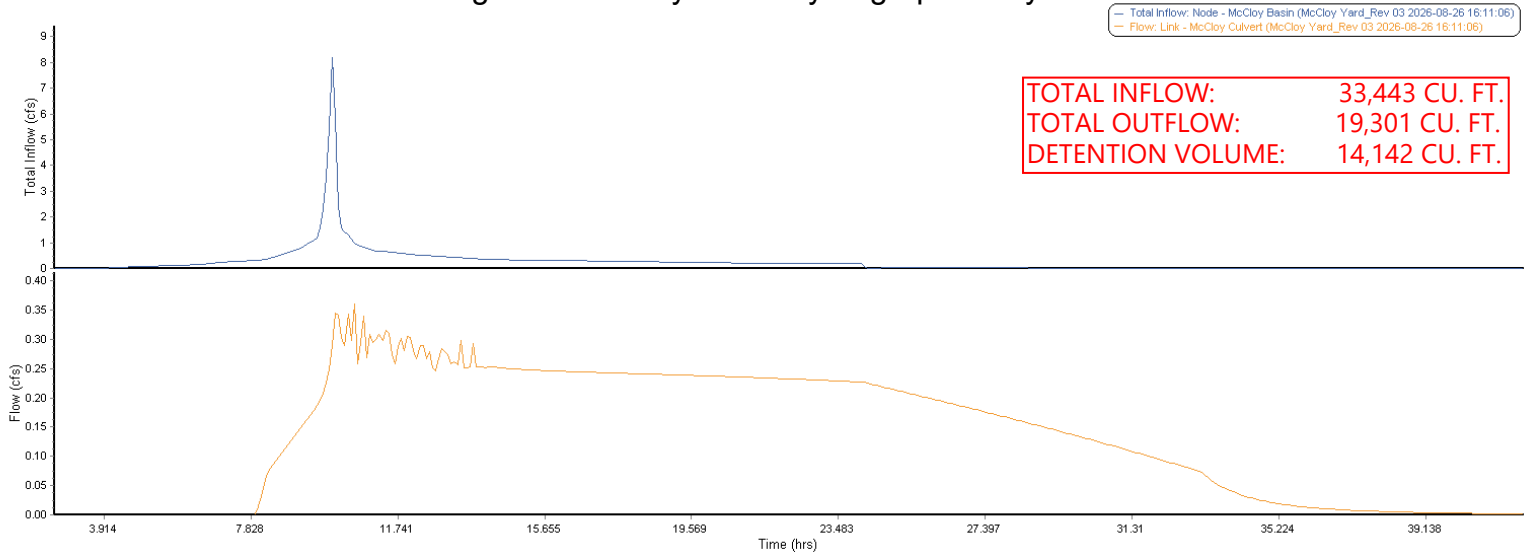


**Figure 2**<sup>4</sup>

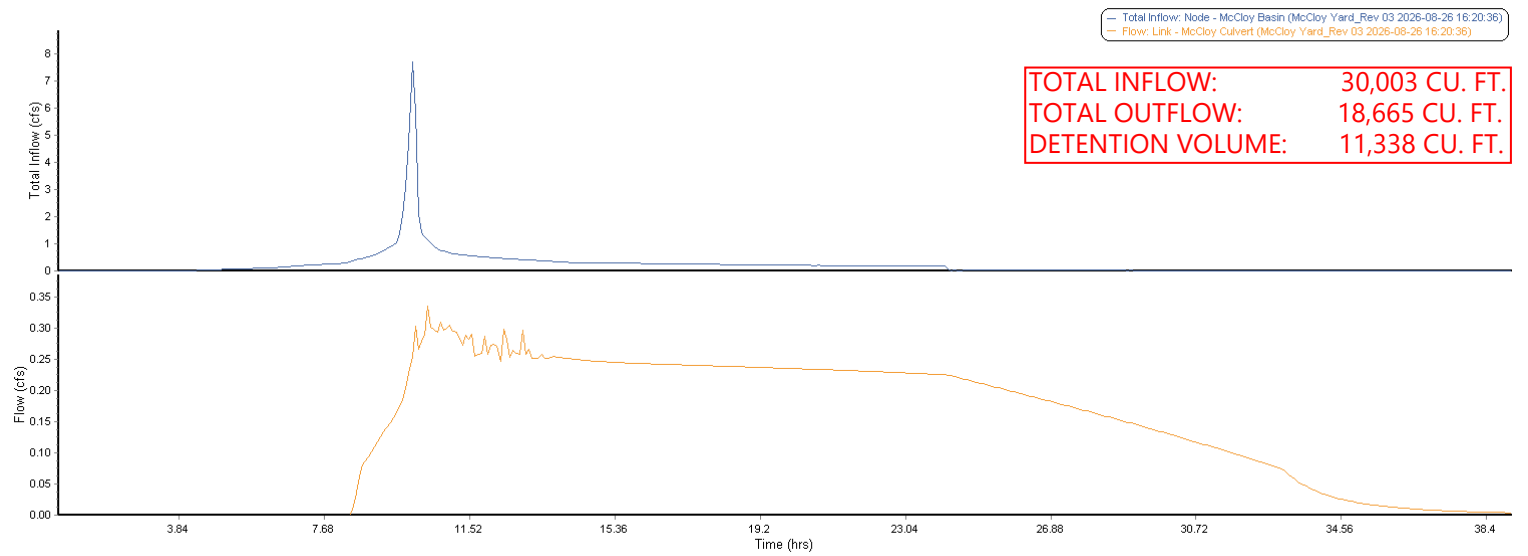
<sup>3</sup> Figure 1 is adapted from Urban Drainage and Flood Control District Figure ND-1 of the Drainage Criteria Manual (Volume 3), Revised August 2006, page ND-9

<sup>4</sup> Figure 2 is adapted from Urban Drainage and Flood Control District Figure RP-2 of the Drainage Criteria Manual (Volume 3), Revised August 2006, page S-102

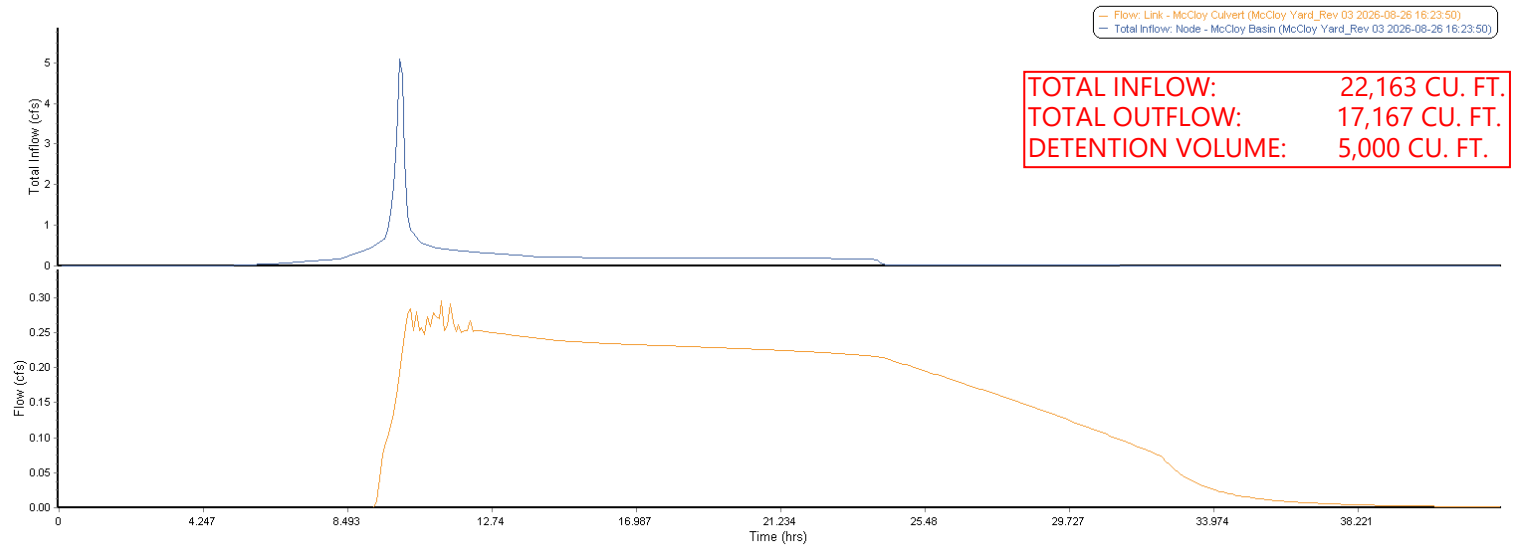
McCloy Rail Yard  
100% Stormwater Report  
Figure 1: McCloy Basin Hydrograph Analysis



100-YR HYDROGRAPH McCLOY BASIN



50-YR HYDROGRAPH McCLOY BASIN



10-YR HYDROGRAPH McCLOY BASIN

**McCloy Rail Yard**  
**100% Stormwater Report**

**Table 3: Proposed Condition Closed Pipes Analysis - 100 -Year**

| SN | Drainage Pipe/ Culv. | Inlet                          | Outlet                  | Length<br>(ft) | Slope<br>(%) | Dia.<br>(inches) | Manning's | Max.<br>Velocity<br>(ft/sec) | Design<br>Capacity<br>(cfs) | Peak Flow<br>(cfs) | Max Design/<br>Capacity | Max Flow<br>Depth<br>(ft) | Max<br>Depth/Dia | Time of Peak<br>Occurrence<br>(days hh:mm) | Total Time<br>Surcharged<br>(min) | Reported<br>Condition |
|----|----------------------|--------------------------------|-------------------------|----------------|--------------|------------------|-----------|------------------------------|-----------------------------|--------------------|-------------------------|---------------------------|------------------|--------------------------------------------|-----------------------------------|-----------------------|
| 1  | Ex. Culv #1          | McCloy Canal                   | Burns Cutoff Outfall #1 | 52.30          | 3.82         | 42.000           | 0.0150    | 5.18                         | 341.04                      | 13.17              | 0.04                    | 0.66                      | 0.19             | 0 10:27                                    | 0.00                              |                       |
| 2  | Ex. Daggett Culv     | Fyffe Ditch #2                 | Fyffe Ditch #1          | 41.75          | 0.77         | 27.960           | 0.0180    | 4.47                         | 41.08                       | 5.77               | 0.14                    | 0.96                      | 0.41             | 0 10:04                                    | 0.00                              |                       |
| 3  | Ex. Expy Culv        | Port Culv.                     | Burns Cutoff Outfall #2 | 143.31         | 0.28         | 18.000           | 0.0150    | 3.21                         | 4.81                        | 3.25               | 0.68                    | 0.82                      | 0.56             | 0 10:00                                    | 0.00                              |                       |
| 4  | Ex. Fyffe Culv       | Fyffe Ditch #3                 | Fyffe Ditch #2          | 59.67          | 0.50         | 18.000           | 0.0140    | 3.63                         | 0.40                        | 5.71               | 14.29                   | 1.25                      | 0.83             | 0 10:09                                    | 0.00                              | > CAPACITY            |
| 5  | Ex. Humphreys Culv   | McCloy Ditch #1                | McCloy Canal            | 67.00          | 1.75         | 30.000           | 0.0170    | 4.81                         | 27.10                       | 11.92              | 0.44                    | 1.26                      | 0.50             | 0 10:22                                    | 0.00                              |                       |
| 6  | Ex. Humphreys Culv 2 | Fyffe Ditch #1                 | McCloy Ditch #1         | 94.09          | 0.73         | 18.000           | 0.0150    | 3.62                         | 6.64                        | 6.41               | 0.97                    | 1.50                      | 1.00             | 0 10:06                                    | 90.00                             | SURCHARGED            |
| 7  | Prop. McCloy Culvert | McCloy Basin                   | McCloy Outfall #1       | 61.00          | 0.82         | 15.0             | 0.0190    | 1.91                         | 4.00                        | 0.41               | 0.10                    | 0.29                      | 0.23             | 0 10:26                                    | 0.00                              |                       |
| 8  | Prop. 21in SD-5      | Prop. 18in SD-1                | McCloy Basin            | 115.00         | 0.31         | 21.000           | 0.0120    | 0.77                         | 5.99                        | 1.86               | 0.31                    | 1.75                      | 1.00             | 0 10:00                                    | 148.00                            | SURCHARGED            |
| 9  | Prop 18in SD-1       | Prop 18in SD-2                 | Prop. 18in Culvert      | 280.01         | 0.20         | 18.0             | 0.0100    | 0.98                         | 5.15                        | 1.73               | 0.34                    | 1.50                      | 1.00             | 0 10:22                                    | 70.00                             | SURCHARGED            |
| 10 | Prop 18in SD-2       | Prop 18in UD-3<br>Prop Culv #3 | Prop 18in SD-3          | 410.34         | 0.20         | 18.0             | 0.0100    | 1.34                         | 5.09                        | 1.94               | 0.38                    | 1.19                      | 0.80             | 0 10:20                                    | 0.00                              |                       |
| 11 | Prop 18in SD-3       | Prop 18in SD-2<br>Prop Culv #3 | Prop 21in SD-4          | 760.35         | 0.20         | 18.0             | 0.0100    | 2.50                         | 5.09                        | 2.01               | 0.40                    | 0.78                      | 0.52             | 0 10:24                                    | 0.00                              |                       |
| 12 | Prop 21 in SD-4      | Prop 18in SD-3<br>Prop Culv #4 | Port V-Ditch            | 22.09          | 0.23         | 21.0             | 0.0150    | 3.40                         | 8.17                        | 3.75               | 0.46                    | 0.83                      | 0.49             | 0 10:04                                    | 0.00                              |                       |
| 13 | Prop UD-1            | -                              | Prop Culv #1            | 260.00         | 0.50         | 10.0             | 0.0150    | 2.47                         | 7.50                        | 1.10               | 0.15                    | 0.45                      | 0.30             | 0 10:00                                    | 0.00                              |                       |
| 14 | Prop UD-2            | -                              | Prop Culv #2            | 300.00         | 0.50         | 10.0             | 0.0120    | 3.05                         | 1.68                        | 0.84               | 0.50                    | 0.41                      | 0.50             | 0 10:01                                    | 0.00                              |                       |
| 15 | Prop UD-3            | -                              | Prop Culv #3            | 520.00         | 0.50         | 10.0             | 0.0110    | 3.52                         | 1.83                        | 1.18               | 0.64                    | 0.47                      | 0.59             | 0 10:02                                    | 0.00                              |                       |
| 16 | Prop UD-4            | -                              | Prop Culv #4            | 500.00         | 0.48         | 12.0             | 0.0110    | 3.72                         | 2.92                        | 2.24               | 0.77                    | 0.69                      | 0.72             | 0 10:00                                    | 0.00                              |                       |
| 17 | Prop UD-5            | -                              | Prop Culv #5            | 781.00         | 0.17         | 15.0             | 0.0120    | 2.51                         | 2.92                        | 2.64               | 0.90                    | 1.01                      | 0.82             | 0 10:01                                    | 0.00                              |                       |
| 18 | Prop UD -6           | -                              | Prop Culv #6            | 737.00         | 0.20         | 15.0             | 0.0120    | 2.33                         | 3.10                        | 1.78               | 0.57                    | 0.81                      | 0.65             | 0 10:01                                    | 0.00                              |                       |
| 19 | Prop UD-7            | -                              | Prop Culv #7            | 842.11         | 0.20         | 15.0             | 0.0120    | 1.83                         | 3.13                        | 2.25               | 0.72                    | 1.25                      | 1.00             | 0 10:00                                    | 11.00                             | SURCHARGED            |
| 20 | Prop Culv #1         | Prop UD-1                      | Prop 18in SD-1          | 79.49          | 0.55         | 12.0             | 0.0110    | 1.80                         | 3.12                        | 1.08               | 0.35                    | 0.92                      | 0.93             | 0 10:00                                    | 0.00                              |                       |
| 21 | Prop Culv #2         | Prop UD-2                      | Prop 18in SD-2          | 76.04          | 1.00         | 12.0             | 0.0110    | 1.14                         | 4.21                        | 0.88               | 0.21                    | 0.93                      | 0.97             | 0 10:01                                    | 0.00                              |                       |
| 22 | Prop Culv #3         | Prop UD-3                      | Prop 18in SD-3          | 76.04          | 1.00         | 12.0             | 0.0110    | 1.65                         | 4.21                        | 1.29               | 0.31                    | 1.00                      | 1.00             | 0 10:00                                    | 7.00                              | SURCHARGED            |
| 23 | Prop Culv #4         | Prop UD-3                      | Prop 18in SD-4          | 76.05          | 1.50         | 12.0             | 0.0110    | 3.03                         | 5.16                        | 2.38               | 0.46                    | 0.99                      | 1.00             | 0 10:00                                    | 2.00                              | SURCHARGED            |
| 24 | Prop Culv #5         | Prop UD-5                      | McCloy Ditch            | 74.13          | 0.27         | 18.0             | 0.0140    | 1.66                         | 5.07                        | 2.48               | 0.49                    | 1.21                      | 0.81             | 0 10:03                                    | 0.00                              |                       |
| 25 | Prop Culv #6         | Prop UD-6                      | McCloy Ditch            | 74.00          | 0.27         | 21.0             | 0.0140    | 1.12                         | 7.63                        | 1.43               | 0.19                    | 1.23                      | 0.70             | 0 10:02                                    | 0.00                              |                       |
| 26 | Prop Culv #7         | Prop UD-7                      | McCloy Ditch            | 60.00          | 0.55         | 24.0             | 0.0150    | 0.04                         | 14.54                       | 0.05               | 0.00                    | 1.87                      | 0.94             | 0 10:06                                    | 0.00                              |                       |
| 27 | Prop. 946 Culvert    | Track 946 Ditch                | Burns Outfall #2        | 94.00          | 0.5000       | 18.000           | 0.0150    | 5.58                         | 6.44                        | 6.46               | 0.97                    | 1.22                      | 0.83             | 0 10:10                                    | 0.00                              |                       |

# McCloy Rail Yard 100% Stormwater Report

## Table 4: Proposed Condition Closed Pipes Analysis - 50 -Year

| SN | Drainage Pipe/ Culv. | Inlet                          | Outlet                  | Length<br>(ft) | Slope<br>(%) | Dia.<br>(inches) | Manning's | Max.<br>Velocity<br>(ft/sec) | Design<br>Capacity<br>(cfs) | Peak Flow<br>(cfs) | Max Design/<br>Capacity | Max Flow<br>Depth<br>(ft) | Max<br>Depth/Dia | Time of Peak<br>Occurrence<br>(days hh:mm) | Total Time<br>Surcharged<br>(min) | Reported<br>Condition |
|----|----------------------|--------------------------------|-------------------------|----------------|--------------|------------------|-----------|------------------------------|-----------------------------|--------------------|-------------------------|---------------------------|------------------|--------------------------------------------|-----------------------------------|-----------------------|
| 1  | Ex. Culv #1          | McCloy Canal                   | Burns Cutoff Outfall #1 | 52.30          | 3.82         | 42.000           | 0.0150    | 5.17                         | 341.04                      | 13.14              | 0.04                    | 0.66                      | 0.19             | 0 10:25                                    | 0.00                              |                       |
| 2  | Ex. Daggett Culv     | Fyffe Ditch #2                 | Fyffe Ditch #1          | 41.75          | 0.77         | 27.960           | 0.0180    | 4.46                         | 41.08                       | 5.67               | 0.14                    | 0.88                      | 0.38             | 0 10:09                                    | 0.00                              |                       |
| 3  | Ex. Expy Culv        | Port Culv.                     | Burns Cutoff Outfall #2 | 143.31         | 0.28         | 18.000           | 0.0150    | 3.07                         | 4.81                        | 2.81               | 0.58                    | 0.76                      | 0.51             | 0 10:01                                    | 0.00                              |                       |
| 4  | Ex. Fyffe Culv       | Fyffe Ditch #3                 | Fyffe Ditch #2          | 59.67          | 0.50         | 18.000           | 0.0140    | 3.37                         | 0.40                        | 5.22               | 13.07                   | 1.23                      | 0.82             | 0 10:09                                    | 0.00                              | > CAPACITY            |
| 5  | Ex. Humphreys Culv   | McCloy Ditch #1                | McCloy Canal            | 67.00          | 1.75         | 30.000           | 0.0170    | 4.77                         | 27.10                       | 10.99              | 0.41                    | 1.22                      | 0.49             | 0 10:22                                    | 0.00                              |                       |
| 6  | Ex. Humphreys Culv 2 | Fyffe Ditch #1                 | McCloy Ditch #1         | 94.09          | 0.73         | 18.000           | 0.0150    | 3.48                         | 6.64                        | 6.15               | 0.93                    | 1.50                      | 1.00             | 0 10:06                                    | 78.00                             | SURCHARGED            |
| 7  | Prop. McCloy Culvert | McCloy Basin                   | McCloy Outfall #1       | 61.00          | 0.82         | 15.0             | 0.0190    | 0.00                         | 4.00                        | 0.38               | 0.09                    | 0.29                      | 0.23             | 0 10:52                                    | 0.00                              |                       |
| 8  | Prop. 21in SD-5      | Prop. 18in SD-1                | McCloy Basin            | 115.00         | 0.31         | 21.000           | 0.0120    | 0.92                         | 5.99                        | 2.21               | 0.37                    | 1.75                      | 1.00             | 0 10:00                                    | 122.00                            | SURCHARGED            |
| 9  | Prop 18in SD-1       | Prop 18in SD-2                 | Prop. 18in Culv.        | 280.01         | 0.20         | 18.0             | 0.0100    | 0.81                         | 5.15                        | 1.41               | 0.27                    | 1.50                      | 1.00             | 0 10:00                                    | 59.00                             | SURCHARGED            |
| 10 | Prop 18in SD-2       | Prop 18in UD-3<br>Prop Culv #3 | Prop 18in SD-3          | 410.34         | 0.20         | 18.0             | 0.0100    | 1.14                         | 5.09                        | 1.54               | 0.30                    | 1.13                      | 0.75             | 0 10:02                                    | 0.00                              |                       |
| 11 | Prop 18in SD-3       | Prop 18in SD-2<br>Prop Culv #3 | Prop 21in SD-4          | 760.35         | 0.20         | 18.0             | 0.0100    | 2.29                         | 5.09                        | 1.50               | 0.30                    | 0.70                      | 0.47             | 0 10:02                                    | 0.00                              |                       |
| 12 | Prop 21 in SD-4      | Prop 18in SD-3<br>Prop Culv #4 | Port V-Ditch            | 22.09          | 0.23         | 21.0             | 0.0150    | 3.28                         | 8.17                        | 3.29               | 0.40                    | 0.76                      | 0.44             | 0 10:03                                    | 0.00                              |                       |
| 13 | Prop Culv #1         | Prop UD-1                      | Prop 18in SD-1          | 79.49          | 0.55         | 12.000           | 0.0110    | 1.80                         | 3.12                        | 0.97               | 0.31                    | 0.92                      | 0.93             | 0 09:58                                    | 0.00                              |                       |
| 14 | Prop Culv #2         | Prop UD-2                      | Prop 18in SD-2          | 76.04          | 1.00         | 12.000           | 0.0110    | 1.08                         | 4.21                        | 0.75               | 0.18                    | 0.92                      | 0.94             | 0 10:03                                    | 0.00                              |                       |
| 15 | Prop Culv #3         | Prop UD-3                      | Prop 18in SD-3          | 76.04          | 1.00         | 12.000           | 0.0110    | 1.42                         | 4.21                        | 1.12               | 0.27                    | 1.00                      | 1.00             | 0 10:02                                    | 3.00                              | SURCHARGED            |
| 16 | Prop Culv #4         | Prop UD-3                      | Prop 18in SD-4          | 76.05          | 1.50         | 12.000           | 0.0110    | 2.44                         | 5.16                        | 1.90               | 0.37                    | 0.96                      | 0.98             | 0 10:01                                    | 0.00                              |                       |
| 17 | Prop Culv #5         | Prop UD-5                      | McCloy Ditch            | 74.13          | 0.27         | 18.000           | 0.0140    | 1.56                         | 5.07                        | 2.17               | 0.43                    | 1.13                      | 0.76             | 0 10:03                                    | 0.00                              |                       |
| 18 | Prop Culv #6         | Prop UD-6                      | McCloy Ditch            | 74.00          | 0.27         | 21.000           | 0.0140    | 1.11                         | 7.63                        | 1.27               | 0.17                    | 1.14                      | 0.65             | 0 10:02                                    | 0.00                              |                       |
| 19 | Prop Culv #7         | Prop UD-7                      | McCloy Ditch            | 60.00          | 0.55         | 24.000           | 0.0150    | 0.03                         | 14.54                       | 0.05               | 0.00                    | 1.83                      | 0.92             | 0 09:55                                    | 0.00                              |                       |
| 20 | Prop UD-1            | -                              | Prop Culv #1            | 260.00         | 0.50         | 9.960            | 0.0150    | 2.27                         | 1.34                        | 0.96               | 0.71                    | 0.67                      | 0.81             | 0 10:00                                    | 0.00                              |                       |
| 21 | Prop UD-2            | -                              | Prop Culv #2            | 300.00         | 0.50         | 9.960            | 0.0120    | 2.72                         | 1.68                        | 0.77               | 0.46                    | 0.51                      | 0.64             | 0 10:00                                    | 0.00                              |                       |
| 22 | Prop UD-3            | -                              | Prop Culv #3            | 520.00         | 0.50         | 9.960            | 0.0110    | 3.24                         | 1.83                        | 1.10               | 0.60                    | 0.63                      | 0.78             | 0 10:00                                    | 0.00                              |                       |
| 23 | Prop UD-4            | -                              | Prop Culv #4            | 500.00         | 0.48         | 12.000           | 0.0110    | 3.68                         | 2.92                        | 2.01               | 0.69                    | 0.63                      | 0.66             | 0 10:01                                    | 0.00                              |                       |
| 24 | Prop UD-5            | -                              | Prop Culv #5            | 781.00         | 0.17         | 15.000           | 0.0120    | 2.47                         | 2.92                        | 2.36               | 0.81                    | 0.94                      | 0.75             | 0 10:01                                    | 0.00                              |                       |
| 25 | Prop UD -6           | -                              | Prop Culv #6            | 737.00         | 0.20         | 15.000           | 0.0120    | 2.30                         | 3.10                        | 1.59               | 0.51                    | 0.75                      | 0.60             | 0 10:01                                    | 0.00                              |                       |
| 26 | Prop UD-7            | -                              | Prop Culv #7            | 842.11         | 0.20         | 15.000           | 0.0120    | 1.64                         | 3.13                        | 2.02               | 0.64                    | 1.25                      | 1.00             | 0 10:00                                    | 9.00                              |                       |
| 27 | Prop. 946 Culvert    | Track 946 Ditch                | Burns Outfall #2        | 94.00          | 0.5000       | 18.000           | 0.0150    | 5.53                         | 6.44                        | 5.48               | 0.83                    | 1.02                      | 0.70             | 0 10:09                                    | 0.00                              |                       |

# McCloy Rail Yard 100% Stormwater Report

Table 5: Proposed Condition Closed Pipes Analysis - 10 -Year

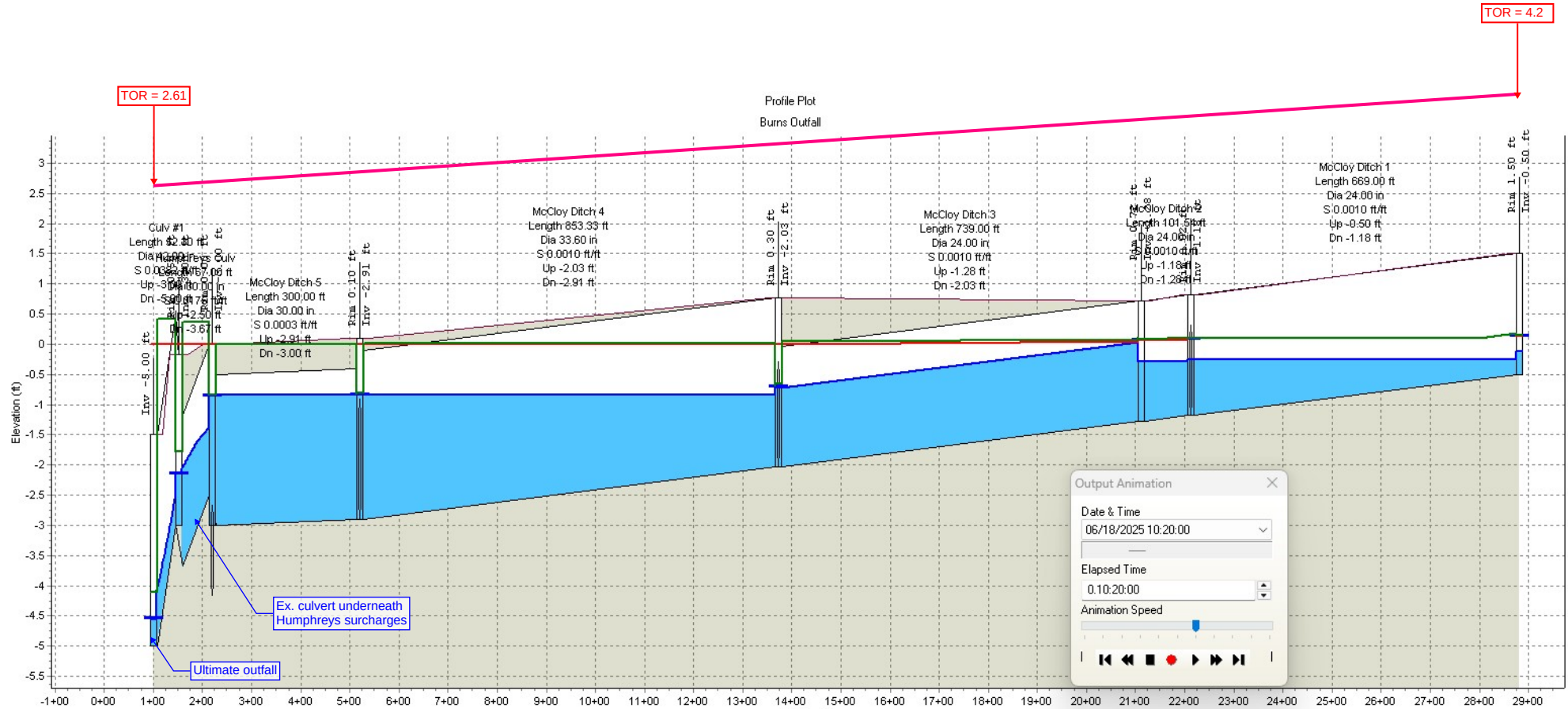
| SN | Drainage Pipe/ Culv. | Inlet                          | Outlet                  | Length<br>(ft) | Slope<br>(%) | Dia.<br>(inches) | Manning's | Max.<br>Velocity<br>(ft/sec) | Design<br>Capacity<br>(cfs) | Peak Flow<br>(cfs) | Max Design/<br>Capacity | Max Flow<br>Depth<br>(ft) | Max<br>Depth/Dia | Time of Peak<br>Occurrence<br>(days hh:mm) | Total Time<br>Surcharged<br>(min) | Reported<br>Condition |
|----|----------------------|--------------------------------|-------------------------|----------------|--------------|------------------|-----------|------------------------------|-----------------------------|--------------------|-------------------------|---------------------------|------------------|--------------------------------------------|-----------------------------------|-----------------------|
| 1  | Ex. Culv #1          | McCloy Canal                   | Burns Cutoff Outfall #1 | 52.30          | 3.82         | 42.000           | 0.0150    | 4.95                         | 341.04                      | 11.01              | 0.03                    | 0.60                      | 0.17             | 0 10:46                                    | 0.00                              |                       |
| 2  | Ex. Daggett Culv     | Fyffe Ditch #2                 | Fyffe Ditch #1          | 41.75          | 0.77         | 27.960           | 0.0180    | 4.42                         | 41.08                       | 4.31               | 0.10                    | 0.68                      | 0.29             | 0 10:06                                    | 0.00                              |                       |
| 3  | Ex. Expy Culv        | Port Culv.                     | Burns Cutoff Outfall #2 | 143.31         | 0.28         | 18.000           | 0.0150    | 2.68                         | 4.81                        | 1.71               | 0.36                    | 0.57                      | 0.39             | 0 10:01                                    | 0.00                              |                       |
| 4  | Ex. Fyffe Culv       | Fyffe Ditch #3                 | Fyffe Ditch #2          | 59.67          | 0.50         | 18.000           | 0.0140    | 3.24                         | 0.40                        | 4.14               | 10.37                   | 1.05                      | 0.70             | 0 10:06                                    | 0.00                              | > CAPACITY            |
| 5  | Ex. Humphreys Culv   | McCloy Ditch #1                | McCloy Canal            | 67.00          | 1.75         | 30.000           | 0.0170    | 4.69                         | 27.10                       | 8.74               | 0.32                    | 1.06                      | 0.42             | 0 10:14                                    | 0.00                              |                       |
| 6  | Ex. Humphreys Culv 2 | Fyffe Ditch #1                 | McCloy Ditch #1         | 94.09          | 0.73         | 18.000           | 0.0150    | 3.31                         | 6.64                        | 5.77               | 0.87                    | 1.50                      | 1.00             | 0 10:03                                    | 42.00                             | SURCHARGED            |
| 7  | Prop. McCloy Culvert | McCloy Basin                   | McCloy Outfall #1       | 61.00          | 0.82         | 15.0             | 0.0190    | 1.65                         | 4.00                        | 0.32               | 0.08                    | 0.27                      | 0.23             | 0 10:52                                    | 0.00                              |                       |
| 8  | Prop. 21in SD-5      | Prop. 18in SD-1                | McCloy Basin            | 115.00         | 0.31         | 21.000           | 0.0120    | 0.85                         | 5.99                        | 1.75               | 0.29                    | 1.73                      | 0.99             | 0 10:03                                    | 0.00                              |                       |
| 9  | Prop 18in SD-1       | Prop 18in SD-2                 | Prop. 18in Culvert      | 280.01         | 0.20         | 18.0             | 0.0100    | 0.82                         | 5.15                        | 1.27               | 0.25                    | 1.39                      | 0.93             | 0 10:03                                    | 0.00                              |                       |
| 10 | Prop 18in SD-2       | Prop 18in UD-3<br>Prop Culv #3 | Prop 18in SD-3          | 410.34         | 0.20         | 18.0             | 0.0100    | 1.42                         | 5.09                        | 1.06               | 0.21                    | 0.85                      | 0.57             | 0 10:02                                    | 0.00                              |                       |
| 11 | Prop 18in SD-3       | Prop 18in SD-2<br>Prop Culv #3 | Prop 21in SD-4          | 760.35         | 0.20         | 18.0             | 0.0100    | 1.77                         | 5.09                        | 1.06               | 0.21                    | 0.58                      | 0.39             | 0 10:02                                    | 0.00                              |                       |
| 12 | Prop 21 in SD-4      | Prop 18in SD-3<br>Prop Culv #4 | Port V-Ditch            | 22.09          | 0.23         | 21.0             | 0.0150    | 2.96                         | 8.17                        | 2.31               | 0.28                    | 0.63                      | 0.36             | 0 10:04                                    | 0.00                              |                       |
| 13 | Prop Culv #1         | Prop UD-1                      | Prop 18in SD-1          | 79.49          | 0.55         | 12.000           | 0.0110    | 1.80                         | 3.12                        | 0.75               | 0.24                    | 0.85                      | 0.87             | 0 10:07                                    | 0.00                              |                       |
| 14 | Prop Culv #2         | Prop UD-2                      | Prop 18in SD-2          | 76.04          | 1.00         | 12.000           | 0.0110    | 1.09                         | 4.21                        | 0.68               | 0.16                    | 0.83                      | 0.85             | 0 10:09                                    | 0.00                              |                       |
| 15 | Prop Culv #3         | Prop UD-3                      | Prop 18in SD-3          | 76.04          | 1.00         | 12.000           | 0.0110    | 1.27                         | 4.21                        | 0.79               | 0.19                    | 0.86                      | 0.88             | 0 10:02                                    | 0.00                              |                       |
| 16 | Prop Culv #4         | Prop UD-3                      | Prop 18in SD-4          | 76.05          | 1.50         | 12.000           | 0.0110    | 1.84                         | 5.16                        | 1.35               | 0.26                    | 0.87                      | 0.88             | 0 10:02                                    | 0.00                              |                       |
| 17 | Prop Culv #5         | Prop UD-5                      | McCloy Ditch            | 74.13          | 0.27         | 18.000           | 0.0140    | 1.37                         | 5.07                        | 1.48               | 0.29                    | 0.92                      | 0.62             | 0 10:03                                    | 0.00                              |                       |
| 18 | Prop Culv #6         | Prop UD-6                      | McCloy Ditch            | 74.00          | 0.27         | 21.000           | 0.0140    | 1.10                         | 7.63                        | 0.91               | 0.12                    | 0.90                      | 0.51             | 0 10:02                                    | 0.00                              |                       |
| 19 | Prop Culv #7         | Prop UD-7                      | McCloy Ditch            | 60.00          | 0.55         | 24.000           | 0.0150    | 0.03                         | 14.54                       | 0.06               | 0.00                    | 1.58                      | 0.79             | 0 10:02                                    | 0.00                              |                       |
| 20 | Prop UD-1            | -                              | Prop Culv #1            | 260.00         | 0.50         | 9.960            | 0.0150    | 2.28                         | 1.34                        | 0.68               | 0.51                    | 0.54                      | 0.70             | 0 10:00                                    | 0.00                              |                       |
| 21 | Prop UD-2            | -                              | Prop Culv #2            | 300.00         | 0.50         | 9.960            | 0.0120    | 2.70                         | 1.68                        | 0.53               | 0.32                    | 0.39                      | 0.48             | 0 10:02                                    | 0.00                              |                       |
| 22 | Prop UD-3            | -                              | Prop Culv #3            | 520.00         | 0.50         | 9.960            | 0.0110    | 3.15                         | 1.83                        | 0.75               | 0.41                    | 0.45                      | 0.56             | 0 10:02                                    | 0.00                              |                       |
| 23 | Prop UD-4            | -                              | Prop Culv #4            | 500.00         | 0.48         | 12.000           | 0.0110    | 3.54                         | 2.92                        | 1.41               | 0.48                    | 0.48                      | 0.51             | 0 10:01                                    | 0.00                              |                       |
| 24 | Prop UD-5            | -                              | Prop Culv #5            | 781.00         | 0.17         | 15.000           | 0.0120    | 2.37                         | 2.92                        | 1.71               | 0.59                    | 0.75                      | 0.60             | 0 10:01                                    | 0.00                              |                       |
| 25 | Prop UD -6           | -                              | Prop Culv #6            | 737.00         | 0.20         | 15.000           | 0.0120    | 2.26                         | 3.10                        | 1.15               | 0.37                    | 0.58                      | 0.47             | 0 10:01                                    | 0.00                              |                       |
| 26 | Prop UD-7            | -                              | Prop Culv #7            | 842.11         | 0.20         | 15.000           | 0.0120    | 1.12                         | 3.13                        | 1.37               | 0.44                    | 1.21                      | 0.98             | 0 10:02                                    | 0.00                              |                       |
| 27 | Prop. 946 Culvert    | Track 946 Ditch                | Burns Outfall #2        | 94.00          | 0.5000       | 18.000           | 0.0150    | 5.61                         | 6.44                        | 5.46               | 0.83                    | 0.75                      | 0.55             | 0 11:28                                    | 0.00                              |                       |
|    |                      |                                |                         |                |              |                  |           |                              |                             |                    |                         |                           |                  |                                            |                                   |                       |

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## Table 6: Proposed Condition Open Channel Analysis

| SN              | Ditch           | Inlet           | Outlet                  | Length<br>(ft) | Slope<br>(%) | Channel<br>Type | Height<br>(ft) | Width<br>(ft) | Manning's | Max<br>Velocity<br>(ft/sec) | Design<br>Capacity<br>(cfs) | Peak Flow<br>(cfs) | Max Design/<br>Capacity | Max Flow<br>Depth<br>(ft) | Max<br>Depth/Dia | Time of Peak<br>Occurrence<br>(days hh:mm) |
|-----------------|-----------------|-----------------|-------------------------|----------------|--------------|-----------------|----------------|---------------|-----------|-----------------------------|-----------------------------|--------------------|-------------------------|---------------------------|------------------|--------------------------------------------|
| <b>100-Year</b> |                 |                 |                         |                |              |                 |                |               |           |                             |                             |                    |                         |                           |                  |                                            |
| 1               | McCloy Ditch 1  | -               | McCloy Ditch 2          | 669.00         | 0.10         | Trapezoidal     | 2.000          | 10.00         | 0.0250    | 0.51                        | 24.18                       | 1.50               | 0.06                    | 0.95                      | 0.48             | 0 10:09                                    |
| 2               | McCloy Ditch 2  | McCloy Ditch 1  | McCloy Ditch 3          | 101.54         | 0.10         | Trapezoidal     | 2.000          | 10.00         | 0.0250    | 0.80                        | 23.80                       | 4.42               | 0.19                    | 1.31                      | 0.66             | 0 10:10                                    |
| 3               | McCloy Ditch 3  | McCloy Ditch 2  | McCloy Ditch 4          | 739.00         | 0.10         | Trapezoidal     | 2.000          | 10.00         | 0.0250    | 1.69                        | 24.18                       | 9.73               | 0.40                    | 1.29                      | 0.65             | 0 10:06                                    |
| 4               | McCloy Ditch 4  | McCloy Ditch 3  | McCloy Ditch 5          | 853.33         | 0.10         | Trapezoidal     | 2.800          | 13.20         | 0.0250    | 1.04                        | 52.34                       | 8.45               | 0.16                    | 1.69                      | 0.61             | 0 10:10                                    |
| 5               | McCloy Ditch 5  | McCloy Ditch 4  | Ex. Humphreys Culv.     | 300.00         | 0.03         | Trapezoidal     | 2.500          | 16.00         | 0.0250    | 0.29                        | 38.96                       | 6.23               | 0.16                    | 2.12                      | 0.85             | 0 10:16                                    |
| 6               | Port Rdwy Ditch | -               | Burns Cutoff Outfall #2 | 222.00         | 0.34         | Triangular      | 1.000          | 5.00          | 0.0160    | 1.35                        | 12.36                       | 0.63               | 0.05                    | 0.46                      | 0.46             | 0 10:00                                    |
| 7               | Track 946 Ditch | Prop. 21in SD-4 | Prop. Expy Culv.        | 418.00         | 0.12         | Trapezoidal     | 1.350          | 4.00          | 0.0160    | 1.10                        | 27.11                       | 6.38               | 0.24                    | 1.14                      | 0.85             | 0 10:04                                    |
| <b>50-Year</b>  |                 |                 |                         |                |              |                 |                |               |           |                             |                             |                    |                         |                           |                  |                                            |
| 1               | McCloy Ditch 1  | -               | McCloy Ditch 2          | 669.00         | 0.1000       | Trapezoidal     | 2.000          | 10.00         | 0.0250    | 0.51                        | 24.18                       | 1.45               | 0.06                    | 0.88                      | 0.45             | 0 10:00                                    |
| 2               | McCloy Ditch 2  | McCloy Ditch 1  | McCloy Ditch 3          | 101.54         | 0.1000       | Trapezoidal     | 2.000          | 10.00         | 0.0250    | 0.78                        | 23.80                       | 3.96               | 0.17                    | 1.24                      | 0.62             | 0 10:10                                    |
| 3               | McCloy Ditch 3  | McCloy Ditch 2  | McCloy Ditch 4          | 739.00         | 0.1000       | Trapezoidal     | 2.000          | 10.00         | 0.0250    | 1.64                        | 24.18                       | 8.61               | 0.36                    | 1.21                      | 0.61             | 0 10:06                                    |
| 4               | McCloy Ditch 4  | McCloy Ditch 3  | McCloy Ditch 5          | 853.33         | 0.1000       | Trapezoidal     | 2.800          | 13.20         | 0.0250    | 1.01                        | 52.34                       | 7.45               | 0.14                    | 1.61                      | 0.57             | 0 10:11                                    |
| 5               | McCloy Ditch 5  | McCloy Ditch 4  | Ex. Humphreys Culv.     | 300.00         | 0.0300       | Trapezoidal     | 2.500          | 16.00         | 0.0250    | 0.27                        | 38.96                       | 5.39               | 0.14                    | 2.04                      | 0.82             | 0 10:18                                    |
| 6               | Port Rdwy Ditch | -               | Burns Cutoff Outfall #2 | 222.00         | 0.34         | Triangular      | 1.000          | 5.00          | 0.0160    | 1.36                        | 12.36                       | 0.54               | 0.04                    | 0.42                      | 0.42             | 0 10:00                                    |
| 7               | Track 946 Ditch | Prop. 21in SD-4 | Prop. Expy Culv.        | 418.00         | 0.12         | Trapezoidal     | 1.350          | 4.00          | 0.0160    | 1.10                        | 27.11                       | 5.63               | 0.21                    | 1.04                      | 0.78             | 0 10:02                                    |
| <b>10-Year</b>  |                 |                 |                         |                |              |                 |                |               |           |                             |                             |                    |                         |                           |                  |                                            |
| 1               | McCloy Ditch 1  | -               | McCloy Ditch 2          | 669.00         | 0.1000       | Trapezoidal     | 2.000          | 10.00         | 0.0250    | 0.47                        | 24.18                       | 1.12               | 0.05                    | 0.71                      | 0.36             | 0 10:04                                    |
| 2               | McCloy Ditch 2  | McCloy Ditch 1  | McCloy Ditch 3          | 101.54         | 0.1000       | Trapezoidal     | 2.000          | 10.00         | 0.0250    | 0.71                        | 23.80                       | 2.81               | 0.12                    | 1.03                      | 0.52             | 0 10:10                                    |
| 3               | McCloy Ditch 3  | McCloy Ditch 2  | McCloy Ditch 4          | 739.00         | 0.1000       | Trapezoidal     | 2.000          | 10.00         | 0.0250    | 1.49                        | 24.18                       | 5.89               | 0.24                    | 1.00                      | 0.50             | 0 10:07                                    |
| 4               | McCloy Ditch 4  | McCloy Ditch 3  | McCloy Ditch 5          | 853.33         | 0.1000       | Trapezoidal     | 2.800          | 13.20         | 0.0250    | 0.89                        | 52.34                       | 5.15               | 0.10                    | 1.36                      | 0.49             | 0 10:12                                    |
| 5               | McCloy Ditch 5  | McCloy Ditch 4  | Ex. Humphreys Culv.     | 300.00         | 0.0300       | Trapezoidal     | 2.500          | 16.00         | 0.0250    | 0.30                        | 38.96                       | 4.81               | 0.12                    | 1.79                      | 0.71             | 0 10:14                                    |
| 6               | Port Rdwy Ditch | -               | Burns Cutoff Outfall #2 | 222.00         | 0.34         | Triangular      | 1.000          | 5.00          | 0.0160    | 1.34                        | 12.36                       | 0.35               | 0.03                    | 0.34                      | 0.34             | 0 10:01                                    |
| 7               | Track 946 Ditch | Prop. 21in SD-4 | Prop. Expy Culv.        | 418.00         | 0.12         | Trapezoidal     | 1.350          | 4.00          | 0.0160    | 1.03                        | 27.11                       | 3.79               | 0.14                    | 0.86                      | 0.64             | 0 10:05                                    |

McCloy Rail Yard  
100% Stormwater Report  
Figure 2: Burns Cutoff Outfall #1 Profile Plot  
100-Year Peak Flow



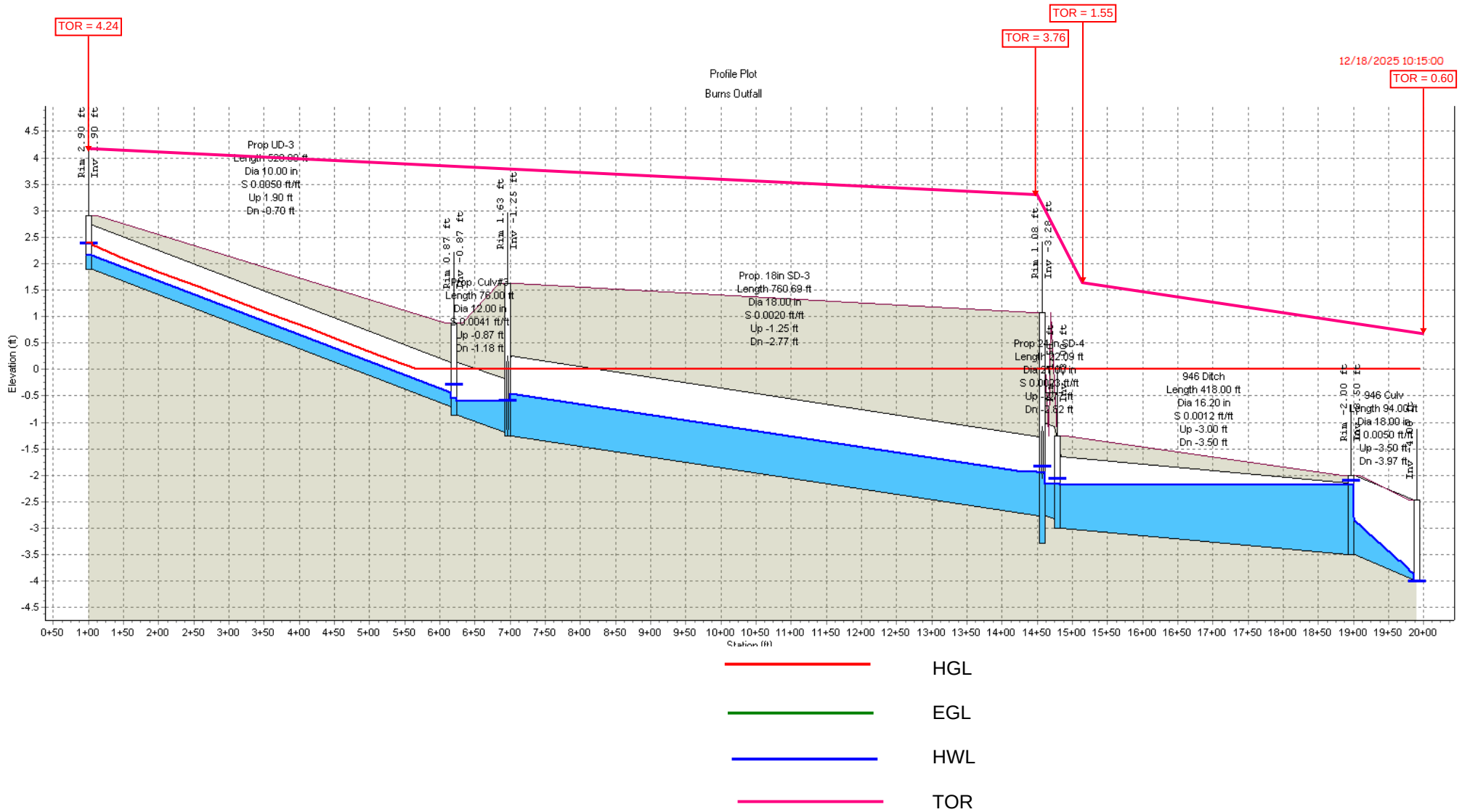
— HGL

— EGL

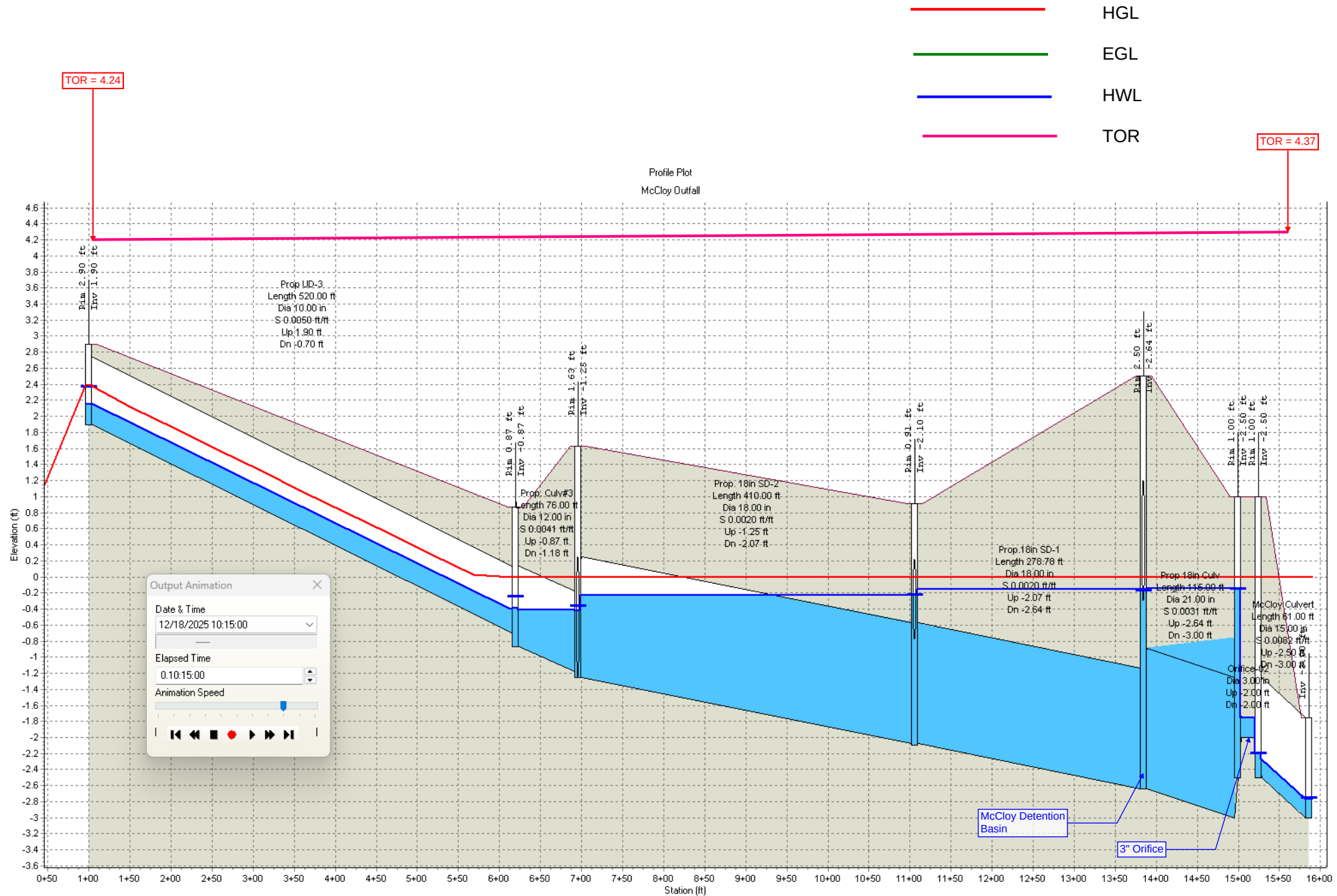
— HWL

— TOR

McCloy Rail Yard  
100% Stormwater Report  
Figure 3: Burns Cutoff Outfall #2 Profile Plot  
100-Year Peak Flow



McCloy Rail Yard  
100% Stormwater Report  
Figure 4: McCloy Outfall #1 Profile Plot  
100-Year Peak Flow





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