

# **Final Drainage Report For Overland Ranch Filing 1**

## **Prepared For:**

**JEN Colorado 19, LLC**  
680 5<sup>th</sup> Avenue, Fl. 25  
New York, NY 10019  
(303) 225-1904  
Contact: Jerry Richmond

## **Prepared By:**

**JR Engineering, LLC**  
7200 South Alton Way Suite C400  
Centennial, CO 80112  
(303) 740-9393  
Contact: Kurtis Williams

APPROVED FOR ONE YEAR FROM THIS DATE	
Aurora Water Department	Date

May 9th, 2024

**Engineer's Certification**

I hereby affirm that this report and plan for the drainage design of Overland Ranch Filing 1 was prepared by me (or under my direct supervision) in accordance with the provision of the *City of Aurora Storm Drainage Design and Technical Criteria Manual* for the owners thereof.

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Kurtis W. Williams, P.E  
State of Colorado No. 34270  
For and on Behalf of JR Engineering

Date



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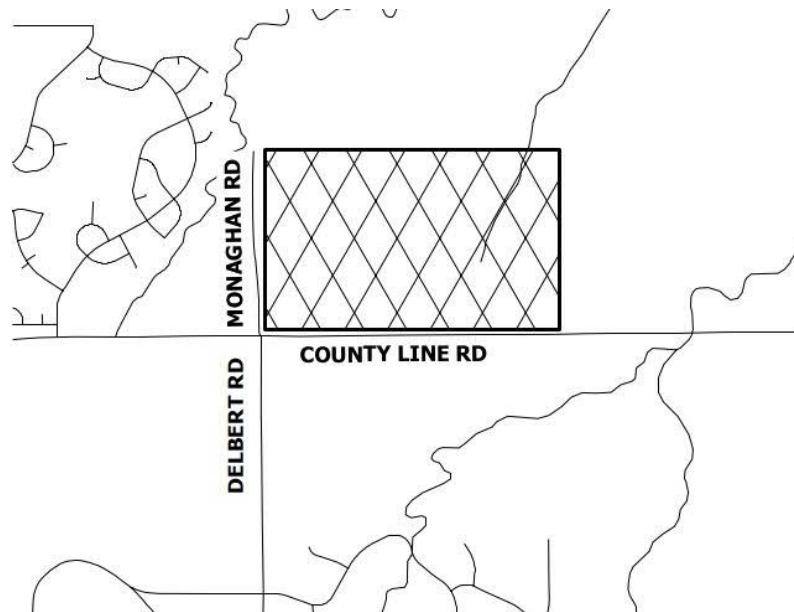
## INTRODUCTION

### 1. Location

The site is bounded to the west by S. Monaghan Road, to the north and east by undeveloped land, and to the south by E. County Line Road. The undeveloped land to the north and east is owned by the State of Colorado. The Overland Ranch Subdivision is approximately 375 acres, which includes the proposed site and half of the right-of-way for the adjacent streets. The Filing 1 portion of this subdivision comprises approximately 170 acres and will contain a density of 2.48 du/ac.

The site is located in the south half of Section 34, Township 5 South, Range 65 West of the 6<sup>th</sup> Principal Meridian within the City of Aurora, Arapahoe County, Colorado.

A vicinity map is provided below and in the appendix.



### 2. Proposed Development

Overland Ranch Filing 1 is currently undeveloped, covered with native grass, and sparsely distributed brush. The site's topography has multiple ridges and has one unregulated drainageway that runs through the site. The existing topography generally slopes towards this existing drainageway and has slopes that range between 3 to 20 percent. The proposed drainage patterns will generally follow the existing condition and will utilize the existing drainageway as a conveyance system.

The proposed site will consist of proposed roads, single-family development, a future amenity center located near the center of the site, and tracts with proposed detention ponds.

### **3. Changes to Master Drainage Report**

The site utilizes Drainageway 1 as a primary outfall. This drainageway in the Master Drainage Report was a Mile High Flood District maintenance eligible stream corridor that would be owned and operated by the City of Aurora. After further analysis, it was determined that the tributary area to this drainageway does not reach 130 acres and would be considered a major stream. This drainageway shall now be considered private and maintained by the HOA.

### **4. Requested Variances**

A variance to allow drops larger than 2.5 feet to occur within a manhole is being requested. This variance would encompass manholes outfalling into the drainageway and manholes within steeper roadways. This variance will help traverse steep slopes and avoid unnecessary manholes for Aurora to maintain.

## **HISTORIC DRAINAGE**

### **1. Description of Property and Drainage Basin**

The soils for the site have been classified by the USDA-NRCS soil survey as Bresser-Stapleton sandy loams, Buick Loam, Renohill-Little-Thedaland complex, and Fondis-Colby silt loams. These soils are classified as Type B & C Soils. A soils map can be found in Appendix 1.

The site historically drains off-site to the northwest and predominantly north through the existing drainageway. A portion of the site also sheet flows directly onto Monaghan Road, and is captured by existing inlets. Runoff from the site continues north through Mutchie Creek where it ultimately outfalls into Coal Creek. The site is located within Zone X (areas outside of the 100-year floodplain) as defined by FEMA Flood Insurance Rate Map, FIRM panels 08005C0508K and 08005C0509K, dated December 17, 2010. The FEMA Firm panels can be found in Appendix 1. Floodplain Development Permit submission is not needed for the drainage way and proposed development.

There is one main drainageway associated with the Filing 1 development. This drainageway does not have a regulated or unregulated floodplain associated with it at this time. Currently, the drainageway shows signs of erosion on the northern portion of the drainageway. These eroded areas will be improved and protected with the addition of Pond 302. Drop structures and a low flow riprap lined channel will be utilized along the southern portions in order to armor the drainageway and prevent future erosion. These improvements will help stabilize the drainageway and allow stormwater to be conveyed through the site effectively. All proposed storm outfalls into this drainageway will utilize impact stilling basins, riprap, and other erosion prevention measures in order prevent erosion and to keep the drainageway operational.

The existing drainage patterns are generally sloping toward the existing drainageway located onsite. Multiple ridgelines located throughout the site force drainage into these natural

drainageways and channels. The proposed drainage patterns will also typically follow these ridgelines, and will utilize the existing drainageway and site low points for pond placements and drainage conveyance.

Sub-basins OS3-OS5 are set to drain off of the property. These sub-basins will consist primarily of open space and proposed Monaghan Road improvements. Due to the topography of the site, these basins were not able to be captured and routed to a detention pond.

Sub-Basins OS1 and OS2 located just south of the site along County Line Road are proposed to be developed, and will be directed to Detention Pond 302. With the development of these basins, the offsite areas will be required to provide 100-year detention to reduce the flows to historic conditions per Elbert County drainage criteria. Because the runoff will mix with the on-site untreated runoff, water quality treatment for these offsite basins will be provided by the proposed Pond 302. The off-site 100-year flow will be routed through Pond 302 undetained. More detailed routing for these basins will be discussed later in this report.

Drainage for this site has been previously analyzed in the *Master Drainage Report Trails at Overland Ranch*, by Innovative Land Consultants, Inc, August 5, 2022 and the *Preliminary Drainage Report for Trails at Overland Ranch Filing 1*, by JR Engineering, LLC, April 18, 2024. These previous reports analyzed the drainage characteristics of this site, and calculated the required detention and WQCV for the onsite detention ponds. This final drainage report has maintained drainage patterns and other various drainage design aspects from the preliminary and master drainage reports.

## **C. DESIGN CRITERIA**

### **1. Hydrologic Criteria**

Rainfall intensities were determined by the equations set forth in the Criteria Manual. P1 values were determined from the charts contained within the NOAA Atlas 14 and the *City of Aurora Storm Drainage Design & Technical Criteria Manual*. One-hour point precipitation values of 0.83 inches and 2.38 inches were used for the 2-Year and 100-year events respectively. The NOAA Atlas 14 point precipitation frequency can be found in Appendix 1.

As per the previous report *Master Drainage Report Trails at Overland Ranch*, prepared by Innovative Land Consultants, Inc., water quality for the proposed site as well as off-site Sub-Basins OS1 & OS2 will be provided in the onsite detention ponds. Due to a watershed area larger than 90 acres for Pond 302, the 100-year detention volume was analyzed using Colorado Urban Hydrograph Procedure (CUHP) in conjunction with hydrograph and reservoir routing through EPA's Storm Water Management Model (SWMM) as per criteria from City of Aurora (COA) Storm Drainage Design & Technical Criteria (SDDTC)-Section 6.33. As can be seen on the SWMM model schematic map in Appendix 3, onsite sub-basins for Basin B were consolidated into 9 sub-basins for the CUHP analysis. Because the road profiles and overlot grading differs slightly from the *Master Drainage Report Trails at*

*Overland Ranch* prepared by Innovative Land Consultants, Inc., the tributary area and composite impervious percentage for Pond 302 have been slightly modified. Thus, the CUHP/SWMM analysis was performed to verify Pond 302's required volume.

MHFD-Detention Workbook (Version 4.05, February 2022) was also utilized to complete the designs for the proposed detention ponds. The pond outlet structure is sized to release the WQCV over a 12-40 hour period, the EURV in an additional 12 - 32 and the 100-year to release based on 90% of the predevelopment 100-year peak flow rate in Section 10.4 of the *City of Aurora Storm Drainage and Technical Criteria Manual*. 1 foot of freeboard above the computed 100-year water surface elevation, as it is being conveyed by the emergency overflow weir, was also provided per MHFD requirements.

The Rational Method was utilized to determine runoff values for the proposed site. These flows were used to size the storm inlets and storm pipes throughout the site. The minor storm was analyzed as the 2-year event. The major storm was analyzed as the 100-year event. All Rational Method calculations can be found in Appendix 2.

## **2. Hydraulic Criteria**

All inlets and pipes will be designed for the 100-year storm. The latest version of Mile High Flood District's workbook "MHFD-Inlet") shall be used to size the inlets. Street capacities shall also be calculated with the Mile High Flood District's workbook "MHFD-Inlet". These street capacities will be based on street geometry, allowable flow spread, and the maximum depth of flow at the street flowline. These street capacities and inlet calculations shall be part of Appendix 3.

GeoHECRAS software was utilized to verify the stabilization of Drainageway 1, and to calculate the 100-year WSEL within the channel to verify drainageway capacity and to ensure minimum finished floor elevations for the proposed lots along this drainageway could be met. The 100-year storm was modeled with the flows obtained from the Rational Method. Manning's roughness coefficients were taken from the *City of Aurora Storm Drainage and Technical Criteria Manual*. Hydraulic calculations and results can be found in Appendix 3.

Bentley Systems' StormCAD modeling software was also utilized to model the storm sewer network's hydraulic grade lines. Per Aurora criteria, HGL's for the 2-year storm did not surcharge the pipes, and the 100-year HGL's were kept 1' below manhole lids, inlet grates, and inlet inverts as a minimum. An ultimate condition model was also created for the County Line Road to ensure developed discharge from Elora Filing 1 were incorporated into the final design. StormCAD results for both models can be found in Appendix 3.

All storm sewer for the proposed development will be public and maintained by the city. Ponds, swales, and the Type C inlets and associated laterals shall be private and maintained by the HOA. Cross sections of the swales have been analyzed and added to Appendix 3. A minimum of one foot freeboard has been provided between the WSEL of the major storm event in the swales and the adjacent top of foundations.

*Master Drainage Report Trails at Overland Ranch*, prepared by Innovative Land Consultants, Inc. as well as the *City of Aurora Storm Drainage and Technical Criteria Manual* were also referenced in the preparation of this report.

## **D. DRAINAGE PLAN**

### **1. General Concept**

The development site has been designed to conform to general drainage characteristics as described in the City of Aurora Storm Drainage Design and Technical Criteria, Aurora Roadway Specifications, Master Drainage Report Trails at Overland Ranch, and the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM). All drainage patterns established with the *Master Drainage Report Trails at Overland Ranch* will remain as designed to the greatest extent possible and will stay consistent with the proposed Preliminary Drainage Plan. Water quality and detention will be provided on-site in the proposed full spectrum detention ponds. The proposed drainage patterns will also typically follow these ridgelines, and will utilize the existing drainageway and site low points for pond placements and drainage conveyance to Mutchie Creek. No Master Drainage Plan Amendment is required with the FDR.

On-site inlets and storm sewer pipes were sized to capture and convey 100-year storm flows below grade. Inlets shown on plan are designed in a sump condition unless otherwise noted.

Sub-Basins OS1 and OS2 located just south of the site along County Line Road are proposed to be developed, and will be directed to Detention Pond 302. With the development of these basins, the offsite areas will be required to provide 100-year detention to reduce the flows to historic conditions per Elbert County drainage criteria. Because the runoff will mix with the on-site untreated runoff, water quality treatment for these offsite basins will be provided by the proposed Pond 302. The off-site 100-year flow will be routed through Pond 302 undetained. Sub-basins OS3-OS5 are set to drain off of the property. These sub-basins will consist primarily of open space and proposed Monaghan Road improvements. Due to the topography of the site, these basins were not able to be captured and routed to a detention pond. More detailed routing for these basins will be discussed later in this report.

### **2. Specific Details**

#### ***Onsite Basins***

##### **Basin A**

The runoff from the proposed Basin A will be collected by proposed storm sewer infrastructure. Flows from this basin will be routed through the site to the proposed Detention Pond 329. The routing for Basin A can be found below.

Basin A1 (1.91 acres, 10.7% impervious) consists entirely of landscaping area. The runoff from this sub-basin will be captured by a Type C inlet located at Design Point 71. It will

then be routed via storm sewer to Design Point 7.0. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 72.

Basin A2 (1.32 acres, 60.3% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 72. It will then be routed via storm sewer to Design Point 7.0. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 73.

Basin A3 (0.45 acres, 74.7% impervious) is comprised of proposed roadway and open space. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 73. It will then be routed via storm sewer to Design Point 7.1. If this inlet clogs, developed runoff from this basin will overflow into Monaghan Road to the proposed inlet at Design Point 75.

Basin A4 (5.13 acres, 42.6% impervious) is comprised of open space and proposed Monaghan Road. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 74. It will then be routed via storm sewer to Design Point 7.2. Carry-over flows from this inlet are conveyed via curb and gutter to the proposed sump inlet at Design Point 72.

Basin A5 (0.62 acres, 71.5% impervious) is comprised of open space and existing Monaghan Road. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 75. This on-grade inlet will need to be sized to capture 100% of the developed runoff, so that the developed runoff reaches Pond 329. It will then be routed via storm sewer to Design Point 7.3. If this inlet clogs, developed runoff from this basin will overflow into an existing inlet along Monaghan Road, located approximately 340 feet north of the site.

Basin A6 (2.06 acres, 27.5% impervious) is comprised of open space and the proposed Pond 329. The runoff from this sub-basin will overland flow into the proposed pond where it will be conveyed to the outlet structure located at Design Point 7.4. From here, the flows generated from Basin A will be released into the existing storm sewer infrastructure located in Monaghan Road.

## **Basin B**

The runoff from the proposed Basin B will be routed through the site to the proposed Detention Pond 302. The runoff will be collected by proposed storm sewer infrastructure and an existing drainageway. The routing for Basin B can be found below.

Basin B1 (1.54 acres, 69.8% impervious) is comprised of open space and existing County Line Road. The runoff from this sub-basin will be captured by a future Type R sump inlet located at Design Point 1. It will then be routed via storm sewer to DP 1.0. Flows from this sub-basin will then be routed via grass lined swale to a proposed culvert located at Design

Point 1.2. If this future inlet clogs, developed runoff from this basin will overflow into a proposed swale where it will be conveyed to Design Point 3.

Basin B2 (1.54 acres, 76.6% impervious) is comprised of open space and existing County Line Road. The runoff from this sub-basin will be captured by a future Type R sump inlet located at Design Point 2. It will then be routed via storm sewer to DP 1.1. Flows from this sub-basin will then be routed via grass lined swale to a proposed culvert located at Design Point 1.2. If this future inlet clogs, developed runoff from this basin will overflow into a proposed swale where it will be conveyed to Design Point 3.

Basin B3 (8.43 acres, 14.5% impervious) is comprised of single-family residential lots and open space. The runoff from this sub-basin will be captured by various grass-lined swales and conveyed to a culvert located at Design Point 1.2. It will then be routed via storm sewer to Design Point 1.5.

Basin B3A (0.85 acres, 11.1% impervious) is comprised of single-family residential lots and open space. The runoff from this sub-basin will be captured by various grass-lined swales and conveyed to a sump inlet located at Design Point 1.0A. It will then be routed via storm sewer to Design Point 1.2. If this inlet clogs, developed runoff from this basin will be conveyed via swale to Design Point 1.2.

Basin B4 (2.51 acres, 56.7% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 4. It will then be routed via storm sewer to Design Point 1.3. If this inlet clogs, developed runoff from this basin will overflow directly into Drainageway 1.

Basin B5 (1.50 acres, 58.5% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 5. It will then be routed via storm sewer to Design Point 1.3. If this inlet clogs, developed runoff from this basin will overflow directly into Drainageway 1.

Basin B6 (1.46 acres, 57.3% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 6. It will then be routed via storm sewer to Design Point 1.4. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 4. If the inlet at Design Point 4 clogs, developed runoff from this basin will overflow into the existing drainageway located just north of the inlet.

Basin B7 (2.66 acres, 55.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 7. It will then be routed via storm sewer to Design Point 1.4. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 4. If the inlet at Design Point 4 clogs, developed runoff from this basin will overflow into the existing drainageway located just north of the inlet.



Basin B8 (1.76 acres, 63.3% impervious) is comprised of future single-family residential and future roadway that will be constructed with the Filing 2 improvements. It also consists of proposed roadway. The composite impervious percentages for the future improvements within this basin were calculated using updated values in the 2023 City of Aurora Storm Drainage Criteria Manual, in order to adequately size proposed storm sewer infrastructure. The runoff from this sub-basin will be captured by a temporary Type C inlet located at Design Point 8. It will then be routed via storm sewer to Design Point 1.6.

Basin B9 (1.53 acres, 55.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 9. It will then be routed via storm sewer to Design Point 1.6. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 10.

Basin B10 (2.40 acres, 56.5% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 10. It will then be routed via storm sewer to Design Point 1.7. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 45.

Basin B11 (0.44 acres, 60.1% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 11. It will then be routed via storm sewer to DP 1.7. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 45.

Basin B12 (0.66 acres, 60.6% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 12. It will then be routed via storm sewer to DP 1.9. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 4.

Basin B13 (2.91 acres, 32.9% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 13. It will then be routed via storm sewer to DP 1.9. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 18.

Basin B14 (1.54 acres, 80.9% impervious) is comprised of the existing Monaghan Road. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 14. It will then be routed via storm sewer to Design Point 2.0. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 16.

Basin B15 (2.20 acres, 5.0% impervious) consists entirely of landscaped area. The runoff from this sub-basin will be captured by a Type C inlet located at Design Point 15. It will

then be routed via storm sewer to Design Point 2.0. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 16.

Basin B16 (0.66 acres, 67.9% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 16. It will then be routed via storm sewer to Design Point 2.1. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 24.

Basin B17 (0.37 acres, 82.0% impervious) is comprised solely of proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 17. It will then be routed via storm sewer to Design Point 2.1. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 24.

Basin B18 (1.97 acres, 52.4% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 18. It will then be routed via storm sewer to Design Point 2.2. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 16.

Basin B19 (1.28 acres, 58.1% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 19. It will then be routed via storm sewer to Design Point 2.2. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 16.

Basin B20 (0.66 acres, 62.4% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 20. It will then be routed via storm sewer to Design Point 2.4. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 26.

Basin B21 (2.61 acres, 52.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 21. It will then be routed via storm sewer to Design Point 2.5. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 20.

Basin B22 (1.45 acres, 58.8% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 22. It will then be routed via storm sewer to Design Point 2.5. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 27.

Basin B23 (22.94 acres, 14.4% impervious) is comprised of single-family residential lots, open space, and an existing drainageway. The runoff from this sub-basin will overland flow into the existing drainageway. It will then be routed by the drainageway to Design Point 2.8.

Basin B24 (3.41 acres, 50.2% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 24. It will then be routed via storm sewer to Design Point 2.9. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 30.

Basin B25 (2.35 acres, 53.1% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 25. It will then be routed via storm sewer to Design Point 2.9. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 28.

Basin B26 (3.57 acres, 51.2% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 26. It will then be routed via storm sewer to Design Point 3.0. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 28.

Basin B27 (1.47 acres, 61.4% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 27. It will then be routed via storm sewer to Design Point 3.0. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 29.

Basin B28 (1.62 acres, 55.7% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 28. It will then be routed via storm sewer to Design Point 3.1. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 32.

Basin B29 (1.19 acres, 54.5% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 29. It will then be routed via storm sewer to Design Point 3.1. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 32.

Basin B30 (3.16 acres, 41.8% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 30. It will then be routed via storm sewer to Design Point 3.2. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 33.

Basin B31 (1.87 acres, 53.4% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 31. It will then be routed via storm sewer to Design Point 3.2. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 33.

Basin B32 (0.20 acres, 77.5% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 32. It will then be routed via storm sewer to Design Point 3.4. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 38.

Basin B33 (0.21 acres, 74.0% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 33. It will then be routed via storm sewer to Design Point 3.4. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 38.

Basin B33A (0.41 acres, 49.0% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 33A. It will then be routed via storm sewer to Design Point 3.5A. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 33.

Basin B33B (0.21 acres, 68.3% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 33B. It will then be routed via storm sewer to Design Point 3.5A. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 39.

Basin B34 (0.98 acres, 58.1% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 34. It will then be routed via storm sewer to Design Point 3.5. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 73.

Basin B35 (0.98 acres, 60.9% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 35. It will then be routed via storm sewer to Design Point 3.5. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 73.

Basin B36 (1.24 acres, 57.5% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 36. It will then be routed via storm sewer to Design Point 3.6. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 37.

Basin B37 (1.74 acres, 53.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 37. It will then be routed via storm sewer to Design Point 3.6. If this inlet clogs, developed runoff from this basin will overflow into the proposed overflow spillway into Pond 302.

Basin B38 (0.91 acres, 58.2% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 38. It will then be routed via storm sewer to Design Point 3.9. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 39.

Basin B39 (0.78 acres, 53.7% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 39. It will then be routed via storm sewer to Design Point 3.9. If this inlet clogs, developed runoff from this basin will overflow directly into the proposed Pond 302.

Basin B39A (0.23 acres, 62.8% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 39A. It will then be routed via storm sewer to Design Point 5.3A. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 39.

Basin B39B (0.26 acres, 81.7% impervious) is comprised solely of proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 39B. It will then be routed via storm sewer to Design Point 5.3A. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 47.

Basin B40 (1.94 acres, 63.6% impervious) is comprised of future single-family residential and future roadway that will be constructed with the Filing 2 improvements. It also consists of proposed roadway. The composite impervious percentages for the future improvements within this basin were calculated using updated values in the 2023 City of Aurora Storm Drainage Criteria Manual, in order to adequately size proposed storm sewer infrastructure. The runoff from this sub-basin will be captured by a temporary Type C inlet located at Design Point 40. It will then be routed via storm sewer to Design Point 4.0.

Basin B41 (0.80 acres, 59.7% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 41. It will then be routed via storm sewer to Design Point 4.0. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 42.

Basin B42 (2.98 acres, 54.7% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 42. It will then be routed via storm sewer to Design Point 4.1. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 55.

Basin B43A (0.95 acres, 59.5% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 43A. It will then be routed via storm sewer to Design Point 4.1A. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 43.

Basin B43 (0.45 acres, 64.4% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 43. It will then be routed via storm sewer to Design Point 4.2. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 47.

Basin B44 (0.22 acres, 77.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 44. It will then be routed via storm sewer to Design Point 4.2. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 47.

Basin B45 (2.01 acres, 50.9% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 45. It will then be routed via storm sewer to Design Point 4.3. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 43.

Basin B46 (1.56 acres, 61.8% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 46. It will then be routed via storm sewer to Design Point 4.3. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 48.

Basin B47 (2.80 acres, 51.3% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 47. It will then be routed via storm sewer to Design Point 4.5. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 38.

Basin B48 (1.29 acres, 61.7% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 48. It will then be routed via storm sewer to Design Point 4.5. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 38.

Basin B49A (4.22 acres, 25.0% impervious) is comprised solely of proposed park. The composite impervious percentages for the future improvements within this basin were calculated using updated values in the 2023 City of Aurora Storm Drainage Criteria Manual, in order to adequately size the proposed storm sewer stub servicing this basin. The runoff from this sub-basin will be captured by future storm sewer. Runoff from this basin will be routed via storm sewer to Design Point 4.0A.

Basin B49B (1.94 acres, 25.0% impervious) is comprised solely of proposed park. The runoff from this sub-basin will be captured by future storm sewer. The composite impervious percentages for the future improvements within this basin were calculated using

updated values in the 2023 City of Aurora Storm Drainage Criteria Manual, in order to adequately size the proposed storm sewer stub servicing this basin. Runoff from this basin will be routed via storm sewer to Design Point 4.6.

Basin B50 (0.46 acres, 80.3% impervious) is comprised of future and proposed roadway. The runoff from this sub-basin will be captured by a future Type R on-grade inlet located at Design Point 50. The composite impervious percentages for the future improvements within this basin were calculated using updated values in the 2023 City of Aurora Storm Drainage Criteria Manual, in order to adequately size proposed storm sewer infrastructure. It will then be routed via storm sewer to Design Point 4.6. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 51.

Basin B51 (0.85 acres, 81.0% impervious) is comprised solely of proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 51. It will then be routed via storm sewer to Design Point 4.7. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 55.

Basin B52 (0.96 acres, 60.0% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 52. It will then be routed via storm sewer to Design Point 4.7. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 55.

Basin B53 (1.33 acres, 58.5% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 53. It will then be routed via storm sewer to Design Point 4.8. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 59.

Basin B54 (0.56 acres, 59.8% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 54. It will then be routed via storm sewer to Design Point 4.8. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 59.

Basin B55 (3.16 acres, 54.4% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 55. It will then be routed via storm sewer to Design Point 5.0. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 39B.

Basin B56 (1.09 acres, 59.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 56. It will then be routed via storm sewer to Design Point 5.0. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 39B.

Basin B57 (0.79 acres, 60.1% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 57. It will then be routed via storm sewer to Design Point 5.1. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 58.

Basin B58 (2.16 acres, 65.0% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 58. It will then be routed via storm sewer to Design Point 5.2. If this inlet clogs, developed runoff from this basin will overflow into a proposed emergency overflow directly into Pond 302.

Basin B58A (0.98 acres, 32.7% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type C inlet located at Design Point 58A. It will then be routed via storm sewer to Design Point 5.2A. If this inlet clogs, developed runoff from this basin will overflow directly into Pond 302.

Basin B59 (3.96 acres, 50.9% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 59. It will then be routed via storm sewer to Design Point 5.1. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 57.

Basin B61 (2.43 acres, 85.0% impervious) is a proposed community center and associated parking lot. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 61. It will then be routed via storm sewer to Design Point 5.5. If this inlet clogs, developed runoff from this basin will overflow directly into Pond 302.

Basin B62 (12.96 acres, 36.7% impervious) is comprised of single-family lots, open space, and the proposed Pond 302. The runoff from this sub-basin will overland flow into the proposed pond where it will be conveyed to the outlet structure located at Design Point 5.7. From here, the flows generated from Basin B will be released into the existing drainageway located just north of the pond.

## **Basin C**

The runoff from the proposed Basin C will be collected by proposed storm sewer infrastructure. Flows from this basin will be routed through the site to the proposed Detention Pond 306. The routing for Basin C can be found below.

Basin C1 (1.51 acres, 40.7% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 81. It will then be routed via storm sewer to Design Point 8.0. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 57.



Basin C2 (1.39 acres, 58.5% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 82. It will then be routed via storm sewer to Design Point 8.0. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 57.

Basin C3 (1.74 acres, 51.6% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 83. It will then be routed via storm sewer to Design Point 8.1. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 85.

Basin C4 (3.68 acres, 50.3% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 84. It will then be routed via storm sewer to Design Point 8.1. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 83.

Basin C5 (2.03 acres, 56.9% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 85. It will then be routed via storm sewer to Design Point 8.2. If this inlet clogs, developed runoff from this basin will overflow directly into Pond 306.

Basin C6 (1.05 acres, 36.2% impervious) is comprised of single-family residential lots and open space. The runoff from this sub-basin will be captured by a proposed swale and conveyed to a Type C inlet located at Design Point 86. It will then be routed via storm sewer to Design Point 8.3. If this inlet clogs, developed runoff from this basin will overflow directly into Pond 306.

Basin C7 (9.17 acres, 71.1% impervious) is comprised of future single-family residential lots and future roadways to be completed with the Filing 2 improvements. The composite impervious percentages for the future improvements within this basin were calculated using updated values in the 2023 City of Aurora Storm Drainage Criteria Manual, in order to adequately size proposed storm sewer infrastructure. The runoff from this sub-basin will be captured by future storm sewer infrastructure and conveyed to Design Point 87. It will then be routed via storm sewer and proposed Pond 306 to Design Point 8.4.

Basin C8 (3.03 acres, 64.9% impervious) is comprised of future single-family residential lots and future roadways to be completed with the Filing 2 improvements. The composite impervious percentages for the future improvements within this basin were calculated using updated values in the 2023 City of Aurora Storm Drainage Criteria Manual, in order to adequately size proposed storm sewer infrastructure. The runoff from this sub-basin will be captured by future storm sewer infrastructure and conveyed to Design Point 88. It will then be routed via storm sewer and proposed Pond 306 to Design Point 8.4.

Basin C9 (4.93 acres, 40.2% impervious) is comprised of single-family lots, open space, and the proposed Pond 306. The runoff from this sub-basin will overland flow into the proposed pond where it will be conveyed to the outlet structure located at Design Point 8.4. From here, the flows generated from Basin C will be released into the existing drainageway located just north of the pond.

## **Basin D**

The runoff from the proposed Basin D will be collected by proposed storm sewer infrastructure and temporary swales. Flows from this basin will be routed through the site to the proposed temporary Detention Pond D. The routing for Basin D can be found below.

Basin D1 (3.06 acres, 54.9% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 91. It will then be routed via storm sewer to Design Point 9.0. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 94.

Basin D2 (3.07 acres, 56.8% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 92. It will then be routed via storm sewer to Design Point 9.0. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 94.

Basin D3 (1.77 acres, 54.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 93. It will then be routed via storm sewer to Design Point 9.1. If this inlet clogs, developed runoff from this basin will overflow into a proposed swale and conveyed to Design Point 95.

Basin D4 (1.65 acres, 64.1% impervious) is comprised of open space, the existing County Line Road, and a future roadway that will be constructed with the Filing 2 improvements. The composite impervious percentages for the future improvements within this basin were calculated using updated values in the 2023 City of Aurora Storm Drainage Criteria Manual, in order to adequately size proposed storm sewer infrastructure. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 94. It will then be routed via storm sewer to Design Point 9.1. If this inlet clogs, developed runoff from this basin will overflow into a proposed swale and conveyed to Design Point 95.

Basin D5 (11.36 acres, 5.7% impervious) is comprised of undeveloped land, a temporary swale, and the proposed temporary Pond D. Developed runoff from Filing 1 will be conveyed through this basin, via swale, to the temporary Pond D at Design Point 95. Due to existing topography, the existing runoff from this sub-basin will also be captured by the temporary grass-lined swale, and conveyed to Design Point 95. These runoffs will then be conveyed by Pond D to the proposed outlet structure at Design Point 9.2. From here, the flows generated from Basin D will be released into the existing drainageway located just

north of the pond. Basin D5 will be developed and analyzed further with the Filing 2 improvements. This future basin will be serviced by the future Pond 309 within the Filing 2 improvements.

### **Offsite Basins**

Basin OS1 (21.79 acres, 5.0% impervious) is anticipated to be “High Density Rural Residential” with a 55% imperviousness. The runoff from this sub-basin, in the interim condition, will follow historic drainage patterns to a low point along County Line Road at Design Point OS1. With the development of this basin (ultimate condition), the offsite areas will be provided 100-year detention in Elora Filing 1’s Pond A to reduce the flows to historic conditions, per Elbert County drainage criteria. From here, the runoff will be conveyed north to Design Point 6.2 (ultimate condition). It will then be routed via storm sewer infrastructure to Pond 302. Because this runoff will mix with the onsite untreated runoff, water quality treatment for this offsite basin will be provided by the proposed Pond 302. The offsite 100-year flow will be routed undetained. The Final Drainage Maps shows this basin in the interim condition, while the Ultimate County Line Road drainage maps incorporate the proposed release rate of the Elora Filing 1 pond, which encompasses the detention of the developed runoff of this basin.

Basin OS2 (13.65 acres, 5.0% impervious) is anticipated to be “High Density Rural Residential” with a 55% imperviousness. The runoff from this sub-basin will follow historic drainage patterns to a low point along County Line Road at Design Point OS2. With the development of this basin (ultimate condition), the offsite areas will be provided 100-year detention in Elora Filing 1’s Pond A to reduce the flows to historic conditions, per Elbert County drainage criteria. From here, the runoff will be conveyed north to Design Point 6.2 (ultimate condition). It will then be routed via storm sewer infrastructure to Pond 302. Because this runoff will mix with the onsite untreated runoff, water quality treatment for this offsite basin will be provided by the proposed Pond 302. The offsite 100-year flow will be routed undetained. The Final Drainage Maps shows this basin in the interim condition, while the Ultimate County Line Road drainage maps incorporate the proposed release rate of the Elora Filing 1 pond, which encompasses the detention of the developed runoff of this basin.

Basin OS3 (0.14 acres, 65.0% impervious) is comprised of open space and future roadway. The runoff from this sub-basin will be captured by a temporary Type C inlet, at Design Point OS3. It will then be routed via storm sewer to Design Point 7.5. In order to accommodate this undetained flow generated by this basin, Pond 329’s allowable release rate has been reduced to result in the same net flow downstream.

Basin OS4 (0.72 acres, 2.0% impervious) is comprised solely of open space. The runoff from this sub-basin will overland flow offsite into an existing drainageway at Design Point OS4.

Basin OS5 (1.69 acres, 31.2% impervious) is comprised of open space and single-family residential lots. The runoff from this sub-basin will overland flow offsite into an existing drainageway at Design Point OS5. In order to accommodate this undetained flow generated

by this basin, Pond 306's allowable release rate has been reduced to result in the same net flow downstream.

### **Ultimate Basins**

The runoff from the proposed ultimate basins will be collected by storm sewer infrastructure and existing swales. Flows from these basin will either be routed through existing swales, Overland Ranch Filing 1 drainage infrastructure, storm sewer proposed with the Elora Filing 1 site, located to the south of County Line Road, or by ultimate storm sewer proposed within County Line Road. The routing for these ultimate basins can be found below. All ultimate runoff routing and associated calculations can be found in their respective appendices.

Basin UB3 (7.32 acres, 14.8% impervious) is the ultimate basin configuration for Basin B3. This basin is comprised of single-family residential lots and open space. The runoff from this sub-basin will be captured by various grass-lined swales and conveyed to a culvert located at Design Point 1.2. It will then be routed via storm sewer to Design Point 1.5.

Basin UB3A (1.05 acres, 19.0% impervious) is the ultimate basin configuration for Basin B3A. This basin is comprised of single-family residential lots and open space. The runoff from this sub-basin will be captured by a Type D inlet located at Design Point 3A. It will then be routed via storm sewer to Design Point 1.0A.

Basin UB12 (0.69 acres, 66.4% impervious) is the ultimate basin configuration for Basin B12. This basin is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 12. It will then be routed via storm sewer to DP 1.9. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 4.

Basin UB13 (3.03 acres, 36.8% impervious) is the ultimate basin configuration for Basin B13. This basin is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 13. It will then be routed via storm sewer to DP 1.9. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 18.

Basin CL1 (2.66 acres, 18.5% impervious) is comprised of open space and existing Delbert Road. The runoff from this sub-basin will be captured by an existing swale and conveyed to DP C1. It will then be routed via existing storm sewer to within County Line Road.

Basin CL2 (1.45 acres, 76.9% impervious) is comprised of future landscaping, future Delbert Road, and the ultimate County Line Road configuration. The runoff from this sub-basin will be conveyed via future curb and gutter to the Elora Site entrance located at Design Point C2. Future storm sewer within the Elora site will then convey these flows to the future Elora Pond A. The ultimate County Line Road and Elora site drainage concept are shown on the ultimate drainage maps.

Basin CL3 (0.59 acres, 93.7% impervious) is comprised of future landscaping and the ultimate County Line Road configuration. The runoff from this sub-basin will be captured by a future Type R inlet located at Design Point C3. It will then be routed via storm sewer to DP 1.0A. If this future inlet clogs, developed runoff from this basin will overflow into a proposed swale where it will be conveyed to Design Point 3A.

Basin CL4 (1.80 acres, 54.2% impervious) is comprised of future landscaping and the ultimate County Line Road configuration. The runoff from this sub-basin will be captured by a future Type R sump inlet located at Design Point C4. It will then be routed via storm sewer to DP 6.1. If this future inlet clogs, developed runoff from this basin will overflow into a proposed swale within Overland Ranch Filing 1, where it will be conveyed to Design Point 1.2.

Basin CL5 (0.58 acres, 92.4% impervious) is comprised of future landscaping and the ultimate County Line Road configuration. The runoff from this sub-basin will be captured by a future Type R sump inlet located at Design Point C5. It will then be routed via storm sewer to DP 6.1. If this future inlet clogs, developed runoff from this basin will overflow into a proposed swale within Overland Ranch Filing 1, where it will be conveyed to Design Point 1.2.

Basin CL6 (1.43 acres, 59.9% impervious) is comprised of future landscaping and the ultimate County Line Road configuration. The runoff from this sub-basin will be captured by a future Type R inlet located at Design Point C6. It will then be routed via storm sewer to DP 6.0. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point C4.

Basin CL7 (0.62 acres, 92.6% impervious) is comprised of future landscaping and the ultimate County Line Road configuration. The runoff from this sub-basin will be captured by a future Type R inlet located at Design Point C7. It will then be routed via storm sewer to DP 6.0. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point C5.

Basin CL8 (0.63 acres, 74.8% impervious) is comprised of future landscaping and the ultimate County Line Road configuration. The runoff from this sub-basin will be conveyed via future curb and gutter to the Elora Site entrance located at Design Point C8. Future storm sewer within the Elora site will then convey these flows to an onsite pond.

Basin CL9 (0.27 acres, 92.2% impervious) is comprised of future landscaping and the ultimate County Line Road configuration. The runoff from this sub-basin will be conveyed via future curb and gutter to the Overland Ranch Filing 1 entrance located at Design Point C9. Runoff will then be conveyed via temp swale to Temporary Pond D. See Basin D4 for more runoff information.

Basin CL10 (0.28 acres, 68.2% impervious) is comprised of open space and County Line Road asphalt tapers to the existing roadway. The runoff from this sub-basin will be captured by an existing swale and conveyed east, per historic condition at Design Point 10.

Basin CL11 (0.28 acres, 61.8% impervious) is comprised of open space and County Line Road asphalt tapers to the existing roadway. The runoff from this sub-basin will be captured by an existing swale and conveyed east, per historic condition at Design Point 11.

### 3. Detention Pond Design

Storm water flood detention and storm water quality management for this development will be provided within the proposed detention ponds denoted as Ponds 329, 302, 306, & temporary Pond D. The location of these ponds can be found on the overall drainage map located in Appendix 5. Sediment and erosion control, Best Management Practices, as presented in the City of Aurora Criteria, will be implemented for the site.

As previously stated, Detention Pond 302 was evaluated in this report using CUHP with SWMM routing, results for this analysis can be found in Appendix 3. MHFD-Detention workbook was used to properly size the outlet structure. The values for the pond stage, pond volume, and outflows for ponds were also designed using the latest MHFD-Detention workbooks. These pond designs and pond calculations can be found in Appendix 3.

The total pond volumes have also been designed to detain the 100-year stormwater event as defined by the COA. For Pond 329, the 100-year water surface elevation is targeted to be at elevation 6071.68' and stage depth of 5.51 feet. The emergency spillway will be installed at an elevation of 6072.00'; 0.32 feet higher than the 100-yr water surface elevation. For Pond 302, the 100-year water surface elevation is targeted to be at elevation 6048.36' and stage depth of 8.69 feet. The emergency spillway will be installed at an elevation of 6048.87'; 0.51 feet higher than the 100-yr water surface elevation. For Pond 306, the 100-year water surface elevation is targeted to be at elevation 6085.03' and stage depth of 7.36 feet. The emergency spillway will be installed at an elevation of 6085.50'; 0.47 feet higher than the 100-yr water surface elevation. For temporary Pond D, the 100-year water surface elevation is targeted to be at elevation 6103.84' and stage depth of 4.67 feet. The emergency spillway will be installed at an elevation of 6104.00'; 0.16 feet higher than the 100-yr water surface elevation.

The following tables summarize the total volume and depth for the 100-year stormwater event, the total volumes provided for each pond, and the stage of each pond's spillway:

POND 329		
WQCV from UDFCD Spreadsheet	0.171	AC-FT
EURV from UDFCD Spreadsheet	0.456	AC-FT
100-Year Volume from UDFCD Spreadsheet	0.905	AC-FT
Total Volume Provided	1.016	AC-FT
100-Year Depth	5.51	FT
Spillway Stage	5.83	FT

POND 302		
WQCV from UDFCD Spreadsheet	2.556	AC-FT
EURV from UDFCD Spreadsheet	6.598	AC-FT
100-Year Volume from CUHP/SWMM	13.972	AC-FT
Total Volume Provided	15.516	AC-FT
100-Year Depth from CUHP SWMM	8.69	FT
Spillway Stage	9.20	FT

POND 306		
WQCV from UDFCD Spreadsheet	0.539	AC-FT
EURV from UDFCD Spreadsheet	1.667	AC-FT
100-Year Volume from UDFCD Spreadsheet	3.269	AC-FT
Total Volume Provided	3.713	AC-FT
100-Year Depth	7.36	FT
Spillway Stage	7.83	FT

TEMPORARY POND D		
WQCV from UDFCD Spreadsheet	0.259	AC-FT
EURV from UDFCD Spreadsheet	0.590	AC-FT
100-Year Volume from UDFCD Spreadsheet	1.558	AC-FT
Total Volume Provided	1.693	AC-FT
100-Year Depth	4.67	FT
Spillway Stage	4.83	FT

Each pond outlet structure was also designed to target the allowable release rate for the 100-year storm event. For the proposed site, a Type B soil was used for each pond in order to be conservative. Per Section 6.33 of the SDDTC, Type B soils can release at 0.85 cfs/acre for a 100-year storm event. The proposed release for Pond 329 and Pond 306 were also reduced to account for undetained flows that were not captured onsite. For Pond 329, the 100-year release was reduced by 0.81 cfs to account for Basin OS3 flows offsite. Pond 306 was reduced by 6.45 cfs to account for Basin OS5 flows offsite. The proposed outlet structure release rates for each pond were designed to be equal to or lower than the allowable release rates provided. The following table summarizes the release rate results for each pond:

DETENTION POND RELEASE RATES			
POND ID	TRIBUTARY AREA (ACRES)	100-YR ALLOWABLE (CFS)	100-YR PROPOSED (CFS)
POND 329	11.49	8.96**	8.95**
POND 302	179.17	152.30*	149.33*
POND 306	28.53	17.80**	17.76**
TEMP POND D	20.91	17.77	17.53
*Includes offsite basins OS1 & OS2.			
** Pond release reduced to account for undetained flows offsite.			

Pond 329 will outfall into existing storm infrastructure located in Monaghans Road. Per the *High Plains Country Club – Filing No. 3 Final Drainage report EDN 216080*, Pond 329 is part of Basin 131A. Basin 131A is captured by an existing inlet at Design Point 181A. The anticipated flows from Basin 131A were set to be 3.3 cfs and 11.9 cfs for the 2-year and 100-year storms respectively. With the addition of Pond 329 and temporary Type C inlet at DP OS3, the storm sewer is set to receive 0.1 cfs and 8.95 cfs for the 2-year and 100-year storms respectively. The connection point for Pond 329 however, will occur further downstream at Design Point J31, rather than the existing stub at Design Point 180 of the approved report. Because this connection occurs further downstream, and the flows have been reduced, the existing storm sewer along Monaghan Road will function as intended. In order to ensure the existing pipe has the capacity needed, final analysis and HGL modeling will be provided for the existing storm sewer with the Final Drainage Report.

Ponds 302 and 306 will utilize existing the drainageway and topography to convey storm water north to Mutchie Creek. With the release rate reductions, the drainageway and downstream conveyance systems will not require stabilization and will continue to convey storm water as intended at a reduced rate.

Pond D is a temporary detention pond, and will utilize the second on-site drainageway associated with the Filing 2 portion of the Overland Ranch Subdivision. The drainageway does not have a regulated or unregulated floodplain associated with it at this time, and will convey the runoff from Pond D north to Mutchie Creek. Pond D will still utilize a forebay, trickle channel, and outlet structure in the temporary condition. Once the storm infrastructure for Filing 2 is complete, the temporary Pond D will be removed. Stormwater will then be piped to the future pond associated with the Filing 2 improvements, where it will be conveyed by the second drainageway north to Mutchie Creek as intended.

For the ultimate County Line condition, coordination with Elora Filing 1 has been conducted to ensure all pond release rates, emergency overflows, and future storm sewer on the Elora Filing 1 site have been incorporated into the ultimate drainage concept. For the ultimate condition, a 100-year release rate of 39.2 cfs was used to model a 100-year storm event incorporating Pond A. The ultimate County Line Road storm sewer configuration, along with Pond A's location on the Elora site can be found on the County Line ultimate condition drainage maps. The UD-Detention workbook for Elora's Pond A can also be found in Appendix 4.



#### **4. Drainageway Stabilization**

The site will utilize Drainageway 1, an existing natural drainageway, as the primary stormwater conveyance method for proposed runoff. This existing natural drainageway is well vegetated, but contains slopes that are too steep in the existing condition. In order to stabilize this drainageway, a tiered cross section is being proposed. This cross section will utilize a meandering 10' wide low flow channel and 45' overbanks. This section will help spread out the 100-year flows within the channel to help reduce velocities to below 5 ft/s and maintain a Froude Number of around 0.80. This approach will also give the drainageway a more natural look and prevent erosion. In order to verify the drainageway's stability in the proposed condition, a GeoHECRAS model was completed for the 100-year storm event. This model used a high Manning's roughness coefficient and a low Manning's roughness coefficient to determine velocities, Froude Numbers, shear stresses, and flow depths as a 100-year storm passed through the drainageway. The flow depths from this model were also used to set minimum finished floor elevations for the lots adjacent to this drainageway.

Roughness coefficients for the new cross section were taken from Table 8-5 of the Mile High Flood District's criteria manual. For the low roughness model, a roughness coefficient of 0.032 was used for the proposed channel overbanks, while 0.035 was used for the riprapped low flow channel. For the high roughness model, values of 0.050 and 0.070 were used for the overbanks and low flow channel respectively. The roughness coefficient table can be found in Appendix 1. The low roughness model was used to assess velocities, Froude Numbers, and shear stresses, while the high roughness model was used to assess the flow depth and determine the 100-year water surface elevation. From the low Manning's roughness model, all velocities within the drainageway were around 5 ft/s, contained Froude Numbers around 0.80, and had a shear stress well below the 1.2 lb/sqft requirement. From the high Manning's roughness model, a max depth of 1.36' was calculated for the drainageway. From the HECRAS results, the drainageway shows complete stabilization and has more than enough capacity, as the 100-year WSEL was contained within the drainageway with around 20' of freeboard. As a result of this analysis, the drainageway should function as intended and the finished floor elevations for the lots adjacent to the drainageway will not be impacted. A preliminary plan and profile for the channel improvements have been included in Appendix 4, and all model results and sections can be found in Appendix 3.

#### **5. Maintenance**

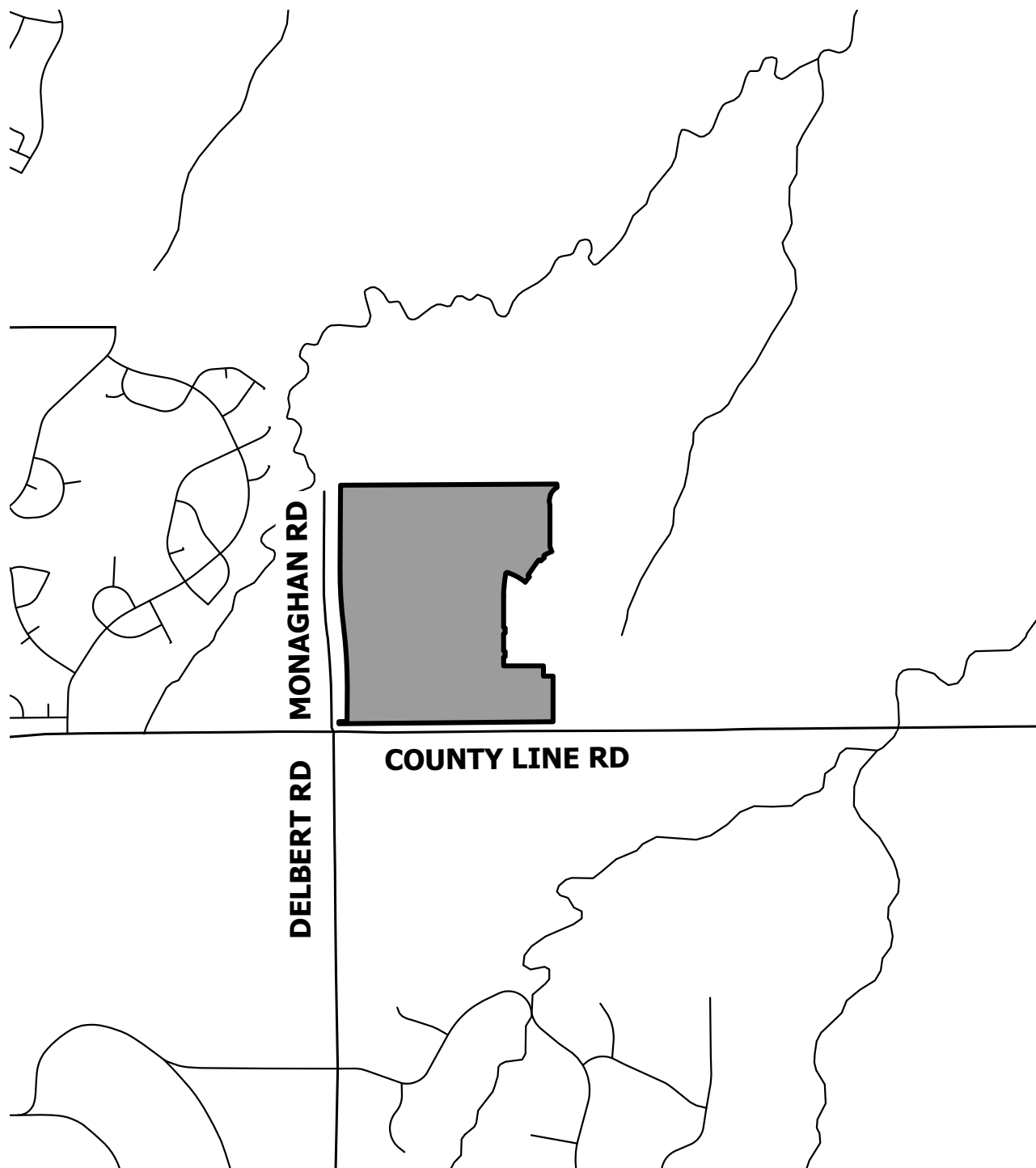
The city will be responsible for ensuring that stormwater facilities installed on their property are properly maintained and function as design. Preventative measures to reduce maintenance costs include but are not limited to educating residents to be aware of how their actions affect water quality, keeping properties, streets and gutters free of trash, sweep paved surfaces regularly, maintaining vegetative stabilization, and cleaning out storm inlets. All stormwater management facilities shall be inspected by a qualified individual at a minimum of once per year. See the *City of Aurora Storm Drainage Design & Technical Criteria Manual* for general guidelines for an inspector. Requirements for the inspection and maintenance of stormwater facilities, as well as reporting requirements will be included in

the Stormwater Management Facility Inspection and Maintenance (I&M) Plan. Pond maintenance trails will provide access to all of the drainage structures within the proposed detention ponds to ensure easy access for maintenance. Detention ponds, drainageways, swales, and Type C inlets and laterals shall be maintained by the HOA. Maintenance of this infrastructure will include, but is not limited to scheduled mowing, trash pickup, removal of debris that may be clogging the outlet structure or inlet, weed control, and mosquito and algae treatment.

## **E. LIST OF REFERENCES**

1. *City of Aurora Storm Drainage Design and Technical Criteria Manual*, City of Aurora, November 9, 2023.
2. *City of Aurora Storm Drainage Design and Technical Criteria Manual*, City of Aurora, November, 2023.
3. *Federal Emergency Management Agency Flood Insurance Rate Map*, Community Panels 08005C0508K & 08005C0509K, Revised December 17, 2010.
4. *Urban Storm Drainage Criteria Manual, Volume 1, Volume 2. & Volume 3*, Mile High Flood District, Current Version.
5. *High Plains Country Club Filing No. 3 Final Drainage Report*, by Bowman Consulting Group, February 17, 2017. EDN 206088
6. *Master Drainage Report Trails at Overland Ranch*, by Innovative Land Consultants, Inc., August 5, 2022.
7. *Elbert County Construction Standards & Specifications 2019 Edition*, Elbert County Public Works, March 11, 2020.
8. *Preliminary Drainage Report For Trails at Overland Ranch Filing 1*, by JR Engineering, LLC, April 18, 2024

APPENDIX 1  
SOIL, PRECIPITATION, FLOODPLAIN, AND AIRPORT POND BUFFER INFORMATION



## VICINITY MAP

2000 1000 0 2000 4000



ORIGINAL SCALE: 1" = 2000'

FIGURE 1 – VICINITY MAP  
TRAILS AT OVERLAND RANCH  
JOB NO. 16118.00  
04/19/22  
SHEET 1 OF 1

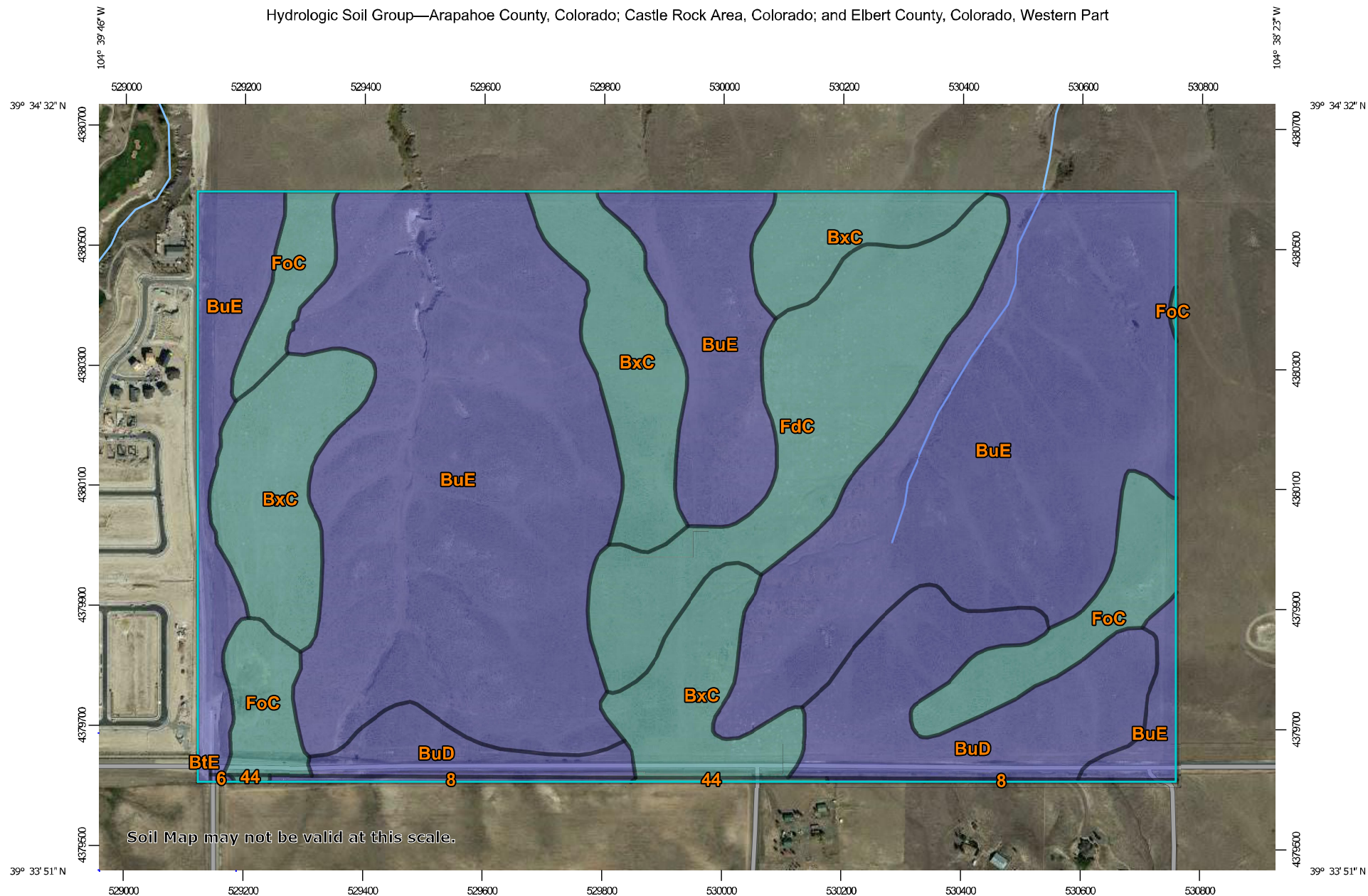


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# Hydrologic Soil Group—Arapahoe County, Colorado; Castle Rock Area, Colorado; and Elbert County, Colorado, Western Part



Map Scale: 1:8,990 if printed on A landscape (11" x 8.5") sheet.

0 100 200 400 600 Meters

0 400 800 1600 2400 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84




**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

8/17/2021  
Page 1 of 5

## MAP LEGEND

### Area of Interest (AOI)









 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons





 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Lines

 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Points

 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available

### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Arapahoe County, Colorado

Survey Area Data: Version 16, Jun 4, 2020

Soil Survey Area: Castle Rock Area, Colorado

Survey Area Data: Version 13, Jun 5, 2020

Soil Survey Area: Elbert County, Colorado, Western Part

Survey Area Data: Version 16, Jun 5, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

## MAP LEGEND

## MAP INFORMATION

Date(s) aerial images were photographed: Oct 3, 2018—Dec 4, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.



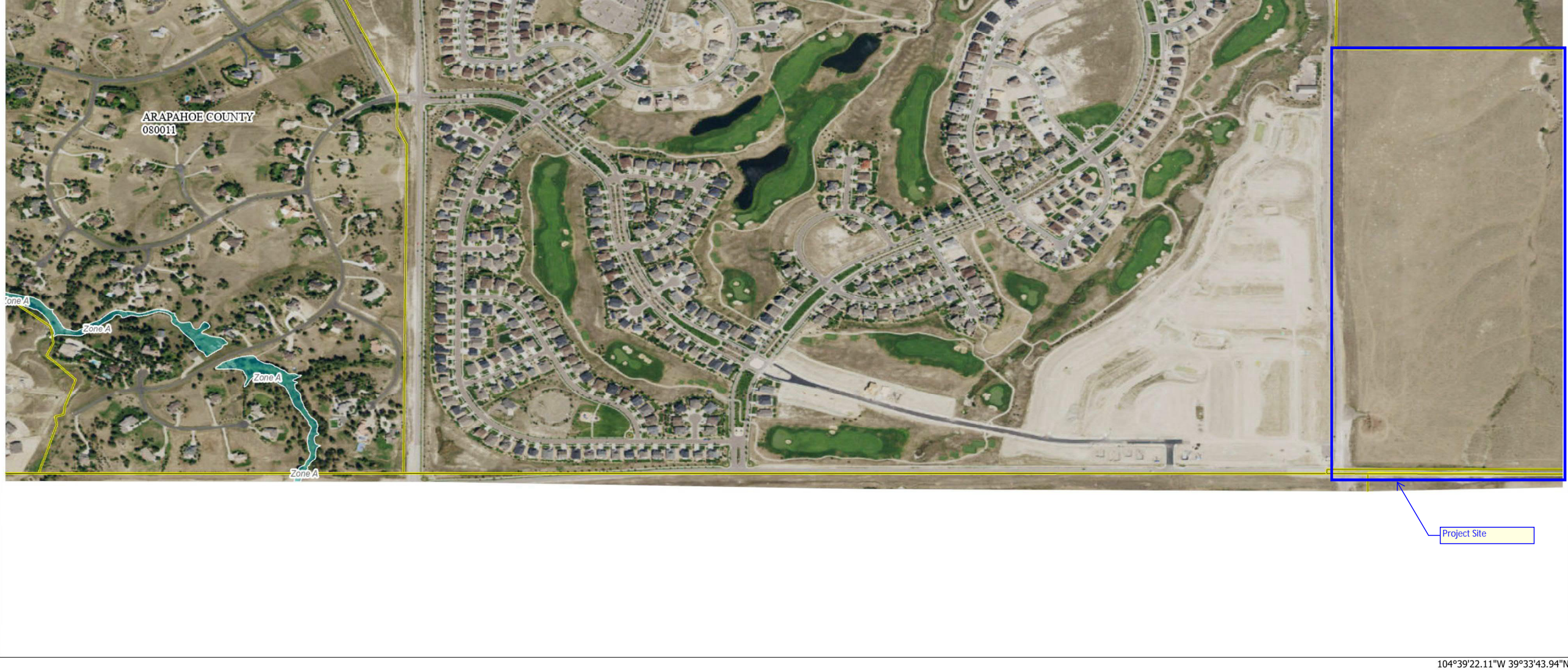
## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BuD	Bresser-Stapleton sandy loams, 3 to 9 percent slopes	B	38.0	9.5%
BuE	Bresser-Stapleton sandy loams, 9 to 20 percent slopes	B	228.5	57.2%
BxC	Buick loam, 3 to 5 percent slopes	C	63.7	15.9%
FdC	Fondis silt loam, 3 to 5 percent slopes	C	39.0	9.8%
FoC	Fondis-Colby silt loams, 3 to 5 percent slopes	C	26.7	6.7%
<b>Subtotals for Soil Survey Area</b>			<b>395.9</b>	<b>99.2%</b>
<b>Totals for Area of Interest</b>			<b>399.2</b>	<b>100.0%</b>

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	B	0.2	0.0%
<b>Subtotals for Soil Survey Area</b>			<b>0.2</b>	<b>0.0%</b>
<b>Totals for Area of Interest</b>			<b>399.2</b>	<b>100.0%</b>

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
6	Bresser sandy loam, cool, 5 to 9 percent slopes	B	0.1	0.0%
8	Bresser-Stapleton sandy loams, 8 to 25 percent slopes	B	2.3	0.6%
44	Weld loam, 4 to 8 percent slopes	C	0.8	0.2%
<b>Subtotals for Soil Survey Area</b>			<b>3.2</b>	<b>0.8%</b>
<b>Totals for Area of Interest</b>			<b>399.2</b>	<b>100.0%</b>
















104°39'22.11"W 39°33'43.94"N

FLOOD HAZARD INFORMATION

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		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 <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee See Notes <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>
OTHER AREAS	NO SCREEN	Area of Minimal Flood Hazard <i>Zone X</i>
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard <i>Zone D</i>
	-----	Channel, Culvert, or Storm Sewer
OTHER FEATURES	- - - - -	Levee, Dike, or Floodwall
		Cross Sections with 1% Annual Chance
		Water Surface Elevation
		Coastal Transect
	-----	Coastal Transect Baseline
	-----	Profile Baseline
	-----	Hydrographic Feature
	~~~~~	Base Flood Elevation Line (BFE)
	=====	Limit of Study
	=====	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at <https://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.

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

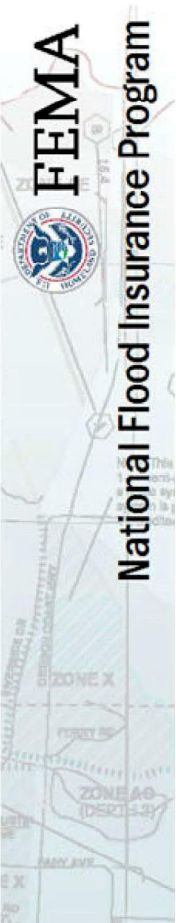
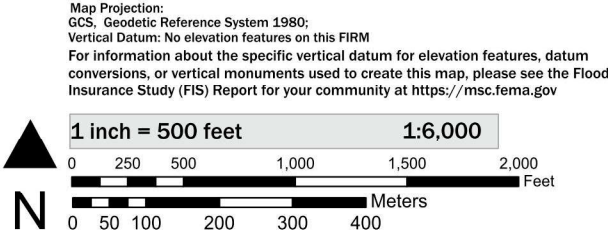
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). The basemap shown is the USGS National Map: Orthoimagery. Last refreshed October, 2020.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **8/6/2021 12:10 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>

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SCALE



NATIONAL FLOOD INSURANCE PROGRAM  
FLOOD INSURANCE RATE MAP

PANEL 508 OF 675

Panel Contains:

COMMUNITY	NUMBER	PANEL
ARAPAHOE COUNTY	080011	0508
CITY OF AURORA	080002	0508
ELBERT COUNTY	080055	0508
DOUGLAS COUNTY	080049	0508

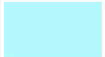









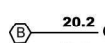
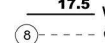






MAP NUMBER  
08005C0508K  
EFFECTIVE DATE  
December 17, 2010





FLOOD HAZARD INFORMATION

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
		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 <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee See Notes <i>Zone X</i>
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		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard <i>Zone D</i>
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
		Cross Sections with 1% Annual Chance
		Water Surface Elevation
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		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary

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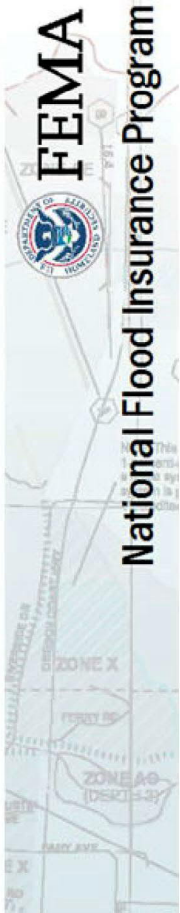
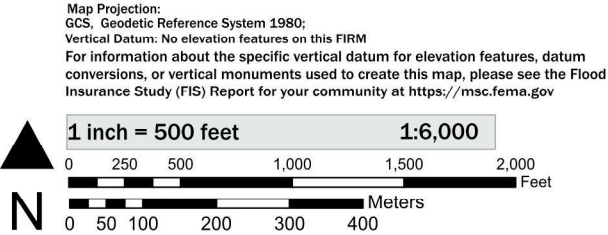
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

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SCALE



NATIONAL FLOOD INSURANCE PROGRAM  
FLOOD INSURANCE RATE MAP

PANEL 509 OF 675

Panel Contains:

COMMUNITY	NUMBER	PANEL
CITY OF AURORA	080002	0509
ELBERT COUNTY	080055	0509
ARAPAHOE COUNTY	080011	0509

MAP NUMBER  
08005C0509K  
EFFECTIVE DATE  
December 17, 2010



**NOAA Atlas 14, Volume 8, Version 2**  
**Location name: Parker, Colorado, USA\***  
**Latitude: 39.5713°, Longitude: -104.6529°**  
**Elevation: m/ft\*\***  
 \* source: ESRI Maps  
 \*\* source: USGS



### POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

### PF tabular

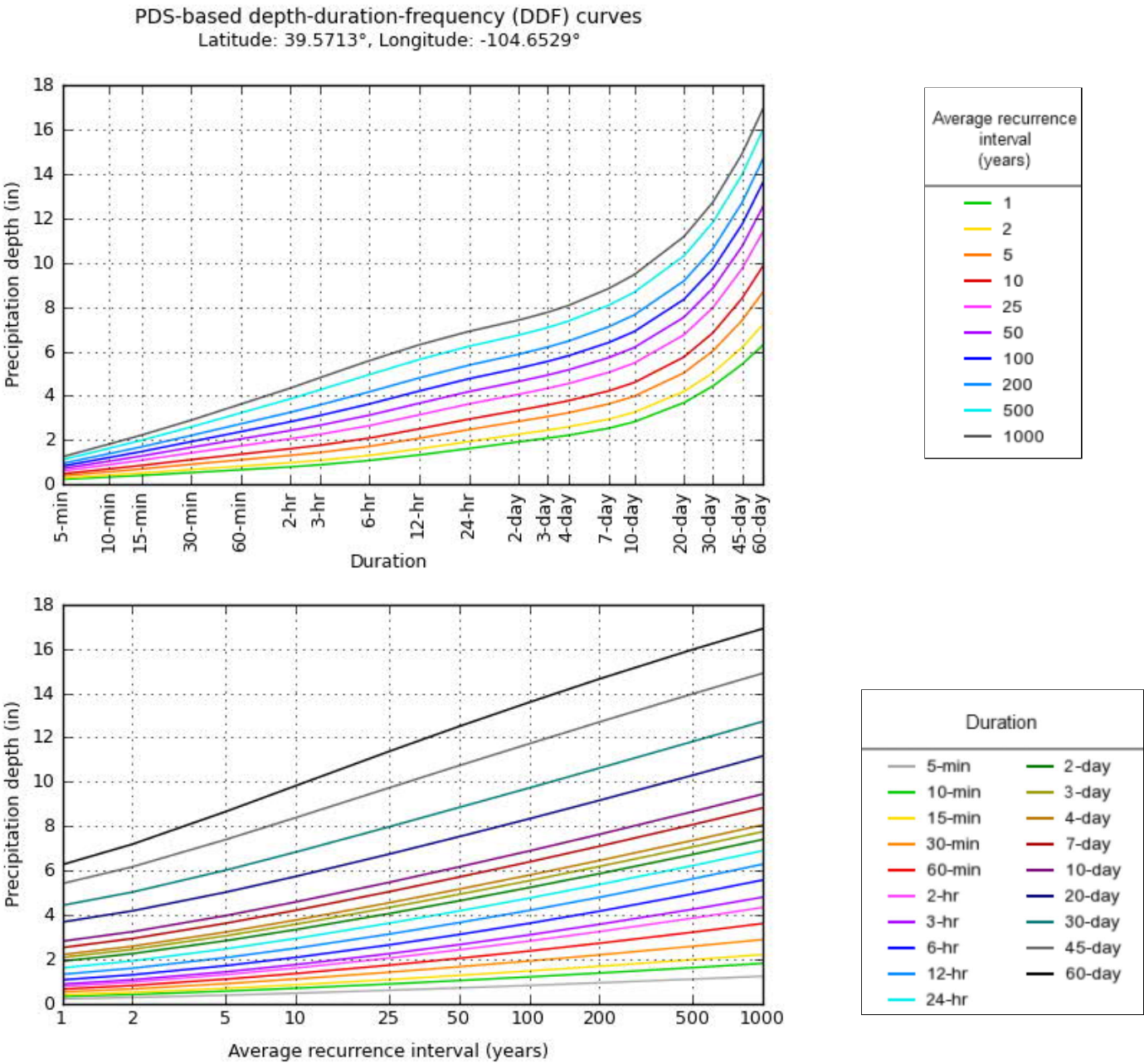
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.230 (0.189-0.282)	0.289 (0.238-0.354)	0.391 (0.320-0.480)	0.481 (0.391-0.592)	0.611 (0.482-0.783)	0.718 (0.551-0.927)	0.830 (0.614-1.09)	0.949 (0.672-1.28)	1.11 (0.757-1.53)	1.25 (0.821-1.73)
10-min	0.337 (0.277-0.413)	0.424 (0.348-0.519)	0.573 (0.468-0.703)	0.704 (0.572-0.867)	0.895 (0.706-1.15)	1.05 (0.807-1.36)	1.22 (0.899-1.60)	1.39 (0.984-1.87)	1.63 (1.11-2.24)	1.82 (1.20-2.53)
15-min	0.411 (0.338-0.504)	0.517 (0.424-0.633)	0.698 (0.571-0.857)	0.858 (0.698-1.06)	1.09 (0.861-1.40)	1.28 (0.984-1.66)	1.48 (1.10-1.95)	1.69 (1.20-2.28)	1.99 (1.35-2.74)	2.22 (1.47-3.08)
30-min	0.535 (0.440-0.655)	0.673 (0.552-0.824)	0.910 (0.744-1.12)	1.12 (0.910-1.38)	1.42 (1.12-1.82)	1.67 (1.28-2.16)	1.93 (1.43-2.54)	2.21 (1.56-2.97)	2.59 (1.76-3.56)	2.90 (1.91-4.01)
60-min	0.665 (0.546-0.814)	0.827 (0.679-1.01)	1.11 (0.910-1.37)	1.37 (1.11-1.68)	1.74 (1.38-2.24)	2.05 (1.58-2.65)	2.38 (1.76-3.14)	2.73 (1.94-3.68)	3.23 (2.19-4.44)	3.62 (2.39-5.02)
2-hr	0.794 (0.656-0.966)	0.982 (0.810-1.20)	1.31 (1.08-1.60)	1.61 (1.32-1.97)	2.06 (1.64-2.63)	2.43 (1.88-3.13)	2.83 (2.11-3.71)	3.26 (2.33-4.36)	3.86 (2.65-5.28)	4.35 (2.89-5.98)
3-hr	0.887 (0.735-1.07)	1.09 (0.899-1.32)	1.44 (1.19-1.75)	1.77 (1.45-2.15)	2.26 (1.80-2.87)	2.67 (2.07-3.42)	3.11 (2.33-4.06)	3.58 (2.57-4.78)	4.26 (2.93-5.81)	4.81 (3.21-6.59)
6-hr	1.08 (0.902-1.30)	1.31 (1.09-1.58)	1.72 (1.43-2.07)	2.09 (1.72-2.53)	2.65 (2.13-3.35)	3.12 (2.44-3.98)	3.63 (2.74-4.71)	4.18 (3.02-5.53)	4.95 (3.43-6.70)	5.58 (3.75-7.59)
12-hr	1.33 (1.12-1.59)	1.61 (1.34-1.92)	2.08 (1.74-2.49)	2.51 (2.08-3.01)	3.14 (2.53-3.92)	3.66 (2.87-4.61)	4.21 (3.19-5.41)	4.80 (3.49-6.30)	5.63 (3.93-7.55)	6.29 (4.26-8.49)
24-hr	1.62 (1.37-1.92)	1.94 (1.63-2.30)	2.47 (2.07-2.94)	2.95 (2.45-3.52)	3.63 (2.94-4.48)	4.18 (3.30-5.22)	4.76 (3.63-6.06)	5.38 (3.93-6.98)	6.23 (4.37-8.27)	6.90 (4.70-9.24)
2-day	1.92 (1.63-2.26)	2.26 (1.91-2.67)	2.84 (2.40-3.36)	3.34 (2.80-3.96)	4.06 (3.30-4.97)	4.64 (3.68-5.73)	5.24 (4.01-6.60)	5.87 (4.31-7.55)	6.73 (4.75-8.86)	7.41 (5.09-9.84)
3-day	2.09 (1.78-2.45)	2.45 (2.08-2.88)	3.06 (2.59-3.60)	3.59 (3.01-4.23)	4.34 (3.53-5.27)	4.93 (3.92-6.06)	5.55 (4.26-6.95)	6.19 (4.56-7.93)	7.07 (5.01-9.26)	7.76 (5.35-10.3)
4-day	2.22 (1.89-2.60)	2.60 (2.21-3.04)	3.23 (2.74-3.79)	3.77 (3.18-4.44)	4.55 (3.71-5.51)	5.17 (4.12-6.32)	5.80 (4.47-7.24)	6.46 (4.77-8.24)	7.36 (5.23-9.61)	8.06 (5.58-10.6)
7-day	2.53 (2.17-2.95)	2.94 (2.51-3.42)	3.63 (3.09-4.23)	4.21 (3.57-4.93)	5.05 (4.14-6.08)	5.71 (4.58-6.95)	6.39 (4.95-7.93)	7.10 (5.28-9.01)	8.07 (5.77-10.5)	8.83 (6.15-11.6)
10-day	2.82 (2.42-3.27)	3.25 (2.78-3.77)	3.97 (3.39-4.62)	4.59 (3.90-5.35)	5.47 (4.50-6.56)	6.17 (4.96-7.48)	6.89 (5.35-8.51)	7.64 (5.70-9.65)	8.66 (6.21-11.2)	9.45 (6.61-12.3)
20-day	3.69 (3.18-4.24)	4.19 (3.61-4.82)	5.03 (4.31-5.80)	5.74 (4.90-6.64)	6.74 (5.58-8.01)	7.53 (6.09-9.05)	8.34 (6.52-10.2)	9.17 (6.89-11.5)	10.3 (7.44-13.2)	11.2 (7.86-14.5)
30-day	4.44 (3.84-5.08)	5.04 (4.35-5.77)	6.02 (5.18-6.91)	6.84 (5.85-7.88)	7.97 (6.60-9.40)	8.85 (7.17-10.6)	9.73 (7.63-11.8)	10.6 (8.00-13.2)	11.8 (8.57-15.0)	12.7 (9.00-16.4)
45-day	5.42 (4.70-6.18)	6.18 (5.35-7.05)	7.40 (6.39-8.46)	8.39 (7.21-9.63)	9.73 (8.06-11.4)	10.7 (8.71-12.7)	11.7 (9.21-14.2)	12.7 (9.59-15.7)	14.0 (10.2-17.6)	14.9 (10.6-19.1)
60-day	6.27 (5.45-7.13)	7.19 (6.25-8.19)	8.66 (7.49-9.87)	9.83 (8.46-11.2)	11.4 (9.43-13.2)	12.5 (10.2-14.7)	13.6 (10.7-16.3)	14.6 (11.1-18.0)	16.0 (11.6-20.1)	16.9 (12.0-21.6)

<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





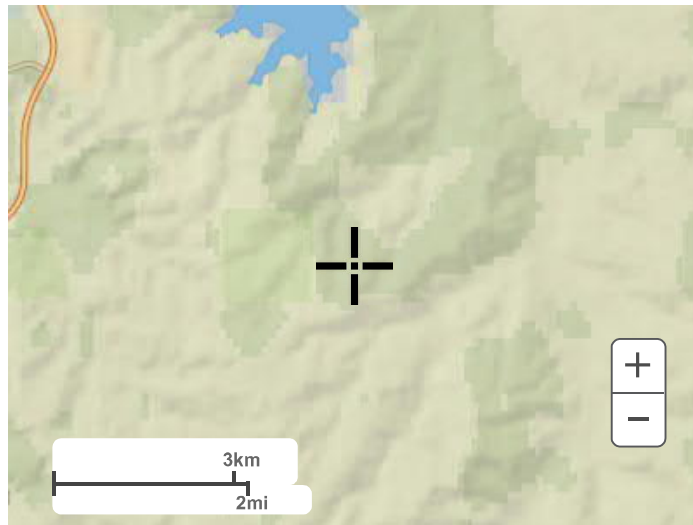
NOAA Atlas 14, Volume 8, Version 2

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Maps & aerials

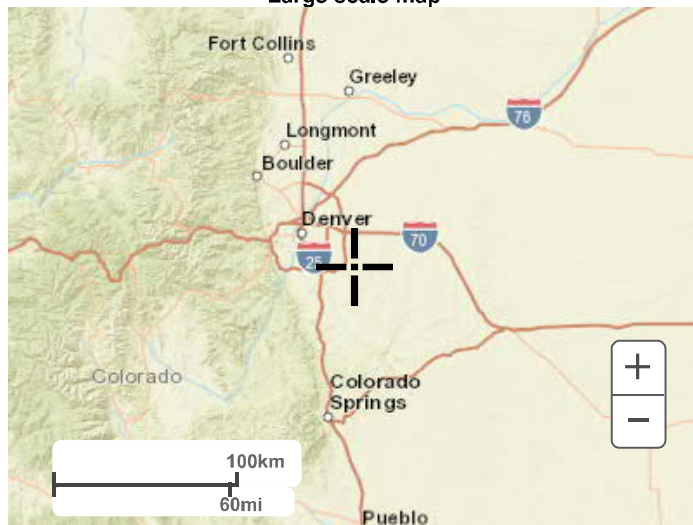
Small scale terrain



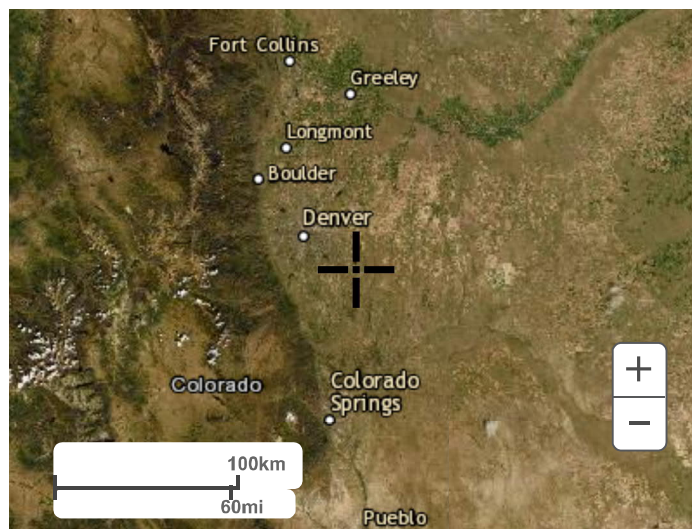
Large scale terrain



Large scale map



Large scale aerial



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**TABLE 1**  
**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
<u>Business:</u>					
Commercial Areas	95	.87	.87	.88	.89
Neighborhood Areas	85	.60	.65	.70	.80
<u>Residential:</u>					
Single-Family (**)	(*)	.40	.45	.50	.60
Multi-Unit (detached)	60	.45	.50	.60	.70
Multi-Unit (attached)	75	.60	.65	.70	.80
1/2 Acre Lot or Larger	(*)	.30	.35	.40	.60
Apartments	80	.65	.70	.70	.80
<u>Industrial:</u>					
Light Areas	80	.71	.72	.76	.82
Heavy Areas	90	.80	.80	.85	.90
<u>Parks, Cemeteries</u>	5	.10	.10	.35	.60
<u>Playgrounds</u>	10	.15	.25	.35	.65
<u>Schools</u>	50	.45	.50	.60	.70
<u>Railroad Yard Areas</u>	15	.40	.45	.50	.60
<u>Undeveloped Areas:</u>					
Historic Flow Analysis, Greenbelts, Agricultural	2	(See "Lawns")			
Off-Site Flow Analysis (when land use not defined)	45	.43	.47	.55	.65

**TABLE 1** (continued)

**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
<u>Streets:</u>					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
<u>Concrete Drive and Walks</u>	96	.87	.87	.88	.89
<u>Roofs</u>	90	.80	.85	.90	.90
<u>Lawns, Sandy Soil (A and B Soils):</u>	2				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
>7% Slope		.15	.16	.18	.20
<u>Lawns, Clay Soil (C and D Soils):</u>	5				
2% Slope		.13	.14	.15	.17
2-7% Slope		.18	.19	.20	.22
>7% Slope		.25	.27	.30	.35

NOTE:       These Rational Formula coefficients may not be valid for large basins

(\*)See Figures RO-3 through RO-5 of USDCM Volume 1 for percent impervious.

(\*\*)Up to 5 units per acre. Single-family with more than 5 units per acre, use values for multi-unit/detached



**Table 5-5. Land Use Based Imperviousness Values for Master Planning**

Land Use/Density	Recommended Imperviousness* (Roads Included)
<b>Residential</b>	
Rural SFH (0 - 3 du/ac)	35%
Low & Medium-Density SFH (3 - 5 du/ac)	55%
Manufactured Housing ( $\geq 10$ du/ac)	65%
Medium-Density MFH/High Density SFH (5 - 20 du/ac)	65%
High-Density MFH ( $>20$ du/ac)	70%
<b>Commercial</b>	
Low-Density Commercial	65%
Medium- to High-Density Commercial	80%
Urban Core Commercial	90%
<b>Industrial/Institutional</b>	
Schools	55%
Office/Institutional	65%
Industrial Areas	75%
Solar Farm, Gravel Cover <sup>*,Δ</sup>	60%
Solar Farm, Grass Cover <sup>*,Δ</sup>	45%
<b>Parks and Open Space</b>	
Open Space	5%
Community Parks	25%
Neighborhood Parks	15%
Golf Courses	30%
Cemeteries	25%

\* Imperviousness values shown in this table are the minimum imperviousness values for a specific land use for Master Drainage Reports (MDRs) and Master Drainage Plans. For Preliminary Drainage Reports (PDRs), imperviousness values must be calculated based on the surface type per Table 5-6. If the Engineer and/or Master Developer are aware of a proposed product type that would increase the imperviousness values beyond what is in this table, the MDR should take this into account.

Imperviousness values at the PDR stage that exceed those used in the MDR may require an amendment to the MDR (see Chapter 2). If the existing downstream infrastructure has already been constructed based on the lower imperviousness values from the MDR, an increase in imperviousness may not be permitted, or may require approved or in-process plans and/or existing infrastructure to be revised.

\* Use these values at the master planning stage when the specific layout of panels is not known. Use the values in Table 5-6 at the site planning and design stages when the orientation of panels relative to contours is known.

Δ Assumes a 1:1 ratio of panels to aisles. See the technical memorandum entitled *Determination of Solar Panel Field Runoff Coefficients and Imperviousness Values* (Earles, Olson, & Howard, 2023) for additional information on procedures to reflect other impervious areas (such as roads and pads that may be part of a solar field) and layouts with wider inter-panel spacing.

At the detailed design and site planning phase for a project, more information is known about the proposed site layout, including the location of buildings, asphalt, sidewalks, pervious areas, and other types of ground cover. At the detailed design stage, the engineer should apply the surface-type-based runoff imperviousness values from Table 5-6 in conjunction with area measurements from Computer-Aided Design (CAD) or Geographic Information System (GIS)

**Table 5-6. Imperviousness Values for Urban Surfaces for Site and Small Watershed Analysis**

Surface Type		Imperviousness
Paved Streets		95%
Concrete Drive and Walks		95%
Roofs		95%
Gravel	No Traffic Areas (pedestrian use)	40%
	Low Traffic Areas (maintenance paths and substations)	60%
	High Traffic Areas (roadways and parking)	80%
Landscaping (including water-wise vegetation, active turf, uncompacted gravel, planting beds, residential artificial turf, etc.)		20%
Artificial Turf (non-residential)	Landscape applications (with subgrade drainage layer)	25 - 45%
	Sport fields with underdrain pipe system	65%
Open Water Areas, including footprint of WQCV		100%
Solar Panels Gravel Cover, Rows Parallel to Contours*		50%
Solar Panels, Gravel Cover, Rows Diagonal to Contours*		60%
Solar Panels, Gravel Cover, Rows Perpendicular to Contours*		75%
Solar Panels, Grass Cover, Rows Parallel to Contours*		10%
Solar Panels, Grass Cover, Rows Diagonal to Contours*		20%
Solar Panels, Grass Cover, Rows Perpendicular to Contours*		45%
Historic Flow Analysis, Undisturbed Native Grasses, Agricultural		5%
Newly Graded Areas		65%

\* Assumes a 1:1 ratio of panels to aisles. See the technical memorandum entitled *Determination of Solar Panel Field Runoff Coefficients and Imperviousness Values* (Earles, Olson, & Howard, 2023) for additional information on procedures to reflect other impervious areas (such as roads and pads that may be part of a solar field) and layouts with wider inter-panel spacing.

### **5.3.2 Runoff Coefficients for Rational Method**

Rational Method runoff coefficients shall be determined using the methodology described in Volume 1, Chapter 6: Runoff of the MHFD Manual. The MHFD methodology uses the imperviousness of a drainage area in conjunction with the hydrologic soil group (HSG) to calculate the runoff coefficient. The imperviousness of the land use/surface type draining to the point of interest should be derived from Table 5-5 or Table 5-6 above (depending on the stage of the design). The HSG may be determined using the Natural Resources Conservation Service's (NRCS's) [Web Soil Survey](#) (Natural Resources Conservation Service). These data may be used alongside the tables, charts, and equations in Volume 1, Chapter 6: Runoff of the MHFD Manual to determine runoff coefficients for the Rational Method.

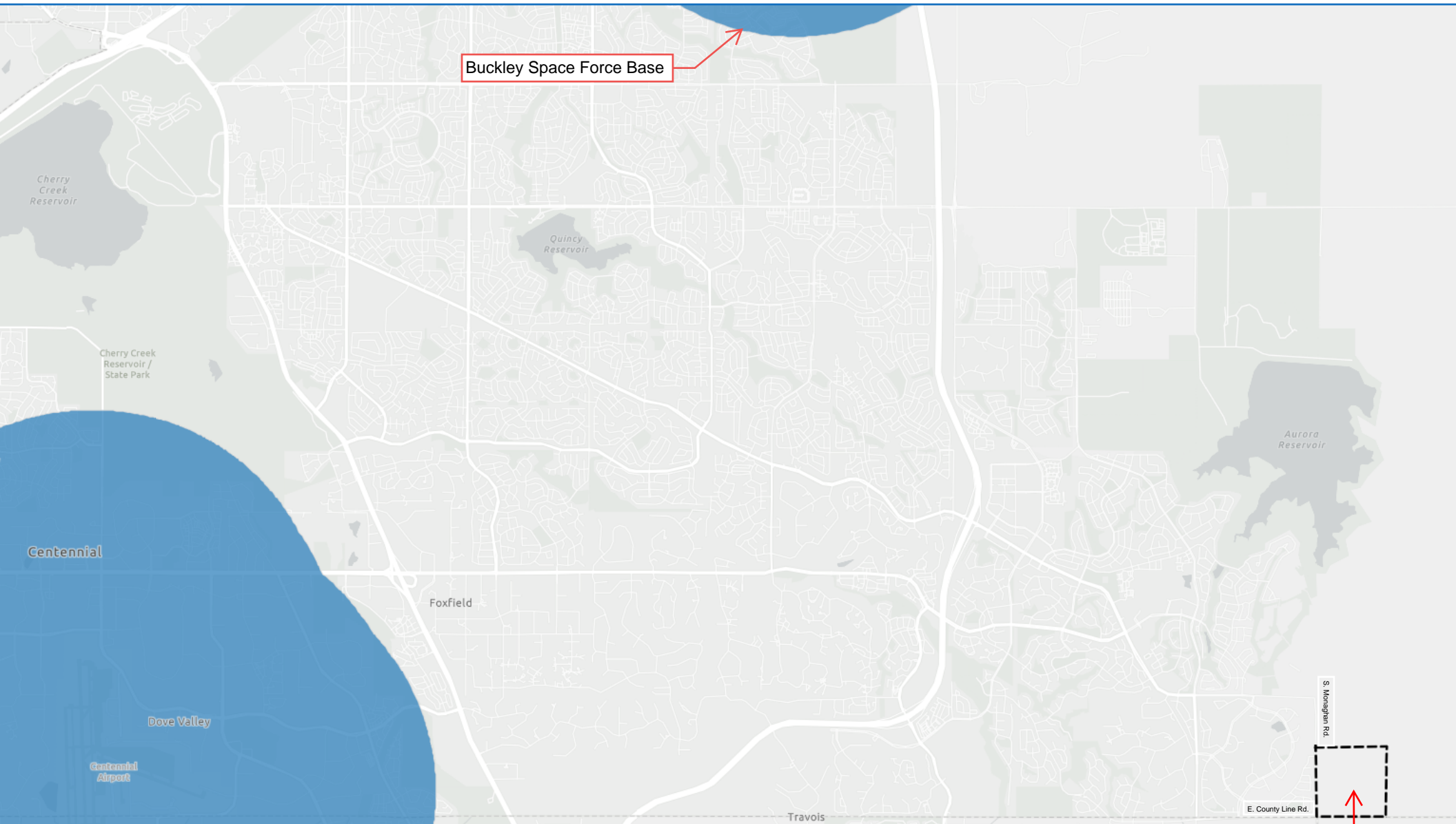
Table 5-7 provides equations for calculating runoff coefficients based on the most up to date information from the MHFD Manual as of the date of publication of this Manual. It is the responsibility of the applicant to confirm that the most current runoff coefficient equations from MHFD are used.

**TABLE 2**  
**Roughness Coefficients (" $n$ ") for Channel Design**  
(after Chow 1959)

Channel Type	Roughness Coefficient ( $n$ )		
	Minimum	Typical	Maximum
I. Excavated or Dredged			
1. Earth, straight and uniform			
a. Gravel, uniform section, clean	0.022	0.025	0.030
b. With short grass, few weeds	0.022	0.027	0.033
2. Earth, winding and sluggish			
a. Grass, some weeds	0.025	0.030	0.033
b. Dense weeds or aquatic plants	0.030	0.035	0.040
c. Earthy bottom and rubble/riprap sides	0.028	0.030	0.035
3. Channels not maintained, weeds and brush uncut			
a. Dense weeds, high as flow depth	0.050	0.080	0.120
b. Clean bottom, brush on sides	0.040	0.050	0.080
II. Natural streams (top width at flood stage 100 ft)			
1. Streams on plain			
a. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
b. Clean, winding, some pools and shoals, some weeds and stones	0.035	0.045	0.050
c. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
III. Lined or Built-Up Channels			
1. Concrete			
a. Towel/float finish	0.011	0.015	0.016
b. Shotcrete	0.016	0.020	0.025
2. Gravel bottom with sides of:			
a. Formed concrete	0.017	0.020	0.025
b. Random stone in mortar	0.020	0.023	0.026
c. Dry rubble or riprap	0.023	0.033	0.036
3. Wetland Bottom Channels	See Figure 6		
4. Grass-Lined Channels and Swales	See Figure 7		

*(Source: USDCM, Volume 1, Major Drainage, 04/2008)*

# Airport Detention Pond Buffer Zone



Overland  
Site

APPENDIX 2  
HYDROLOGIC CALCULATIONS

## COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: \_\_\_\_\_  
Location: Aurora

Project Name: Overland Ranch Filing 1  
Project No.: 16118.00  
Calculated By: AAM  
Checked By: \_\_\_\_\_  
Date: 4/26/24

Basin ID	Total Area (ac)	Paving, Drives, Walks, Ponds			Landscaping/Park			Use (Commercial, Residential)			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
A1	1.91	100%	0.17	8.9%	2%	1.74	1.8%	45%	0.00	0.0%	10.7%
A2	1.32	100%	0.65	49.2%	5%	0.39	1.5%	45%	0.28	9.5%	60.3%
A3	0.45	100%	0.33	73.3%	5%	0.12	1.3%	45%	0.00	0.0%	74.7%
A4	5.13	100%	2.03	39.6%	5%	3.10	3.0%	45%	0.00	0.0%	42.6%
A5	0.62	100%	0.44	71.0%	2%	0.18	0.6%	45%	0.00	0.0%	71.5%
A6	2.06	100%	0.30	14.6%	2%	1.22	1.2%	45%	0.54	11.8%	27.5%
TOTAL A	11.49										39.4%
B1	1.54	100%	1.05	68.2%	5%	0.49	1.6%	45%	0.00	0.0%	69.8%
B2	1.54	100%	1.16	75.3%	5%	0.38	1.2%	45%	0.00	0.0%	76.6%
B3	6.43	100%	0.00	0.0%	5%	5.12	4.0%	45%	1.31	9.2%	13.1%
B3A	0.85	100%	0.00	0.0%	5%	0.72	4.2%	45%	0.13	6.9%	11.1%
B4	2.51	100%	0.78	31.1%	5%	0.34	0.7%	45%	1.39	24.9%	56.7%
B5	1.50	100%	0.60	40.0%	5%	0.32	1.1%	45%	0.58	17.4%	58.5%
B6	1.46	100%	0.40	27.4%	5%	0.10	0.3%	45%	0.96	29.6%	57.3%
B7	2.66	100%	0.60	22.6%	5%	0.15	0.3%	45%	1.91	32.3%	55.2%
B8*	1.76	95%	0.46	24.8%	20%	0.11	1.3%	55%	1.19	37.2%	63.3%
B9	1.53	100%	0.35	22.9%	5%	0.09	0.3%	45%	1.09	32.1%	55.2%
B10	2.40	100%	0.61	25.4%	5%	0.15	0.3%	45%	1.64	30.8%	56.5%
B11	0.44	100%	0.15	34.1%	5%	0.04	0.5%	45%	0.25	25.6%	60.1%
B12	0.66	100%	0.26	39.4%	5%	0.10	0.8%	45%	0.30	20.5%	60.6%
B13	2.91	100%	0.22	7.6%	5%	1.18	2.0%	45%	1.51	23.4%	32.9%
B14	1.54	100%	1.23	79.9%	5%	0.31	1.0%	45%	0.00	0.0%	80.9%
B15	2.20	100%	0.00	0.0%	5%	2.20	5.0%	45%	0.00	0.0%	5.0%
B16	0.66	100%	0.34	51.5%	5%	0.09	0.7%	45%	0.23	15.7%	67.9%
B17	0.37	100%	0.30	81.1%	5%	0.07	0.9%	45%	0.00	0.0%	82.0%
B18	1.97	100%	0.36	18.3%	5%	0.13	0.3%	45%	1.48	33.8%	52.4%
B19	1.28	100%	0.37	28.9%	5%	0.09	0.4%	45%	0.82	28.8%	58.1%
B20	0.66	100%	0.26	39.4%	5%	0.07	0.5%	45%	0.33	22.5%	62.4%
B21	2.61	100%	0.42	16.1%	5%	0.11	0.2%	45%	2.08	35.9%	52.2%
B22	1.45	100%	0.45	31.0%	5%	0.12	0.4%	45%	0.88	27.3%	58.8%

Per Table 1, City of Aurora Storm Drainage and Technical Criteria Manual:

Paving, Drives, Walks: 100% impervious

Undeveloped Areas 2%-5% impervious  
(Lawns): (Does not include roads)

Commercial Areas: 95% impervious (Does not include roads)  
Neighborhood Areas: 85% impervious (Does not include roads)

Single-Family Residential 45% impervious  
(0.25 Acres or Less): (Does not include roads)

\*Per Table 5-5, City of Aurora Storm Drainage Criteria Manual:

Paving, Drives, Walks: 95% impervious

Open Space 5% impervious

Landscaping: 20% impervious

Community Park: 25% impervious

Low & Medium-Density SFH (3 - 5 du/ac) 55% impervious (Includes roads)

Medium-Density MFH/  
High Density SFH (5 - 20 du/ac) 65% impervious (Includes roads)

\*Basins marked with an asterisk are future basins and must adhere to the new composite impervious values, as shown in Table 5-5 of the revised City of Aurora Storm Drainage Criteria Manual.

Basin ID	Total Area (ac)	Paving, Drives, Walks, Ponds			Landscaping/Park			Use (Commercial, Residential)			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
B23A	0.22	100%	0.00	0.0%	5%	0.11	2.5%	45%	0.11	22.5%	25.0%
B23	22.94	100%	0.00	0.0%	5%	17.54	3.8%	45%	5.40	10.6%	14.4%
B24	3.41	100%	0.54	15.8%	5%	0.30	0.4%	45%	2.57	33.9%	50.2%
B25	2.35	100%	0.53	22.6%	5%	0.25	0.5%	45%	1.57	30.1%	53.1%
B26	3.57	100%	0.65	18.2%	5%	0.34	0.5%	45%	2.58	32.5%	51.2%
B27	1.47	100%	0.54	36.7%	2%	0.13	0.2%	45%	0.80	24.5%	61.4%
B28	1.62	100%	0.38	23.5%	5%	0.09	0.3%	45%	1.15	31.9%	55.7%
B29	1.19	100%	0.25	21.0%	5%	0.06	0.3%	45%	0.88	33.3%	54.5%
B30	3.16	100%	0.53	16.8%	5%	0.98	1.6%	45%	1.65	23.5%	41.8%
B31	1.87	100%	0.35	18.7%	5%	0.09	0.2%	45%	1.43	34.4%	53.4%
B32	0.20	100%	0.14	70.0%	5%	0.03	0.8%	45%	0.03	6.8%	77.5%
B33	0.21	100%	0.14	66.7%	5%	0.04	1.0%	45%	0.03	6.4%	74.0%
B33A	0.41	100%	0.19	46.3%	5%	0.22	2.7%	45%	0.00	0.0%	49.0%
B33B	0.21	100%	0.14	66.7%	5%	0.07	1.7%	45%	0.00	0.0%	68.3%
B34	0.98	100%	0.27	27.6%	5%	0.05	0.3%	45%	0.66	30.3%	58.1%
B35	0.98	100%	0.35	35.6%	5%	0.09	0.5%	45%	0.54	24.8%	60.9%
B36	1.24	100%	0.34	27.4%	5%	0.08	0.3%	45%	0.82	29.8%	57.5%
B37	1.74	100%	0.39	22.4%	5%	0.18	0.5%	45%	1.17	30.3%	53.2%
B38	0.91	100%	0.51	56.0%	5%	0.40	2.2%	45%	0.00	0.0%	58.2%
B39	0.78	100%	0.40	51.3%	5%	0.38	2.4%	45%	0.00	0.0%	53.7%
B39A	0.23	100%	0.14	60.9%	5%	0.09	2.0%	45%	0.00	0.0%	62.8%
B39B	0.26	100%	0.21	80.8%	5%	0.05	1.0%	45%	0.00	0.0%	81.7%
B40*	1.94	95%	0.53	26.0%	20%	0.13	1.3%	55%	1.28	36.3%	63.6%
B41	0.80	100%	0.26	32.5%	2%	0.06	0.2%	45%	0.48	27.0%	59.7%
B42	2.98	100%	0.66	22.1%	2%	0.17	0.1%	45%	2.15	32.5%	54.7%
B43A	0.95	100%	0.32	33.7%	2%	0.09	0.2%	45%	0.54	25.6%	59.5%
B43	0.45	100%	0.19	42.2%	2%	0.04	0.2%	45%	0.22	22.0%	64.4%
B44	0.22	100%	0.16	72.7%	2%	0.04	0.4%	45%	0.02	4.1%	77.2%
B45	2.01	100%	0.27	13.4%	2%	0.07	0.1%	45%	1.67	37.4%	50.9%
B46	1.56	100%	0.57	36.5%	2%	0.12	0.2%	45%	0.87	25.1%	61.8%
B47	2.80	100%	0.40	14.3%	2%	0.10	0.1%	45%	2.30	37.0%	51.3%
B48	1.29	100%	0.47	36.4%	2%	0.10	0.2%	45%	0.72	25.1%	61.7%
B49A*	4.22	95%	0.00	0.0%	25%	4.22	25.0%	55%	0.00	0.0%	25.0%
B49B*	1.94	95%	0.00	0.0%	25%	1.94	25.0%	55%	0.00	0.0%	25.0%
B50*	0.46	95%	0.37	76.4%	20%	0.09	3.9%	45%	0.00	0.0%	80.3%
B51	0.85	100%	0.68	80.0%	5%	0.17	1.0%	45%	0.00	0.0%	81.0%
B52	0.96	100%	0.32	33.3%	5%	0.08	0.4%	45%	0.56	26.3%	60.0%

Basin ID	Total Area (ac)	Paving, Drives, Walks, Ponds			Landscaping/Park			Use (Commercial, Residential)			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
B53	1.33	100%	0.40	30.1%	5%	0.10	0.4%	45%	0.83	28.1%	58.5%
B54	0.56	100%	0.18	32.1%	5%	0.04	0.4%	45%	0.34	27.3%	59.8%
B55	3.16	100%	0.71	22.5%	5%	0.23	0.4%	45%	2.22	31.6%	54.4%
B56	1.09	100%	0.34	31.2%	5%	0.08	0.4%	45%	0.67	27.7%	59.2%
B57	0.79	100%	0.26	32.9%	5%	0.06	0.4%	45%	0.47	26.8%	60.1%
B58	2.16	100%	0.98	45.4%	5%	0.27	0.6%	45%	0.91	19.0%	65.0%
B58A	0.98	100%	0.00	0.0%	2%	0.28	0.6%	45%	0.70	32.1%	32.7%
B59	3.96	100%	0.69	17.4%	5%	0.36	0.5%	45%	2.91	33.1%	50.9%
B61	2.43	100%	0.00	0.0%	5%	0.00	0.0%	85%	2.43	85.0%	85.0%
B62	12.96	100%	3.57	27.5%	5%	7.61	2.9%	45%	1.78	6.2%	36.7%
TOTAL B	143.73										44.0%
C1	1.51	100%	0.17	11.3%	2%	0.37	0.5%	45%	0.97	28.9%	40.7%
C2	1.39	100%	0.45	32.4%	5%	0.15	0.5%	45%	0.79	25.6%	58.5%
C3	1.74	100%	0.26	14.9%	5%	0.07	0.2%	45%	1.41	36.5%	51.6%
C4	3.68	100%	0.55	14.9%	5%	0.27	0.4%	45%	2.86	35.0%	50.3%
C5	2.03	100%	0.65	32.0%	5%	0.29	0.7%	45%	1.09	24.2%	56.9%
C6	1.05	100%	0.00	0.0%	5%	0.23	1.1%	45%	0.82	35.1%	36.2%
C7*	9.17	95%	2.99	31.0%	20%	0.75	1.6%	65%	5.43	38.5%	71.1%
C8*	3.03	95%	0.97	30.4%	20%	0.25	1.7%	55%	1.81	32.9%	64.9%
C9	4.93	100%	1.02	20.7%	2%	1.86	0.8%	45%	2.05	18.7%	40.2%
TOTAL C	28.53										56.7%
D1	3.06	100%	0.73	23.9%	5%	0.25	0.4%	45%	2.08	30.6%	54.9%
D2	3.07	100%	0.78	25.4%	5%	0.17	0.3%	45%	2.12	31.1%	56.8%
D3	1.77	100%	0.36	20.3%	5%	0.09	0.3%	45%	1.32	33.6%	54.2%
D4*	1.65	95%	0.97	55.8%	20%	0.68	8.2%	55%	0.00	0.0%	64.1%
D5	11.36	100%	0.43	3.8%	2%	10.93	1.9%	45%	0.00	0.0%	5.7%
TOTAL D	20.91										29.1%
OS1	21.79	100%	0.00	0.0%	5%	21.79	5.0%	15%	0.00	0.0%	5.0%
OS2	13.65	100%	0.00	0.0%	5%	13.65	5.0%	15%	0.00	0.0%	5.0%
OS3	0.14	100%	0.09	64.3%	2%	0.05	0.7%	45%	0.00	0.0%	65.0%
OS4	0.72	100%	0.00	0.0%	2%	0.72	2.0%	45%	0.00	0.0%	2.0%
OS5*	1.69	95%	0.00	0.0%	20%	1.15	13.6%	55%	0.54	17.6%	31.2%
TOTAL OS	37.99										6.3%



# COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora \_\_\_\_\_ Project No.: 16118.00  
 Calculated By: AAM \_\_\_\_\_  
 Checked By: \_\_\_\_\_  
 Date: 4/26/24 \_\_\_\_\_

C-Value - 100-Year

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Hydrologic Soil Group			Minor Coefficients			Major Coefficients			Major Coefficients			Basins Total Weighted C <sub>2</sub>	Basins Total Weighted C <sub>5</sub>	Basins Total Weighted C <sub>100</sub>
			Area A (ac)	Area B (ac)	Area C/D (ac)	% A (ac)	% B (ac)	% C/D (ac)	C <sub>2,A</sub>	C <sub>2,B</sub>	C <sub>2,C/D</sub>	C <sub>5,A</sub>	C <sub>5,B</sub>	C <sub>5,C/D</sub>	C <sub>100,A</sub>	C <sub>100,B</sub>	C <sub>100,C/D</sub>			
A1	1.91	10.7%	0.00	1.72	0.19	0%	90%	10%	0.05	0.06	0.07	0.05	0.08	0.12	0.19	0.48	0.53	0.06	0.08	0.48
A2	1.32	60.3%	0.00	0.86	0.46	0%	65%	35%	0.43	0.47	0.47	0.45	0.50	0.53	0.58	0.71	0.73	0.47	0.51	0.72
A3	0.45	74.7%	0.00	0.44	0.01	0%	98%	2%	0.57	0.60	0.60	0.59	0.63	0.65	0.69	0.78	0.79	0.60	0.63	0.78
A4	5.13	42.6%	0.00	2.47	2.66	0%	48%	52%	0.28	0.31	0.32	0.29	0.34	0.38	0.44	0.63	0.66	0.31	0.36	0.64
A5	0.62	71.5%	0.00	0.62	0.00	0%	100%	0%	0.54	0.57	0.57	0.56	0.60	0.62	0.67	0.76	0.78	0.57	0.60	0.76
A6	2.06	27.5%	0.00	2.06	0.00	0%	100%	0%	0.16	0.19	0.19	0.17	0.21	0.26	0.32	0.56	0.60	0.19	0.21	0.56
B1	1.54	69.8%	0.00	1.03	0.51	0%	67%	33%	0.53	0.55	0.55	0.54	0.58	0.61	0.65	0.75	0.77	0.55	0.59	0.76
B2	1.54	76.6%	0.00	1.54	0.00	0%	100%	0%	0.59	0.62	0.62	0.61	0.64	0.66	0.71	0.79	0.80	0.62	0.64	0.79
B3	6.43	13.1%	0.00	6.43	0.00	0%	100%	0%	0.06	0.08	0.09	0.06	0.09	0.14	0.21	0.49	0.54	0.08	0.09	0.49
B3A	0.85	11.1%	0.00	0.85	0.00	0%	100%	0%	0.05	0.06	0.07	0.05	0.08	0.13	0.20	0.48	0.53	0.06	0.08	0.48
B4	2.51	56.7%	0.00	2.28	0.23	0%	91%	9%	0.40	0.43	0.44	0.42	0.46	0.50	0.55	0.69	0.72	0.43	0.47	0.69
B5	1.50	58.5%	0.00	1.50	0.00	0%	100%	0%	0.42	0.45	0.46	0.43	0.48	0.51	0.57	0.70	0.72	0.45	0.48	0.70
B6	1.46	57.3%	0.00	1.46	0.00	0%	100%	0%	0.41	0.44	0.44	0.42	0.47	0.50	0.56	0.69	0.72	0.44	0.47	0.69
B7	2.66	55.2%	0.00	2.66	0.00	0%	100%	0%	0.39	0.42	0.43	0.40	0.45	0.49	0.54	0.69	0.71	0.42	0.45	0.69
B8*	1.76	63.3%	0.00	0.23	1.53	0%	13%	87%	0.46	0.49	0.50	0.48	0.52	0.55	0.60	0.72	0.74	0.50	0.55	0.74
B9	1.53	55.2%	0.00	1.53	0.00	0%	100%	0%	0.39	0.42	0.43	0.40	0.45	0.49	0.54	0.69	0.71	0.42	0.45	0.69
B10	2.40	56.5%	0.00	2.40	0.00	0%	100%	0%	0.40	0.43	0.44	0.41	0.46	0.50	0.55	0.69	0.72	0.43	0.46	0.69
B11	0.44	60.1%	0.00	0.44	0.00	0%	100%	0%	0.43	0.46	0.47	0.45	0.49	0.53	0.58	0.71	0.73	0.46	0.49	0.71
B12	0.66	60.6%	0.00	0.18	0.48	0%	27%	73%	0.44	0.47	0.47	0.45	0.50	0.53	0.58	0.71	0.73	0.47	0.52	0.73
B13	2.91	32.9%	0.00	0.58	2.33	0%	20%	80%	0.20	0.23	0.24	0.21	0.26	0.31	0.37	0.58	0.62	0.24	0.30	0.61
B14	1.54	80.9%	0.00	0.06	1.48	0%	4%	96%	0.64	0.65	0.65	0.66	0.68	0.70	0.74	0.81	0.82	0.65	0.70	0.82
B15	2.20	5.0%	0.00	0.48	1.72	0%	22%	78%	0.02	0.03	0.03	0.02	0.03	0.08	0.15	0.45	0.50	0.03	0.07	0.49
B16	0.66	67.9%	0.00	0.09	0.57	0%	14%	86%	0.51	0.53	0.54	0.52	0.56	0.59	0.64	0.75	0.76	0.54	0.59	0.76
B17	0.37	82.0%	0.00	0.03	0.34	0%	8%	92%	0.65	0.67	0.67	0.67	0.69	0.71	0.75	0.81	0.82	0.67	0.71	0.82
B18	1.97	52.4%	0.00	0.00	1.97	0%	0%	100%	0.36	0.40	0.40	0.38	0.43	0.47	0.52	0.67	0.70	0.40	0.47	0.70
B19	1.28	58.1%	0.00	0.05	1.23	0%	4%	96%	0.41	0.44	0.45	0.43	0.48	0.51	0.56	0.70	0.72	0.45	0.51	0.72
B20	0.66	62.4%	0.00	0.15	0.51	0%	23%	77%	0.46	0.48	0.49	0.47	0.51	0.55	0.60	0.72	0.74	0.49	0.54	0.74
B21	2.61	52.2%	0.00	1.51	1.10	0%	58%	42%	0.36	0.39	0.40	0.38	0.42	0.46	0.52	0.67	0.70	0.40	0.44	0.68
B22	1.45	58.8%	0.00	1.45	0.00	0%	100%	0%	0.42	0.45	0.46	0.44	0.48	0.52	0.57	0.70	0.73	0.45	0.48	0.70

B23A	0.22	25.0%	0.00	0.22	0.00	0%	100%	0%	0.14	0.17	0.17	0.15	0.19	0.24	0.31	0.54	0.59	0.17	0.19	0.54
B23	22.94	14.4%	0.00	22.94	0.00	0%	100%	0%	0.07	0.09	0.09	0.07	0.10	0.15	0.22	0.49	0.54	0.09	0.10	0.49
B24	3.41	50.2%	0.00	0.00	3.41	0%	0%	100%	0.34	0.38	0.38	0.36	0.41	0.45	0.50	0.66	0.69	0.38	0.45	0.69
B25	2.35	53.1%	0.00	0.00	2.35	0%	0%	100%	0.37	0.40	0.41	0.38	0.43	0.47	0.52	0.68	0.70	0.41	0.47	0.70
B26	3.57	51.2%	0.00	1.37	2.20	0%	38%	62%	0.35	0.38	0.39	0.37	0.41	0.46	0.51	0.67	0.69	0.39	0.44	0.68
B27	1.47	61.4%	0.00	1.47	0.00	0%	100%	0%	0.44	0.47	0.48	0.46	0.51	0.54	0.59	0.71	0.74	0.47	0.51	0.71
B28	1.62	55.7%	0.00	0.00	1.62	0%	0%	100%	0.39	0.42	0.43	0.41	0.46	0.49	0.54	0.69	0.71	0.43	0.49	0.71
B29	1.19	54.5%	0.00	0.78	0.41	0%	66%	34%	0.38	0.41	0.42	0.40	0.44	0.48	0.54	0.68	0.71	0.42	0.46	0.69
B30	3.16	41.8%	0.00	1.39	1.77	0%	44%	56%	0.27	0.30	0.31	0.28	0.33	0.38	0.44	0.62	0.65	0.31	0.36	0.64
B31	1.87	53.4%	0.00	1.19	0.68	0%	64%	36%	0.37	0.40	0.41	0.39	0.43	0.47	0.53	0.68	0.70	0.41	0.45	0.69
B32	0.20	77.5%	0.00	0.16	0.04	0%	80%	20%	0.60	0.62	0.62	0.62	0.65	0.67	0.71	0.79	0.80	0.62	0.66	0.79
B33	0.21	74.0%	0.00	0.19	0.02	0%	90%	10%	0.57	0.59	0.59	0.59	0.62	0.64	0.69	0.77	0.79	0.59	0.62	0.78
B33A	0.41	49.0%	0.00	0.41	0.00	0%	100%	0%	0.33	0.37	0.37	0.35	0.40	0.44	0.49	0.66	0.69	0.37	0.40	0.66
B33B	0.21	68.3%	0.00	0.21	0.00	0%	100%	0%	0.51	0.54	0.54	0.53	0.57	0.60	0.64	0.75	0.76	0.54	0.57	0.75
B34	0.98	58.1%	0.00	0.98	0.00	22%	100%	0%	0.00	0.44	0.45	0.43	0.48	0.51	0.56	0.70	0.72	0.44	0.57	0.82
B35	0.98	60.9%	0.00	0.17	0.81	0%	17%	83%	0.44	0.47	0.48	0.46	0.50	0.53	0.58	0.71	0.73	0.48	0.53	0.73
B36	1.24	57.5%	0.00	0.01	1.23	0%	1%	99%	0.41	0.44	0.45	0.42	0.47	0.51	0.56	0.70	0.72	0.45	0.51	0.72
B37	1.74	53.2%	0.00	0.55	1.19	0%	32%	68%	0.37	0.40	0.41	0.38	0.43	0.47	0.52	0.68	0.70	0.41	0.46	0.69
B38	0.91	58.2%	0.00	0.91	0.00	0%	100%	0%	0.42	0.45	0.45	0.43	0.48	0.51	0.56	0.70	0.72	0.45	0.48	0.70
B39	0.78	53.7%	0.00	0.78	0.00	0%	100%	0%	0.37	0.41	0.41	0.39	0.44	0.47	0.53	0.68	0.70	0.41	0.44	0.68
B39A	0.23	62.8%	0.00	0.23	0.00	0%	100%	0%	0.46	0.49	0.49	0.47	0.52	0.55	0.60	0.72	0.74	0.49	0.52	0.72
B39B	0.26	81.7%	0.00	0.26	0.00	0%	100%	0%	0.65	0.66	0.66	0.67	0.69	0.70	0.75	0.81	0.82	0.66	0.69	0.81
B40*	1.94	63.6%	0.00	0.58	1.36	0%	30%	70%	0.47	0.50	0.50	0.48	0.52	0.56	0.61	0.73	0.75	0.50	0.55	0.74
B41	0.80	59.7%	0.00	0.80	0.00	0%	100%	0%	0.43	0.46	0.47	0.44	0.49	0.52	0.57	0.71	0.73	0.46	0.49	0.71
B42	2.98	54.7%	0.00	2.98	0.00	0%	100%	0%	0.38	0.41	0.42	0.40	0.45	0.48	0.54	0.68	0.71	0.41	0.45	0.68
B43A	0.95	59.5%	0.00	0.95	0.00	0%	100%	0%	0.43	0.46	0.46	0.44	0.49	0.52	0.57	0.70	0.73	0.46	0.49	0.70
B43	0.45	64.4%	0.00	0.45	0.00	0%	100%	0%	0.47	0.50	0.51	0.49	0.53	0.56	0.61	0.73	0.75	0.50	0.53	0.73
B44	0.22	77.2%	0.00	0.22	0.00	0%	100%	0%	0.60	0.62	0.62	0.62	0.65	0.67	0.71	0.79	0.80	0.62	0.65	0.79
B45	2.01	50.9%	0.00	2.01	0.00	0%	100%	0%	0.35	0.38	0.39	0.36	0.41	0.45	0.51	0.67	0.69	0.38	0.41	0.67
B46	1.56	61.8%	0.00	1.56	0.00	0%	100%	0%	0.45	0.48	0.48	0.47	0.51	0.54	0.59	0.72	0.74	0.48	0.51	0.72
B47	2.80	51.3%	0.00	2.80	0.00	0%	100%	0%	0.35	0.38	0.39	0.37	0.42	0.46	0.51	0.67	0.69	0.38	0.42	0.67
B48	1.29	61.7%	0.00	1.29	0.00	0%	100%	0%	0.45	0.48	0.48	0.46	0.51	0.54	0.59	0.72	0.74	0.48	0.51	0.72
B49A*	4.22	25.0%	0.00	2.35	1.87	0%	56%	44%	0.14	0.17	0.17	0.15	0.19	0.24	0.31	0.54	0.59	0.17	0.21	0.56
B49B*	1.94	25.0%	0.00	0.13	1.81	0%	7%	93%	0.14	0.17	0.17	0.15	0.19	0.24	0.31	0.54	0.59	0.17	0.24	0.58
B50*	0.46	80.3%	0.00	0.16	0.30	0%	35%	65%	0.63	0.65	0.65	0.65	0.68	0.69	0.74	0.80	0.81	0.65	0.69	0.81
B51	0.85	81.0%	0.00	0.85	0.00	0%	100%	0%	0.64	0.66	0.65	0.66	0.68	0.70	0.74	0.81	0.82	0.66	0.68	0.81
B52	0.96	60.0%	0.00	0.96	0.00	0%	100%	0%	0.43	0.46	0.47	0.45	0.49	0.53	0.58	0.71	0.73	0.46	0.49	0.71
B53	1.33	58.5%	0.00	0.12	1.21	0%	9%	91%	0.42	0.45	0.46	0.43	0.48	0.51	0.57	0.70	0.72	0.45	0.51	0.72
B54	0.56	59.8%	0.00	0.35	0.21	0%	63%	38%	0.43	0.46	0.47	0.45	0.49	0.53	0.58	0.71	0.73	0.46	0.50	0.72
B55	3.16	54.4%	0.00	3.16	0.00	0%	100%	0%	0.38	0.41	0.42	0.40	0.44	0.48	0.54	0.68	0.71	0.41	0.44	0.68

B56	1.09	59.2%	0.00	1.09	0.00	0%	100%	0%	0.43	0.46	0.46	0.44	0.49	0.52	0.57	0.70	0.73	0.46	0.49	0.70
B57	0.79	60.1%	0.00	0.77	0.02	0%	97%	3%	0.43	0.46	0.47	0.45	0.49	0.53	0.58	0.71	0.73	0.46	0.49	0.71
B58	2.16	65.0%	0.00	1.74	0.42	0%	81%	19%	0.48	0.51	0.51	0.50	0.54	0.57	0.62	0.73	0.75	0.51	0.54	0.73
B58A	0.98	32.7%	0.00	0.64	0.34	0%	65%	35%	0.20	0.23	0.24	0.21	0.25	0.30	0.37	0.58	0.62	0.23	0.27	0.59
B59	3.96	50.9%	0.00	3.96	0.00	0%	100%	0%	0.35	0.38	0.39	0.36	0.41	0.45	0.51	0.67	0.69	0.38	0.41	0.67
B61	2.43	85.0%	0.00	2.43	0.00	0%	100%	0%	0.68	0.69	0.69	0.70	0.72	0.73	0.77	0.83	0.83	0.69	0.72	0.83
B62	12.96	36.7%	0.00	12.96	0.00	0%	100%	0%	0.23	0.26	0.27	0.24	0.29	0.34	0.40	0.60	0.63	0.26	0.29	0.60
C1	1.51	40.7%	0.00	1.34	0.17	0%	89%	11%	0.26	0.29	0.30	0.27	0.32	0.37	0.43	0.62	0.65	0.29	0.33	0.62
C2	1.39	58.5%	0.00	0.27	1.12	0%	19%	81%	0.42	0.45	0.46	0.43	0.48	0.51	0.57	0.70	0.72	0.45	0.51	0.72
C3	1.74	51.6%	0.00	0.00	1.74	0%	0%	100%	0.35	0.39	0.40	0.37	0.42	0.46	0.51	0.67	0.70	0.40	0.46	0.70
C4	3.68	50.3%	0.00	0.00	3.68	0%	0%	100%	0.34	0.38	0.38	0.36	0.41	0.45	0.50	0.66	0.69	0.38	0.45	0.69
C5	2.03	56.9%	0.00	0.24	1.79	0%	12%	88%	0.40	0.43	0.44	0.42	0.47	0.50	0.55	0.69	0.72	0.44	0.50	0.71
C6	1.05	36.2%	0.00	0.54	0.51	0%	51%	49%	0.22	0.26	0.27	0.24	0.28	0.33	0.39	0.60	0.63	0.26	0.31	0.61
C7*	9.17	71.1%	0.00	6.67	2.50	0%	73%	27%	0.54	0.56	0.57	0.56	0.59	0.62	0.67	0.76	0.78	0.56	0.60	0.76
C8*	3.03	64.9%	0.00	3.03	0.00	0%	100%	0%	0.48	0.51	0.51	0.50	0.54	0.57	0.62	0.73	0.75	0.51	0.54	0.73
C9	4.93	40.2%	0.00	4.79	0.14	0%	97%	3%	0.26	0.29	0.30	0.27	0.32	0.36	0.42	0.62	0.65	0.29	0.32	0.62
D1	3.06	54.9%	0.00	0.50	2.56	0%	16%	84%	0.38	0.42	0.42	0.40	0.45	0.49	0.54	0.68	0.71	0.42	0.48	0.70
D2	3.07	56.8%	0.00	1.05	2.02	0%	34%	66%	0.40	0.43	0.44	0.42	0.46	0.50	0.55	0.69	0.72	0.44	0.49	0.71
D3	1.77	54.2%	0.00	0.05	1.72	0%	3%	97%	0.38	0.41	0.42	0.39	0.44	0.48	0.53	0.68	0.71	0.42	0.48	0.71
D4*	1.65	64.1%	0.00	1.65	0.00	0%	100%	0%	0.47	0.50	0.50	0.49	0.53	0.56	0.61	0.73	0.75	0.50	0.53	0.73
D5	11.36	5.7%	0.00	8.48	2.88	0%	75%	25%	0.02	0.03	0.03	0.02	0.04	0.08	0.16	0.45	0.51	0.03	0.05	0.47
OS1	21.79	5.0%	0.00	12.74	9.05	0%	58%	42%	0.02	0.03	0.03	0.02	0.03	0.08	0.15	0.45	0.50	0.03	0.05	0.47
OS2	13.65	5.0%	0.00	12.40	1.25	0%	91%	9%	0.02	0.03	0.03	0.02	0.03	0.08	0.15	0.45	0.50	0.03	0.04	0.45
OS3	0.14	65.0%	0.00	0.14	0.00	0%	100%	0%	0.48	0.51	0.51	0.50	0.54	0.57	0.62	0.73	0.75	0.51	0.54	0.73
OS4	0.72	2.0%	0.00	0.72	0.00	0%	100%	0%	0.00	0.01	0.01	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.01	0.44
OS5*	1.69	31.2%	0.00	1.69	0.00	0%	100%	0%	0.18	0.22	0.22	0.19	0.24	0.29	0.35	0.57	0.61	0.22	0.24	0.57
TOTAL	242.65	38.1%	0.00	170.93	71.72	0%	70%	30%	---	---	---	---	---	---	---	---	---	0.29	0.32	0.61

Table 5-7. Runoff Coefficient Equations Based on NRCS Soil Group and Storm Return Period<sup>26</sup>

NRCS Soil Group	Storm Return Period						
	2-year	5-year	10-year	25-year	50-year	100-year	500-year
<b>A</b>	$C_A = 0.84/i^{.302}$	$C_A = 0.86/i^{.276}$	$C_A = 0.87/i^{.232}$	$C_A = 0.88/i^{.124}$	$C_A = 0.85/i + 0.025$	$C_A = 0.78/i + 0.110$	$C_A = 0.65/i + 0.254$
<b>B</b>	$C_B = 0.84/i^{.169}$	$C_B = 0.86/i^{.088}$	$C_B = 0.81/i + 0.057$	$C_B = 0.63/i + 0.249$	$C_B = 0.56/i + 0.328$	$C_B = 0.47/i + 0.426$	$C_B = 0.37/i + 0.536$
<b>C/D</b>	$C_{CD} = 0.83/i^{.122}$	$C_{CD} = 0.82/i + 0.035$	$C_{CD} = 0.74/i + 0.132$	$C_{CD} = 0.56/i + 0.319$	$C_{CD} = 0.49/i + 0.393$	$C_{CD} = 0.41/i + 0.484$	$C_{CD} = 0.32/i + 0.588$

Where:

$i$  = % imperviousness (expressed as a decimal)

$C_A$  = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

$C_B$  = Runoff coefficient for NRCS HSG B soils

$C_{CD}$  = Runoff coefficient for NRCS HSG C and D soils.

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora Project No.: 16118.00  
 Calculated By: AAM  
 Checked By: \_\_\_\_\_  
 Date: 4/26/24

SUB-BASIN							INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA							(T <sub>i</sub> )			(T <sub>t</sub> )					(URBANIZED BASINS)			
BASIN	D.A.	Hydrologic	Impervious	C <sub>2</sub>	C <sub>5</sub>	C <sub>100</sub>	L	S <sub>o</sub>	t <sub>i</sub>	L <sub>t</sub>	S <sub>t</sub>	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	
A1	1.91	B	10.7%	0.06	0.08	0.48	150.00	4.7%	13.5	345.00	4.3%	15.00	3.1	1.8	15.4	495.00	26.8	15.4
A2	1.32	B	60.3%	0.47	0.51	0.72	102.00	3.3%	7.3	189.00	1.9%	20.00	2.8	1.1	8.4	291.00	17.1	8.4
A3	0.45	B	74.7%	0.60	0.63	0.78	62.00	2.0%	5.4	126.00	1.9%	20.00	2.8	0.8	6.1	188.00	14.1	6.1
A4	5.13	C	42.6%	0.31	0.36	0.64	165.00	2.0%	13.6	1332.00	3.2%	20.00	3.6	6.2	19.8	1497.00	27.1	19.8
A5	0.62	B	71.5%	0.57	0.60	0.76	182.00	3.6%	8.0	316.00	4.0%	20.00	4.0	1.3	9.3	498.00	15.2	9.3
A6	2.06	B	27.5%	0.19	0.21	0.56	118.00	16.2%	7.0	84.00	0.5%	20.00	1.4	1.0	7.9	202.00	22.9	7.9
B1	1.54	B	69.8%	0.55	0.59	0.76	51.00	2.0%	5.2	649.00	4.0%	20.00	4.0	2.7	7.9	700.00	17.0	7.9
B2	1.54	B	76.6%	0.62	0.64	0.79	39.00	2.0%	4.1	836.00	3.5%	20.00	3.7	3.7	7.8	875.00	16.8	7.8
B3	6.43	B	13.1%	0.08	0.09	0.49	106.00	4.1%	11.7	665.00	2.5%	15.00	2.4	4.7	16.4	771.00	30.2	16.4
B3A	0.85	B	11.1%	0.06	0.08	0.48	91.00	5.8%	9.8	241.00	6.7%	15.00	3.9	1.0	10.9	332.00	25.6	10.9
B4	2.51	B	56.7%	0.43	0.47	0.69	156.00	2.5%	10.5	877.00	2.9%	20.00	3.4	4.3	14.8	1033.00	21.4	14.8
B5	1.50	B	58.5%	0.45	0.48	0.70	71.00	2.5%	7.0	837.00	2.9%	20.00	3.4	4.1	11.1	908.00	20.8	11.1
B6	1.46	B	57.3%	0.44	0.47	0.69	75.00	2.5%	7.3	569.00	2.9%	20.00	3.4	2.8	10.1	644.00	19.5	10.1
B7	2.66	B	55.2%	0.42	0.45	0.69	135.00	2.5%	10.1	448.00	1.4%	20.00	2.4	3.2	13.2	583.00	20.4	13.2
B8*	1.76	C	63.3%	0.50	0.55	0.74	137.00	2.5%	8.6	133.00	1.0%	20.00	2.0	1.1	9.7	270.00	16.5	9.7
B9	1.53	B	55.2%	0.42	0.45	0.69	220.00	6.0%	9.6	163.00	3.2%	20.00	3.6	0.8	10.4	383.00	17.5	10.4
B10	2.40	B	56.5%	0.43	0.46	0.69	61.00	2.5%	6.6	744.00	3.9%	20.00	3.9	3.1	9.8	805.00	20.1	9.8
B11	0.44	B	60.1%	0.46	0.49	0.71	65.00	2.5%	6.5	135.00	1.5%	20.00	2.4	0.9	7.4	200.00	16.8	7.4
B12	0.66	C	60.6%	0.47	0.52	0.73	135.00	2.5%	8.9	266.00	2.8%	20.00	3.3	1.3	10.3	401.00	17.2	10.3
B13	2.91	C	32.9%	0.24	0.30	0.61	279.00	6.6%	13.0	223.00	2.8%	20.00	3.3	1.1	14.1	502.00	22.0	14.1
B14	1.54	B	80.9%	0.65	0.70	0.82	23.00	2.0%	2.8	1060.00	4.0%	20.00	4.0	4.4	7.2	1083.00	16.6	7.2
B15	2.20	C	5.0%	0.03	0.07	0.49	156.00	7.9%	11.8	546.00	4.6%	15.00	3.2	2.8	14.6	702.00	29.5	14.6
B16	0.66	C	67.9%	0.54	0.59	0.76	146.00	2.5%	8.3	186.00	3.8%	20.00	3.9	0.8	9.0	332.00	15.3	9.0
B17	0.37	C	82.0%	0.67	0.71	0.82	30.00	2.0%	3.1	186.00	1.4%	20.00	2.3	1.3	4.4	216.00	13.4	5.0
B18	1.97	C	52.4%	0.40	0.47	0.70	146.00	2.5%	10.2	447.00	4.0%	20.00	4.0	1.9	12.1	593.00	19.4	12.1
B19	1.28	C	58.1%	0.45	0.51	0.72	81.00	2.1%	7.5	529.00	4.0%	20.00	4.0	2.2	9.7	610.00	18.7	9.7
B20	0.66	C	62.4%	0.49	0.54	0.74	81.00	2.5%	6.7	308.00	1.9%	20.00	2.7	1.9	8.6	389.00	17.5	8.6
B21	2.61	C	52.2%	0.40	0.44	0.68	88.00	2.5%	8.3	608.00	4.0%	20.00	4.0	2.5	10.8	696.00	20.2	10.8
B22	1.45	B	58.8%	0.45	0.48	0.70	103.00	2.5%	8.4	655.00	4.0%	20.00	4.0	2.7	11.1	758.00	19.2	11.1
B23A	0.22	B	25.0%	0.17	0.19	0.54	120.00	4.7%	10.8	0.00	1.0%	1.00	0.1	0.0	10.8	120.00	21.8	10.8
B23	22.94	B	14.4%	0.09	0.10	0.49	200.00	8.0%	12.8	1580.00	3.1%	15.00	2.6	10.0	22.8	1780.00	37.1	22.8
B24	3.41	C	50.2%	0.38	0.45	0.69	146.00	2.5%	10.5	825.00	4.4%	20.00	4.2	3.3	13.8	971.00	21.6	13.8

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora Project No.: 16118.00  
 Calculated By: AAM  
 Checked By: \_\_\_\_\_  
 Date: 4/26/24

SUB-BASIN							INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA							(T <sub>i</sub> )			(T <sub>t</sub> )					(URBANIZED BASINS)			
BASIN	D.A.	Hydrologic	Impervious	C <sub>2</sub>	C <sub>5</sub>	C <sub>100</sub>	L	S <sub>o</sub>	t <sub>i</sub>	L <sub>t</sub>	S <sub>t</sub>	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	
B25	2.35	C	53.1%	0.41	0.47	0.70	86.00	2.5%	7.8	795.00	4.4%	20.00	4.2	3.2	10.9	881.00	20.8	10.9
B26	3.57	C	51.2%	0.39	0.44	0.68	195.00	2.5%	12.3	793.00	4.0%	20.00	4.0	3.3	15.6	988.00	21.4	15.6
B27	1.47	B	61.4%	0.47	0.51	0.71	65.00	2.5%	6.4	767.00	4.0%	20.00	4.0	3.2	9.6	832.00	19.2	9.6
B28	1.62	C	55.7%	0.43	0.49	0.71	206.00	3.3%	10.6	334.00	3.3%	20.00	3.6	1.5	12.2	540.00	18.4	12.2
B29	1.19	B	54.5%	0.42	0.46	0.69	65.00	2.5%	6.9	293.00	2.3%	20.00	3.0	1.6	8.5	358.00	18.7	8.5
B30	3.16	C	41.8%	0.31	0.36	0.64	135.00	2.5%	11.5	417.00	2.1%	20.00	2.9	2.4	13.9	552.00	22.1	13.9
B31	1.87	B	53.4%	0.41	0.45	0.69	87.00	2.5%	8.1	424.00	2.1%	20.00	2.9	2.4	10.6	511.00	19.9	10.6
B32	0.20	B	77.5%	0.62	0.66	0.79	28.00	2.0%	3.4	67.00	1.0%	20.00	2.0	0.6	3.9	95.00	13.4	5.0
B33	0.21	B	74.0%	0.59	0.62	0.78	24.00	2.0%	3.4	81.00	1.0%	20.00	2.0	0.7	4.0	105.00	14.1	5.0
B33A	0.41	B	49.0%	0.37	0.40	0.66	47.00	2.0%	6.9	232.00	1.2%	20.00	2.2	1.8	8.7	279.00	19.9	8.7
B33B	0.21	B	68.3%	0.54	0.57	0.22	17.00	2.0%	0.0	169.00	1.2%	20.00	2.2	1.3	1.3	186.00	15.8	5.0
B34	0.98	B	58.1%	0.44	0.57	0.82	161.00	2.4%	9.1	260.00	2.3%	20.00	3.0	1.4	10.5	421.00	17.8	10.5
B35	0.98	C	60.9%	0.48	0.53	0.73	80.00	2.5%	6.8	142.00	2.5%	20.00	3.2	0.7	7.6	222.00	16.5	7.6
B36	1.24	C	57.5%	0.45	0.51	0.72	129.00	2.5%	9.0	208.00	2.1%	20.00	2.9	1.2	10.2	337.00	17.6	10.2
B37	1.74	B	53.2%	0.41	0.46	0.69	161.00	2.5%	10.9	298.00	3.6%	20.00	3.8	1.3	12.2	459.00	18.5	12.2
B38	0.91	B	58.2%	0.45	0.48	0.70	55.00	4.5%	5.1	314.00	1.1%	20.00	2.1	2.5	7.6	369.00	19.0	7.6
B39	0.78	B	53.7%	0.41	0.44	0.68	17.00	2.0%	3.9	409.00	1.2%	20.00	2.2	3.1	7.0	426.00	20.6	7.0
B39A	0.23	B	62.8%	0.49	0.52	0.72	17.00	2.0%	3.4	199.00	4.0%	20.00	4.0	0.8	4.3	216.00	16.3	5.0
B39B	0.26	B	81.7%	0.66	0.69	0.81	23.00	2.0%	2.8	199.00	4.0%	20.00	4.0	0.8	3.6	222.00	12.9	5.0
B40*	1.94	C	63.6%	0.50	0.55	0.74	205.00	3.0%	10.0	230.00	1.8%	20.00	2.7	1.4	11.4	435.00	16.8	11.4
B41	0.80	B	59.7%	0.46	0.49	0.71	65.00	2.5%	6.6	414.00	3.6%	20.00	3.8	1.8	8.4	479.00	18.0	8.4
B42	2.98	B	54.7%	0.41	0.45	0.68	205.00	2.5%	12.5	426.00	4.3%	20.00	4.1	1.7	14.2	631.00	18.8	14.2
B43A	0.95	B	59.5%	0.46	0.49	0.70	62.00	2.1%	6.8	489.00	4.3%	20.00	4.1	2.0	8.8	551.00	18.2	8.8
B43	0.45	B	64.4%	0.50	0.53	0.73	80.00	2.1%	7.2	130.00	2.6%	20.00	3.2	0.7	7.8	210.00	15.8	7.8
B44	0.22	B	77.2%	0.62	0.65	0.79	19.00	2.0%	2.8	188.00	2.6%	20.00	3.2	1.0	3.8	207.00	13.9	5.0
B45	2.01	B	50.9%	0.38	0.41	0.67	199.00	4.2%	10.9	308.00	4.0%	20.00	4.0	1.3	12.2	507.00	18.9	12.2
B46	1.56	B	61.8%	0.48	0.51	0.72	65.00	2.5%	6.3	777.00	4.0%	20.00	4.0	3.2	9.6	842.00	19.2	9.6
B47	2.80	B	51.3%	0.38	0.42	0.67	200.00	3.0%	12.2	457.00	3.5%	20.00	3.7	2.0	14.2	657.00	19.8	14.2
B48	1.29	B	61.7%	0.48	0.51	0.72	65.00	2.5%	6.4	594.00	3.5%	20.00	3.7	2.6	9.0	659.00	18.5	9.0
B49A*	4.22	C	25.0%	0.17	0.21	0.56	200.00	3.1%	15.6	217.00	3.1%	7.00	1.2	2.9	18.5	417.00	23.4	18.5
B49B*	1.94	C	25.0%	0.17	0.24	0.58	200.00	3.1%	15.2	330.00	3.1%	7.00	1.2	4.5	19.6	530.00	24.2	19.6
B50*	0.46	C	80.3%	0.65	0.69	0.81	16.00	2.0%	2.4	466.00	3.0%	20.00	3.5	2.2	4.6	482.00	14.6	5.0

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora Project No.: 16118.00  
 Calculated By: AAM  
 Checked By: \_\_\_\_\_  
 Date: 4/26/24

SUB-BASIN							INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA							(T <sub>i</sub> )			(T <sub>t</sub> )					(URBANIZED BASINS)			
BASIN	D.A.	Hydrologic	Impervious	C <sub>2</sub>	C <sub>5</sub>	C <sub>100</sub>	L	S <sub>o</sub>	t <sub>i</sub>	L <sub>t</sub>	S <sub>t</sub>	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	
B51	0.85	B	81.0%	0.66	0.68	0.81	15.00	2.5%	2.1	642.00	2.4%	20.00	3.1	3.5	5.6	657.00	15.6	5.6
B52	0.96	B	60.0%	0.46	0.49	0.71	65.00	2.5%	6.5	411.00	2.4%	20.00	3.1	2.2	8.7	476.00	18.3	8.7
B53	1.33	C	58.5%	0.45	0.51	0.72	75.00	2.5%	6.8	223.00	1.6%	20.00	2.5	1.5	8.3	298.00	17.8	8.3
B54	0.56	B	59.8%	0.46	0.50	0.72	75.00	2.5%	6.9	208.00	1.6%	20.00	2.5	1.4	8.2	283.00	17.4	8.2
B55	3.16	B	54.4%	0.41	0.44	0.68	205.00	7.0%	8.9	446.00	2.4%	20.00	3.1	2.4	11.3	651.00	19.6	11.3
B56	1.09	B	59.2%	0.46	0.49	0.70	70.00	2.5%	6.9	451.00	2.4%	20.00	3.1	2.4	9.3	521.00	18.7	9.3
B57	0.79	B	60.1%	0.46	0.49	0.71	198.00	2.5%	11.4	150.00	1.0%	20.00	2.0	1.3	12.6	348.00	17.2	12.6
B58	2.16	B	65.0%	0.51	0.54	0.73	65.00	2.5%	6.0	495.00	1.0%	20.00	2.0	4.1	10.1	560.00	19.5	10.1
B58A	0.98	B	32.7%	0.23	0.27	0.59	84.00	2.5%	10.1	355.00	6.0%	15.00	3.7	1.6	11.7	439.00	22.2	11.7
B59	3.96	B	50.9%	0.38	0.41	0.67	211.00	5.7%	10.1	663.00	1.0%	20.00	2.0	5.5	15.7	874.00	24.2	15.7
B61	2.43	B	85.0%	0.69	0.72	0.83	194.00	5.4%	5.5	176.00	3.0%	20.00	3.5	0.8	6.3	370.00	12.4	6.3
B62	12.96	B	36.7%	0.26	0.29	0.60	200.00	25.0%	7.2	531.00	0.6%	20.00	1.5	5.7	12.9	731.00	27.9	12.9
C1	1.51	B	40.7%	0.29	0.33	0.62	92.00	2.5%	9.9	563.00	1.5%	20.00	2.4	3.8	13.7	655.00	24.3	13.7
C2	1.39	B	58.5%	0.45	0.51	0.72	92.00	2.5%	7.6	556.00	1.5%	20.00	2.4	3.8	11.4	648.00	20.5	11.4
C3	1.74	C	51.6%	0.40	0.46	0.70	233.00	2.6%	12.9	125.00	2.3%	20.00	3.0	0.7	13.6	358.00	18.1	13.6
C4	3.68	C	50.3%	0.38	0.45	0.69	88.00	2.5%	8.2	854.00	2.0%	20.00	2.8	5.0	13.2	942.00	23.7	13.2
C5	2.03	C	56.9%	0.44	0.50	0.71	65.00	2.5%	6.5	695.00	1.7%	20.00	2.6	4.4	10.9	760.00	21.6	10.9
C6	1.05	B	36.2%	0.26	0.31	0.61	92.00	12.0%	6.0	547.00	2.3%	15.00	2.3	4.0	10.0	639.00	24.1	10.0
C7*	9.17	B	71.1%	0.56	0.60	0.76	104.00	4.0%	5.8	1253.00	1.4%	20.00	2.4	8.8	14.7	1357.00	23.2	14.7
C8*	3.03	B	64.9%	0.51	0.54	0.73	85.00	2.5%	6.9	590.00	1.8%	20.00	2.7	3.7	10.6	675.00	19.0	10.6
C9	4.93	B	40.2%	0.29	0.32	0.62	214.00	13.5%	8.7	485.00	3.3%	15.00	2.7	3.0	11.7	699.00	22.2	11.7
D1	3.06	C	54.9%	0.42	0.48	0.70	135.00	2.5%	9.6	574.00	3.3%	20.00	3.6	2.6	12.3	709.00	19.8	12.3
D2	3.07	C	56.8%	0.44	0.49	0.71	146.00	2.5%	9.9	524.00	3.3%	20.00	3.6	2.4	12.3	670.00	19.2	12.3
D3	1.77	C	54.2%	0.42	0.48	0.71	71.00	2.5%	7.0	436.00	2.8%	20.00	3.3	2.2	9.2	507.00	19.4	9.2
D4*	1.65	C	64.1%	0.50	0.53	0.73	40.00	2.0%	5.2	883.00	2.6%	20.00	3.2	4.6	9.7	923.00	20.2	9.7
D5	11.36	B	5.7%	0.03	0.05	0.47	300.00	5.0%	19.3	930.00	4.0%	15.00	3.0	5.2	24.5	1230.00	32.9	24.5
OS1	21.79	B	5.0%	0.03	0.05	0.47	200.00	5.5%	15.3	649.00	4.9%	7.00	1.9	5.7	21.0	849.00	30.2	21.0
OS2	13.65	B	5.0%	0.03	0.04	0.45	200.00	4.2%	16.9	496.00	4.6%	7.00	2.5	3.3	20.2	696.00	29.1	20.2
OS3	0.14	B	65.0%	0.51	0.54	0.73	32.00	5.0%	3.4	62.00	4.0%	20.00	4.0	0.3	3.6	94.00	15.2	5.0
OS4	0.72	B	2.0%	0.01	0.01	0.44	100.00	16.0%	7.9	166.00	18.0%	7.00	3.0	0.9	8.8	266.00	26.4	8.8
OS5*	1.69	B	31.2%	0.22	0.24	0.57	108.00	9.0%	7.8	219.00	14.0%	7.00	2.6	1.4	9.2	327.00	21.4	9.2

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora Project No.: 16118.00  
 Calculated By: AAM  
 Checked By: \_\_\_\_\_  
 Date: 4/26/24

SUB-BASIN							INITIAL/OVERLAND			TRAVEL TIME					tc CHECK			FINAL
DATA							(T <sub>i</sub> )			(T <sub>t</sub> )					(URBANIZED BASINS)			
BASIN	D.A.	Hydrologic	Impervious	C <sub>2</sub>	C <sub>5</sub>	C <sub>100</sub>	L	S <sub>o</sub>	t <sub>i</sub>	L <sub>t</sub>	S <sub>t</sub>	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	t <sub>c</sub> (min)

## NOTES:

$$t_c = t_i + t_t$$

Equation 6-2

Where:

t<sub>c</sub> = computed time of concentration (minutes)

t<sub>i</sub> = overland (initial) flow time (minutes)

t<sub>t</sub> = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Equation 6-4

Where:

t<sub>t</sub> = channelized flow time (travel time, min)

L<sub>t</sub> = waterway length (ft)

S<sub>o</sub> = waterway slope (ft/ft)

V<sub>t</sub> = travel time velocity (ft/sec) = K√S<sub>o</sub>

K = NRCS conveyance factor (see Table 6-2).

t<sub>c</sub> is lesser of Equation 6-2 and Equation 6-5

For Urbanized basins a minimum t<sub>c</sub> of 5.0 minutes is required.

For non-urbanized basins a minimum t<sub>c</sub> of 10.0 minutes is required.

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_o}}{S_o^{0.33}}$$

Where:

t<sub>i</sub> = overland (initial) flow time (minutes)

C<sub>s</sub> = runoff coefficient for 5-year frequency (from Table 6-4)

L<sub>o</sub> = length of overland flow (ft)

S<sub>o</sub> = average slope along the overland flow path (ft/ft).

Equation 6-3

Where:

I = rainfall intensity (inches per hour)

P<sub>t</sub> = 1-hour point rainfall depth from Table 5-1 or NOAA Atlas 14 online tool (inches)

T<sub>a</sub> = storm duration (minutes)

D = rainfall depth (inches)

$$I = \frac{28.5 \cdot P_t}{(10 + T_a)^{0.786}}$$

Equation 5-1

Equation 5-2

$$t_t = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Equation 6-5

Where:

t<sub>t</sub> = minimum time of concentration for first design point when less than t<sub>i</sub> from Equation 6-1.

L<sub>t</sub> = length of channelized flow path (ft)

i = imperviousness (expressed as a decimal)

S<sub>t</sub> = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
Location: Aurora \_\_\_\_\_ Project No.: 16118.00  
Design Storm: 2-Year \_\_\_\_\_ Calculated By: AAM  
P<sub>1</sub>: 0.83 Inches \_\_\_\_\_ Checked By: \_\_\_\_\_  
Date: 4/26/24

Flow	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	71	A1	1.91	0.06	15.37	0.12	1.86	0.22								0.22	0.12	1.0	18	50	2.2	0.4	Type C Inlet Piped to DP 7.0
	72	A2	1.32	0.47	8.43	0.62	2.39	1.48								1.48	0.62	1.0	18	3	4.1	0.0	Sump Inlet Piped to DP 7.0
	7.0								15.75	0.74	1.83	1.35				1.35	0.74	1.0	18	60	4.0	0.3	Sum of DP 71 & DP 72 Piped to DP 7.1
	73	A3	0.45	0.60	6.12	0.27	2.65	0.72								0.72	0.27	1.0	18	21	3.3	0.1	Sump Inlet Piped to DP 7.1
	7.1								16.00	1.01	1.82	1.84				1.84	1.01	1.0	18	147	4.4	0.6	Sum of DP 7.0 & DP 73 Piped to DP 20.2
	74	A4	5.13	0.31	19.81	1.61	1.64	2.64								2.64	1.61	5.0	18	102	8.8	0.2	On-grade inlet Piped to DP 7.2
	7.2								20.00	2.62	1.63	4.27				4.27	2.62	2.5	24	320	7.6	0.7	Sum of DP 7.1 & DP 74 Piped to DP 20.3
	75	A5	0.62	0.57	9.34	0.35	2.30	0.81								0.81	0.35	1.6	18	73	3.9	0.3	On-grade inlet Piped to DP 7.3
	7.3								20.70	2.97	1.60	4.75				4.75	2.97	1.0	24	107	5.6	0.3	Sum of DP 7.2 & DP 75 Piped/Pond conveyance to DP 20.4
	76	A6	2.06	0.19	7.94	0.38	2.44	0.93					0.93	0.38	0.5								Pond 329 Pond conveyance to DP 7.4
	7.4								21.02	3.35	1.58	5.29											Pond 329 Outlet Structure Release into existing storm sewer along Monaghans
	OS3	OS3	0.14	0.51	5.00	0.07	2.81	0.20								0.20	0.07	1.0	18	0	2.1	0.0	Temporary Type C Inlet Piped to DP 7.5
	7.5															0.30	0.13	1.0	18	42	2.5	0.3	Sum of Pond 329 release and DP OS3 Piped to existing storm sewer
	OS1	OS1	21.79	0.03	20.96	0.58	1.59	0.92								0.92	0.58	0.3	30	57	2.2	0.4	Existing 30" Culvert Piped to DP 1.0
	1	B1	1.54	0.55	7.94	0.85	2.44	2.07								2.07	0.85	0.3	30	3	2.8	0.0	Sump Inlet Piped to DP 1.0
	1.0								21.39	1.43	1.57	2.25				2.25	1.43	1.0	42	107	4.1	0.4	Sum of DP OS1 and DP 1 Piped to DP 1.0A
	3A	B3A	0.85	0.06	10.88	0.05	2.16	0.11								0.11	0.05	0.3	30	3	1.1	0.0	Sump Inlet Piped to DP 1.0A
	1.0A								21.82	1.48	1.55	2.29	2.29	1.48	2.5					665	3.2	3.5	Sum of DP 1.0 and DP 3A Swale Conveyance to DP 1.2
	OS2	OS2	13.65	0.03	20.21	0.35	1.62	0.57								0.57	0.35	5.0	30	41	4.7	0.1	Existing 24" Culvert Piped to DP 1.1
	2	B2	1.54	0.62	7.82	0.95	2.45	2.33								2.33	0.95	0.3	30	3	2.9	0.0	Future Sump Inlet Piped to DP 1.1
	1.1								20.36	1.30	1.61	2.09	2.09	1.30	5.5					337	4.7	1.2	Sum of DP OS2 and DP 2 Swale Conveyance to DP 1.2
	3	B3	6.43	0.08	16.40	0.50	1.80	0.90								0.90	0.50	8.0	48	0	6.5	0.0	54" Culvert Piped to DP 1.2
	1.2								25.32	3.28	1.43	4.69				4.69	3.28	8.0	48	83	10.4	0.1	Sum of DP 1.0A, DP 1.1 & DP 3 Piped to DP 1.5



STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
Location: Aurora \_\_\_\_\_ Project No.: 16118.00  
Design Storm: 2-Year \_\_\_\_\_ Calculated By: AAM  
P<sub>1</sub>: 0.83 Inches \_\_\_\_\_ Checked By: \_\_\_\_\_  
Date: 4/26/24

Flow	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	4	B4	2.51	0.43	14.84	1.09	1.89	2.06								2.06	1.09	1.0	18	21	4.6	0.1	Sump Inlet Piped to DP 1.3
	5	B5	1.50	0.45	11.07	0.67	2.15	1.44								1.44	0.67	1.0	18	21	4.1	0.1	Sump Inlet Piped to DP 1.3
	1.3								14.91	1.76	1.88	3.31				3.31	1.76	1.0	18	42	5.3	0.1	Sum of DP 4 & DP 5 Piped to DP 1.5
	6	B6	1.46	0.44	10.08	0.64	2.23	1.43								1.43	0.64	1.0	18	19	4.1	0.1	Sump Inlet Piped to DP 1.3
	7	B7	2.66	0.42	13.23	1.11	1.99	2.21								2.21	1.11	1.0	18	19	4.7	0.1	Sump Inlet Piped to DP 1.3
	1.4								13.30	1.75	1.98	3.47				3.47	1.75	3.0	18	357	7.8	0.8	Sum of DP 6 & DP 7 Piped to DP 1.5
	1.5								25.45	6.79	1.43	9.71	9.71	6.79	3.2					371	5.0	1.2	Sum of DP 1.2, DP 1.3, & DP 1.4 Channel conveyance to DP 1.8
	8	B8*	1.76	0.50	9.70	0.87	2.26	1.97								1.97	0.87	1.0	18	338	4.6	1.2	Storm Sewer Stub Piped to DP 1.6
	9	B9	1.53	0.42	10.38	0.64	2.20	1.41								1.41	0.64	1.0	18	19	4.0	0.1	On-grade inlet Piped to DP 1.6
	1.6								10.94	1.51	2.16	3.26				3.26	1.51	2.0	18	240	6.7	0.6	Sum of DP 8 & DP 9 Piped to DP 1.7
	10	B10	2.40	0.43	9.79	1.03	2.26	2.33								2.33	1.03	1.0	18	19	4.8	0.1	Sump Inlet Piped to DP 1.7
	11	B11	0.44	0.46	7.44	0.20	2.49	0.50								0.50	0.20	1.0	18	19	2.9	0.1	Sump Inlet Piped to DP 1.7
	1.7								11.54	2.74	2.11	5.78				5.78	2.74	5.0	24	475	10.6	0.7	Sum of DP 1.6, DP 10, & DP 11 Piped to DP 1.8
	1.8								26.69	9.53	1.39	13.25	13.25	9.53	3.0					386	5.0	1.3	Sum of DP 1.5 & DP 1.7 Channel conveyance to DP 2.7
	12	B12	0.66	0.47	10.27	0.31	2.21	0.69								0.69	0.31	1.0	18	19	3.3	0.1	Sump Inlet Piped to DP 1.9
	13	B13	2.91	0.24	14.13	0.69	1.93	1.33								1.33	0.69	1.0	18	19	3.9	0.1	Sump Inlet Piped to DP 1.9
	1.9								14.21	1.00	1.93	1.93				1.93	1.00	4.0	18	843	7.3	1.9	Sum of DP 12 & DP 13 Piped to DP 2.5
	14	B14	1.54	0.65	7.18	1.01	2.52	2.55								2.89	1.01	2.7	18	167	7.1	0.4	On-grade inlet Piped to DP 2.0
	15	B15	2.20	0.03	14.61	0.06	1.90	0.11								0.11	0.06	1.0	18	65	2.0	0.6	Type C Inlet Piped to DP 2.0
	2.0								15.16	1.07	1.87	2.00				2.00	1.07	1.5	18	64	5.3	0.2	Sum of DP 14 & DP 15 Piped to DP 2.1
	16	B16	0.66	0.54	9.05	0.35	2.32	0.81								0.81	0.35	1.0	18	22	3.4	0.1	Sump Inlet Piped to DP 2.1
	17	B17	0.37	0.67	5.00	0.25	2.81	0.70								0.70	0.25	1.0	18	32	3.3	0.2	Sump Inlet Piped to DP 2.1
	2.1								15.36	1.67	1.86	3.11				3.11	1.67	1.0	24	126	5.1	0.4	Sum of DP 2.0, DP 16 & DP 17 Piped to DP 2.3

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora \_\_\_\_\_ Project No.: 16118.00  
 Design Storm: 2-Year \_\_\_\_\_ Calculated By: AAM  
 P<sub>1</sub>: 0.83 Inches \_\_\_\_\_ Checked By: \_\_\_\_\_  
 Date: 4/26/24

Flow	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	18	B18	1.97	0.40	12.10	0.79	2.07	1.64								1.64	0.79	1.0	18	28	4.3	0.1	On-grade inlet Piped to DP 2.2
	19	B19	1.28	0.45	9.69	0.58	2.26	1.31								1.31	0.58	1.0	18	28	4.0	0.1	On-grade inlet Piped to DP 2.2
	2.2								12.21	1.37	2.06	2.82				2.82	1.37	3.0	18	103	7.5	0.2	Sum of DP 18 & DP 19 Piped to DP 2.3
	2.3								15.78	3.04	1.83	5.56				5.56	3.04	2.0	24	262	7.5	0.6	Sum of DP 2.1 & DP 2.2 Piped to DP 2.4
	20	B20	0.66	0.49	8.62	0.32	2.37	0.76								0.76	0.32	1.0	18	32	3.3	0.2	On-grade Inlet Sum of carryover from DP19 and Sub-Basin B20,Piped to DP 2.4
	2.4								16.36	3.36	1.80	6.05				6.05	3.36	0.5	30	56	4.6	0.2	Sum of DP 2.3 & DP 20 Piped to DP 2.6
	21	B21	2.61	0.40	10.79	1.03	2.17	2.24								2.24	1.03	1.0	18	19	4.7	0.1	On-grade inlet Piped to DP 2.5
	22	B22	1.45	0.45	11.10	0.65	2.15	1.40								1.40	0.65	1.0	18	19	4.1	0.1	On-grade inlet, carryover flow to DP 27 Piped to DP 2.5
	2.5								16.13	2.68	1.81	4.85				4.85	2.68	4.0	24	87	9.2	0.2	Sum of DP 1.9, DP 21 & DP 22 Piped to DP 2.6
	2.6								16.56	6.04	1.79	10.81				10.81	6.04	3.0	30	365	10.4	0.6	Sum of DP 2.4 & DP 2.5 Piped to DP 2.7
	2.7								27.98	15.57	1.35	21.02	21.02	15.57	3.3					723	6.0	2.0	Sum of DP 1.8 & DP 2.6 Channel conveyance to DP 2.8
	23	B23	22.94	0.09	22.76	2.00	1.52	3.04								3.04	2.00	8.0	48	0	9.3	0.0	66" Culvert Piped to DP 2.8
	23A	B23A	0.22	0.17	10.80	0.04	2.17	0.09								0.09	0.04	8.0	48	0	2.9	0.0	Area Drain Piped to DP 2.8
	2.8								29.99	17.61	1.30	22.89				22.89	17.61	4.0	84	179	12.5	0.2	Sum of DP 2.7, DP 23, & DP 23A Culvert Conveyance to DP 5.6
	24	B24	3.41	0.38	13.81	1.31	1.95	2.55								2.55	1.31	1.0	18	21	4.8	0.1	On-grade inlet Piped to DP 2.9
	25	B25	2.35	0.41	10.94	0.96	2.16	2.07								2.07	0.96	1.0	18	21	4.5	0.1	On-grade inlet Piped to DP 2.9
	2.9								13.88	2.27	1.95	4.43				4.43	2.27	3.0	18	289	8.4	0.6	Sum of DP 24 & DP 25 Piped to DP 3.3
	26	B26	3.57	0.39	15.61	1.39	1.84	2.56								2.56	1.39	1.0	18	21	4.8	0.1	On-grade inlet Piped to DP 3.0
	27	B27	1.47	0.47	9.59	0.70	2.27	1.59								1.59	0.70	1.0	18	21	4.2	0.1	On-grade inlet Piped to DP 3.0
	3.0								0.08	2.09	3.83	8.00				8.00	2.09	3.5	18	284	10.5	0.5	Sum of DP 26 & DP 27 Piped to DP 3.1
	28	B28	1.62	0.43	12.16	0.70	2.06	1.44								1.44	0.70	1.0	18	19	4.1	0.1	Sump Inlet Piped to DP 3.1
	29	B29	1.19	0.42	8.52	0.50	2.38	1.19								1.19	0.50	1.0	18	19	3.8	0.1	Sump Inlet Piped to DP 3.1
	3.1								0.53	3.29	3.70	12.17				12.17	3.29	1.0	30	99	7.2	0.2	Sum of DP 3.0, DP 28, & DP 29 Piped to DP 3.3

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora \_\_\_\_\_ Project No.: 16118.00  
 Design Storm: 2-Year \_\_\_\_\_ Calculated By: AAM  
 P<sub>1</sub>: 0.83 Inches \_\_\_\_\_ Checked By: \_\_\_\_\_  
 Date: 4/26/24

Flow	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	30	B30	3.16	0.31	13.90	0.97	1.95	1.89								1.89	0.97	1.0	18	19	4.4	0.1	Sump Inlet Piped to DP 3.2
	31	B31	1.87	0.41	10.55	0.76	2.19	1.66								1.66	0.76	1.0	18	19	4.3	0.1	Sump Inlet Piped to DP 3.2
	3.2								10.63	1.73	2.18	3.77				3.77	1.73	1.0	24	19	5.2	0.1	Sum of DP 30 & DP 31 Piped to DP 3.3
	3.3								14.46	7.29	1.91	13.92				13.92	7.29	1.0	36	105	7.5	0.2	Sum of DP 2.9, DP 3.1, & DP 3.2 Piped to DP 3.4
	32	B32	0.20	0.62	5.00	0.12	2.81	0.34								0.34	0.12	1.0	18	21	2.6	0.1	Sump Inlet Piped to DP 3.4
	33	B33	0.21	0.59	5.00	0.12	2.81	0.34								0.34	0.12	1.0	18	21	2.6	0.1	Sump Inlet Piped to DP 3.4
	3.4								14.69	7.53	1.90	14.31				14.31	7.53	1.0	36	127	7.4	0.3	Sum of DP 3.3, DP 32, & DP 33 Piped to DP 3.8
	34	B34	0.98	0.44	10.49	0.44	2.20	0.97								0.97	0.44	1.0	18	25	3.7	0.1	Sump Inlet Piped to DP 3.5
	35	B35	0.98	0.48	7.57	0.47	2.48	1.17								1.17	0.47	1.0	18	19	3.9	0.1	Sump Inlet Piped to DP 3.5
	3.5								10.60	0.91	2.19	1.99				1.99	0.91	1.0	18	595	4.5	2.2	Sum of DP 34 & DP 35 Piped to DP 3.5A
	36	B36	1.24	0.45	10.24	0.55	2.22	1.22								1.22	0.55	1.0	18	19	3.9	0.1	Sump Inlet Piped to DP 3.6
	37	B37	1.74	0.41	12.19	0.71	2.06	1.46								1.46	0.71	1.0	18	19	4.2	0.1	Sump Inlet Piped to DP 3.6
	3.6								12.27	1.26	2.06	2.60				2.60	1.26	1.0	18	107	4.9	0.4	Sum of DP 36 & DP 37 Piped/ Pond Conveyance to DP 5.7
	33A	B33A	0.41	0.37	8.70	0.15	2.36	0.35								0.35	0.15	1.0	18	27	2.7	0.2	Sump Inlet Piped to DP 3.5A
	33B	B33B	0.21	0.54	5.00	0.11	2.81	0.31								0.31	0.11	1.0	18	27	2.6	0.2	Sump Inlet Piped to DP 3.5A
	3.5A								12.82	1.17	2.02	2.36				2.36	1.17	1.0	18	59	4.7	0.2	Sum of DP 3.5, DP36, & DP 37 Piped to DP 3.8
	3.8								14.97	8.70	1.88	16.36				16.36	8.70	0.5	42	341	6.0	0.9	Sum of DP 3.4 & DP 3.5A Piped to DP 3.9A
	38	B38	0.91	0.45	7.56	0.41	2.48	1.02								1.02	0.41	7.0	18	55	7.3	0.1	Sump Inlet Piped to DP 3.9
	39	B39	0.78	0.41	7.04	0.32	2.54	0.81								0.81	0.32	7.0	18	3	6.8	0.0	Sump Inlet Piped to DP 3.9
	3.9								7.69	0.73	2.46	1.80				1.80	0.73	7.0	18	49	8.8	0.1	Sum of DP 38 & DP 39 Piped to DP 3.9A
	3.9A								15.92	9.43	1.82	17.16				17.16	9.43	3.0	42	97	11.4	0.1	Sum of DP 3.8 & DP 3.9 Piped to DP 5.6
	40	B40*	1.94	0.50	11.38	0.97	2.12	2.06								2.06	0.97	2.3	18	237	6.1	0.7	Storm Sewer Stub Piped to DP 4.0

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
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Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora Project No.: 16118.00  
 Design Storm: 2-Year Calculated By: AAM  
 P<sub>1</sub>: 0.83 Inches Checked By: \_\_\_\_\_  
 Date: 4/26/24

Flow	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	41	B41	0.80	0.46	8.38	0.37	2.39	0.88								0.88	0.37	1.0	18	19	3.5	0.1	On-grade Inlet Piped to DP 4.0
	4.0								12.03	1.34	2.07	2.77				2.77	1.34	3.8	18	95	7.9	0.2	Sum of DP 40 & DP 41 Piped to DP 4.0A
	49A	B49A*	4.22	0.17	18.54	0.72	1.69	1.22								1.22	0.72	1.0	24	42	3.8	0.2	Proposed Stub Piped to DP 4.0A
	4.0A								18.73	2.06	1.68	3.46				3.46	2.06	3.0	18	245	7.8	0.5	Sum of DP49A & DP4.0 Piped to DP 4.1
	42	B42	2.98	0.41	14.21	1.24	1.93	2.39								2.39	1.24	1.0	18	22	4.8	0.1	On-grade Inlet Piped to DP 4.1
	4.1								19.25	3.30	1.66	5.48				5.48	3.30	3.5	24	74	9.2	0.1	Sum of DP 42 & DP 4.0A Piped to DP 4.1A
	43A	B43A	0.95	0.46	8.78	0.43	2.35	1.01								1.01	0.43	1.0	18	22	3.7	0.1	On-grade Inlet Piped to DP 4.1A
	4.1A								19.39	3.73	1.65	6.15				6.15	3.73	3.5	24	167	9.5	0.3	Sum of DP 43A & DP 4.1 Piped to DP 4.2
	43	B43	0.45	0.50	7.84	0.23	2.45	0.56								0.56	0.23	1.0	18	19	3.1	0.1	Sump Inlet Piped to DP 4.2
	44	B44	0.22	0.62	5.00	0.14	2.81	0.39								0.39	0.14	1.0	18	19	2.8	0.1	Sump Inlet Piped to DP 4.2
	4.2								19.68	3.67	1.64	6.02				6.02	3.67	1.0	24	79	6.0	0.2	Sum of DP 4.1A, DP43, & DP 44 Piped to DP 4.4
	45	B45	2.01	0.38	12.20	0.77	2.06	1.59								1.59	0.77	2.0	18	22	5.3	0.1	On-grade Inlet Piped to DP 4.3
	46	B46	1.56	0.48	9.56	0.75	2.28	1.71								1.71	0.75	1.0	18	19	4.4	0.1	On-grade Inlet Piped to DP 4.3
	4.3								12.27	1.52	2.06	3.13				3.13	1.52	4.0	18	81	8.3	0.2	Sum of DP DP45 & DP 46 Piped to DP 4.4
	4.4								19.90	5.19	1.63	8.46				8.46	5.19	3.4	36	519	9.8	0.9	Sum of DP 4.2 & DP 4.3 Piped to DP 4.5
	47	B47	2.80	0.38	14.19	1.08	1.93	2.08								2.08	1.08	2.0	18	19	5.9	0.1	Sump Inlet Piped to DP 4.5
	48	B48	1.29	0.48	9.00	0.62	2.33	1.44								1.44	0.62	2.0	18	19	5.2	0.1	Sump Inlet Piped to DP 4.5
	4.5								20.78	6.89	1.59	10.96				10.96	6.89	1.0	30	127	7.0	0.3	Sum of DP 4.4, DP 47, & DP 48 Piped to DP 5.4
	49	B49B*	1.94	0.17	19.64	0.34	1.64	0.56								0.56	0.34	2.8	18	239	4.3	0.9	Proposed Stub Piped to DP 4.6
	50	B50*	0.46	0.65	5.00	0.30	2.81	0.84								0.84	0.30	1.0	18	27	3.5	0.1	Future Sump Inlet Piped to DP 4.6
	4.6								20.57	0.64	1.60	1.02				1.02	0.64	4.0	18	53	6.0	0.1	Sum of DP 49 & DP 50 Piped to DP 4.9
	51	B51	0.85	0.66	5.60	0.56	2.72	1.52								1.52	0.56	1.0	18	19	4.2	0.1	Sump Inlet Piped to DP 4.7

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
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Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora \_\_\_\_\_ Project No.: 16118.00  
 Design Storm: 2-Year \_\_\_\_\_ Calculated By: AAM  
 P<sub>1</sub>: 0.83 Inches \_\_\_\_\_ Checked By: \_\_\_\_\_  
 Date: 4/26/24

Flow	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	52	B52	0.96	0.46	8.74	0.44	2.35	1.03								1.03	0.44	1.0	18	19	3.8	0.1	Sump Inlet Piped to DP 4.7
	4.7								8.83	1.00	2.35	2.35				2.35	1.00	1.0	18	112	4.7	0.4	Sum of DP 51 & DP 52 Piped to DP 4.9
	53	B53	1.33	0.45	8.27	0.60	2.40	1.44								1.44	0.60	1.0	18	19	4.1	0.1	Sump Inlet Piped to DP 4.8
	54	B54	0.56	0.46	8.25	0.26	2.40	0.62								0.62	0.26	1.0	18	19	3.2	0.1	Sump Inlet Piped to DP 4.8
	4.8								8.35	0.86	2.39	2.06				2.06	0.86	1.0	18	107	4.6	0.4	Sum of DP 53 & DP 54 Piped to DP 4.9
	4.9								20.71	2.50	1.60	4.00				4.00	2.50	4.0	30	313	8.5	0.6	Sum of DP 4.6, DP 4.7, & DP 4.8 Piped to DP 5.3
	55	B55	3.16	0.41	11.32	1.31	2.13	2.79								2.79	1.31	1.0	18	19	5.0	0.1	Sump Inlet Piped to DP 5.0
	56	B56	1.09	0.46	9.28	0.50	2.30	1.15								1.15	0.50	1.0	18	19	3.8	0.1	Sump Inlet Piped to DP 5.0
	5.0								11.39	1.81	2.12	3.84				3.84	1.81	2.0	24	112	6.8	0.3	Sum of DP 55 & DP 56 Piped to DP 5.3
	57	B57	0.79	0.46	12.61	0.37	2.03	0.75								0.75	0.37	2.0	18	19	4.4	0.1	Sump Inlet Piped to DP 5.1
	59	B59	3.96	0.38	15.67	1.51	1.84	2.78								2.78	1.51	1.0	18	205	5.0	0.7	On-grade inlet Piped to DP 5.1
	5.1								16.36	1.88	1.80	3.38				3.38	1.88	1.0	24	26	5.1	0.1	Sum of DP 57 & DP 59 Piped to DP 5.2
	58	B58	2.16	0.51	10.11	1.10	2.23	2.45								2.45	1.10	1.0	24	3	4.6	0.0	Sump Inlet Piped to DP 5.2
	5.2								16.44	2.98	1.80	5.36				5.36	2.98	2.0	24	488	7.5	1.1	Sum of DP 5.1 & DP 58 Piped/Pond Conveyance to DP 5.7
	58A	B58A	0.98	0.23	11.74	0.23	2.10	0.48								0.48	0.23	6.0	18	42	5.3	0.1	Type C Inlet Piped to DP 5.2A
	5.2A								17.53	3.21	1.74	5.59				5.59	3.21	6.0	24	373	11.3	0.6	Sum of DP 5.2 & DP 58A Piped to DP 5.7
	5.3								21.33	4.31	1.57	6.77				6.77	4.31	3.7	42	245	9.4	0.4	Sum of DP 4.9 & DP 5.0 Piped to DP 5.3A
	39A	B39A	0.23	0.49	5.00	0.11	2.81	0.31								0.31	0.11	1.0	18	27	2.6	0.2	On-Grade Inlet Piped to DP 5.3A
	39B	B39B	0.26	0.66	5.00	0.17	2.81	0.48								0.48	0.17	1.0	18	27	3.0	0.2	On-Grade Inlet Piped to DP 5.3A
	5.3A								21.76	4.59	1.56	7.16				7.16	4.59	3.0	42	59	8.8	0.1	Sum of DP 5.3, DP 39A & DP 39B Piped to DP 5.4
	5.4								21.88	11.48	1.55	17.79				17.79	11.48	3.0	42	367	11.6	0.5	Sum of DP 4.5 & DP 5.3A Piped to DP 5.5
	61	B61	2.43	0.69	6.31	1.69	2.63	4.44								4.44	1.69	1.0	18	143	5.6	0.4	Sump Inlet Piped to DP 5.5

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora \_\_\_\_\_ Project No.: 16118.00  
 Design Storm: 2-Year \_\_\_\_\_ Calculated By: AAM  
 P<sub>1</sub>: 0.83 Inches \_\_\_\_\_ Checked By: \_\_\_\_\_  
 Date: 4/26/24

Flow	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	5.5							22.41	13.17	1.53	20.15				20.15	13.17	3.0	42	52	12.0	0.1	Sum of DP 5.4 & DP 61 Piped to DP 5.6	
	5.6							30.23	40.21	1.29	51.87	51.9	40.21	0.5					531	1.4	6.3	Sum of DP 2.8, DP 3.9A, & DP 5.5 Pond Conveyance to DP 5.7	
	62	B62	12.96	0.26	12.87	3.37	2.01	6.77				6.77	3.37	0.5									Pond 302 Pond conveyance to DP 5.7
	5.7							36.48	48.05	1.15	55.26												Sum of DP 3.6, DP 5.6, DP 5.2A, and DP 62 Pond 302 Outlet Structure
	81	C1	1.51	0.29	13.71	0.44	1.96	0.86							0.86	0.44	1.0	18	19	3.4	0.1		Sump Inlet Piped to DP 8.0
	82	C2	1.39	0.45	11.36	0.63	2.12	1.34							1.34	0.63	1.0	18	19	3.9	0.1		Sump Inlet Piped to DP 8.0
	8.0							13.80	1.07	1.95	2.09				2.09	1.07	2.5	18	524	6.4	1.4		Sum of DP 8.1 & DP 8.2 Piped to DP 8.2
	83	C3	1.74	0.40	13.60	0.69	1.96	1.35							1.35	0.69	2.0	18	26	5.1	0.1		Sump Inlet Piped to DP 8.1
	84	C4	3.68	0.38	13.21	1.41	1.99	2.81							2.81	1.41	2.5	18	211	6.9	0.5		On-grade inlet Piped to DP 8.1
	8.1							13.71	2.10	1.96	4.12				4.12	2.10	1.0	18	27	5.5	0.1		Sum of DP 8.3 & DP 8.4 Piped to DP 8.2
	8.2							15.17	3.17	1.87	5.93				5.93	3.17	1.0	24	21	6.1	0.1		Sum of DP 8.0 & DP 8.1 Piped to DP 8.3
	85	C5	2.03	0.44	10.92	0.89	2.16	1.92							1.92	0.89	1.0	18	3	4.5	0.0		Sump Inlet Piped to DP 8.3
	8.3							15.23	4.06	1.86	7.55				7.55	4.06	5.0	30	140	11.1	0.2		Sum of DP 8.2 & DP 8.5 Piped to DP 8.4
	86	C6	1.05	0.26	10.05	0.27	2.23	0.60							0.60	0.27	6.0	18	14	6.0	0.0		Type C Inlet Piped to DP 8.4
	8.4							15.44	4.33	1.85	8.01				8.01	4.33	6.0	30	89	12.2	0.1		Sum of DP 8.3 & DP 8.6 Piped/Pond Conveyance to DP 8.5
	87	C7*	9.17	0.56	14.65	5.18	1.90	9.84				9.8	5.18	0.5					484	1.4	5.7		Future Storm Infrastructure Piped/Pond Conveyance to DP 8.5
	88	C8*	3.03	0.51	10.59	1.54	2.19	3.37							3.37	1.54	5.0	24	193	9.1	0.4		Future Storm Infrastructure Piped/Pond Conveyance to DP 8.5
	89	C9	4.93	0.29	11.69	1.43	2.10	3.00				3.00	1.43	0.5									Pond 306 Pond Conveyance to DP 8.5
	8.5							20.36	12.48	1.61	20.09				20.09	12.48	5.0	30	140	14.8	0.2		Sum of DP 8.4, DP 8.7, DP 8.8 & DP 8.9 Pond 306 Outlet Structure
	91	D1	3.06	0.42	12.26	1.29	2.06	2.66							2.66	1.29	1.0	18	19	4.9	0.1		Sump Inlet Piped to DP 9.0
	92	D2	3.07	0.44	12.28	1.34	2.06	2.76							2.76	1.34	1.0	18	19	4.9	0.1		Sump Inlet Piped to DP 9.0
	9.0							12.34	2.63	2.05	5.39				5.39	2.63	1.0	24	210	5.8	0.6		Sum of DP 9.1 & DP 9.2 Piped to DP 9.1

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Project Name: Overland Ranch Filing 1  
Project No.: 16118.00  
Calculated By: AAM  
Checked By:  
Date: 4/26/24

Subdivision:  
Location: Aurora  
Design Storm: 2-Year  
P<sub>1</sub>: 0.83 Inches

Flow	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	93	D3	1.77	0.42	9.17	0.74	2.31	1.71								1.71	0.74	1.0	18	21	4.4	0.1	Sump Inlet Piped to DP 9.1
	94	D4*	1.65	0.50	9.74	0.82	2.26	1.85								1.85	0.82	1.0	18	21	4.4	0.1	Sump Inlet Piped to DP 9.1
	9.1								12.94	4.19	2.01	8.42	8.4	4.19	4.0					958	4.0	4.0	Sum of DP 9.0, DP 93 & DP 94 Swale Conveyance to DP 9.2
	95	D5	11.36	0.03	24.49	0.35	1.46	0.51					0.5	0.35	4.0					0	4.0	0.0	Pond D Pond Conveyance to DP 9.2
	9.2								24.49	4.54	1.46	6.63											Sum of DP 9.1 and DP 95 Pond D Outlet Structure
	OS4	OS4	0.72	0.01	8.80	0.01	2.35	0.02					0.02	0.01	18.0								Overland Flow Surface conveyance offsite to DP OS4
	OS5	OS5*	1.69	0.22	9.19	0.36	2.31	0.83					0.83	0.36	14.0								Overland Flow Surface conveyance offsite to DP OS5

Notes:  
Street and Pipe C\*A values are determined by Q/I using the catchment's intensity value.

**STANDARD FORM SF-3**  
**STORM DRAINAGE SYSTEM DESIGN**  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_  
Location: Aurora  
Design Storm: 100-Year  
P<sub>1</sub>: 2.38 Inches

Project Name: Overland Ranch Filing 1  
Project No.: 16118.00  
Calculated By: AAM  
Checked By: \_\_\_\_\_  
Date: 4/26/24

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	71	A1	1.91	0.48	15.37	0.92	5.34	4.91								4.91	0.92	1.0	18	50	5.8	0.1	Type C Inlet Piped to DP 7.0
	72	A2	1.32	0.72	8.43	0.95	6.87	6.53	20.96	2.38	4.57	10.88				10.88	2.38	1.0	18	3	6.8	0.0	Sump Inlet Sum of carryover from DP74 and Sub-Basin A2,Piped to DP 7.0
	7.0								20.96	3.30	4.57	15.09				15.09	3.30	1.0	18	60	8.6	0.1	Sum of DP 71 & DP 72 Piped to DP 7.1
	73	A3	0.45	0.78	6.12	0.35	7.63	2.67								2.67	0.35	1.0	18	21	4.9	0.1	Sump Inlet Piped to DP 7.1
	7.1								21.08	3.65	4.55	16.61				16.61	3.65	1.0	18	147	9.4	0.3	Sum of DP 7.0 & DP 73 Piped to DP 20.2
	74	A4	5.13	0.64	19.81	3.30	4.71	15.54					6.7	1.43	1.4	8.80	1.87	5.0	18	164	2.4	1.2	On-grade inlet, carryover flow to DP 72 Piped to DP 7.2
	7.2								21.34	5.52	4.52	24.95				24.95	5.52	2.5	24	320	12.3	0.4	Sum of DP 7.1 & DP 74 Piped to DP 20.3
	75	A5	0.62	0.76	9.34	0.47	6.61	3.11								3.11	0.47	1.6	18	73	6.0	0.2	On-grade inlet Piped to DP 7.3
	7.3								21.77	5.99	4.48	26.84				26.84	5.99	1.0	24	107	8.6	0.2	Sum of DP 7.2 & DP 75 Piped/Pond conveyance to DP 20.4
	76	A6	2.06	0.56	7.94	1.14	7.01	7.99					7.99	1.14	0.5								Pond 329 Pond conveyance to DP 7.4
	7.4								21.98	7.13	4.45	31.73											Pond 329 Outlet Structure Release into existing storm sewer along Monaghans
	OS3	OS3	0.14	0.73	5.00	0.10	8.07	0.81								0.81	0.10	1.0	18	0	3.4	0.0	Temporary Type C Inlet Piped to DP 7.5
	7.5															9.76	2.03	1.0	18	42	6.7	0.1	Sum of Pond 329 release and DP OS3 Piped to existing storm sewer
	OS1	OS1	21.79	0.47	20.96	10.28	4.57	46.98								46.98	10.28	0.3	30	57	9.6	0.1	Existing 30" Culvert Piped to DP 1.0
	1	B1	1.54	0.76	7.94	1.17	7.01	8.20								8.20	1.17	0.3	30	3	4.2	0.0	Sump Inlet Piped to DP 1.0
	1.0								21.05	11.45	4.56	52.21				52.21	11.45	1.0	42	107	10.6	0.2	Sum of DP OS1 and DP 1 Piped to DP 1.0A
	3A	B3A	0.85	0.48	10.88	0.41	6.22	2.55								2.55	0.41	0.3	30	3	3.0	0.0	Sump Inlet Piped to DP 1.0A
	1.0A								21.22	11.86	4.54	53.84	53.84	11.86	2.5					665	3.2	3.5	Sum of DP 1.0 and DP 3A Swale Conveyance to DP 1.2
	OS2	OS2	13.65	0.45	20.21	6.20	4.66	28.89								28.89	6.20	5.0	30	41	16.4	0.0	Existing 24" Culvert Piped to DP 1.1
	2	B2	1.54	0.79	7.82	1.21	7.05	8.53								8.53	1.21	0.3	30	3	4.3	0.0	Future Sump Inlet Piped to DP 1.1
	1.1								20.25	7.41	4.65	34.46	34.46	7.41	5.5					337	4.7	1.2	Sum of DP OS2 and DP 2 Swale Conveyance to DP 1.2
	3	B3	6.43	0.49	16.40	3.14	5.18	16.27								16.27	3.14	8.0	48	0	15.6	0.0	54" Culvert Piped to DP 1.2
	1.2								24.73	22.41	4.17	93.45				93.45	22.41	8.0	48	83	26.1	0.1	Sum of DP 1.0A, DP 1.1 & DP 3 Piped to DP 1.5



**STANDARD FORM SF-3**  
**STORM DRAINAGE SYSTEM DESIGN**  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_  
Location: Aurora  
Design Storm: 100-Year  
P<sub>1</sub>: 2.38 Inches

Project Name: Overland Ranch Filing 1  
Project No.: 16118.00  
Calculated By: AAM  
Checked By: \_\_\_\_\_  
Date: 4/26/24

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	4	B4	2.51	0.69	14.84	1.74	5.43	9.45								9.45	1.74	1.0	18	21	6.7	0.1	Sump Inlet Piped to DP 1.3
	5	B5	1.50	0.70	11.07	1.05	6.18	6.49								6.49	1.05	1.0	18	21	6.2	0.1	Sump Inlet Piped to DP 1.3
	1.3								14.89	2.79	5.42	15.12				15.12	2.79	1.0	18	42	8.6	0.1	Sum of DP 4 & DP 5 Piped to DP 1.5
	6	B6	1.46	0.69	10.08	1.01	6.42	6.48								6.48	1.01	1.0	18	19	6.2	0.1	Sump Inlet Piped to DP 1.3
	7	B7	2.66	0.69	13.23	1.82	5.72	10.41								10.41	1.82	1.0	18	19	6.8	0.0	Sump Inlet Piped to DP 1.3
	1.4								13.28	2.83	5.71	16.16				16.16	2.83	3.0	18	357	11.6	0.5	Sum of DP 6 & DP 7 Piped to DP 1.5
	1.5								24.78	28.03	4.17	116.89	116.89	28.03	3.2					371	5.0	1.2	Sum of DP 1.2, DP 1.3, & DP 1.4 Channel conveyance to DP 1.8
	8	B8*	1.76	0.74	9.70	1.30	6.52	8.48								8.48	1.30	1.0	18	338	6.6	0.9	Storm Sewer Stub Piped to DP 1.6
	9	B9	1.53	0.69	10.38	1.05	6.34	6.66					3.0	0.47	2.5	3.67	0.58	1.0	18	236 19	3.2 5.3	1.2 0.1	On-grade inlet, carryover flow to DP 10 Piped to DP 1.6
	1.6								10.55	1.88	6.30	11.84				11.84	1.88	2.0	18	240	9.4	0.4	Sum of DP 8 & DP 9 Piped to DP 1.7
	10	B10	2.40	0.69	9.79	1.66	6.49	10.77	11.63	2.13	6.06	12.91				12.91	2.13	1.0	18	19	7.3	0.0	Sump Inlet Sum of carryover from DP9 and Sub-Basin B10,Piped to DP 1.7
	11	B11	0.44	0.71	7.44	0.31	7.17	2.22								2.22	0.31	1.0	18	19	4.7	0.1	Sump Inlet Piped to DP 1.7
	1.7								11.67	4.32	6.05	26.14				26.14	4.32	5.0	24	475	16.2	0.5	Sum of DP 1.6, DP 10, & DP 11 Piped to DP 1.8
	1.8								26.02	32.35	4.06	131.34	131.34	32.35	3.0					386	5.0	1.3	Sum of DP 1.5 & DP 1.7 Channel conveyance to DP 2.7
	12	B12	0.66	0.73	10.27	0.48	6.37	3.06								3.06	0.48	1.0	18	19	5.1	0.1	Sump Inlet Piped to DP 1.9
	13	B13	2.91	0.61	14.13	1.78	5.56	9.90								9.90	1.78	1.0	18	19	6.8	0.0	Sump Inlet Piped to DP 1.9
	1.9								14.17	2.26	5.55	12.54				12.54	2.26	4.0	18	843	12.3	1.1	Sum of DP 12 & DP 13 Piped to DP 2.5
	14	B14	1.54	0.82	7.18	1.26	7.26	9.15					2.38	0.33	1.5	6.77	0.93	2.7	18	206 167	2.4 9.0	1.4 0.3	On-grade inlet, carryover flow to DP 16 Piped to DP 2.0
	15	B15	2.20	0.49	14.61	1.08	5.47	5.91								5.91	1.08	1.0	18	65	6.1	0.2	Type C Inlet Piped to DP 2.0
	2.0								14.79	2.01	5.44	10.95				10.95	2.01	1.5	18	64	8.1	0.1	Sum of DP 14 & DP 15 Piped to DP 2.1
	16	B16	0.66	0.76	9.05	0.50	6.69	3.35	13.00	1.53	5.77	8.82				8.82	1.53	1.0	18	22	6.7	0.1	Sump Inlet Sum of carryover from DP14, DP 18, and Sub-Basin B16,Piped to DP 2.1
	17	B17	0.37	0.82	5.00	0.30	8.07	2.42								2.42	0.30	1.0	18	32	4.8	0.1	Sump Inlet Piped to DP 2.1
	2.1								14.92	3.84	5.42	20.82				20.82	3.84	1.0	24	126	8.2	0.3	Sum of DP 2.0, DP 16 & DP 17 Piped to DP 2.3

**STANDARD FORM SF-3**  
**STORM DRAINAGE SYSTEM DESIGN**  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_  
Location: Aurora  
Design Storm: 100-Year  
P<sub>1</sub>: 2.38 Inches

Project Name: Overland Ranch Filing 1  
Project No.: 16118.00  
Calculated By: AAM  
Checked By: \_\_\_\_\_  
Date: 4/26/24

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS	
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)		
	18	B18	1.97	0.70	12.10	1.38	5.95	8.21					4.17	0.70	3.0		4.04	0.68	1.0	18	186	3.5	0.9	On-grade inlet, carryover flow to DP 16
													2.49	0.38	1.9						28	5.5	0.1	Piped to DP 2.2
	19	B19	1.28	0.72	9.69	0.92	6.52	6.00									3.51	0.54	1.0	18	308	2.8	1.9	On-grade inlet, carryover flow to DP 20
																					28	5.3	0.1	Piped to DP 2.2
	2.2								12.19	1.22	5.93	7.22					7.22	1.22	3.0	18	103	9.6	0.2	Sum of DP 18 & DP 19
																								Piped to DP 2.3
	2.3								15.18	5.06	5.37	27.16					27.16	5.06	2.0	24	262	11.4	0.4	Sum of DP 2.1 & DP 2.2
																								Piped to DP 2.4
	20	B20	0.66	0.74	8.62	0.49	6.81	3.34	11.55	0.87	6.07	5.29					5.29	0.87	1.0	18	32	5.9	0.1	On-grade Inlet
																								Sum of carryover from DP19 and Sub-Basin B20,Piped to DP 2.4
	2.4								15.56	5.93	5.31	31.49					31.49	5.93	0.5	30	56	6.4	0.1	Sum of DP 2.3 & DP 20
																								Piped to DP 2.6
	21	B21	2.61	0.68	10.79	1.78	6.25	11.13					2.86	0.46	4.0		8.26	1.32	1.0	18	921	4.0	3.8	On-grade inlet, carryover flow to DP 26
																					19	6.5	0.0	Piped to DP 2.5
	22	B22	1.45	0.70	11.10	1.02	6.17	6.29					2.70	0.44	4.0		3.59	0.58	1.0	18	896	4.0	3.7	On-grade inlet, carryover flow to DP 27
																					19	5.3	0.1	Piped to DP 2.5
	2.5								15.31	4.16	5.35	22.28					22.28	4.16	4.0	24	87	14.4	0.1	Sum of DP 1.9, DP 21 & DP 22
																								Piped to DP 2.6
	2.6								15.71	10.09	5.29	53.40					53.40	10.09	3.0	30	365	15.9	0.4	Sum of DP 2.4 & DP 2.5
																								Piped to DP 2.7
	2.7								27.30	42.44	3.94	167.23	167.23	42.44	3.3						723	5.0	2.4	Sum of DP 1.8 & DP 2.6
																								Channel conveyance to DP 2.8
	23	B23	22.94	0.49	22.76	11.33	4.37	49.51									49.51	11.33	8.0	60	0	21.3	0.0	66" Culvert
																								Piped to DP 2.8
	23A	B23A	0.22	0.54	10.80	0.12	6.24	0.75									0.75	0.12	8.0	60	0	5.4	0.0	Area Drain
																								Piped to DP 2.8
	2.8								29.71	53.89	3.76	202.64					202.64	53.89	4.0	60	179	24.8	0.1	Sum of DP 2.7, DP 23, & DP 23A
																								Culvert Conveyance to DP 5.6
	24	B24	3.41	0.69	13.81	2.35	5.61	13.18					4.13	0.74	2.8		9.05	1.61	1.0	18	347	3.3	1.7	On-grade inlet, carryover flow to DP 30
																					21	6.7	0.1	Piped to DP 2.9
	25	B25	2.35	0.70	10.94	1.65	6.21	10.25					2.28	0.37	2.8		7.97	1.28	1.0	18	334	3.3	1.7	On-grade inlet, carryover flow to DP 28
																					21	6.5	0.1	Piped to DP 2.9
	2.9								13.86	2.90	5.61	16.25					16.25	2.90	3.0	18	289	11.6	0.4	Sum of DP 24 & DP 25
																								Piped to DP 3.3
	26	B26	3.57	0.68	15.61	2.44	5.30	12.93	15.61	2.90	5.30	15.36	5.73	1.08	2.0		9.63	1.82	1.0	18	268	2.8	1.6	On-grade inlet, carryover flow to DP 28
																					21	6.7	0.1	Sum of Carryover from DP21 and Sub-Basin B26 Piped to DP 3.0
	27	B27	1.47	0.71	9.59	1.05	6.55	6.88	14.83	1.49	5.43	8.08	1.16	0.21	1.9		6.92	1.27	1.0	18	295	2.8	1.8	On-grade inlet, carryover flow to DP 29
																					21	6.3	0.1	Sum of Carryover from DP22 and Sub-Basin B27, Piped to DP 3.0
	3.0								15.66	3.09	5.29	16.35					16.35	3.09	3.5	18	284	12.4	0.4	Sum of DP 26 & DP 27
																								Piped to DP 3.1
	28	B28	1.62	0.71	12.16	1.15	5.94	6.83	17.19	2.60	5.06	13.15					13.15	2.60	1.0	18	19	7.5	0.0	Sump Inlet
																								Sum of carryover from DP 25, DP26, & Sub-Basin B28,Piped to DP 3.1
	29	B29	1.19	0.69	8.52	0.82	6.84	5.61	16.62	1.03	5.14	5.31					5.31	1.03	1.0	18	19	5.9	0.1	Sump Inlet
																								Sum of carryover from DP27 and Sub-Basin B29,Piped to DP 3.1
	3.1								17.23	6.72	5.05	33.95					33.95	6.72	1.0	30	99	9.3	0.2	Sum of DP 3.0, DP 28, & DP 29
																								Piped to DP 3.3

**STANDARD FORM SF-3**  
**STORM DRAINAGE SYSTEM DESIGN**  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_  
Location: Aurora  
Design Storm: 100-Year  
P<sub>1</sub>: 2.38 Inches

Project Name: Overland Ranch Filing 1  
Project No.: 16118.00  
Calculated By: AAM  
Checked By: \_\_\_\_\_  
Date: 4/26/24

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	30	B30	3.16	0.64	13.90	2.03	5.60	11.37	15.53	2.77	5.31	14.69				14.69	2.77	1.0	18	19	8.3	0.0	Sump Inlet Sum of carryover from DP24 and Sub-Basin B30,Piped to DP 3.2
	31	B31	1.87	0.69	10.55	1.28	6.30	8.06								8.06	1.28	1.0	18	19	6.5	0.0	Sump Inlet Piped to DP 3.2
	3.2								15.57	4.05	5.31	21.49				21.49	4.05	1.0	24	19	8.2	0.0	Sum of DP 30 & DP 31 Piped to DP 3.3
	3.3								17.41	13.67	5.03	68.74				68.74	13.67	1.0	36	105	10.7	0.2	Sum of DP 2.9, DP 3.1, & DP 3.2 Piped to DP 3.4
	32	B32	0.20	0.79	5.00	0.16	8.07	1.29								1.29	0.16	1.0	18	21	4.0	0.1	Sump Inlet Piped to DP 3.4
	33	B33	0.21	0.78	5.00	0.16	8.07	1.29								1.29	0.16	1.0	18	21	4.0	0.1	Sump Inlet Piped to DP 3.4
	3.4								17.57	13.99	5.00	69.93				69.93	13.99	1.0	36	127	10.7	0.2	Sum of DP 3.3, DP 32, & DP 33 Piped to DP 3.8
	34	B34	0.98	0.82	10.49	0.81	6.32	5.12								5.12	0.81	1.0	18	25	5.9	0.1	Sump Inlet Piped to DP 3.5
	35	B35	0.98	0.73	7.57	0.72	7.13	5.13								5.13	0.72	1.0	18	19	5.9	0.1	Sump Inlet Piped to DP 3.5
	3.5								10.56	1.53	6.30	9.64				9.64	1.53	1.0	18	595	6.8	1.5	Sum of DP 34 & DP 35 Piped to DP 3.5A
	36	B36	1.24	0.72	10.24	0.89	6.38	5.68								5.68	0.89	1.0	18	44	6.0	0.1	Sump Inlet Piped to DP 3.6
	37	B37	1.74	0.69	12.19	1.21	5.93	7.18								7.18	1.21	1.0	18	3	6.4	0.0	Sump Inlet Piped to DP 3.6
	3.6								12.20	2.10	5.93	12.45				12.45	2.10	2.0	18	472	9.4	0.8	Sum of DP 36 & DP 37 Piped/ Pond Conveyance to DP 5.7
	33A	B33A	0.41	0.66	8.70	0.27	6.79	1.83								1.83	0.27	1.0	18	27	4.4	0.1	Sump Inlet Piped to DP 3.5A
	33B	B33B	0.21	0.22	5.00	0.05	8.07	0.40								0.40	0.05	1.0	18	27	2.7	0.2	Sump Inlet Piped to DP 3.5A
	3.5A								12.03	1.85	5.97	11.04				11.04	1.85	1.0	18	59	6.8	0.1	Sum of DP 3.5, DP36, & DP 37 Piped to DP 3.8
	3.8								17.77	15.84	4.97	78.70				78.70	15.84	0.5	42	341	8.2	0.7	Sum of DP 3.4 & DP 3.5A Piped to DP 3.9A
	38	B38	0.91	0.70	7.56	0.64	7.13	4.56								4.56	0.64	7.0	18	55	11.3	0.1	Sump Inlet Piped to DP 3.9
	39	B39	0.78	0.68	7.04	0.53	7.30	3.87								3.87	0.53	7.0	18	3	11.0	0.0	Sump Inlet Piped to DP 3.9
	3.9								7.65	1.17	7.10	8.31				8.31	1.17	7.0	18	49	13.5	0.1	Sum of DP 38 & DP 39 Piped to DP 3.9A
	3.9A								18.46	17.01	4.88	82.99				82.99	17.01	3.0	42	97	17.9	0.1	Sum of DP 3.8 & DP 3.9 Piped to DP 5.6
	40	B40*	1.94	0.74	11.38	1.43	6.11	8.74								8.74	1.43	2.3	18	237	9.1	0.4	Storm Sewer Stub Piped to DP 4.0

**STANDARD FORM SF-3**  
**STORM DRAINAGE SYSTEM DESIGN**  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_  
Location: Aurora  
Design Storm: 100-Year  
P<sub>1</sub>: 2.38 Inches

Project Name: Overland Ranch Filing 1  
Project No.: 16118.00  
Calculated By: AAM  
Checked By: \_\_\_\_\_  
Date: 4/26/24

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	41	B41	0.80	0.71	8.38	0.56	6.88	3.85					1.1	0.15	4.0	2.80	0.41	1.0	18	302 19	4.0 5.0	1.3 0.1	On-grade inlet, carryover flow to DP 43A Piped to DP 4.0
	4.0								11.81	1.84	6.01	11.04				11.04	1.84	3.8	18	95	11.7	0.1	Sum of DP 40 & DP 41 Piped to DP 4.0A
	49A	B49A*	4.22	0.56	18.54	2.37	4.87	11.54								11.54	2.37	1.0	24	42	7.2	0.1	Proposed Stub Piped to DP 4.0A
	4.0A								18.64	4.21	4.86	20.45				20.45	4.21	3.0	18	245	11.6	0.4	Sum of DP49A & DP4.0 Piped to DP 4.1
	42	B42	2.98	0.68	14.21	2.04	5.54	11.30					0.67	0.12	4.0	10.63	1.92	1.0	18	76 22	4.0 6.8	0.3 0.1	On-grade Inlet, Carryover flow to DP 43A Piped to DP 4.1
	4.1								18.99	6.13	4.81	29.46				29.46	6.13	3.5	24	74	14.5	0.1	Sum of DP 42 & DP 4.0A Piped to DP 4.1A
	43A	B43A	0.95	0.70	8.78	0.67	6.77	4.54	14.52	0.94	5.49	5.18	0.08	0.02	2.3	5.10	0.93	1.0	18	170 22	3.0 5.9	0.9 0.1	On-grade Inlet, Carryover flow to DP 43 Sum of carryover from DP 41, DP42 and Sub-Basin B43A,Piped to DP 4.1A
	4.1A								19.08	7.05	4.80	33.86				33.86	7.05	3.5	24	167	14.9	0.2	Sum of DP 43A & DP 4.1 Piped to DP 4.2
	43	B43	0.45	0.73	7.84	0.33	7.04	2.32	15.46	1.01	5.33	5.40				5.40	1.01	1.0	18	19	5.9	0.1	Sump Inlet Sum of carryover from DP43A, DP45 and Sub-Basin B43,Piped to DP 4.2
	44	B44	0.22	0.79	5.00	0.17	8.07	1.37								1.37	0.17	1.0	18	19	4.1	0.1	Sump Inlet Piped to DP 4.2
	4.2								19.26	7.31	4.77	34.86				34.86	7.31	1.0	24	79	11.1	0.1	Sum of DP 4.1A, DP43, & DP 44 Piped to DP 4.4
	45	B45	2.01	0.67	12.20	1.34	5.93	7.95					4.0	0.67	4.0	3.98	0.67	2.0	18	132 22	4.0 7.1	0.6 0.1	On-grade inlet, carryover flow to DP 43 Piped to DP 4.3
	46	B46	1.56	0.72	9.56	1.12	6.55	7.34					3.5	0.53	4.0	3.85	0.59	1.0	18	594 19	4.0 5.5	2.5 0.1	On-grade inlet, carryover flow to DP 48 Piped to DP 4.3
	4.3								12.25	1.26	5.92	7.46				7.46	1.26	4.0	18	81	10.8	0.1	Sum of DP DP45 & DP 46 Piped to DP 4.4
	4.4								19.38	8.57	4.76	40.79				40.79	8.57	3.4	36	519	15.6	0.6	Sum of DP 4.2 & DP 4.3 Piped to DP 4.5
	47	B47	2.80	0.67	14.19	1.87	5.54	10.36								10.36	1.87	2.0	18	19	9.0	0.0	Sump Inlet Piped to DP 4.5
	48	B48	1.29	0.72	9.00	0.92	6.70	6.16	12.04	1.45	5.97	8.67				8.67	1.45	2.0	18	19	8.6	0.0	Sump Inlet Sum of carryover from DP46 and Sub-Basin B48,Piped to DP 4.5
	4.5								19.94	11.89	4.69	55.77				55.77	11.89	1.0	30	127	11.4	0.2	Sum of DP 4.4, DP 47, & DP 48 Piped to DP 5.4
	49	B49B*	1.94	0.58	19.64	1.13	4.73	5.34								5.34	1.13	1.0	24	42	5.8	0.1	Proposed Stub Piped to DP 4.6
	50	B50*	0.46	0.81	5.00	0.37	8.07	2.99								2.99	0.37	3.0	18	96	7.4	0.2	Future Sump Inlet Piped to DP 4.6
	4.6								19.76	1.50	4.71	7.07				7.07	1.50	3.0	24	257	9.3	0.5	Sum of DP 49 & DP 50 Piped to DP 4.9
	51	B51	0.85	0.81	5.60	0.69	7.83	5.40								5.40	0.69	1.0	18	19	5.9	0.1	Sump Inlet Piped to DP 4.7

**STANDARD FORM SF-3**  
**STORM DRAINAGE SYSTEM DESIGN**  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_  
Location: Aurora  
Design Storm: 100-Year  
P<sub>1</sub>: 2.38 Inches

Project Name: Overland Ranch Filing 1  
Project No.: 16118.00  
Calculated By: AAM  
Checked By: \_\_\_\_\_  
Date: 4/26/24

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	52	B52	0.96	0.71	8.74	0.68	6.78	4.61								4.61	0.68	1.0	18	19	5.7	0.1	Sump Inlet Piped to DP 4.7
	4.7								8.80	1.37	6.76	9.26				9.26	1.37	1.0	18	112	6.7	0.3	Sum of DP 51 & DP 52 Piped to DP 4.9
	53	B53	1.33	0.72	8.27	0.96	6.91	6.63								6.63	0.96	1.0	18	19	6.2	0.1	Sump Inlet Piped to DP 4.8
	54	B54	0.56	0.72	8.25	0.40	6.92	2.77								2.77	0.40	1.0	18	19	5.0	0.1	Sump Inlet Piped to DP 4.8
	4.8								8.32	1.36	6.90	9.38				9.38	1.36	1.0	18	107	6.7	0.3	Sum of DP 53 & DP 54 Piped to DP 4.9
	4.9								20.22	4.23	4.66	19.71				19.71	4.23	4.0	30	313	13.6	0.4	Sum of DP 4.6, DP 4.7, & DP 4.8 Piped to DP 5.3
	55	B55	3.16	0.68	11.32	2.16	6.12	13.22								13.22	2.16	1.0	18	19	7.5	0.0	Sump Inlet Piped to DP 5.0
	56	B56	1.09	0.70	9.28	0.77	6.63	5.11								5.11	0.77	1.0	18	19	5.9	0.1	Sump Inlet Piped to DP 5.0
	5.0								11.36	2.93	6.11	17.90				17.90	2.93	2.0	24	112	10.5	0.2	Sum of DP 55 & DP 56 Piped to DP 5.3
	57	B57	0.79	0.71	12.61	0.56	5.85	3.28	16.91	1.54	5.10	7.87				7.87	1.54	2.0	18	19	8.5	0.0	Sump Inlet Sum of carryover from DP59 and Sub-Basin B57,Piped to DP 5.1
	59	B59	3.96	0.67	15.67	2.63	5.29	13.91					5.20	0.98	1.0	8.71	1.65	1.0	18	149	2.0	1.2	On-grade inlet, carryover flow to DP 57 Piped to DP 5.1
	5.1								16.95	3.19	5.09	16.24				16.24	3.19	1.0	24	26	7.8	0.1	Sum of DP 57 & DP 59 Piped to DP 5.2
	58	B58	2.16	0.73	10.11	1.59	6.41	10.19								10.19	1.59	1.0	24	3	7.0	0.0	Sump Inlet Piped to DP 5.2
	5.2								17.00	4.78	5.09	24.33				24.33	4.78	6.0	24	163	17.0	0.2	Sum of DP 5.1 & DP 58 Piped/Pond Conveyance to DP 5.2A
	58A	B58A	0.98	0.59	11.74	0.58	6.03	3.50								3.50	0.58	6.0	18	42	9.9	0.1	Type C Inlet Piped to DP 5.2A
	5.2A								17.16	5.36	5.06	27.12				27.12	5.36	6.0	24	373	17.5	0.4	Sum of DP 5.2 & DP 58A Piped to DP 5.7
	5.3								20.60	7.16	4.61	33.01				33.01	7.16	3.7	42	245	15.0	0.3	Sum of DP 4.9 & DP 5.0 Piped to DP 5.3A
	39A	B39A	0.23	0.72	5.00	0.17	8.07	1.37								1.37	0.17	1.0	18	27	4.1	0.1	On-Grade Inlet Piped to DP 5.3A
	39B	B39B	0.26	0.81	5.00	0.21	8.07	1.69								1.69	0.21	1.0	18	27	4.3	0.1	On-Grade Inlet Piped to DP 5.3A
	5.3A								20.87	7.54	4.58	34.53				34.53	7.54	3.0	42	59	14.0	0.1	Sum of DP 5.3, DP 39A & DP 39B Piped to DP 5.4
	5.4								20.94	19.43	4.57	88.80				88.80	19.43	3.0	42	367	18.2	0.3	Sum of DP 4.5 & DP 5.3A Piped to DP 5.5
	61	B61	2.43	0.83	6.31	2.01	7.56	15.20								15.20	2.01	1.0	18	143	8.6	0.3	Sump Inlet Piped to DP 5.5

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_  
Location: Aurora  
Design Storm: 100-Year  
**P<sub>1</sub>** 2.38 Inches

Project Name: Overland Ranch Filing 1  
Project No.: 16118.00  
Calculated By: AAM  
Checked By: \_\_\_\_\_  
Date: 4/26/24

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS	
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)		
	5.5								21.28	21.44	4.53	97.13				97.13	21.44	3.0	42	32	18.6	0.0	Sum of DP 5.4 & DP 61 Piped to DP 5.6	
	5.6								29.84	92.34	3.75	346.28	346.28	92.34	0.5					531	1.4	6.3	Sum of DP 2.8, DP 3.9, & DP 5.5 Pond Conveyance to DP 5.7	
	62	B62	12.96	0.60	12.87	7.75	5.79	44.87					44.87	7.75	0.5									Pond 302 Pond conveyance to DP 5.7
	5.7								29.84	107.55	3.75	403.32												Sum of DP 3.6, DP 5.6, DP 5.2A, and DP 62 Pond 302 Outlet Structure
	81	C1	1.51	0.62	13.71	0.94	5.63	5.29								5.29	0.94	1.0	18	19	5.9	0.1	Sump Inlet Piped to DP 8.0	
	82	C2	1.39	0.72	11.36	1.00	6.11	6.11								6.11	1.00	1.0	18	19	6.1	0.1	Sump Inlet Piped to DP 8.0	
	8.0								13.76	1.94	5.62	10.90				10.90	1.94	2.5	18	524	10.0	0.9	Sum of DP 8.1 & DP 82 Piped to DP 8.2	
	83	C3	1.74	0.70	13.60	1.21	5.65	6.84	14.75	2.15	5.45	11.74				11.74	2.15	2.0	18	26	9.3	0.0	Sump Inlet Sum of carryover from DP 84 and Sub-Basin C3,Piped to DP 8.1	
	84	C4	3.68	0.69	13.21	2.54	5.73	14.55					5.41	0.94	1.0		9.15	1.60	2.5	18	185	2.0	1.5	On-grade inlet, carryover flow to DP 83 Piped to DP 8.1
	8.1								14.79	3.75	5.44	20.40				20.40	3.75	1.0	18	27	11.6	0.0	Sum of DP 8.3 & DP 84 Piped to DP 8.2	
	8.2								14.83	5.69	5.43	30.90				30.90	5.69	1.0	24	21	9.8	0.0	Sum of DP 8.0 & DP 8.1 Piped to DP 8.3	
	85	C5	2.03	0.71	10.92	1.45	6.22	9.02								9.02	1.45	1.0	18	3	6.7	0.0	Sump Inlet Piped to DP 8.3	
	8.3								14.87	7.14	5.43	38.77				38.77	7.14	5.0	30	140	17.8	0.1	Sum of DP 8.2 & DP 85 Piped to DP 8.4	
	86	C6	1.05	0.61	10.05	0.64	6.43	4.12								4.12	0.64	6.0	18	14	10.5	0.0	Type C Inlet Piped to DP 8.4	
	8.4								15.00	7.78	5.40	42.01				42.01	7.78	6.0	30	89	19.5	0.1	Sum of DP 8.3 & DP 86 Piped/Pond Conveyance to DP 8.5	
	87	C7*	9.17	0.76	14.65	7.01	5.46	38.27					38.27	7.01	0.5					484	1.4	5.7	Future Storm Infrastructure Piped/Pond Conveyance to DP 8.5	
	88	C8*	3.03	0.73	10.59	2.21	6.29	13.90								13.90	2.21	5.0	24	193	13.7	0.2	Future Storm Infrastructure Piped/Pond Conveyance to DP 8.5	
	89	C9	4.93	0.62	11.69	3.04	6.04	18.36					18.36	3.04	0.5									Pond 306 Pond Conveyance to DP 8.5
	8.5								20.36	20.04	4.64	92.99				92.99	20.04	5.0	30	140	21.3	0.1	Sum of DP 8.4, DP 87, DP 88 & DP 89 Pond 306 Outlet Structure	
	91	D1	3.06	0.70	12.26	2.16	5.92	12.79								12.79	2.16	1.0	18	19	7.2	0.0	Sump Inlet Piped to DP 9.0	
	92	D2	3.07	0.71	12.28	2.18	5.92	12.91								12.91	2.18	1.0	18	19	7.3	0.0	Sump Inlet Piped to DP 9.0	
	9.0								12.32	4.34	5.91	25.65				25.65	4.34	1.0	24	210	8.2	0.4	Sum of DP 9.1 & DP 92 Piped to DP 9.1	

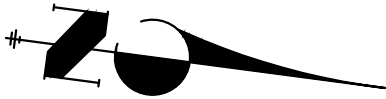
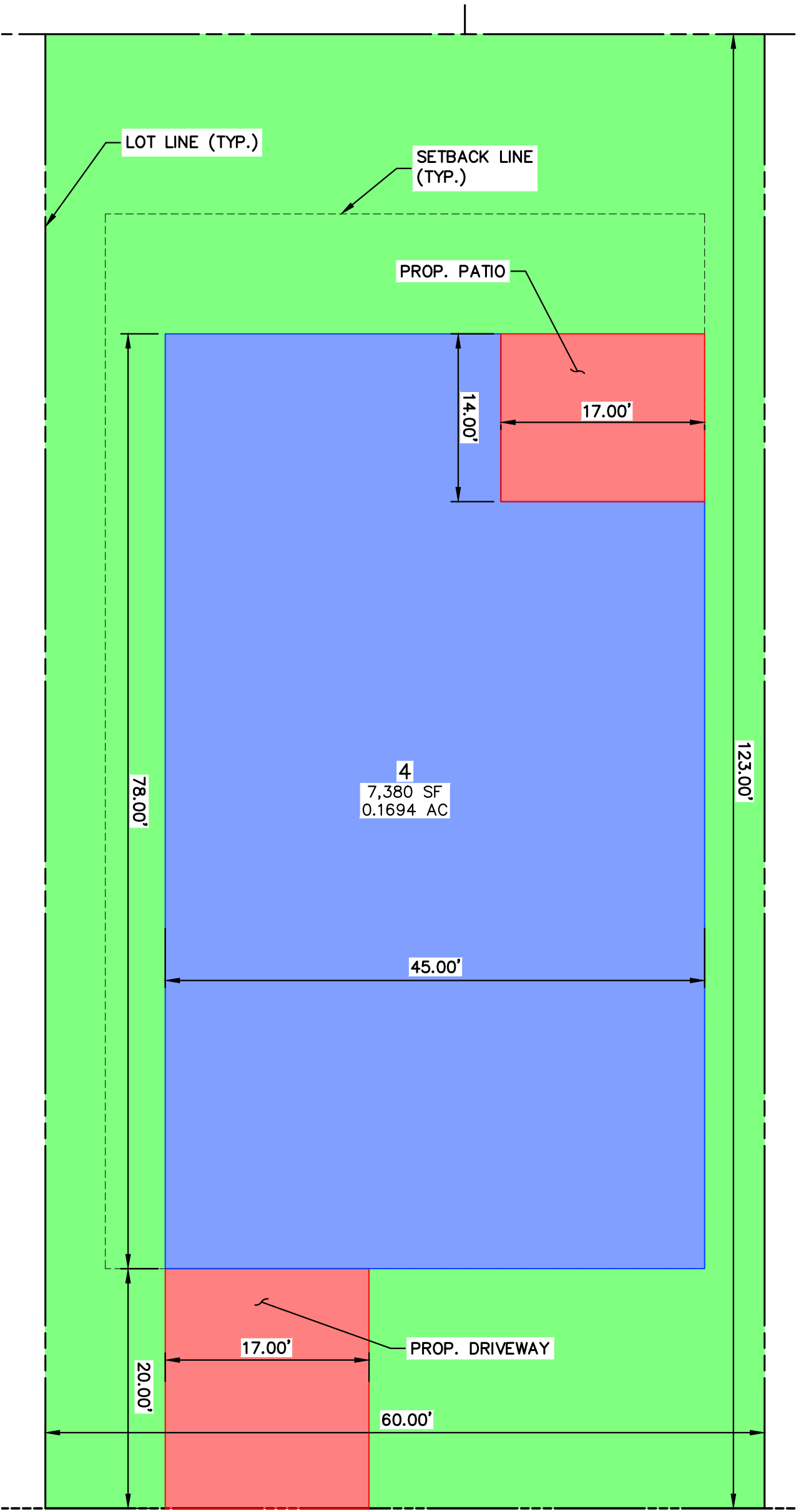
STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_  
 Location: Aurora  
 Design Storm: 100-Year  
P<sub>1</sub> 2.38 Inches

Project Name: Overland Ranch Filing 1  
 Project No.: 16118.00  
 Calculated By: AAM  
 Checked By: \_\_\_\_\_  
 Date: 4/26/24

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	93	D3	1.77	0.71	9.17	1.25	6.66	8.33								8.33	1.25	1.0	18	21	6.6	0.1	Sump Inlet Piped to DP 9.1
	94	D4*	1.65	0.73	9.74	1.20	6.51	7.81								7.81	1.20	1.0	18	21	6.5	0.1	Sump Inlet Piped to DP 9.1
	9.1								12.75	6.79	5.82	39.52	39.52	6.79	4.0					958	4.0	4.0	Sum of DP 9.0, DP 93 & DP 94 Swale Conveyance to DP 9.2
	95	D5	11.36	0.47	24.49	5.30	4.20	22.26					22.26	5.30	4.0					0	4.0	0.0	Pond D Pond Conveyance to DP 9.2
	9.2								24.49	12.09	4.20	50.78											Sum of DP 9.1 and DP 95 Pond D Outlet Structure
	OS4	OS4	0.72	0.44	8.80	0.31	6.76	2.10					2.10	0.31	18.0								Overland Flow Surface conveyance offsite to DP OS4
	OS5	OS5*	1.69	0.57	9.19	0.97	6.65	6.45					6.45	0.97	14.0								Overland Flow Surface conveyance offsite to DP OS5

Notes:  
 Street and Pipe C\*A values are determined by Q/i using the catchment's intensity value.



**LEGEND:**

- PROPOSED ROOF
- PROPOSED PAVING
- PROPOSED LANDSCAPING

Basin ID	Total Area (ac)	Roof			Landscaping			Paving			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
LOT	0.17	90%	0.07	36.0%	5%	0.09	2.7%	100%	0.01	5.6%	44.3%

LOT IMPERVIOUS AREA EXHIBIT  
OVERLAND RANCH FILING 1  
JOB NO. 16118.00  
2/16/24  
SHEET 1 OF 1



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COUNTY LINE ROAD  
ULTIMATE CONDITION ROUTING

## COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: \_\_\_\_\_  
 Location: Aurora

Project Name: Overland Ranch Filing 1  
 Project No.: 16118.00  
 Calculated By: AAM  
 Checked By: \_\_\_\_\_  
 Date: 7/23/24

Basin ID	Total Area (ac)	Paving, Drives, Walks, Ponds			Landscaping/Park			Open Space			Basins Total
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	Weighted % Imp.
CL1	2.66	95%	0.40	14.3%	20%	0.00	0.0%	5%	2.26	4.2%	18.5%
CL2	1.45	95%	1.10	72.1%	20%	0.35	4.8%	5%	0.00	0.0%	76.9%
CL3	0.59	95%	0.58	93.4%	20%	0.01	0.3%	5%	0.00	0.0%	93.7%
CL4	1.80	95%	0.82	43.3%	20%	0.98	10.9%	5%	0.00	0.0%	54.2%
CL5	0.58	95%	0.56	91.7%	20%	0.02	0.7%	5%	0.00	0.0%	92.4%
CL6	1.43	95%	0.76	50.5%	20%	0.67	9.4%	5%	0.00	0.0%	59.9%
CL7	0.62	95%	0.60	91.9%	20%	0.02	0.6%	5%	0.00	0.0%	92.6%
CL8	0.63	95%	0.46	69.4%	20%	0.17	5.4%	5%	0.00	0.0%	74.8%
CL9	0.27	95%	0.26	91.5%	20%	0.01	0.7%	5%	0.00	0.0%	92.2%
CL10	0.28	95%	0.19	64.5%	20%	0.04	2.9%	5%	0.05	0.9%	68.2%
CL11	0.28	95%	0.17	57.7%	20%	0.04	2.9%	5%	0.07	1.3%	61.8%
TOTAL CL	10.59										58.4%
UB3*	7.32	100%	0.20	2.7%	5%	5.81	4.0%	45%	1.31	8.1%	14.8%
UB3A*	1.05	100%	0.10	9.5%	5%	0.82	3.9%	45%	0.13	5.6%	19.0%
UB12*	0.69	100%	0.32	46.4%	5%	0.07	0.5%	45%	0.30	19.6%	66.4%
UB13*	3.03	100%	0.38	12.5%	5%	1.14	1.9%	45%	1.51	22.4%	36.8%
TOTAL B	12.09										23.6%

Per Table 5-5, City of Aurora Storm Drainage Criteria Manual:

Paving, Drives, Walks: 95% impervious  
 Open Space 5% impervious  
 Landscaping: 20% impervious  
 Community Park: 25% impervious  
 Low & Medium-Density SFH (3 - 5 du/ac) 55% impervious (Includes roads)  
 Medium-Density MFH/  
 High Density SFH 65% impervious (Includes roads)  
 (5 - 20 du/ac)

\*Per Table 1, City of Aurora Storm Drainage and Technical Criteria Manual:

Paving, Drives, Walks: 100% impervious  
 Undeveloped Areas 2%-5% impervious  
 (Lawns): (Does not include roads)  
 Commercial Areas: 95% impervious (Does not include roads)  
 Neighborhood Areas: 85% impervious (Does not include roads)  
 Single-Family Residential 45% impervious  
 (0.25 Acres or Less): (Does not include roads)

# COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora Project No.: 16118.00  
 Calculated By: AAM  
 Checked By: \_\_\_\_\_  
 Date: 7/23/24

C-Value - 100-Year

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Hydrologic Soil Group			Minor Coefficients			Major Coefficients			Major Coefficients			Basins Total Weighted C <sub>2</sub>	Basins Total Weighted C <sub>5</sub>	Basins Total Weighted C <sub>100</sub>
			Area A (ac)	Area B (ac)	Area C/D (ac)	% A (ac)	% B (ac)	% C/D (ac)	C <sub>2,A</sub>	C <sub>2,B</sub>	C <sub>2,C/D</sub>	C <sub>5,A</sub>	C <sub>5,B</sub>	C <sub>5,C/D</sub>	C <sub>100,A</sub>	C <sub>100,B</sub>	C <sub>100,C/D</sub>			
CL1	2.66	18.5%	0.00	2.66	0.00	0%	100%	0%	0.09	0.12	0.13	0.10	0.14	0.19	0.25	0.51	0.56	0.12	0.14	0.51
CL2	1.45	76.9%	0.00	0.83	0.62	0%	57%	43%	0.60	0.62	0.62	0.62	0.65	0.67	0.71	0.79	0.80	0.62	0.65	0.79
CL3	0.59	93.7%	0.00	0.20	0.39	0%	34%	66%	0.77	0.78	0.77	0.79	0.80	0.80	0.84	0.87	0.87	0.77	0.80	0.87
CL4	1.80	54.2%	0.00	1.80	0.00	0%	100%	0%	0.38	0.41	0.42	0.39	0.44	0.48	0.53	0.68	0.71	0.41	0.44	0.68
CL5	0.58	92.4%	0.00	0.58	0.00	0%	100%	0%	0.76	0.77	0.76	0.78	0.79	0.79	0.83	0.86	0.86	0.77	0.79	0.86
CL6	1.43	59.9%	0.00	1.43	0.00	0%	100%	0%	0.43	0.46	0.47	0.45	0.49	0.53	0.58	0.71	0.73	0.46	0.49	0.71
CL7	0.62	92.6%	0.00	0.62	0.00	0%	100%	0%	0.76	0.77	0.76	0.78	0.79	0.79	0.83	0.86	0.86	0.77	0.79	0.86
CL8	0.63	74.8%	0.00	0.60	0.03	0%	95%	5%	0.57	0.60	0.60	0.59	0.63	0.65	0.69	0.78	0.79	0.60	0.63	0.78
CL9	0.27	92.2%	0.00	0.00	0.27	0%	0%	100%	0.76	0.76	0.76	0.78	0.79	0.79	0.83	0.86	0.86	0.76	0.79	0.86
CL10	0.28	68.2%	0.00	0.00	0.28	0%	0%	100%	0.51	0.54	0.54	0.53	0.57	0.59	0.64	0.75	0.76	0.54	0.59	0.76
CL11	0.28	61.8%	0.00	0.00	0.28	0%	0%	100%	0.45	0.48	0.48	0.47	0.51	0.54	0.59	0.72	0.74	0.48	0.54	0.74
UB3*	7.32	14.8%	0.00	7.32	0.00	0%	100%	0%	0.07	0.09	0.10	0.08	0.11	0.16	0.22	0.50	0.54	0.09	0.11	0.50
UB3A*	1.05	19.0%	0.00	1.05	0.00	0%	100%	0%	0.10	0.12	0.13	0.10	0.14	0.19	0.26	0.51	0.56	0.12	0.14	0.51
UB12*	0.69	66.4%	0.00	0.19	0.50	0%	28%	72%	0.49	0.52	0.52	0.51	0.55	0.58	0.63	0.74	0.76	0.52	0.57	0.75
UB13*	3.03	36.8%	0.00	0.60	2.43	0%	20%	80%	0.23	0.26	0.27	0.24	0.29	0.34	0.40	0.60	0.63	0.27	0.33	0.63
TOTAL	22.68	39.9%	0.00	17.88	4.80	0%	79%	21%	---	---	---									

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
 Location: Aurora Project No.: 16118.00  
 Calculated By: AAM  
 Checked By: \_\_\_\_\_  
 Date: 7/23/24

SUB-BASIN							INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA							(T <sub>i</sub> )			(T <sub>t</sub> )					(URBANIZED BASINS)			
BASIN	D.A.	Hydrologic	Impervious	C <sub>2</sub>	C <sub>5</sub>	C <sub>100</sub>	L	S <sub>o</sub>	t <sub>i</sub>	L <sub>t</sub>	S <sub>t</sub>	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	
CL1	2.66	B	18.5%	0.12	0.14	0.51	30.0	6.2%	5.2	1117.0	4.1%	15.00	3.0	6.1	11.3	1147.00	30.8	11.3
CL2	1.45	B	76.9%	0.62	0.65	0.79	30.0	2.0%	3.5	1058.0	3.0%	20.00	3.5	5.1	8.6	1088.00	18.1	8.6
CL3	0.59	C	93.7%	0.77	0.80	0.87	45.0	2.0%	2.9	672.0	3.6%	20.00	3.8	3.0	5.8	717.00	12.7	5.8
CL4	1.80	B	54.2%	0.41	0.44	0.68	45.0	2.0%	6.3	525.0	2.5%	20.00	3.2	2.8	9.1	570.00	20.1	9.1
CL5	0.58	B	92.4%	0.77	0.79	0.86	33.0	2.0%	2.6	442.0	2.5%	20.00	3.2	2.3	4.9	475.00	12.4	5.0
CL6	1.43	B	59.9%	0.46	0.49	0.71	39.0	2.0%	5.5	806.0	2.6%	20.00	3.2	4.2	9.6	845.00	20.6	9.6
CL7	0.62	B	92.6%	0.77	0.79	0.86	26.0	2.0%	2.3	806.0	2.6%	20.00	3.2	4.2	6.4	832.00	14.1	6.4
CL8	0.63	C	74.8%	0.60	0.63	0.78	39.0	2.0%	4.2	345.0	2.1%	20.00	2.9	2.0	6.2	384.00	15.3	6.2
CL9	0.27	C	92.2%	0.76	0.79	0.86	26.0	2.0%	2.3	285.0	1.7%	20.00	2.6	1.8	4.1	311.00	12.0	5.0
CL10	0.28	C	68.2%	0.54	0.59	0.76	54.0	6.7%	3.6	362.0	3.8%	15.00	2.9	2.1	5.7	416.00	16.1	5.7
CL11	0.28	C	61.8%	0.48	0.54	0.74	54.0	6.7%	4.0	362.0	3.7%	15.00	2.9	2.1	6.0	416.00	17.3	6.0
UB3*	7.32	C	14.8%	0.09	0.11	0.50	106.0	4.1%	11.6	665.0	2.5%	15.00	2.4	4.7	16.3	771.00	29.8	16.3
UB3A*	1.05	C	19.0%	0.12	0.14	0.51	91.0	5.8%	9.2	241.0	6.7%	15.00	3.9	1.0	10.3	332.00	24.1	10.3
UB12*	0.69	C	66.4%	0.52	0.57	0.75	135.0	2.5%	8.2	266.0	2.8%	20.00	3.3	1.3	9.5	401.00	16.2	9.5
UB13*	3.03	C	36.8%	0.27	0.33	0.63	279.0	6.6%	12.5	223.0	2.8%	20.00	3.3	1.1	13.6	502.00	21.3	13.6

NOTES:

$$t_c = t_i + t_t$$

Equation 6-2

Where:

*t<sub>c</sub>* = computed time of concentration (minutes)

*t<sub>i</sub>* = overland (initial) flow time (minutes)

*t<sub>t</sub>* = channelized flow time (minutes).

$$t_t = \frac{L_t}{60KV_t} = \frac{L_t}{60V_t}$$

Equation 6-4

Where:

*t<sub>t</sub>* = channelized flow time (travel time, min)

*L<sub>t</sub>* = waterway length (ft)

*S<sub>o</sub>* = waterway slope (ft/ft)

*V<sub>t</sub>* = travel time velocity (ft/sec) = *K*√*S<sub>o</sub>*

*K* = NRCS conveyance factor (see Table 6-2).

*t<sub>c</sub>* is lesser of Equation 6-2 and Equation 6-5

For Urbanized basins a minimum *t<sub>c</sub>* of 5.0 minutes is required.

For non-urbanized basins a minimum *t<sub>c</sub>* of 10.0 minutes is required.

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_o^{0.33}}$$

Equation 6-3

Where:

*I* = rainfall intensity (inches per hour)

*P<sub>1</sub>* = 1-hour point rainfall depth from Table 5-1 or NOAA Atlas 14 online tool (inches)

*T<sub>s</sub>* = storm duration (minutes)

*D* = rainfall depth (inches)

$$I = \frac{28.5 \cdot P_1}{(10 + T_s)^{0.786}}$$

$$D = \frac{I \cdot T_s}{60}$$

Equation 5-1

Equation 5-2

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Equation 6-5

Where:

*t<sub>c</sub>* = minimum time of concentration for first design point when less than *t<sub>c</sub>* from Equation 6-1.

*L<sub>t</sub>* = length of channelized flow path (ft)

*i* = imperviousness (expressed as a decimal)

*S<sub>t</sub>* = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

**STANDARD FORM SF-3**  
**STORM DRAINAGE SYSTEM DESIGN**  
(RATIONAL METHOD PROCEDURE)

Subdivision: \_\_\_\_\_ Project Name: Overland Ranch Filing 1  
Location: Aurora Project No.: 16118.00  
Design Storm: 2-Year Calculated By: AAM  
Checked By: \_\_\_\_\_  
P<sub>1</sub>: 0.83 Inches Date: 7/23/24

Flow	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	C1	CL1	2.66	0.12	11.34	0.31	2.13	0.66					0.66	0.31	2.0					25	2.8	0.1	Existing swale conveyance to existing 42" culvert.
	C2	CL2	1.45	0.62	8.59	0.90	2.37	2.13					2.13	0.90	2.0					25	2.8	0.1	Road Conveyance to Elora Site
	C3	CL3	0.59	0.77	5.81	0.46	2.69	1.24								1.24	0.46	1.0	18	46	4.0	0.2	On-grade inlet Piped to DP1.0A
	3A	UB3A*	1.05	0.12	10.28	0.13	2.21	0.29								0.29	0.13	1.0	18	3	2.4	0.0	Ex. Type D inlet Piped to DP1.0A
	1.0A								10.30	0.59	2.21	1.30	1.30	0.59	2.5					665	3.2	3.5	Sum of DP C3 & 3A Swale conveyance to DP 1.2
	C6	CL6	1.43	0.46	9.62	0.66	2.27	1.50								1.50	0.66	2.0	18	46	5.2	0.1	On-grade inlet Piped to DP 6.0
	C7	CL7	0.62	0.77	6.43	0.48	2.61	1.25								1.25	0.48	2.0	18	21	5.0	0.1	On-grade inle Piped to DP 6.0
	6.0								9.77	1.14	2.26	2.58				2.58	1.14	2.0	18	27	6.2	0.1	Sum of DP C6 & DP C7 Piped to DP 6.2
	C4	CL4	1.80	0.41	9.12	0.74	2.32	1.72								1.72	0.74	1.0	18	47	4.4	0.2	Sump inlet Piped to DP 6.1
	C5	CL5	0.58	0.77	5.00	0.44	2.81	1.24								1.24	0.44	1.0	18	21	4.0	0.1	Sump inlet Sum of carryover flow from DP C7 & Sub-Basin CL5, Piped to DP 6.1
	6.1								9.30	1.18	2.30	2.71				2.71	1.18	1.0	18	255	5.0	0.9	Sum of DP C4 & DP C5 Piped to DP 6.2
	Pond A		31.68		30.00	0.09	3.73	0.34								0.34	0.09	1.0	42	170	2.4	1.2	Elora Pond Release Piped to DP 6.2
	6.2								31.21	2.41	1.27	3.06	3.06	2.41	5.5	3.06	2.41	1.00	42	337	4.7	1.2	Sum of DP 6.0, DP 6.1 & Elora Pond A Release into Overland Filing 1 Drainage Infrastructure
	3	UB3*	7.32	0.09	16.26	0.66	1.81	1.19								1.19	0.66	2.4	54	0	4.5	0.0	54" Culvert Piped to DP 1.2
	1.2								32.40	3.66	1.24	4.54				4.54	3.66	2.4	54				Sum of DP 1.0A, DP 6.2, & DP 3 Piped to Overland Ranch Infrastructure
	C8	CL8	0.63	0.60	6.22	0.38	2.64	1.00					1.00	0.38	2.0								Road Conveyance to Elora Site
	C9	CL9	0.27	0.76	5.00	0.20	2.81	0.56					0.56	0.20	2.0								Road Conveyance to Overland Ranch Site
	C10	CL10	0.28	0.54	5.65	0.15	2.71	0.41					0.41	0.15	2.0								Roadside Swale Conveyance to Historic Outfall
	C11	CL11	0.28	0.48	6.05	0.14	2.66	0.37					0.37	0.14	2.0								Roadside Swale Conveyance to Historic Outfall
	12	UB12*	0.69	0.52	9.51	0.36	2.28	0.82								0.82	0.36	1.0	18	19	3.4	0.1	Sump Inlet Piped to DP 1.9
	13	UB13*	3.03	0.27	13.61	0.82	1.96	1.61								1.61	0.82	1.0	18	19	4.3	0.1	Sump Inlet Piped to DP 1.9
	1.9								13.68	1.18	1.96	2.31				2.31	1.18	4.0	18	843	7.7	1.8	Sum of DP 12 & DP 13 Piped to Overland Ranch Infrastructure

Notes:  
Street and Pipe C\*A values are determined by Q/i using the catchment's intensity value.

**STANDARD FORM SF-3**  
**STORM DRAINAGE SYSTEM DESIGN**  
(RATIONAL METHOD PROCEDURE)

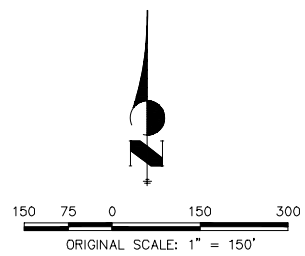
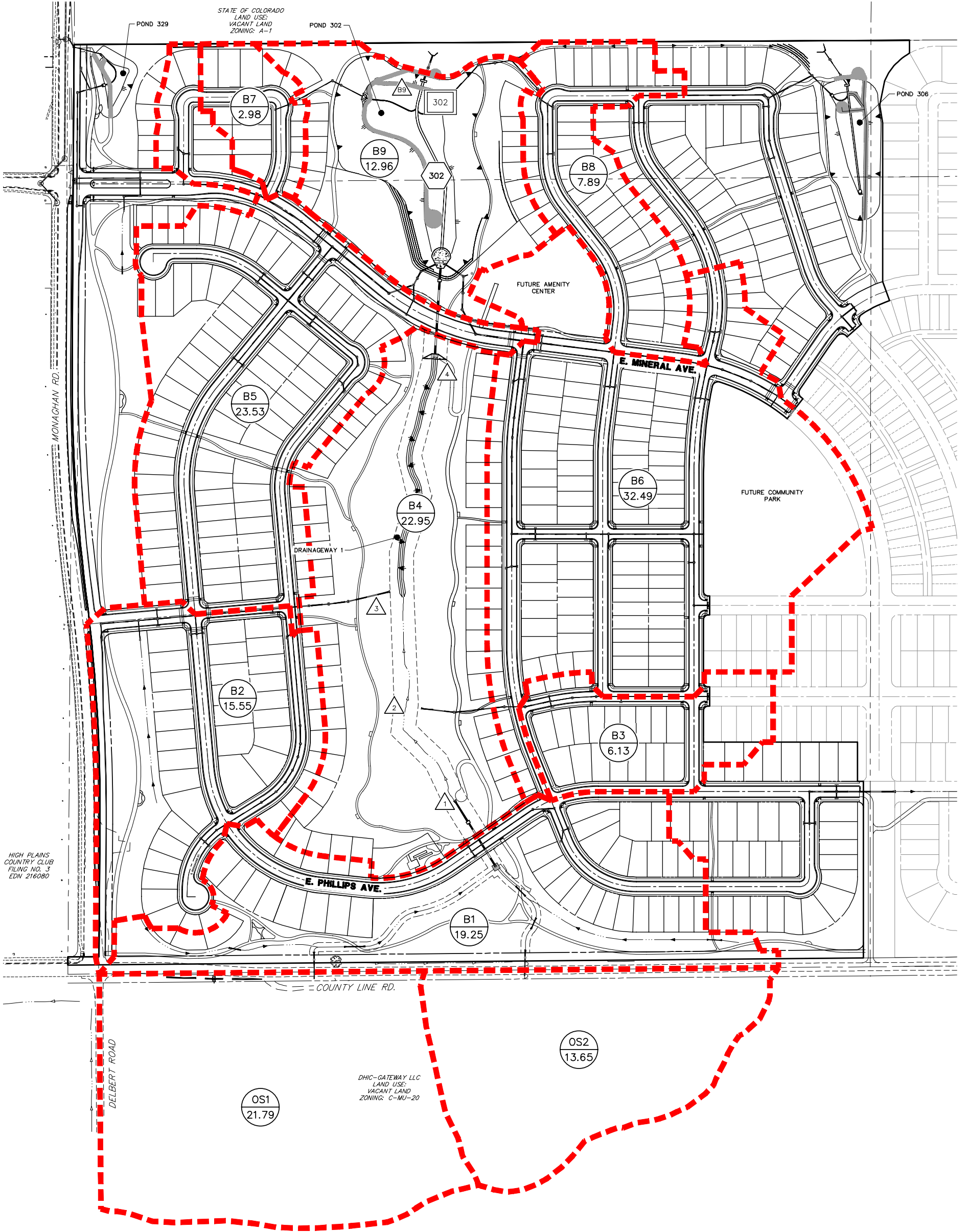
Subdivision: \_\_\_\_\_  
Location: Aurora  
Design Storm: 100-Year  
P<sub>1</sub>: 2.38 Inches

Project Name: Overland Ranch Filing 1  
Project No.: 16118.00  
Calculated By: AAM  
Checked By: \_\_\_\_\_  
Date: 7/23/24

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	C1	CL1	2.66	0.51	11.34	1.36	6.12	8.32					8.32	1.36	2.0					25	2.8	0.1	Existing swale conveyance to existing 42" culvert.
	C2	CL2	1.45	0.79	8.59	1.15	6.82	7.84					7.84	1.15	2.0					25	2.8	0.1	Road Conveyance to Elora Site
	C3	CL3	0.59	0.87	5.81	0.51	7.74	3.95								3.95	0.51	1.0	18	46	5.5	0.1	On-grade inlet Piped to DP1.0A
	3A	UB3A*	1.05	0.51	10.28	0.54	6.37	3.44								3.44	0.54	1.0	18	3	5.3	0.0	Ex. Type D inlet Piped to DP1.0A
	1.0A								10.29	1.05	6.37	6.69	6.69	1.05	2.5					665	3.2	3.5	Sum of DP C3 & 3A Swale conveyance to DP 1.2
	C6	CL6	1.43	0.71	9.62	1.01	6.54	6.61					3.4	0.52	1.6	3.20	0.49	2.0	18	281 46	2.5 6.6	1.9 0.1	On-grade inlet, carryover flow to DP C4 Piped to DP 6.0
	C7	CL7	0.62	0.86	6.43	0.53	7.52	3.99					1.4	0.18	1.6	2.60	0.35	2.0	18	281 21	2.5 6.2	1.9 0.1	On-grade inlet, carryover flow to DP C5 Piped to DP 6.0
	6.0								9.74	0.84	6.51	5.44				5.44	0.84	2.0	18	27	7.7	0.1	Sum of DP C6 & DP C7 Piped to DP 6.2
	C4	CL4	1.80	0.68	9.12	1.23	6.67	8.20	11.47	1.75	6.09	10.66				10.66	1.75	1.0	18	47	6.8	0.1	Sump inlet Sum of carryover flow from DP C6 & Sub-Basin CL4, Piped to DP 6.1
	C5	CL5	0.58	0.86	5.00	0.50	8.07	4.04	8.28	0.68	6.91	4.73				4.73	0.68	1.0	18	21	5.7	0.1	Sump inlet Sum of carryover flow from DP C7 & Sub-Basin CL5, Piped to DP 6.1
	6.1								11.59	2.43	6.06	14.76				14.76	2.43	1.0	18	255	8.4	0.5	Sum of DP C4 & DP C5 Piped to DP 6.2
	Pond A		31.68		40.00	12.53	3.13	39.22								39.22	12.53	1.0	42	170	9.8	0.3	Elora Pond Release Piped to DP 6.2
	6.2								40.29	15.80	3.12	49.30	49.30	15.80	5.5					337	4.7	1.2	Sum of DP 6.0, DP 6.1 & Elora Pond A Swale Conveyance to DP 1.2
	3	UB3*	7.32	0.50	16.26	3.62	5.20	18.82								18.82	3.62	2.4	54	0	10.6	0.0	54" Culvert Piped to DP 1.2
	1.2								41.49	20.47	3.06	62.64				62.64	20.47	2.4	54				54" Culvert Piped to Overland Ranch Infrastructure
	C8	CL8	0.63	0.78	6.22	0.49	7.59	3.72					3.72	0.49	2.0								Road Conveyance to Elora Site
	C9	CL9	0.27	0.86	5.00	0.23	8.07	1.86					1.86	0.23	2.0								Road Conveyance to Overland Ranch Site
	C10	CL10	0.28	0.76	5.65	0.21	7.81	1.64					1.64	0.21	2.0								Roadside Swale Conveyance to Historic Outfall
	C11	CL11	0.28	0.74	6.05	0.21	7.65	1.61					1.61	0.21	2.0								Roadside Swale Conveyance to Historic Outfall
	12	UB12*	0.69	0.75	9.51	0.52	6.57	3.42								3.42	0.52	1.0	18	19	5.3	0.1	Sump Inlet Piped to DP 1.9
	13	UB13*	3.03	0.63	13.61	1.90	5.65	10.74								10.74	1.90	1.0	18	19	6.8	0.0	Sump Inlet Piped to DP 1.9
	1.9								13.65	2.42	5.64	13.65				13.65	2.42	4.0	18				Sum of DP 12 & DP 13 Piped to Overland Ranch Infrastructure

Notes:  
Street and Pipe C\*A values are determined by Q/i using the catchment's intensity value.

APPENDIX 3  
HYDRAULIC CALCULATIONS



CUHP DRAINAGE BASINS  
TRAILS AT OVERLAND RANCH FIL 01  
JOB NO. 16118.00  
11/30/23  
SHEET 1 OF 1

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COMPOSITE % IMPERVIOUS CALCULATIONS

Basin ID	Total Area (ac)	Paving, Drives, Walks, Ponds			Landscaping/Park			Use (Commercial, Residential)			Neighborhood Areas			Paving, Drives, Walks (2023 Criteria)			Landscaping (2023 Criteria)			Park (2023 Criteria)			Use (Commercial, Residential) (2023 Criteria)			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
B1	19.25	100%	4.57	23.7%	5%	8.00	2.1%	45%	6.68	15.6%	85%	0.00	0.0%	95%	0.00	0.0%	20%	0.00	0.0%	25%	0.00	0.0%	55%	0.00	0.0%	41.4%
B2	15.55	100%	4.21	27.1%	5%	4.06	1.3%	45%	7.28	21.1%	85%	0.00	0.0%	95%	0.00	0.0%	20%	0.00	0.0%	25%	0.00	0.0%	55%	0.00	0.0%	49.4%
B3	6.13	100%	1.11	18.1%	5%	0.28	0.2%	45%	2.98	21.9%	85%	0.00	0.0%	95%	0.46	7.1%	20%	0.11	0.4%	25%	0.00	0.0%	55%	1.19	10.7%	58.4%
B4	22.95	100%	0.00	0.0%	5%	17.55	3.8%	45%	5.40	10.6%	85%	0.00	0.0%	95%	0.00	0.0%	20%	0.00	0.0%	25%	0.00	0.0%	55%	0.00	0.0%	14.4%
B5	23.53	100%	5.90	25.1%	5%	3.63	0.8%	45%	14.00	26.8%	85%	0.00	0.0%	95%	0.00	0.0%	20%	0.00	0.0%	25%	0.00	0.0%	55%	0.00	0.0%	52.6%
B6	32.49	100%	6.28	19.3%	5%	1.63	0.3%	45%	13.59	18.8%	85%	2.43	6.4%	95%	0.90	2.6%	20%	0.22	0.1%	25%	6.16	4.7%	55%	1.28	2.2%	54.4%
B7	2.98	100%	0.73	24.5%	5%	0.26	0.4%	45%	1.99	30.1%	85%	0.00	0.0%	95%	0.00	0.0%	20%	0.00	0.0%	25%	0.00	0.0%	55%	0.00	0.0%	55.0%
B8	7.89	100%	1.93	24.4%	5%	0.97	0.6%	45%	4.99	28.5%	85%	0.00	0.0%	95%	0.00	0.0%	20%	0.00	0.0%	25%	0.00	0.0%	55%	0.00	0.0%	53.4%
B9	12.96	100%	3.57	27.5%	5%	7.61	2.9%	45%	1.78	6.2%	85%	0.00	0.0%	95%	0.00	0.0%	20%	0.00	0.0%	25%	0.00	0.0%	55%	0.00	0.0%	36.7%
TOTAL B	143.73																									44%
OS1	21.79	100%	0.00	0.0%	5%	21.79	5.0%	45%	0.00	0.0%	85%	0.00	0.0%	95%	0.00	0.0%	20%	0.00	0.0%	25%	0.00	0.0%	55%	0.00	0.0%	5.0%
OS2	13.65	100%	0.00	0.0%	5%	13.65	5.0%	45%	0.00	0.0%	85%	0.00	0.0%	95%	0.00	0.0%	20%	0.00	0.0%	25%	0.00	0.0%	55%	0.00	0.0%	5.0%
TOTAL OS	35.44																									5%

Per Table 1, City of Aurora Storm Drainage and Technical Criteria Manual:

Paving, Drives, Walks: 100% impervious  
Undeveloped Areas (Lawns): 2%-5% impervious  
Commercial Areas: 95% impervious  
Neighborhood Areas: 85% impervious  
Single-Family Residential (0.25 Acres or Less): 45% impervious

\*Per Table 5-5, City of Aurora Storm Drainage Criteria Manual:

Paving, Drives, Walks: 95% impervious  
Open Space 5% impervious  
Landscaping: 20% impervious  
Community Park: 25% impervious  
Low & Medium-Density SFH (3 - 5 du/ac) 55% impervious (Does not include roads)  
Medium-Density MFH/High Density SFH (5 - 20 du/ac) 65% impervious (Does not include roads)

\*Basins marked with an asterisk are future basins and must adhere to the new composite impervious values, as shown in Table 5-5 of the revised City of Aurora Storm Drainage Criteria Manual.

100-Year Input  
Summary of CUHP Input Parameters (Version 2.0.1)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
Basin OS1	OS1	RAINGAGE	0.034	0.072	0.193	0.060	5.0	0.35	0.10	4.50	0.60	0.0018	0.00	0.10	0.05	4.34
Basin OS2	OS2	RAINGAGE	0.021	0.070	0.148	0.050	5.0	0.35	0.10	4.50	0.60	0.0018	0.00	0.10	0.05	4.34
Basin B1	B1	RAINGAGE	0.030	0.069	0.223	0.030	41.4	0.35	0.10	4.50	0.60	0.0018	0.00	0.81	0.20	40.08
Basin B2	B2	RAINGAGE	0.024	0.100	0.193	0.030	49.4	0.35	0.10	3.00	0.50	0.0018	0.00	0.85	0.23	48.41
Basin B3	B3	RAINGAGE	0.010	0.074	0.147	0.030	58.4	0.35	0.10	4.50	0.60	0.0018	0.00	0.89	0.26	57.32
Basin B4	B4	RAINGAGE	0.036	0.157	0.298	0.044	14.4	0.20	0.10	4.50	0.60	0.0018	0.00	0.29	0.11	12.98
Basin B5	B5	RAINGAGE	0.037	0.102	0.260	0.050	52.6	0.35	0.10	3.00	0.50	0.0018	0.00	0.86	0.24	51.64
Basin B6	B6	RAINGAGE	0.051	0.144	0.242	0.050	54.4	0.35	0.10	4.50	0.60	0.0018	0.00	0.87	0.25	53.23
Basin B7	B7	RAINGAGE	0.005	0.023	0.069	0.030	55.0	0.35	0.10	3.00	0.50	0.0018	0.00	0.88	0.25	54.08
Basin B8	B8	RAINGAGE	0.012	0.073	0.166	0.030	53.4	0.35	0.10	4.50	0.60	0.0018	0.00	0.87	0.24	52.21
Basin B9	B9	RAINGAGE	0.020	0.071	0.150	0.120	36.7	0.35	0.10	4.50	0.60	0.0018	0.00	0.73	0.19	35.18

100-Year Output
Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f.)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
Basin OS1		0.147	0.096	18.0	2.83	9.4	2.00	4.7	57	79,098	1.28	101,005	35.0	43	98,863	1.95
Basin OS2		0.147	0.078	20.1	2.71	10.5	1.91	4.5	32	49,550	1.28	63,273	35.0	24	61,853	1.78
Basin B1		0.093	0.100	13.6	2.55	7.1	1.80	4.2	66	69,878	1.74	121,302	35.0	52	116,013	2.73
Basin B2		0.089	0.101	14.5	2.62	7.5	1.85	4.4	50	56,447	1.93	108,688	35.0	44	104,272	2.82
Basin B3		0.085	0.071	14.8	2.31	7.7	1.63	3.8	19	22,252	1.96	43,628	35.0	17	41,423	2.76
Basin B4		0.121	0.084	32.7	3.62	17.0	2.56	6.0	33	83,309	1.52	126,333	40.0	34	125,708	1.50
Basin B5		0.087	0.125	11.8	2.63	6.1	1.86	4.4	93	85,414	1.96	167,611	35.0	76	160,555	3.21
Basin B6		0.087	0.147	11.4	2.78	5.9	1.96	4.6	134	117,939	1.91	224,921	35.0	105	217,412	3.22
Basin B7		0.086	0.050	8.5	1.83	4.4	1.29	3.0	16	10,817	1.99	21,527	30.0	11	19,309	3.52
Basin B8		0.087	0.077	14.8	2.37	7.7	1.68	4.0	25	28,641	1.89	54,239	35.0	21	51,612	2.71
Basin B9		0.096	0.077	10.9	2.15	5.7	1.52	3.6	56	47,045	1.67	78,624	35.0	39	73,772	2.98

100-YEAR SUMMARY REPORT  
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.1)

\*\*\*\*\*

Analysis Options

\*\*\*\*\*

Flow Units ..... CFS

Process Models:

Rainfall/Runoff ..... NO

RDII ..... NO

Snowmelt ..... NO

Groundwater ..... NO

Flow Routing ..... YES

Ponding Allowed ..... NO

Water Quality ..... NO

Flow Routing Method ..... KINWAVE

Starting Date ..... 01/01/2005 00:00:00

Ending Date ..... 01/05/2005 06:00:00

Antecedent Dry Days ..... 0.0

Report Time Step ..... 00:15:00

Routing Time Step ..... 30.00 sec

	Volume acre-feet	Volume 10 <sup>6</sup> gal
Flow Routing Continuity	-----	-----
Dry Weather Inflow .....	0.000	0.000
Wet Weather Inflow .....	0.000	0.000
Groundwater Inflow .....	0.000	0.000
RDII Inflow .....	0.000	0.000
External Inflow .....	24.581	8.010
External Outflow .....	24.566	8.005
Flooding Loss .....	0.000	0.000
Evaporation Loss .....	0.000	0.000
Exfiltration Loss .....	0.000	0.000
Initial Stored Volume ....	0.000	0.000
Final Stored Volume .....	0.000	0.000
Continuity Error (%) .....	0.060	

\*\*\*\*\*

Highest Flow Instability Indexes

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All links are stable.

\*\*\*\*\*

Routing Time Step Summary

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Minimum Time Step	:	30.00 sec
Average Time Step	:	30.00 sec
Maximum Time Step	:	30.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	1.00
% of Steps Not Converging	:	0.00

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Node Depth Summary

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Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
2	JUNCTION	0.01	1.17	6100.17	0 00:37	1.10
OS1	JUNCTION	0.01	1.17	6148.17	0 00:35	1.12
OS2	JUNCTION	0.01	0.83	6145.83	0 00:35	0.81
B1	JUNCTION	0.00	0.00	6142.00	0 00:00	0.00
B7	JUNCTION	0.00	0.00	6085.00	0 00:00	0.00
B8	JUNCTION	0.00	0.00	6100.00	0 00:00	0.00

4	JUNCTION	0.02	1.66	6066.66	0	00:39	1.61
1	JUNCTION	0.01	1.16	6111.16	0	00:37	1.13
B3	JUNCTION	0.00	0.00	6134.00	0	00:00	0.00
B2	JUNCTION	0.00	0.00	6130.00	0	00:00	0.00
B4	JUNCTION	0.00	0.00	6066.00	0	00:00	0.00
3	JUNCTION	0.01	1.50	6086.50	0	00:37	1.41
B9	JUNCTION	0.00	0.00	6042.00	0	00:00	0.00
B5	JUNCTION	0.00	0.00	6071.00	0	00:00	0.00
B6	JUNCTION	0.00	0.00	6068.00	0	00:00	0.00
5	OUTFALL	0.00	0.00	6036.00	0	00:00	0.00
Pond302	STORAGE	2.86	8.69	6048.69	0	01:12	8.68

\*\*\*\*\*  
Node Inflow Summary  
\*\*\*\*\*

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
2	JUNCTION	0.00	133.99	0 00:37	0	2.38	0.000
OS1	JUNCTION	42.51	42.51	0 00:35	0.739	0.739	0.000
OS2	JUNCTION	24.29	24.29	0 00:35	0.463	0.463	0.000
B1	JUNCTION	52.48	52.48	0 00:35	0.868	0.868	0.000
B7	JUNCTION	10.50	10.50	0 00:30	0.144	0.144	0.000
B8	JUNCTION	21.35	21.35	0 00:35	0.386	0.386	0.000
4	JUNCTION	0.00	209.30	0 00:39	0	4.1	0.000
1	JUNCTION	0.00	117.66	0 00:36	0	2.07	0.000
B3	JUNCTION	16.91	16.91	0 00:35	0.31	0.31	0.000
B2	JUNCTION	43.90	43.90	0 00:35	0.78	0.78	0.000
B4	JUNCTION	34.43	34.43	0 00:40	0.94	0.94	0.000
3	JUNCTION	0.00	176.37	0 00:37	0	3.16	0.000
B9	JUNCTION	38.67	38.67	0 00:35	0.552	0.552	0.000
B5	JUNCTION	75.55	75.55	0 00:35	1.2	1.2	0.000
B6	JUNCTION	104.73	104.73	0 00:35	1.63	1.63	0.000
5	OUTFALL	0.00	149.33	0 01:12	0	8	0.000
Pond302	STORAGE	0.00	443.91	0 00:37	0	8.01	0.055

\*\*\*\*\*  
Node Flooding Summary  
\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*  
Storage Volume Summary  
\*\*\*\*\*

Storage Unit	Average Volume 1000 ft <sup>3</sup>	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft <sup>3</sup>	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
Pond302	93.663	8	0	0	608.634	52	0 01:12	149.33

\*\*\*\*\*  
Outfall Loading Summary  
\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
5	77.55	3.76	149.33	8.005
System	77.55	3.76	149.33	8.005

\*\*\*\*\*  
Link Flow Summary  
\*\*\*\*\*

Link	Type	Maximum  Flow  CFS	Time of Max Occurrence days hr:min	Maximum  Veloc  ft/sec	Max/ Full Flow	Max/ Full Depth
3	DUMMY	10.50	0 00:30			
4	CONDUIT	209.29	0 00:39	32.77	0.17	0.28
5	DUMMY	21.35	0 00:35			
7	CONDUIT	117.45	0 00:37	7.04	0.01	0.11
8	CONDUIT	42.19	0 00:37	7.80	0.04	0.29
9	DUMMY	52.48	0 00:35			
10	CONDUIT	24.28	0 00:37	8.77	0.02	0.21
11	DUMMY	16.91	0 00:35			
12	CONDUIT	133.79	0 00:38	7.83	0.01	0.12
13	CONDUIT	175.59	0 00:39	7.39	0.02	0.15
14	DUMMY	34.43	0 00:40			
15	DUMMY	43.90	0 00:35			
16	DUMMY	38.67	0 00:35			
17	DUMMY	104.73	0 00:35			
18	DUMMY	75.55	0 00:35			
302	DUMMY	149.33	0 01:12			

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Wed Dec 6 15:08:00 2023  
Analysis ended on: Wed Dec 6 15:08:00 2023  
Total elapsed time: < 1 sec

# TRAILS AT OVERLAND RANCH INPUT DATA

;;Project Title/Notes

## [OPTIONS]

;;Option Value  
FLOW\_UNITS CFS  
INFILTRATION HORTON  
FLOW\_ROUTING KINWAVE  
LINK\_OFFSETS DEPTH  
MIN\_SLOPE 0  
ALLOW\_PONDING NO  
SKIP\_STEADY\_STATE NO

START\_DATE 01/01/2005  
START\_TIME 00:00:00  
REPORT\_START\_DATE 01/01/2005  
REPORT\_START\_TIME 00:00:00  
END\_DATE 01/05/2005  
END\_TIME 06:00:00  
SWEEP\_START 01/01  
SWEEP\_END 12/31  
DRY\_DAYS 0  
REPORT\_STEP 00:15:00  
WET\_STEP 00:05:00  
DRY\_STEP 01:00:00  
ROUTING\_STEP 0:00:30  
RULE\_STEP 00:00:00

INERTIAL\_DAMPING PARTIAL  
NORMAL\_FLOW\_LIMITED BOTH  
FORCE\_MAIN\_EQUATION H-W  
VARIABLE\_STEP 0.75  
LENGTHENING\_STEP 0  
MIN\_SURFAREA 12.566  
MAX\_TRIALS 8  
HEAD\_TOLERANCE 0.005  
SYS\_FLOW\_TOL 5  
LAT\_FLOW\_TOL 5  
MINIMUM\_STEP 0.5  
THREADS 1

## [FILES]

;;Interfacing Files  
USE INFLOWS "X:\1610000.all\1611800\Excel\Drainage\CUHP\100-Year.txt"

## [EVAPORATION]

;;Data Source Parameters  
;;-----  
CONSTANT 0.0  
DRY\_ONLY NO

## [JUNCTIONS]

;;Name	Elevation	MaxDepth	InitDepth	SurDepth	Aponded
;;-----	-----	-----	-----	-----	-----
2	6099	15	0	0	0
OS1	6147	0	0	0	0
OS2	6145	0	0	0	0
B1	6142	10	0	0	0
B7	6085	10	0	0	0
B8	6100	10	0	0	0
4	6065	10	0	0	0
1	6110	10	0	0	0
B3	6134	10	0	0	0
B2	6130	10	0	0	0
B4	6066	10	0	0	0
3	6085	10	0	0	0
B9	6042	0	0	0	0
B5	6071	0	0	0	0
B6	6068	0	0	0	0

## [OUTFALLS]

;;Name	Elevation	Type	Stage Data	Gated	Route To
;;-----	-----	-----	-----	-----	-----
5	6036	FREE		NO	

```

[STORAGE]
;;Name      Elev.      MaxDepth  InitDepth  Shape      Curve Type/Params      SurDepth  Fevap
Psi      Ksat      IMD
;;-----
Pond302      6040      13      0      TABULAR      PondB      0      0

[CONDUITS]
;;Name      From Node      To Node      Length      Roughness  InOffset      OutOffset      InitFlow
MaxFlow
;;-----
3      B7      Pond302      100      0.01      0      0      0
0
4      4      Pond302      289      0.013      0      0      0
0
5      B8      Pond302      100      0.01      0      0      0
0
7      1      2      368      .033      0      0      0
0
8      OS1      1      701      0.03      0      0      0
0
9      B1      1      400      0.01      0      0      0
0
10      OS2      1      336      0.03      0      0      0
0
11      B3      2      100      0.01      0      0      0
0
12      2      3      386      .033      0      0      0
0
13      3      4      816      0.033      0      0      0
0
14      B4      4      10      0.01      0      0      0
0
15      B2      3      100      0.01      0      0      0
0
16      B9      Pond302      100      0.01      0      0      0
0
17      B6      Pond302      100      0.01      0      0      0
0
18      B5      Pond302      100      0.01      0      0      0
0

[OUTLETS]
;;Name      From Node      To Node      Offset      Type      QTable/Qcoeff      Qexpon
Gated
;;-----
302      Pond302      5      0      TABULAR/DEPTH      PondBOutlet
NO

[XSECTIONS]
;;Link      Shape      Geom1      Geom2      Geom3      Geom4      Barrels      Culvert
;;-----
3      DUMMY      0      0      0      0      1
4      CIRCULAR      6      0      0      0      1
5      DUMMY      0      0      0      0      1
7      TRAPEZOIDAL      10      10      4      4      1
8      TRIANGULAR      4      32      0      0      1
9      DUMMY      0      0      0      0      1
10      TRIANGULAR      4      32      0      0      1
11      DUMMY      0      0      0      0      1
12      TRAPEZOIDAL      10      10      4      4      1
13      TRAPEZOIDAL      10      10      4      4      1
14      DUMMY      0      0      0      0      1
15      DUMMY      0      0      0      0      1
16      DUMMY      0      0      0      0      1
17      DUMMY      0      0      0      0      1
18      DUMMY      0      0      0      0      1

```



```

[CURVES]
;;Name          Type          X-Value    Y-Value
;;-----
PondBOutlet    Rating      .25        .12
PondBOutlet    Rating      .5         .17
PondBOutlet    Rating      .75        .21
PondBOutlet    Rating      1          .24
PondBOutlet    Rating      1.25      .26
PondBOutlet    Rating      1.5       .4
PondBOutlet    Rating      1.75      .47
PondBOutlet    Rating      2          .53
PondBOutlet    Rating      2.25      .59
PondBOutlet    Rating      2.5       .63
PondBOutlet    Rating      2.75      .78
PondBOutlet    Rating      3          .87
PondBOutlet    Rating      3.25      .95
PondBOutlet    Rating      3.5       1.02
PondBOutlet    Rating      3.75      1.09
PondBOutlet    Rating      4          1.18
PondBOutlet    Rating      4.25      1.29
PondBOutlet    Rating      4.5       1.38
PondBOutlet    Rating      4.75      1.46
PondBOutlet    Rating      5          1.53
PondBOutlet    Rating      5.25      1.59
PondBOutlet    Rating      5.5       1.65
PondBOutlet    Rating      5.75      1.71
PondBOutlet    Rating      6          17.41
PondBOutlet    Rating      6.25     48.97
PondBOutlet    Rating      6.5      90.3
PondBOutlet    Rating      6.75    126.19
PondBOutlet    Rating      7        129.4
PondBOutlet    Rating      7.25    132.53
PondBOutlet    Rating      7.5     135.6
PondBOutlet    Rating      7.75    138.59
PondBOutlet    Rating      8        141.52
PondBOutlet    Rating      8.25    144.39
PondBOutlet    Rating      8.5     147.21
PondBOutlet    Rating      8.75    149.97
PondBOutlet    Rating      9        152.69
PondBOutlet    Rating      9.25    158.71
PondBOutlet    Rating      9.5     207.74
PondBOutlet    Rating      9.75    285.07
PondBOutlet    Rating     10     383.24
;
PondB          Storage      0          100
PondB          Storage     .33        200
PondB          Storage     1.33      5625
PondB          Storage     2.33     33263
PondB          Storage     3.33    67714
PondB          Storage     4.33    88539
PondB          Storage     5.33    97703
PondB          Storage     6.33   104274
PondB          Storage     7.33   110433
PondB          Storage     8.33   116638
PondB          Storage     9.33   122892
PondB          Storage    10.33   129053
PondB          Storage    11.33   134805
PondB          Storage    12.33   140713

[REPORT]
;;Reporting Options
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node          X-Coord          Y-Coord
;;-----





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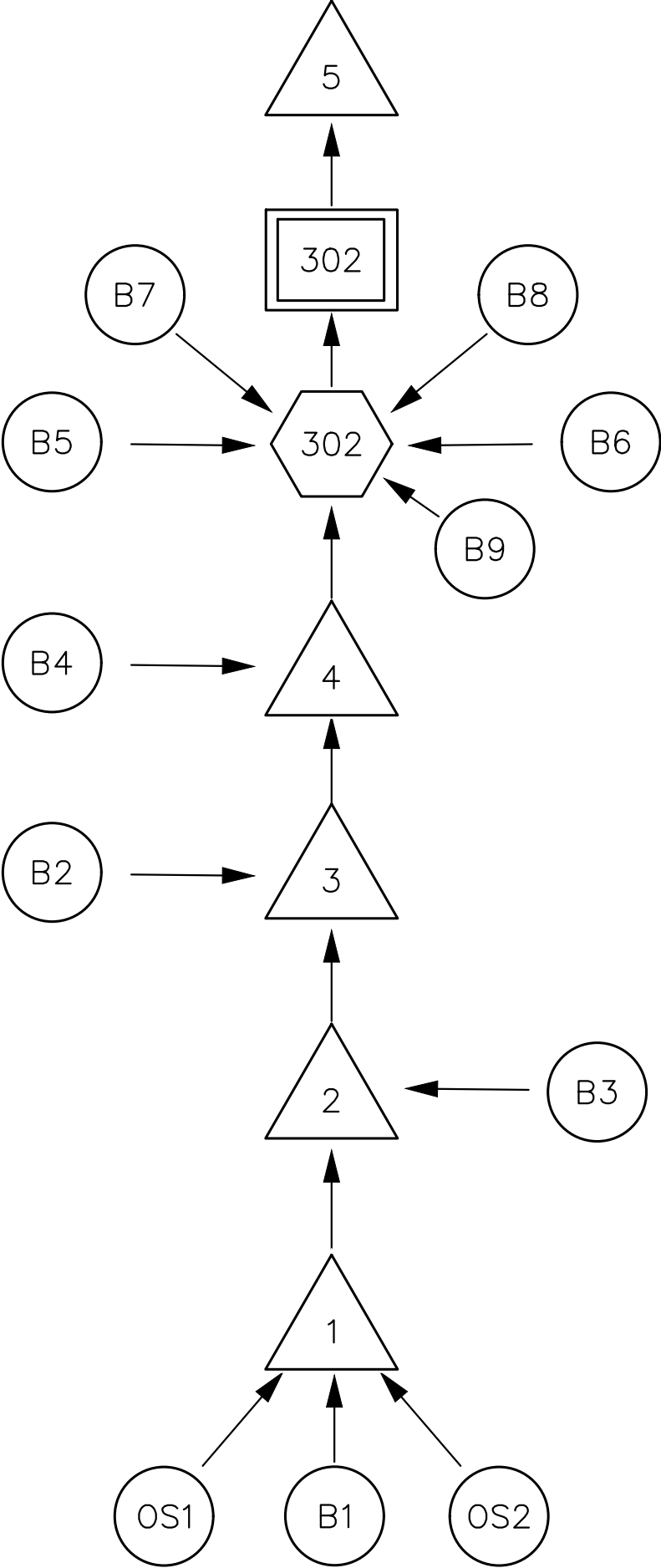
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OS1	1248.471	2451.726
OS2	3819.905	2635.071
B1	2881.517	2862.559
B7	2445.700	6836.592
B8	2972.018	6824.765
4	2767.773	6511.848
1	2710.900	3383.886
B3	3639.810	4454.976
B2	1952.607	4985.782
B4	2570.873	6514.540
3	2777.251	5090.047
B9	2729.196	6787.010
B5	2691.053	6668.632
B6	2826.541	6679.288
5	2786.730	7412.322
Pond302	2762.777	6711.668

[VERTICES]

;Link	X-Coord	Y-Coord
9	2720.379	3213.270
13	2786.730	6113.744
302	2791.707	7193.828

**LEGEND**

-  SUB-WATERSHED
-  OUTFALL
-  DETENTION POND
-  POND OUTLET STRUCTURE



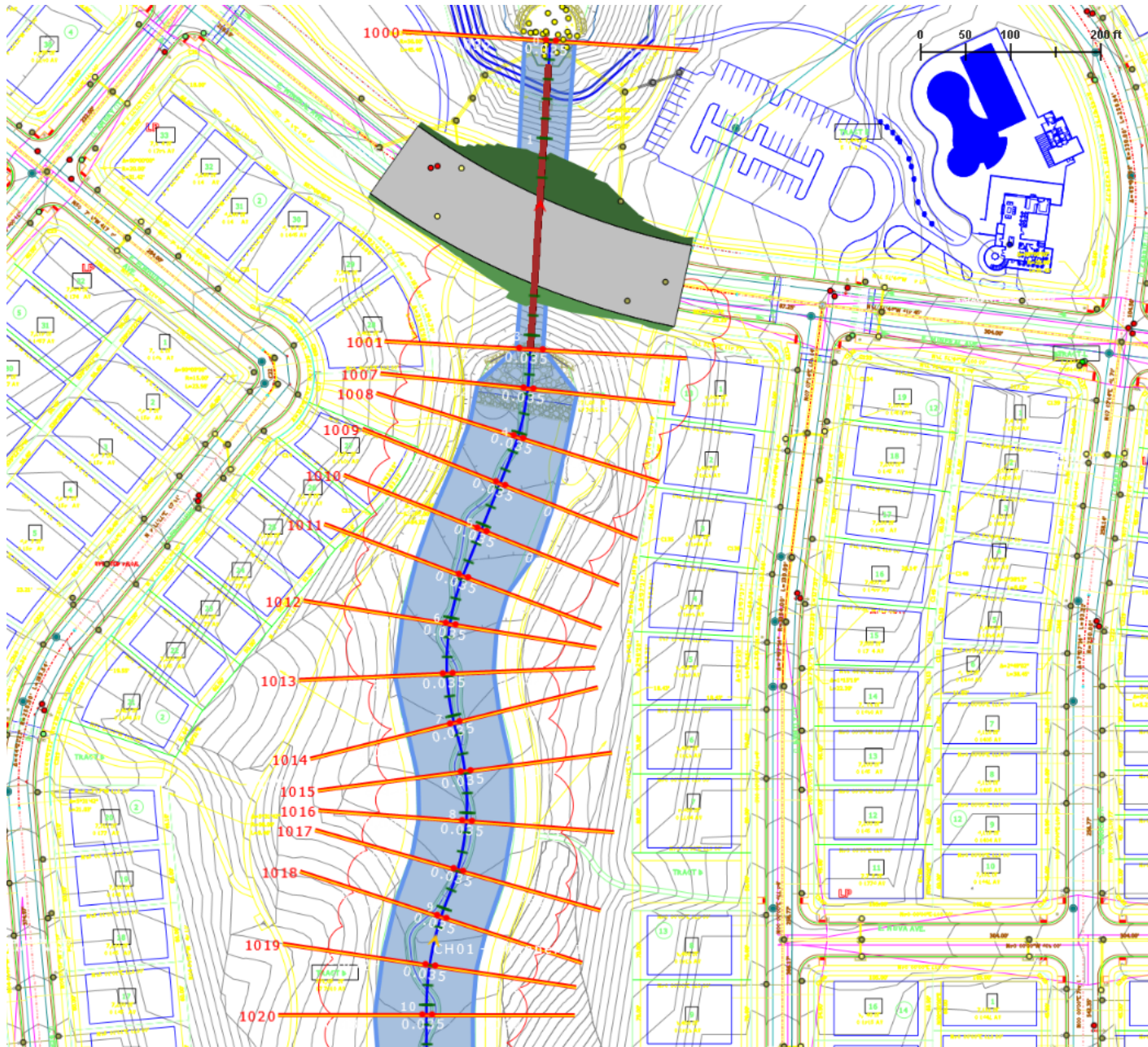
SWMM MODEL  
SCHEMATICS  
POND 302  
JOB NO. 16118.00  
10/20/23  
SHEET 1 OF 1

Trails at Overland Ranch HEC RAS Model Output Table (Low N Value)

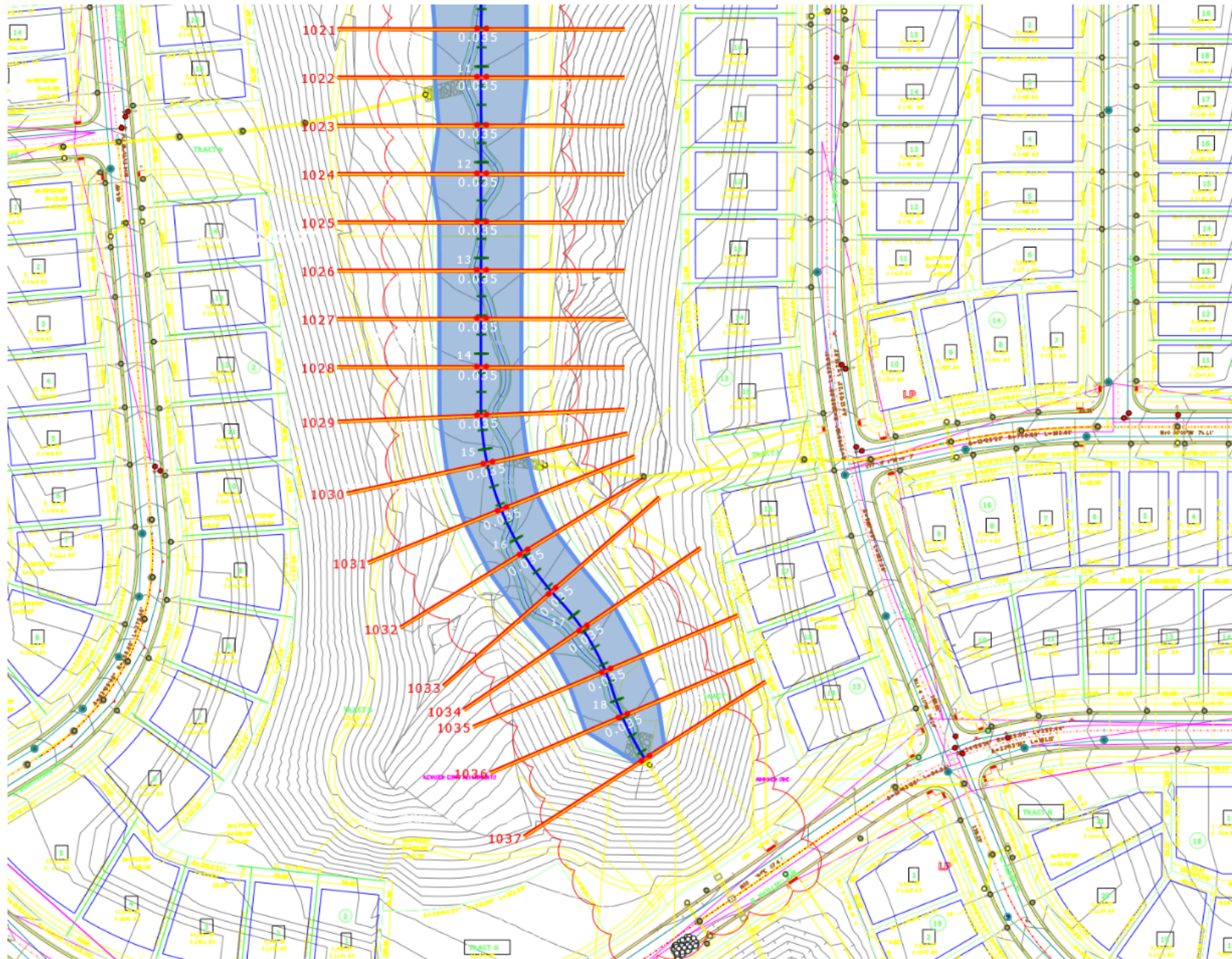
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Shear LOB (lb/sq ft)	Shear Chan (lb/sq ft)	Shear ROB (lb/sq ft)
Channel 01	1037	PF# 1	117.35	6108.48	6109.65	6109.65	6109.84	0.011017	4.63	39.29	94.24	0.79	0.23	0.73	0.24
Channel 01	1036	PF# 1	117.35	6107.22	6108.39	6108.39	6108.57	0.010731	4.56	40.46	99.8	0.78	0.22	0.71	0.22
Channel 01	1035	PF# 1	117.35	6105.95	6107.13	6107.13	6107.31	0.01037	4.49	40.95	99.73	0.76	0.22	0.69	0.22
Channel 01	1034	PF# 1	117.35	6104.69	6105.86	6105.86	6106.04	0.010644	4.55	40.43	98.83	0.77	0.22	0.7	0.22
Channel 01	1033	PF# 1	117.35	6103.43	6104.61	6104.61	6104.78	0.010232	4.48	41.1	99.68	0.76	0.22	0.68	0.22
Channel 01	1032	PF# 1	117.35	6102.17	6103.34	6103.34	6103.52	0.010815	4.57	40.23	98.68	0.78	0.23	0.71	0.23
Channel 01	1031	PF# 1	117.35	6100.91	6102.08	6102.08	6102.26	0.01027	4.47	41.15	100.01	0.76	0.22	0.68	0.22
Channel 01	1030	PF# 1	133.95	6099.65	6100.86	6100.86	6101.04	0.010035	4.53	45.39	100.35	0.76	0.24	0.69	0.24
Channel 01	1029	PF# 1	133.95	6098.38	6099.6	6099.6	6099.78	0.010168	4.57	45.15	100.3	0.76	0.24	0.7	0.24
Channel 01	1028	PF# 1	133.95	6097.12	6098.34	6098.34	6098.52	0.01024	4.58	45.04	100.29	0.77	0.24	0.7	0.24
Channel 01	1027	PF# 1	133.95	6095.86	6097.08	6097.08	6097.26	0.010187	4.57	45.11	100.3	0.76	0.24	0.7	0.24
Channel 01	1026	PF# 1	133.95	6094.6	6095.81	6095.81	6096	0.010361	4.6	45.16	102.33	0.77	0.24	0.71	0.23
Channel 01	1025	PF# 1	133.95	6093.34	6094.55	6094.55	6094.73	0.010146	4.56	45.21	100.35	0.76	0.24	0.7	0.24
Channel 01	1024	PF# 1	133.95	6092.08	6093.3	6093.3	6093.47	0.010085	4.55	45.6	102.48	0.76	0.24	0.69	0.23
Channel 01	1023	PF# 1	133.95	6090.81	6092.03	6092.03	6092.21	0.010101	4.56	45.51	102.22	0.76	0.23	0.7	0.24
Channel 01	1022	PF# 1	176.19	6089.55	6090.83	6090.83	6091.06	0.011961	5.15	52.14	105.59	0.84	0.3	0.87	0.33
Channel 01	1021	PF# 1	176.19	6088.29	6089.57	6089.57	6089.8	0.0122	5.2	51.82	105.71	0.84	0.31	0.89	0.33
Channel 01	1020	PF# 1	176.19	6087.03	6088.31	6088.31	6088.54	0.011972	5.15	52.09	105.18	0.84	0.32	0.87	0.31
Channel 01	1019	PF# 1	176.19	6085.77	6087.06	6087.06	6087.28	0.011306	5.03	53.25	106.37	0.81	0.32	0.83	0.29
Channel 01	1018	PF# 1	176.19	6084.51	6085.8	6085.8	6086.02	0.011296	5.03	53.28	106.46	0.81	0.32	0.83	0.29
Channel 01	1017	PF# 1	176.19	6083.24	6084.53	6084.53	6084.76	0.012168	5.21	52.71	111.13	0.84	0.31	0.89	0.31
Channel 01	1016	PF# 1	176.19	6081.98	6083.27	6083.27	6083.49	0.011708	5.12	53.26	110.17	0.83	0.3	0.86	0.3
Channel 01	1015	PF# 1	176.19	6080.72	6082.01	6082.01	6082.23	0.011511	5.07	53.11	107.49	0.82	0.29	0.85	0.32
Channel 01	1014	PF# 1	176.19	6079.46	6080.75	6080.75	6080.97	0.011914	5.15	53.15	111.31	0.83	0.3	0.87	0.3
Channel 01	1013	PF# 1	176.19	6078.2	6079.5	6079.5	6079.7	0.010818	4.94	54.36	108.28	0.8	0.3	0.8	0.28
Channel 01	1012	PF# 1	176.19	6076.93	6078.23	6078.23	6078.44	0.010932	4.97	53.87	106.57	0.8	0.31	0.81	0.28
Channel 01	1011	PF# 1	209.12	6075.67	6077.03	6077.03	6077.26	0.011903	5.35	60.63	118.05	0.84	0.33	0.92	0.33
Channel 01	1010	PF# 1	209.12	6074.41	6075.76	6075.76	6076	0.011746	5.28	58.28	103.5	0.83	0.35	0.9	0.37
Channel 01	1009	PF# 1	209.12	6073.15	6074.5	6074.5	6074.73	0.01158	5.24	58.21	101.66	0.83	0.36	0.89	0.36
Channel 01	1008	PF# 1	209.12	6071.89	6073.24	6073.24	6073.47	0.011538	5.24	58.64	103.55	0.83	0.36	0.89	0.35
Channel 01	1007	PF# 1	209.12	6070.63	6072.14	6072.14	6072.27	0.005284	3.84	75.31	104.19	0.57	0.22	0.46	0.21
Channel 01	1001	PF# 1	209.12	6065.2	6072.11	6066.56	6072.13	0.000066	1.25	176.16	27.4	0.08	0	0.03	0
Channel 01	1000.65		Culvert												
Channel 01	1000	PF# 1	209.12	6042.98	6044.05	6044.05	6044.46	0.01672	5.57	40.89	49.88	0.97	0.78	1.07	0.78

Trails at Overland Ranch HEC RAS Model Output Table (High N Value)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Shear LOB (lb/sq ft)	Shear Chan (lb/sq ft)	Shear ROB (lb/sq ft)
Channel 01	1037	PF# 1	117.35	6108.48	6109.69		6109.82	0.025178	3.58	43.07	96.71	0.6	0.55	1.73	0.6
Channel 01	1036	PF# 1	117.35	6107.22	6108.42		6108.55	0.025554	3.59	43.44	100.22	0.6	0.57	1.73	0.58
Channel 01	1035	PF# 1	117.35	6105.95	6107.16		6107.28	0.02419	3.5	44.22	100.23	0.59	0.56	1.65	0.55
Channel 01	1034	PF# 1	117.35	6104.69	6105.89		6106.02	0.025933	3.61	43.21	100.15	0.61	0.58	1.76	0.58
Channel 01	1033	PF# 1	117.35	6103.43	6104.64		6104.76	0.023991	3.49	44.33	100.24	0.58	0.55	1.64	0.55
Channel 01	1032	PF# 1	117.35	6102.17	6103.36		6103.49	0.026601	3.64	42.96	100.78	0.61	0.58	1.79	0.59
Channel 01	1031	PF# 1	117.35	6100.91	6102.12		6102.24	0.02857	3.41	45.06	100.32	0.57	0.54	1.56	0.54
Channel 01	1030	PF# 1	133.95	6099.65	6100.88		6101.02	0.025938	3.68	47.11	100.48	0.61	0.64	1.81	0.64
Channel 01	1029	PF# 1	133.95	6098.38	6099.63		6099.76	0.024132	3.58	48.19	100.54	0.59	0.61	1.71	0.61
Channel 01	1028	PF# 1	133.95	6097.12	6098.36		6098.49	0.026079	3.7	47	100.45	0.61	0.64	1.83	0.64
Channel 01	1027	PF# 1	133.95	6095.86	6097.11		6097.24	0.0238	3.56	48.4	100.56	0.59	0.6	1.69	0.61
Channel 01	1026	PF# 1	133.95	6094.6	6095.83	6095.77	6095.97	0.026724	3.74	47.07	103.33	0.62	0.66	1.87	0.62
Channel 01	1025	PF# 1	133.95	6093.34	6094.59		6094.72	0.023237	3.52	48.79	100.63	0.58	0.6	1.65	0.6
Channel 01	1024	PF# 1	133.95	6092.08	6093.31	6093.24	6093.45	0.027664	3.79	46.5	102.96	0.63	0.67	1.92	0.64
Channel 01	1023	PF# 1	133.95	6090.81	6092.08	6091.98	6092.2	0.021246	3.41	50.87	105.05	0.56	0.52	1.53	0.57
Channel 01	1022	PF# 1	176.19	6089.55	6090.89		6091.04	0.024709	3.82	58.26	108.65	0.6	0.68	1.89	0.76
Channel 01	1021	PF# 1	176.19	6088.29	6089.63		6089.78	0.025274	3.86	57.89	108.91	0.61	0.68	1.93	0.77
Channel 01	1020	PF# 1	176.19	6087.03	6088.37		6088.52	0.024945	3.83	57.66	105.96	0.61	0.75	1.9	0.72
Channel 01	1019	PF# 1	176.19	6085.77	6087.1		6087.26	0.025362	3.86	57.82	108.81	0.61	0.78	1.93	0.69
Channel 01	1018	PF# 1	176.19	6084.51	6085.85		6086	0.02477	3.82	58.28	108.94	0.61	0.76	1.89	0.68
Channel 01	1017	PF# 1	176.19	6083.24	6084.59		6084.74	0.025408	3.89	59.22	116.74	0.61	0.7	1.95	0.69
Channel 01	1016	PF# 1	176.19	6081.98	6083.33		6083.47	0.024556	3.82	59.2	112.94	0.6	0.68	1.89	0.71
Channel 01	1015	PF# 1	176.19	6080.72	6082.06		6082.21	0.025617	3.88	57.89	110.32	0.62	0.68	1.95	0.78
Channel 01	1014	PF# 1	176.19	6079.46	6080.81		6080.95	0.024406	3.81	59.9	116.15	0.6	0.67	1.88	0.69
Channel 01	1013	PF# 1	176.19	6078.2	6079.53		6079.68	0.026019	3.89	57.61	109.92	0.62	0.77	1.97	0.71
Channel 01	1012	PF# 1	176.19	6076.93	6078.28	6078.2	6078.43	0.023675	3.75	59.14	109.15	0.59	0.74	1.82	0.65
Channel 01	1011	PF# 1	209.12	6075.67	6077.1		6077.25	0.022991	3.86	69.15	122.52	0.59	0.7	1.88	0.73
Channel 01	1010	PF# 1	209.12	6074.41	6075.79	6075.72	6075.97	0.027743	4.13	61.68	104.19	0.64	0.88	2.18	0.92
Channel 01	1009	PF# 1	209.12	6073.15	6074.58		6074.74	0.020573	3.66	67.35	102.88	0.56	0.75	1.69	0.74
Channel 01	1008	PF# 1	209.12	6071.89	6073.23	6073.2	6073.44	0.033418	4.44	58.09	103.44	0.7	1.04	2.56	1
Channel 01	1007	PF# 1	209.12	6070.63	6072.25		6072.34	0.009208	2.67	86.7	105.03	0.38	0.44	0.86	0.43
Channel 01	1001	PF# 1	209.12	6065.2	6072.11	6066.56	6072.13	0.000262	1.24	176.17	27.4	0.08	0.01	0.11	0.01
Channel 01	1000.65		Culvert												
Channel 01	1000	PF# 1	209.12	6042.98	6044.05	6044.05	6044.46	0.047157	4.66	40.63	49.88	0.81	2.2	2.99	2.2



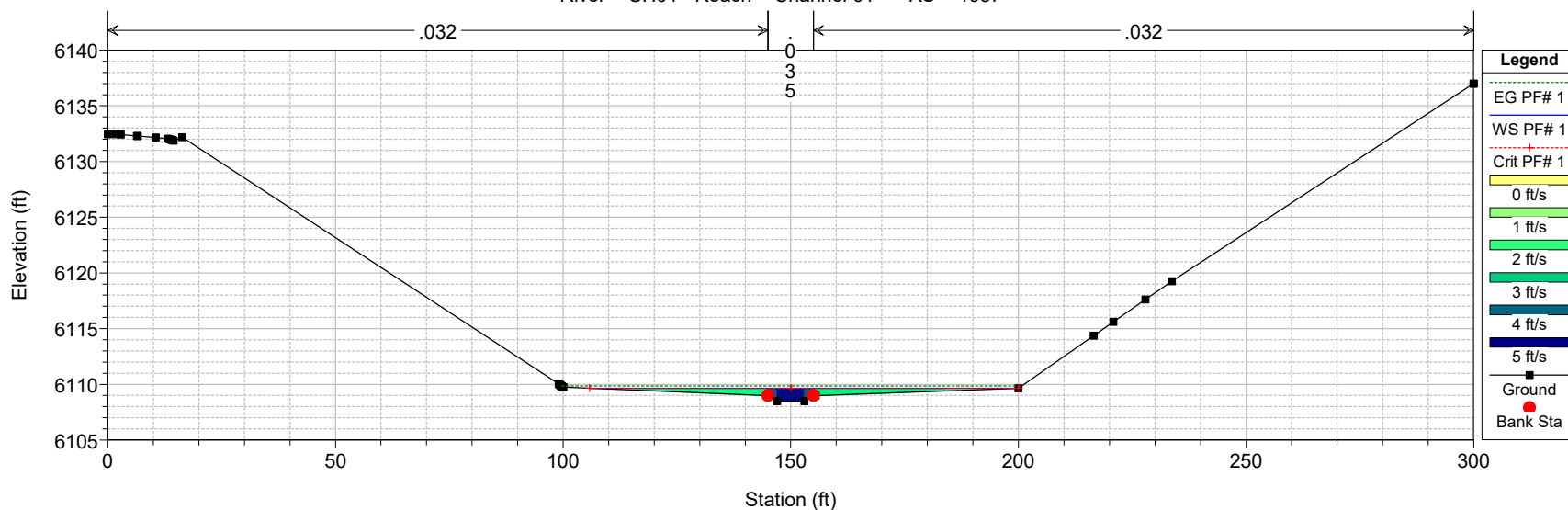




# LOW MANNINGS VALUE MODEL

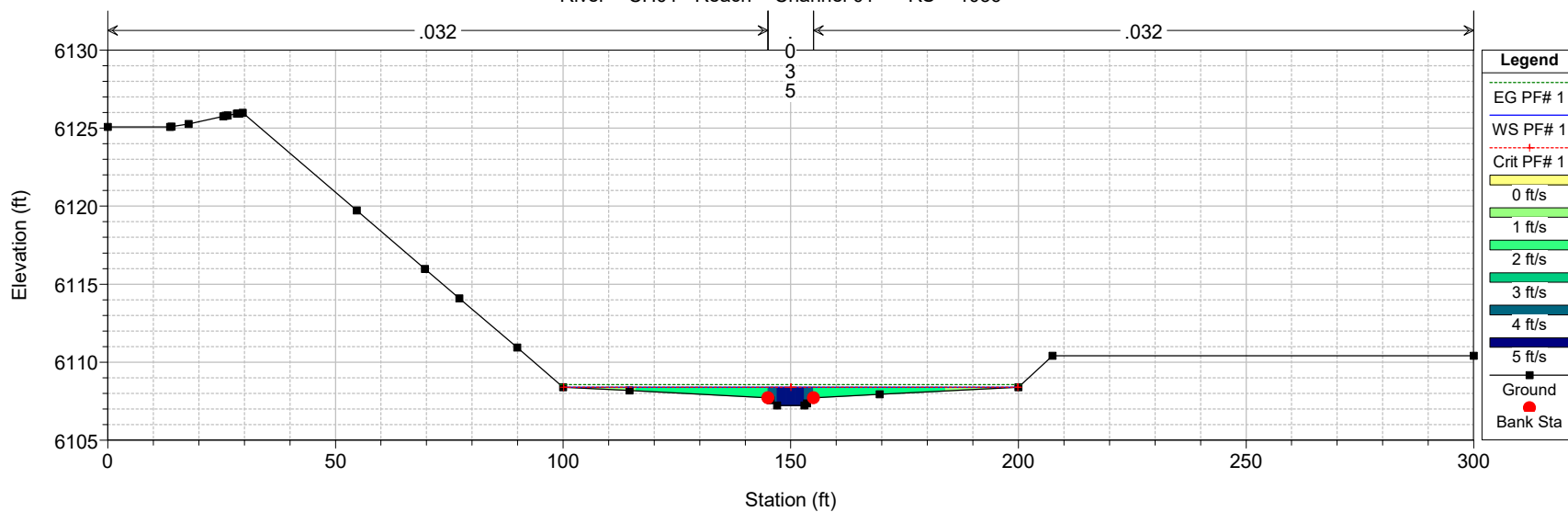
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1037



HEC-RAS Model Plan: Default Scenario 2/14/2024

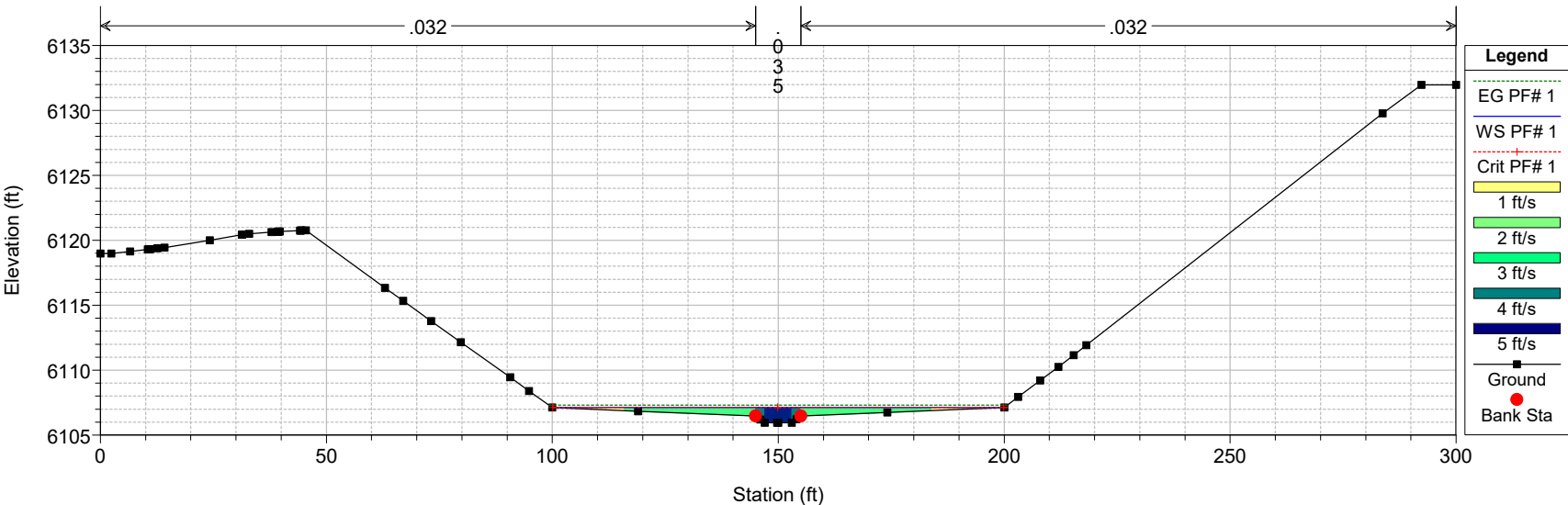
River = CH01 Reach = Channel 01 RS = 1036



LOW MANNINGS VALUE MODEL

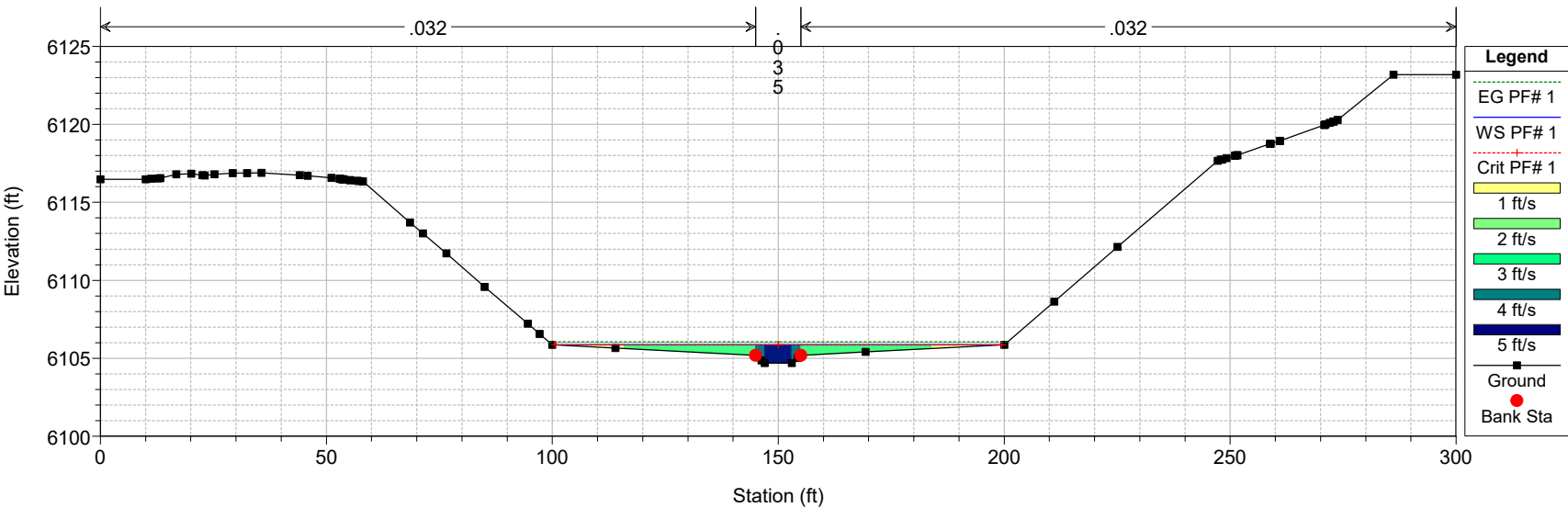
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1035



HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1034

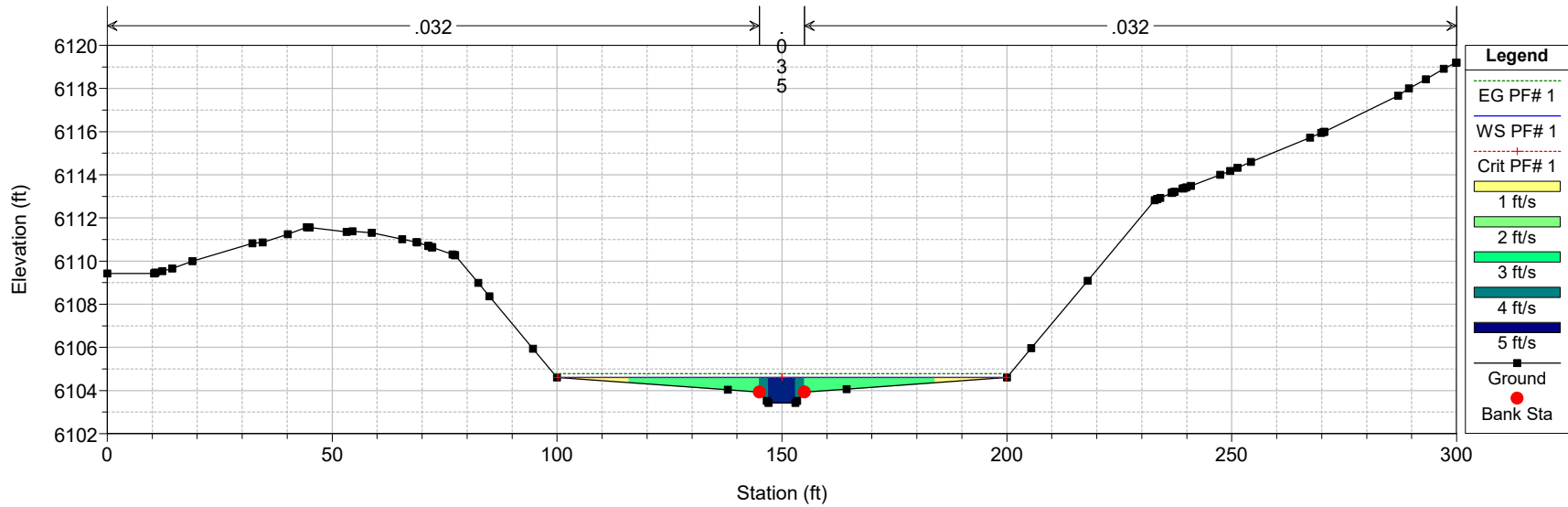




# LOW MANNINGS VALUE MODEL

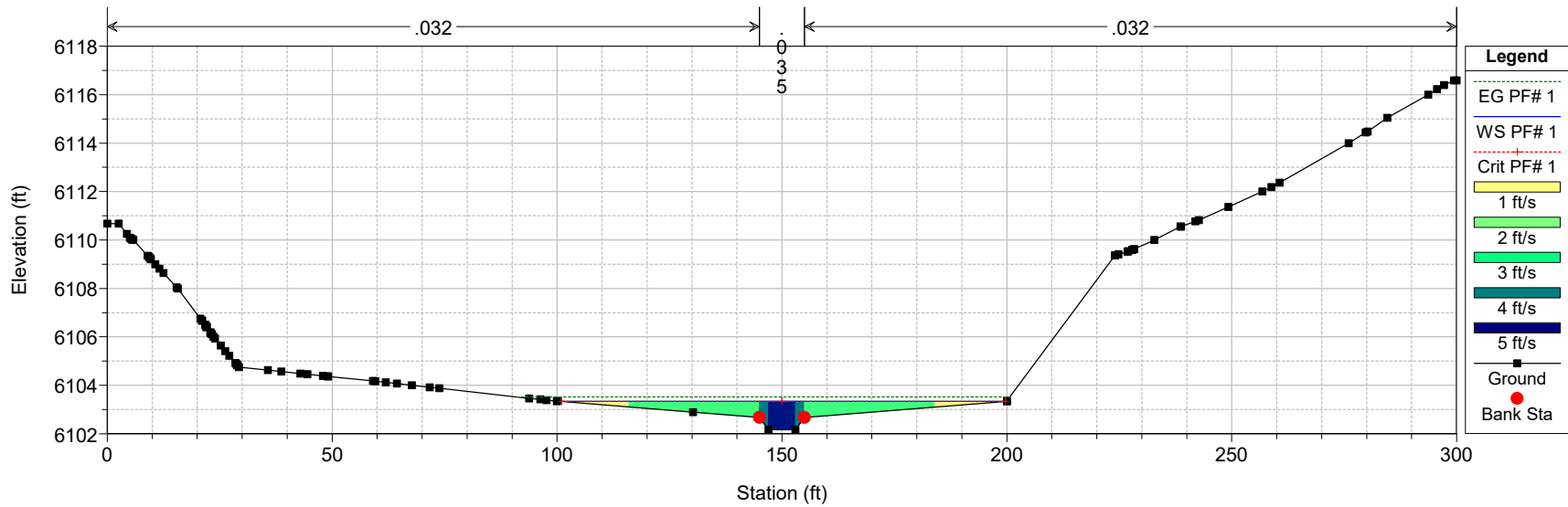
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1033



HEC-RAS Model Plan: Default Scenario 2/14/2024

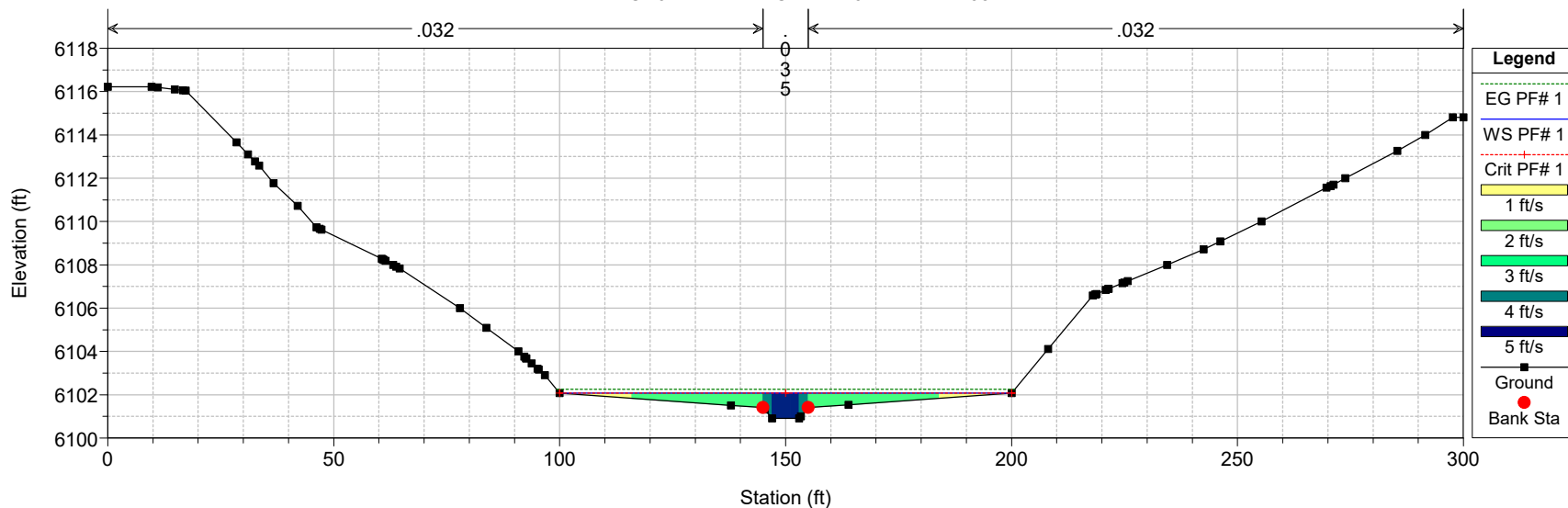
River = CH01 Reach = Channel 01 RS = 1032



# LOW MANNINGS VALUE MODEL

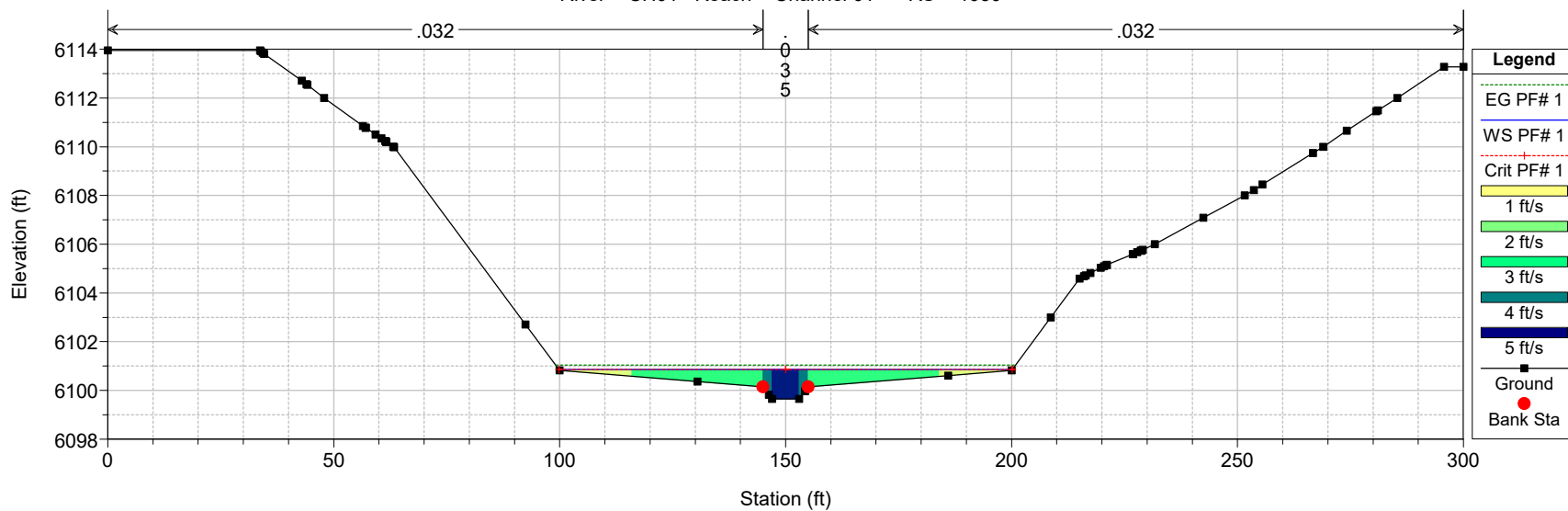
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1031



HEC-RAS Model Plan: Default Scenario 2/14/2024

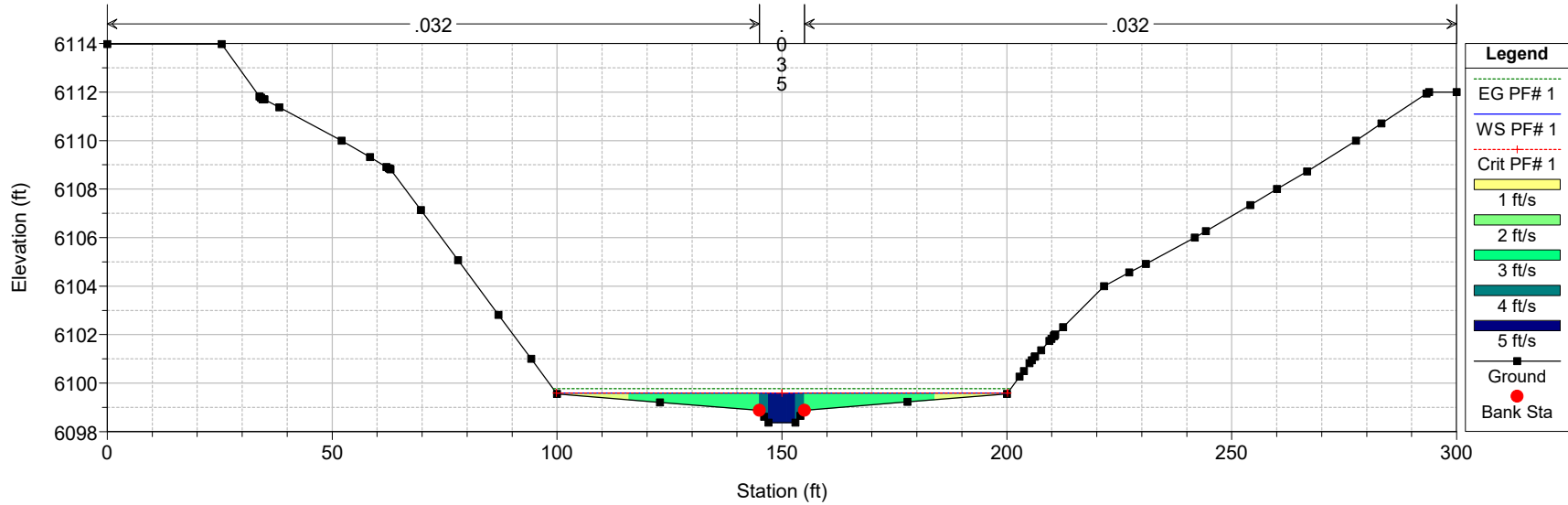
River = CH01 Reach = Channel 01 RS = 1030



# LOW MANNINGS VALUE MODEL

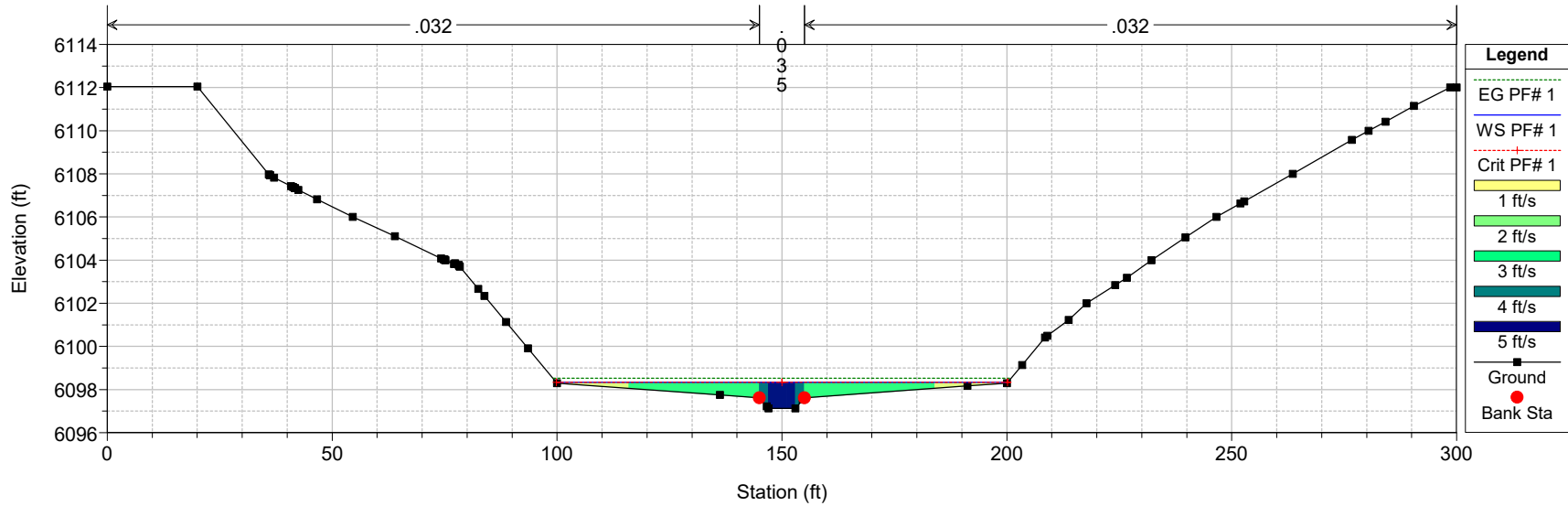
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1029

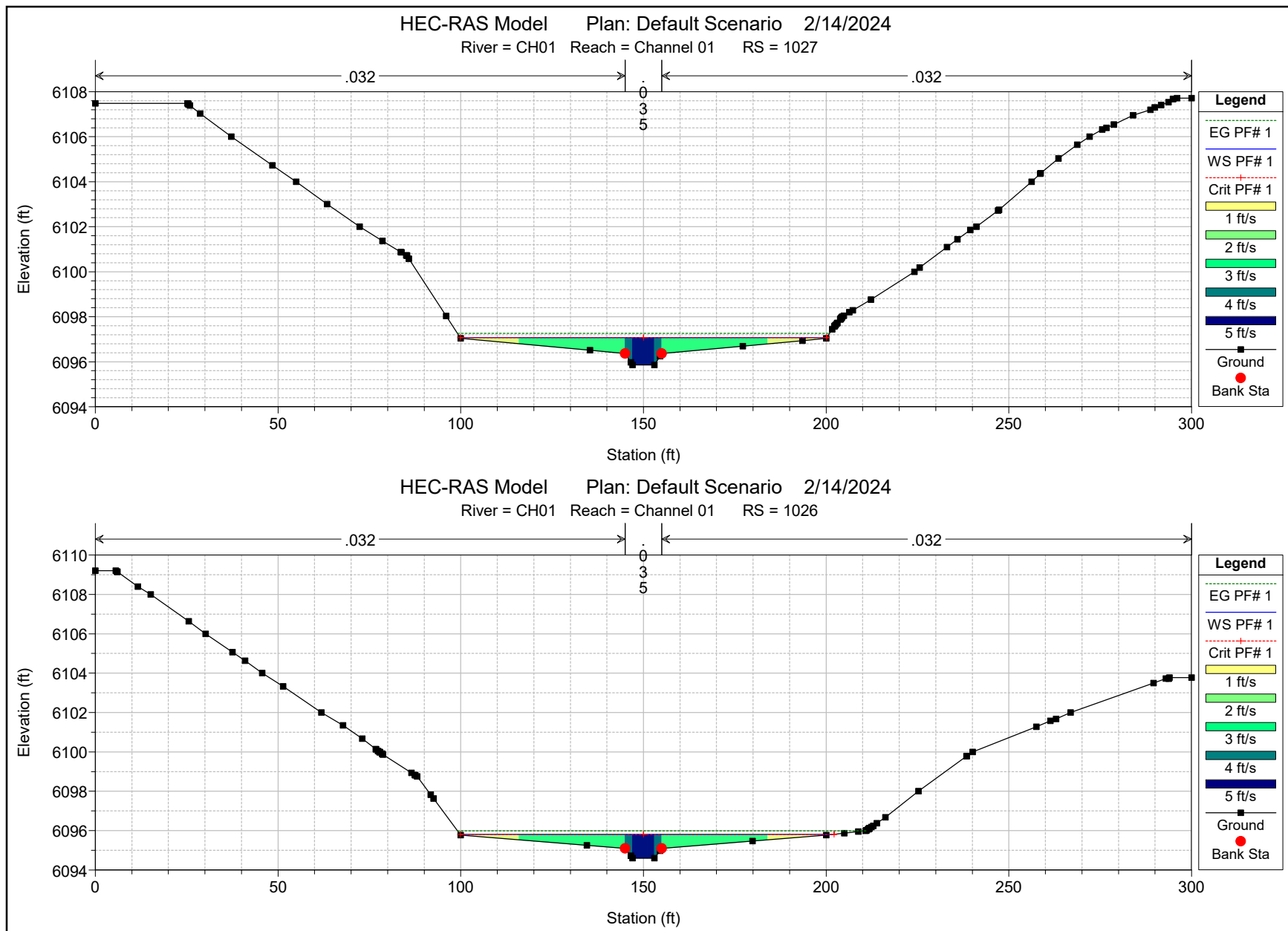


HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1028



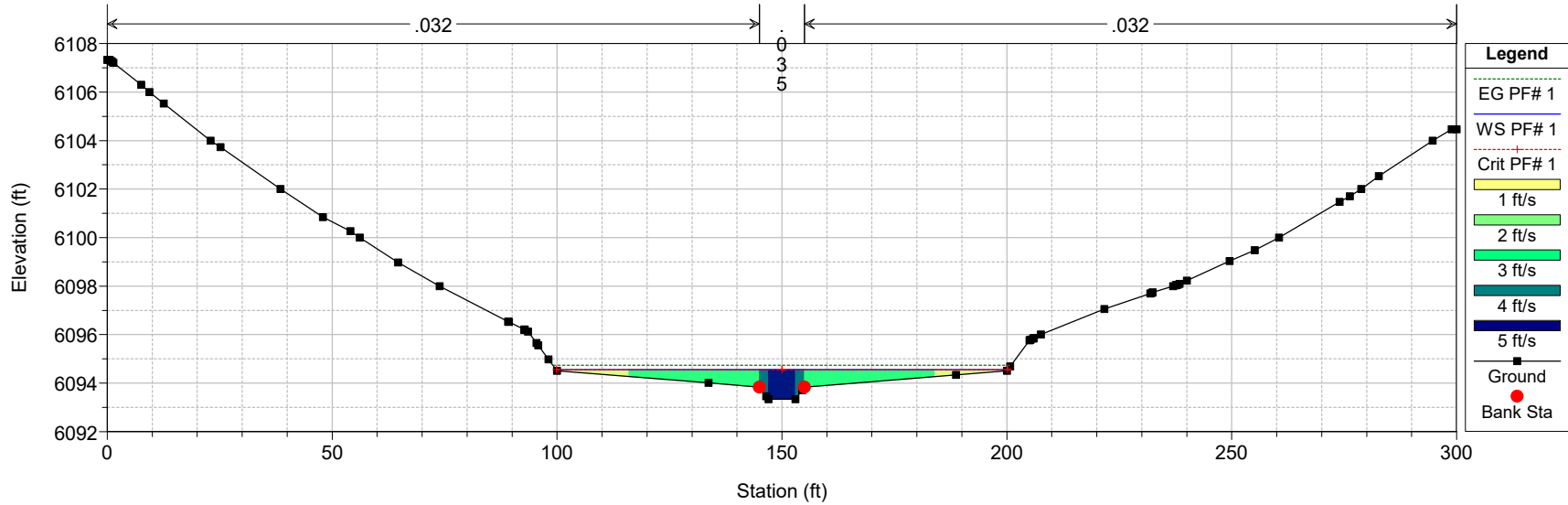
### LOW MANNINGS VALUE MODEL



# LOW MANNINGS VALUE MODEL

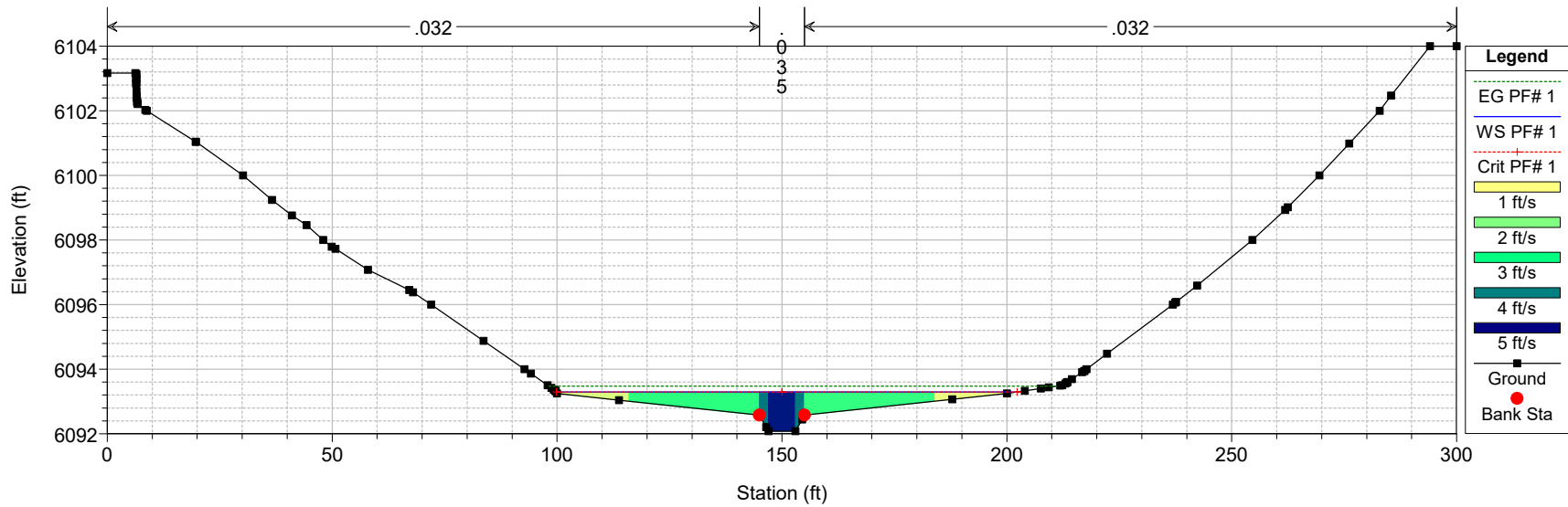
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1025



HEC-RAS Model Plan: Default Scenario 2/14/2024

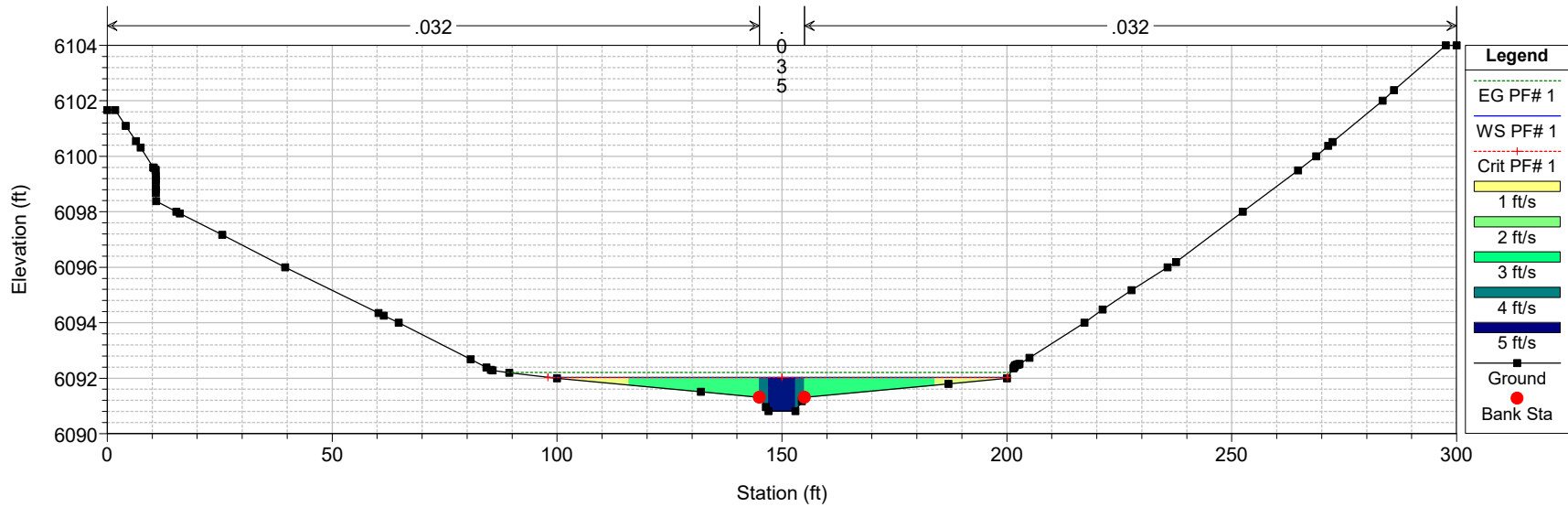
River = CH01 Reach = Channel 01 RS = 1024



# LOW MANNINGS VALUE MODEL

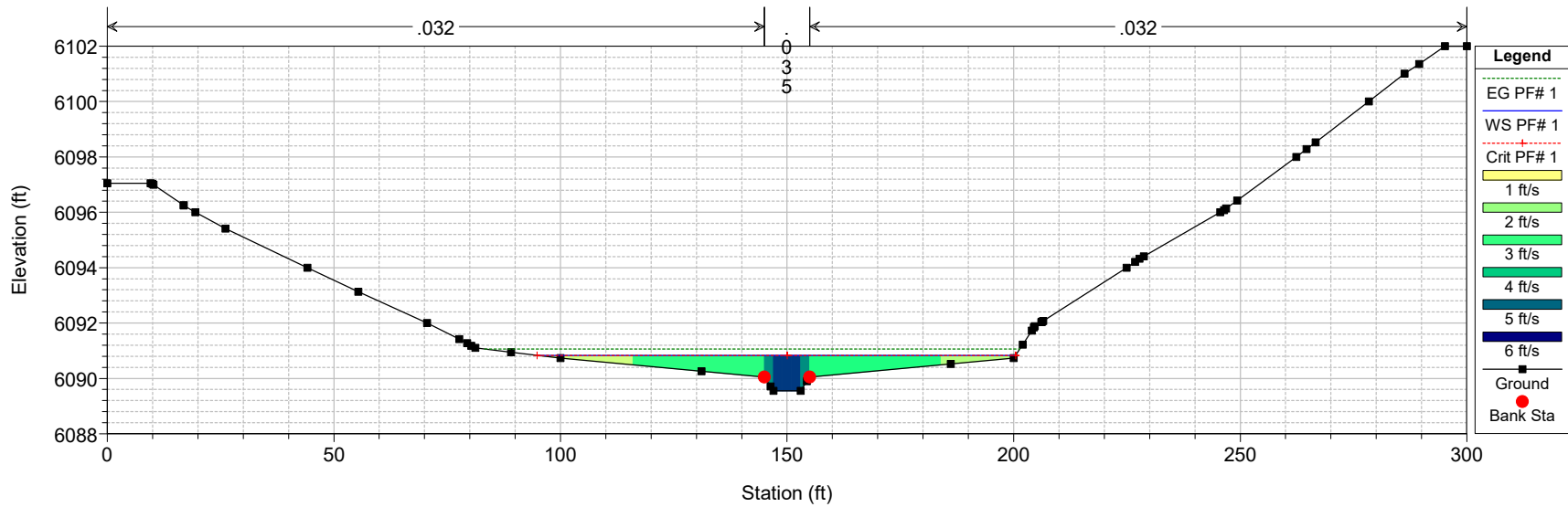
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1023



HEC-RAS Model Plan: Default Scenario 2/14/2024

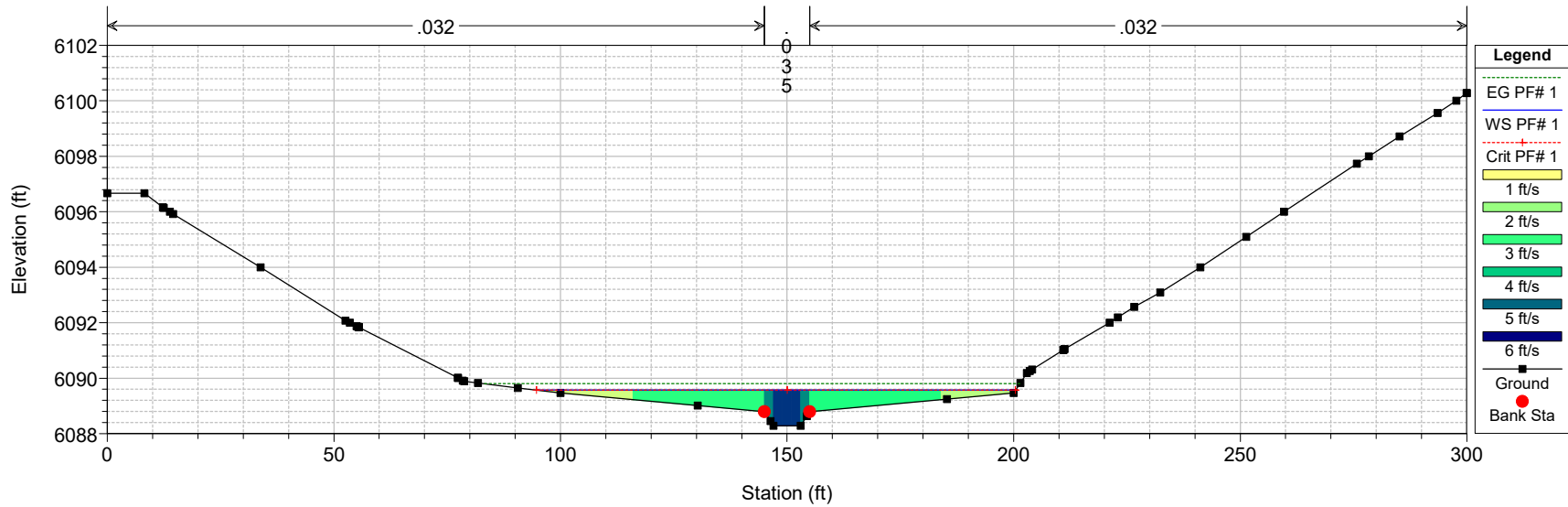
River = CH01 Reach = Channel 01 RS = 1022



# LOW MANNINGS VALUE MODEL

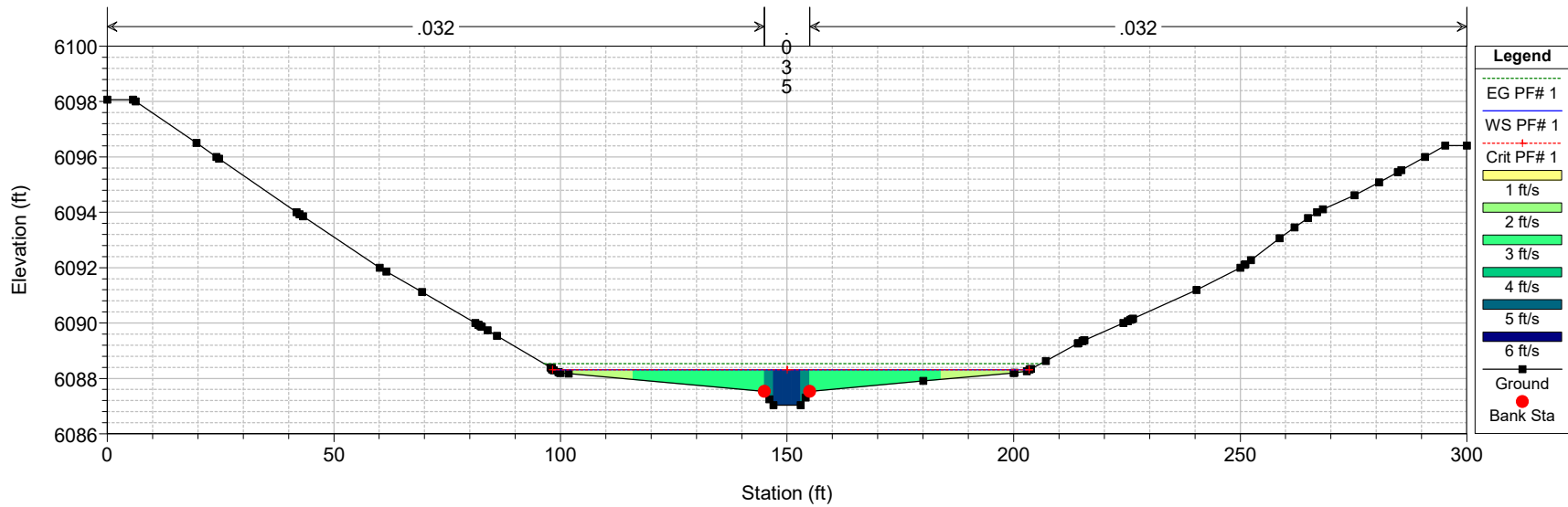
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1021



HEC-RAS Model Plan: Default Scenario 2/14/2024

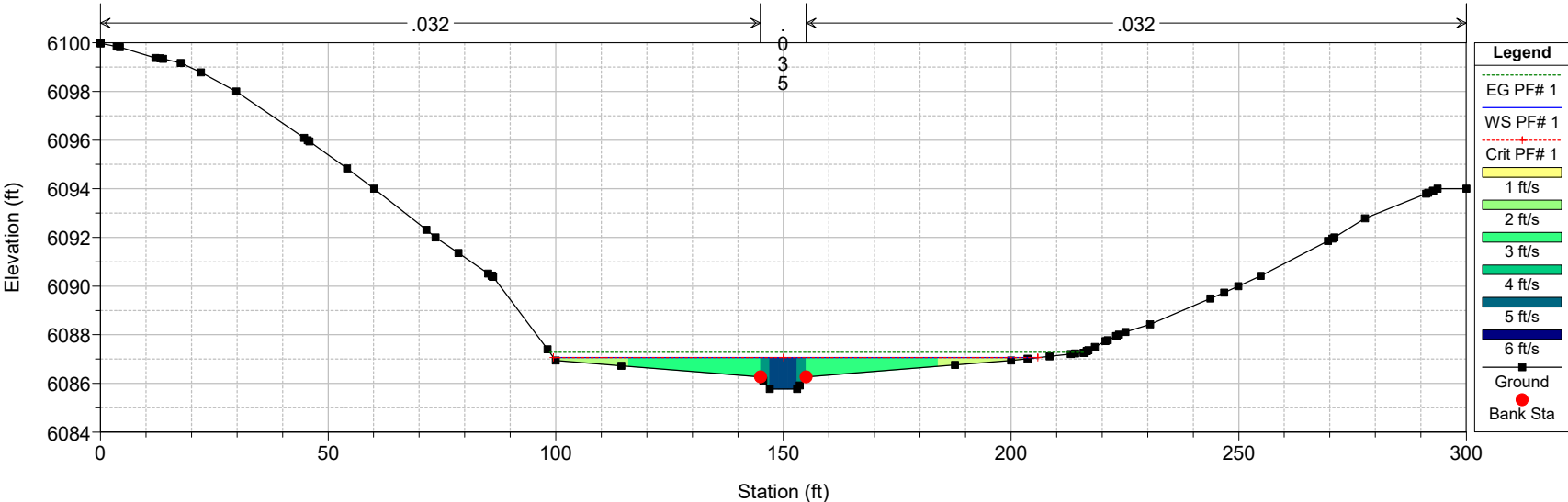
River = CH01 Reach = Channel 01 RS = 1020



LOW MANNINGS VALUE MODEL

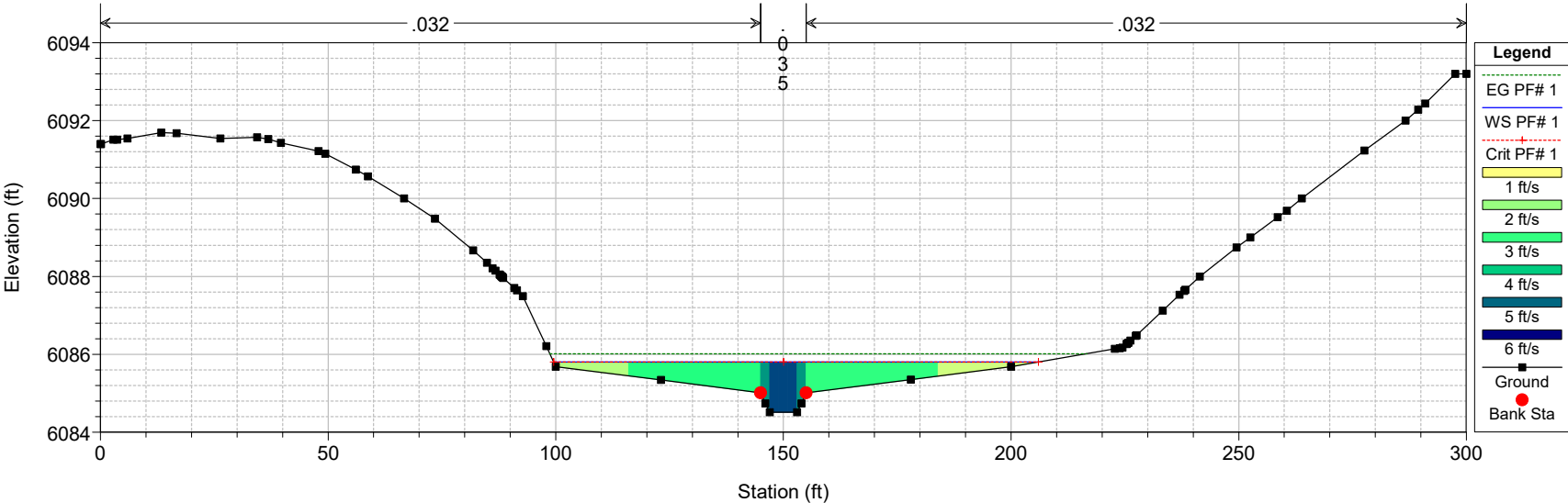
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1019



HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1018

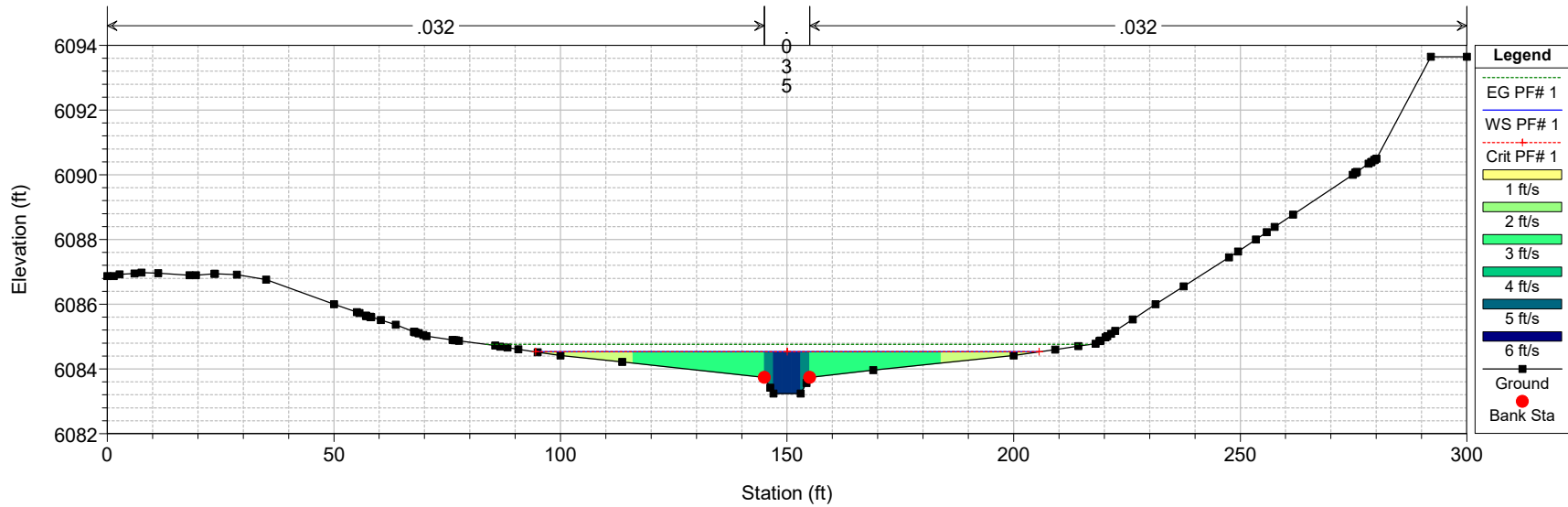




# LOW MANNINGS VALUE MODEL

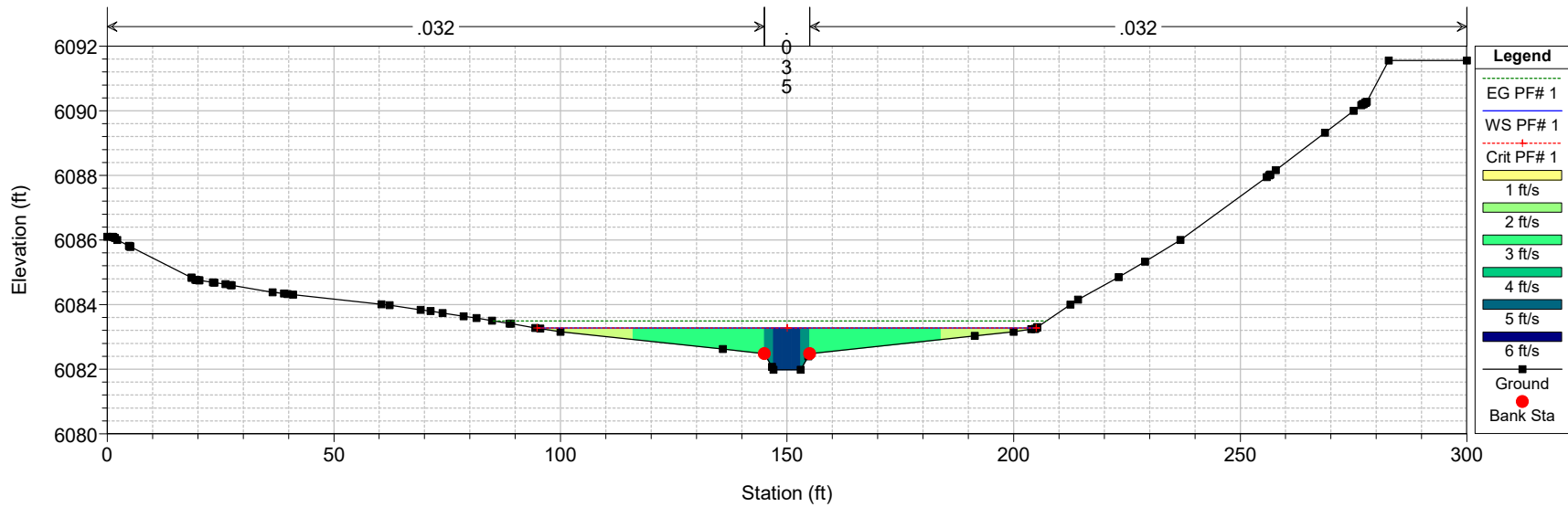
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1017



HEC-RAS Model Plan: Default Scenario 2/14/2024

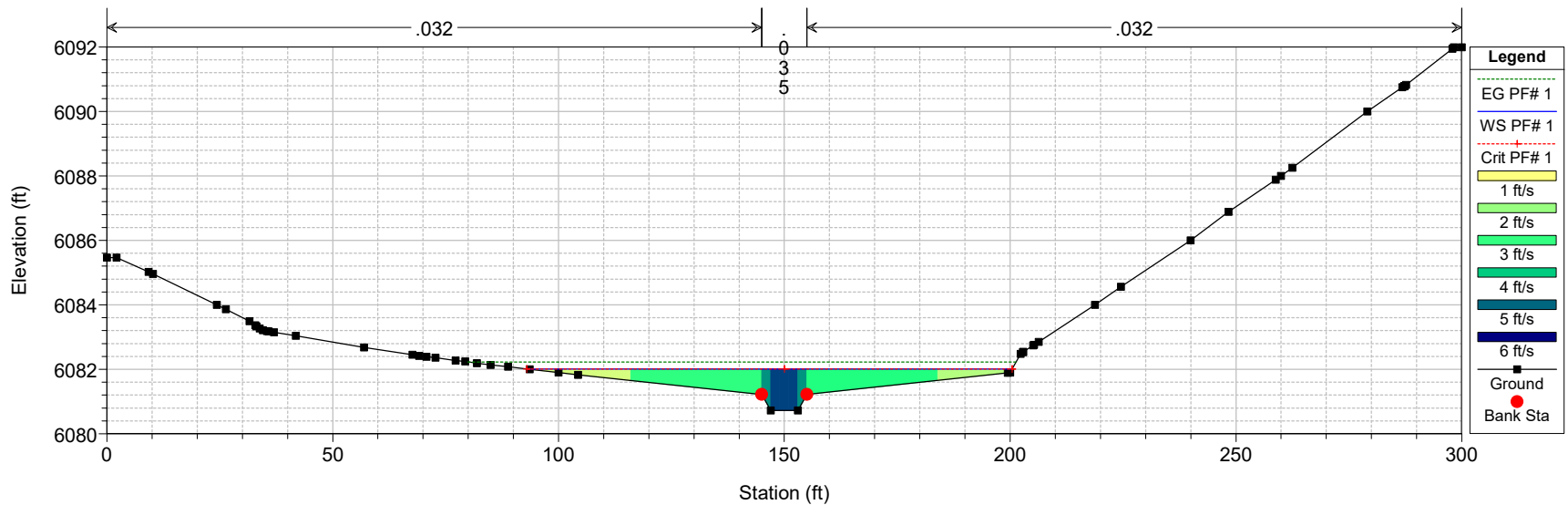
River = CH01 Reach = Channel 01 RS = 1016



# LOW MANNINGS VALUE MODEL

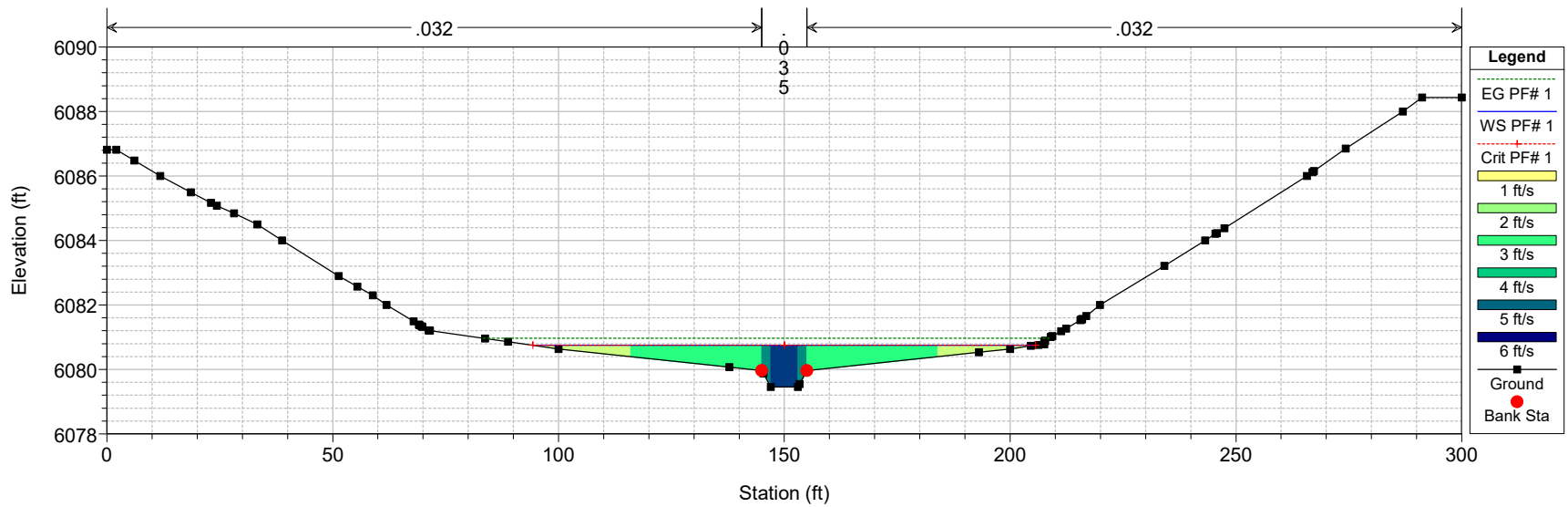
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1015



HEC-RAS Model Plan: Default Scenario 2/14/2024

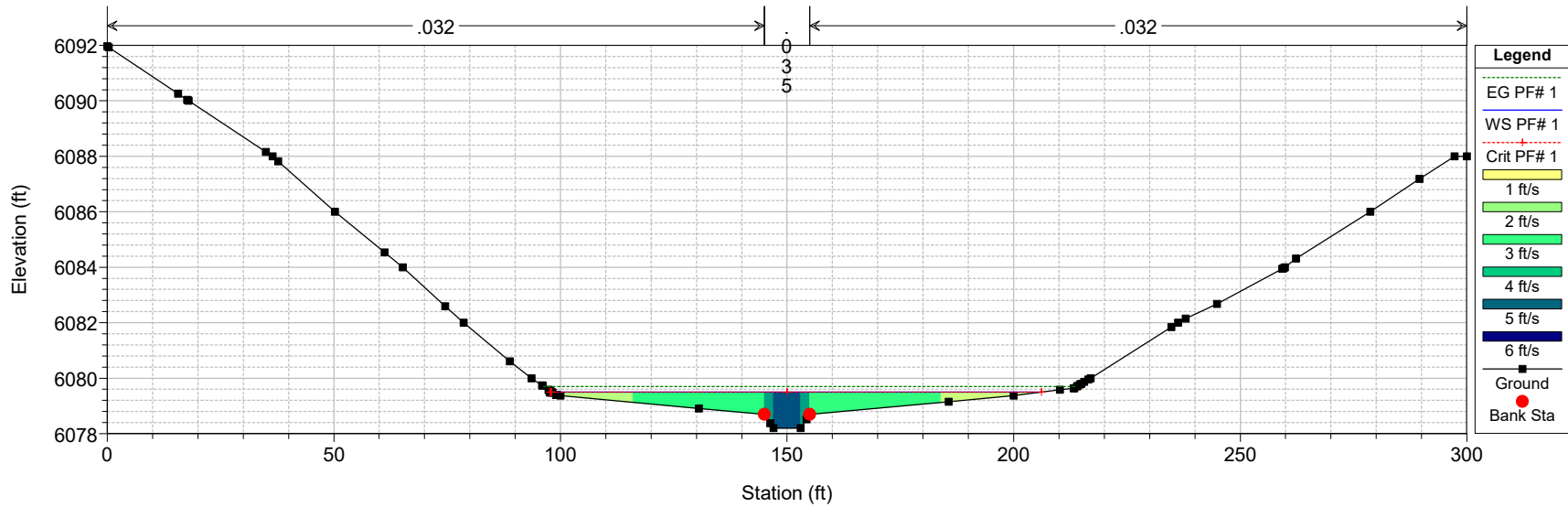
River = CH01 Reach = Channel 01 RS = 1014



# LOW MANNINGS VALUE MODEL

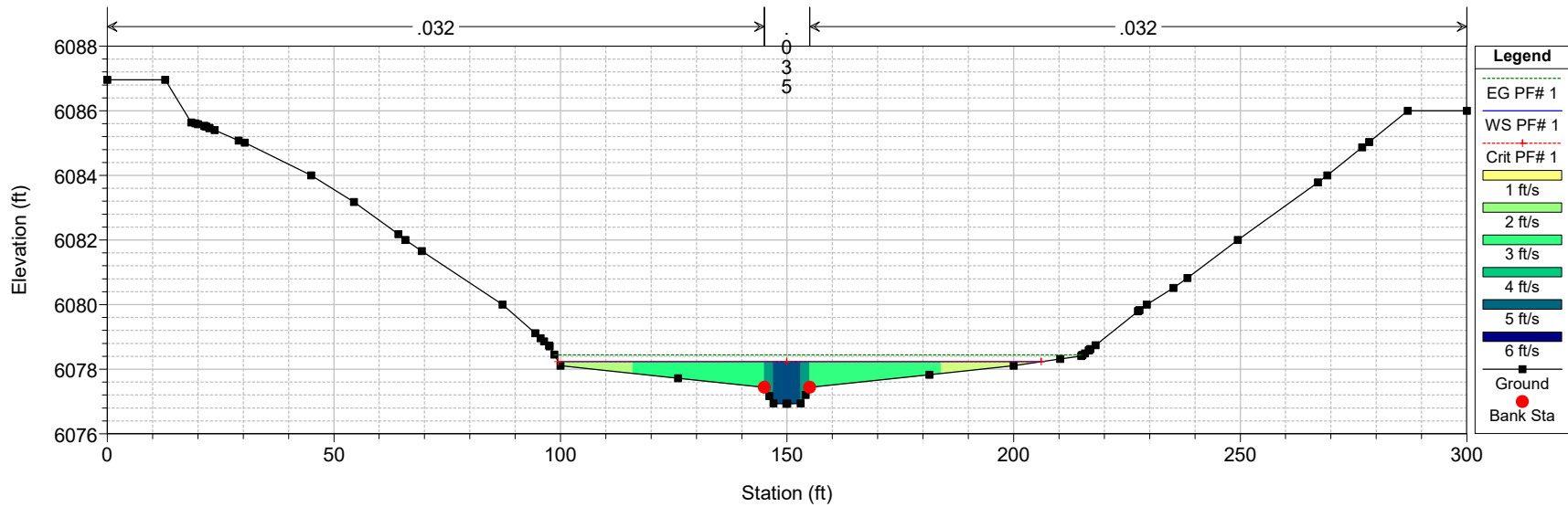
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1013



HEC-RAS Model Plan: Default Scenario 2/14/2024

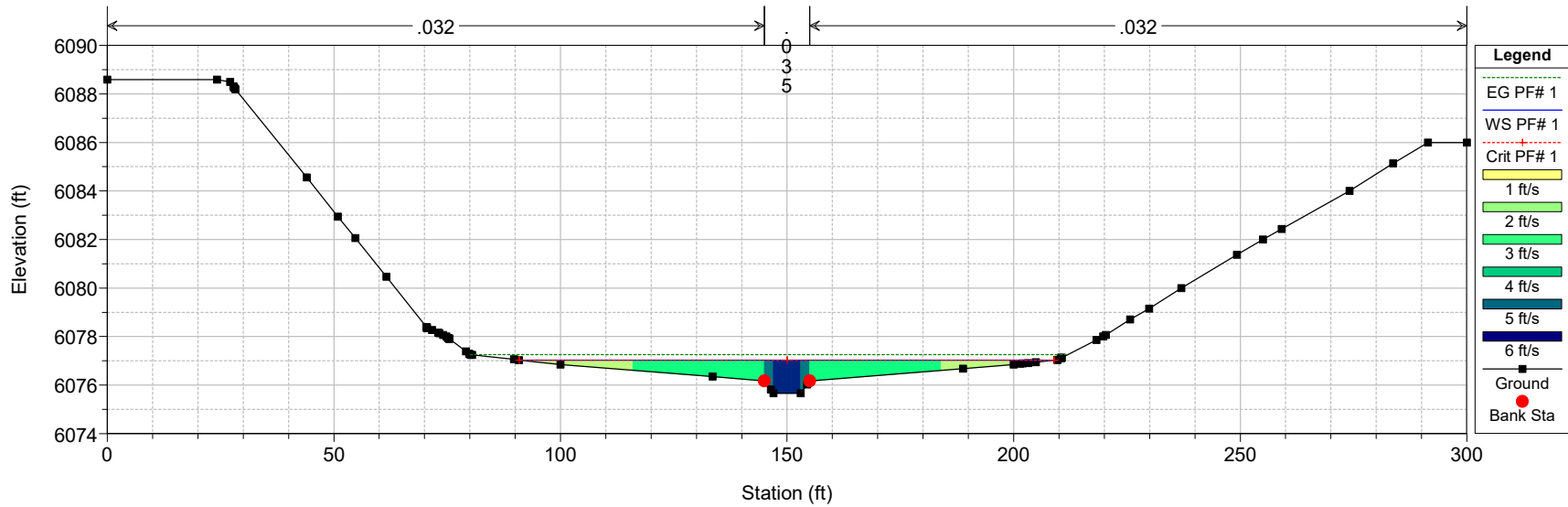
River = CH01 Reach = Channel 01 RS = 1012



# LOW MANNINGS VALUE MODEL

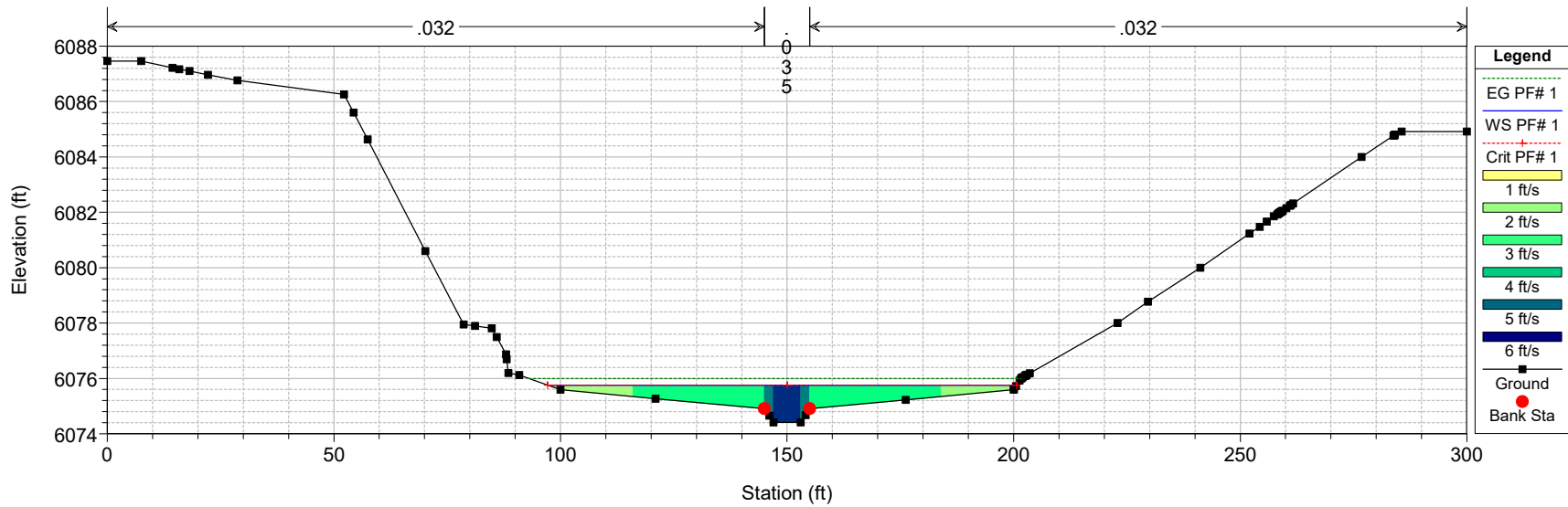
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1011



HEC-RAS Model Plan: Default Scenario 2/14/2024

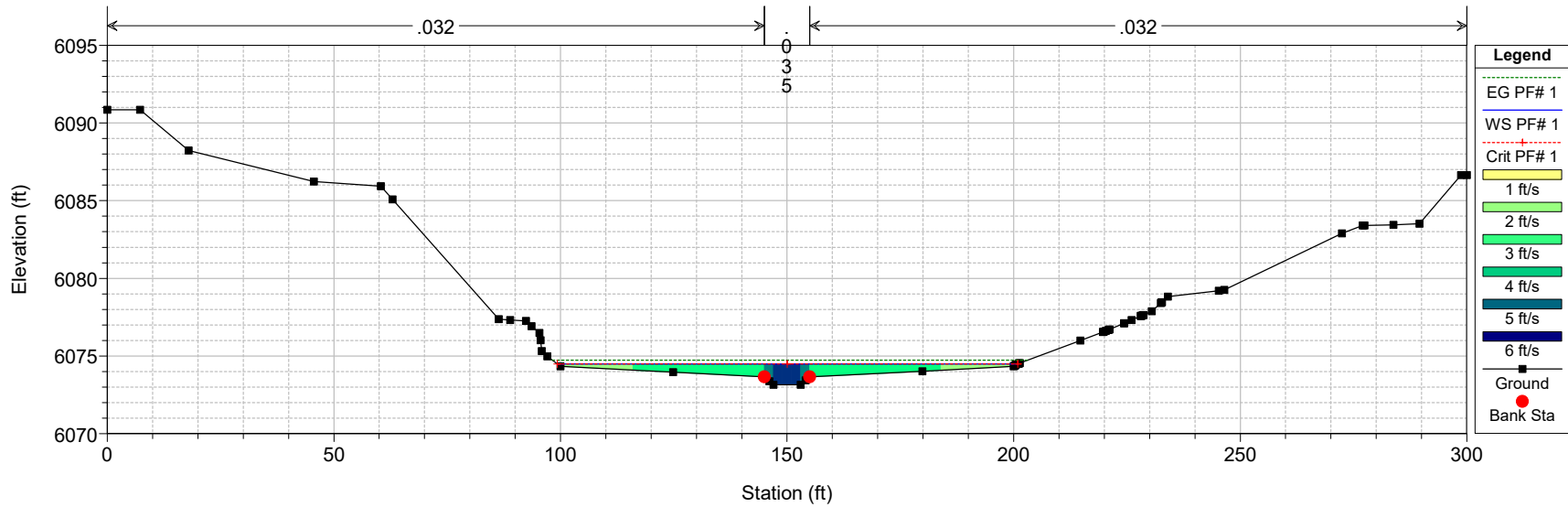
River = CH01 Reach = Channel 01 RS = 1010



# LOW MANNINGS VALUE MODEL

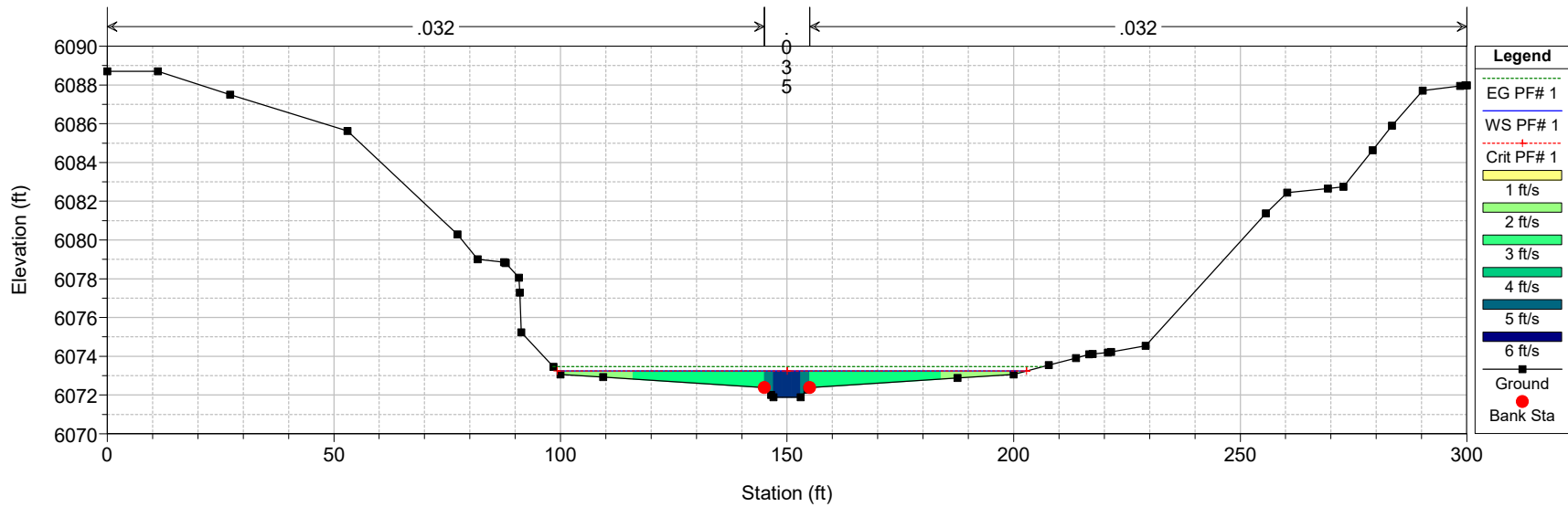
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1009



HEC-RAS Model Plan: Default Scenario 2/14/2024

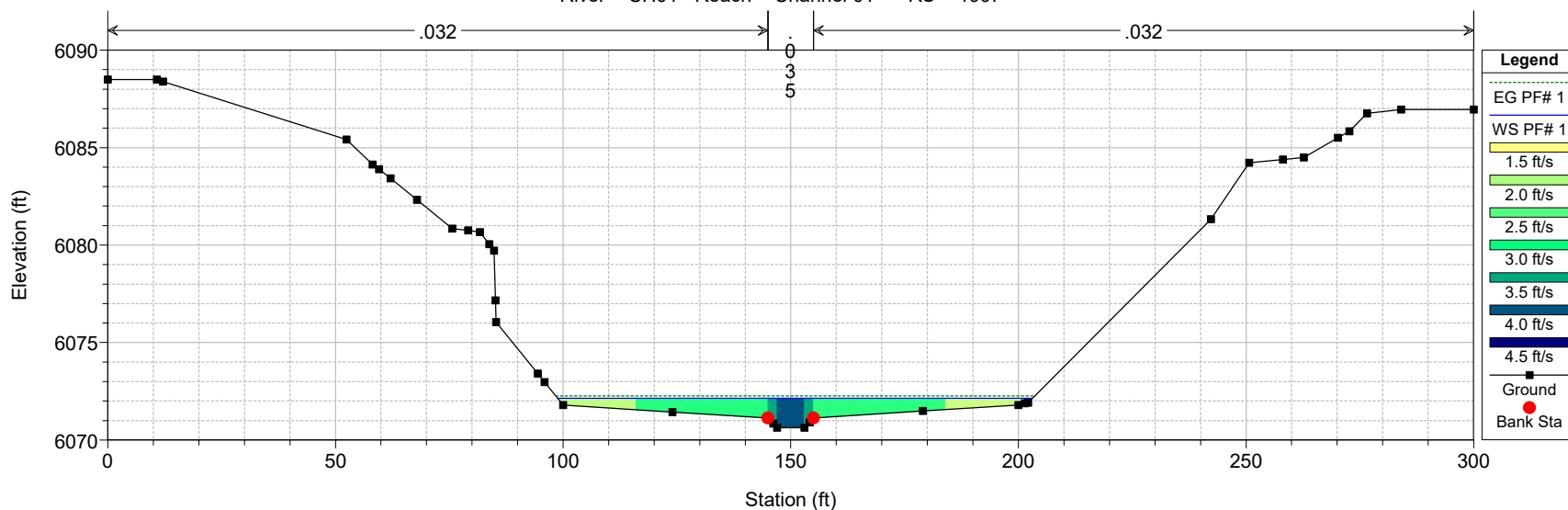
River = CH01 Reach = Channel 01 RS = 1008



# LOW MANNINGS VALUE MODEL

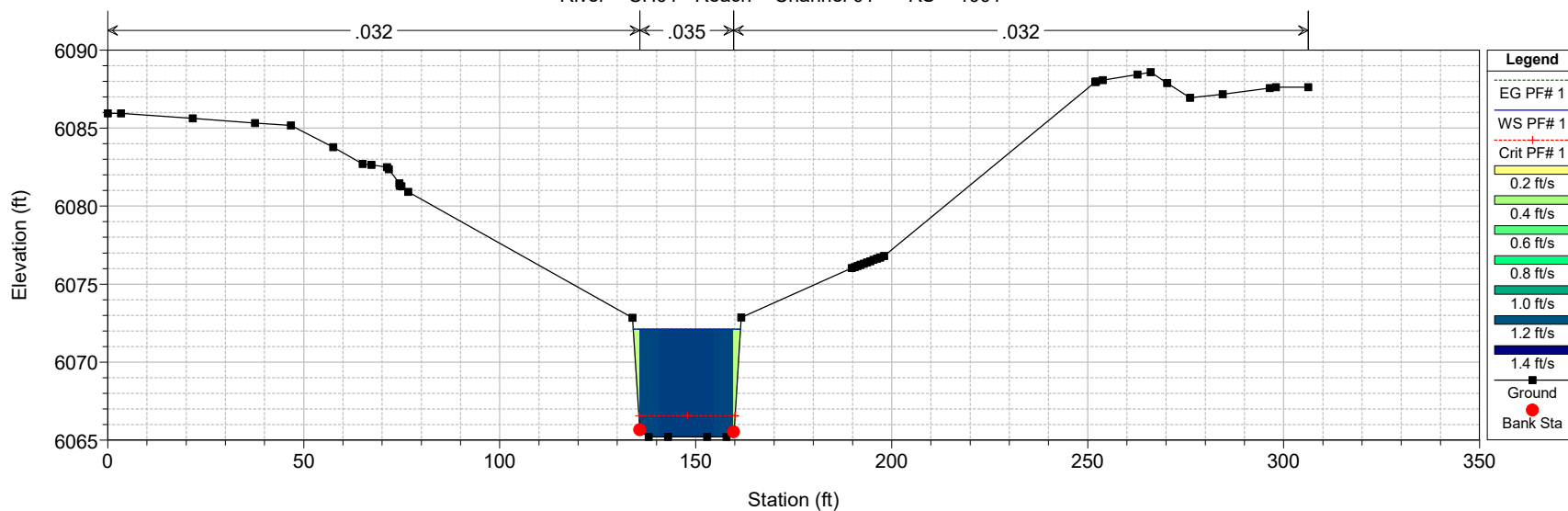
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1007



HEC-RAS Model Plan: Default Scenario 2/14/2024

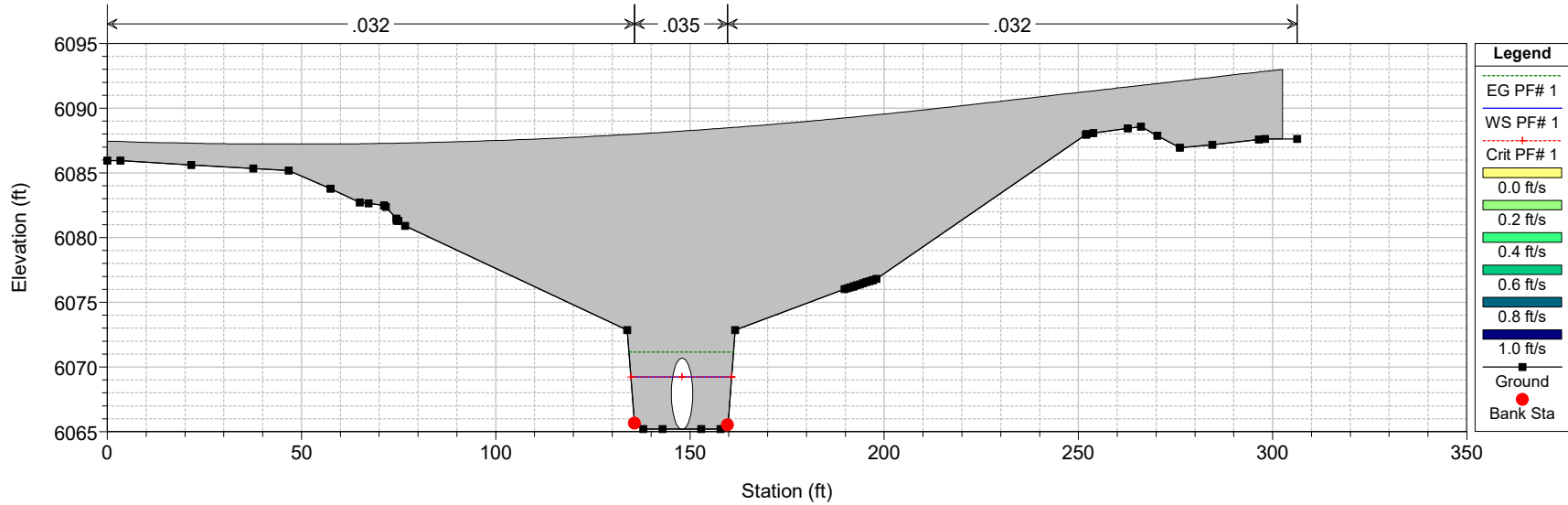
River = CH01 Reach = Channel 01 RS = 1001



# LOW MANNINGS VALUE MODEL

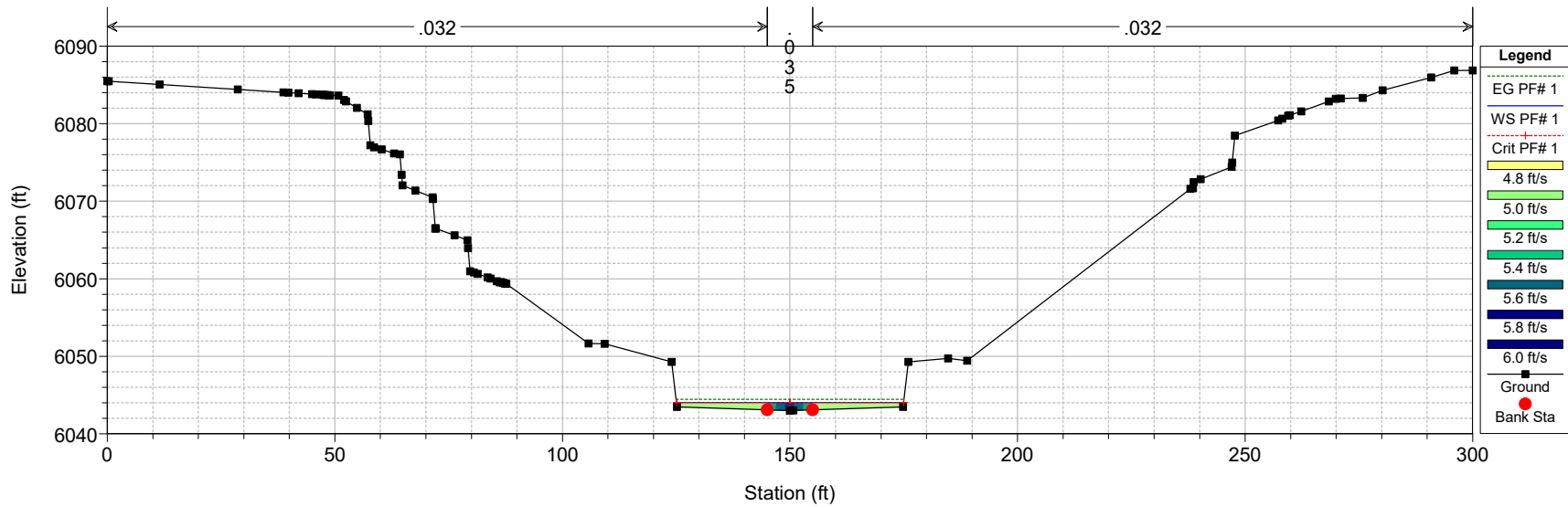
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1000.65 Culv



HEC-RAS Model Plan: Default Scenario 2/14/2024

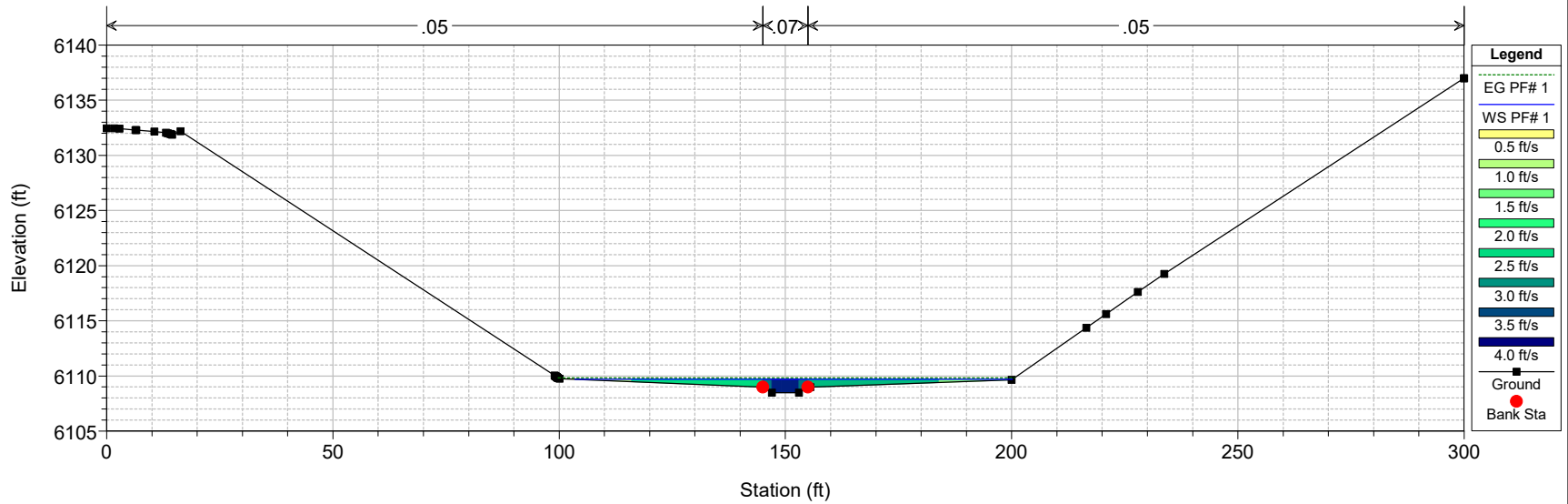
River = CH01 Reach = Channel 01 RS = 1000



# HIGH MANNINGS VALUE MODEL

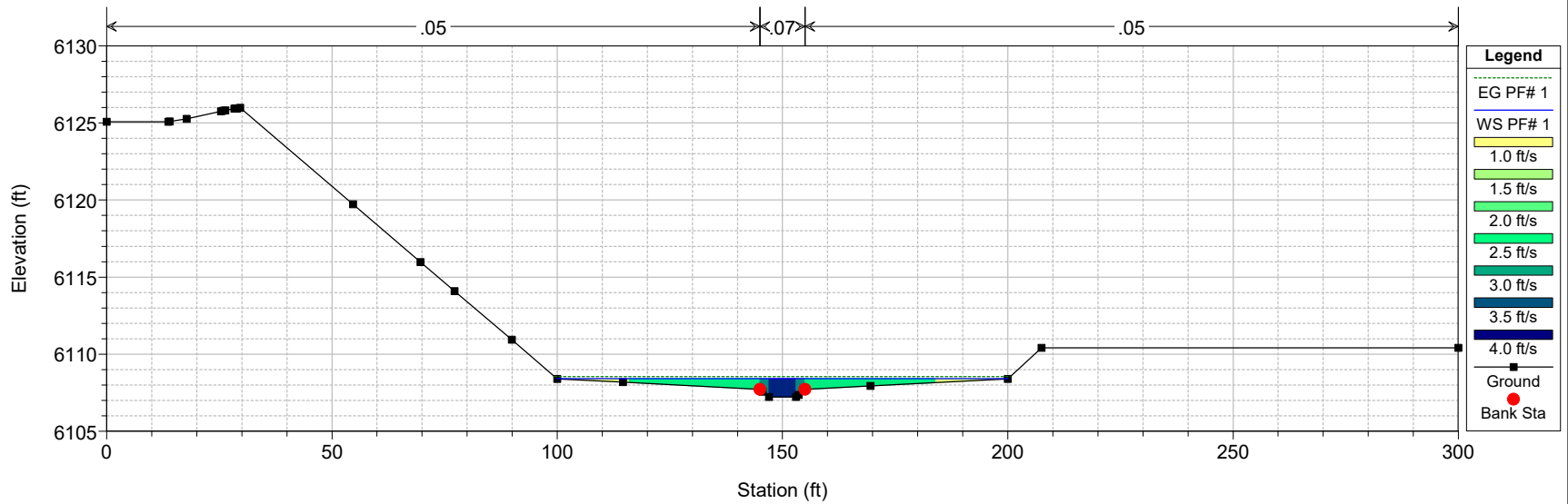
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1037



HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1036

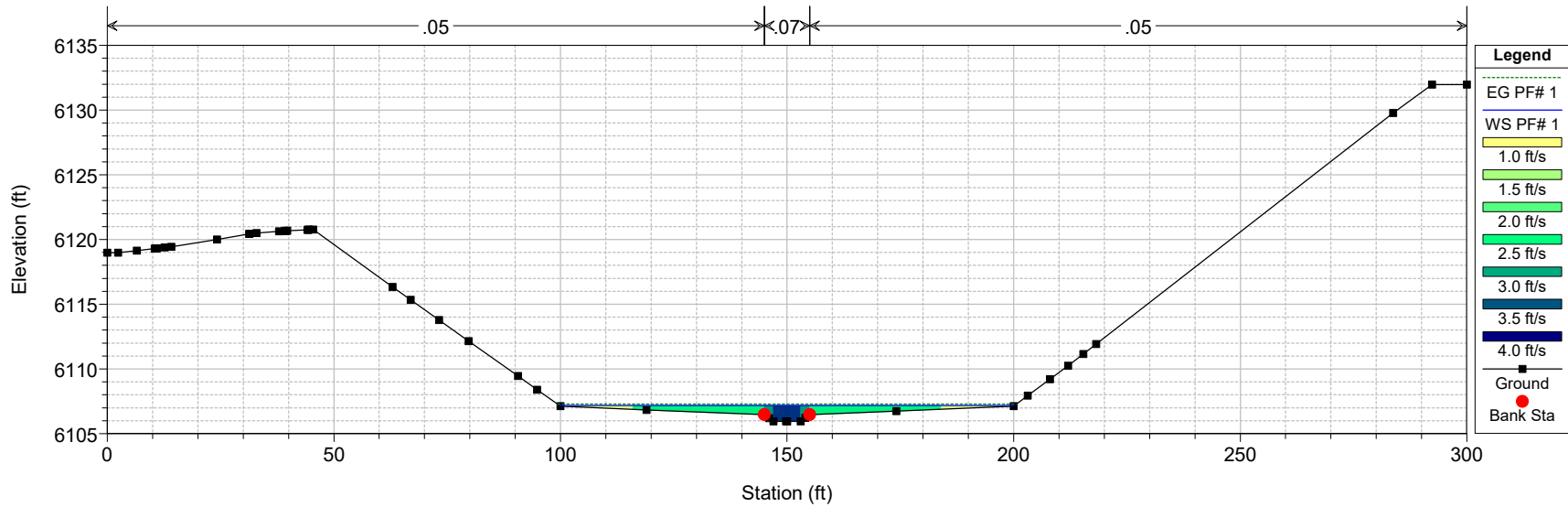




# HIGH MANNINGS VALUE MODEL

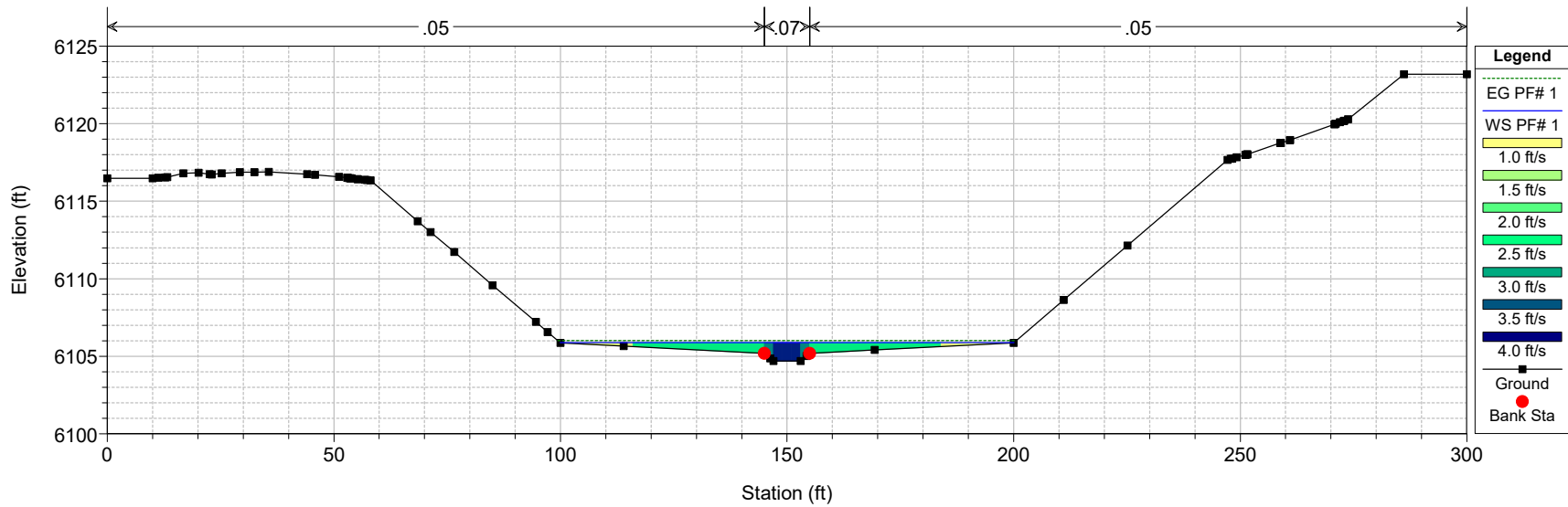
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1035



HEC-RAS Model Plan: Default Scenario 2/14/2024

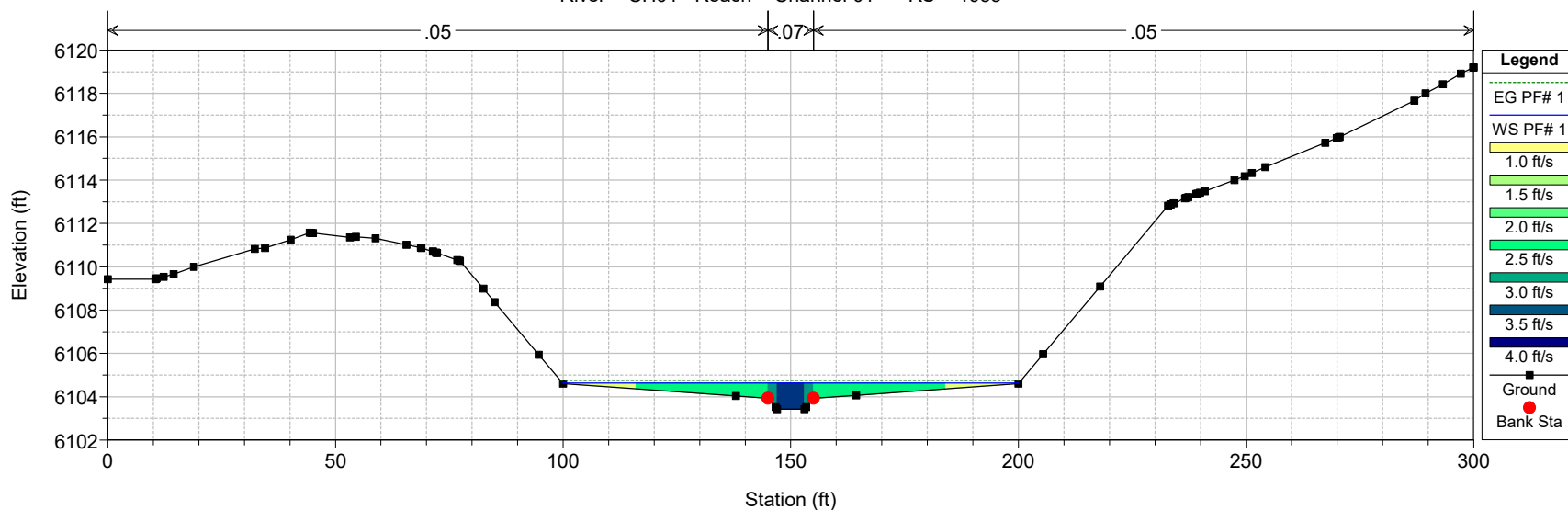
River = CH01 Reach = Channel 01 RS = 1034



# HIGH MANNINGS VALUE MODEL

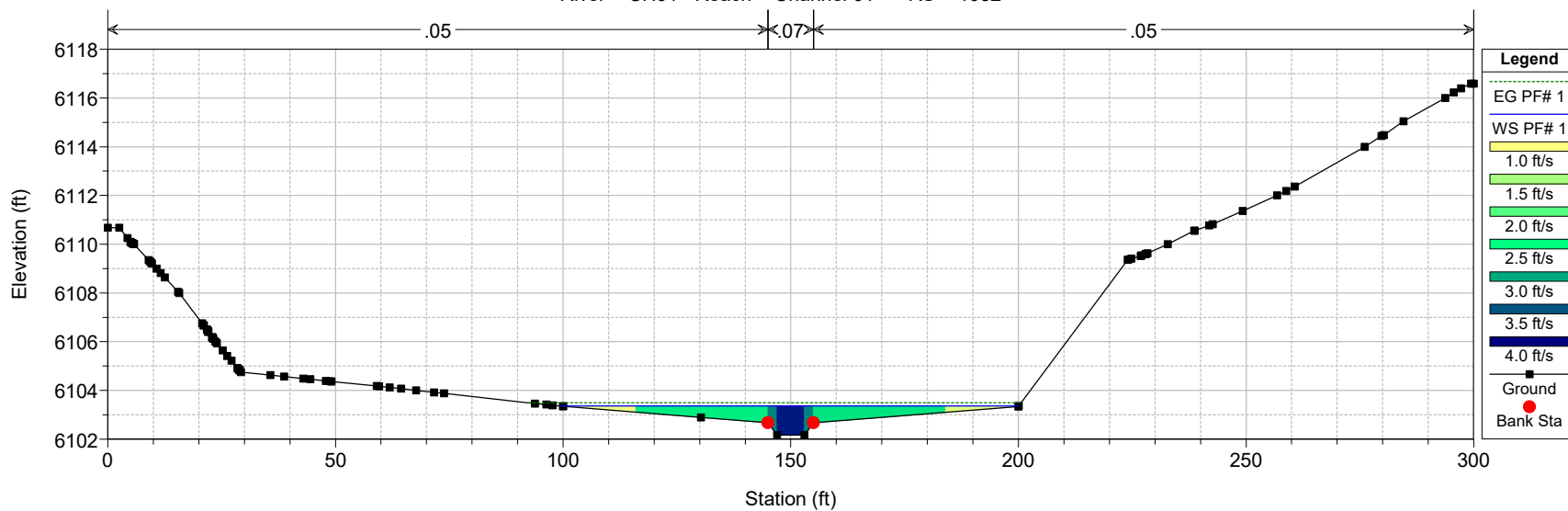
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1033



HEC-RAS Model Plan: Default Scenario 2/14/2024

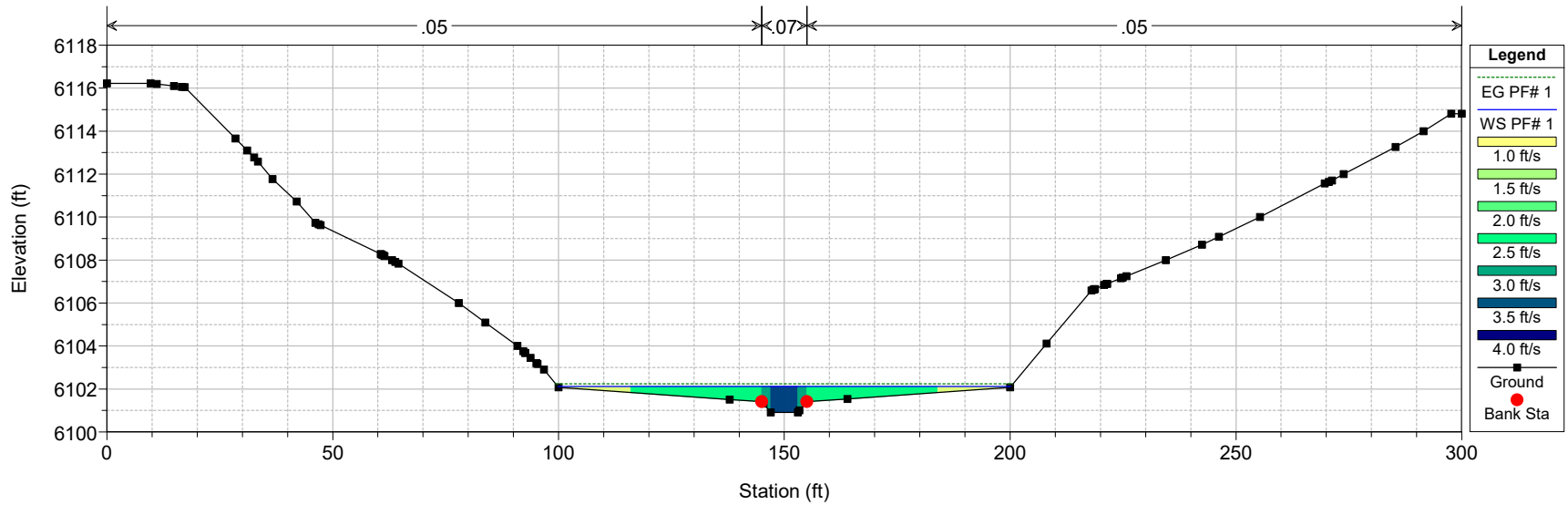
River = CH01 Reach = Channel 01 RS = 1032



# HIGH MANNINGS VALUE MODEL

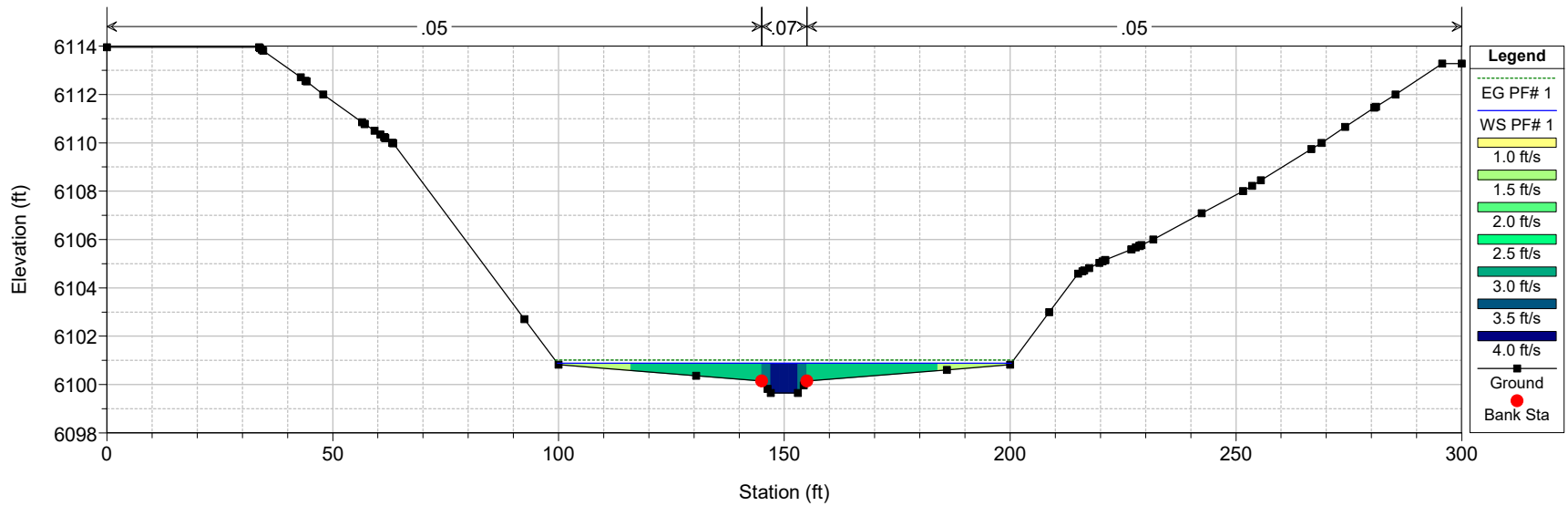
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1031



HEC-RAS Model Plan: Default Scenario 2/14/2024

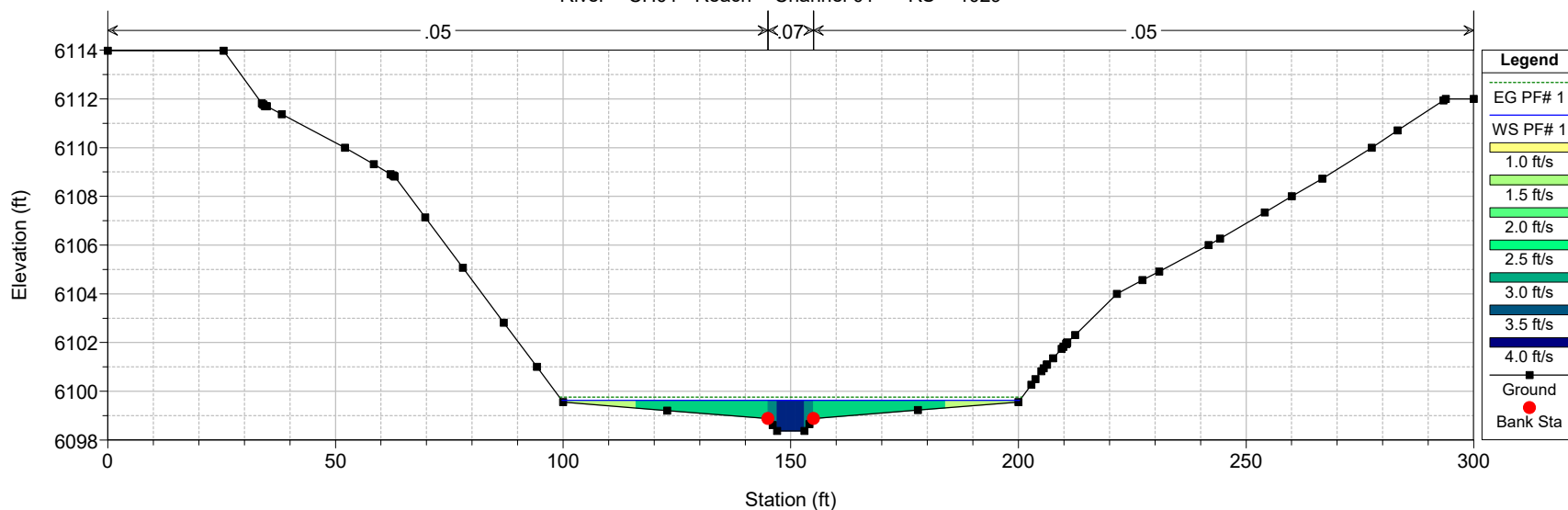
River = CH01 Reach = Channel 01 RS = 1030



# HIGH MANNINGS VALUE MODEL

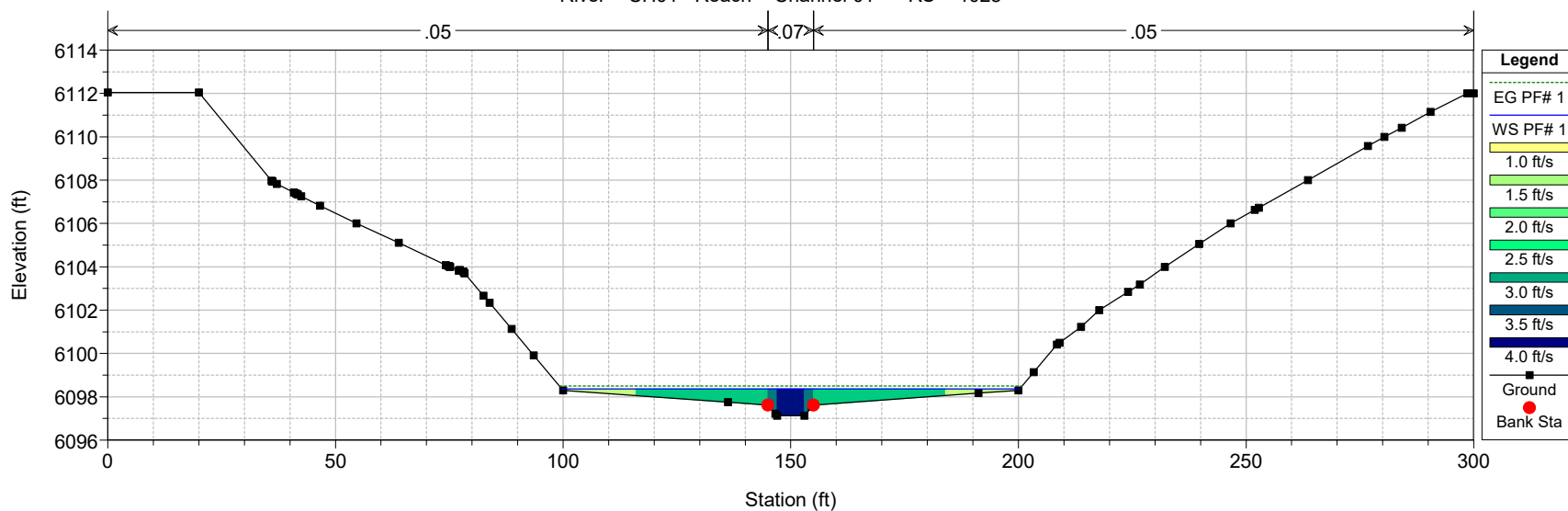
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1029



HEC-RAS Model Plan: Default Scenario 2/14/2024

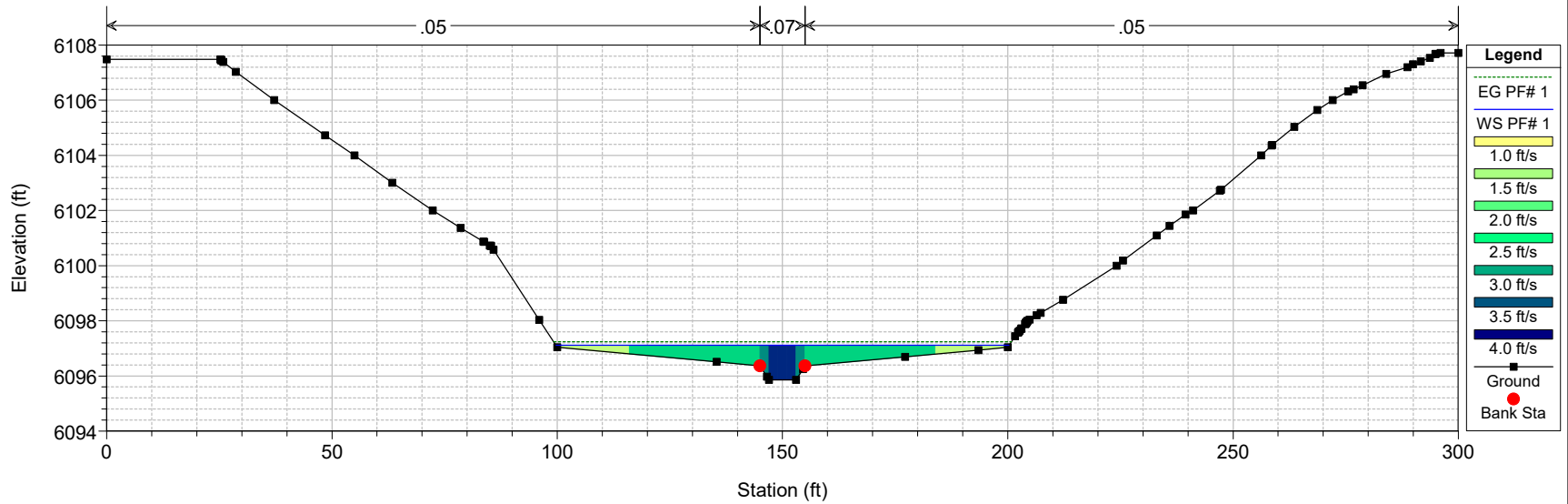
River = CH01 Reach = Channel 01 RS = 1028



# HIGH MANNINGS VALUE MODEL

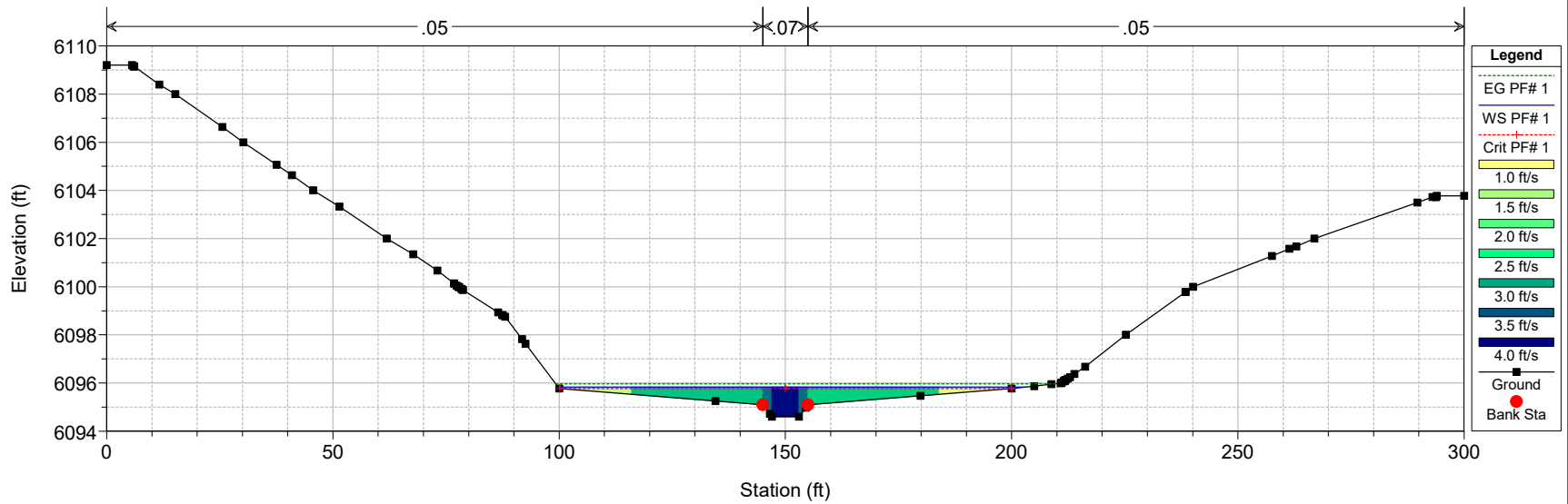
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1027



HEC-RAS Model Plan: Default Scenario 2/14/2024

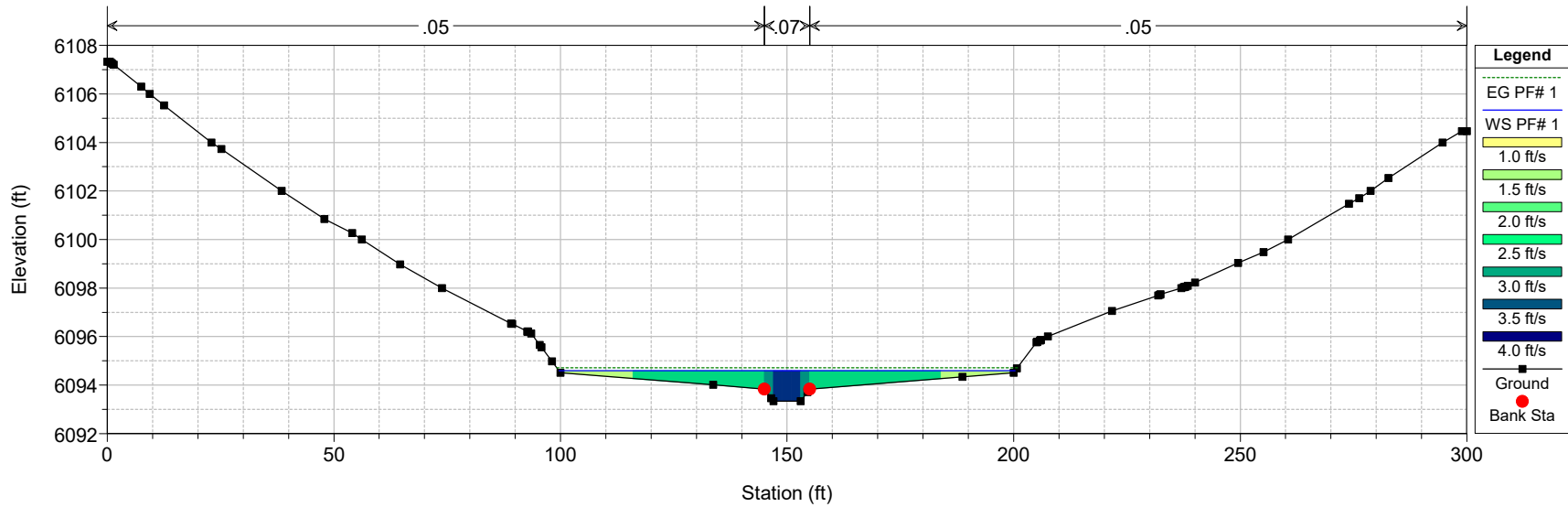
River = CH01 Reach = Channel 01 RS = 1026



# HIGH MANNINGS VALUE MODEL

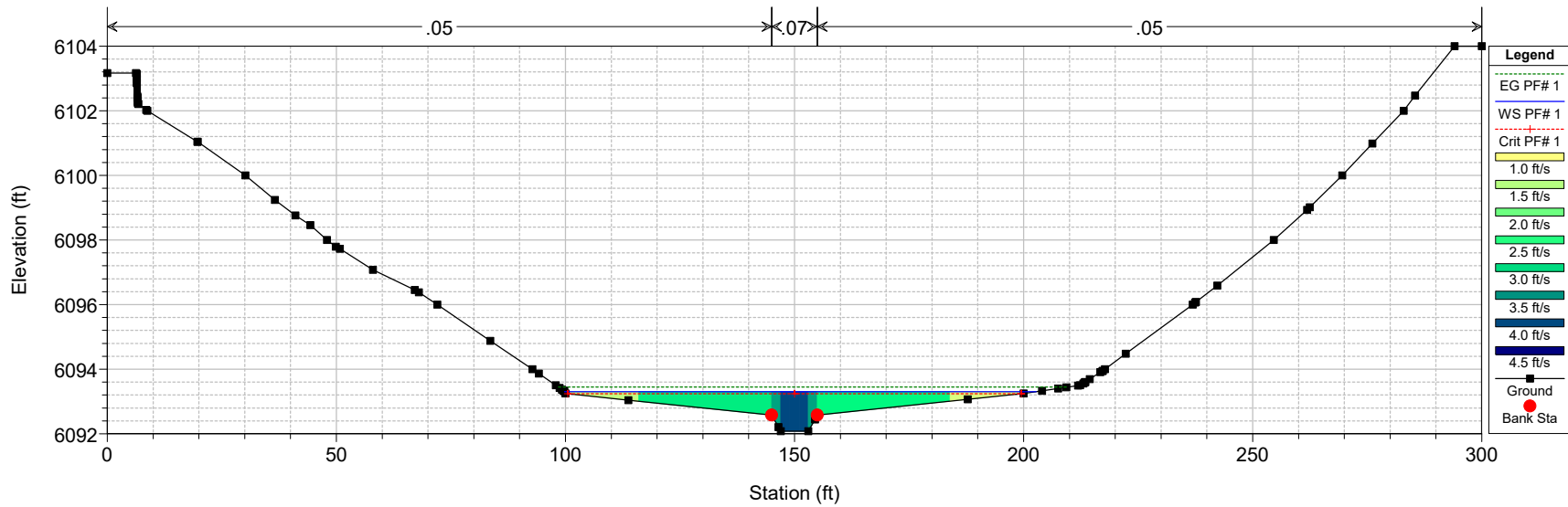
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1025



HEC-RAS Model Plan: Default Scenario 2/14/2024

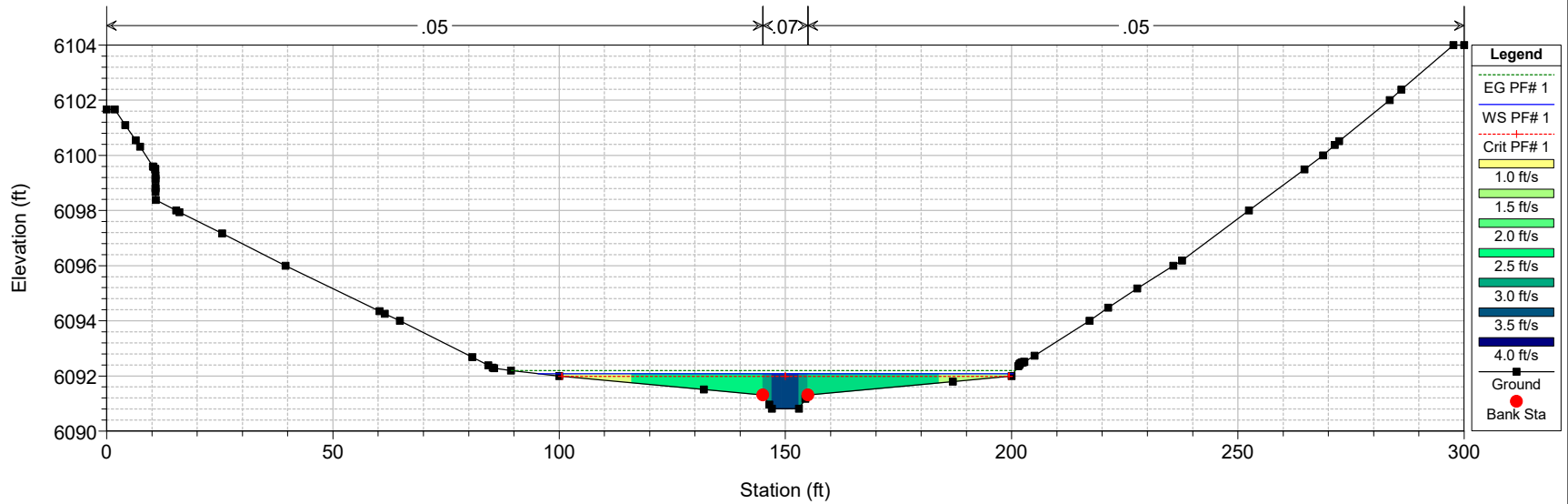
River = CH01 Reach = Channel 01 RS = 1024



# HIGH MANNINGS VALUE MODEL

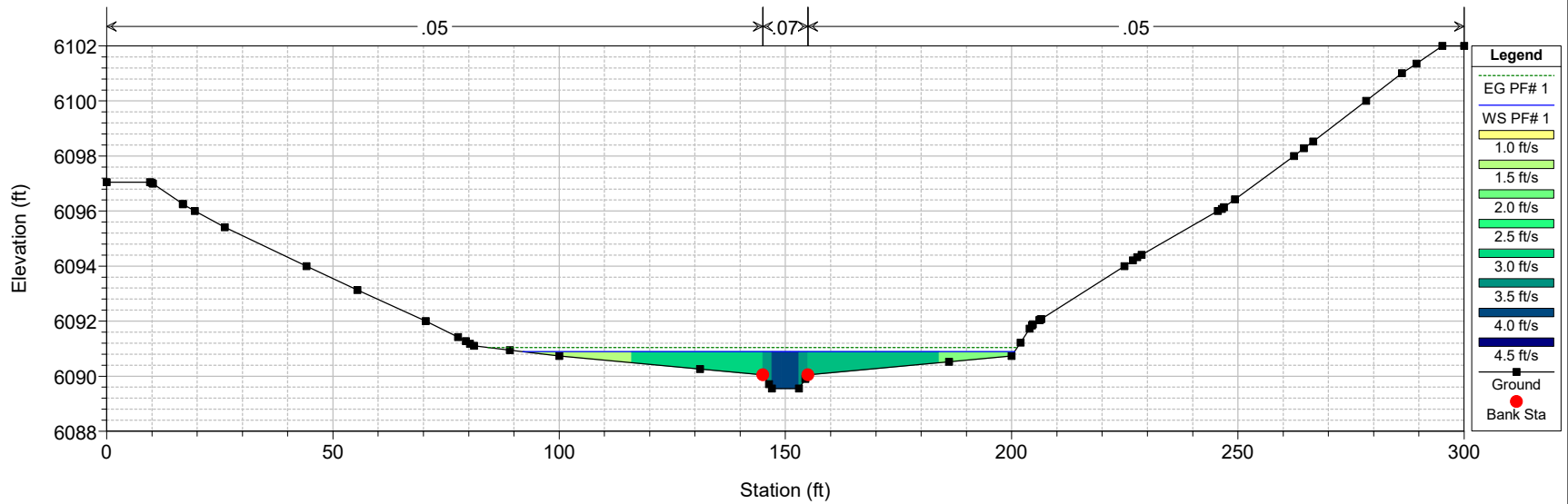
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1023

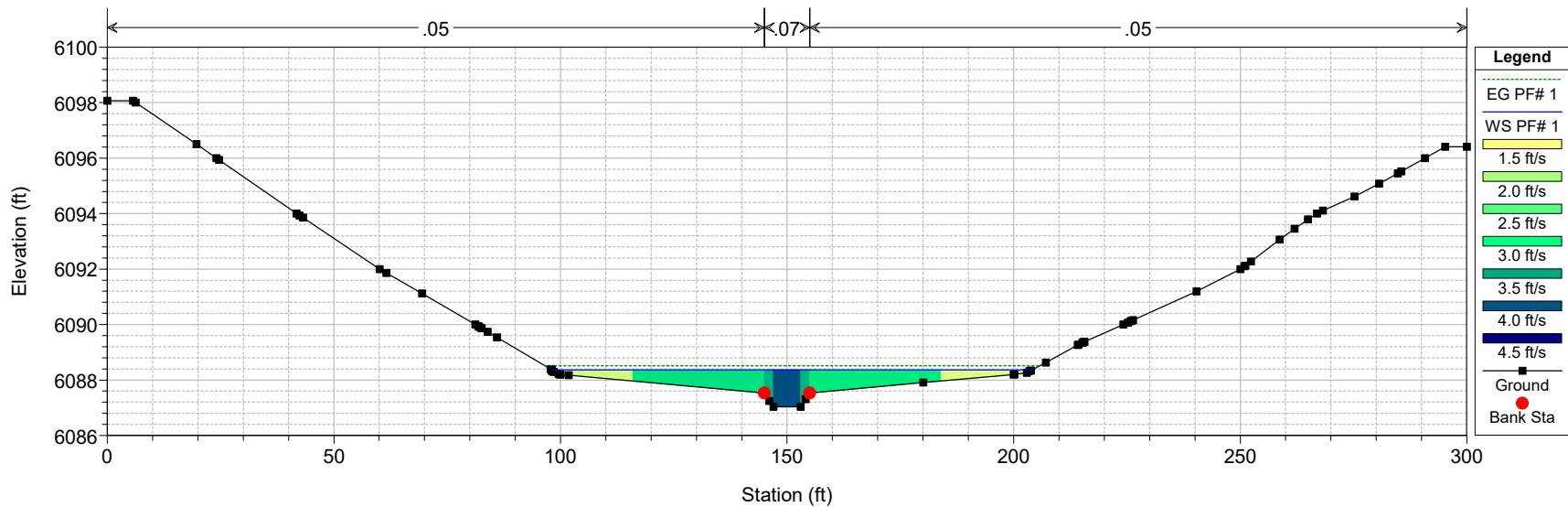
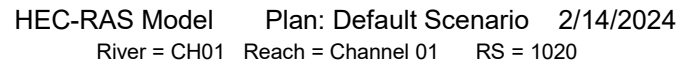


HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1022



HEC-RAS Model      Plan: Default Scenario    2/14/2024  
River = CH01    Reach = Channel 01    RS = 1021

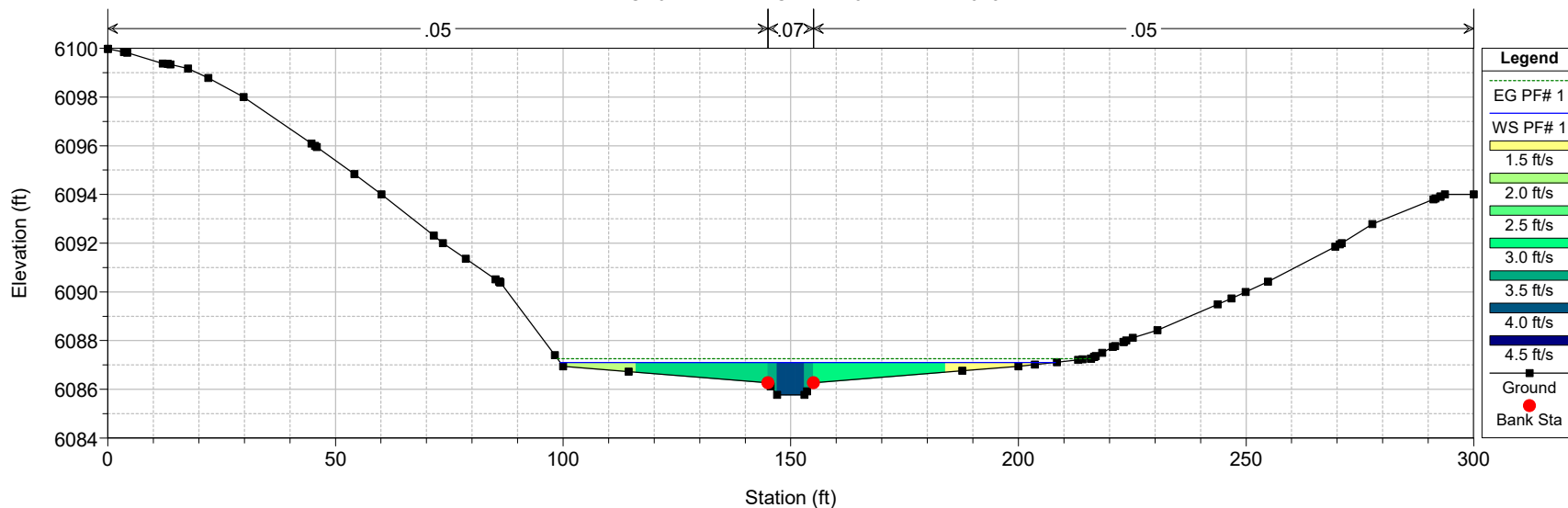




# HIGH MANNINGS VALUE MODEL

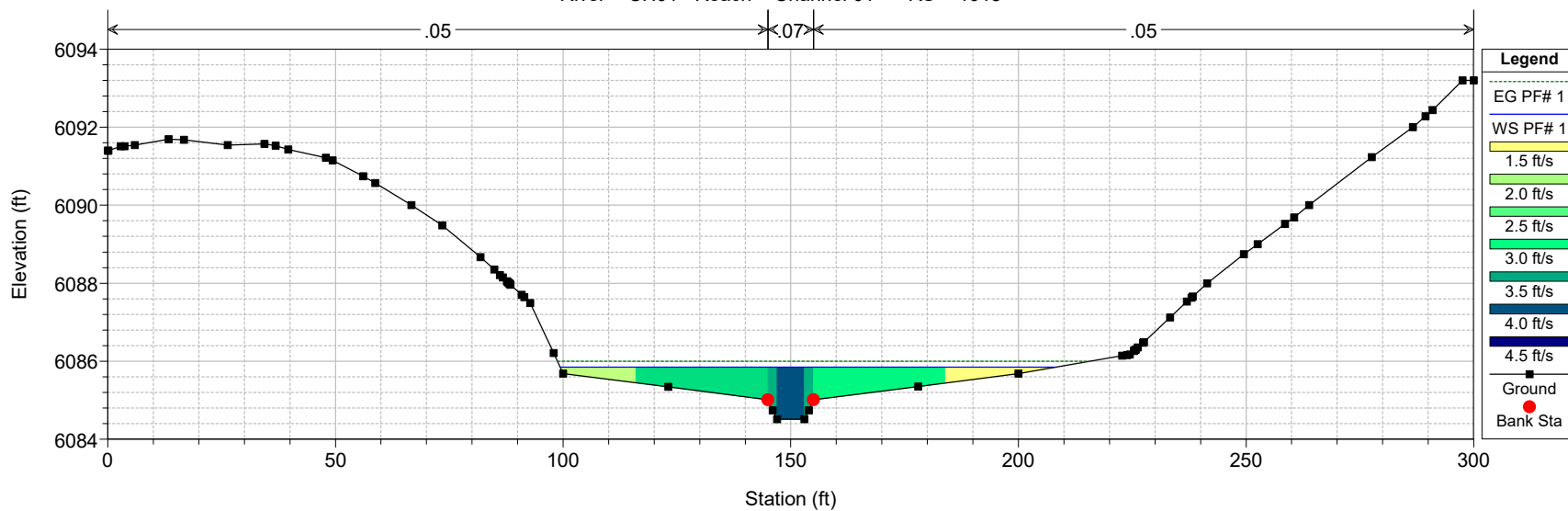
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1019



HEC-RAS Model Plan: Default Scenario 2/14/2024

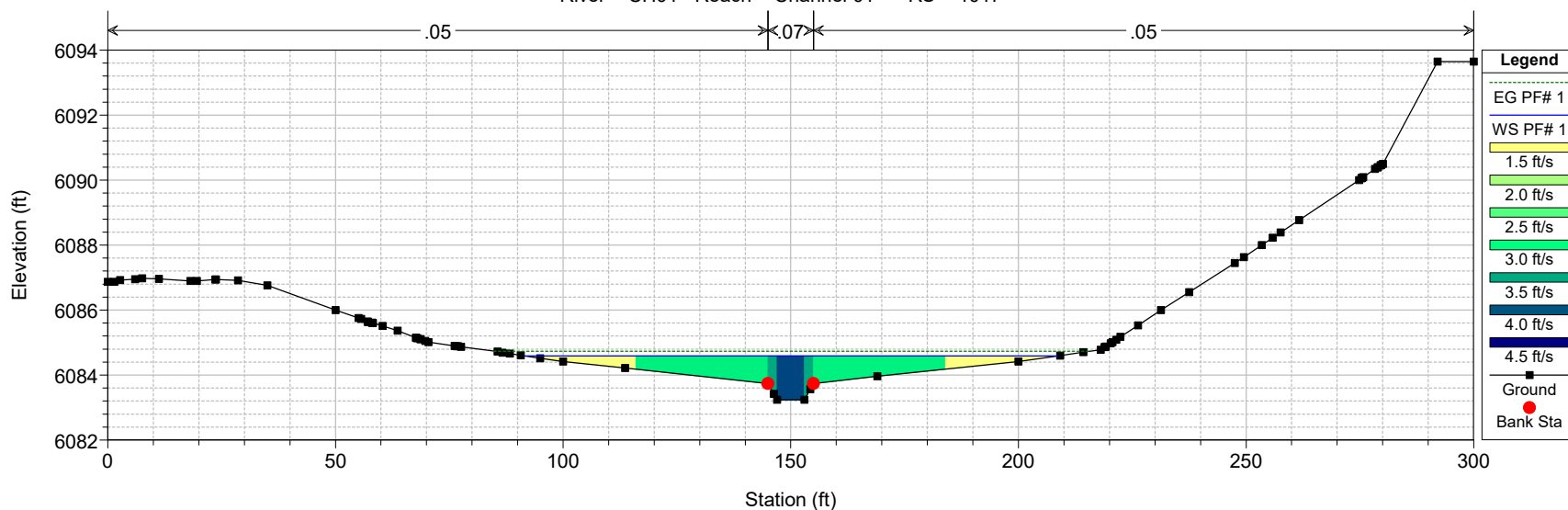
River = CH01 Reach = Channel 01 RS = 1018



# HIGH MANNINGS VALUE MODEL

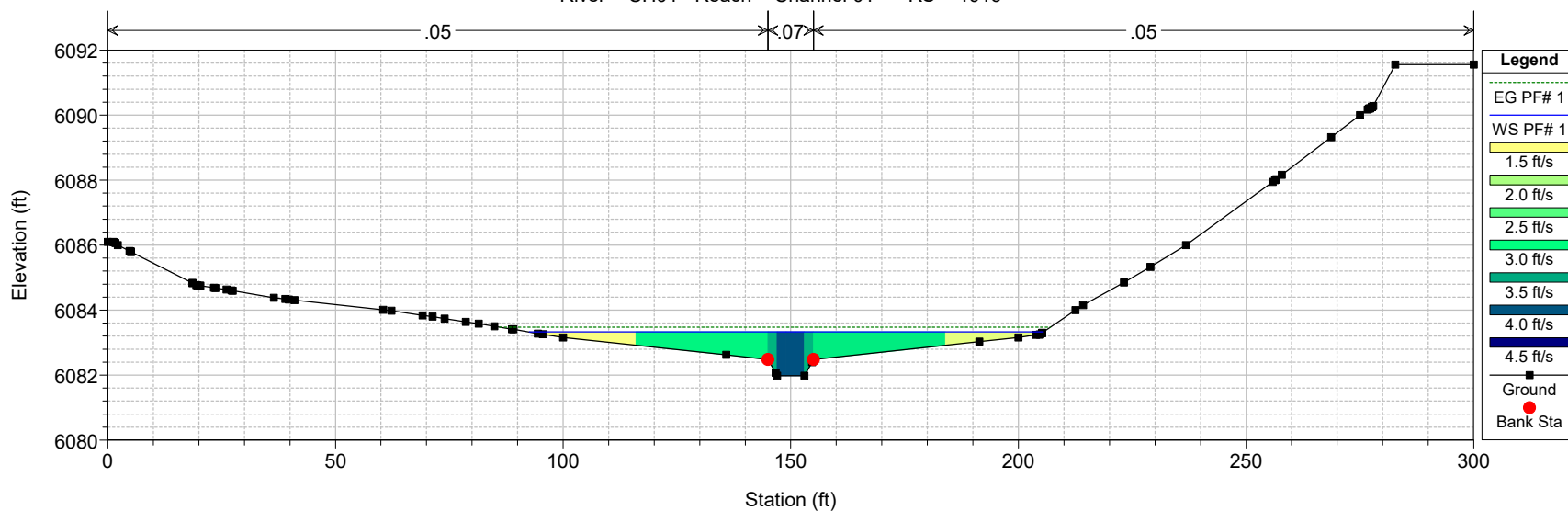
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1017



HEC-RAS Model Plan: Default Scenario 2/14/2024

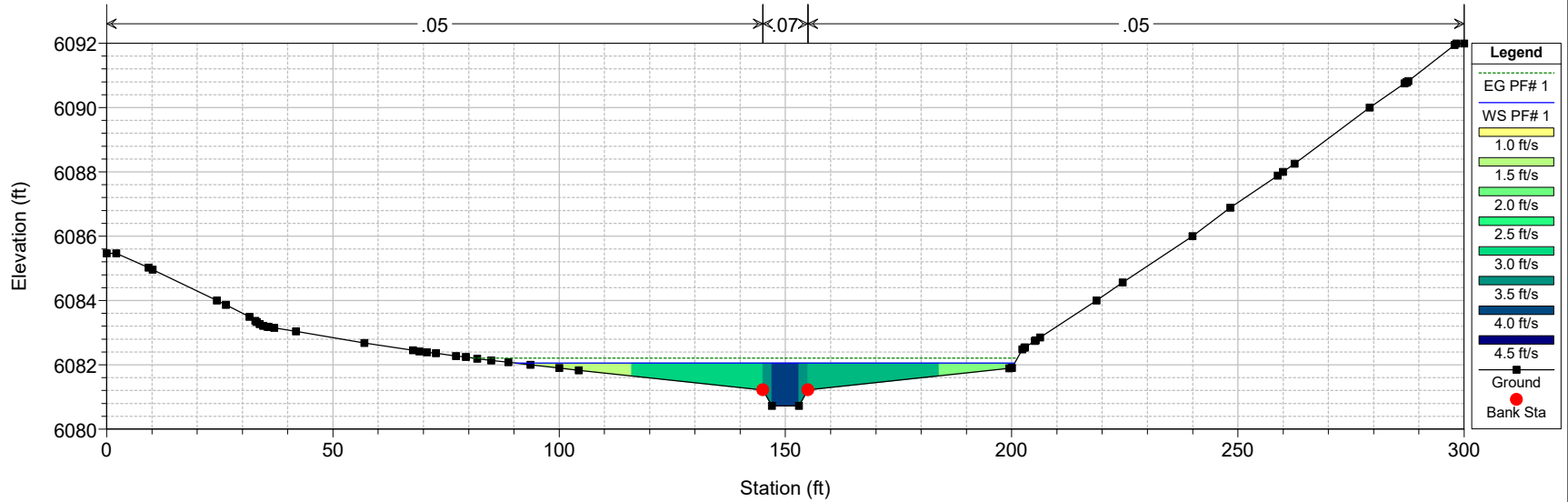
River = CH01 Reach = Channel 01 RS = 1016



# HIGH MANNINGS VALUE MODEL

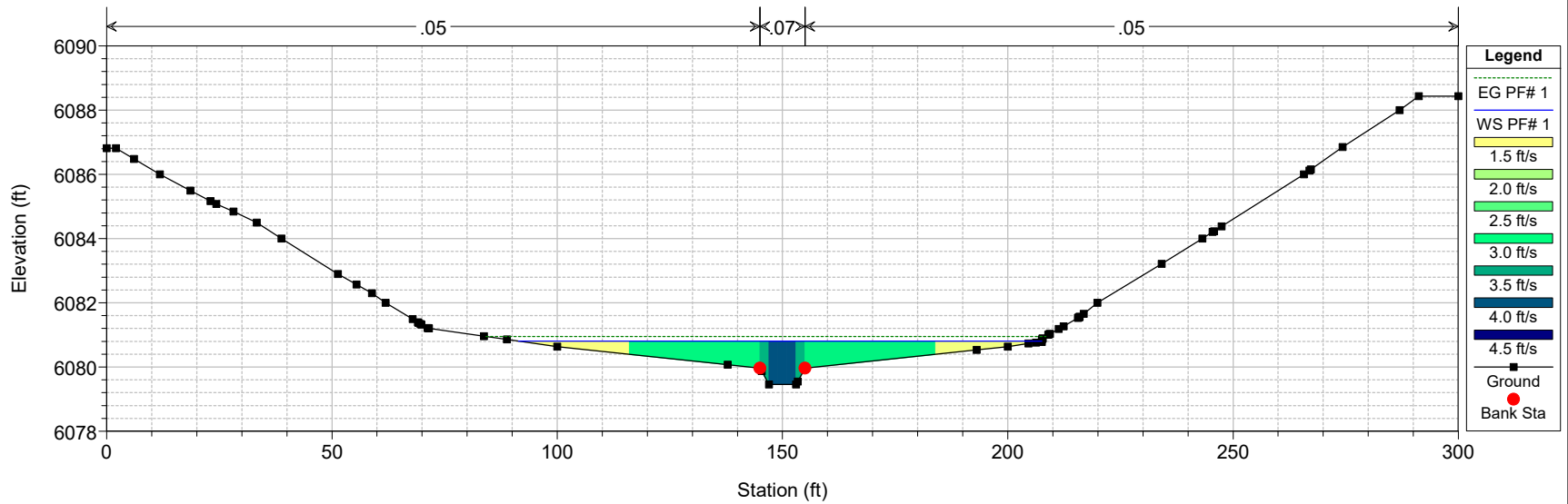
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1015



HEC-RAS Model Plan: Default Scenario 2/14/2024

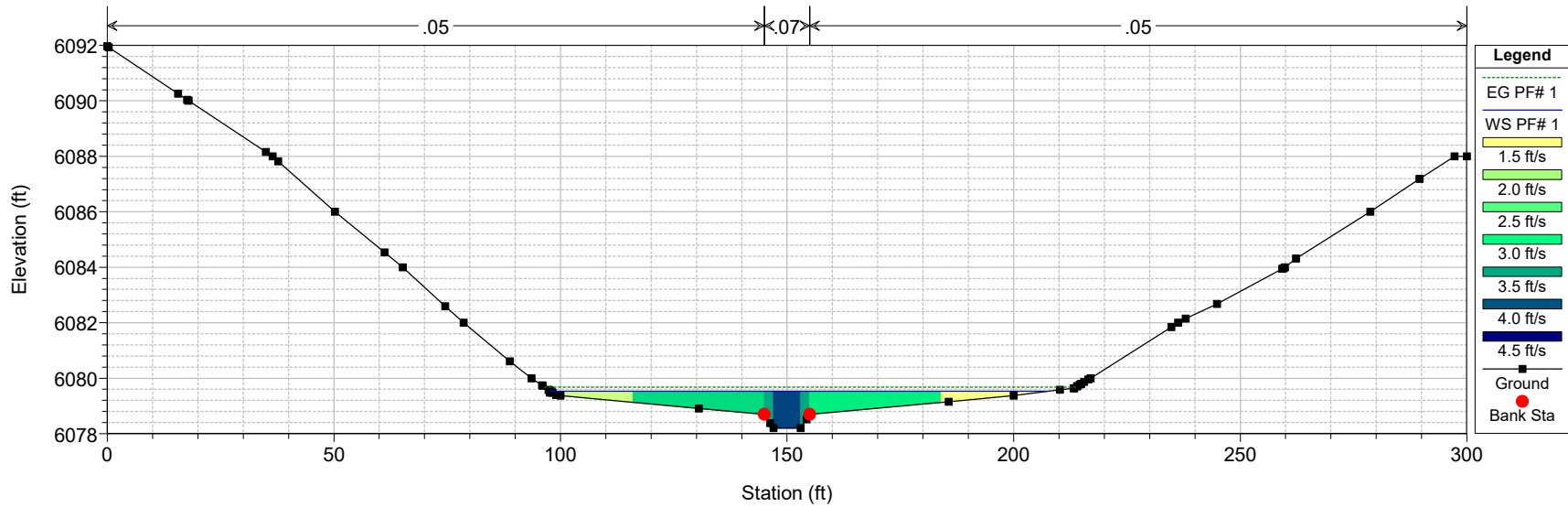
River = CH01 Reach = Channel 01 RS = 1014



# HIGH MANNINGS VALUE MODEL

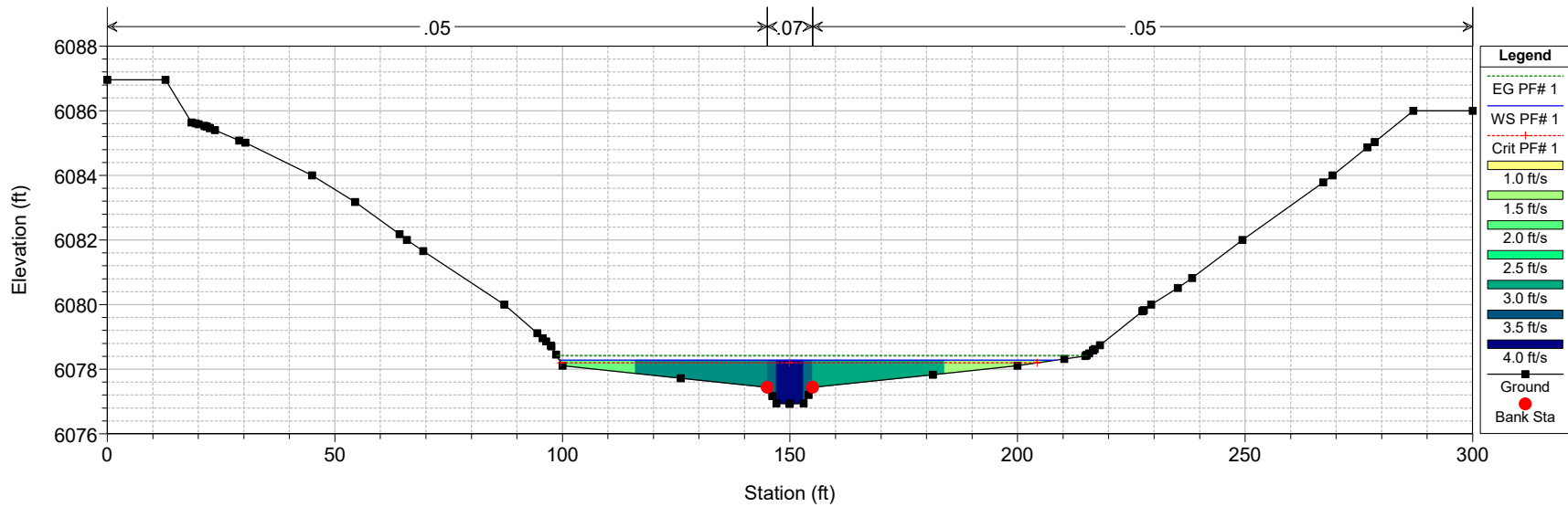
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1013

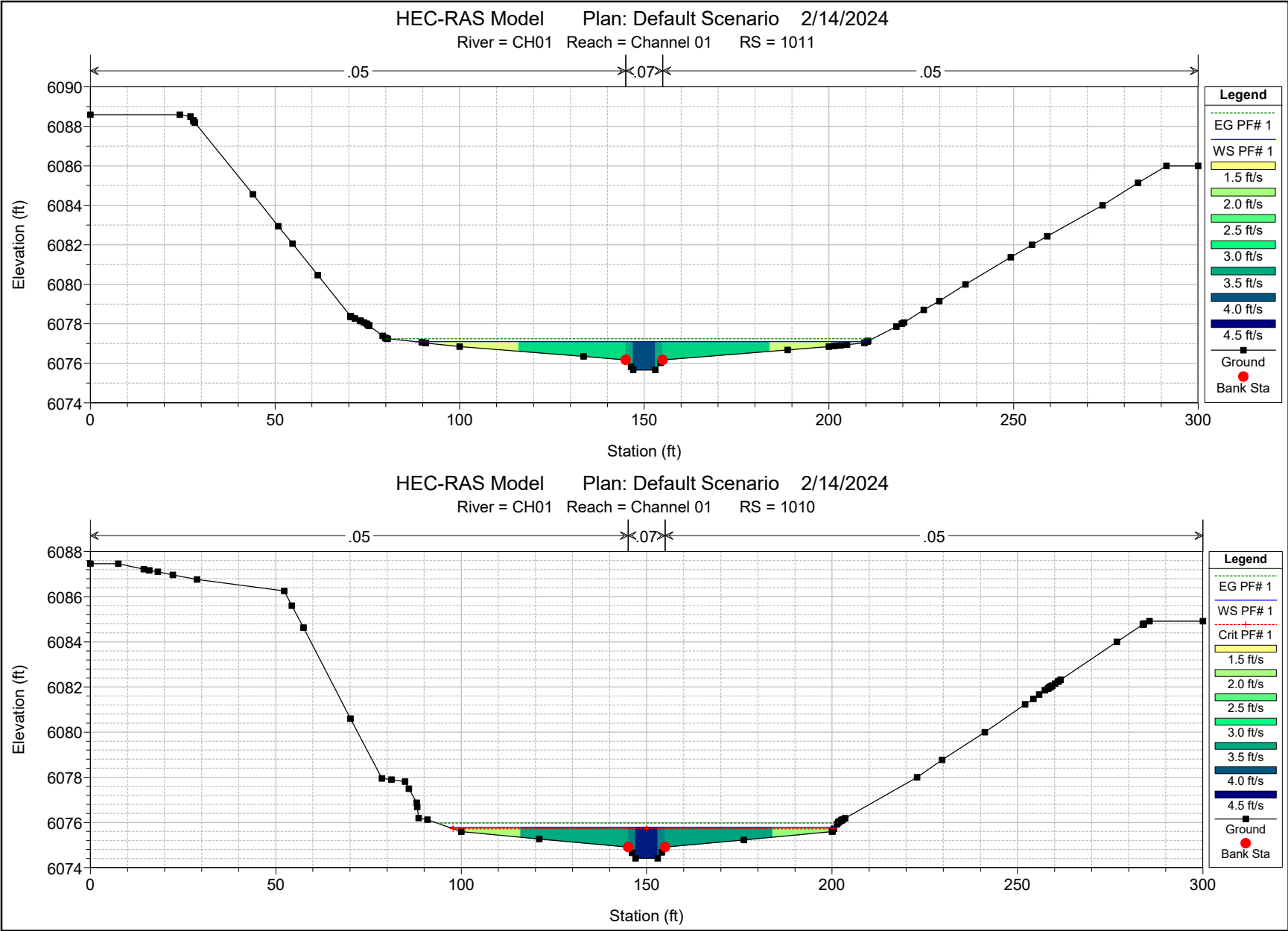


HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1012



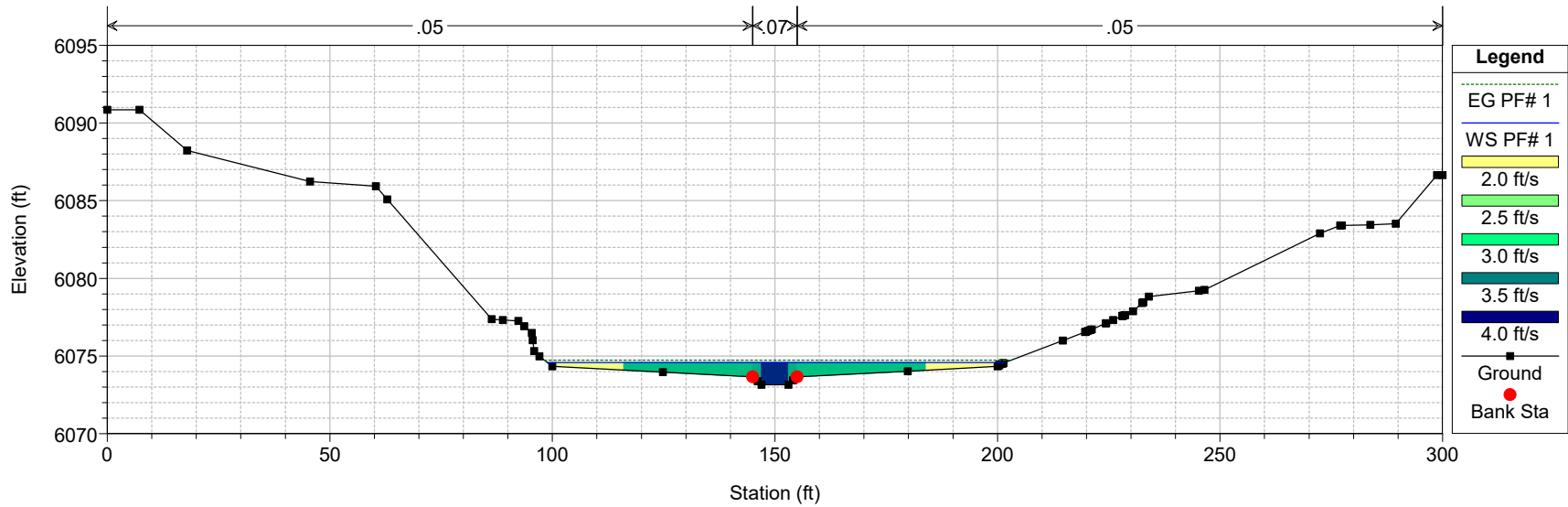
# HIGH MANNINGS VALUE MODEL



# HIGH MANNINGS VALUE MODEL

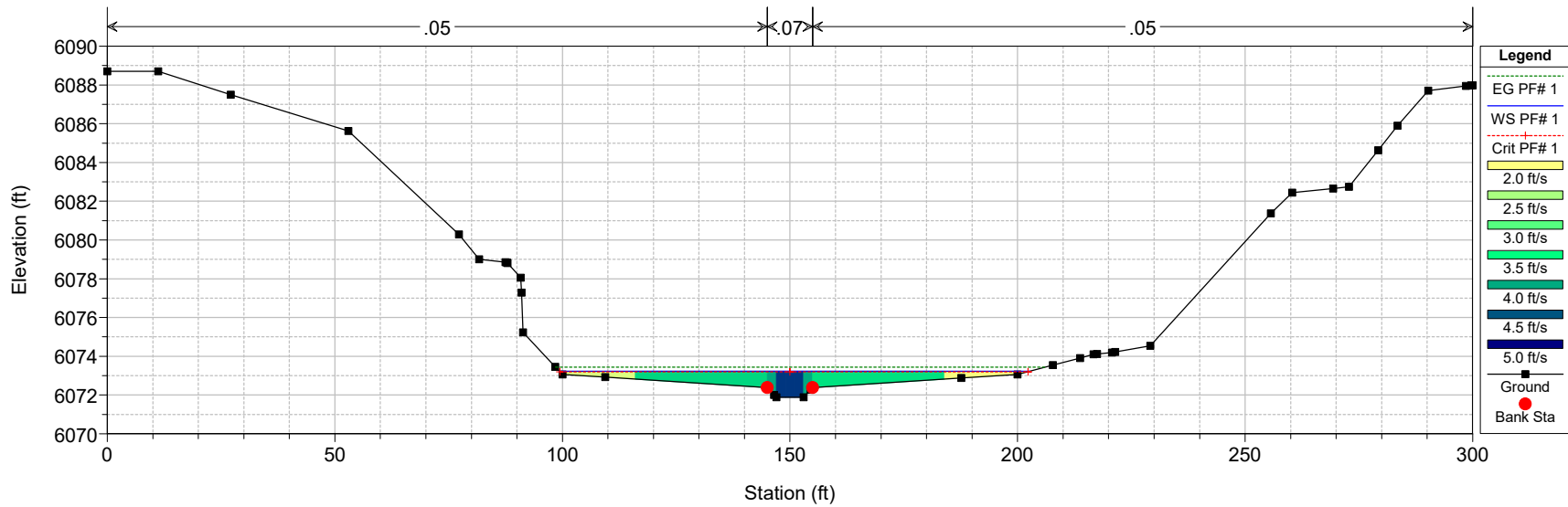
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1009



HEC-RAS Model Plan: Default Scenario 2/14/2024

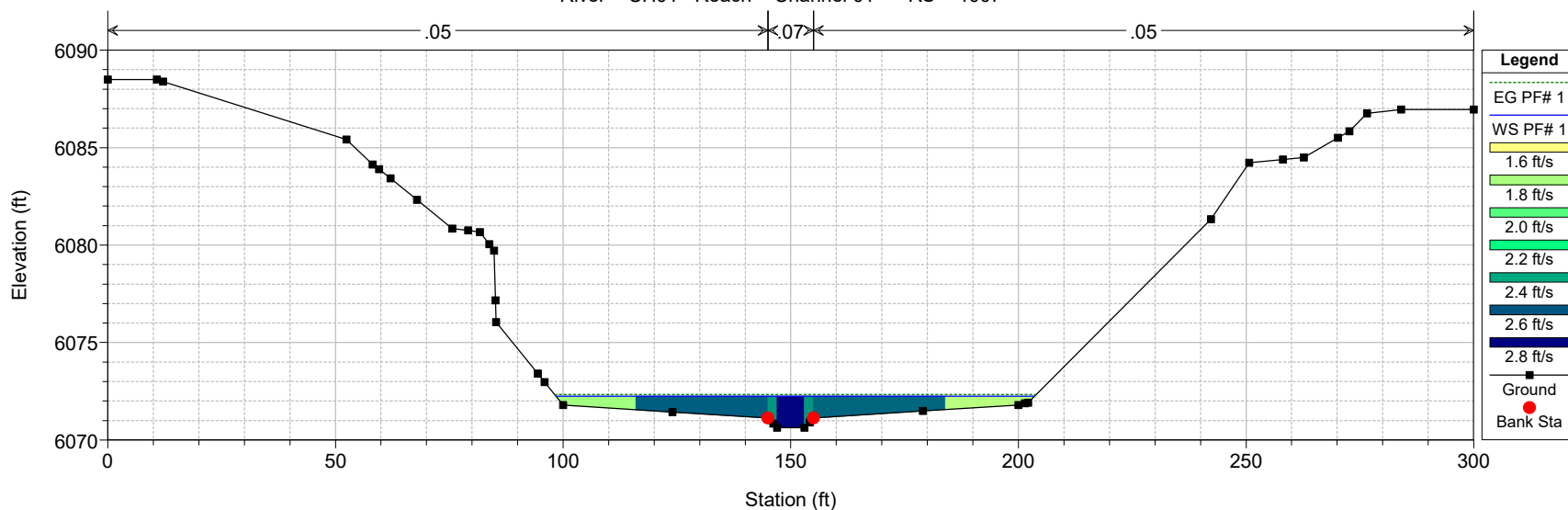
River = CH01 Reach = Channel 01 RS = 1008



# HIGH MANNINGS VALUE MODEL

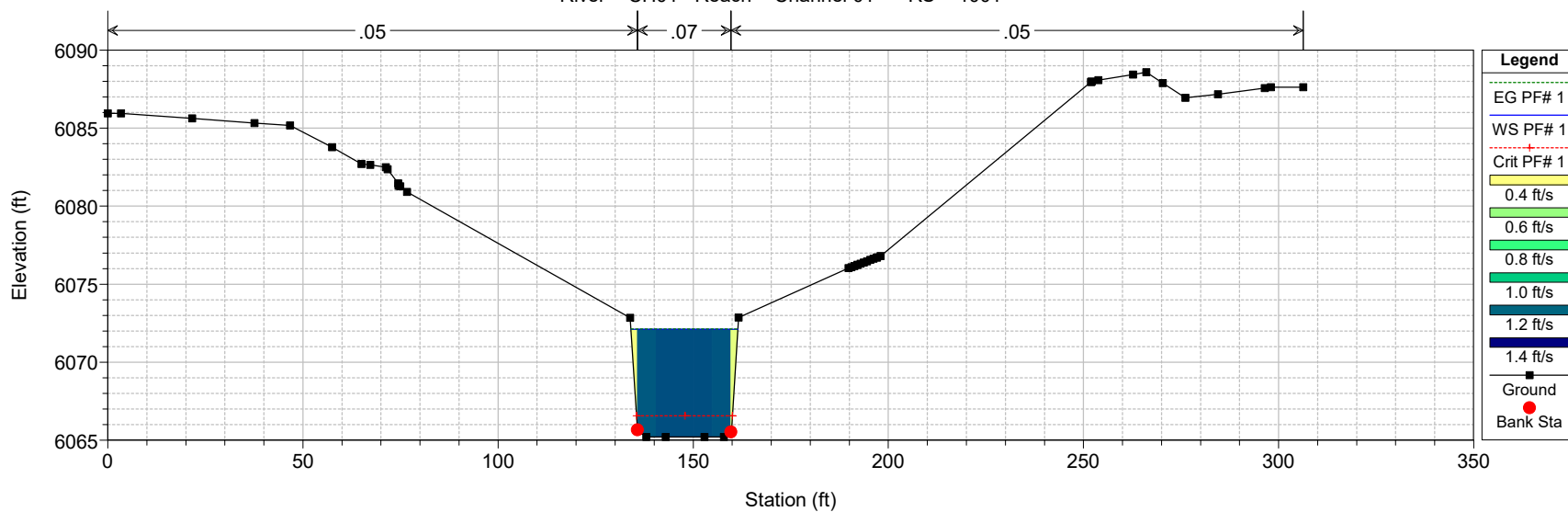
HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1007

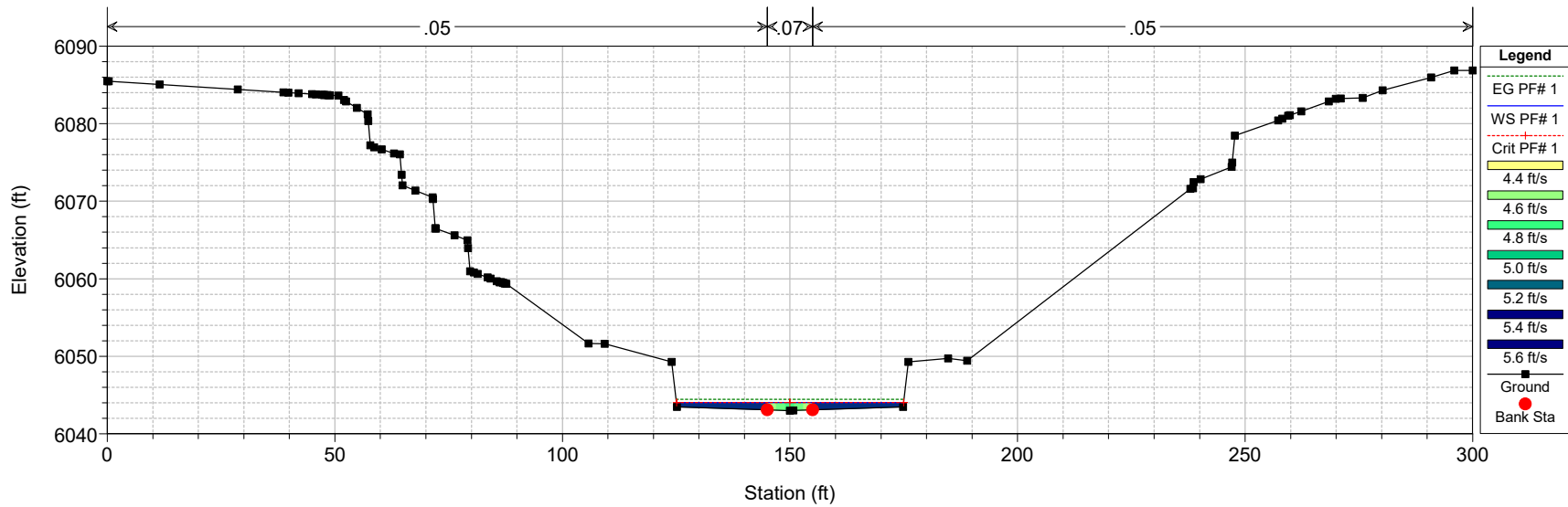
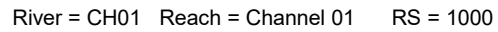


HEC-RAS Model Plan: Default Scenario 2/14/2024

River = CH01 Reach = Channel 01 RS = 1001

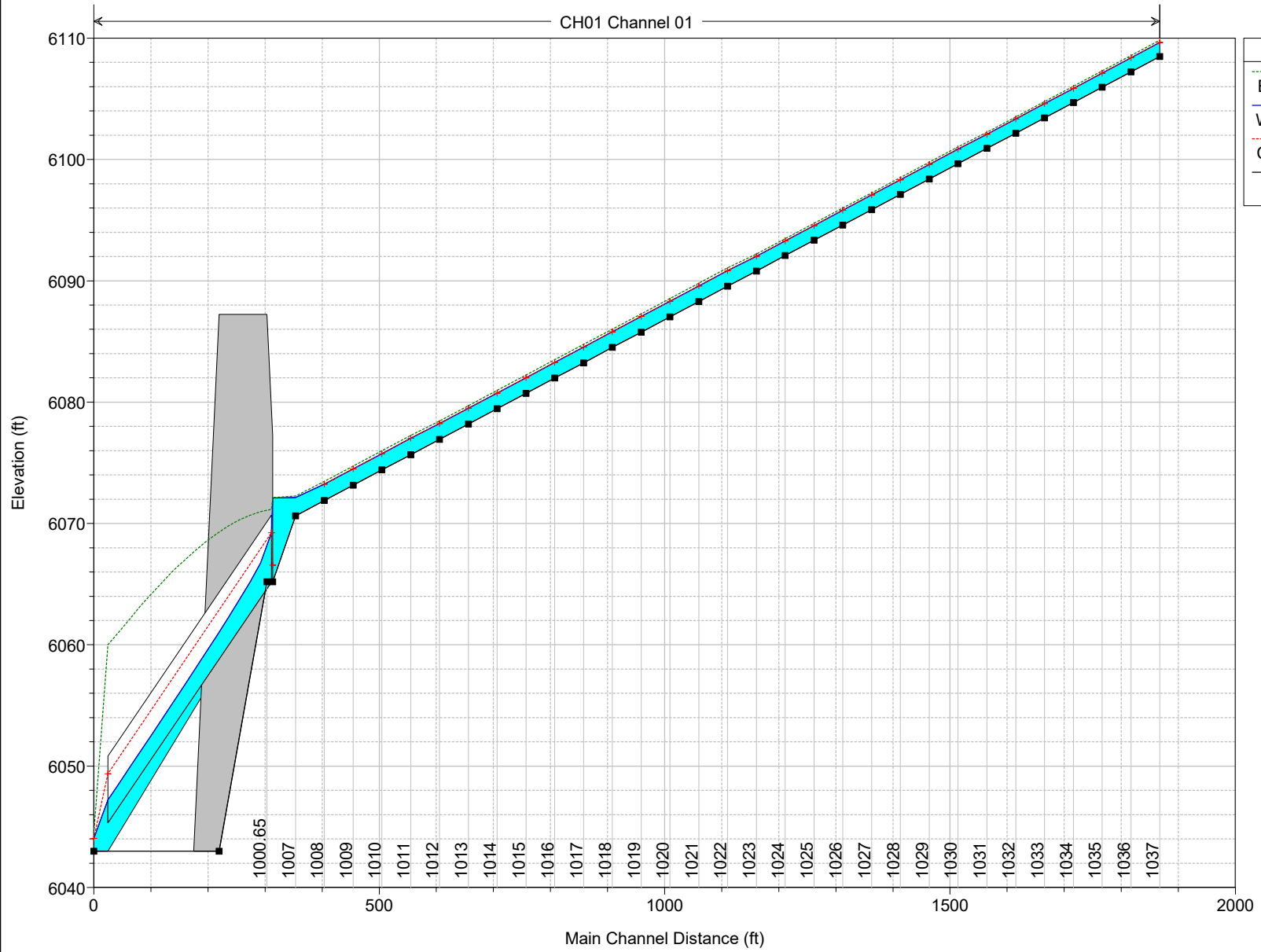


River = CH01    Reach = Channel 01    RS = 1000.65    Culv





CH01 Channel 01

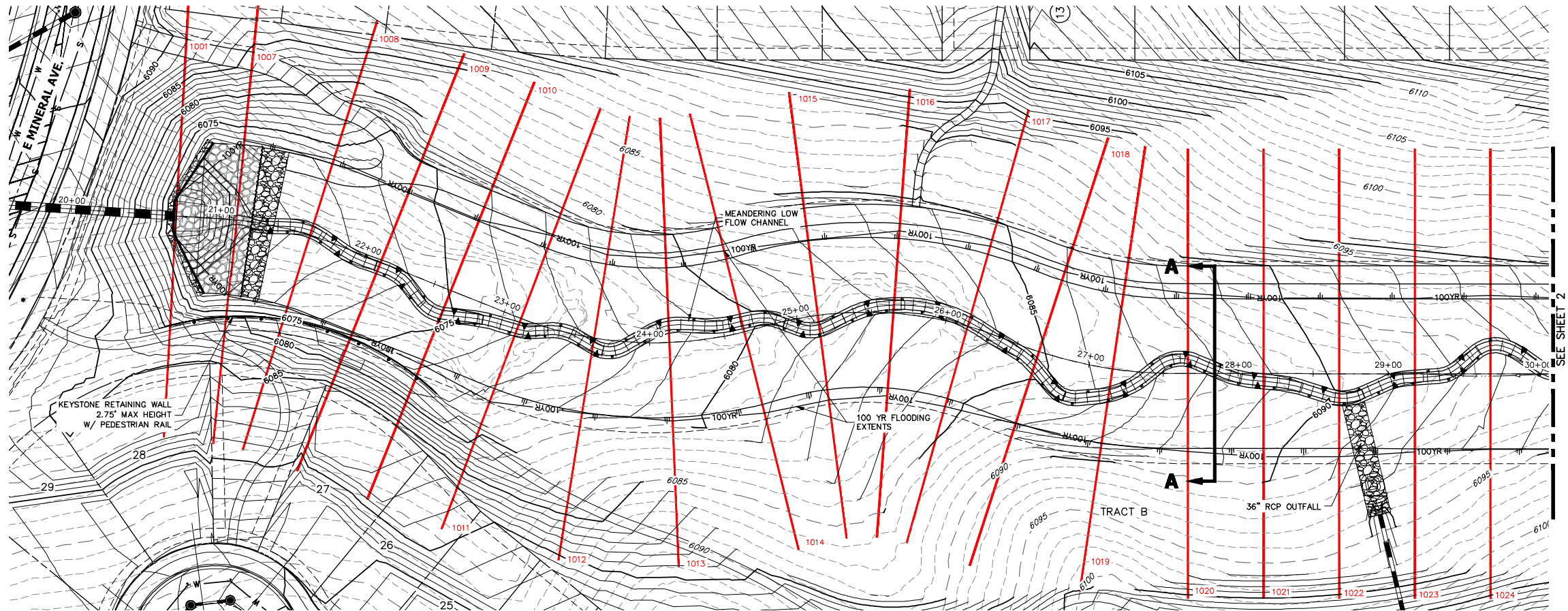


**Legend**

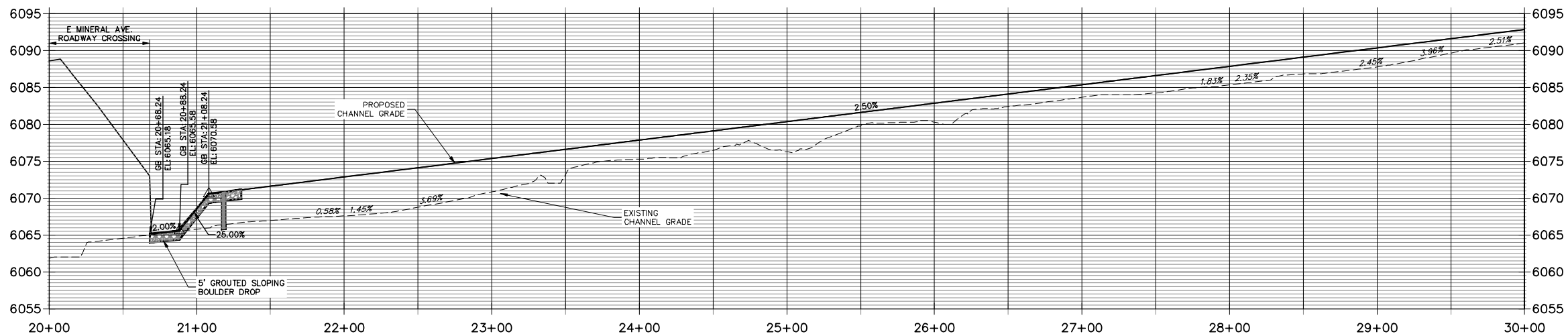
- EG PF# 1
- WS PF# 1
- Crit PF# 1
- Ground

# TRAILS AT OVERLAND RANCH

## CHANNEL PLAN & PROFILE

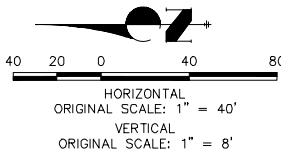


DP20 PROFILE (1)  
STA 20+00.00 TO 30+00.00



### NOTES

1. DETAILS OF RIPRAP SIZING AND OTHER ELEMENTS OF EROSION PROTECTION INCLUDING THE SOIL RIPRAP AND REVEGETATION WHERE APPROPRIATE WILL BE EVALUATED WITH THE CD'S/FDR.
2. LOCALIZED EROSION PROTECTION FOR ERODED CHANNEL BANKS OUTSIDE OF THE MAIN CHANNEL WILL BE EVALUATED AND PROVIDED WITH CD'S/FDR.
3. STORM SEWER DROPS AND SLOPES WILL BE DESIGNED AND EVALUATED WITH CD'S/FDR.
4. ENERGY DISSIPATER WILL BE DESIGNED AS WARRANTED AT TIME OF CIVIL CONSTRUCTION DRAWINGS.
5. HEADWALLS, WINGWALLS, SAFETY GRATE, EROSION PROTECTION AND ENERGY DISSIPATION TO BE EVALUATED WITH THE CD'S/FDR.
6. DROP MANHOLES WITH GREATER THAN A 30" DROP REQUIRE A VARIANCE AND DESIGN MEASURE TO ADDRESS STRUCTURAL STABILITY, POTENTIAL FOR INCREASED EROSION AND POSSIBLE PROVISION OF AIR VENTS. THIS SHALL BE EVALUATED AT TIME OF CIVIL PLANS ALONG WITH ALTERNATIVE APPROACHES.

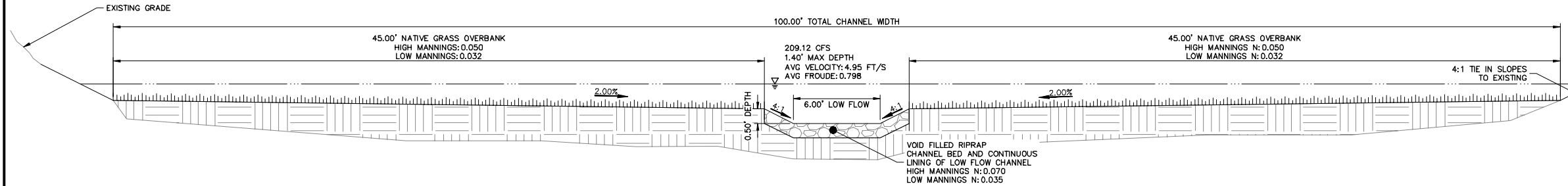


CHANNEL PLAN & PROFILE  
TRAILS AT OVERLAND RANCH  
JOB NO. 16118.10  
02/02/24  
SHEET 1 OF 2



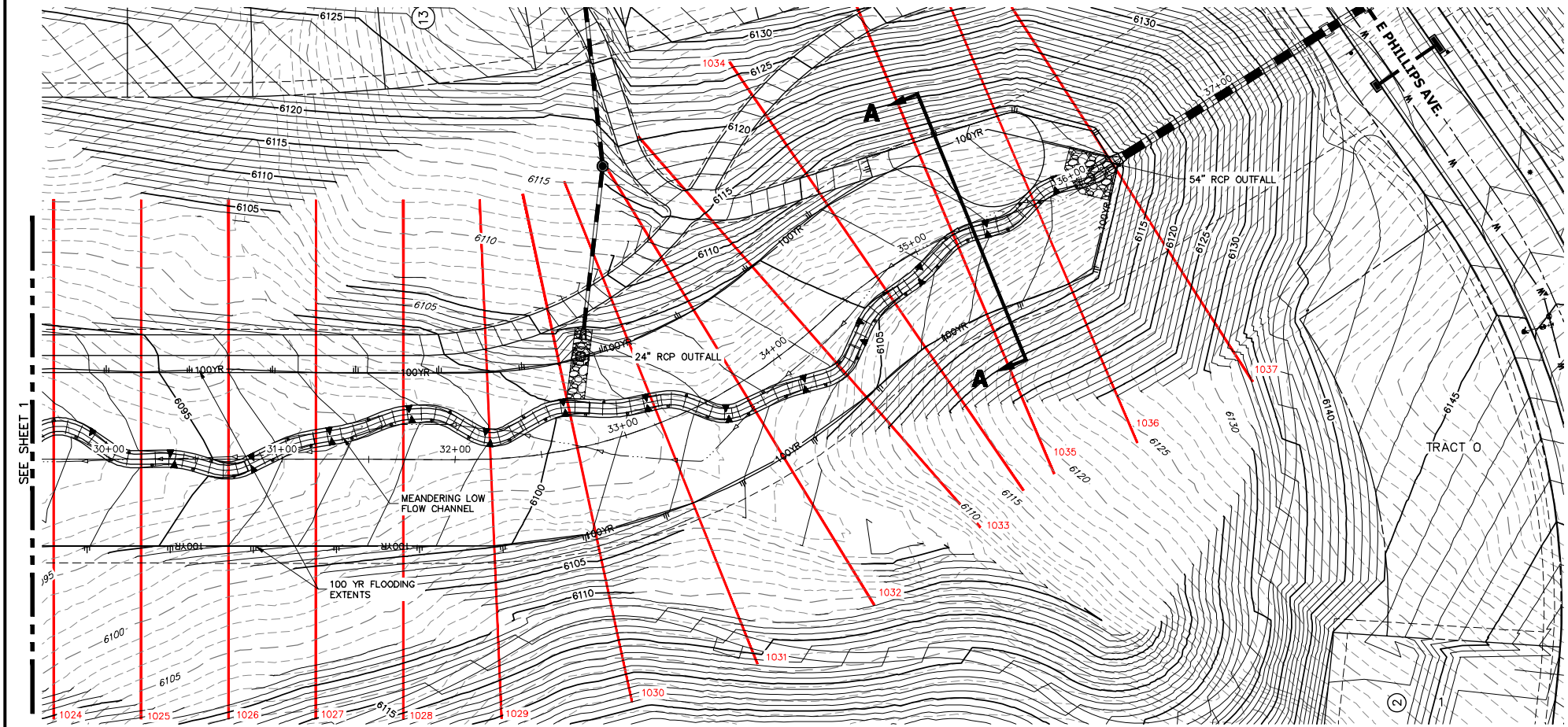
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SECTION A-A  
SCALE: 1"=4'

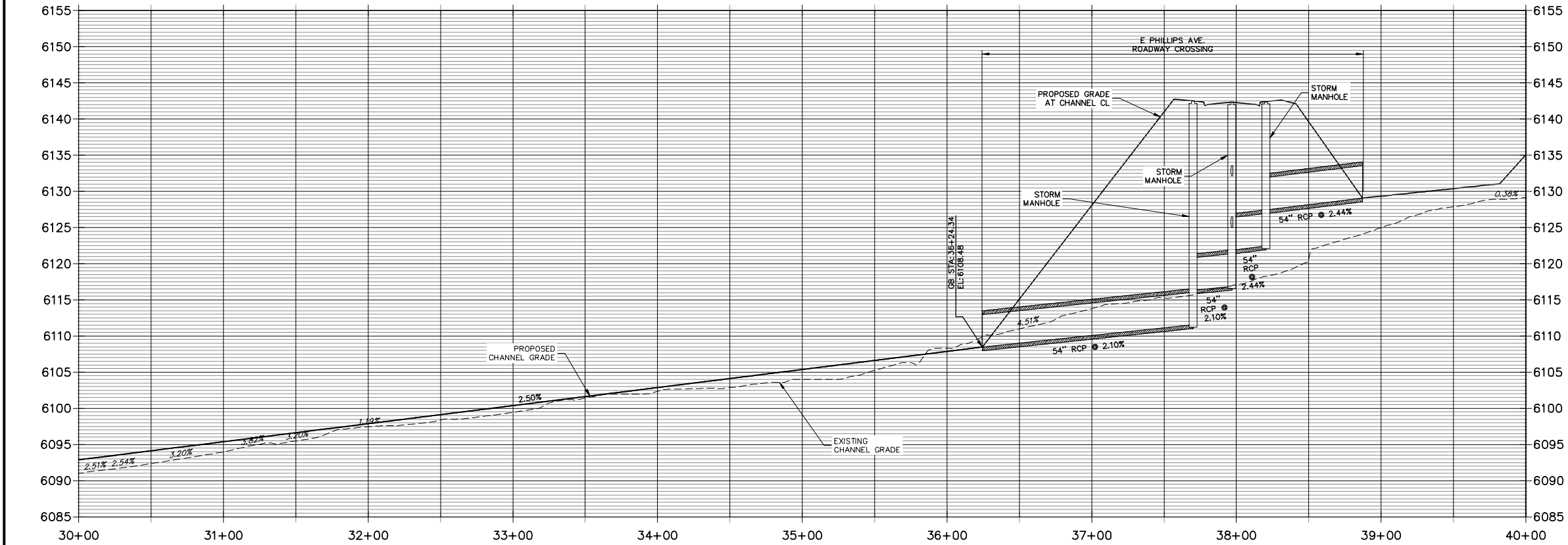




TRAILS AT OVERLAND RANCH  
CHANNEL PLAN & PROFILE

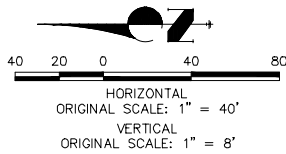


DP20 PROFILE  
STA 30+00.00 TO 40+00.00



NOTES

1. DETAILS OF RIPRAP SIZING AND OTHER ELEMENTS OF EROSION PROTECTION INCLUDING THE SOIL RIPRAP AND REVEGETATION WHERE APPROPRIATE WILL BE EVALUATED WITH THE CD'S/FDR.
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6. DROP MANHOLES WITH GREATER THAN A 30' DROP REQUIRE A VARIANCE AND DESIGN MEASURE TO ADDRESS STRUCTURAL STABILITY. POTENTIAL FOR INCREASED EROSION AND POSSIBLE PROVISION OF AIR VENTS. THIS SHALL BE EVALUATED AT TIME OF CIVIL PLANS ALONG WITH ALTERNATIVE APPROACHES.

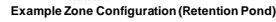


CHANNEL PLAN & PROFILE  
TRAILS AT OVERLAND RANCH  
JOB NO. 16118.10  
02/02/24  
SHEET 2 OF 2



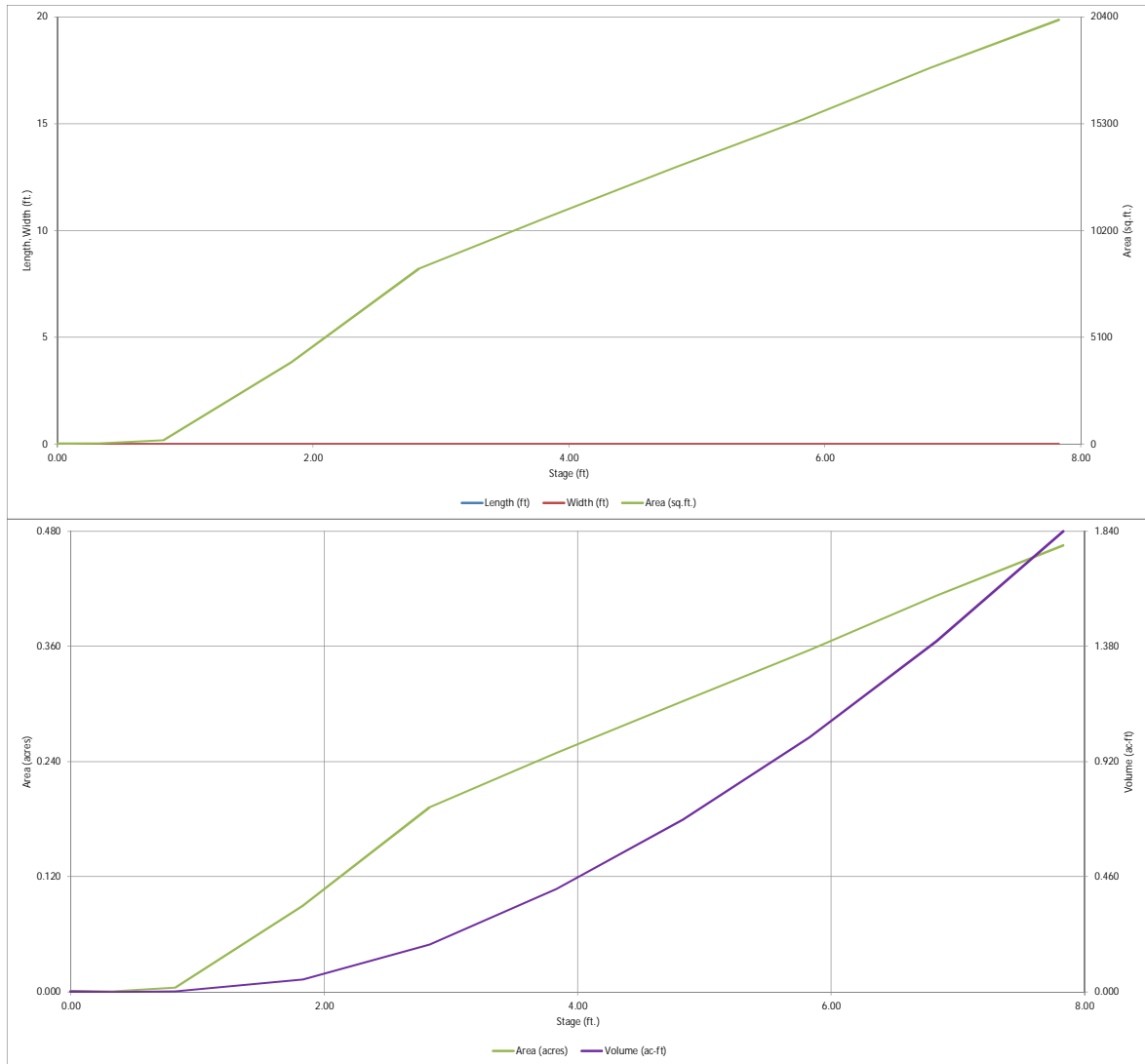
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## MHFD-Detention, Version 4.05 (January 2022)

Basin ID: Pond 329[illegible]

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

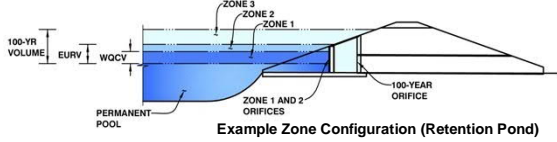


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.05 (January 2022)

Project: Trails at Overland Ranch

Basin ID: Pond 329



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WOCV)	2.73	0.171	Orifice Plate
Zone 2 (EURV)	4.01	0.284	Circular Orifice
Zone 3 (100-year)	5.36	0.397	Weir&Pipe (Restrict)
Total (all zones)		0.851	

User Input: Orifice at Underdrain Outlet (typically used to drain WOCV in a Filtration BMP)

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WOCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 13/16 inch)

WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.91	1.82					
Orifice Area (sq. inches)	0.55	0.55	0.55					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Gate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Gate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Gate Type =   
Debris Clogging % =  %

Height of Gate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Gate Open Area / 100-yr Orifice Area =   
Overflow Gate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Gate Open Area w/ Debris =  ft<sup>2</sup>

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

Calculated Parameters for Spillway

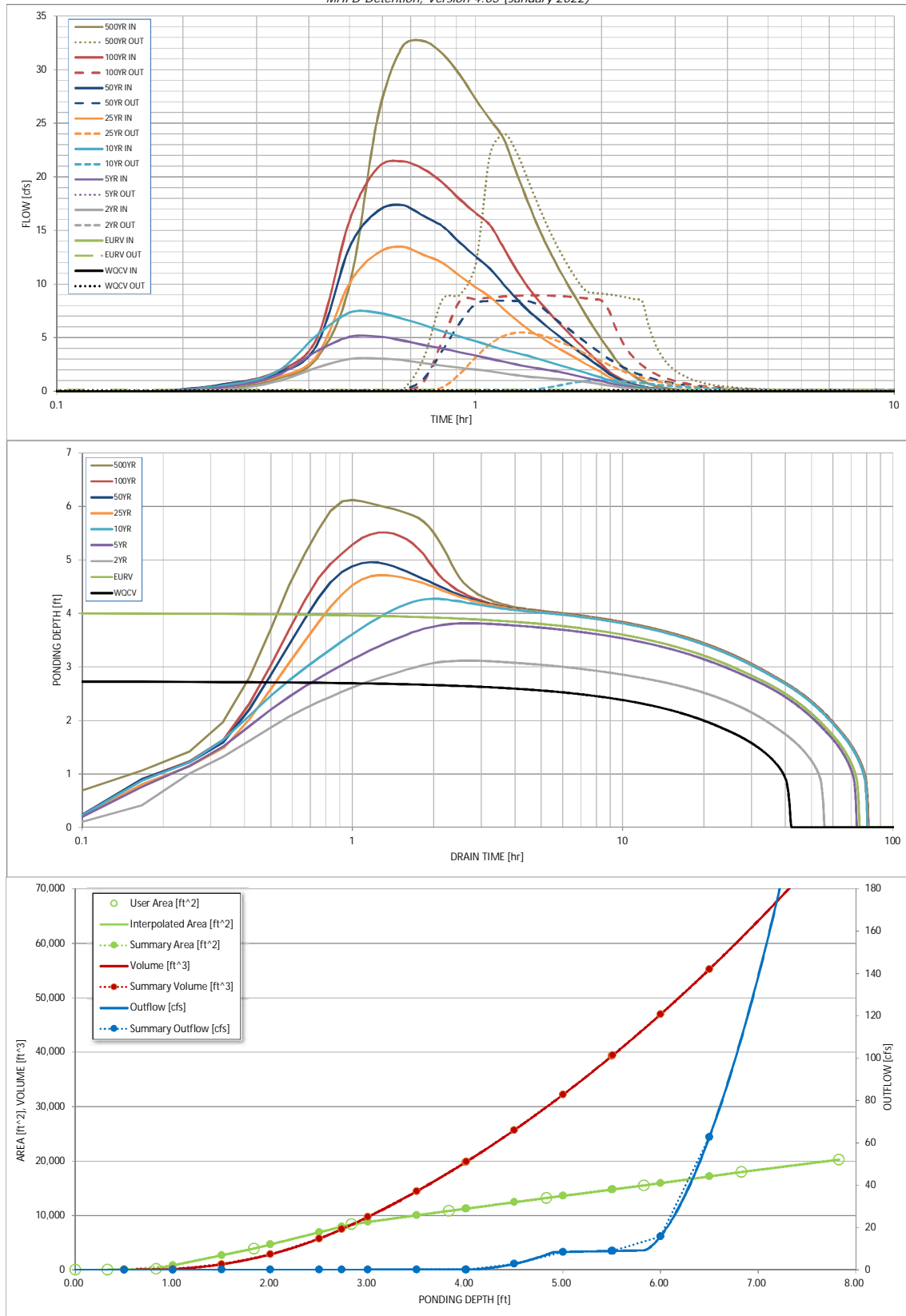
## Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WOCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.83	1.14	1.37	1.76	2.08	2.38	3.30
One-Hour Rainfall Depth (in) =									
CUHP Runoff Volume (acre-ft) =	0.171	0.455	0.265	0.430	0.602	1.019	1.316	1.648	2.559
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.265	0.430	0.602	1.019	1.316	1.648	2.559
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.7	2.1	6.6	9.2	12.4	20.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.06	0.18	0.57	0.80	1.08	1.77
Peak Inflow Q (cfs) =	N/A	N/A	3.1	5.1	7.3	13.5	17.4	21.5	32.7
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.1	1.0	5.5	8.4	8.95	24.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.5	0.8	0.9	0.7	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.8	1.3	1.4	1.4
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	68	51	67	72	68	66	63	57
Time to Drain 99% of Inflow Volume (hours) =	40	72	54	71	77	75	74	73	70
Maximum Ponding Depth (ft) =	2.73	4.01	3.12	3.82	4.27	4.72	4.96	5.51	6.12
Area at Maximum Ponding Depth (acres) =	0.18	0.26	0.21	0.25	0.27	0.30	0.31	0.34	0.37
Maximum Volume Stored (acre-ft) =	0.171	0.456	0.246	0.406	0.525	0.650	0.726	0.905	1.122

# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)



S-A-V-D Chart Axis Override

	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: \_\_\_\_\_

## Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
	0:15:00	0.00	0.00	0.11	0.39	0.55	0.45	0.64	0.65	1.14
	0:20:00	0.00	0.00	0.90	1.43	1.79	1.29	1.64	1.80	3.04
	0:25:00	0.00	0.00	2.20	3.72	5.20	3.25	4.27	4.87	9.93
	0:30:00	0.00	0.00	3.03	5.08	7.34	10.09	13.46	15.95	25.50
	0:35:00	0.00	0.00	3.06	5.12	7.33	12.90	16.80	20.85	32.09
	0:40:00	0.00	0.00	2.91	4.76	6.80	13.49	17.38	21.46	32.69
	0:45:00	0.00	0.00	2.64	4.34	6.20	12.72	16.37	20.74	31.48
	0:50:00	0.00	0.00	2.40	3.99	5.60	11.99	15.40	19.47	29.54
	0:55:00	0.00	0.00	2.20	3.65	5.11	10.76	13.88	17.91	27.25
	1:00:00	0.00	0.00	2.03	3.33	4.68	9.71	12.57	16.63	25.33
	1:05:00	0.00	0.00	1.87	3.04	4.26	8.78	11.41	15.47	23.56
	1:10:00	0.00	0.00	1.67	2.76	3.88	7.68	9.98	13.37	20.47
	1:15:00	0.00	0.00	1.50	2.50	3.60	6.66	8.65	11.39	17.66
	1:20:00	0.00	0.00	1.38	2.29	3.32	5.80	7.55	9.73	15.15
	1:25:00	0.00	0.00	1.29	2.12	3.00	5.13	6.68	8.42	13.12
	1:30:00	0.00	0.00	1.20	1.96	2.71	4.52	5.87	7.31	11.39
	1:35:00	0.00	0.00	1.13	1.81	2.45	3.98	5.13	6.34	9.86
	1:40:00	0.00	0.00	1.05	1.62	2.20	3.48	4.47	5.46	8.46
	1:45:00	0.00	0.00	0.97	1.44	1.95	3.01	3.84	4.62	7.15
	1:50:00	0.00	0.00	0.90	1.26	1.72	2.56	3.24	3.84	5.93
	1:55:00	0.00	0.00	0.77	1.09	1.49	2.14	2.68	3.13	4.82
	2:00:00	0.00	0.00	0.66	0.95	1.28	1.76	2.18	2.49	3.86
	2:05:00	0.00	0.00	0.53	0.77	1.03	1.32	1.64	1.85	2.92
	2:10:00	0.00	0.00	0.43	0.62	0.84	1.01	1.26	1.39	2.22
	2:15:00	0.00	0.00	0.35	0.51	0.68	0.78	0.97	1.05	1.70
	2:20:00	0.00	0.00	0.29	0.41	0.55	0.61	0.76	0.79	1.29
	2:25:00	0.00	0.00	0.24	0.33	0.45	0.48	0.59	0.60	0.97
	2:30:00	0.00	0.00	0.19	0.27	0.36	0.37	0.46	0.44	0.72
	2:35:00	0.00	0.00	0.15	0.21	0.28	0.29	0.35	0.33	0.53
	2:40:00	0.00	0.00	0.12	0.17	0.22	0.22	0.27	0.25	0.40
	2:45:00	0.00	0.00	0.10	0.13	0.17	0.17	0.21	0.19	0.31
	2:50:00	0.00	0.00	0.08	0.10	0.13	0.14	0.16	0.15	0.25
	2:55:00	0.00	0.00	0.06	0.08	0.10	0.11	0.13	0.12	0.19
	3:00:00	0.00	0.00	0.05	0.06	0.08	0.08	0.10	0.09	0.15
	3:05:00	0.00	0.00	0.03	0.04	0.06	0.06	0.07	0.07	0.11
	3:10:00	0.00	0.00	0.02	0.03	0.04	0.04	0.05	0.05	0.07
	3:15:00	0.00	0.00	0.02	0.02	0.02	0.03	0.03	0.03	0.05
	3:20:00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.02
	3:25:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



## DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

### Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]

## POND 329 FOREBAY VOLUME REQUIREMENTS

Equation 3-1       $WQCV = a(0.91I^3 - 1.19I^2 + 0.781I)$   
 $a=1$  (40 hour drain time)

Basin A               $I=.394$                $WQCV=$               0.1782

Equation 3-2               $V=(WQCV/12)A$   
 Basin A               $A= 11.49$  Acres               $V=$       0.171

**3% OF WQCV**  
 FOREBAY TOTAL VOLUME=    .03(V)

VOLUME REQUIRED FOR POND A FOREBAY =              0.0051    AC-FT              223    CF

VOLUME PROVIDED FOR POND A FOREBAY =              0.0058    AC-FT              251    CF

$Q_{100}$  Discharges    2% OF  $Q_{100}$

$Q_{100}$  BASIN A=    .02\*21.5 CFS= 0.43 CFS

# Weir Report

## Pond 329 Forebay Notch

### Compound Weir

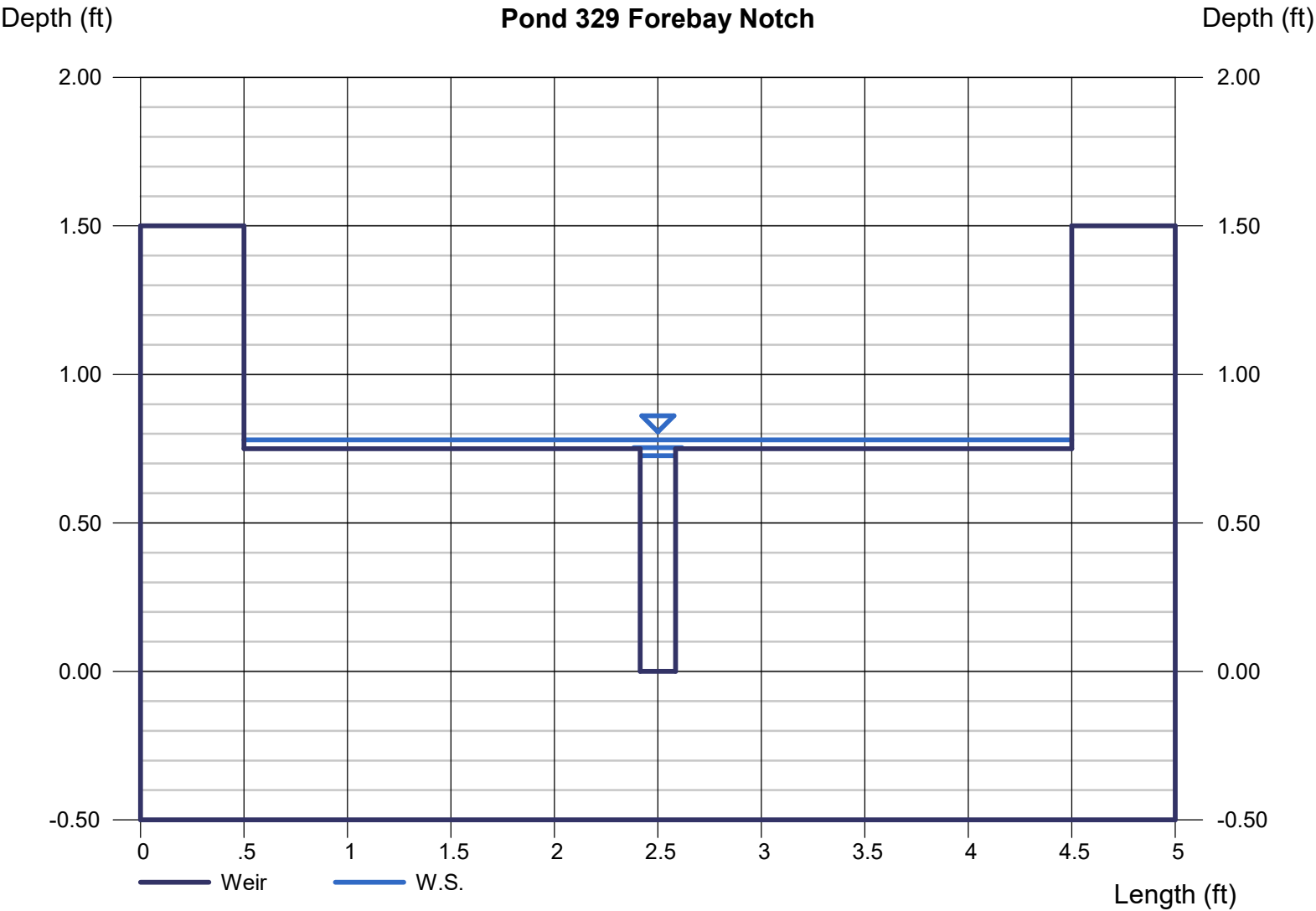
Crest	= Sharp
Bottom Length (ft)	= 4.00
Total Depth (ft)	= 1.50
Length, x (ft)	= 0.17
Depth, a (ft)	= 0.75

### Highlighted

Depth (ft)	= 0.78
Q (cfs)	= 0.430
Area (sqft)	= 0.25
Velocity (ft/s)	= 1.74
Top Width (ft)	= 4.00

### Calculations

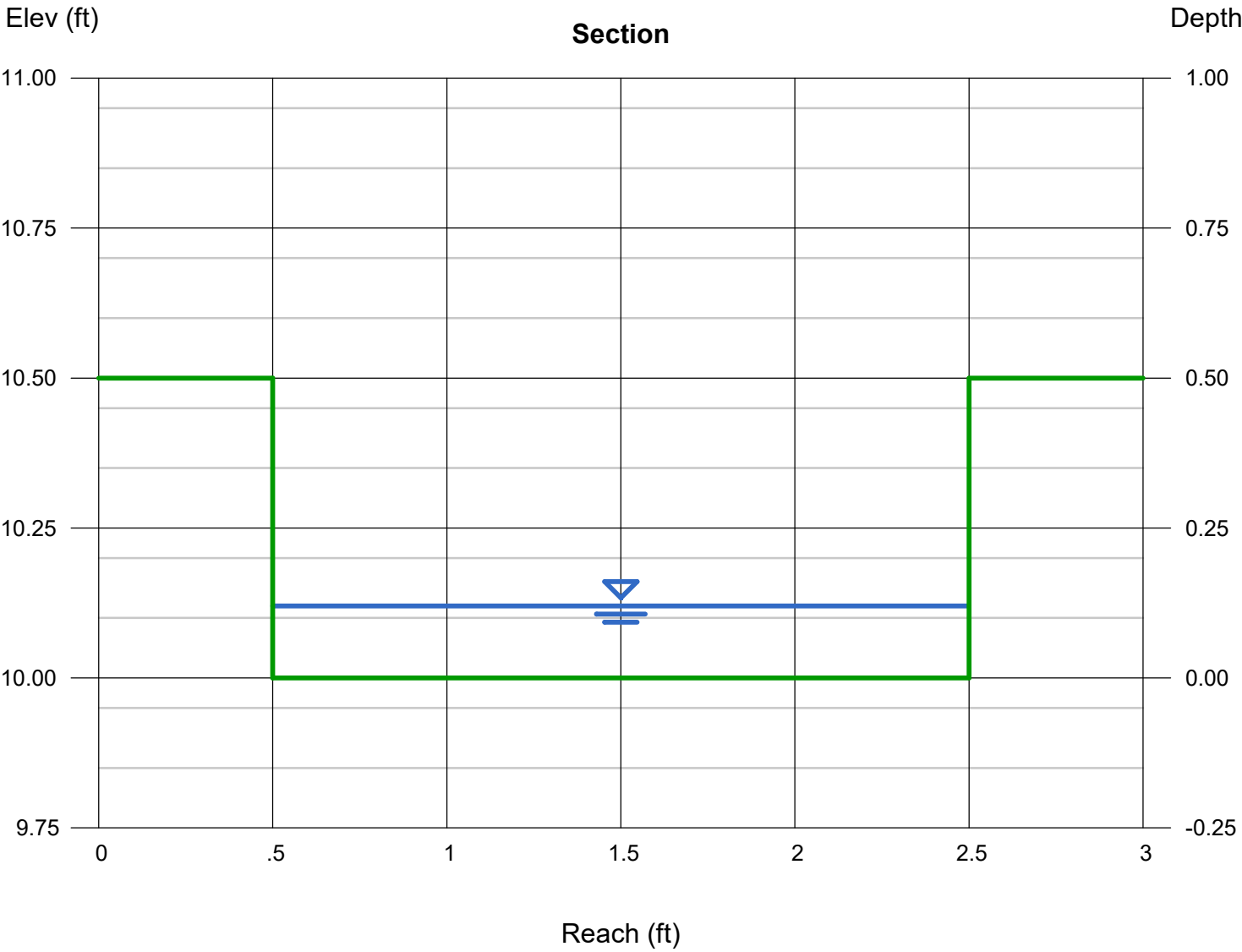
Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 0.43



# Channel Report

## Pond 329 Trickle Channel

<b>Rectangular</b>		<b>Highlighted</b>	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.12
Total Depth (ft)	= 0.50	Q (cfs)	= 0.430
		Area (sqft)	= 0.24
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 1.79
Slope (%)	= 0.50	Wetted Perim (ft)	= 2.24
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.12
		Top Width (ft)	= 2.00
		EGL (ft)	= 0.17
<b>Calculations</b>			
Compute by:	Known Q		
Known Q (cfs)	= 0.43		



# Weir Report

## Pond 329 Spillway

### Trapezoidal Weir

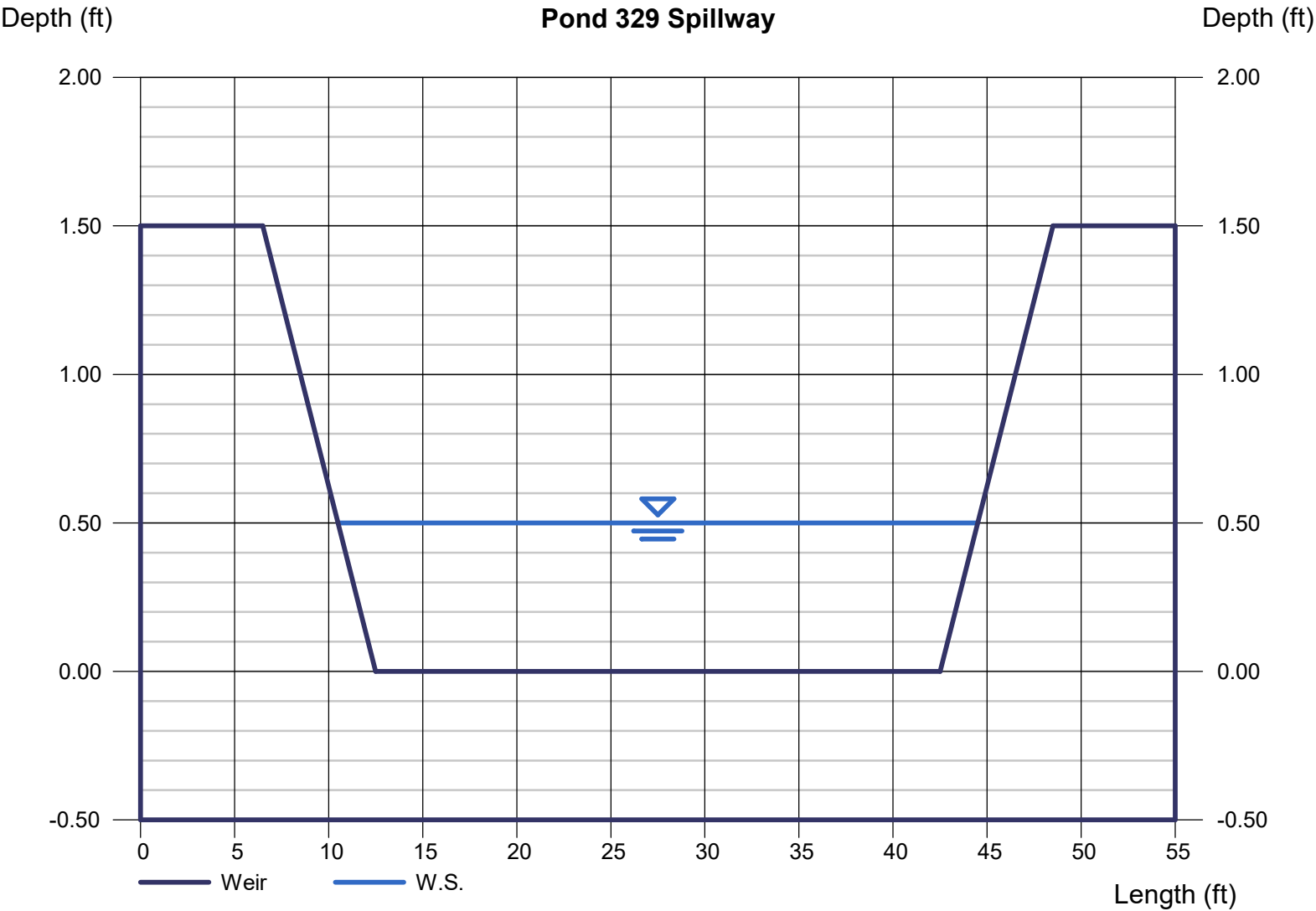
Crest	= Broad
Bottom Length (ft)	= 30.00
Total Depth (ft)	= 1.50
Side Slope (z:1)	= 4.00

### Highlighted

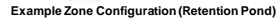
Depth (ft)	= 0.50
Q (cfs)	= 33.01
Area (sqft)	= 16.00
Velocity (ft/s)	= 2.06
Top Width (ft)	= 34.00

### Calculations

Weir Coeff. Cw	= 3.00
Compute by:	Known Q
Known Q (cfs)	= 33.01



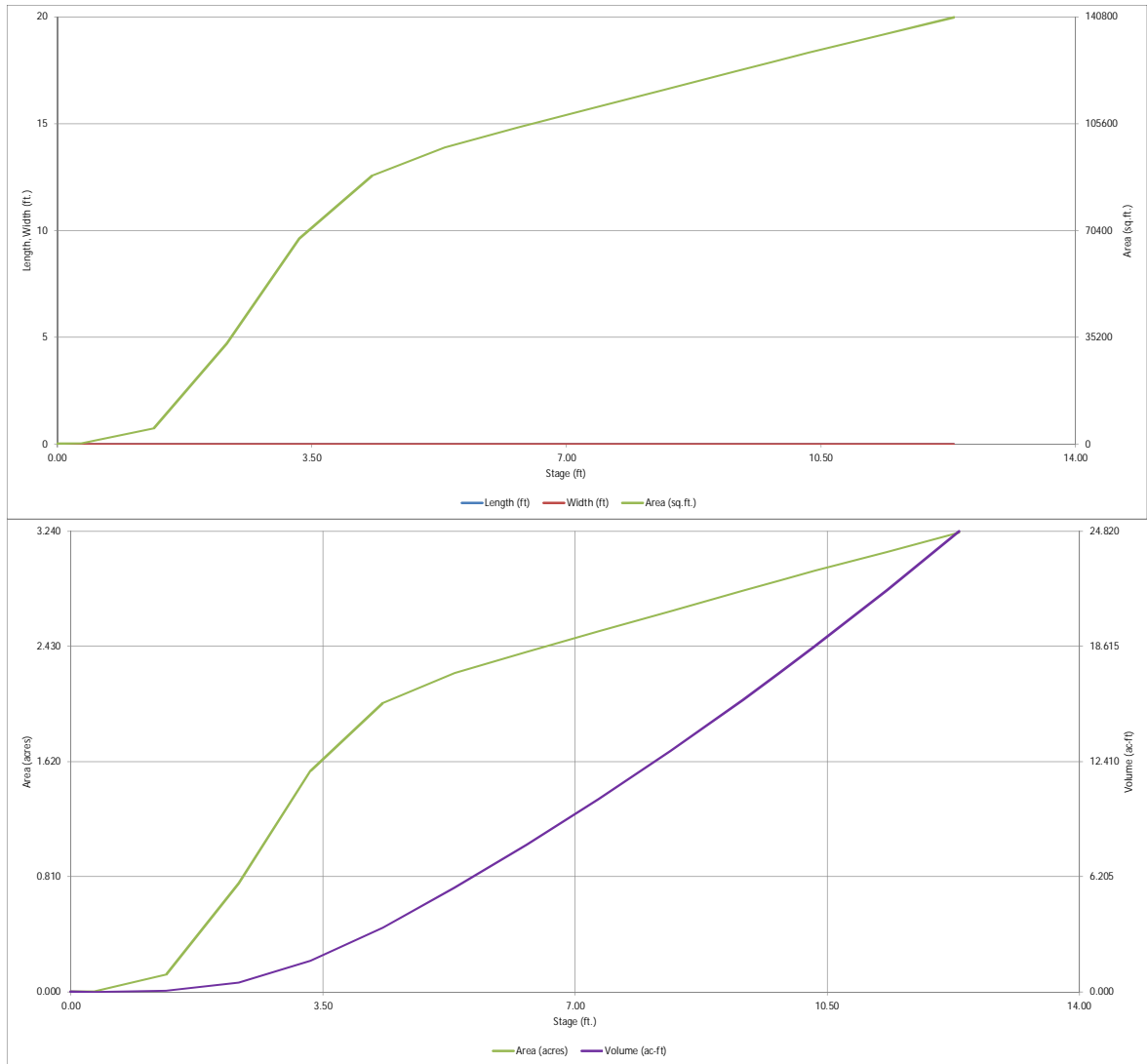
## MHFD-Detention, Version 4.05 (January 2022)

Basin ID: Pond 302

	acre-feet
	acre-feet
0.83	inches
	inches
1.37	inches
	inches
	inches
2.38	inches
	inches

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

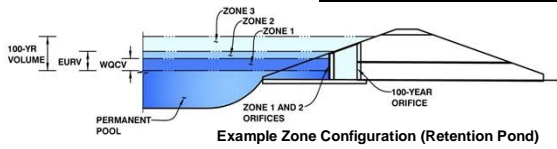
MHFD-Detention, Version 4.05 (January 2022)



# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.05 (January 2022)

Project: Trails at Overland Ranch  
Basin ID: Pond 302



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WOCV)	3.86	2.543	Orifice Plate
Zone 2 (EURV)	5.77	4.054	Rectangular Orifice
Zone 3 (100-year)	8.22	6.074	Weir&Pipe (Restrict)
Total (all zones)		12.671	

User Input: Orifice at Underdrain Outlet (typically used to drain WOCV in a Filtration BMP)

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WOCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (use rectangular openings)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.29	2.57					
Orifice Area (sq. inches)	7.08	7.08	7.08					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Height =  inches  
Vertical Orifice Width =  inches

Calculated Parameters for Vertical Orifice  
Zone 2 Rectangular:  Not Selected  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Gate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Gate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Gate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Zone 3 Weir:  Not Selected  
Height of Gate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Gate Open Area / 100-yr Orifice Area =   
Overflow Gate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Gate Open Area w/ Debris =  ft<sup>2</sup>

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Zone 3 Restrictor:  Not Selected  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

## Routed Hydrograph Results

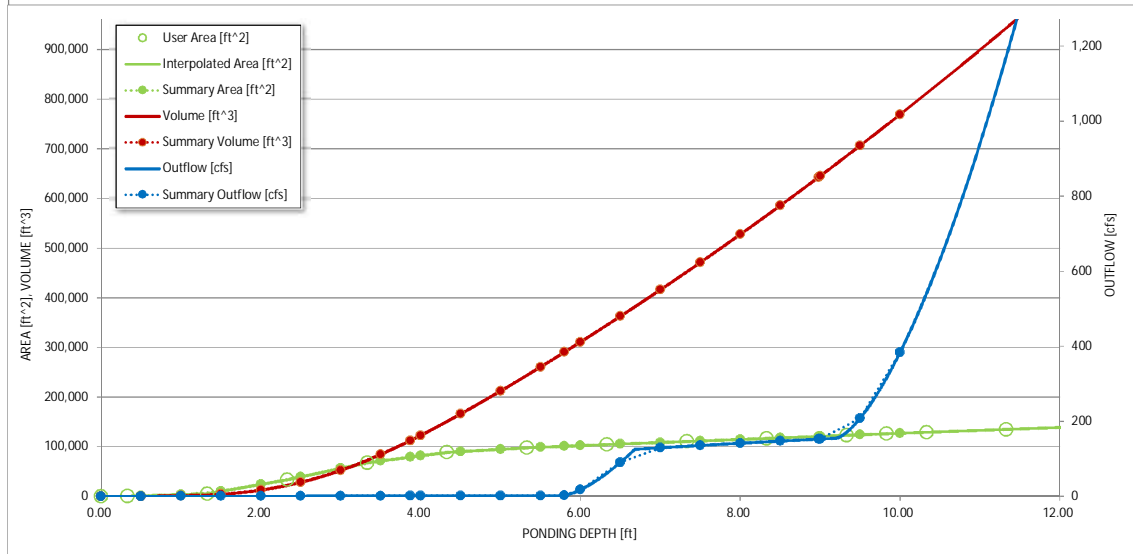
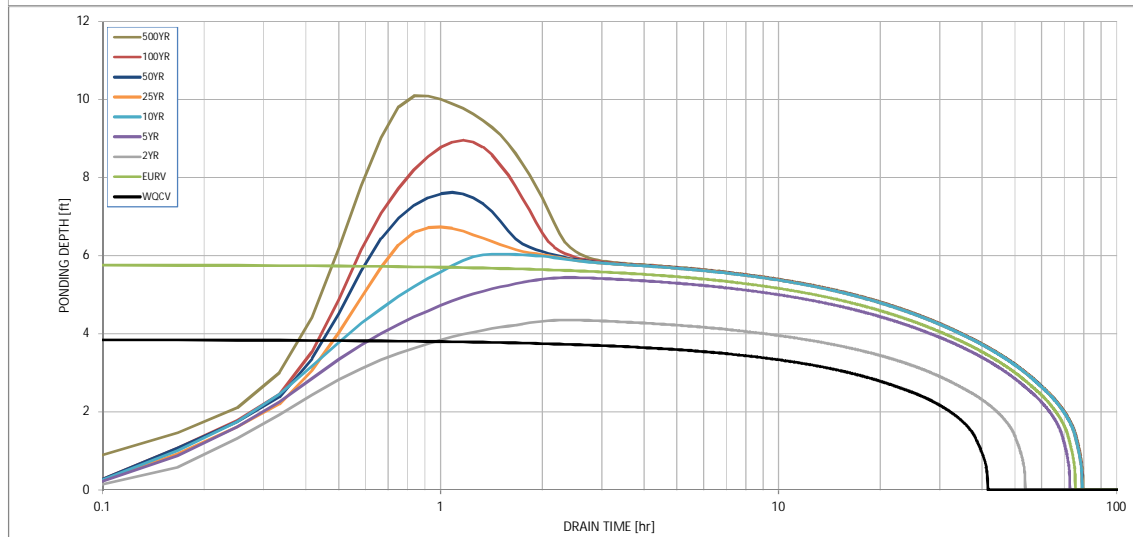
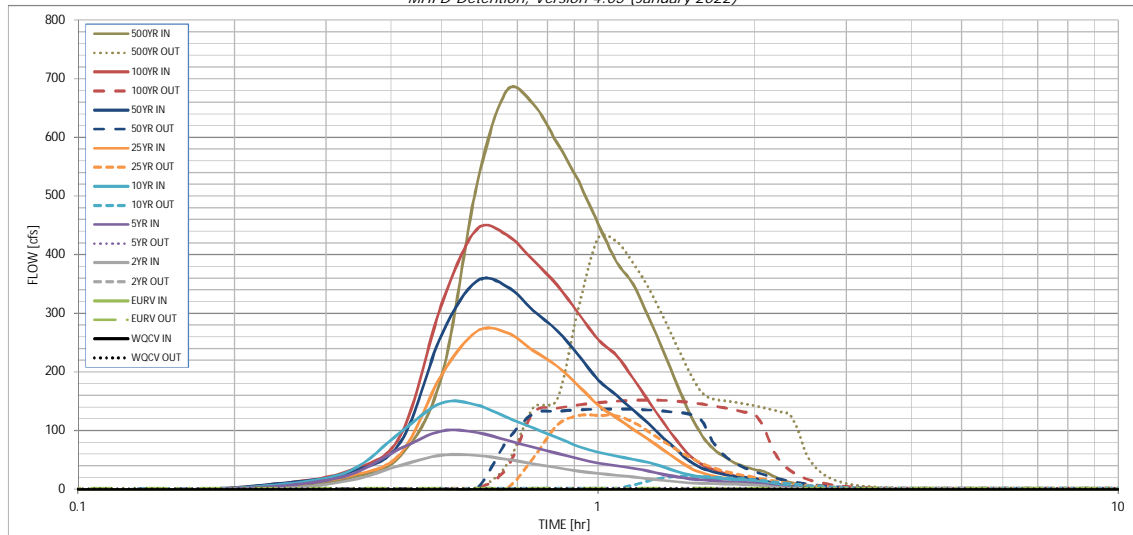
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.83	1.14	1.37	1.76	2.08	2.38	3.30
One-Hour Rainfall Depth (in) =	N/A	N/A	0.83	1.14	1.37	1.76	2.08	2.38	3.30
CUHP Runoff Volume (acre-ft) =	2.543	6.597	3.723	6.124	8.746	15.241	19.889	25.173	39.335
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.723	6.124	8.746	15.241	19.889	25.173	39.335
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.1	14.2	48.3	147.4	210.3	277.4	454.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.08	0.27	0.82	1.17	1.55	2.53
Peak Inflow Q (cfs) =	N/A	N/A	58.3	99.3	147.4	269.0	354.6	442.8	679.6
Peak Outflow Q (cfs) =	1.1	1.7	1.3	1.6	22.1	126.1	137.1	152.3	428.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.5	0.9	0.7	0.5	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	0.3	1.7	1.8	2.1	2.2
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	49	66	70	66	63	61	54
Time to Drain 99% of Inflow Volume (hours) =	40	72	52	69	75	73	72	71	68
Maximum Ponding Depth (ft) =	3.86	5.77	4.35	5.44	6.04	6.74	7.62	8.97	10.10
Area at Maximum Ponding Depth (acres) =	1.81	2.31	2.04	2.26	2.35	2.45	2.58	2.77	2.93
Maximum Volume Stored (acre-ft) =	2.556	6.598	3.499	5.844	7.227	8.908	11.121	14.701	17.950



# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: \_\_\_\_\_

## Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.36
	0:15:00	0.00	0.00	1.86	6.44	9.17	7.45	10.74	10.92	19.77
	0:20:00	0.00	0.00	15.09	24.93	31.41	23.00	29.51	32.31	57.13
	0:25:00	0.00	0.00	40.78	69.60	97.37	60.65	80.13	91.44	192.14
	0:30:00	0.00	0.00	58.30	99.32	147.41	195.58	263.99	315.60	515.64
	0:35:00	0.00	0.00	57.61	96.99	144.07	269.01	354.62	442.81	679.63
	0:40:00	0.00	0.00	51.21	83.81	122.90	267.55	346.32	434.09	657.28
	0:45:00	0.00	0.00	43.68	71.59	104.54	236.84	305.25	390.79	590.91
	0:50:00	0.00	0.00	36.73	61.61	88.09	210.12	271.01	348.35	525.71
	0:55:00	0.00	0.00	31.08	51.98	73.34	176.53	228.26	299.98	452.59
	1:00:00	0.00	0.00	26.97	44.83	63.31	143.54	186.53	255.24	388.90
	1:05:00	0.00	0.00	24.18	40.02	56.80	122.49	160.98	228.43	349.63
	1:10:00	0.00	0.00	21.13	36.03	51.18	102.87	135.44	189.83	293.35
	1:15:00	0.00	0.00	18.09	31.12	45.68	84.95	111.57	150.47	236.01
	1:20:00	0.00	0.00	15.31	25.70	38.60	67.35	88.07	114.67	179.79
	1:25:00	0.00	0.00	12.84	21.02	30.30	51.55	66.96	83.21	129.89
	1:30:00	0.00	0.00	11.04	17.98	24.40	36.92	47.76	57.34	91.71
	1:35:00	0.00	0.00	10.08	16.36	21.17	27.97	36.38	42.18	68.85
	1:40:00	0.00	0.00	9.65	14.64	19.10	22.65	29.48	33.32	54.88
	1:45:00	0.00	0.00	9.42	13.14	17.62	19.33	25.04	27.11	45.03
	1:50:00	0.00	0.00	9.27	12.06	16.61	17.08	22.00	22.90	38.36
	1:55:00	0.00	0.00	8.35	11.27	15.59	15.72	20.08	19.94	33.57
	2:00:00	0.00	0.00	7.33	10.42	14.12	14.76	18.74	17.90	30.24
	2:05:00	0.00	0.00	5.78	8.21	10.97	11.58	14.62	13.65	23.07
	2:10:00	0.00	0.00	4.30	5.99	7.91	8.32	10.47	9.79	16.38
	2:15:00	0.00	0.00	3.20	4.40	5.71	6.01	7.52	7.08	11.77
	2:20:00	0.00	0.00	2.35	3.21	4.14	4.36	5.45	5.20	8.62
	2:25:00	0.00	0.00	1.71	2.27	2.96	3.09	3.84	3.70	6.11
	2:30:00	0.00	0.00	1.22	1.58	2.08	2.16	2.68	2.58	4.25
	2:35:00	0.00	0.00	0.85	1.10	1.46	1.54	1.91	1.83	3.00
	2:40:00	0.00	0.00	0.56	0.74	0.97	1.03	1.27	1.21	1.97
	2:45:00	0.00	0.00	0.33	0.46	0.57	0.62	0.76	0.72	1.15
	2:50:00	0.00	0.00	0.17	0.24	0.28	0.31	0.38	0.35	0.55
	2:55:00	0.00	0.00	0.07	0.10	0.10	0.11	0.12	0.11	0.17
	3:00:00	0.00	0.00	0.02	0.02	0.01	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

### Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]

## POND 302 FOREBAY VOLUME REQUIREMENTS

EQUATION 3-1

$$WQCV = a(0.91I^3 - 1.19I^2 + 0.781I)$$

$a=1$  (40 hour drain time)

FOREBAY 1	$I=.568$	$WQCV=$	0.22588
FOREBAY 2	$I=.348$	$WQCV=$	0.16568
FOREBAY 3	$I=.534$	$WQCV=$	0.21575

EQUATION 3-3

$$V = (WQCV/12)A$$

FOREBAY 1       $A= 4.94$  Acres       $V= 0.09299$       AC-FT

FOREBAY 2       $A= 166.34$  Acres       $V= 2.29657$       AC-FT

FOREBAY 3       $A= 7.89$  Acres       $V= 0.14186$       AC-FT

TOTAL WQCV REQUIRED =      2.53141      AC-FT

**3% OF WQCV**      0.0759423

FOREBAY TOTAL VOLUME=      .03(V)

VOLUME REQUIRED FOR FOREBAY 1=      0.0028      AC-FT      122 CF

VOLUME PROVIDED FOR FOREBAY 1=      0.0040      AC-FT      176 CF

$Q_{100}$  DISCHARGES      2% OF  $Q_{100}$

$Q_{100}$  FOREBAY 1=      .02\*12.45 CFS= 0.25 CFS

VOLUME REQUIRED FOR FOREBAY 2=      0.0689      AC-FT      3001 CF

VOLUME PROVIDED FOR FOREBAY 2=      0.0916      AC-FT      3988 CF

$Q_{100}$  DISCHARGES      2% OF  $Q_{100}$

$Q_{100}$  FOREBAY 2=      .02\*400.85 CFS= 8.02 CFS

VOLUME REQUIRED FOR FOREBAY 3=      0.0043      AC-FT      185 CF

VOLUME PROVIDED FOR FOREBAY 3=      0.0060      AC-FT      261 CF

$Q_{100}$  DISCHARGES      2% OF  $Q_{100}$

$Q_{100}$  FOREBAY 3=      .02\*27.76 CFS= 0.56 CFS      See hydraflow models for discharge confirmation

# Weir Report

## Pond 302 Forebay 1 Notch

### Compound Weir

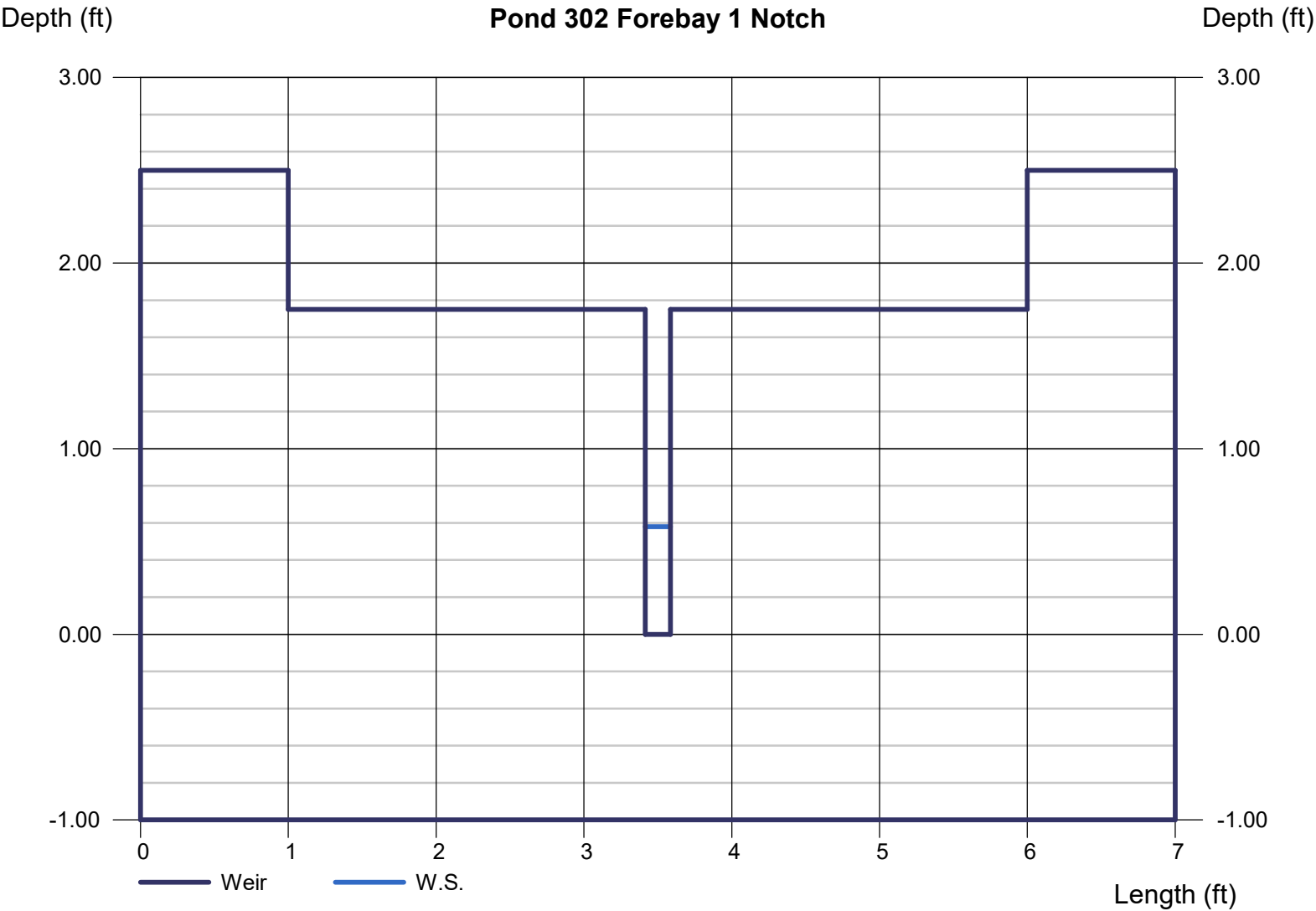
Crest	= Sharp
Bottom Length (ft)	= 5.00
Total Depth (ft)	= 2.50
Length, x (ft)	= 0.17
Depth, a (ft)	= 1.75

### Highlighted

Depth (ft)	= 0.58
Q (cfs)	= 0.250
Area (sqft)	= 0.10
Velocity (ft/s)	= 2.54
Top Width (ft)	= 0.17

### Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 0.25



# Weir Report

## Pond 302 Forebay 2 Notch

### Compound Weir

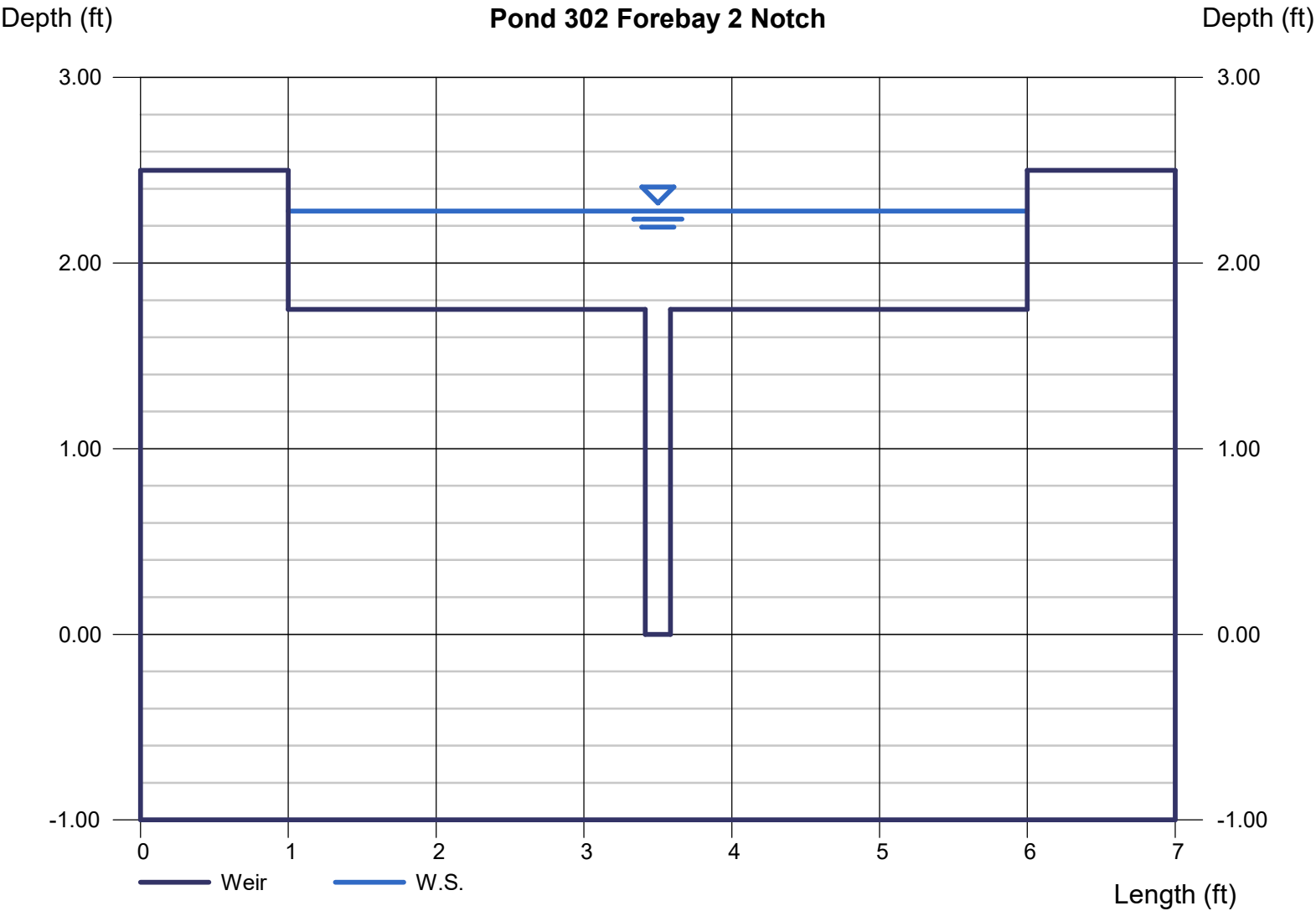
Crest	= Sharp
Bottom Length (ft)	= 5.00
Total Depth (ft)	= 2.50
Length, x (ft)	= 0.17
Depth, a (ft)	= 1.75

### Highlighted

Depth (ft)	= 2.28
Q (cfs)	= 8.020
Area (sqft)	= 2.95
Velocity (ft/s)	= 2.72
Top Width (ft)	= 5.00

### Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 8.02



# Weir Report

## Pond 302 Forebay 3 Notch

### Compound Weir

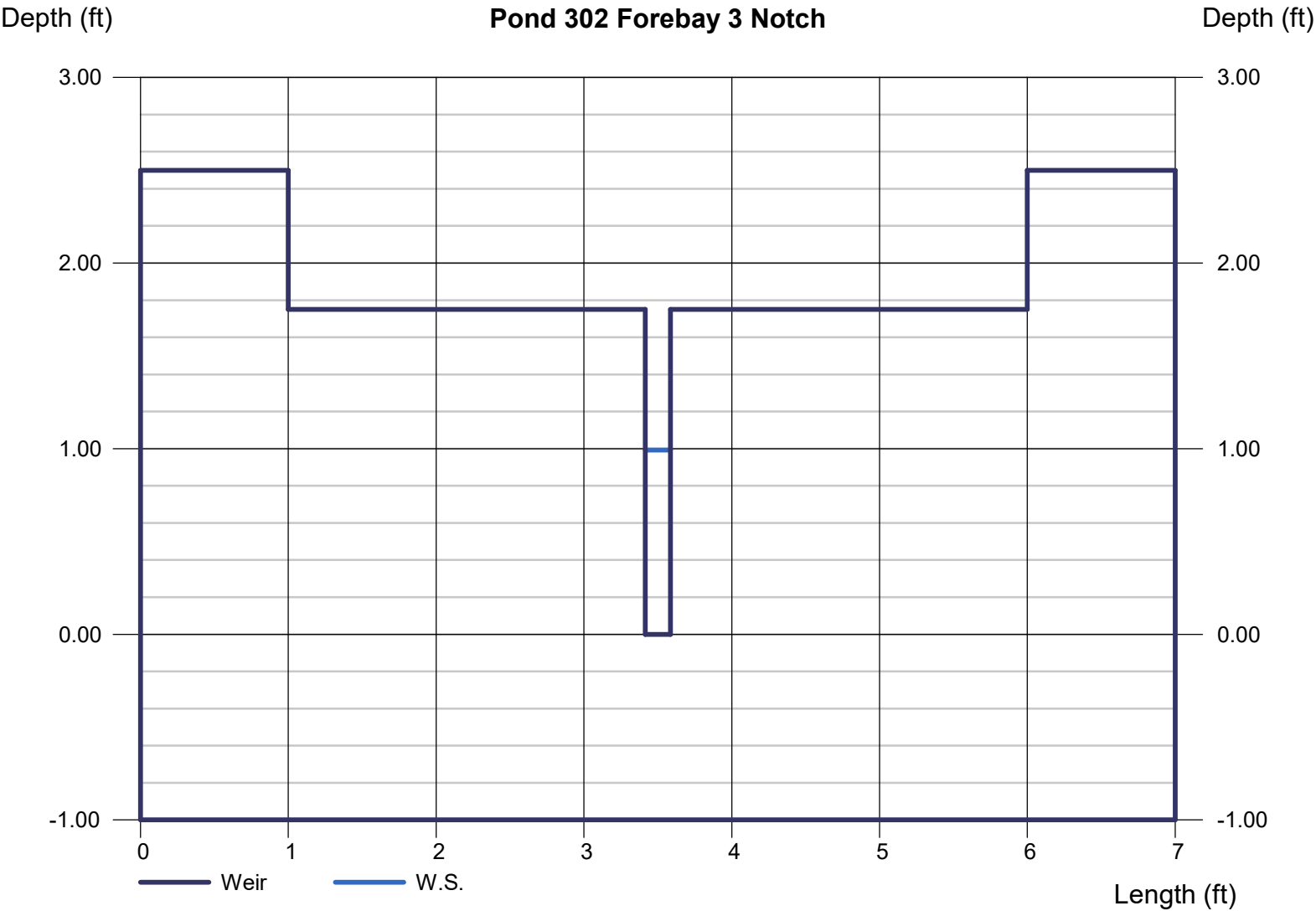
Crest	= Sharp
Bottom Length (ft)	= 5.00
Total Depth (ft)	= 2.50
Length, x (ft)	= 0.17
Depth, a (ft)	= 1.75

### Highlighted

Depth (ft)	= 0.99
Q (cfs)	= 0.560
Area (sqft)	= 0.17
Velocity (ft/s)	= 3.32
Top Width (ft)	= 0.17

### Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 0.56



# Channel Report

## Pond 302 Trickle Channel 1

### Rectangular

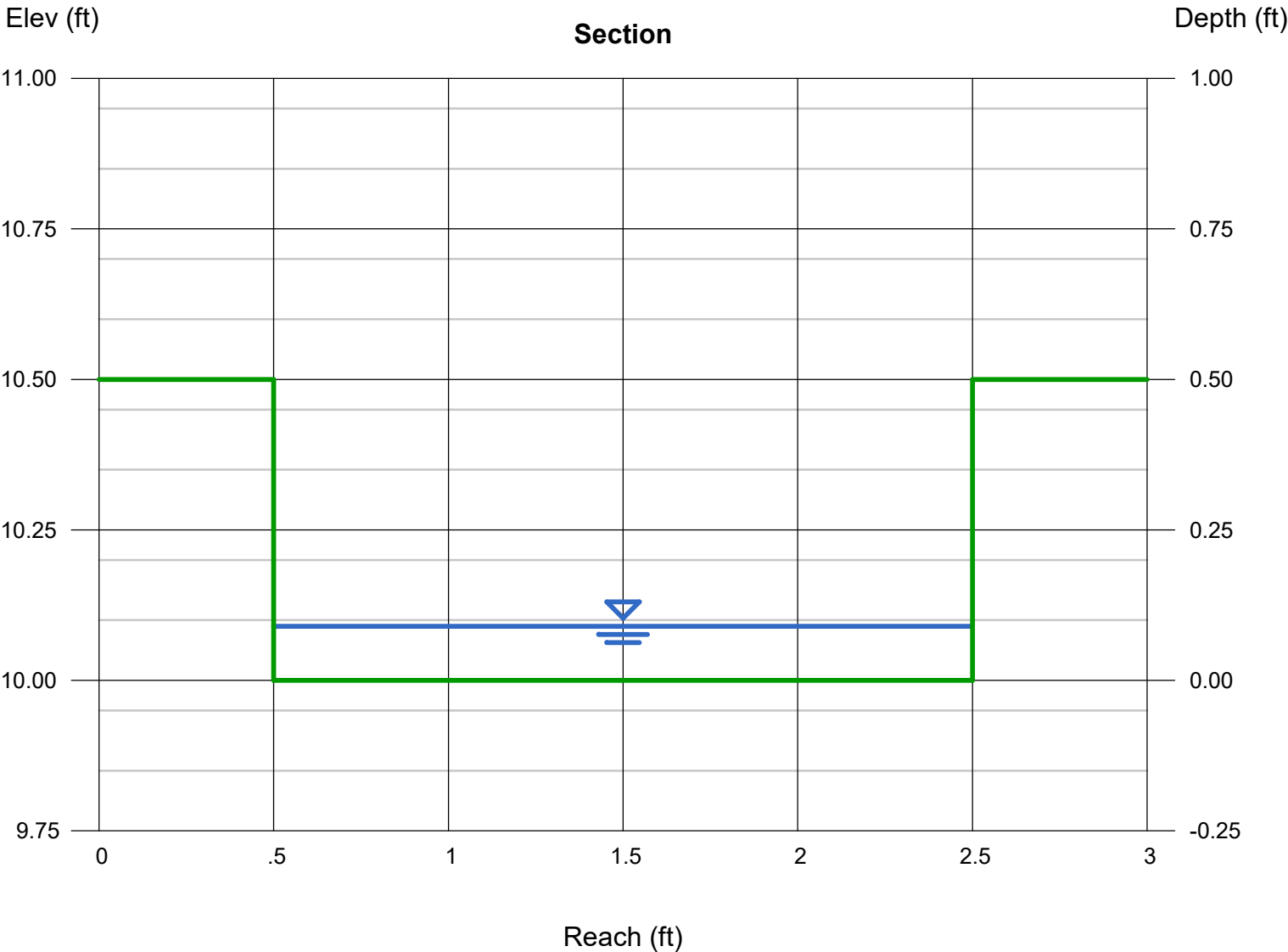
Bottom Width (ft) = 2.00  
Total Depth (ft) = 0.50  
  
Invert Elev (ft) = 10.00  
Slope (%) = 0.50  
N-Value = 0.013

### Calculations

Compute by: Known Q  
Known Q (cfs) = 0.25

### Highlighted

Depth (ft) = 0.09  
Q (cfs) = 0.250  
Area (sqft) = 0.18  
Velocity (ft/s) = 1.39  
Wetted Perim (ft) = 2.18  
Crit Depth, Yc (ft) = 0.08  
Top Width (ft) = 2.00  
EGL (ft) = 0.12

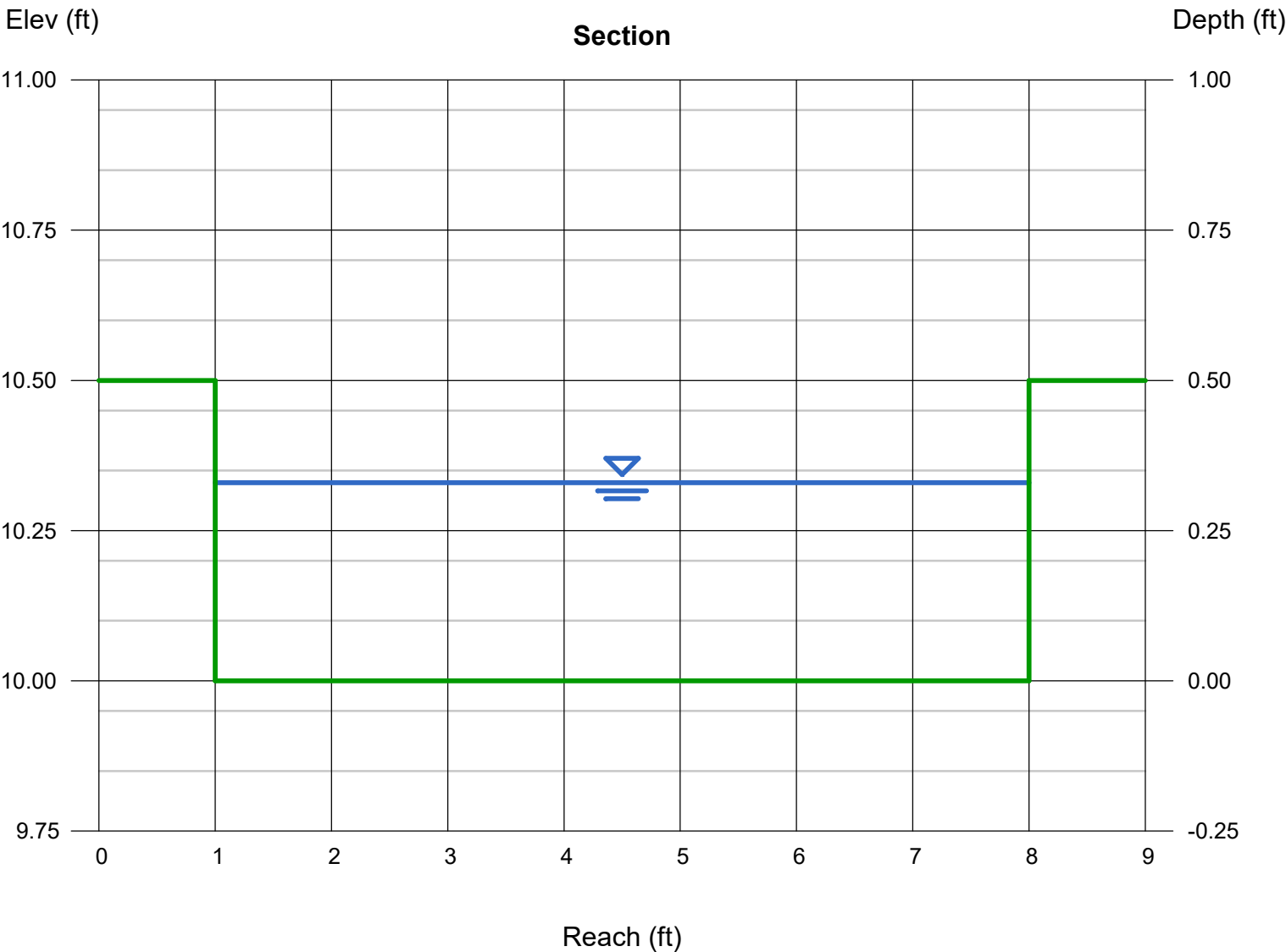




# Channel Report

## Pond 302 Trickle Channel 2

<b>Rectangular</b>		<b>Highlighted</b>	
Bottom Width (ft)	= 7.00	Depth (ft)	= 0.33
Total Depth (ft)	= 0.50	Q (cfs)	= 8.020
		Area (sqft)	= 2.31
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 3.47
Slope (%)	= 0.50	Wetted Perim (ft)	= 7.66
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.35
		Top Width (ft)	= 7.00
		EGL (ft)	= 0.52
<b>Calculations</b>			
Compute by:	Known Q		
Known Q (cfs)	= 8.02		



# Channel Report

## Pond 302 Trickle Channel 3

### Rectangular

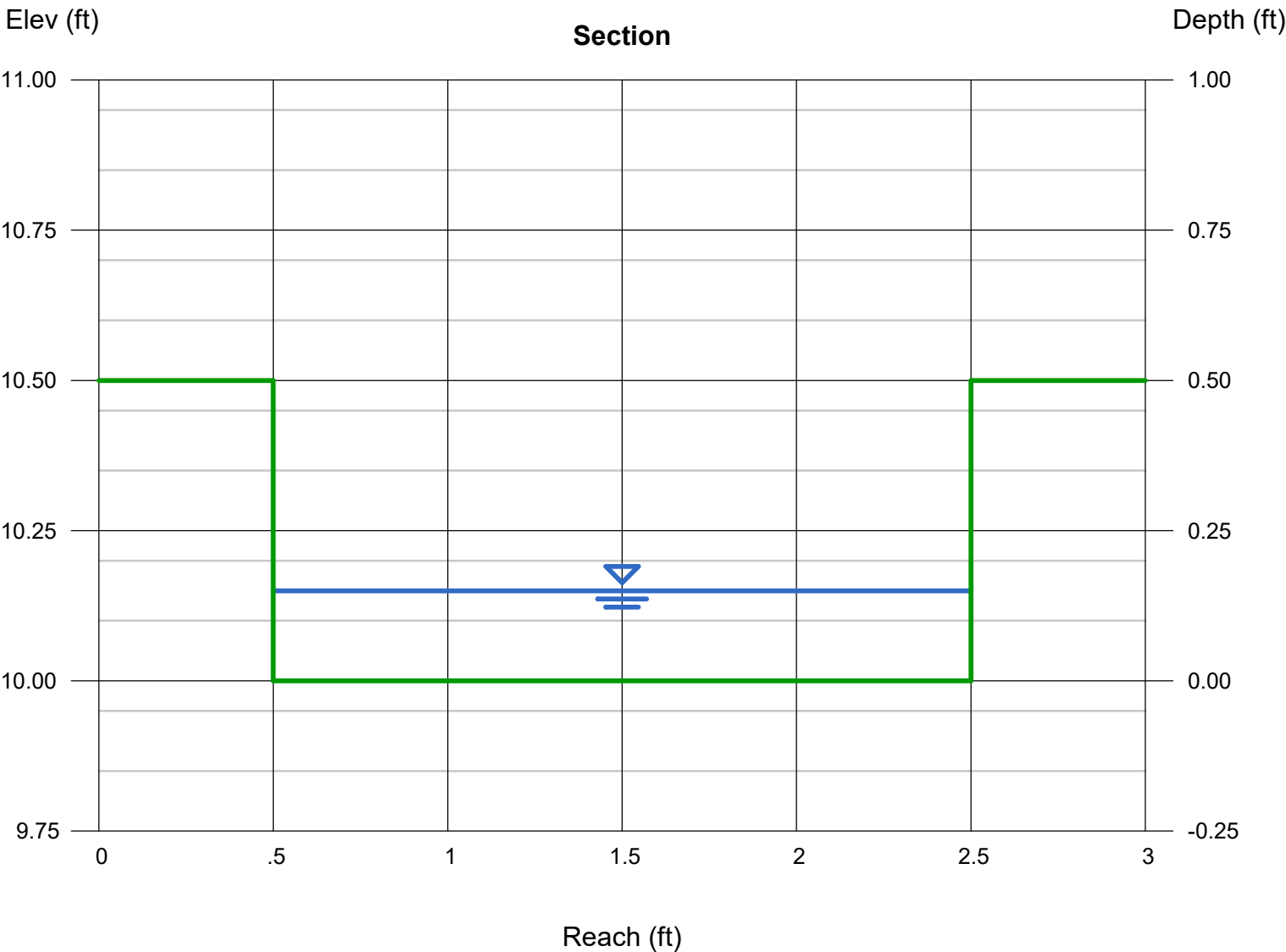
Bottom Width (ft) = 2.00  
Total Depth (ft) = 0.50  
  
Invert Elev (ft) = 10.00  
Slope (%) = 0.50  
N-Value = 0.013

### Calculations

Compute by: Known Q  
Known Q (cfs) = 0.56

### Highlighted

Depth (ft) = 0.15  
Q (cfs) = 0.560  
Area (sqft) = 0.30  
Velocity (ft/s) = 1.87  
Wetted Perim (ft) = 2.30  
Crit Depth, Yc (ft) = 0.14  
Top Width (ft) = 2.00  
EGL (ft) = 0.20



# Weir Report

## Pond 302 Spillway

### Trapezoidal Weir

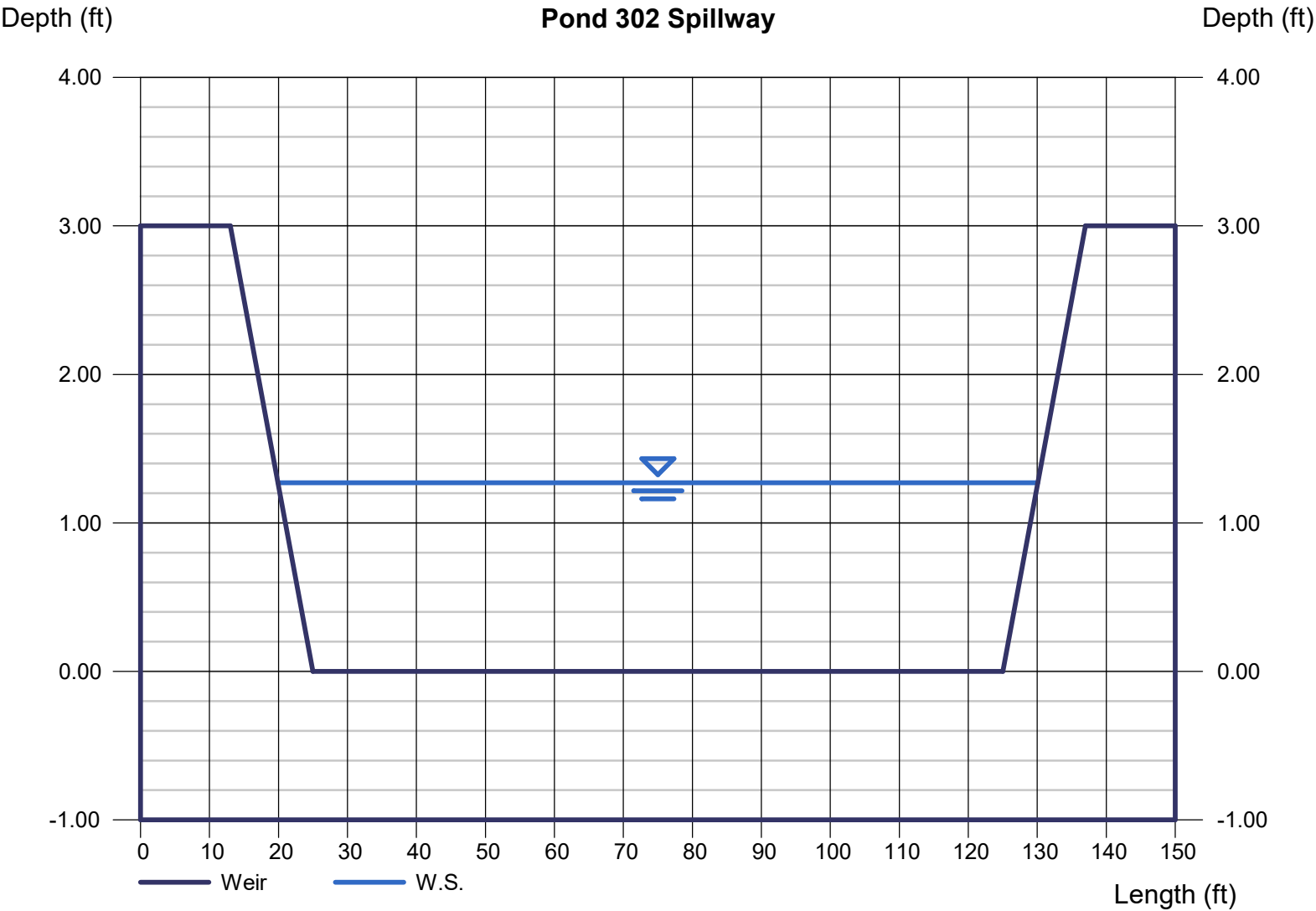
Crest = Broad  
Bottom Length (ft) = 100.00  
Total Depth (ft) = 3.00  
Side Slope (z:1) = 4.00

### Highlighted

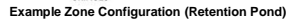
Depth (ft) = 1.27  
Q (cfs) = 443.91  
Area (sqft) = 133.45  
Velocity (ft/s) = 3.33  
Top Width (ft) = 110.16

### Calculations

Weir Coeff. Cw = 3.00  
Compute by: Known Q  
Known Q (cfs) = 443.91



*MHFD-Detention, Version 4.05 (January 2022)*

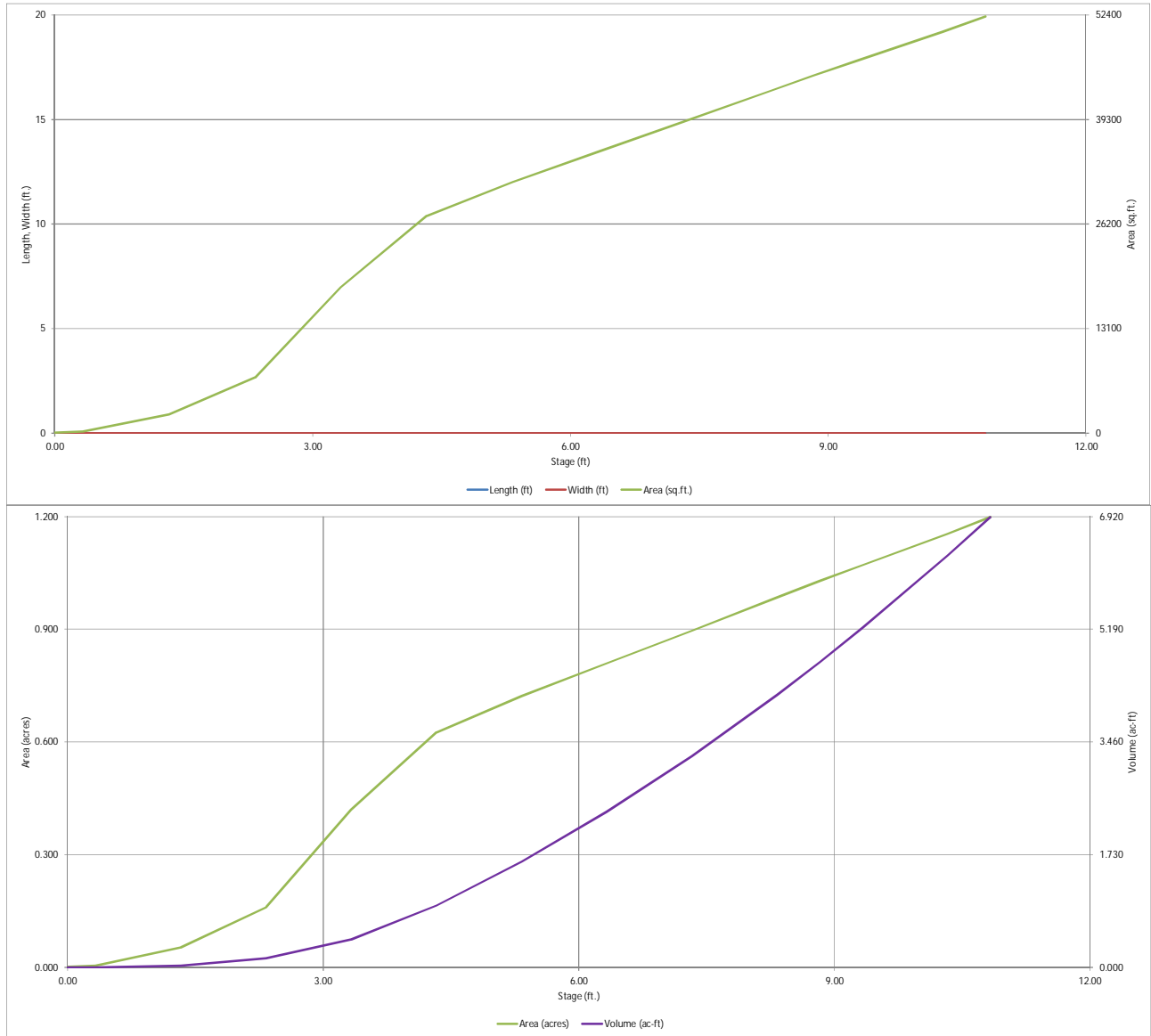
Basin ID: Pond 306

Initial Surcharge Area ( $A_{SIV}$ )	=	user	ft <sup>2</sup>
Surcharge Volume Length ( $L_{SIV}$ )	=	user	ft
Surcharge Volume Width ( $W_{SIV}$ )	=	user	ft
Depth of Basin Floor ( $H_{1LOOR}$ )	=	user	ft
Length of Basin Floor ( $L_{1LOOR}$ )	=	user	ft
Width of Basin Floor ( $W_{1LOOR}$ )	=	user	ft
Area of Basin Floor ( $A_{1LOOR}$ )	=	user	ft <sup>2</sup>
Volume of Basin Floor ( $V_{1LOOR}$ )	=	user	ft <sup>3</sup>
Depth of Main Basin ( $H_{MAIN}$ )	=	user	ft
Length of Main Basin ( $L_{MAIN}$ )	=	user	ft
Width of Main Basin ( $W_{MAIN}$ )	=	user	ft
Area of Main Basin ( $A_{MAIN}$ )	=	user	ft <sup>2</sup>
Volume of Main Basin ( $V_{MAIN}$ )	=	user	ft <sup>3</sup>
Calculated Total Basin Volume ( $V_{TOTAL}$ )	=	user	acre-feet

[illegible]

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

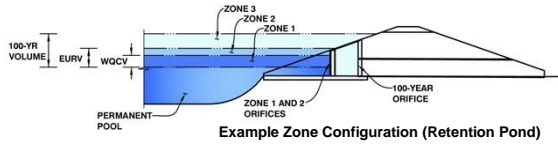


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: Trails at Overland Ranch

Basin ID: Pond 306



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WOCV)	3.58	0.536	Orifice Plate
Zone 2 (EURV)	5.39	1.128	Circular Orifice
Zone 3 (100-year)	6.74	1.059	Weir&Pipe (Restrict)
Total (all zones)		2.723	

User Input: Orifice at Underdrain Outlet (typically used to drain WOCV in a Filtration BMP)

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WOCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-7/16 inches)

Calculated Parameters for Plate  
WO Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.19	2.39					
Orifice Area (sq. inches)	1.61	1.61	1.61					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Zone 2 Circular   
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Zone 3 Weir   
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Zone 3 Restrictor   
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

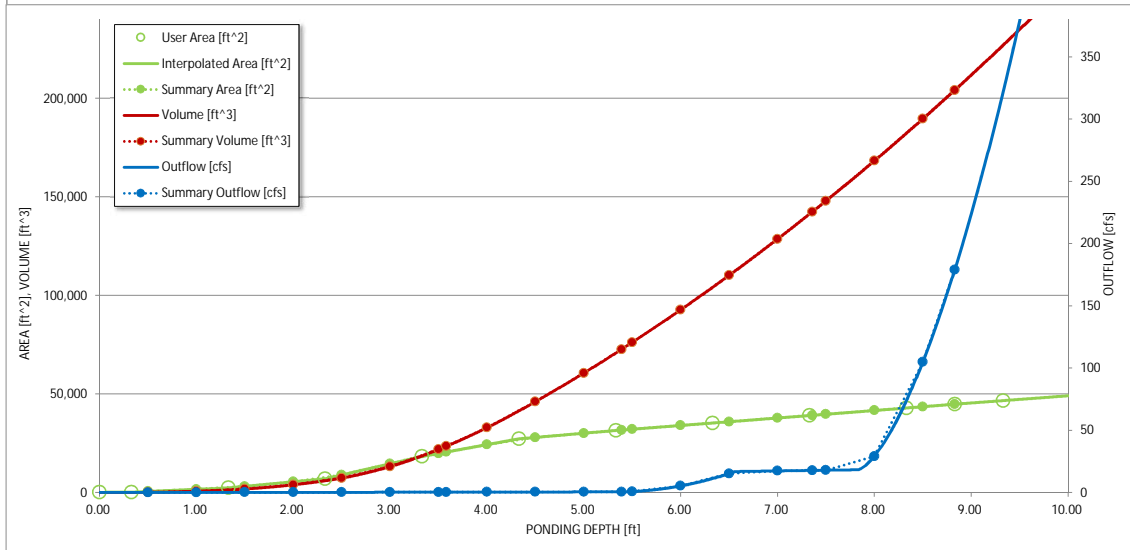
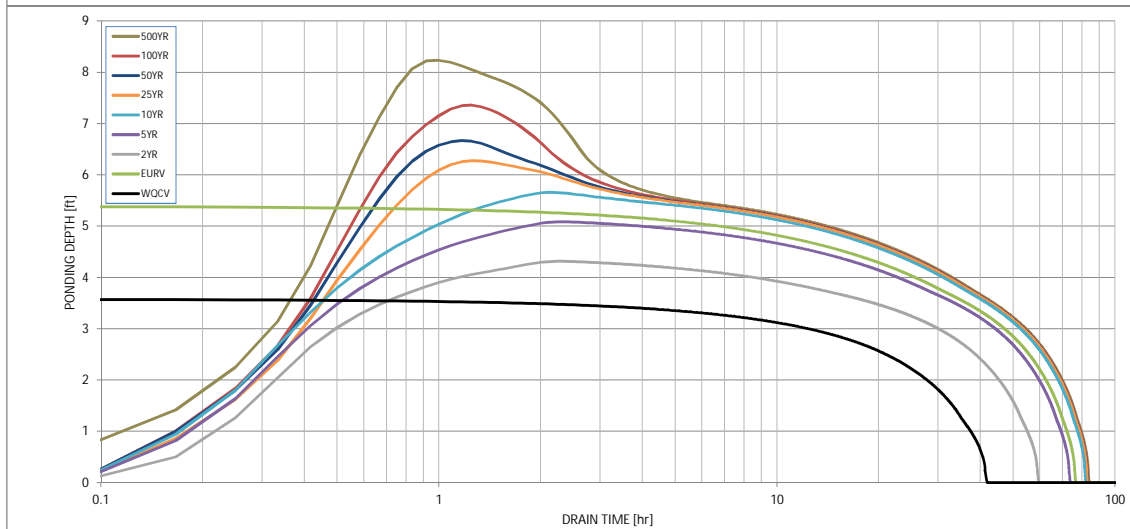
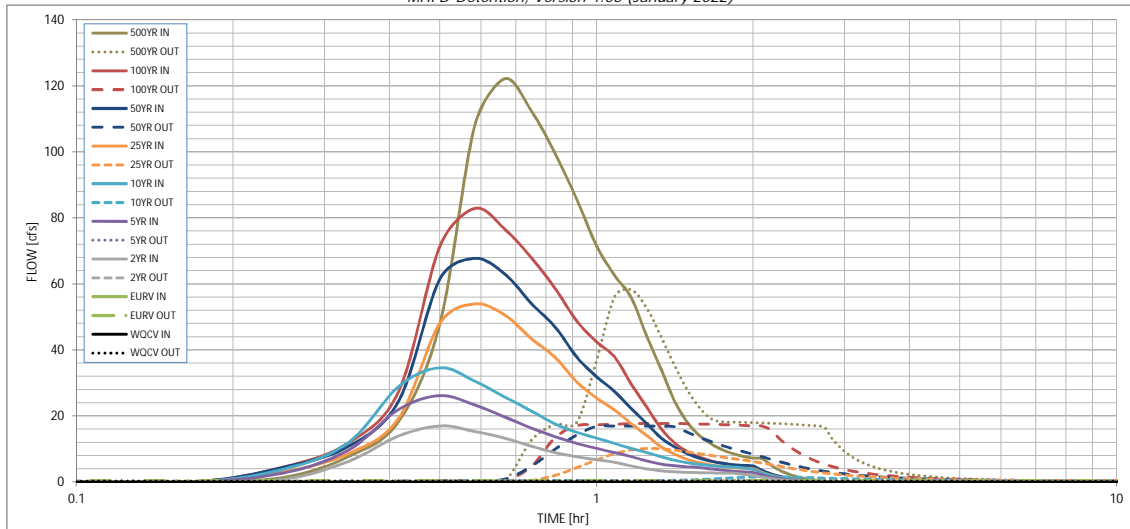
## Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WOCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period	N/A	N/A	0.83	1.14	1.37	1.76	2.08	2.38	3.30
One-Hour Rainfall Depth (in)	N/A	N/A	0.998	1.522	1.997	3.012	3.770	4.573	6.849
CUHP Runoff Volume (acre-ft)	N/A	N/A	0.998	1.522	1.997	3.012	3.770	4.573	6.849
Inflow Hydrograph Volume (acre-ft)	N/A	N/A	0.3	2.3	6.8	20.1	28.4	37.6	61.3
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	0.01	0.08	0.24	0.71	0.99	1.32	2.15
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A	17.0	26.2	34.6	54.0	67.8	82.9	122.2
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.4	0.5	1.6	10.2	17.0	17.76	58.3
Peak Inflow Q (cfs)	N/A	N/A	0.2	0.2	0.2	0.5	0.6	0.5	0.9
Peak Outflow Q (cfs)	N/A	N/A	0.2	0.2	0.2	0.5	0.6	0.5	0.9
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Structure Controlling Flow	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps)	N/A	N/A	N/A	N/A	0.1	0.8	1.4	1.5	1.6
Max Velocity through Grate 2 (fps)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours)	37	67	52	65	71	69	67	65	61
Time to Drain 99% of Inflow Volume (hours)	40	72	56	69	77	76	75	74	72
Maximum Ponding Depth (ft)	3.58	5.39	4.31	5.08	5.66	6.28	6.67	7.36	8.23
Area at Maximum Ponding Depth (acres)	0.47	0.73	0.62	0.70	0.75	0.80	0.84	0.90	0.98
Maximum Volume Stored (acre-ft)	0.539	1.667	0.937	1.446	1.859	2.341	2.670	3.269	4.085

# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Depotion, Version 4.05 (January 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: \_\_\_\_\_

## Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39
	0:15:00	0.00	0.00	0.81	2.74	3.88	3.12	4.48	4.52	7.69
	0:20:00	0.00	0.00	6.26	9.67	11.95	8.58	10.79	11.87	18.42
	0:25:00	0.00	0.00	13.98	22.01	28.98	19.34	24.61	27.53	48.06
	0:30:00	0.00	0.00	17.00	26.18	34.61	48.18	61.54	71.46	108.00
	0:35:00	0.00	0.00	15.34	23.35	30.59	53.98	67.76	82.91	122.21
	0:40:00	0.00	0.00	13.30	19.68	25.72	50.56	62.98	76.60	112.39
	0:45:00	0.00	0.00	10.84	16.34	21.51	43.41	54.06	67.91	99.43
	0:50:00	0.00	0.00	8.92	13.73	17.58	37.71	46.90	58.60	85.60
	0:55:00	0.00	0.00	7.66	11.69	15.07	30.32	37.82	48.76	71.62
	1:00:00	0.00	0.00	6.78	10.22	13.32	25.46	31.92	42.52	62.61
	1:05:00	0.00	0.00	5.99	8.90	11.69	21.82	27.44	37.91	55.86
	1:10:00	0.00	0.00	4.89	7.69	10.18	17.68	22.24	29.68	44.07
	1:15:00	0.00	0.00	3.97	6.37	8.92	14.06	17.67	22.65	33.98
	1:20:00	0.00	0.00	3.38	5.42	7.67	10.59	13.27	16.02	24.16
	1:25:00	0.00	0.00	3.07	4.90	6.56	8.41	10.56	11.72	17.81
	1:30:00	0.00	0.00	2.91	4.60	5.81	6.80	8.47	9.09	13.87
	1:35:00	0.00	0.00	2.83	4.40	5.30	5.79	7.15	7.48	11.42
	1:40:00	0.00	0.00	2.77	3.93	4.94	5.11	6.24	6.36	9.70
	1:45:00	0.00	0.00	2.72	3.57	4.70	4.69	5.67	5.62	8.56
	1:50:00	0.00	0.00	2.69	3.31	4.52	4.39	5.27	5.09	7.75
	1:55:00	0.00	0.00	2.32	3.12	4.27	4.20	5.01	4.77	7.25
	2:00:00	0.00	0.00	2.03	2.89	3.84	4.09	4.85	4.65	7.05
	2:05:00	0.00	0.00	1.48	2.10	2.75	2.96	3.50	3.37	5.09
	2:10:00	0.00	0.00	1.04	1.47	1.92	2.07	2.44	2.37	3.57
	2:15:00	0.00	0.00	0.72	1.02	1.34	1.44	1.70	1.66	2.51
	2:20:00	0.00	0.00	0.50	0.68	0.92	0.99	1.16	1.14	1.71
	2:25:00	0.00	0.00	0.33	0.45	0.61	0.66	0.77	0.75	1.13
	2:30:00	0.00	0.00	0.21	0.30	0.40	0.45	0.52	0.51	0.76
	2:35:00	0.00	0.00	0.12	0.19	0.24	0.27	0.32	0.31	0.47
	2:40:00	0.00	0.00	0.06	0.10	0.12	0.15	0.17	0.16	0.24
	2:45:00	0.00	0.00	0.02	0.04	0.04	0.06	0.06	0.06	0.09
	2:50:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



## DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

### Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]

## POND 306 FOREBAY VOLUME REQUIREMENTS

EQUATION 3-1       $WQCV = a(0.91I^3 - 1.19I^2 + 0.781I)$   
 $a=1$  (40 hour drain time)

FOREBAY 1	$I=.501$	$WQCV=$	0.20652
FOREBAY 2	$I=.711$	$WQCV=$	0.28009
FUTURE FOREBAY 3	$I=.649$	$WQCV=$	0.25375

EQUATION 3-3       $V=(WQCV/12)A$

FOREBAY 1       $A= 11.40$  Acres       $V= 0.19620$  AC-FT

FOREBAY 2       $A= 9.17$  Acres       $V= 0.21403$  AC-FT

FUTURE FOREBAY 3       $A= 3.03$  Acres       $V= 0.06407$  AC-FT

### 3% OF WQCV

FOREBAY TOTAL VOLUME=       $.03(V)$

VOLUME REQUIRED FOR FOREBAY 1=      0.0059 AC-FT      256 CF

VOLUME PROVIDED FOR FOREBAY 1=      0.0063 AC-FT      274 CF

$Q_{100}$  DISCHARGES      2% OF  $Q_{100}$

$Q_{100}$  FOREBAY 1 =       $.02*42.01$  CFS= 0.84 CFS

VOLUME REQUIRED FOR FOREBAY 2=      0.0064 AC-FT      280 CF

VOLUME PROVIDED FOR FOREBAY 2=      0.0065 AC-FT      282 CF

$Q_{100}$  DISCHARGES      2% OF  $Q_{100}$

$Q_{100}$  FOREBAY 2 =       $.02*38.3$  CFS= 0.77 CFS

VOLUME REQUIRED FOR FUTURE FOREBAY 3=      0.0019 AC-FT      84 CF

$Q_{100}$  DISCHARGES      2% OF  $Q_{100}$

$Q_{100}$  FOREBAY 3 =       $.02*13.9$  CFS=0.28 CFS

# Weir Report

## Pond 306 Forebay 1 Notch

### Compound Weir

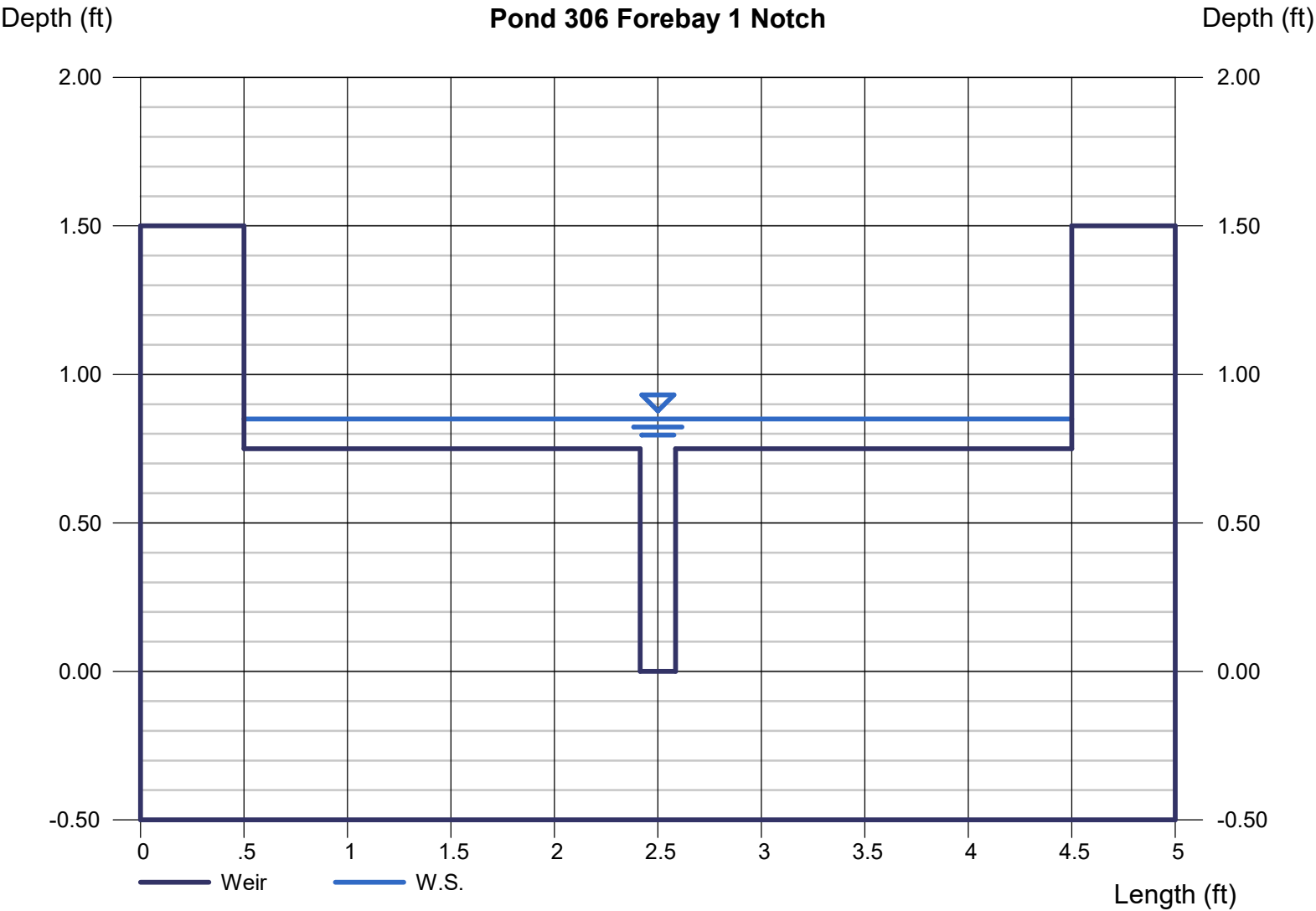
Crest	= Sharp
Bottom Length (ft)	= 4.00
Total Depth (ft)	= 1.50
Length, x (ft)	= 0.17
Depth, a (ft)	= 0.75

### Highlighted

Depth (ft)	= 0.85
Q (cfs)	= 0.840
Area (sqft)	= 0.53
Velocity (ft/s)	= 1.59
Top Width (ft)	= 4.00

### Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 0.84



# Weir Report

## Pond 306 Forebay 2 Notch

### Compound Weir

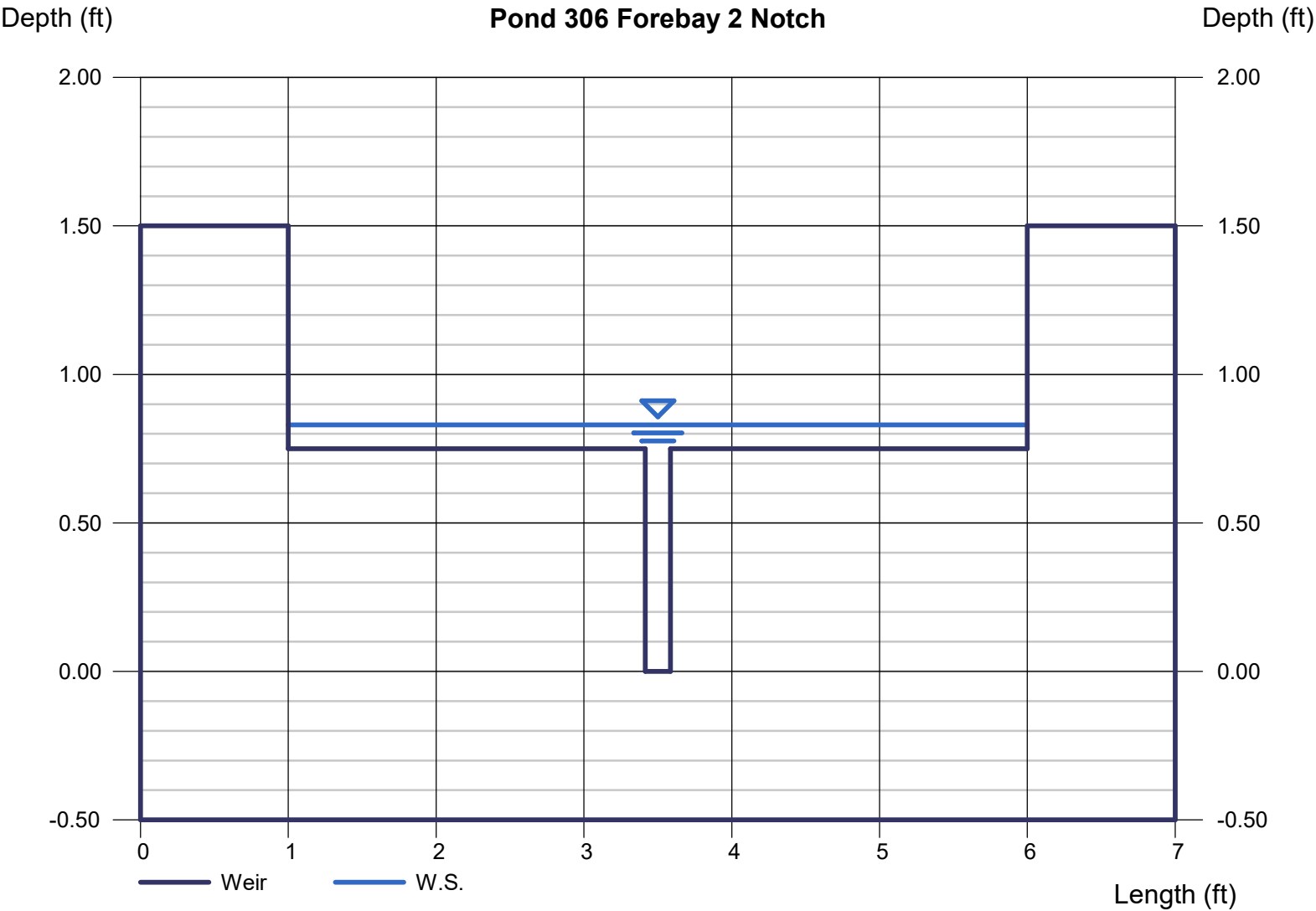
Crest	= Sharp
Bottom Length (ft)	= 5.00
Total Depth (ft)	= 1.50
Length, x (ft)	= 0.17
Depth, a (ft)	= 0.75

### Highlighted

Depth (ft)	= 0.83
Q (cfs)	= 0.770
Area (sqft)	= 0.53
Velocity (ft/s)	= 1.46
Top Width (ft)	= 5.00

### Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 0.77



# Channel Report

## Pond 306 Trickle Channel 1

### Rectangular

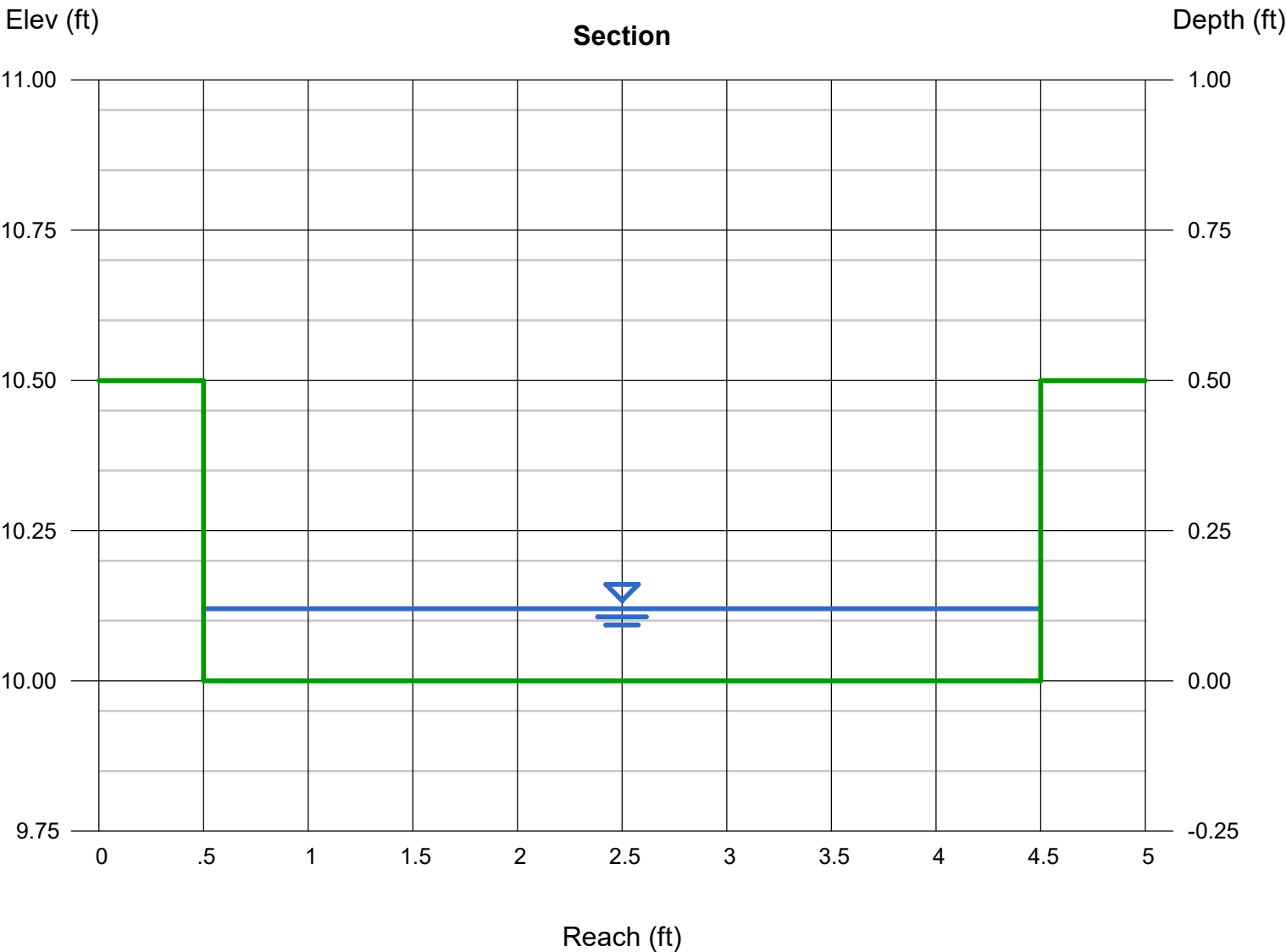
Bottom Width (ft)	= 4.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.50
N-Value	= 0.013

### Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.84

### Highlighted

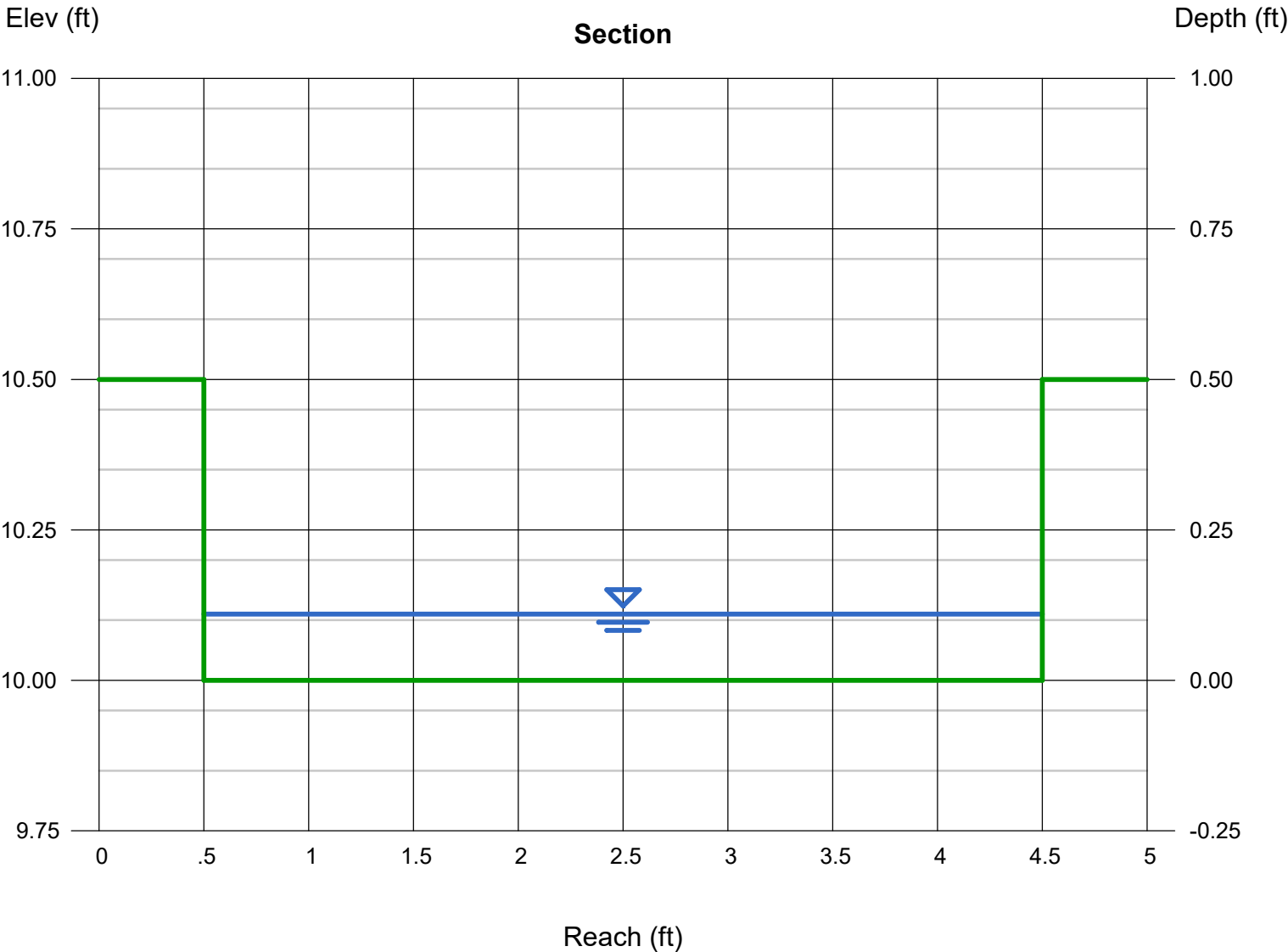
Depth (ft)	= 0.12
Q (cfs)	= 0.840
Area (sqft)	= 0.48
Velocity (ft/s)	= 1.75
Wetted Perim (ft)	= 4.24
Crit Depth, Yc (ft)	= 0.12
Top Width (ft)	= 4.00
EGL (ft)	= 0.17



# Channel Report

## Pond 306 Trickle Channel 2

<b>Rectangular</b>		<b>Highlighted</b>	
Bottom Width (ft)	= 4.00	Depth (ft)	= 0.11
Total Depth (ft)	= 0.50	Q (cfs)	= 0.770
		Area (sqft)	= 0.44
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 1.75
Slope (%)	= 0.50	Wetted Perim (ft)	= 4.22
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.11
		Top Width (ft)	= 4.00
		EGL (ft)	= 0.16
<b>Calculations</b>			
Compute by:	Known Q		
Known Q (cfs)	= 0.77		



# Weir Report

## Pond 306 Spillway

### Trapezoidal Weir

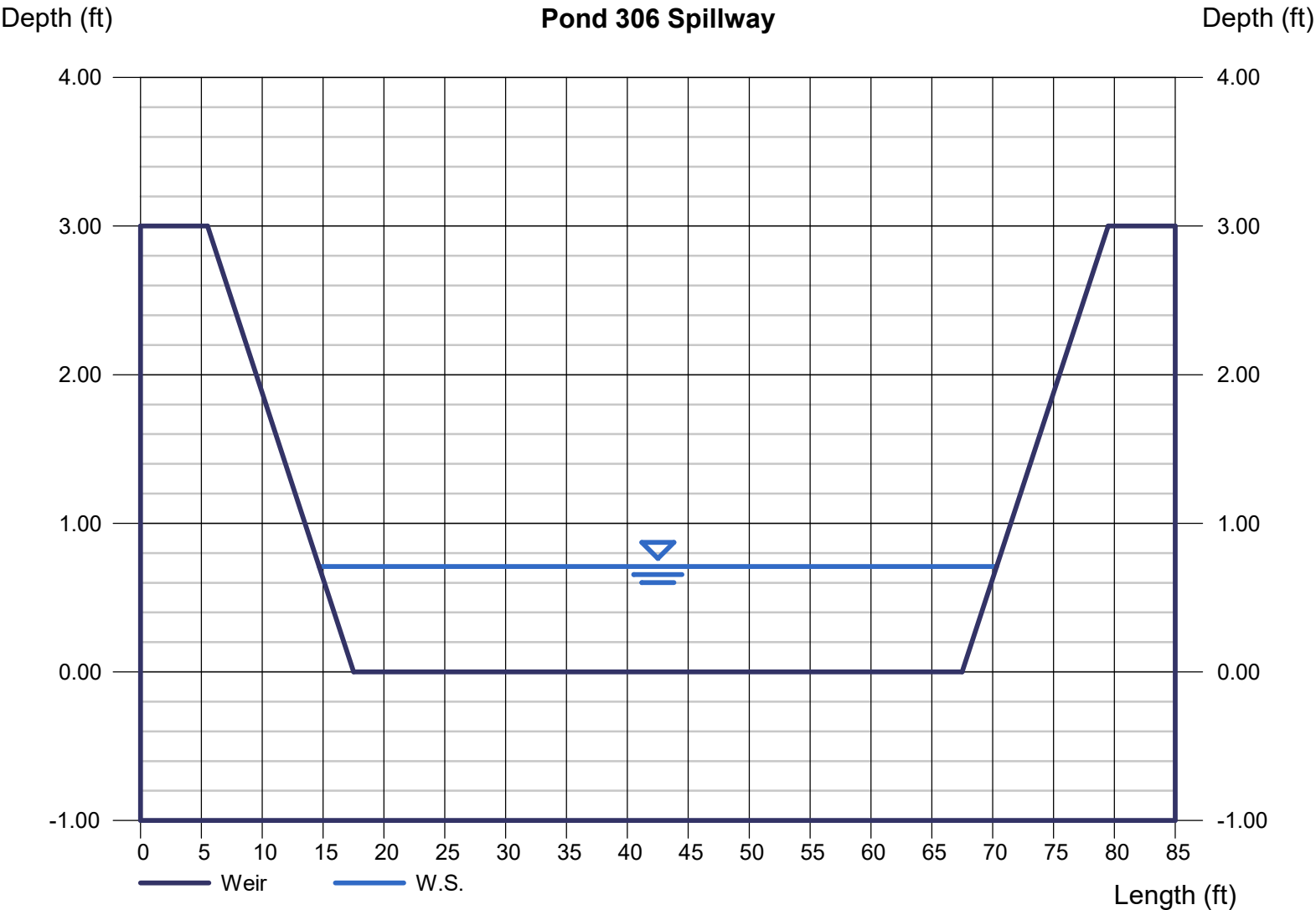
Crest	= Broad
Bottom Length (ft)	= 50.00
Total Depth (ft)	= 3.00
Side Slope (z:1)	= 4.00

### Highlighted

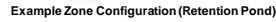
Depth (ft)	= 0.71
Q (cfs)	= 92.99
Area (sqft)	= 37.52
Velocity (ft/s)	= 2.48
Top Width (ft)	= 55.68

### Calculations

Weir Coeff. Cw	= 3.00
Compute by:	Known Q
Known Q (cfs)	= 92.99



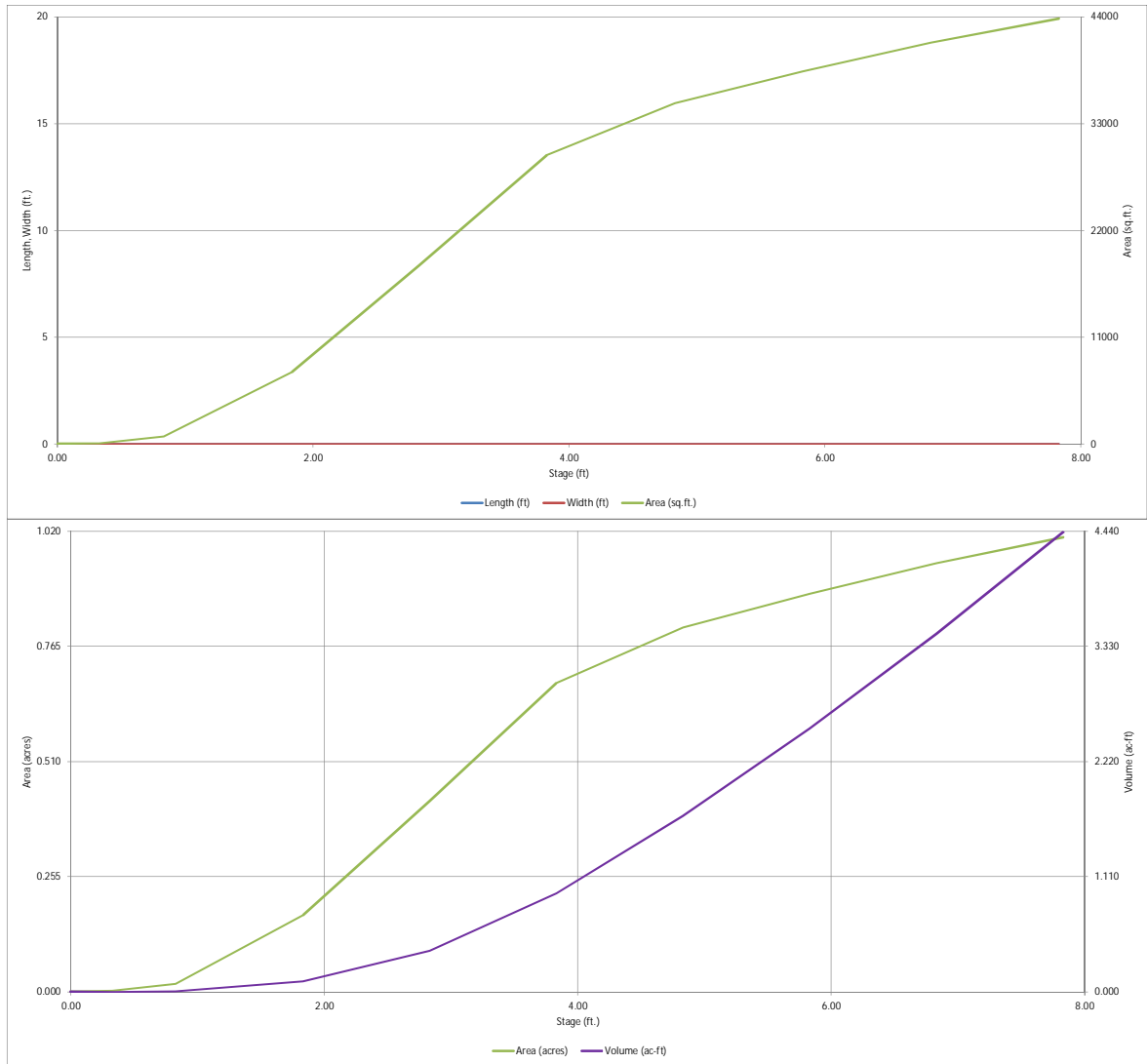
## MHFD-Detention, Version 4.05 (January 2022)

Basin ID: Temp Pond D[illegible]



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

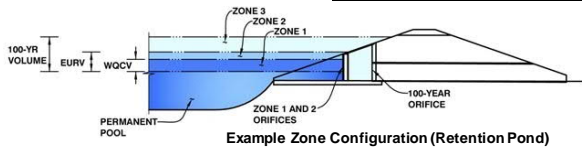
MHFD-Detention, Version 4.05 (January 2022)



# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: Trails at Overland Ranch  
Basin ID: Temp Pond D



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.47	0.259	Orifice Plate
Zone 2 (EURV)	3.24	0.327	Orifice Plate
Zone 3 (100-year)	4.30	0.691	Weir&Pipe (Restrict)
Total (all zones)		1.277	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain	
Underdrain Orifice Area =	N/A ft <sup>2</sup>
Underdrain Orifice Centroid =	N/A feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.24	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	0.89	sq. inches (diameter = 1-1/16 inches)

Calculated Parameters for Plate	
WO Orifice Area per Row =	6.181E-03 ft <sup>2</sup>
Elliptical Half-Width =	N/A feet
Elliptical Slot Centroid =	N/A feet
Elliptical Slot Area =	N/A ft <sup>2</sup>

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.83	1.65					
Orifice Area (sq. inches)	0.89	0.89	0.89					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice	
Vertical Orifice Area =	N/A ft <sup>2</sup>
Vertical Orifice Centroid =	N/A feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Gate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.24	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Gate Slope =	4.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Gate Type =	Type C Gate	N/A	
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir	
Height of Gate Upper Edge, H <sub>1</sub> =	4.24 feet
Overflow Weir Slope Length =	4.12 feet
Gate Open Area / 100-yr Orifice Area =	6.50
Overflow Gate Open Area w/o Debris =	11.48 ft <sup>2</sup>
Overflow Gate Open Area w/ Debris =	11.48 ft <sup>2</sup>

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.33	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	
Outlet Orifice Area =	1.77 ft <sup>2</sup>
Outlet Orifice Centroid =	0.75 feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14 radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	4.83	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	40.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway	
Spillway Design Flow Depth =	0.47 feet
Stage at Top of Freeboard =	6.30 feet
Basin Area at Top of Freeboard =	0.91 acres
Basin Volume at Top of Freeboard =	2.96 acre-ft

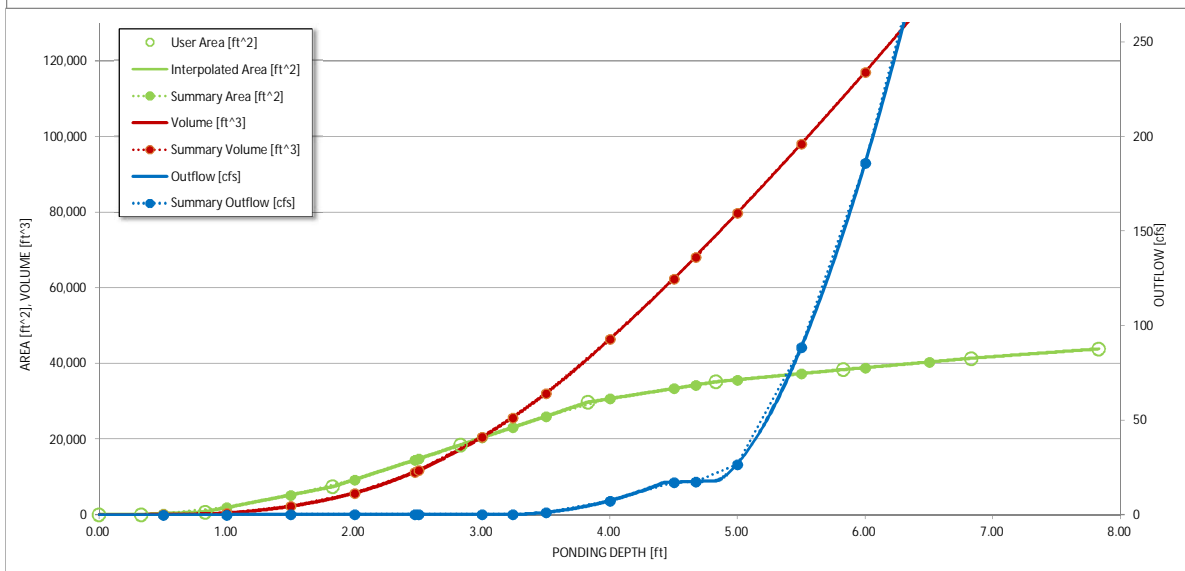
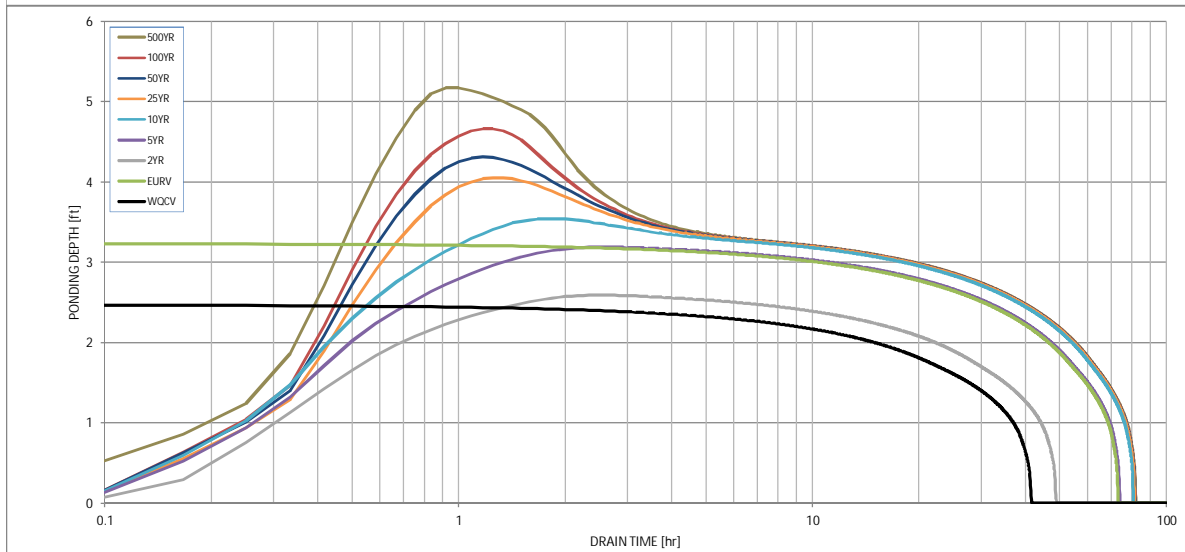
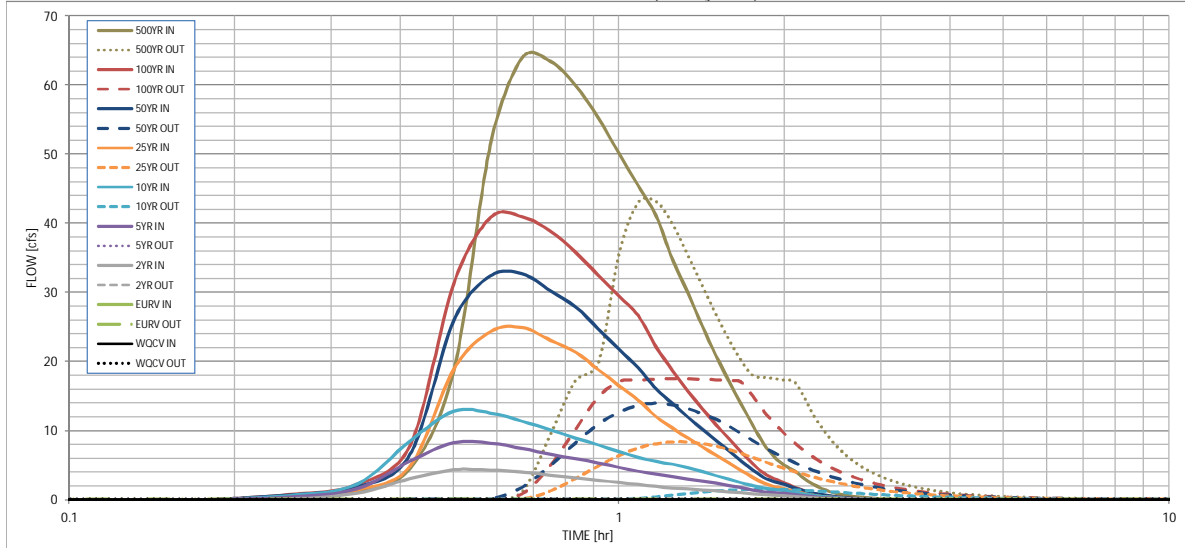
## Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period									
One-Hour Rainfall Depth (in)	N/A	N/A	0.83	1.14	1.37	1.76	2.08	2.38	3.30
CUHP Runoff Volume (acre-ft)	0.259	0.586	0.323	0.589	0.884	1.645	2.185	2.793	4.431
Inflow Hydrograph Volume (acre-ft)	N/A	N/A	0.323	0.589	0.884	1.645	2.185	2.793	4.431
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	0.2	2.2	6.0	17.1	23.9	31.1	50.7
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.01	0.11	0.29	0.82	1.14	1.49	2.43
Peak Inflow Q (cfs)	N/A	N/A	4.4	8.3	12.8	24.9	32.7	41.0	64.0
Peak Outflow Q (cfs)	0.1	0.1	0.1	0.1	1.5	8.4	14.0	17.53	43.2
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	0.1	0.3	0.5	0.6	0.6	0.9
Structure Controlling Flow	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps)	N/A	N/A	N/A	N/A	0.1	0.7	1.2	1.5	1.6
Max Velocity through Gate 2 (fps)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours)	38	67	45	68	72	68	65	62	55
Time to Drain 99% of Inflow Volume (hours)	40	70	47	71	77	75	74	73	70
Maximum Ponding Depth (ft)	2.47	3.24	2.59	3.19	3.54	4.05	4.31	4.67	5.17
Area at Maximum Ponding Depth (acres)	0.33	0.53	0.36	0.51	0.61	0.71	0.74	0.79	0.83
Maximum Volume Stored (acre-ft)	0.259	0.590	0.297	0.559	0.761	1.101	1.283	1.558	1.972

# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: \_\_\_\_\_

## Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
	0:15:00	0.00	0.00	0.13	0.44	0.63	0.51	0.74	0.75	1.31
	0:20:00	0.00	0.00	0.99	1.60	2.28	1.46	1.86	2.24	4.53
	0:25:00	0.00	0.00	3.08	5.62	8.55	4.89	6.61	7.89	18.62
	0:30:00	0.00	0.00	4.36	8.28	12.85	18.85	25.92	31.22	51.36
	0:35:00	0.00	0.00	4.34	8.22	12.58	24.36	32.42	40.86	64.01
	0:40:00	0.00	0.00	4.07	7.44	11.40	24.95	32.71	40.96	63.47
	0:45:00	0.00	0.00	3.58	6.61	10.16	23.12	30.25	38.92	59.97
	0:50:00	0.00	0.00	3.17	5.97	8.96	21.37	27.92	35.84	55.27
	0:55:00	0.00	0.00	2.84	5.33	7.96	18.84	24.74	32.49	50.12
	1:00:00	0.00	0.00	2.53	4.73	7.03	16.52	21.79	29.49	45.44
	1:05:00	0.00	0.00	2.25	4.17	6.16	14.44	19.13	26.68	41.16
	1:10:00	0.00	0.00	1.96	3.77	5.56	12.08	16.09	22.20	34.84
	1:15:00	0.00	0.00	1.75	3.41	5.19	10.42	13.98	18.79	29.98
	1:20:00	0.00	0.00	1.59	3.05	4.70	8.96	12.00	15.79	25.15
	1:25:00	0.00	0.00	1.44	2.72	4.09	7.71	10.29	13.19	20.92
	1:30:00	0.00	0.00	1.31	2.42	3.53	6.48	8.62	10.94	17.24
	1:35:00	0.00	0.00	1.18	2.12	2.99	5.35	7.10	8.87	13.87
	1:40:00	0.00	0.00	1.04	1.77	2.50	4.29	5.67	6.96	10.79
	1:45:00	0.00	0.00	0.91	1.44	2.05	3.30	4.35	5.23	8.11
	1:50:00	0.00	0.00	0.80	1.19	1.74	2.44	3.26	3.86	6.19
	1:55:00	0.00	0.00	0.68	1.04	1.52	1.93	2.64	3.04	5.00
	2:00:00	0.00	0.00	0.60	0.93	1.34	1.63	2.26	2.51	4.21
	2:05:00	0.00	0.00	0.49	0.75	1.08	1.25	1.74	1.87	3.17
	2:10:00	0.00	0.00	0.39	0.60	0.86	0.94	1.31	1.36	2.32
	2:15:00	0.00	0.00	0.32	0.47	0.68	0.72	1.00	0.98	1.68
	2:20:00	0.00	0.00	0.25	0.37	0.53	0.54	0.75	0.70	1.21
	2:25:00	0.00	0.00	0.20	0.29	0.40	0.41	0.56	0.51	0.88
	2:30:00	0.00	0.00	0.16	0.22	0.31	0.31	0.42	0.38	0.66
	2:35:00	0.00	0.00	0.12	0.17	0.23	0.23	0.31	0.29	0.49
	2:40:00	0.00	0.00	0.10	0.13	0.17	0.17	0.24	0.22	0.38
	2:45:00	0.00	0.00	0.07	0.10	0.13	0.13	0.18	0.17	0.29
	2:50:00	0.00	0.00	0.06	0.07	0.10	0.10	0.14	0.13	0.21
	2:55:00	0.00	0.00	0.04	0.05	0.07	0.07	0.10	0.09	0.15
	3:00:00	0.00	0.00	0.03	0.03	0.05	0.05	0.06	0.06	0.09
	3:05:00	0.00	0.00	0.02	0.02	0.03	0.03	0.04	0.03	0.05
	3:10:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02
	3:15:00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.01
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

### Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]

## POND D FOREBAY VOLUME REQUIREMENTS

EQUATION 3-1       $WQCV = a(0.91I^3 - 1.19I^2 + 0.781I)$   
 $a=1$  (40 hour drain time)

FOREBAY 1       $I=.291$        $WQCV= 0.14863$

EQUATION 3-3       $V=(WQCV/12)A$   
 FOREBAY 1       $A= 20.91$  Acres       $V= 0.25899$

### 3% OF WQCV

FOREBAY TOTAL VOLUME =       $.03(V)$

VOLUME REQUIRED FOR POND D FOREBAY =      0.0078 AC-FT      338 CF

VOLUME PROVIDED FOR POND D FOREBAY =      0.0111 AC-FT      485 CF

$Q_{100}$  DISCHARGES      2% OF  $Q_{100}$

$Q_{100}$  FOREBAY 1 =       $.02*41.0$  CFS= 0.82 CFS

# Weir Report

## Pond D Forebay Notch

### Compound Weir

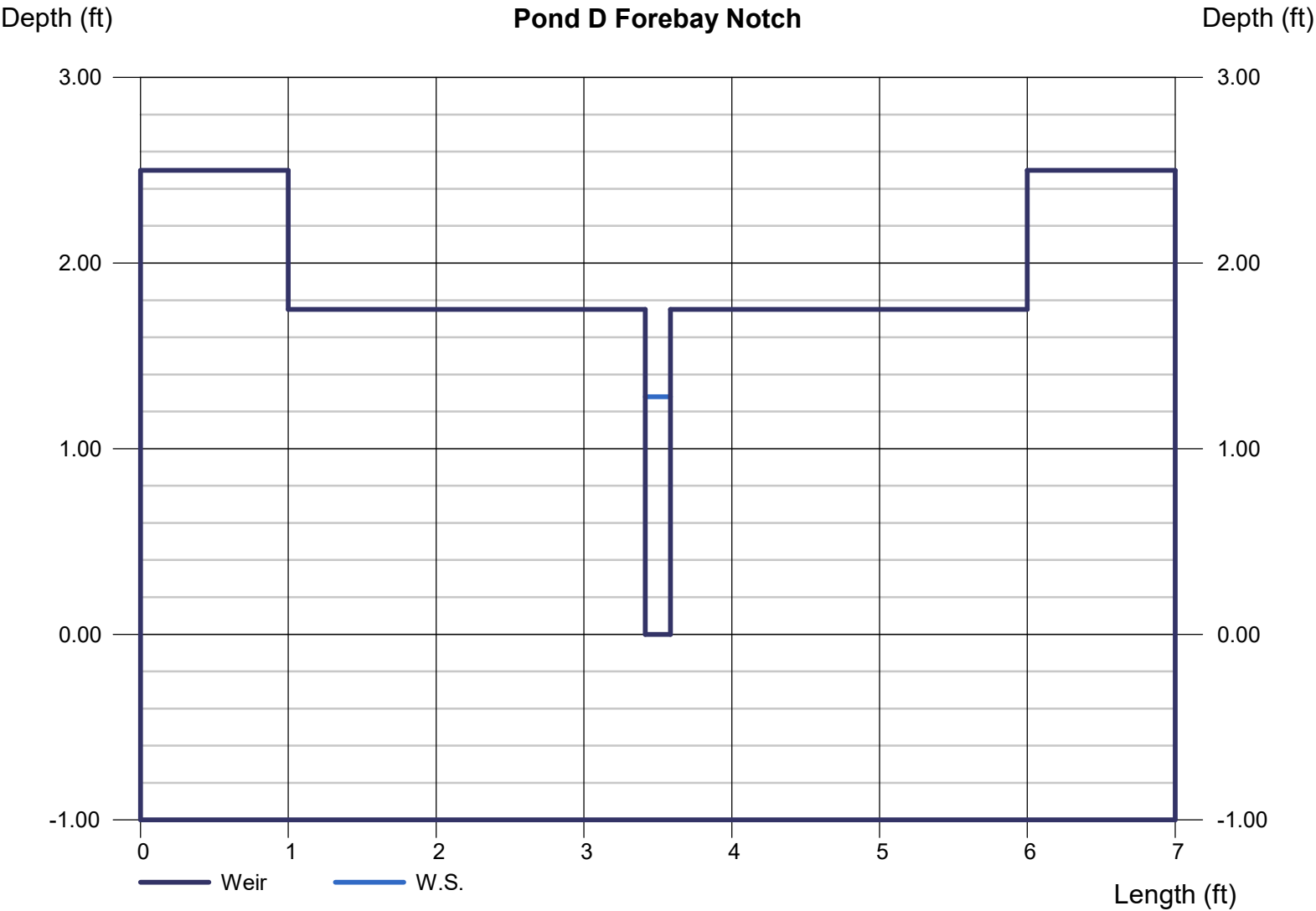
Crest	= Sharp
Bottom Length (ft)	= 5.00
Total Depth (ft)	= 2.50
Length, x (ft)	= 0.17
Depth, a (ft)	= 1.75

### Highlighted

Depth (ft)	= 1.28
Q (cfs)	= 0.820
Area (sqft)	= 0.22
Velocity (ft/s)	= 3.77
Top Width (ft)	= 0.17

### Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 0.82



# Channel Report

## Pond D Trickle Channel

### Rectangular

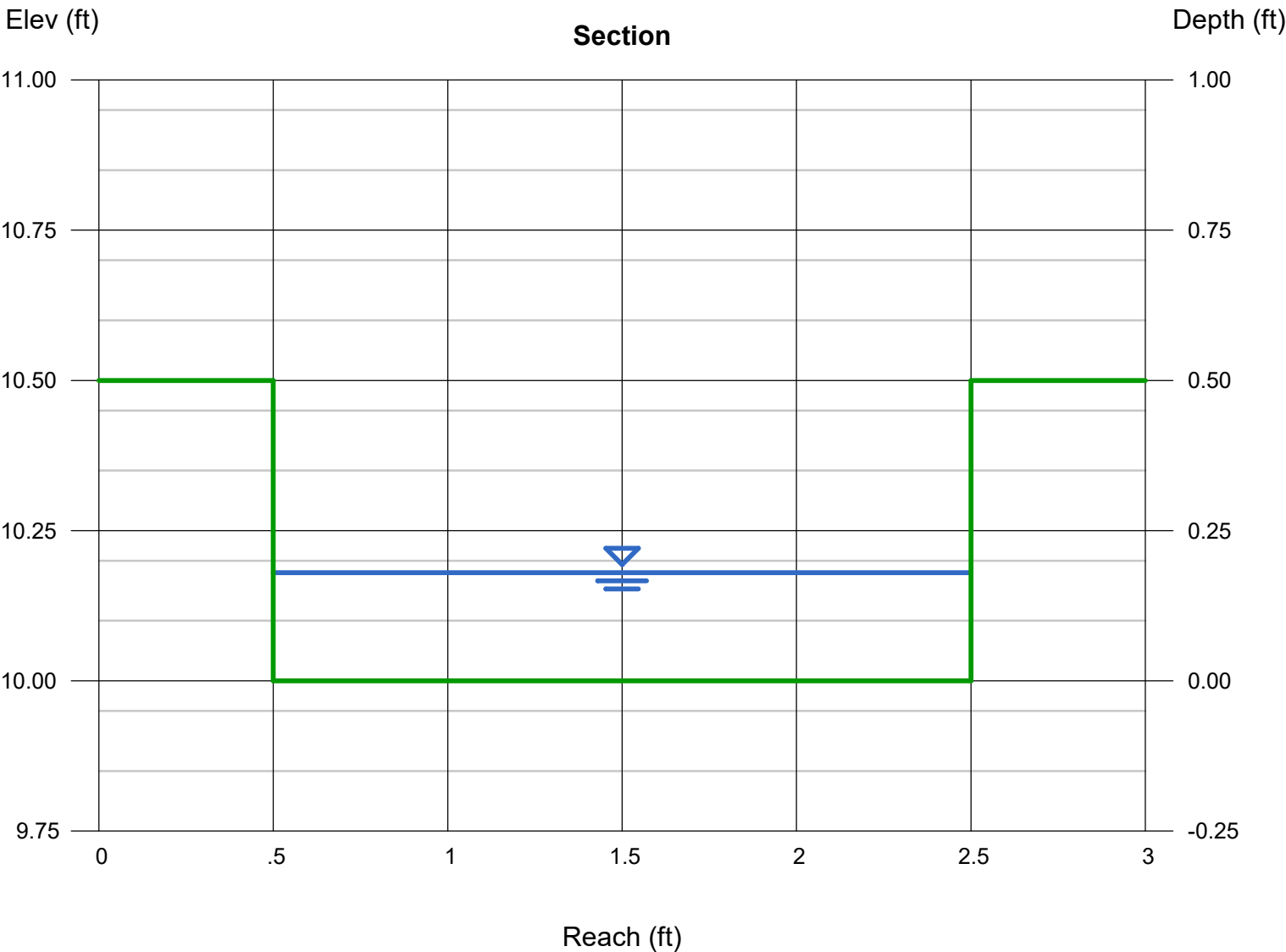
Bottom Width (ft) = 2.00  
Total Depth (ft) = 0.50  
  
Invert Elev (ft) = 10.00  
Slope (%) = 0.50  
N-Value = 0.013

### Calculations

Compute by: Known Q  
Known Q (cfs) = 0.82

### Highlighted

Depth (ft) = 0.18  
Q (cfs) = 0.820  
Area (sqft) = 0.36  
Velocity (ft/s) = 2.28  
Wetted Perim (ft) = 2.36  
Crit Depth, Yc (ft) = 0.18  
Top Width (ft) = 2.00  
EGL (ft) = 0.26





# Weir Report

## Pond D Spillway

### Trapezoidal Weir

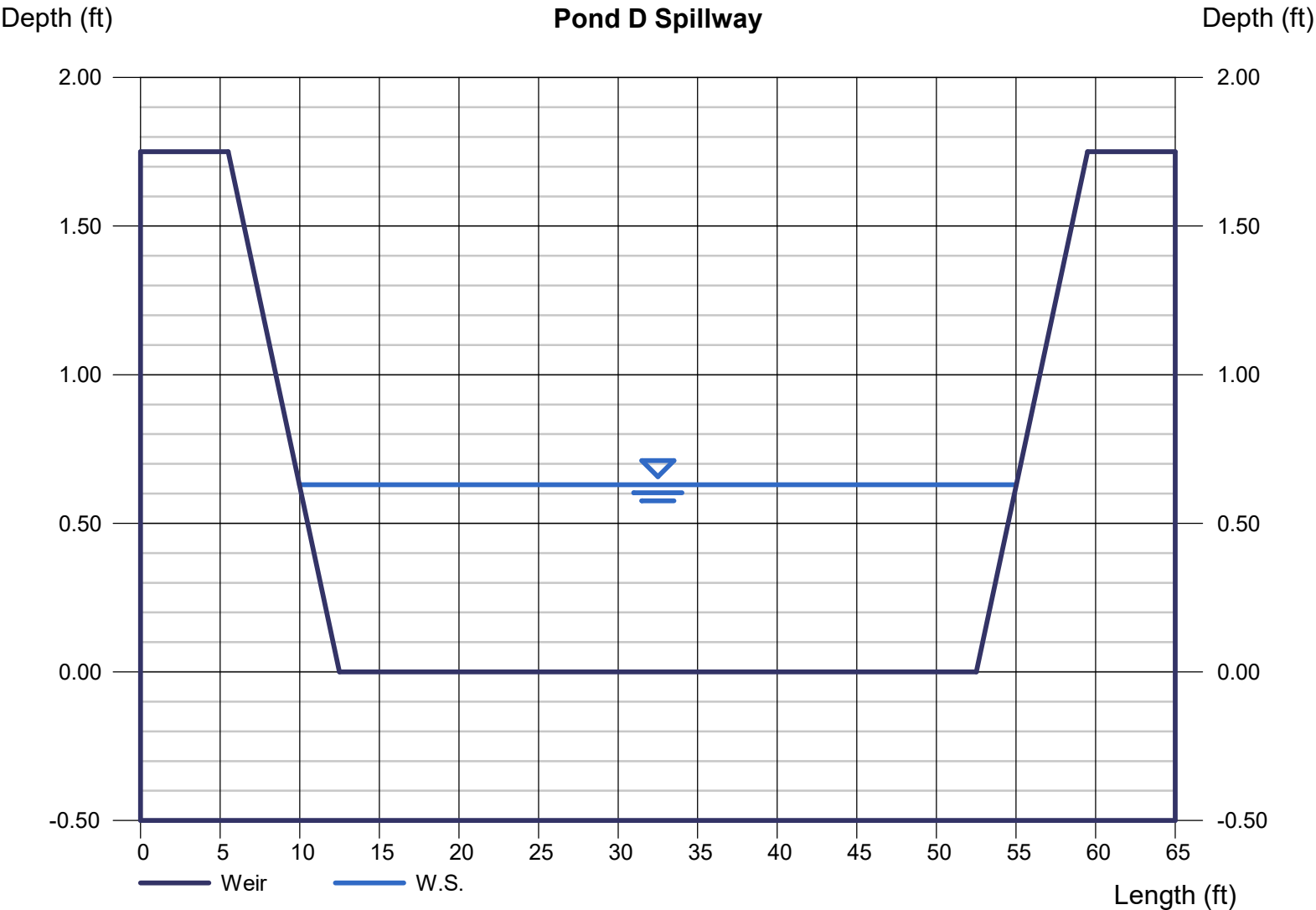
Crest = Broad  
Bottom Length (ft) = 40.00  
Total Depth (ft) = 1.75  
Side Slope (z:1) = 4.00

### Highlighted

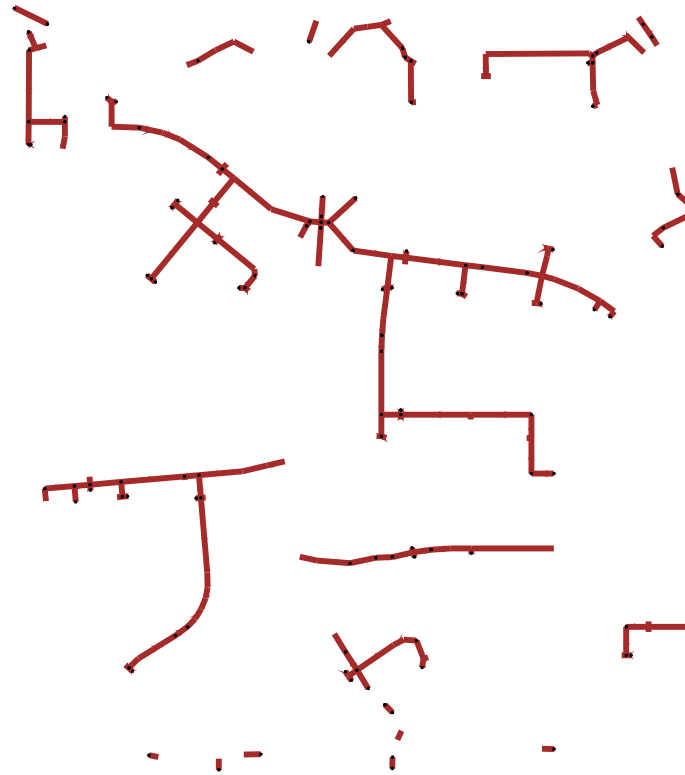
Depth (ft) = 0.63  
Q (cfs) = 61.78  
Area (sqft) = 26.79  
Velocity (ft/s) = 2.31  
Top Width (ft) = 45.04

### Calculations

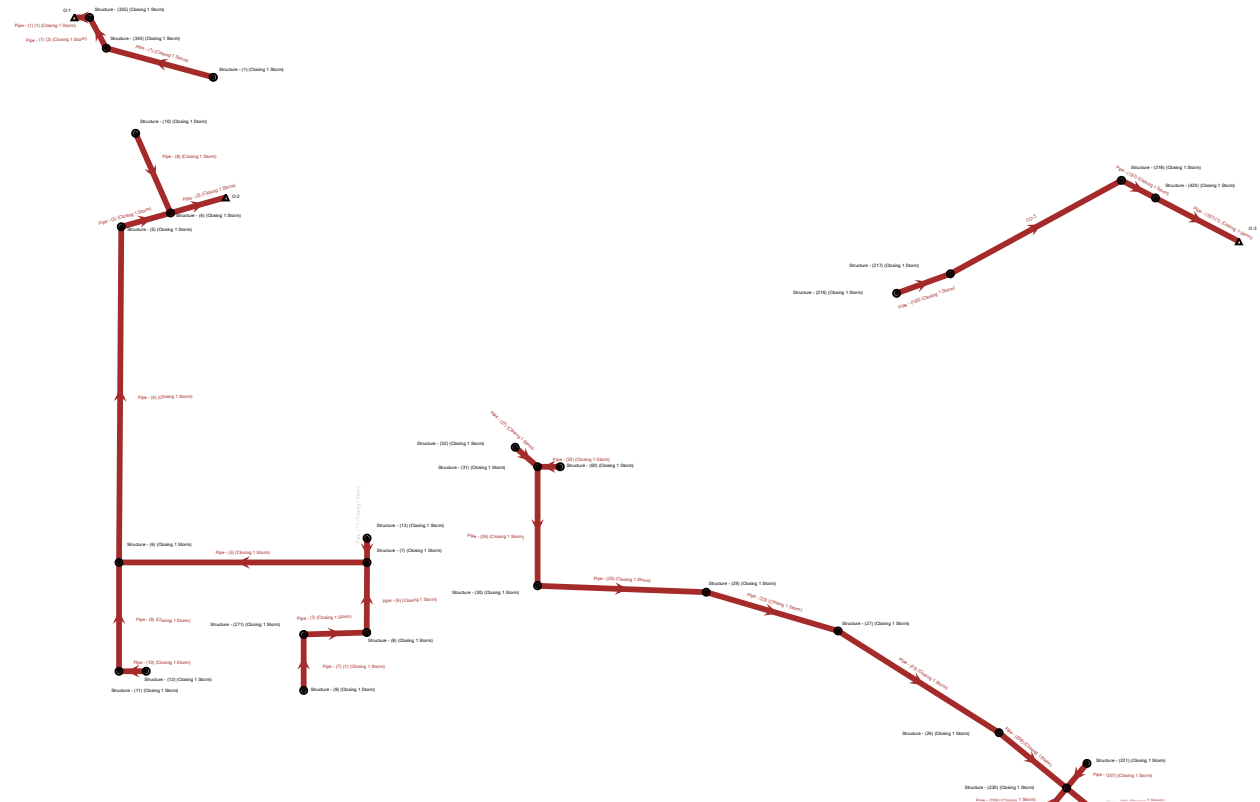
Weir Coeff. Cw = 3.00  
Compute by: Known Q  
Known Q (cfs) = 61.78



### Scenario: 100-year

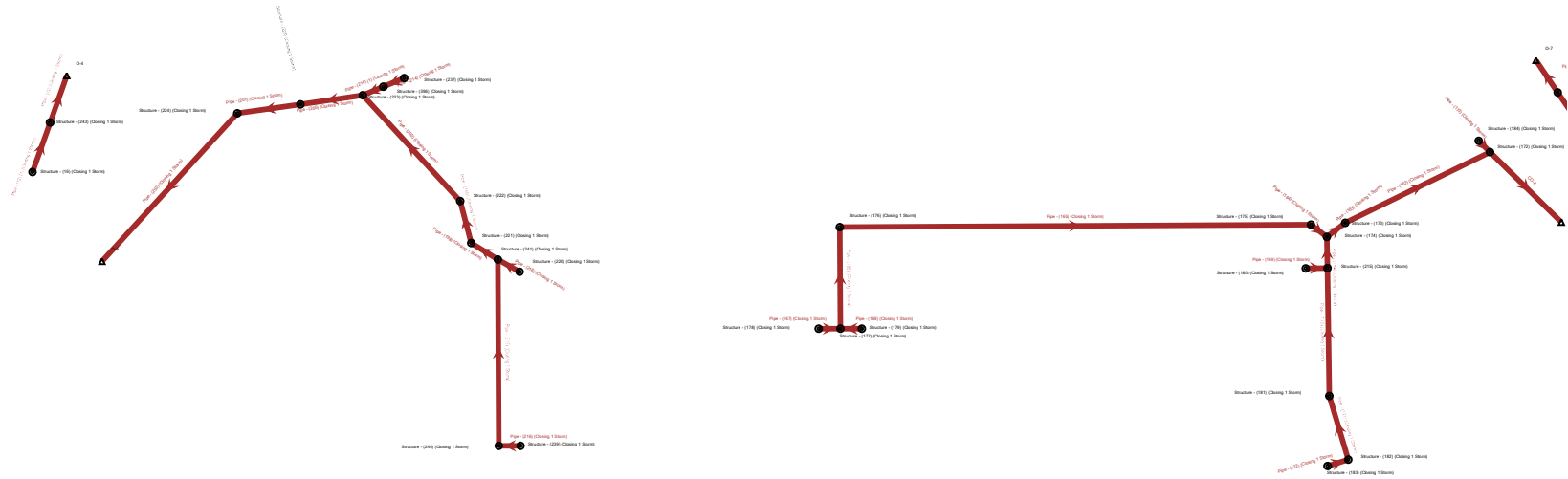


## Scenario: 100-Year

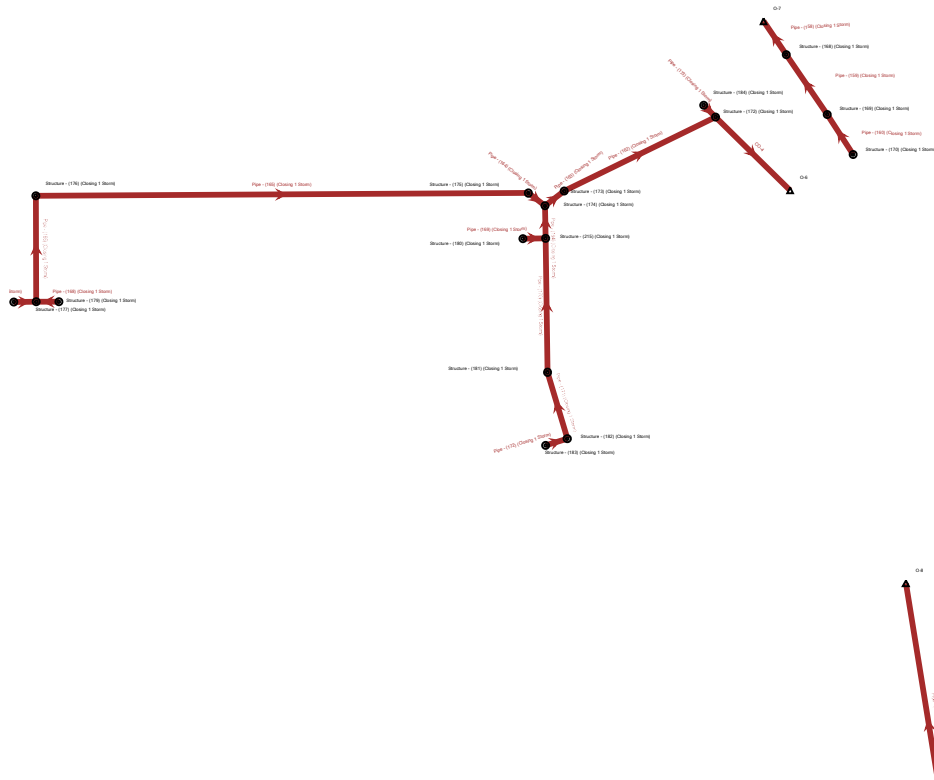




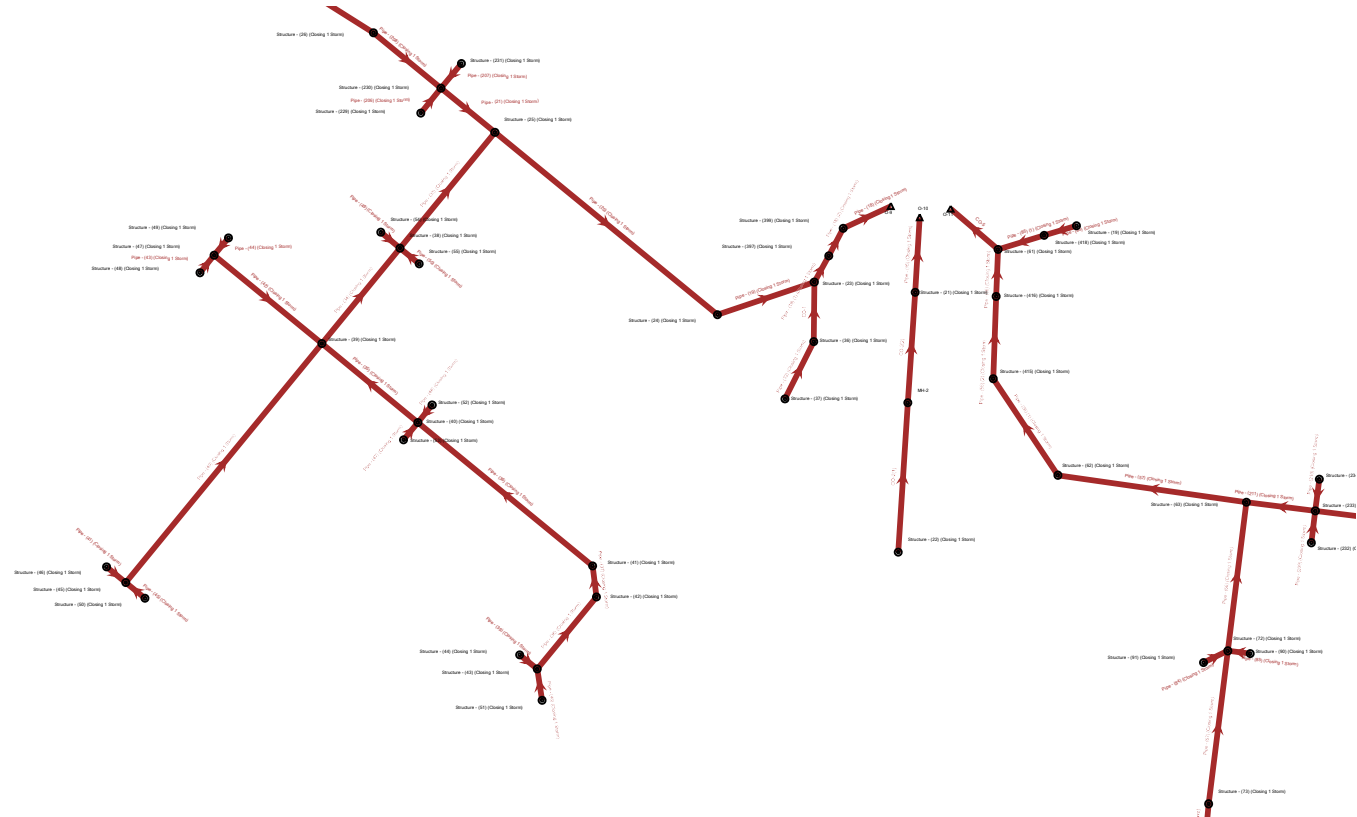
## Scenario: 100-Year



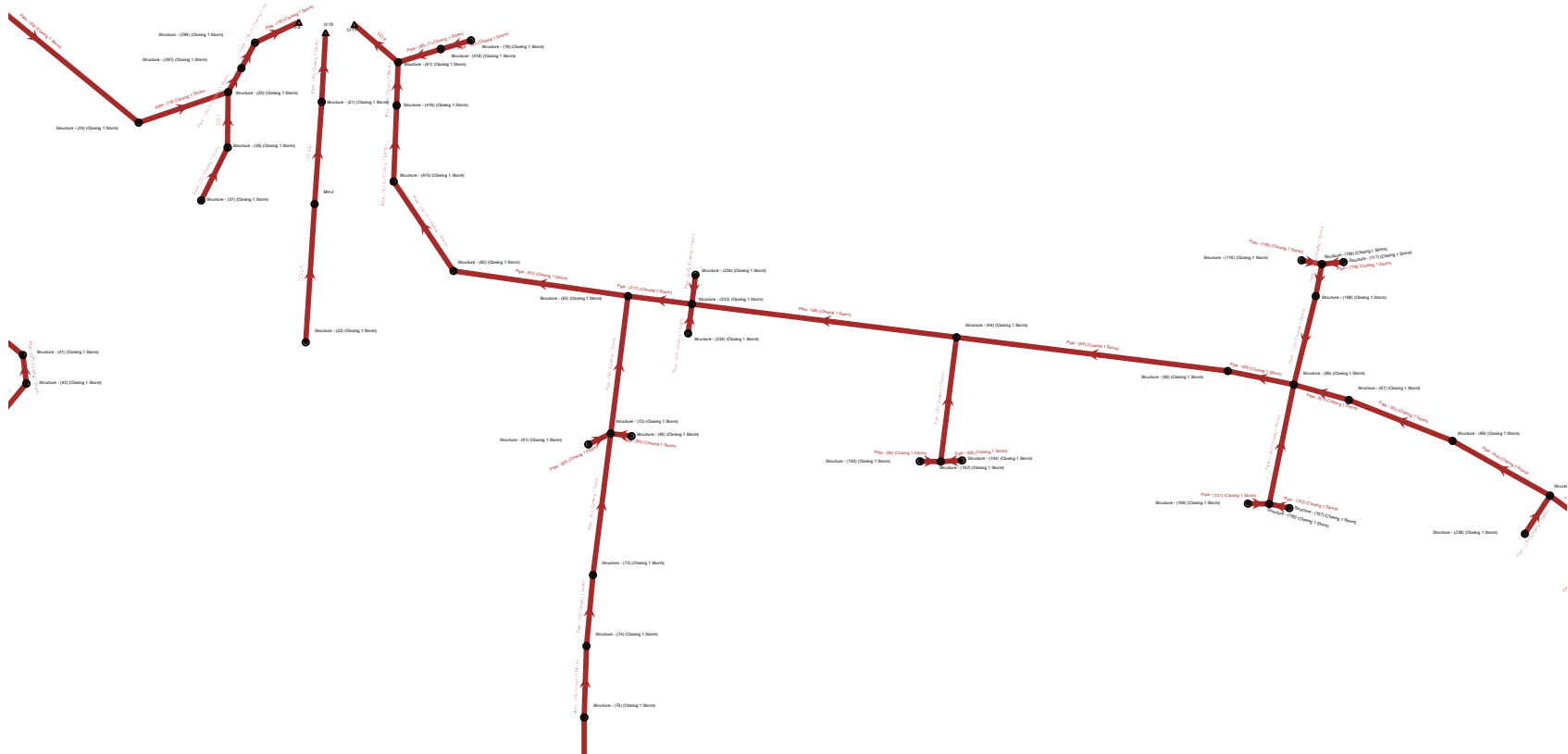
## Scenario: 100-Year



## Scenario: 100-Year

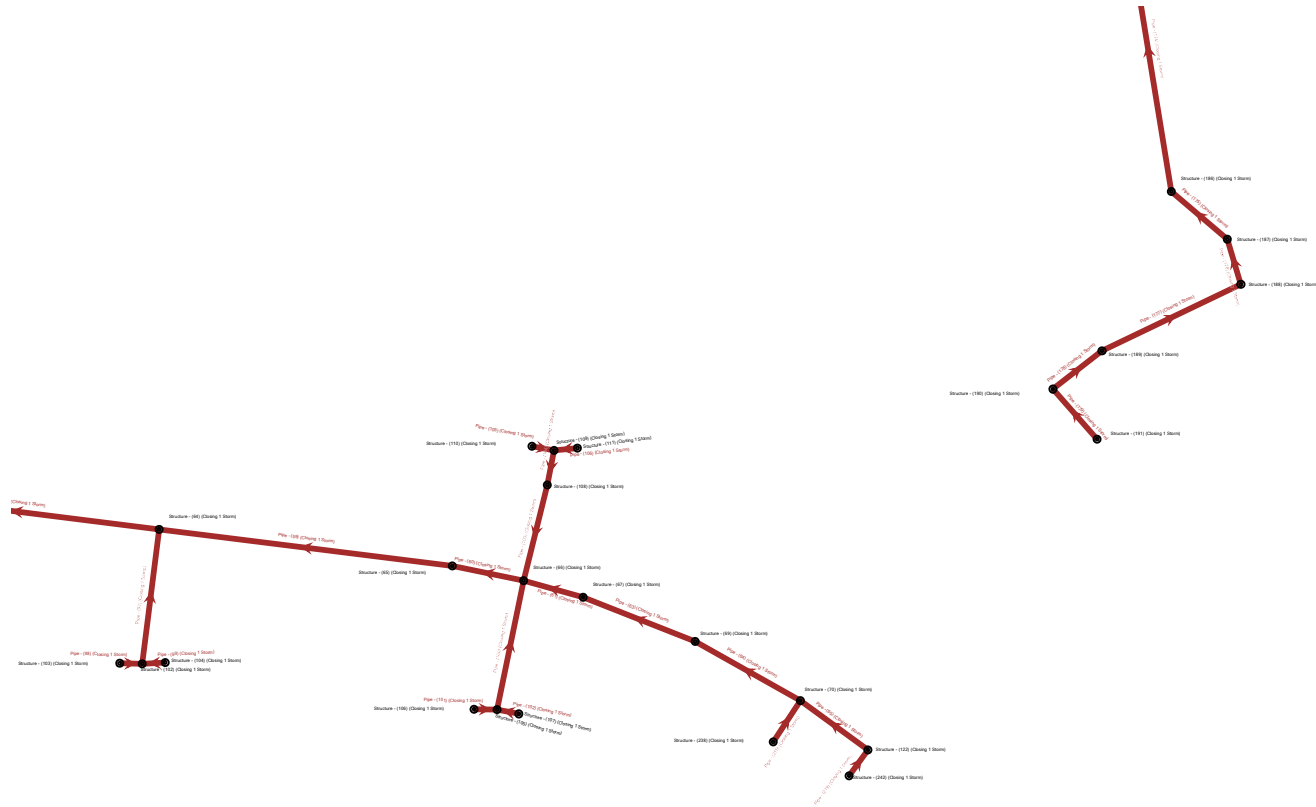


## Scenario: 100-Year

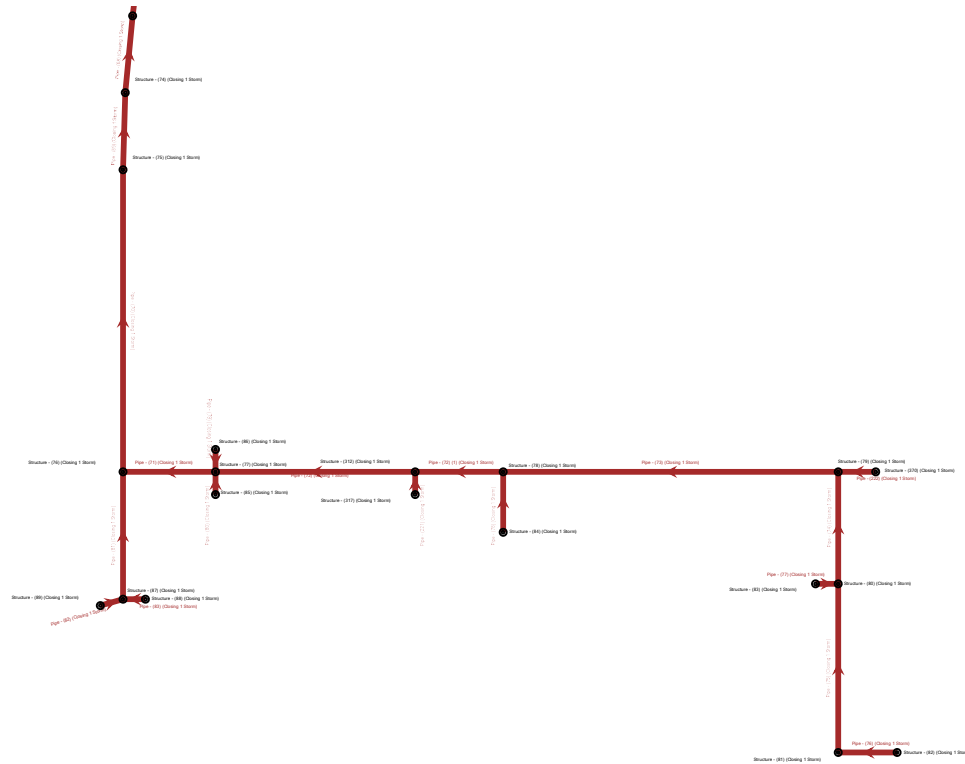




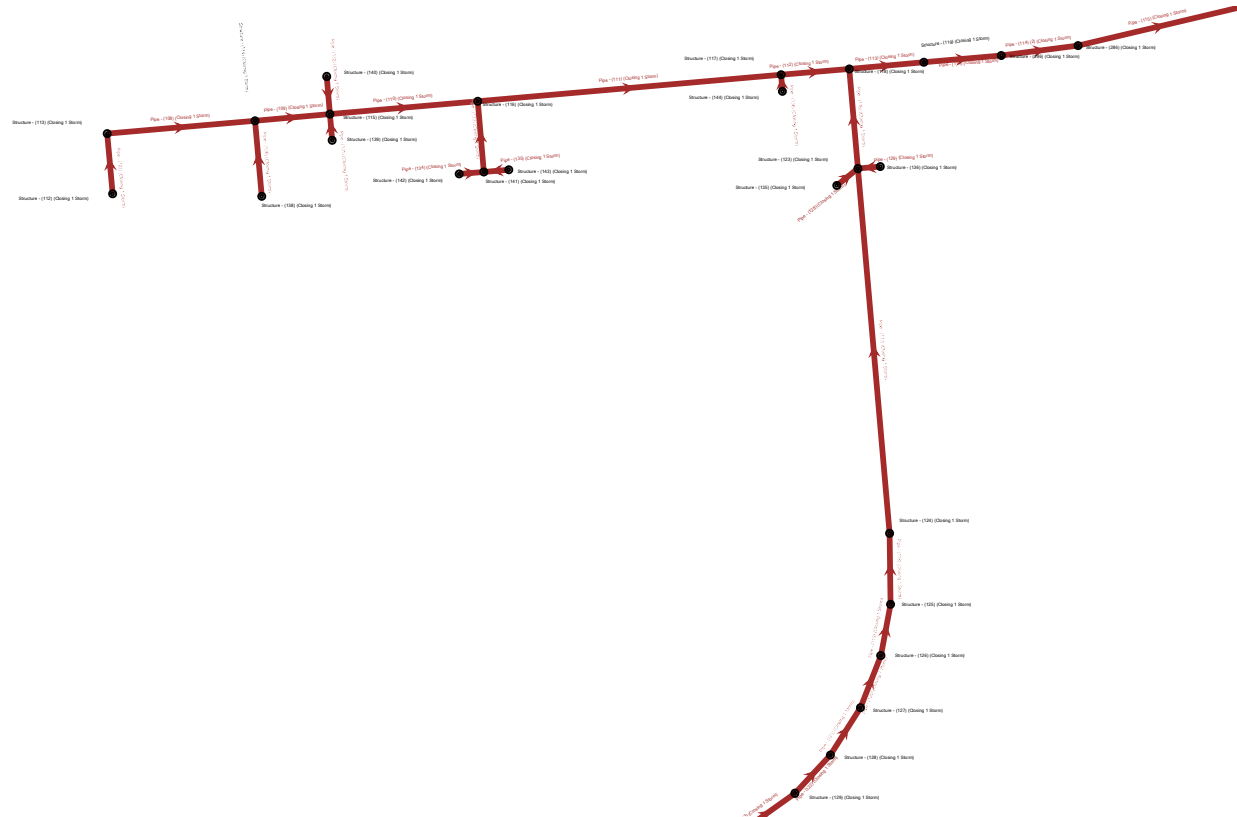
## Scenario: 100-Year



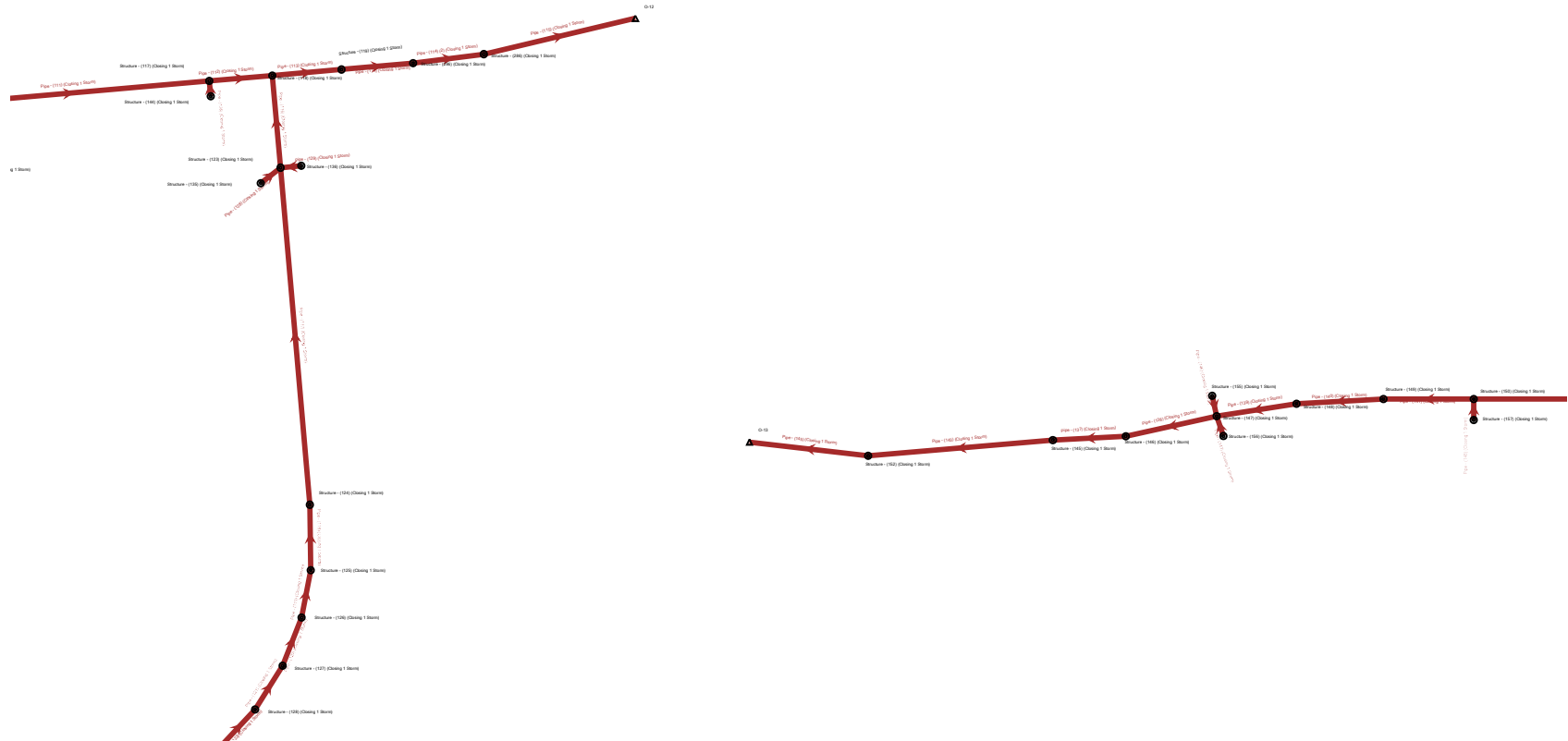
## Scenario: 100-Year



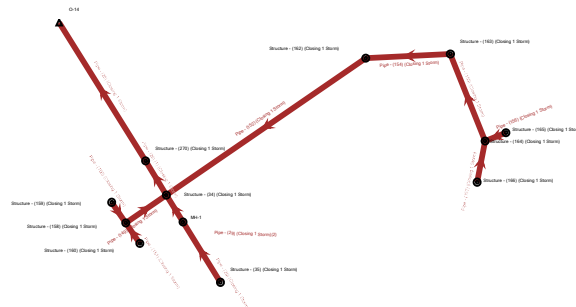
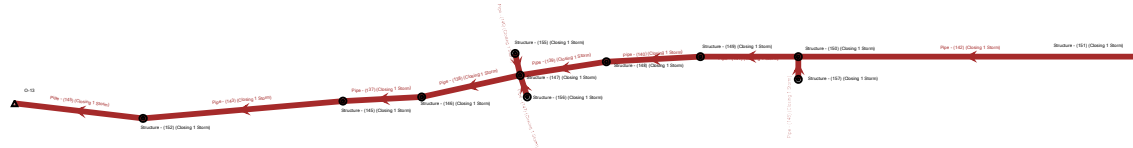
## Scenario: 100-Year



## Scenario: 100-Year

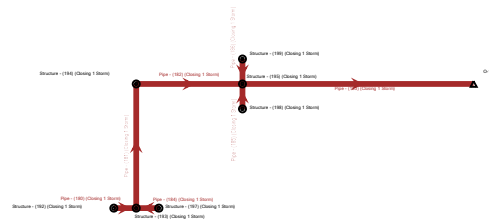


## Scenario: 100-Year

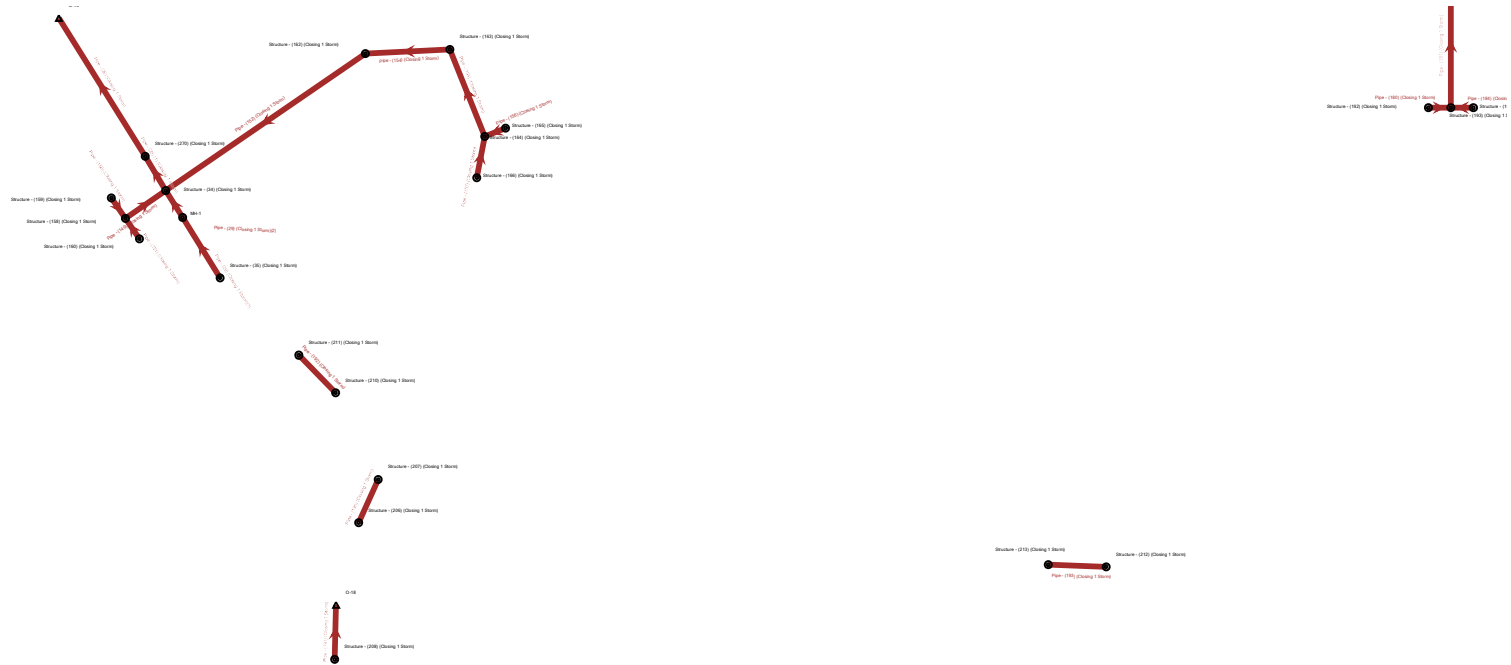


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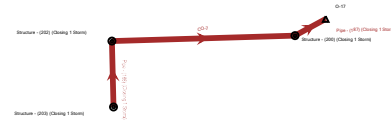
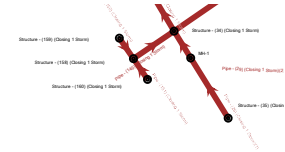
100-Year



## Scenario: 100-Year



## Scenario: 100-Year



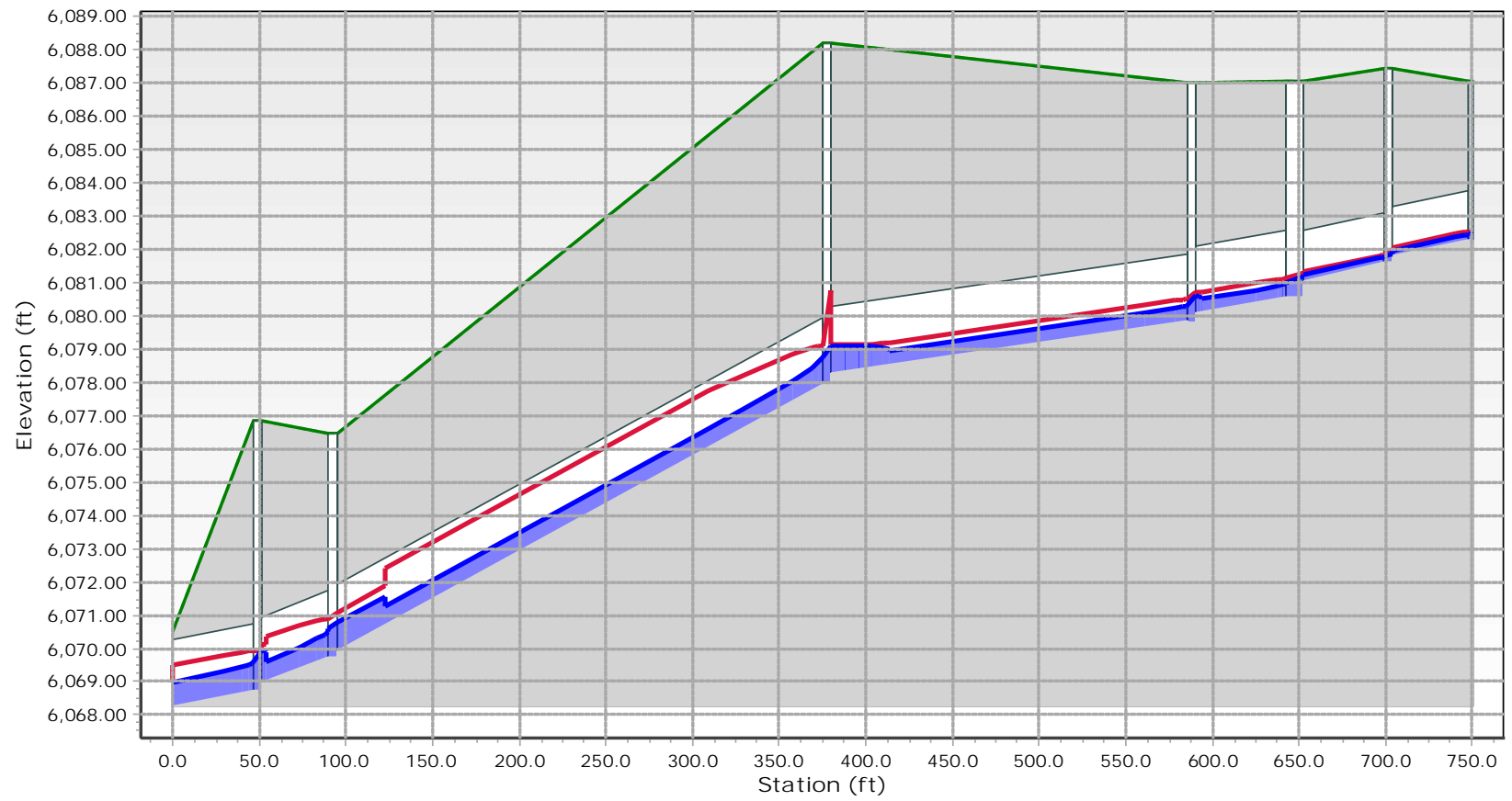




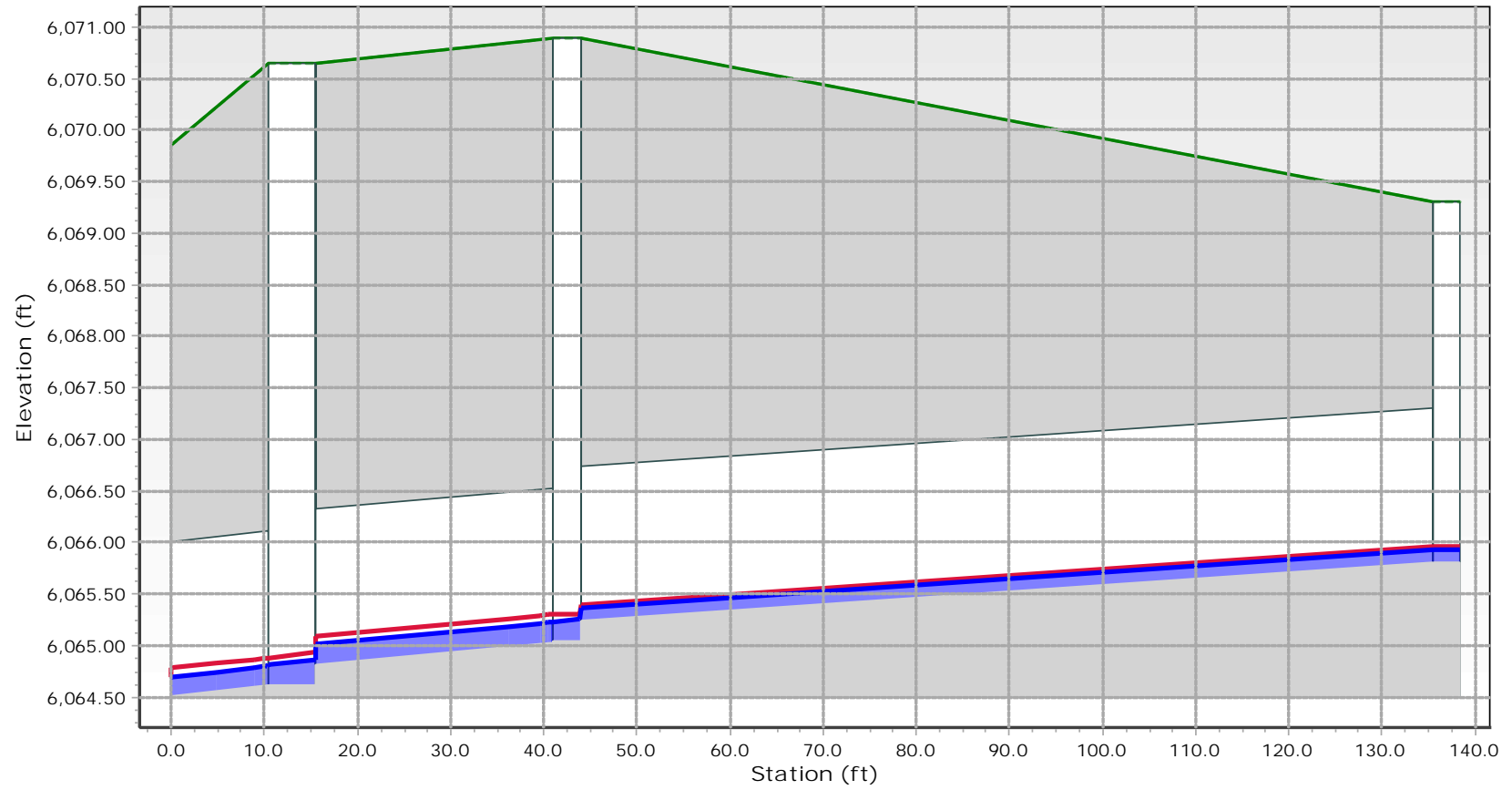




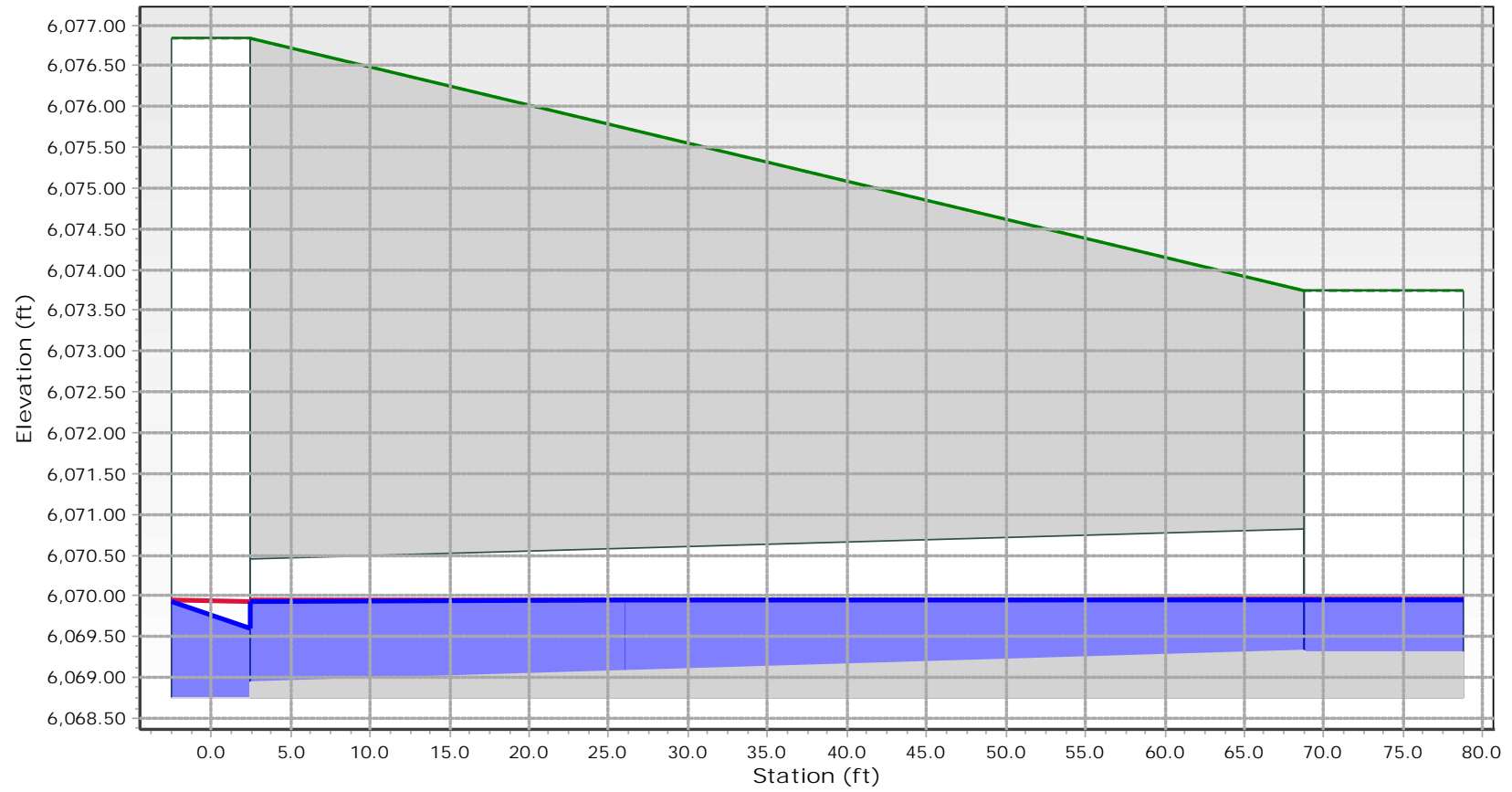
DP01 - 2-Year



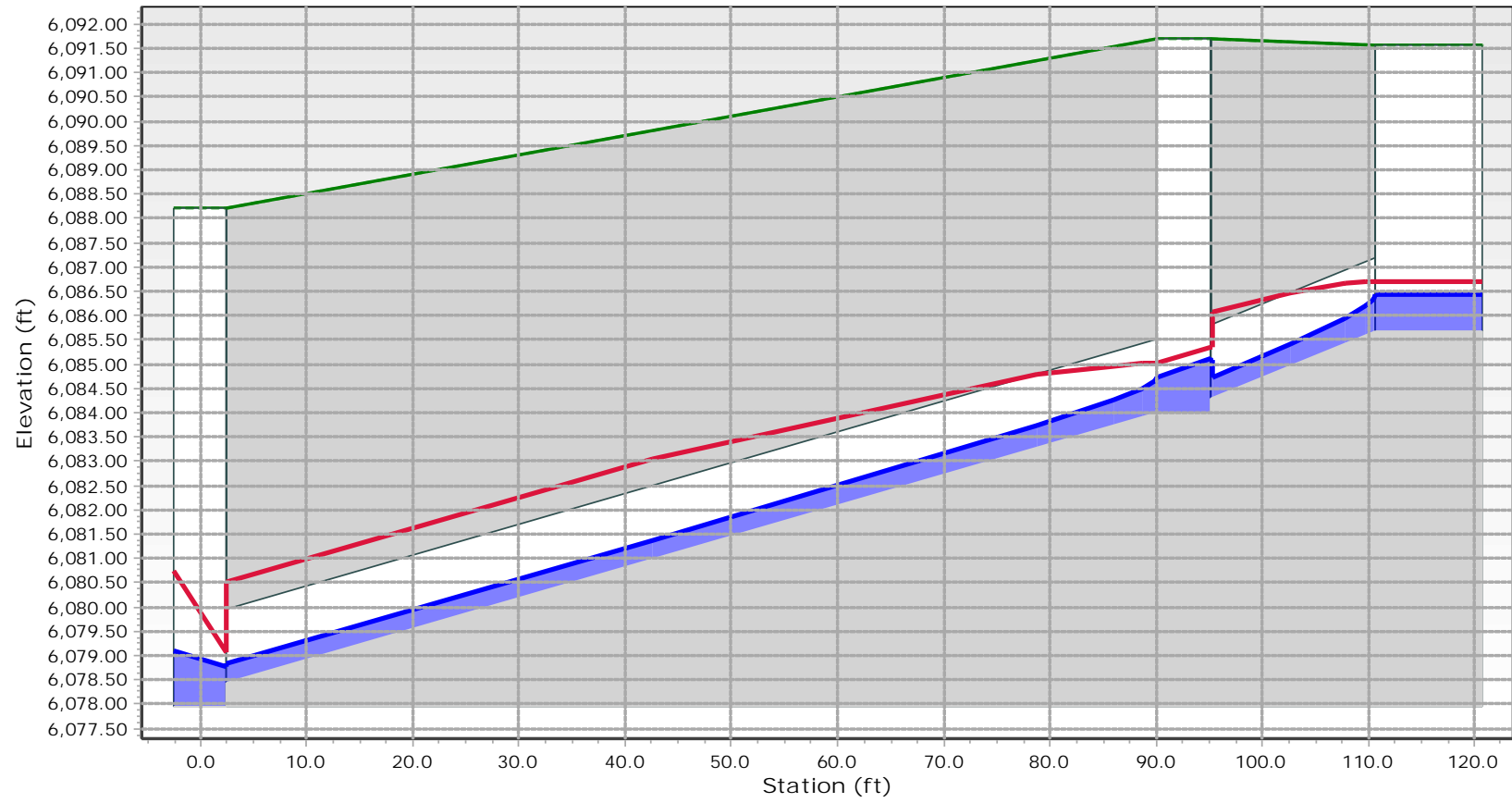
Pond A Outfall - 2-Year



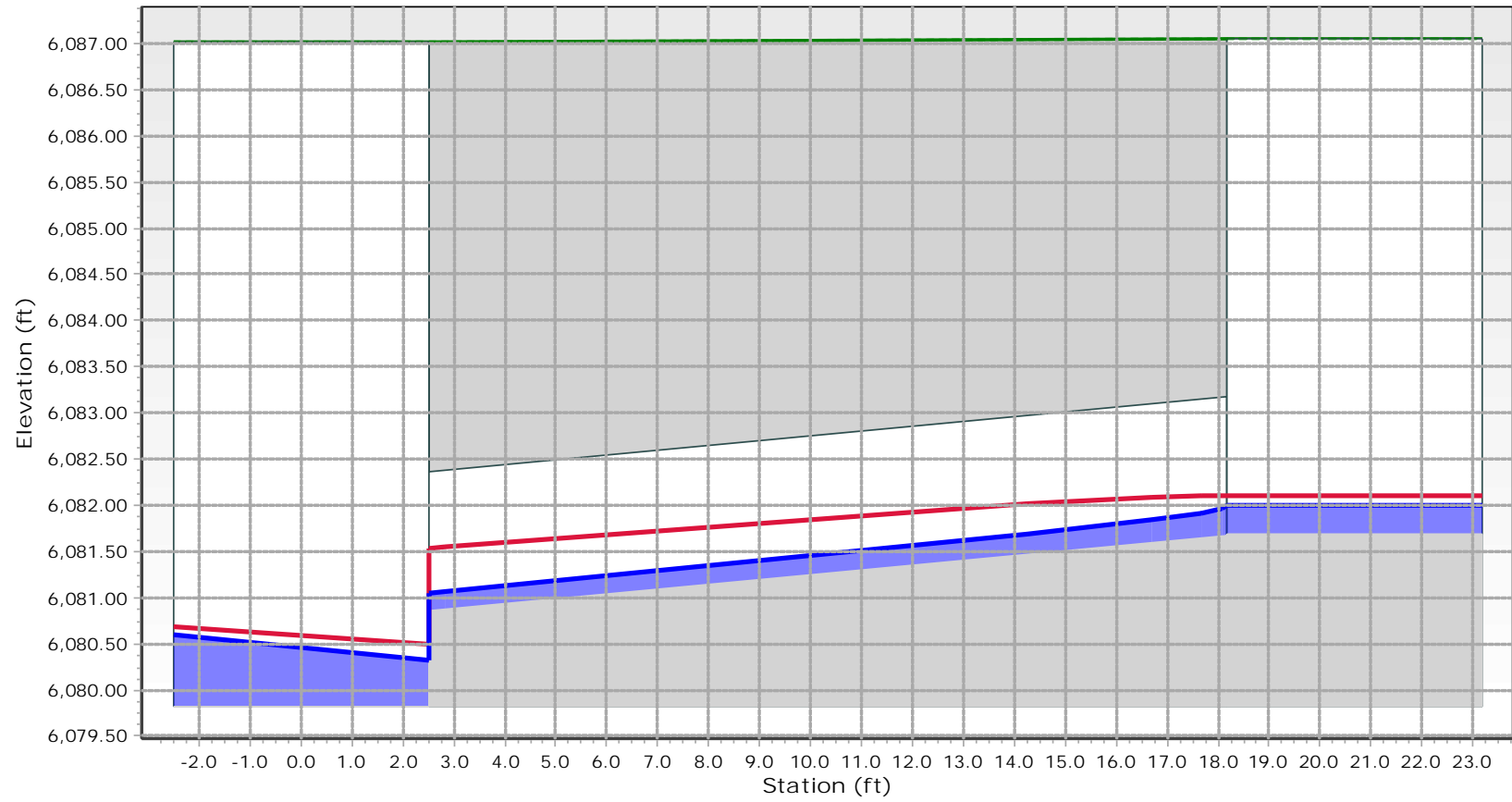
DPO2 - 2-Year



DPO3 - 2-Year

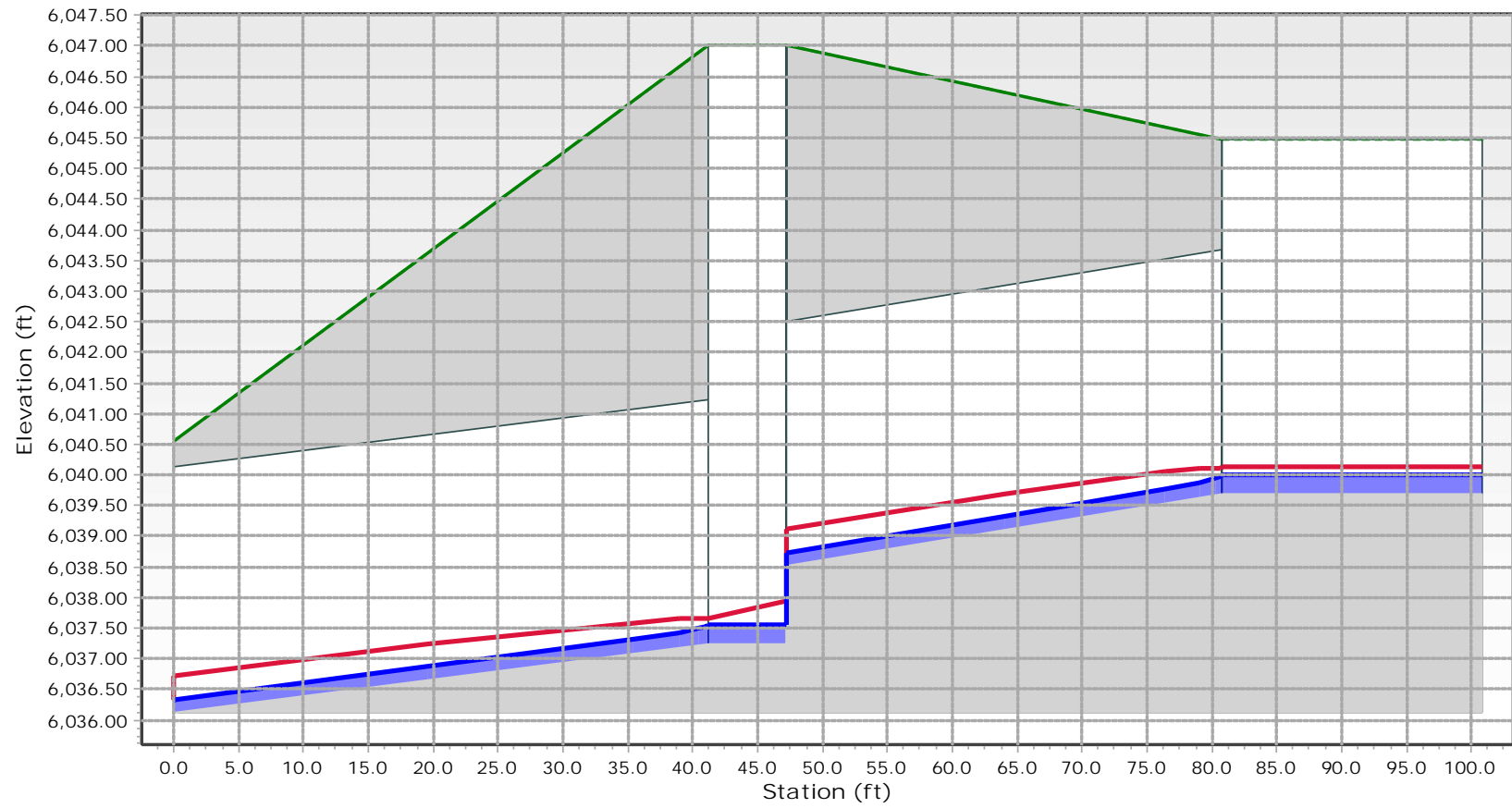


DP04 - 2-Year

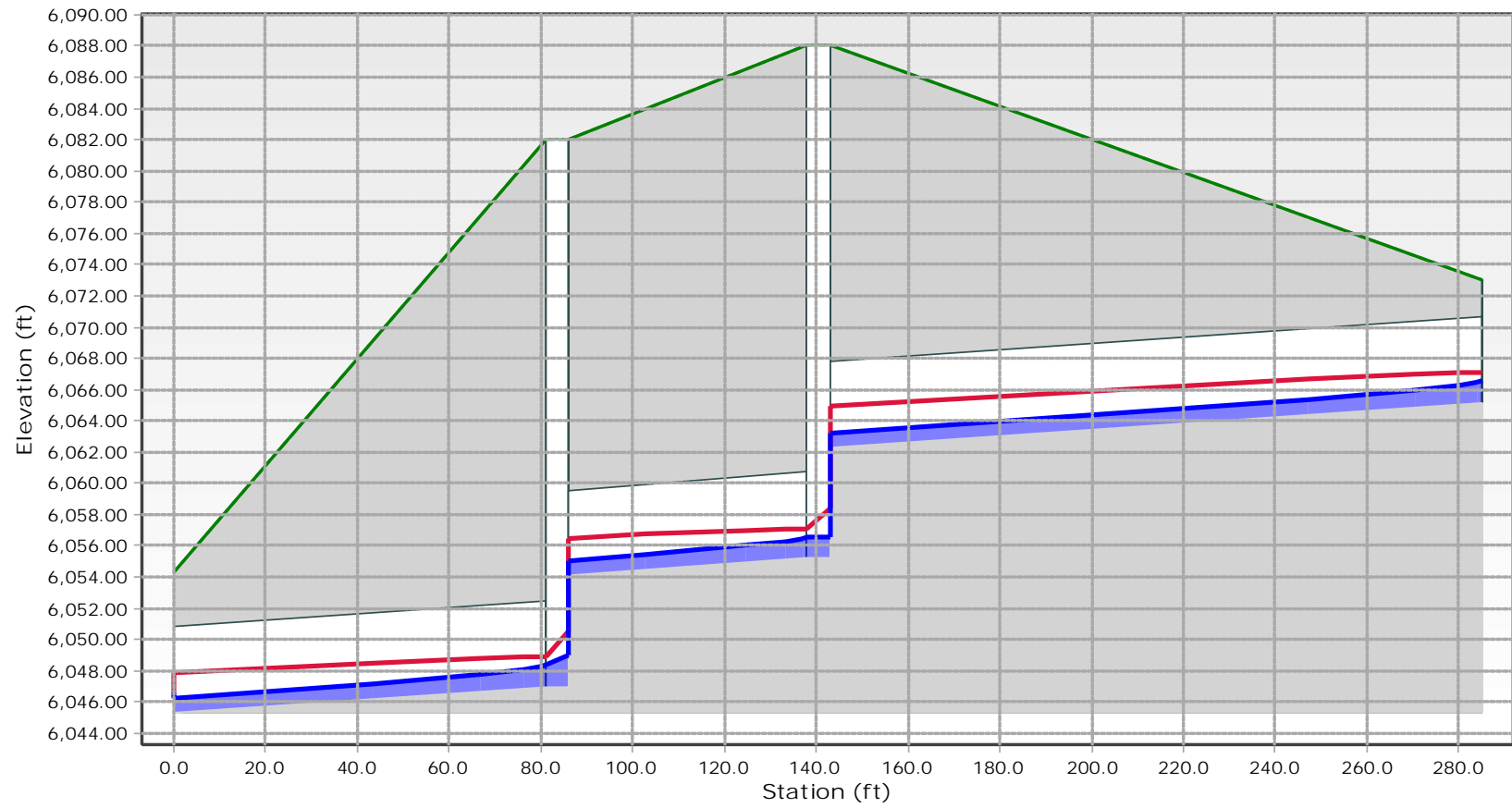




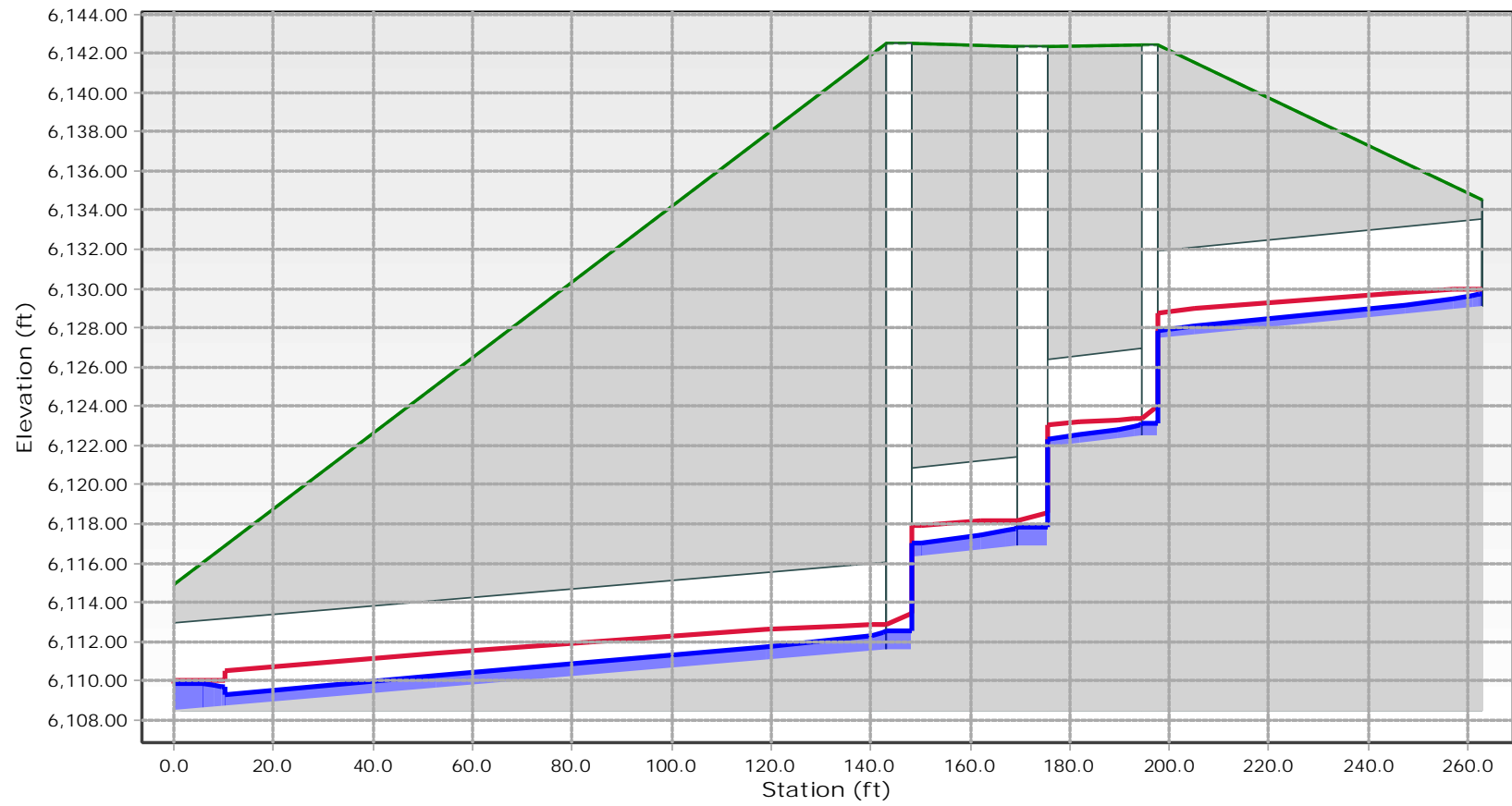
Pond B Outfall - 2-Year



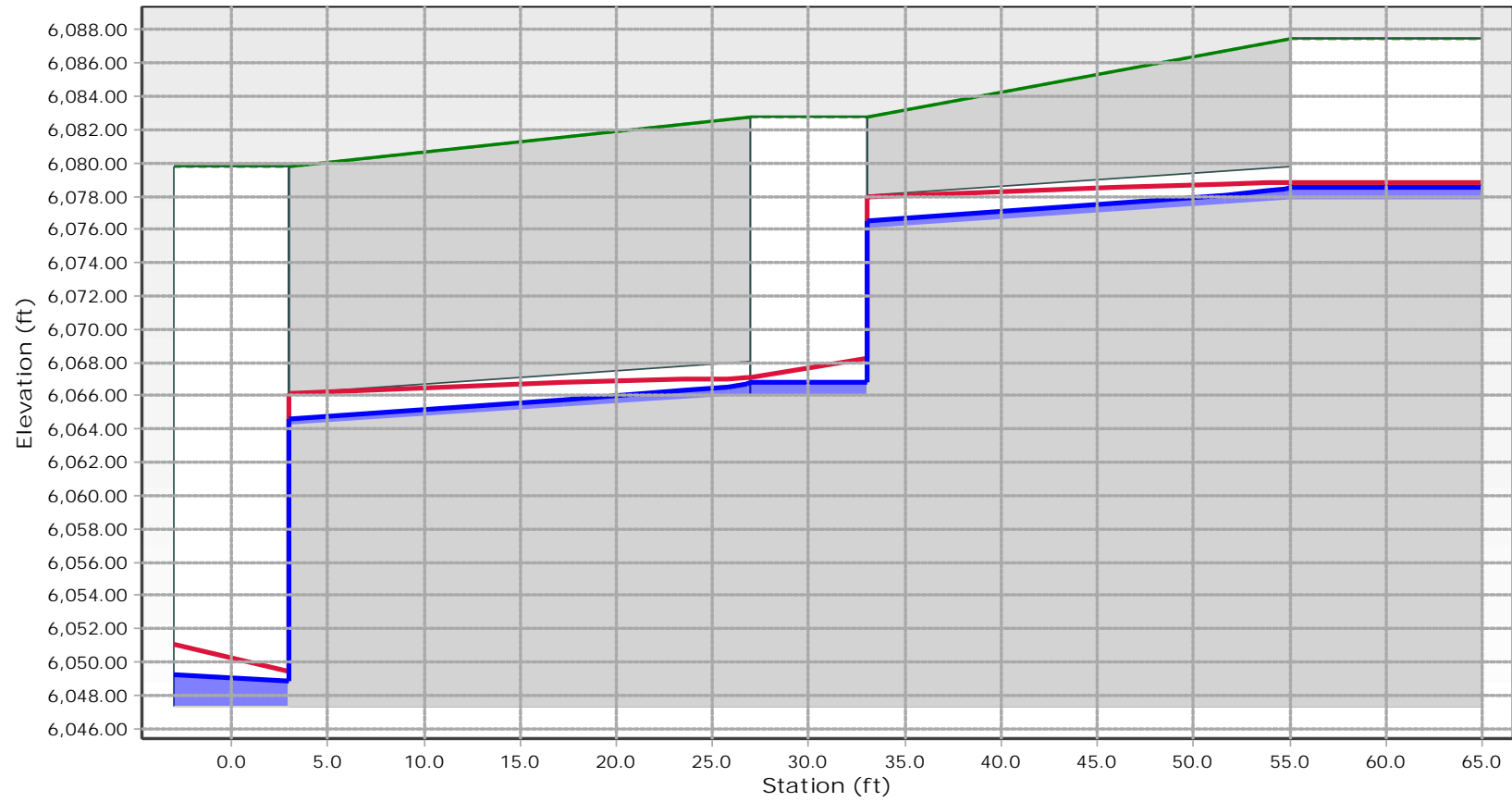
DP20 North Culvert - 2-Year



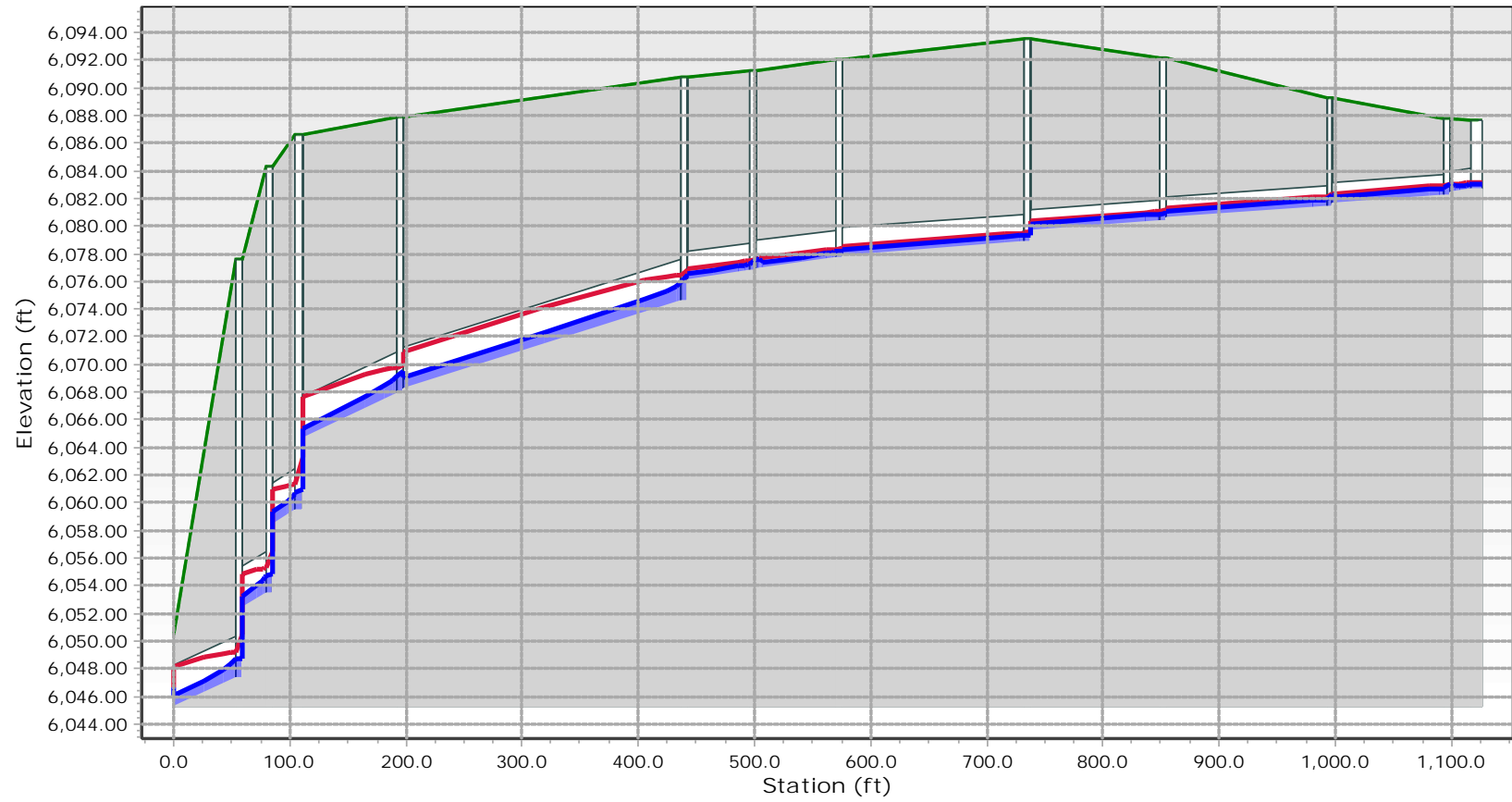
DP20 South Culvert - 2-Year



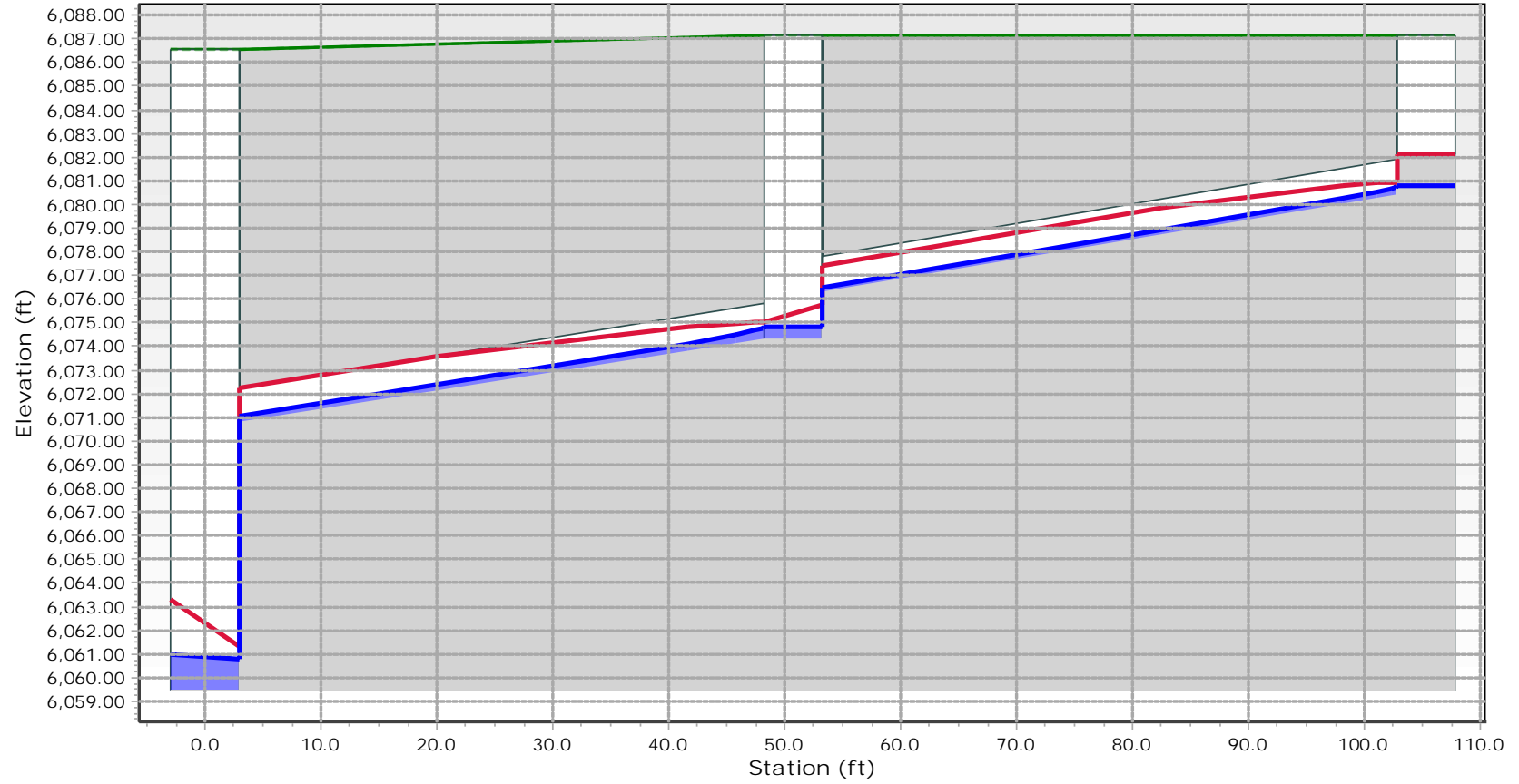
DP21 - 2-Year



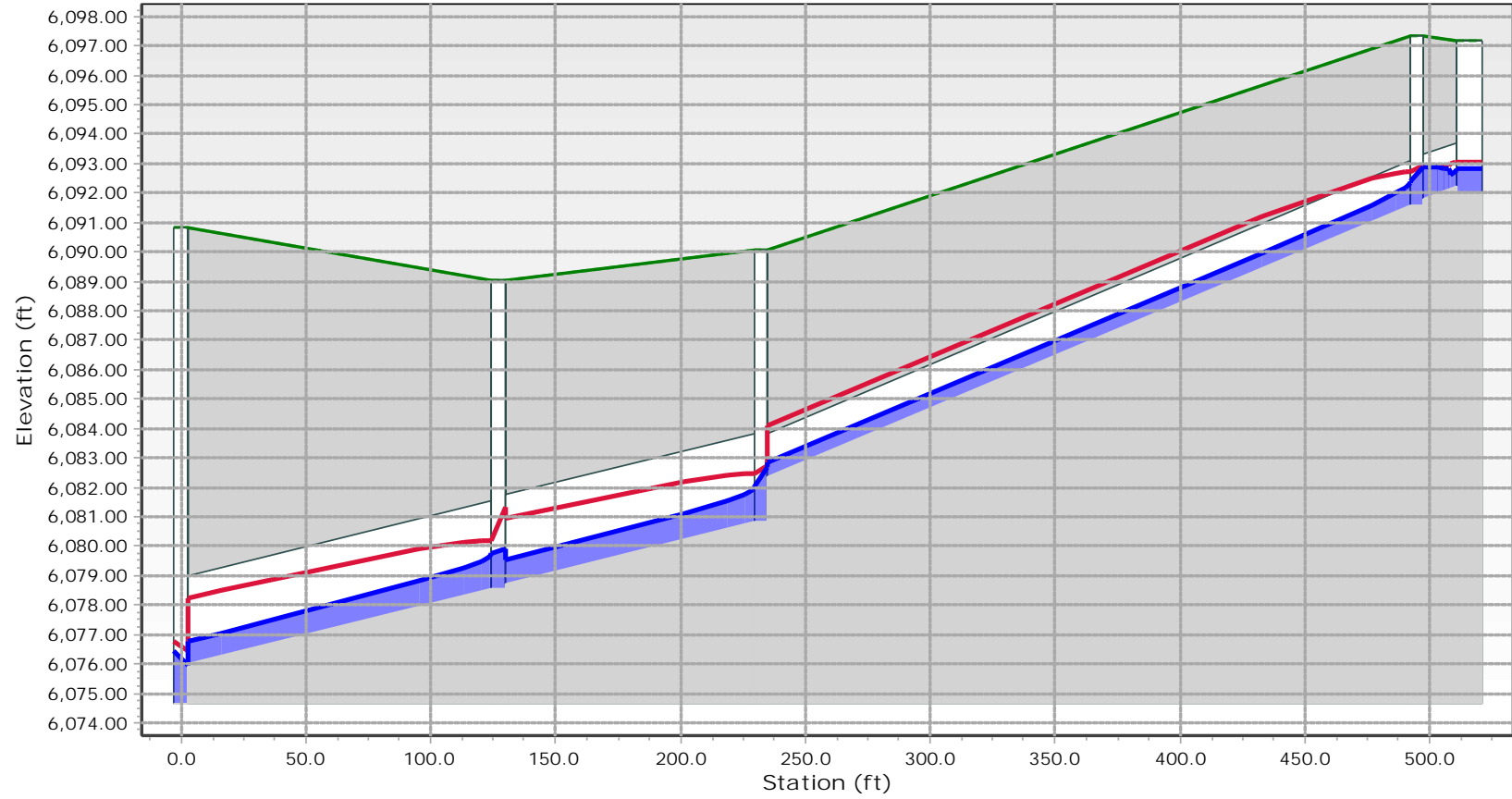
DP22 - 2-Year



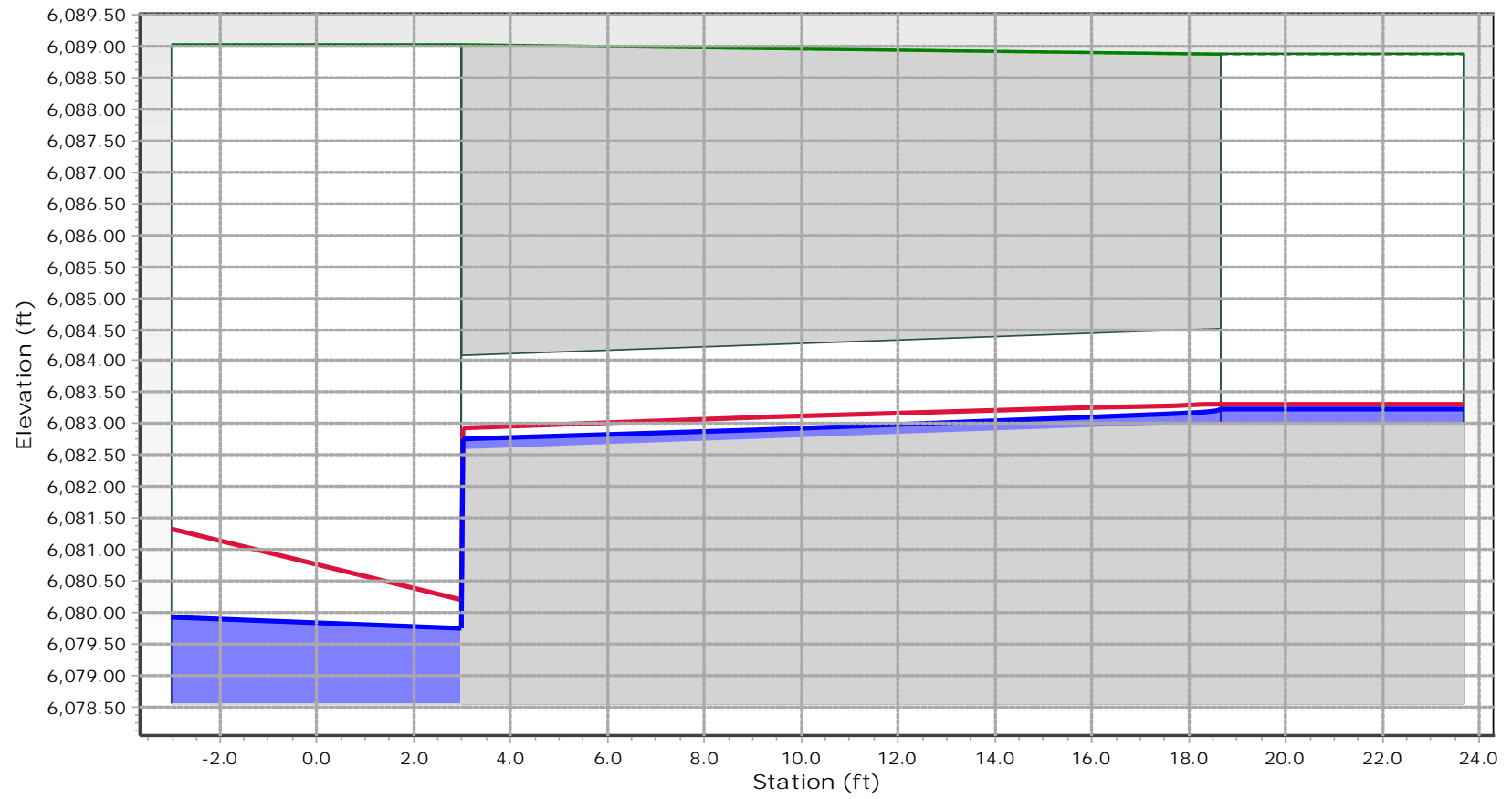
DP23 - 2-Year



DP24 - 2-Year

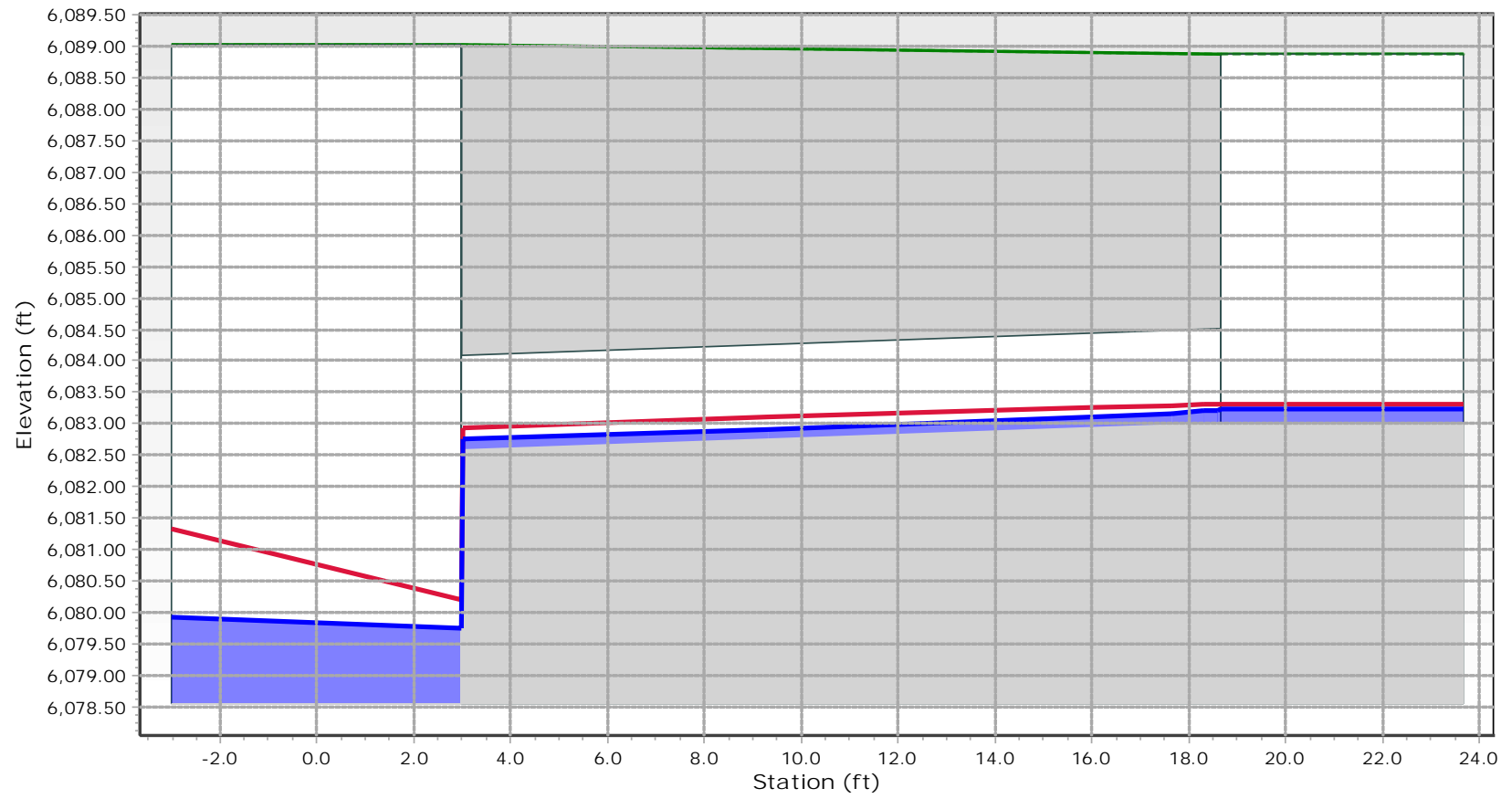


DP25 - 2-Year

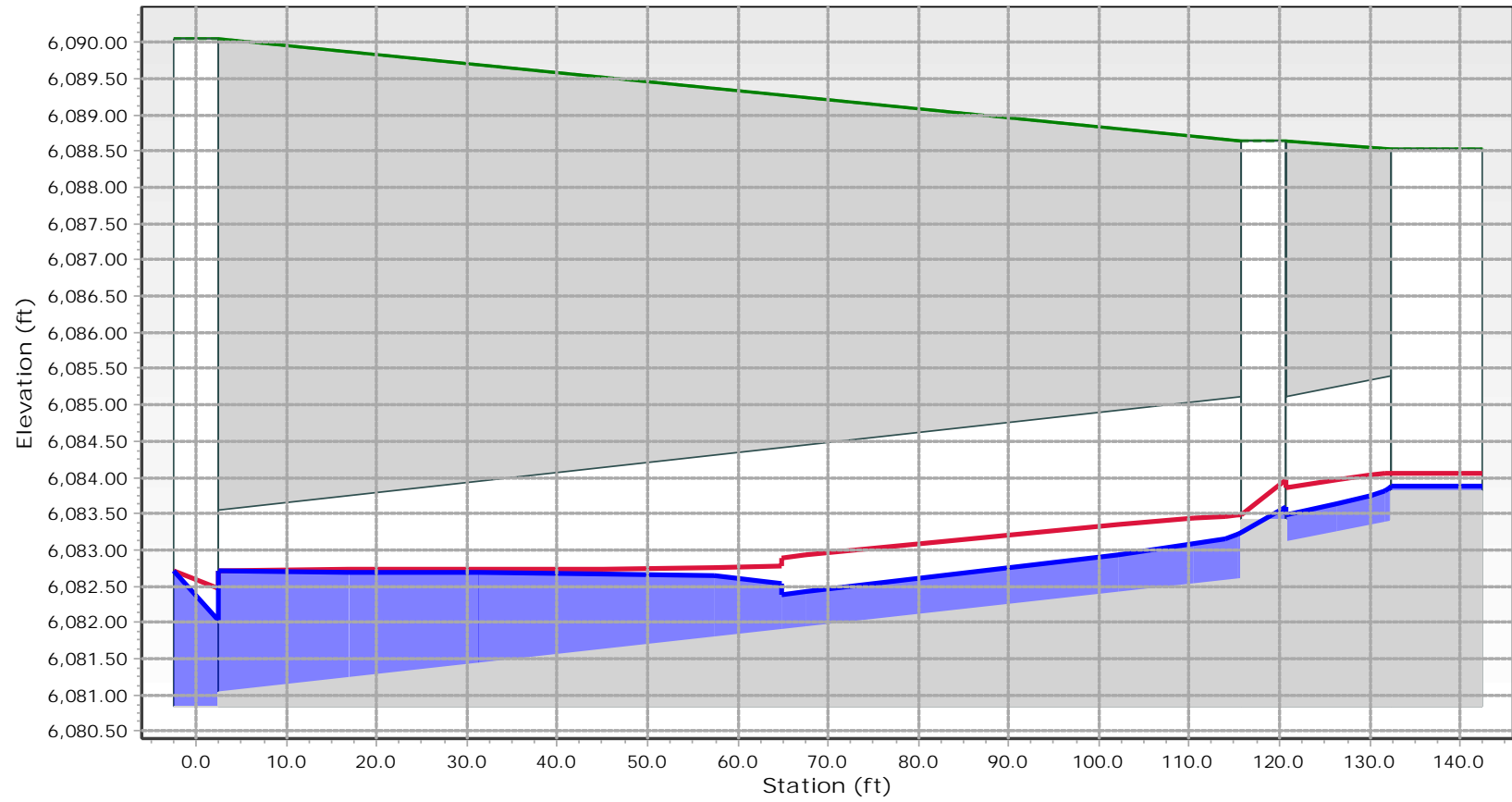




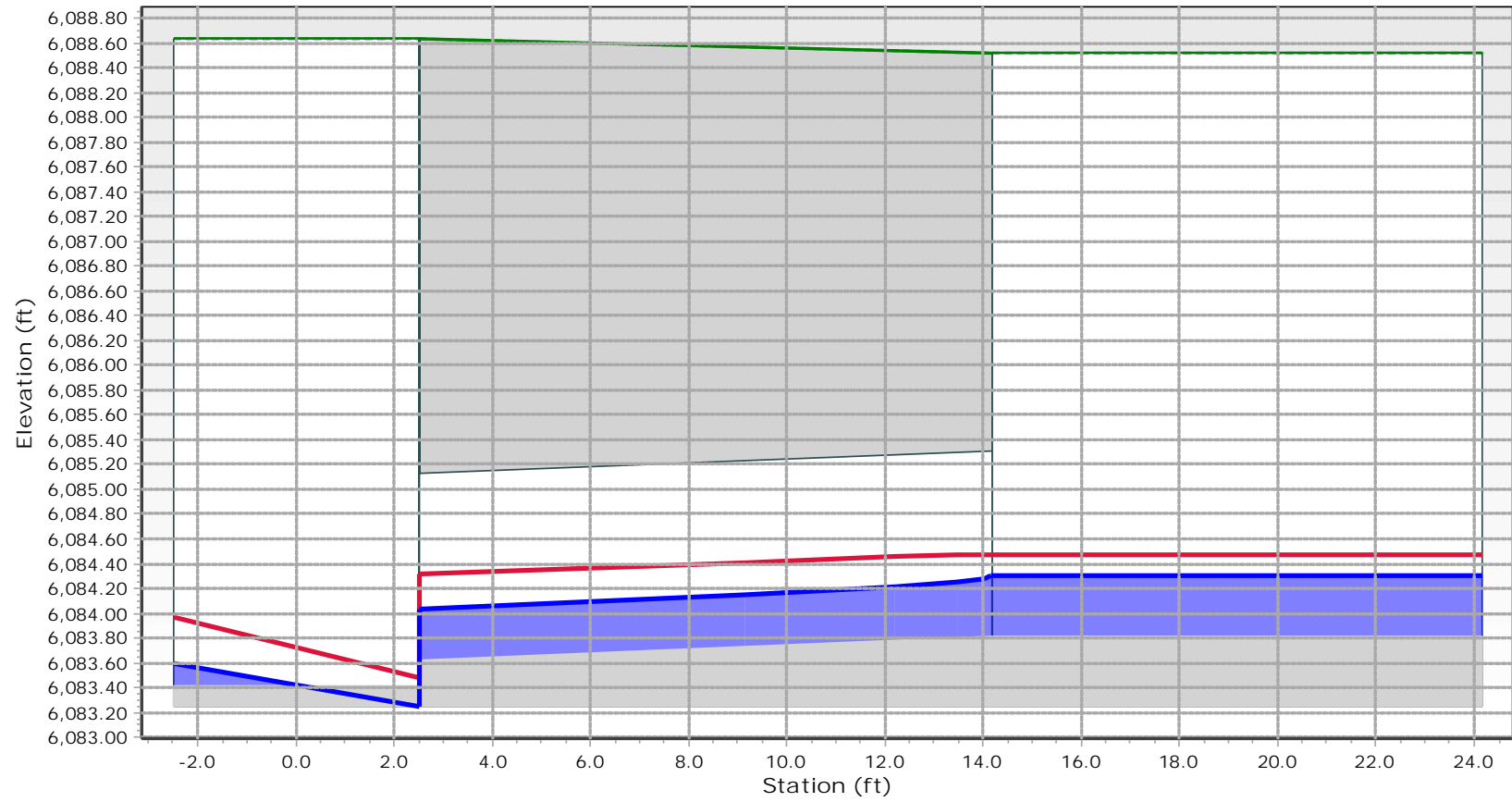
DP26 - 2-Year



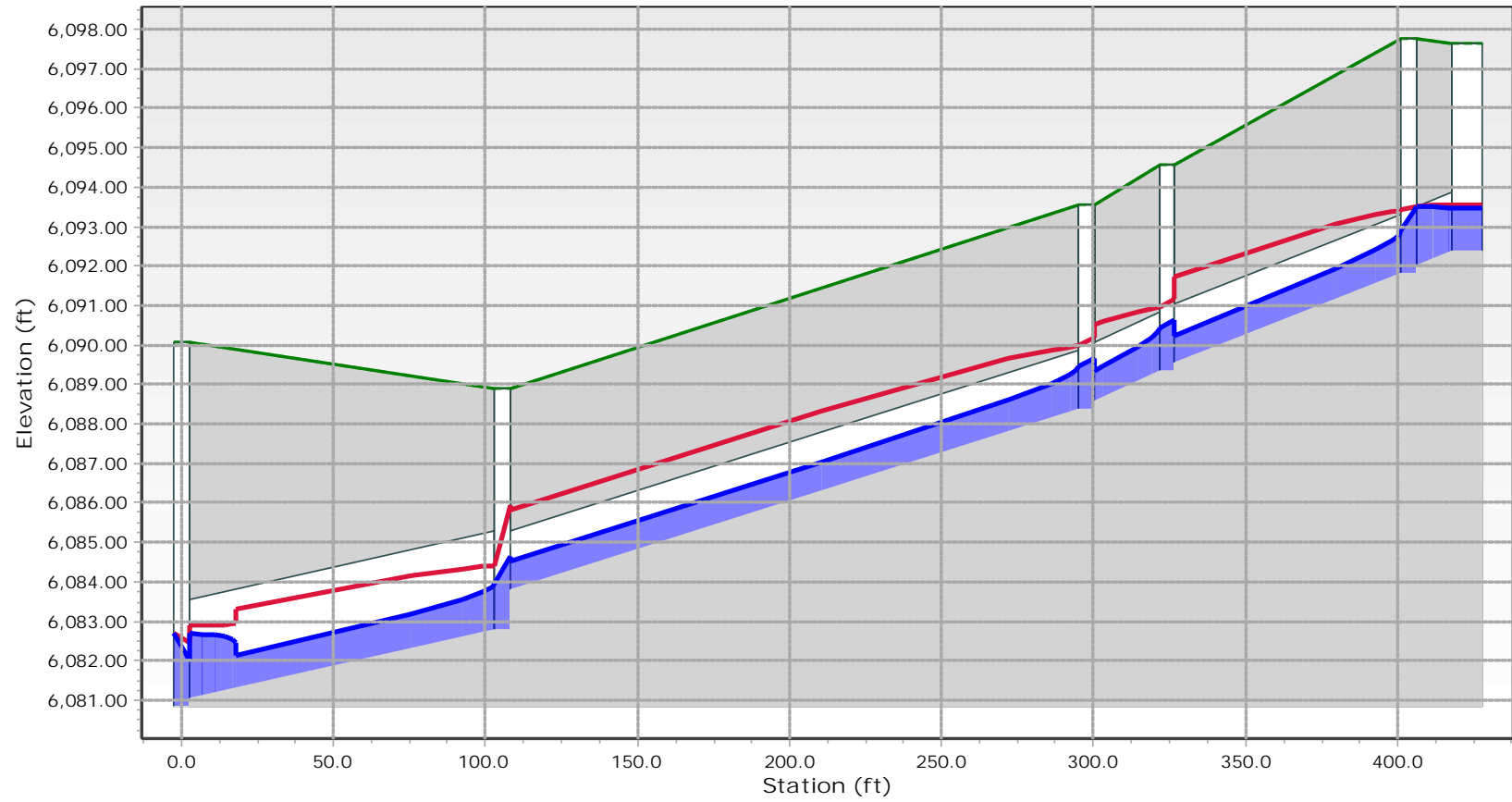
DP27 - 2-Year



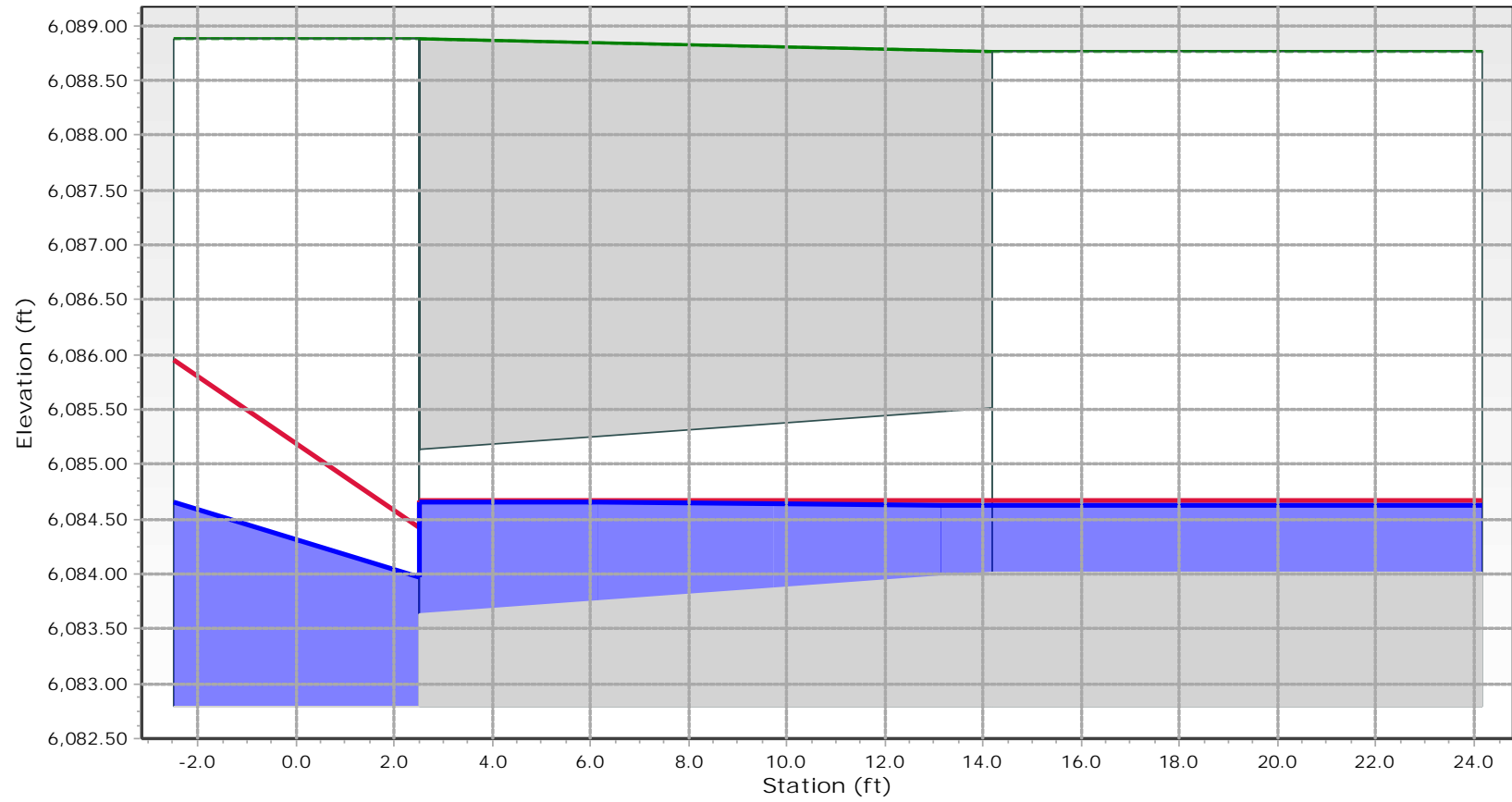
DP28 - 2-Year



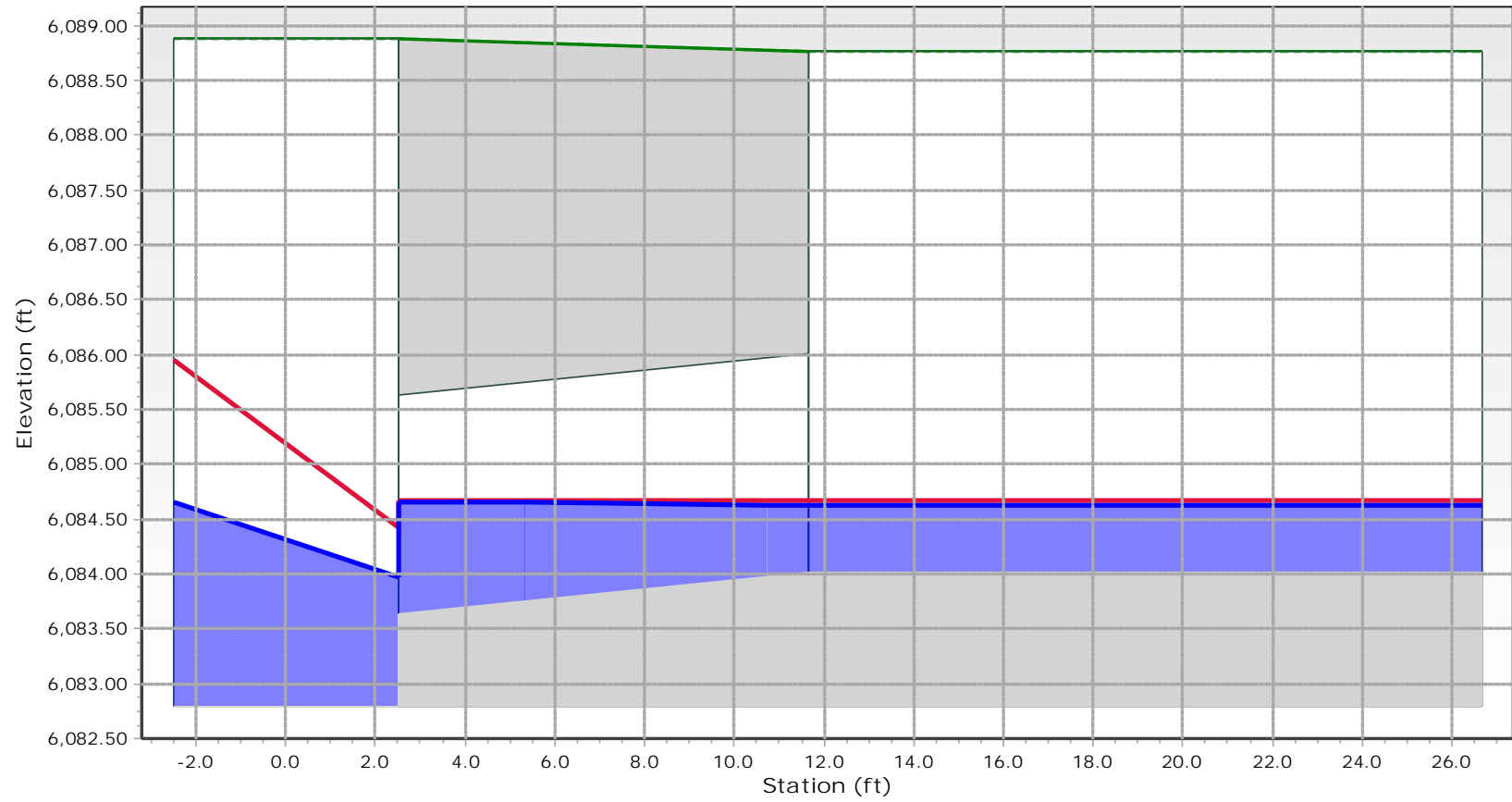
DP29 - 2-Year



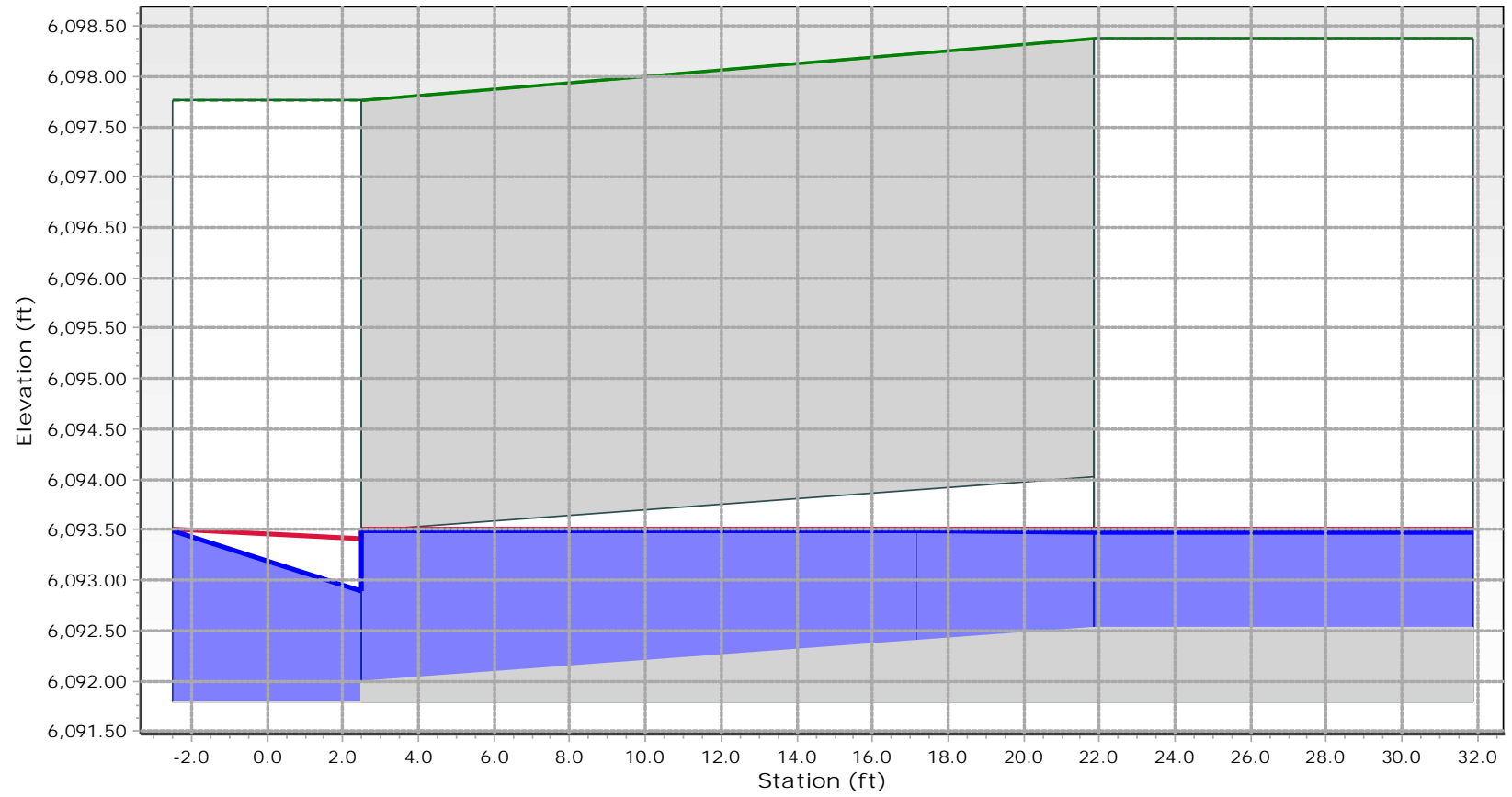
DP30 - 2-Year



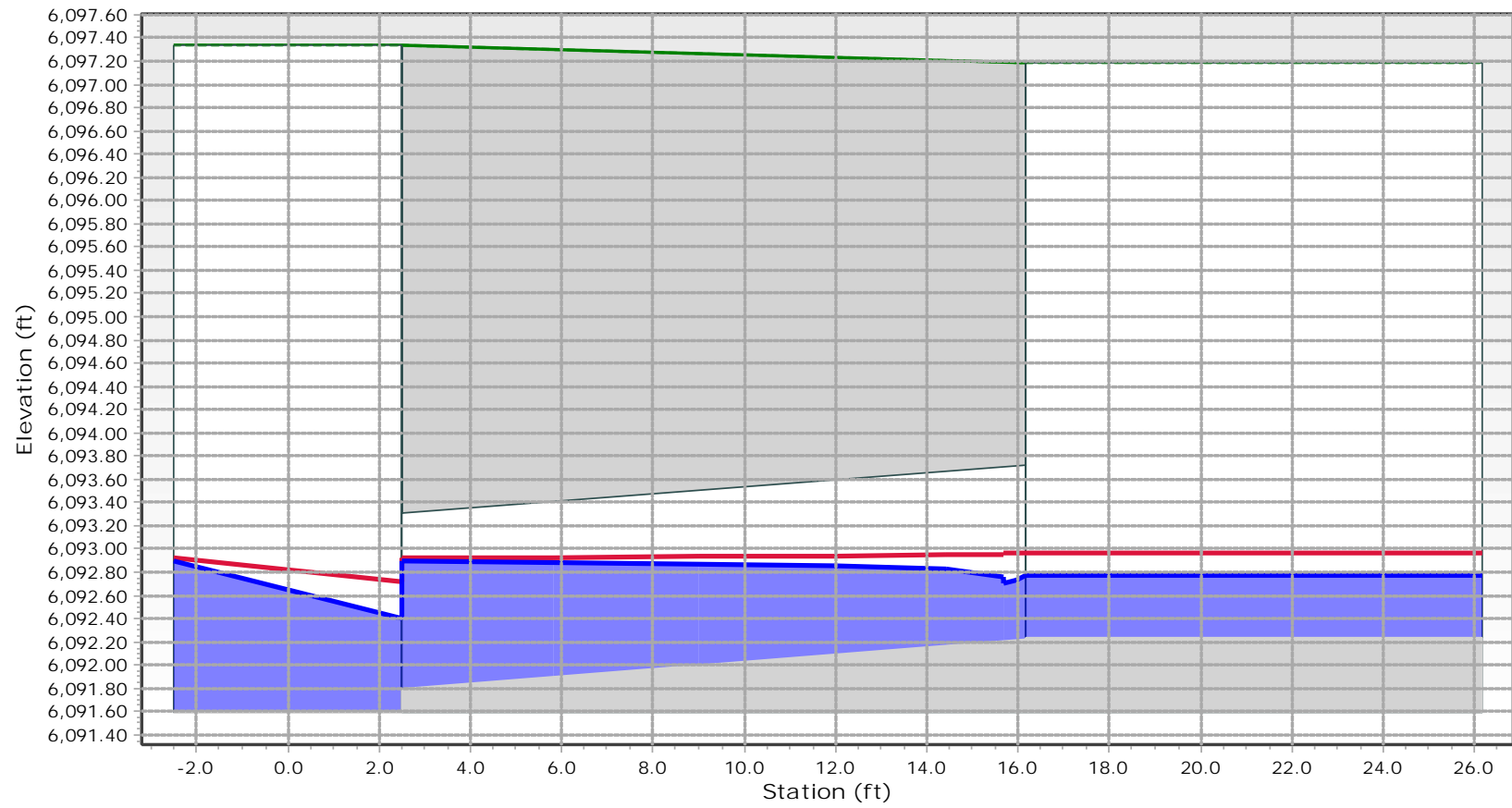
DP31 - 2-Year



DP32 - 2-Year

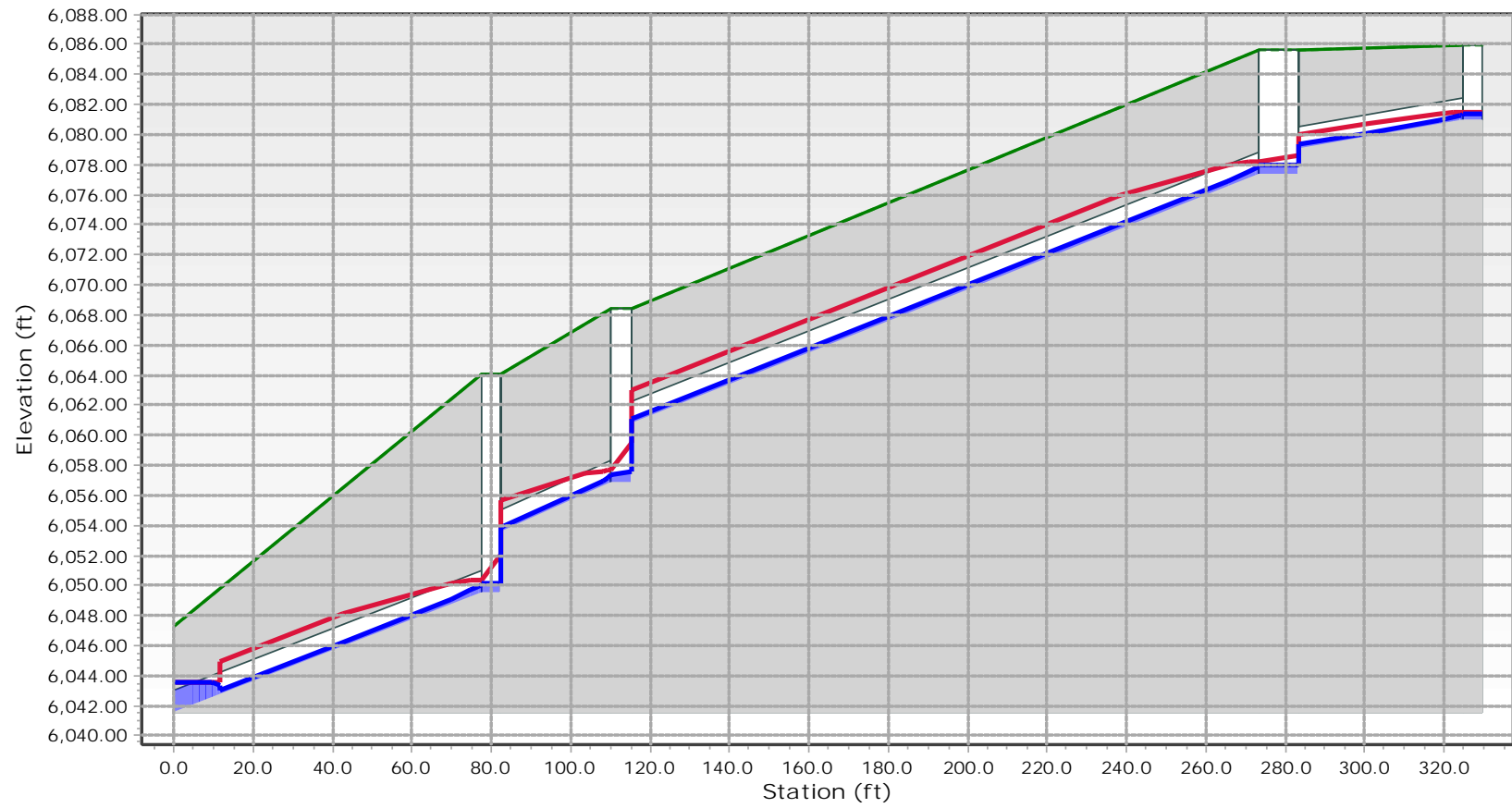


DP33 - 2-Year

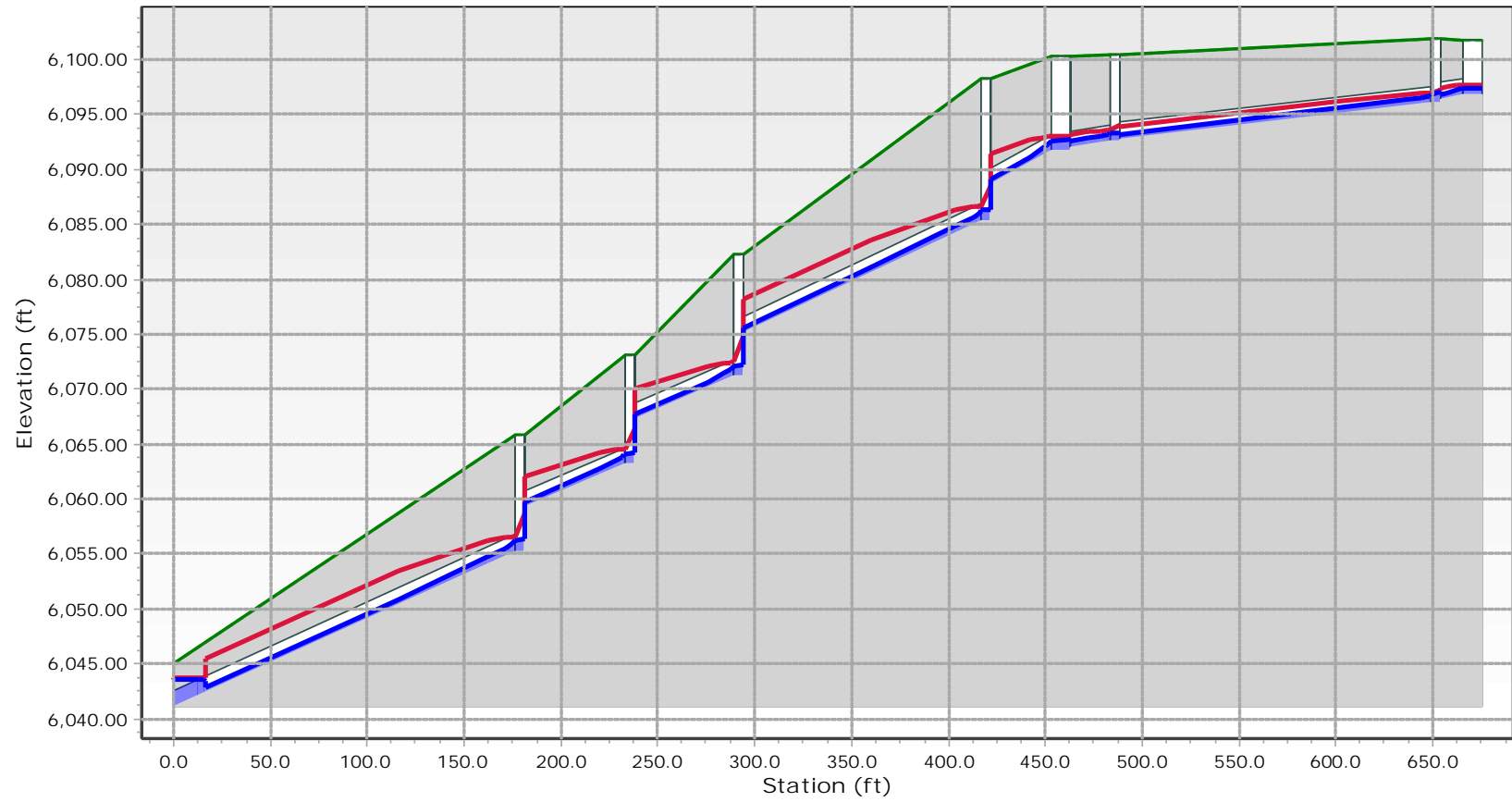




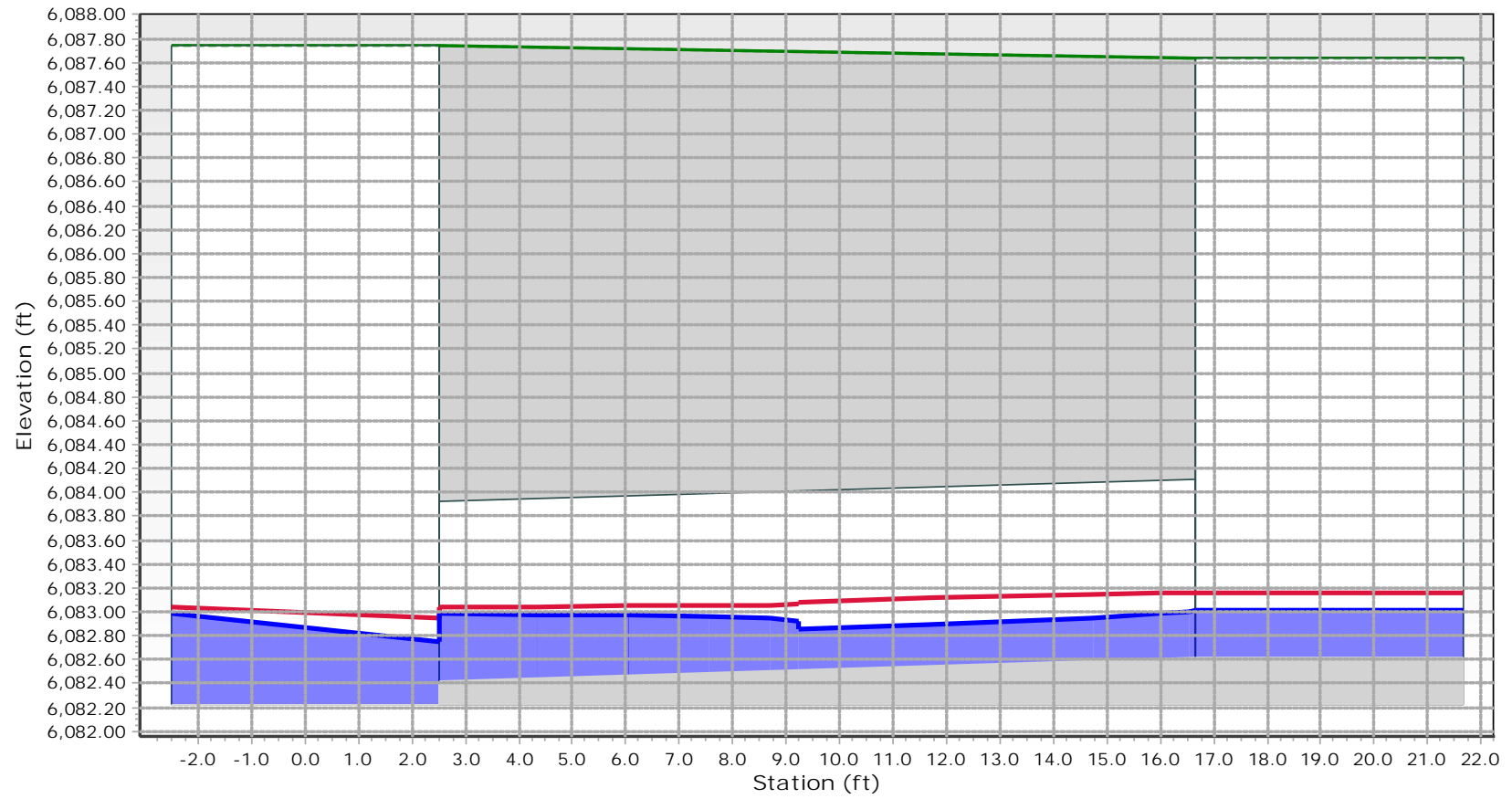
DP34 - 2-Year



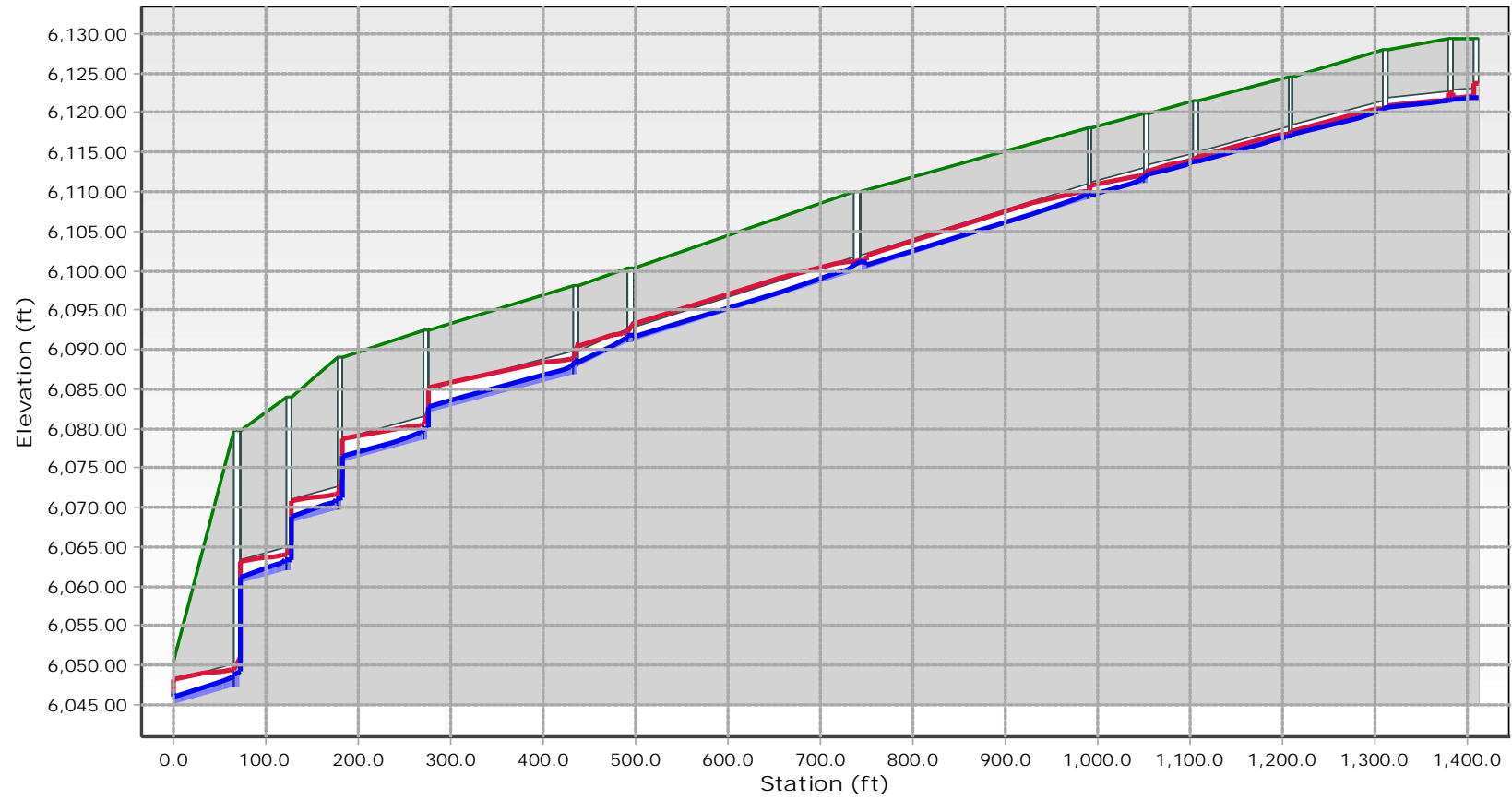
DP35 - 2-Year



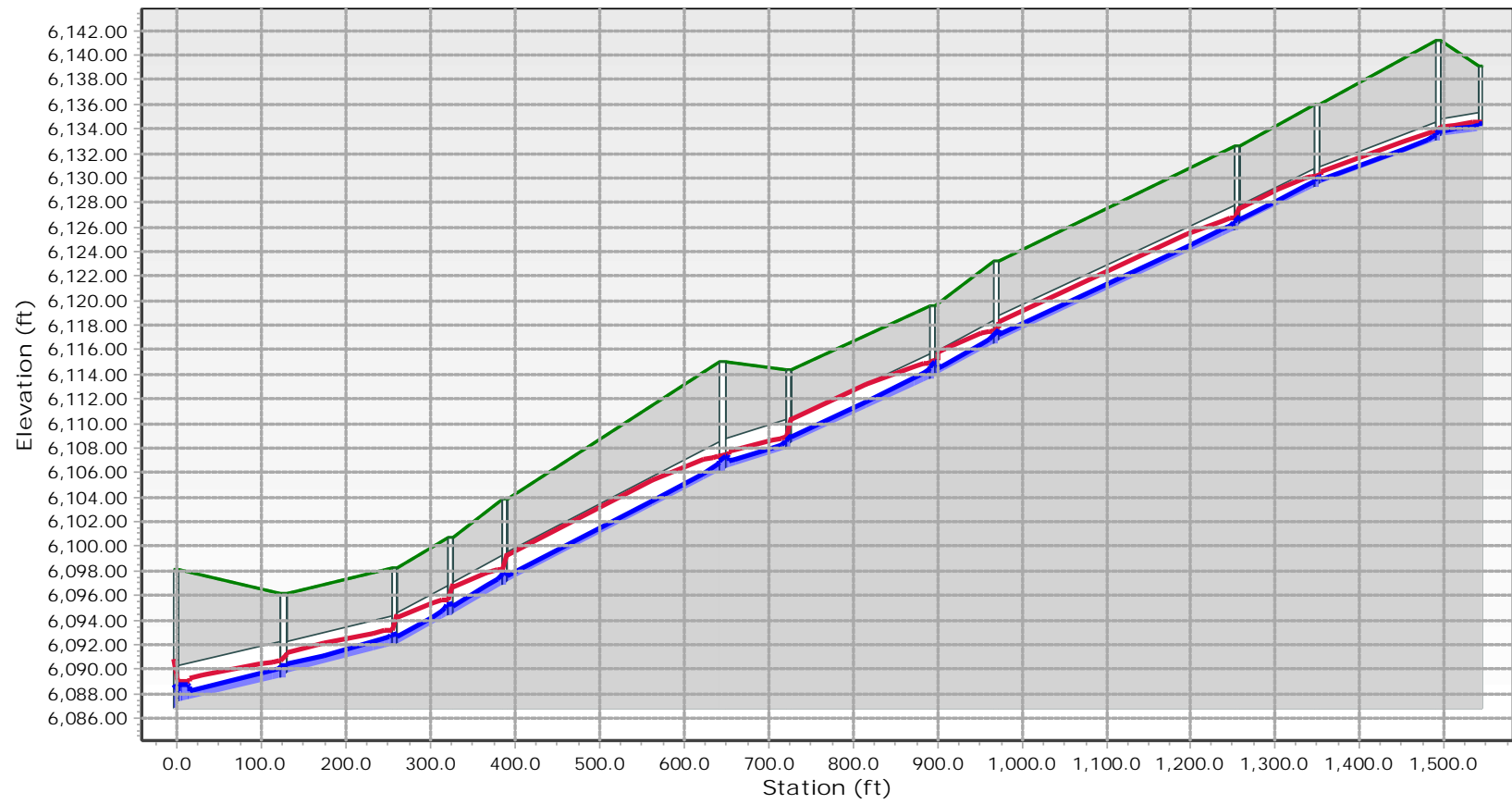
DP36 - 2-Year



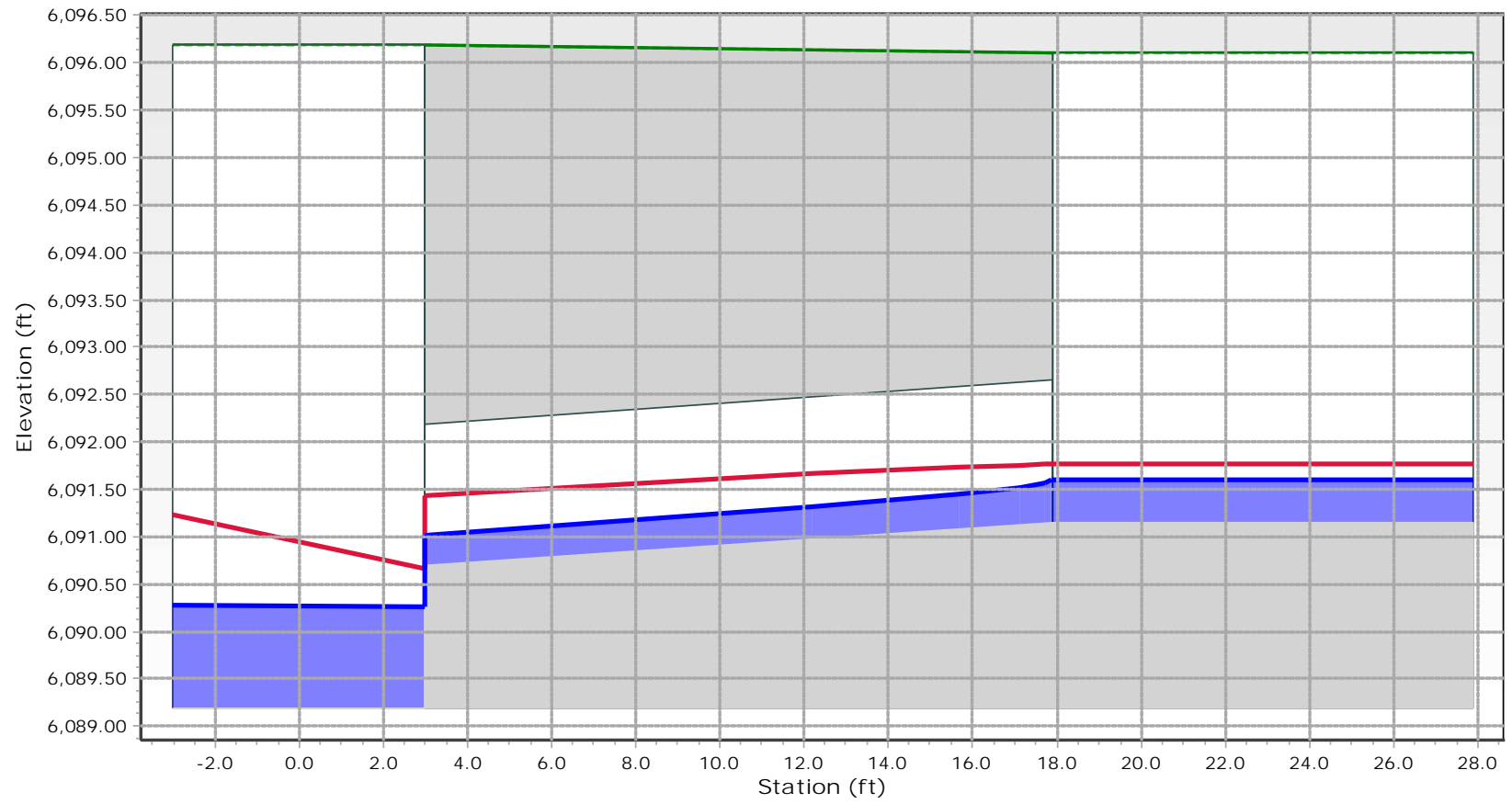
DP37 - 2-Year



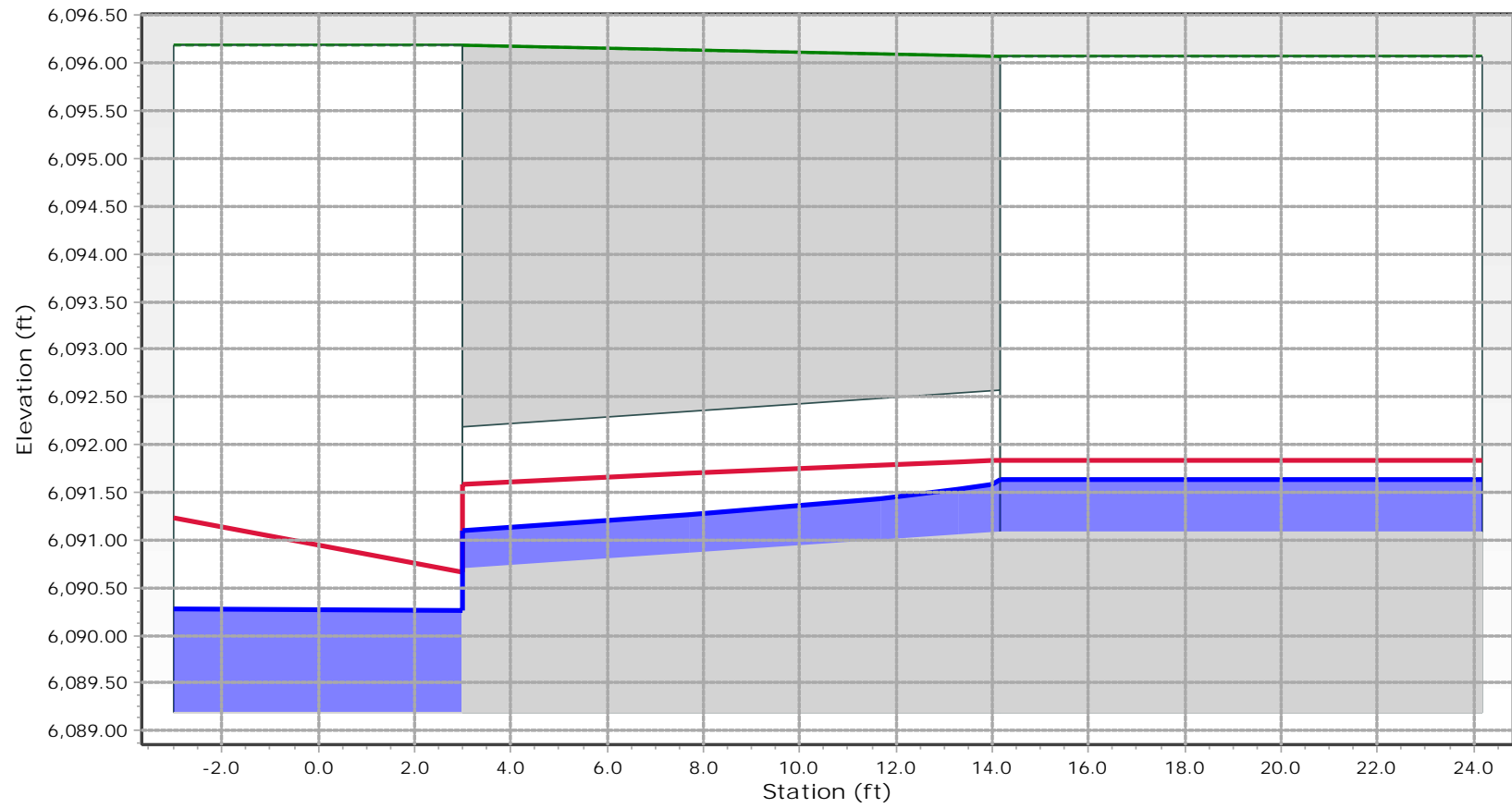
DP38 - 2-Year



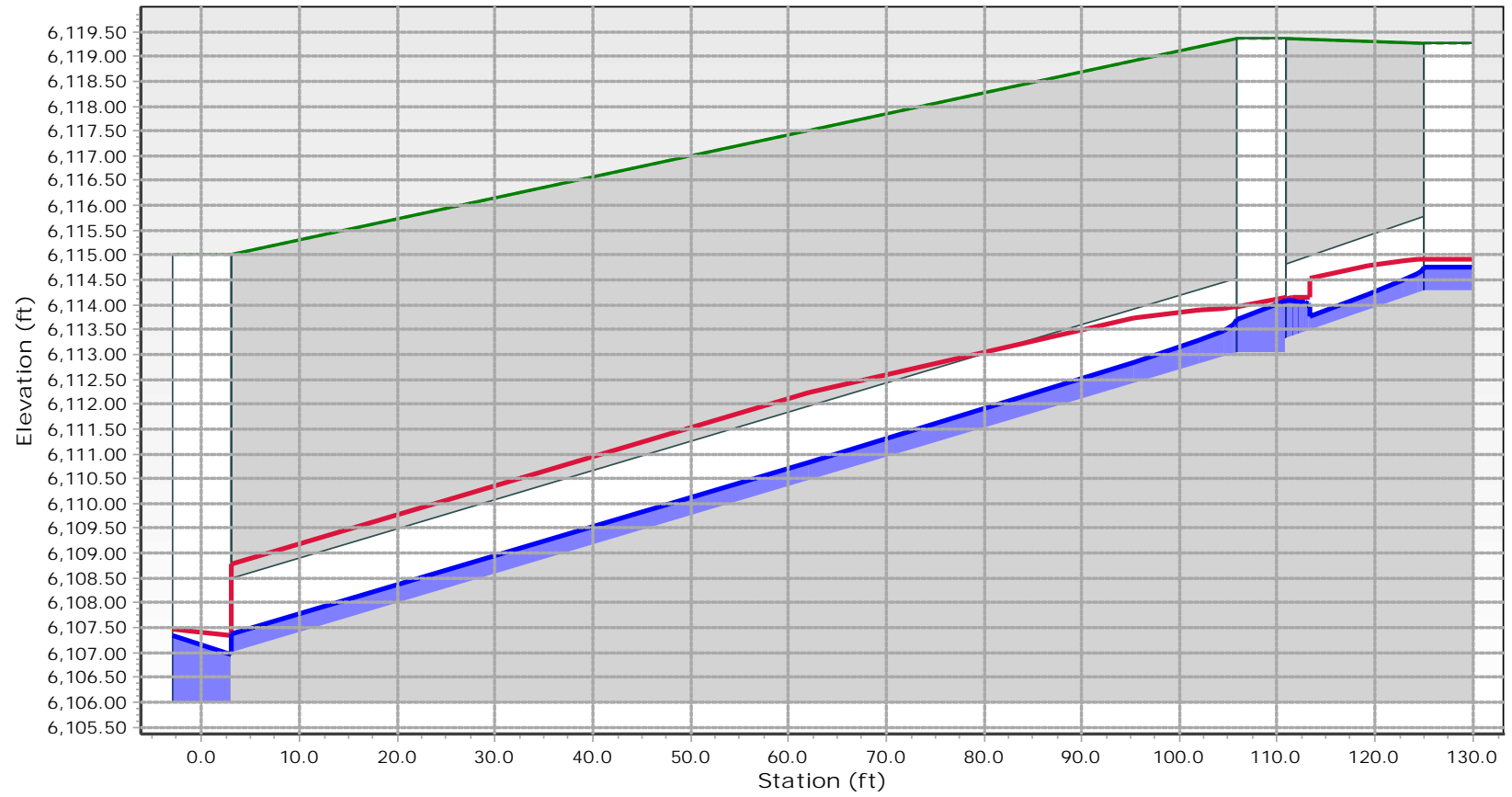
DP39 - 2-Year



DP40 - 2-Year

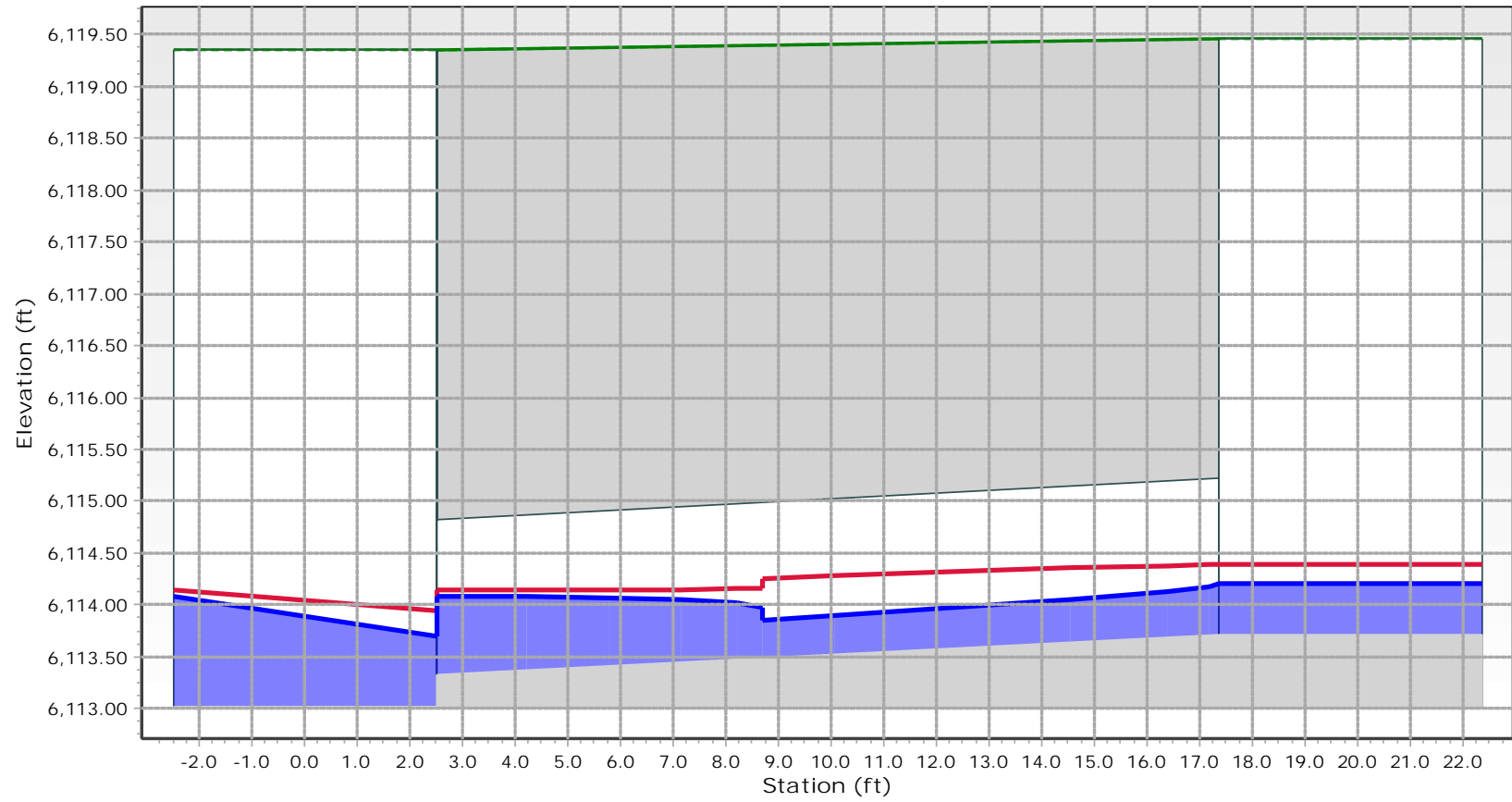


DP41 - 2-Year

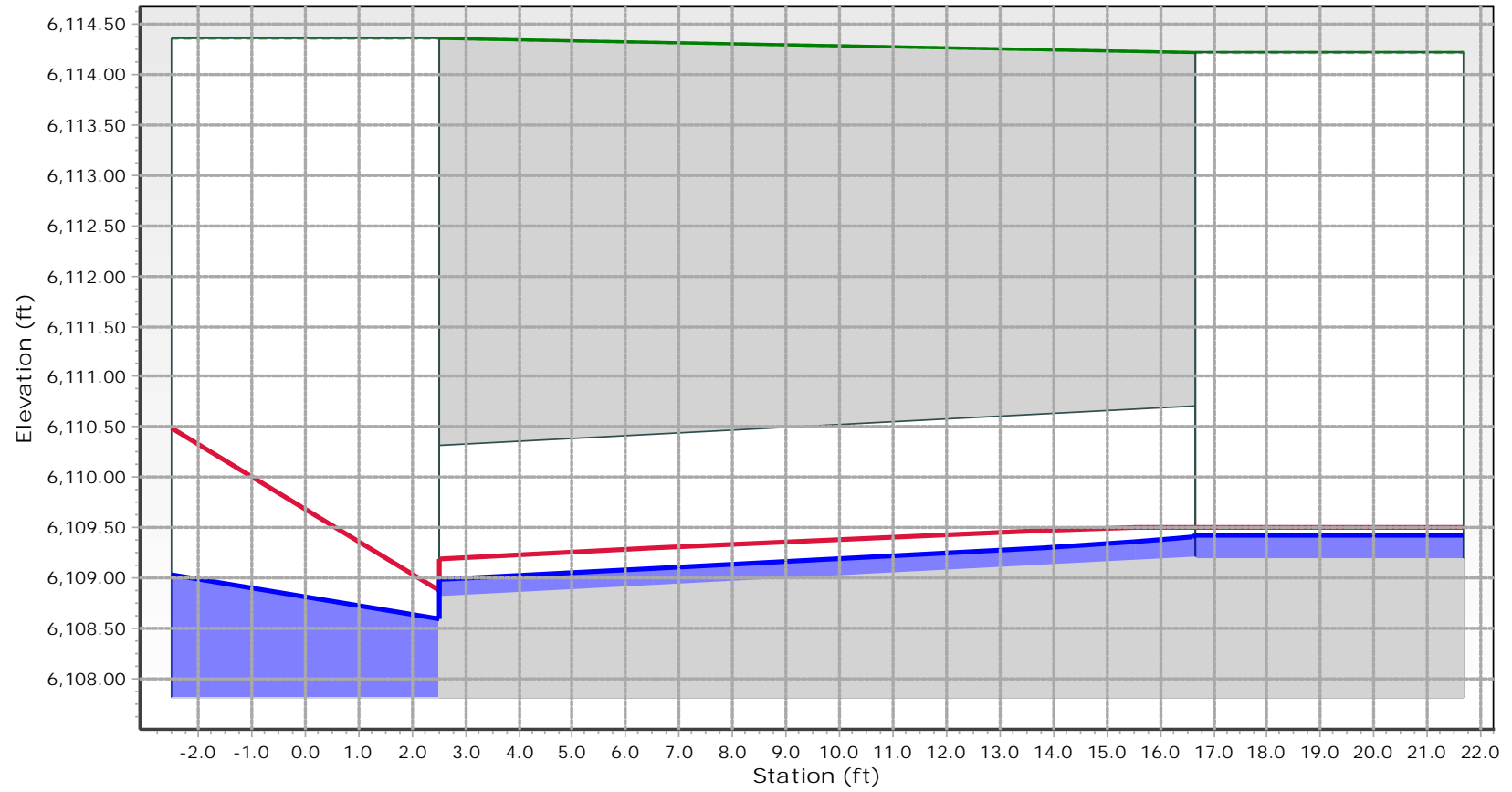




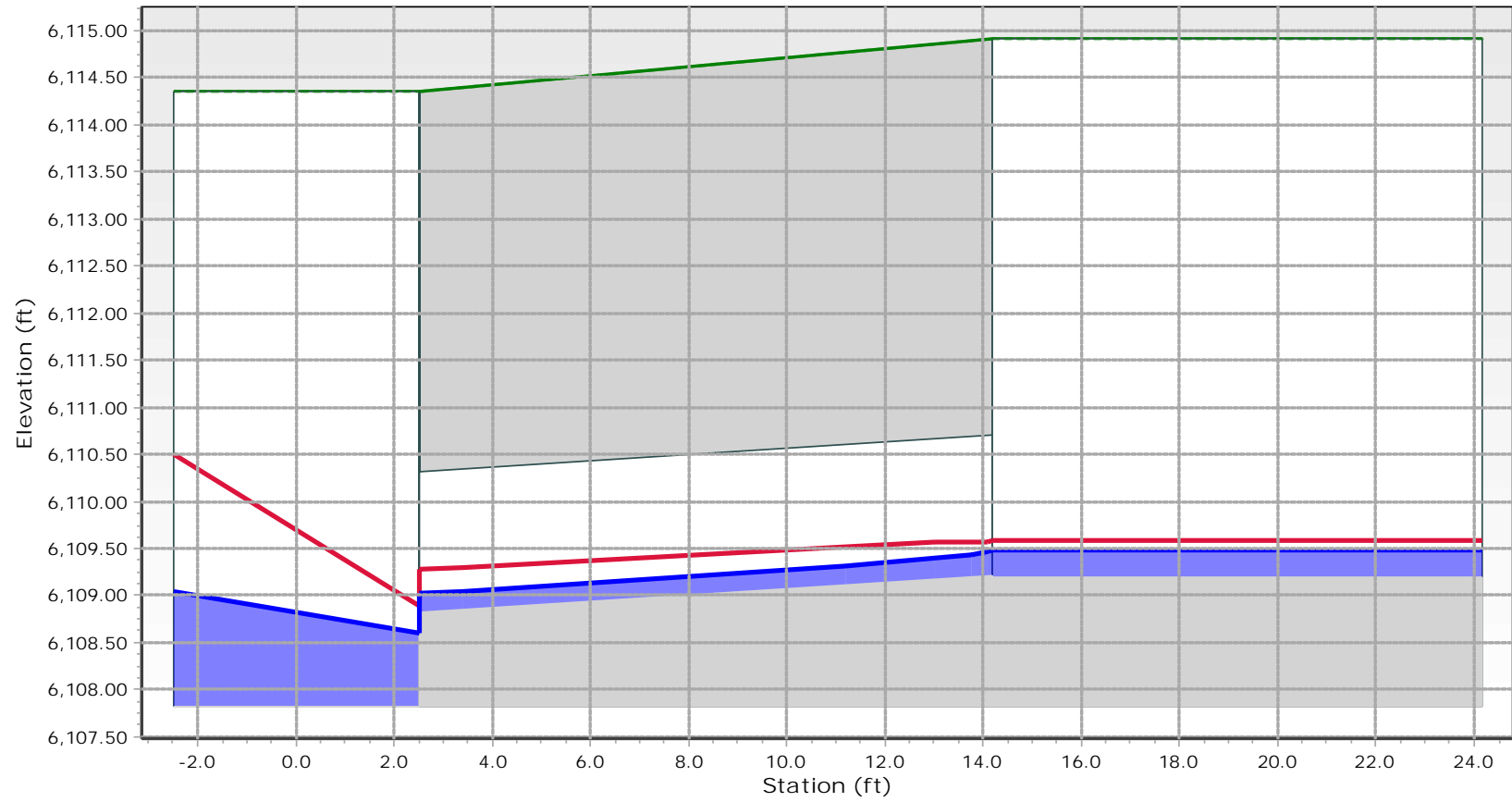
DP42 - 2-Year



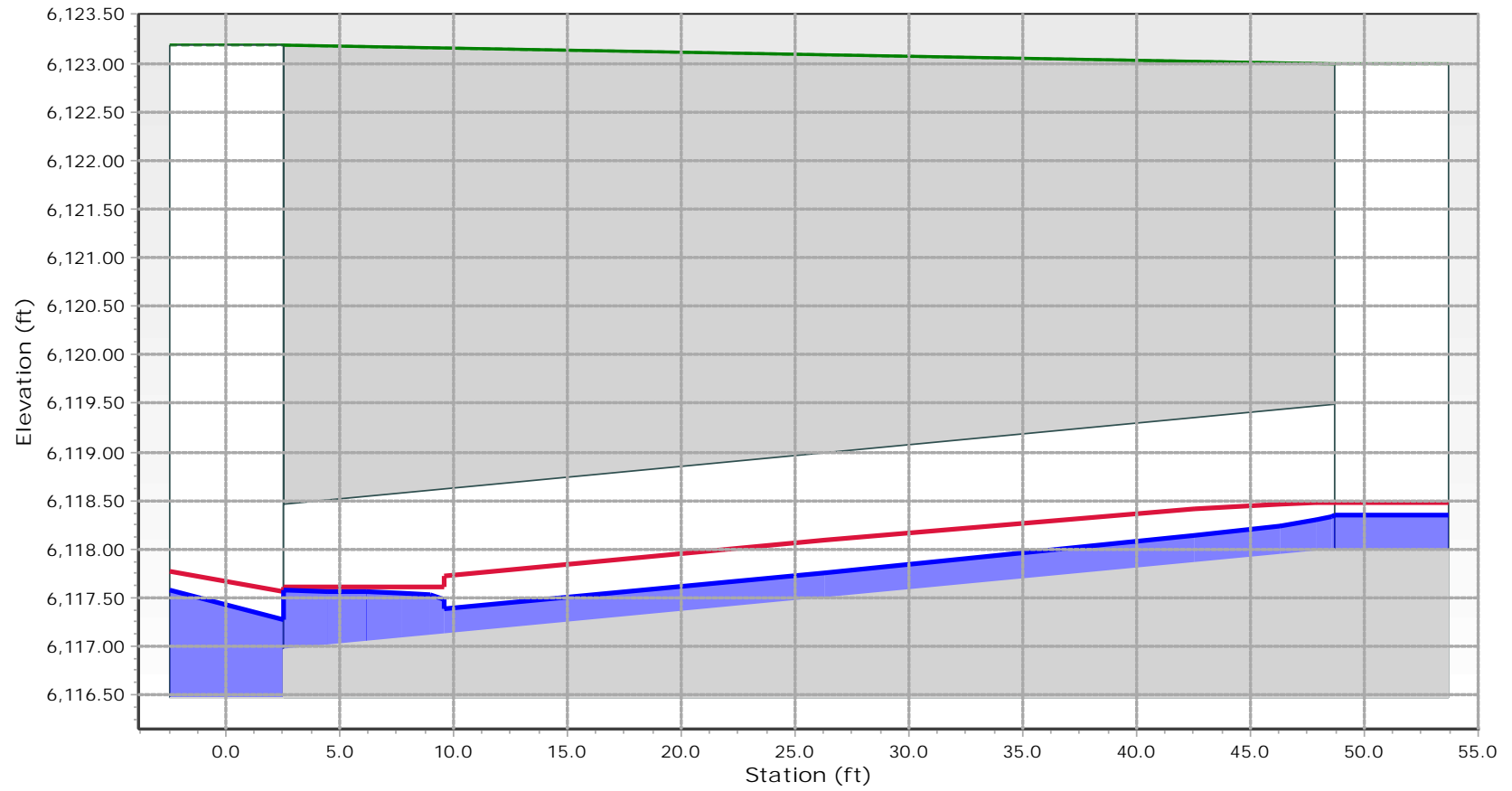
DP43 - 2-Year



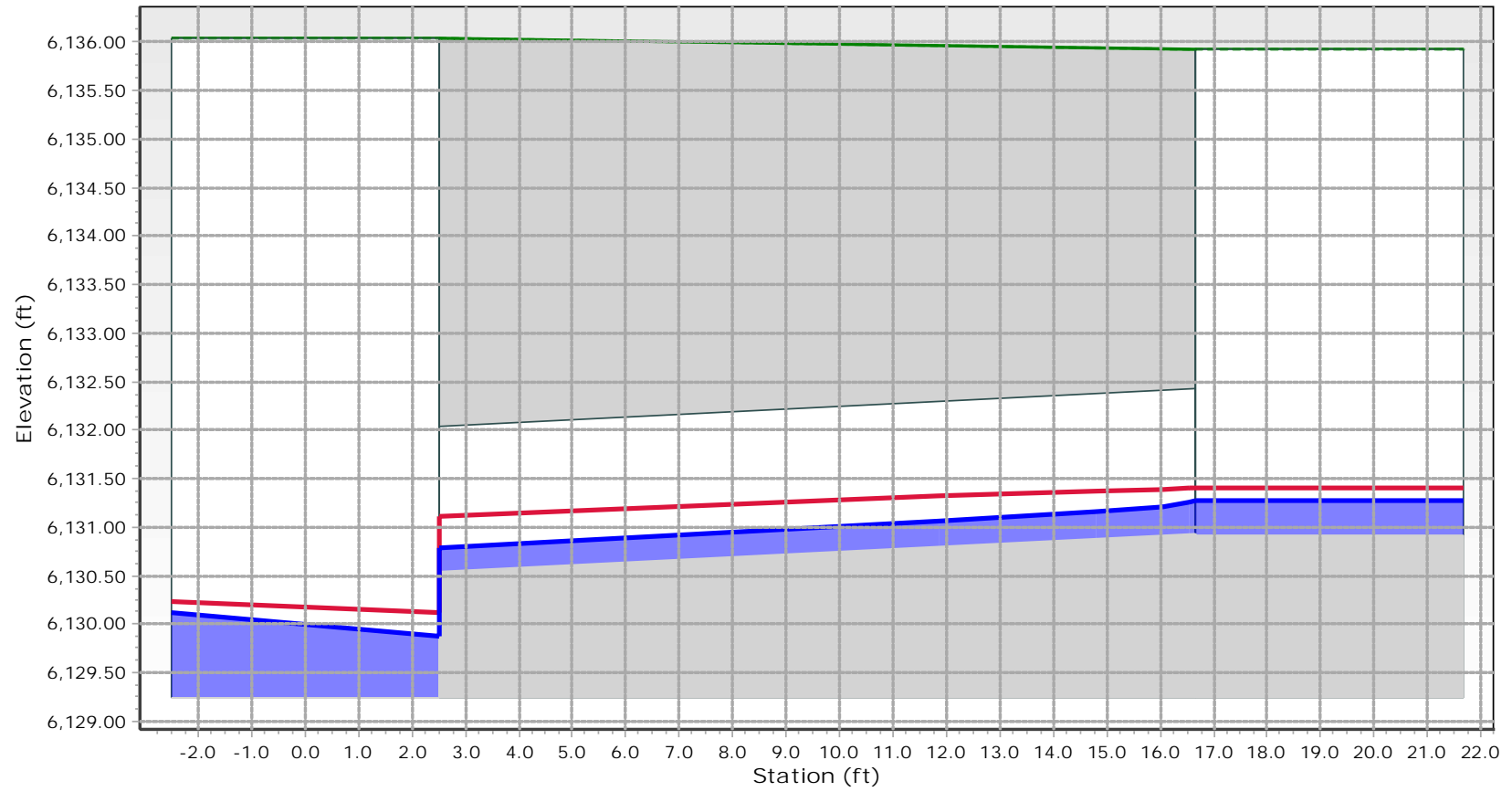
DP44 - 2-Year



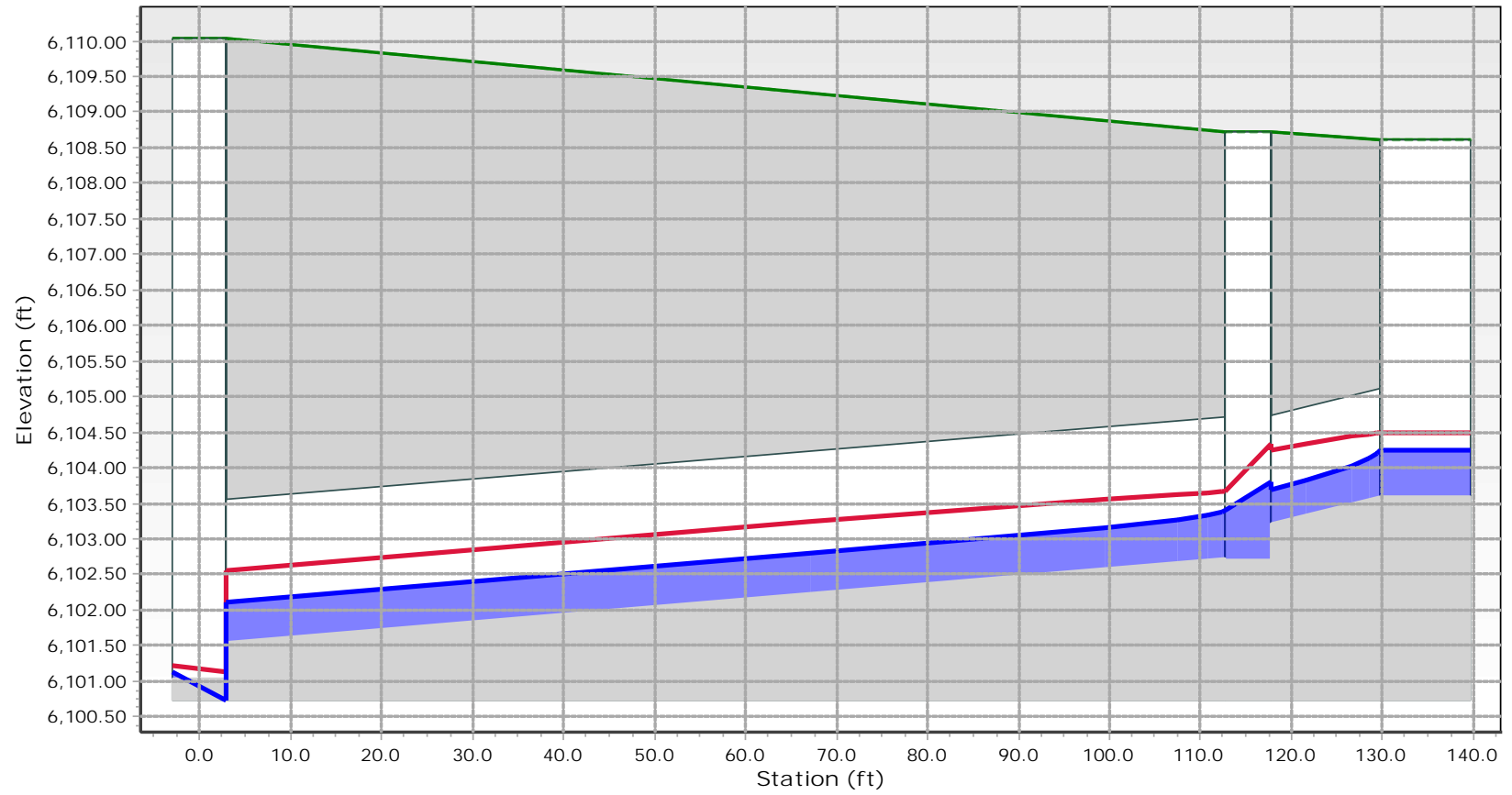
DP45 - 2-Year



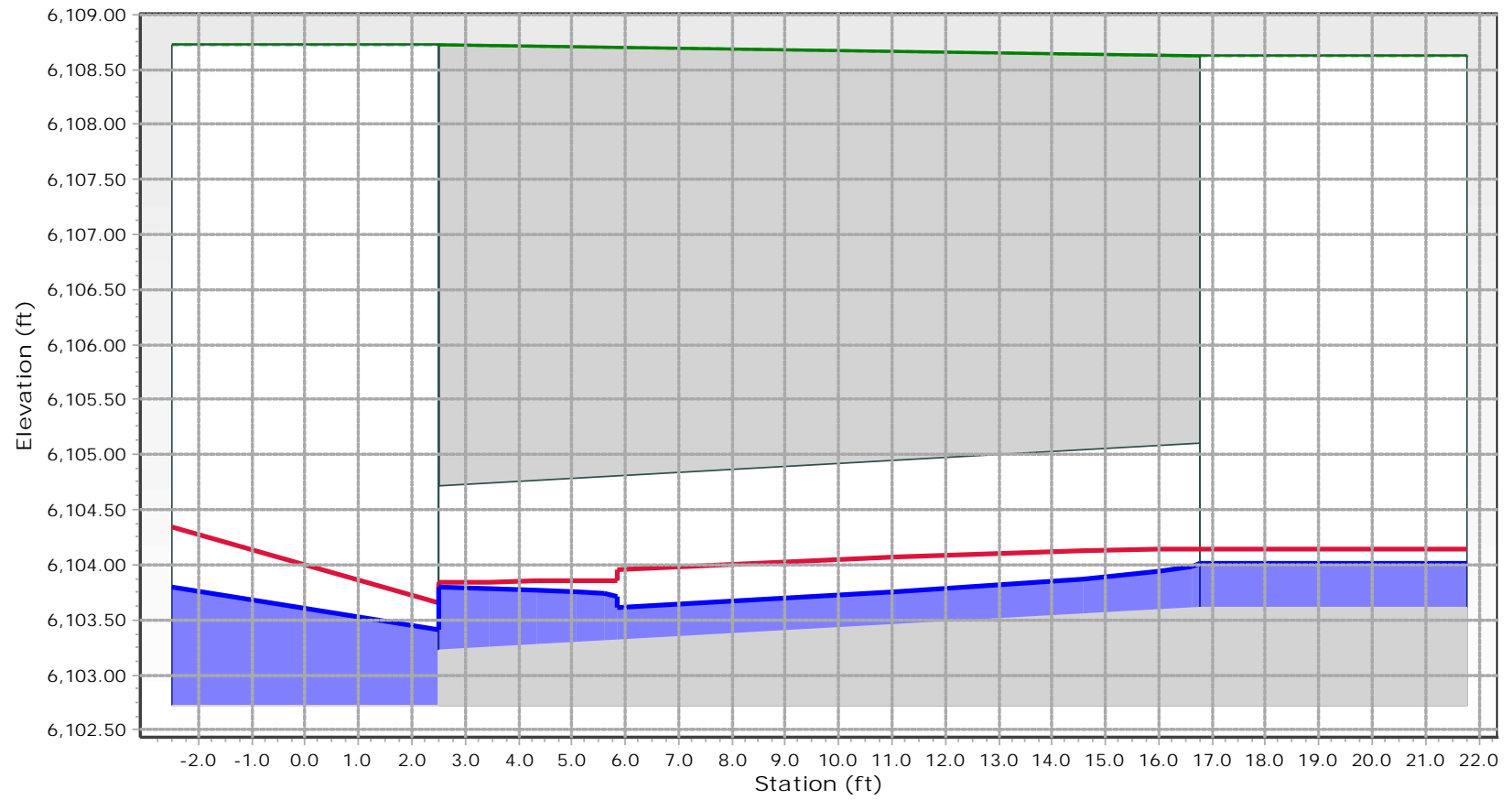
DP46 - 2-Year



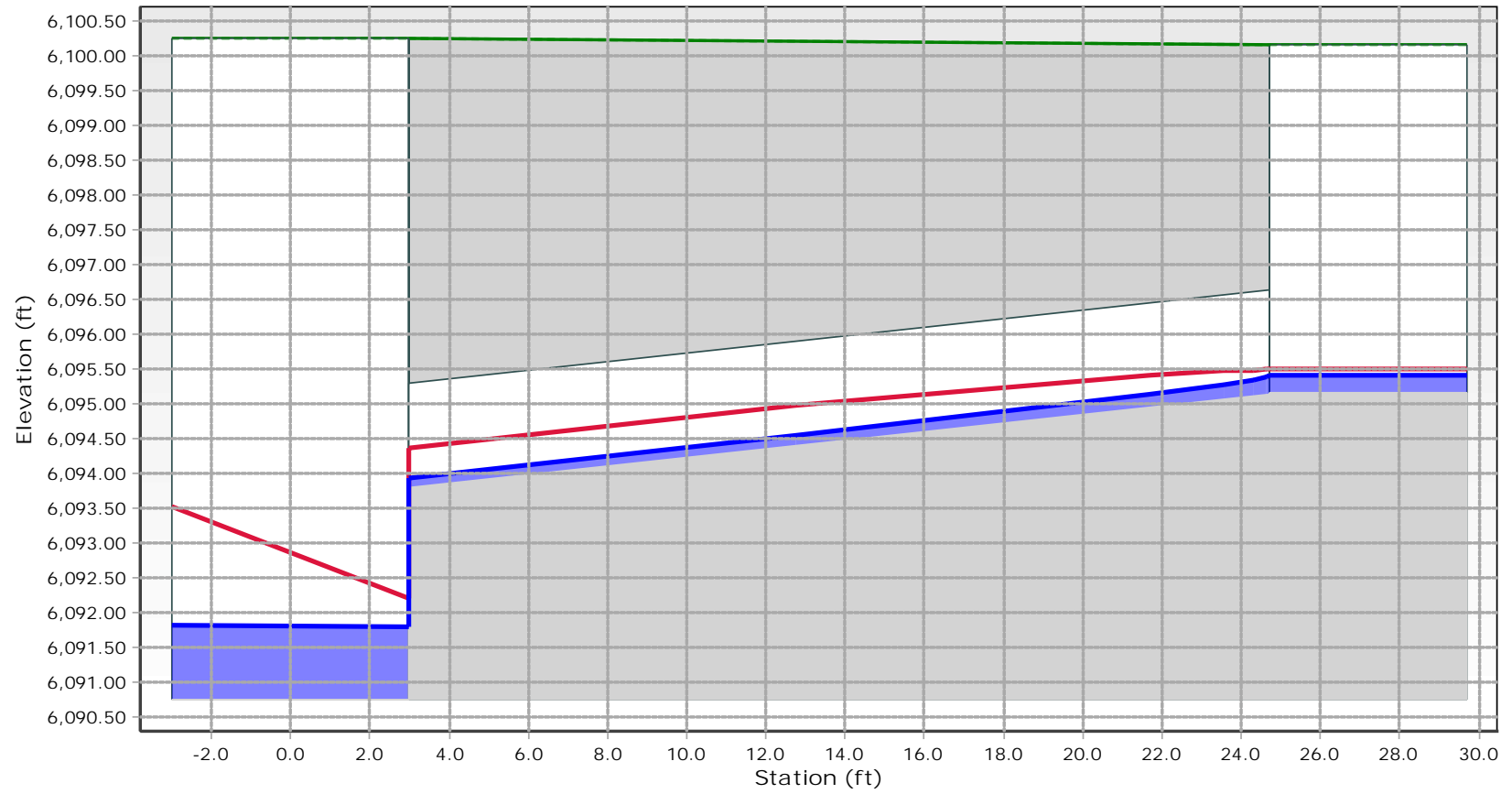
DP47 - 2-Year



DP48 - 2-Year

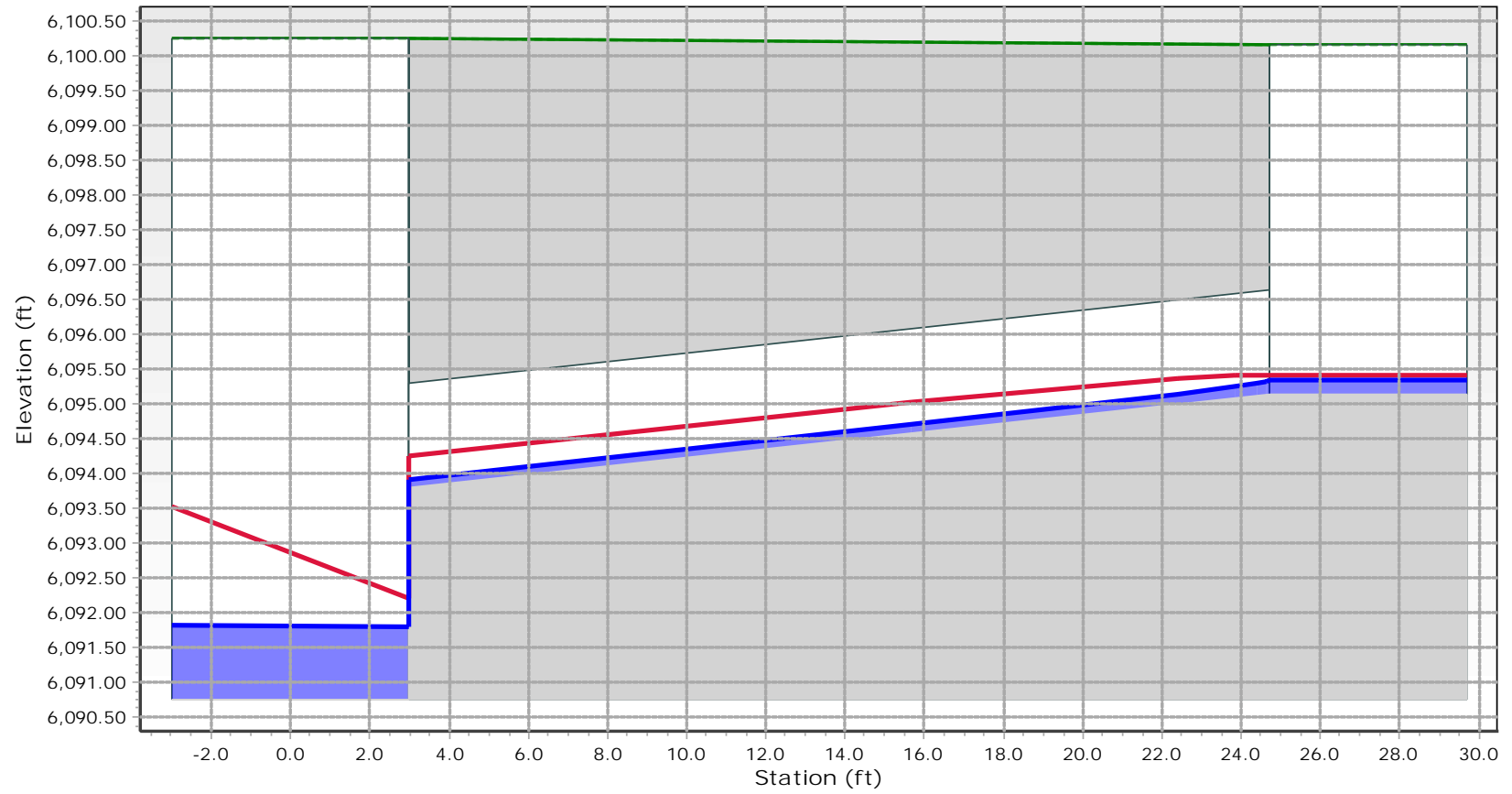


DP49 - 2-Year

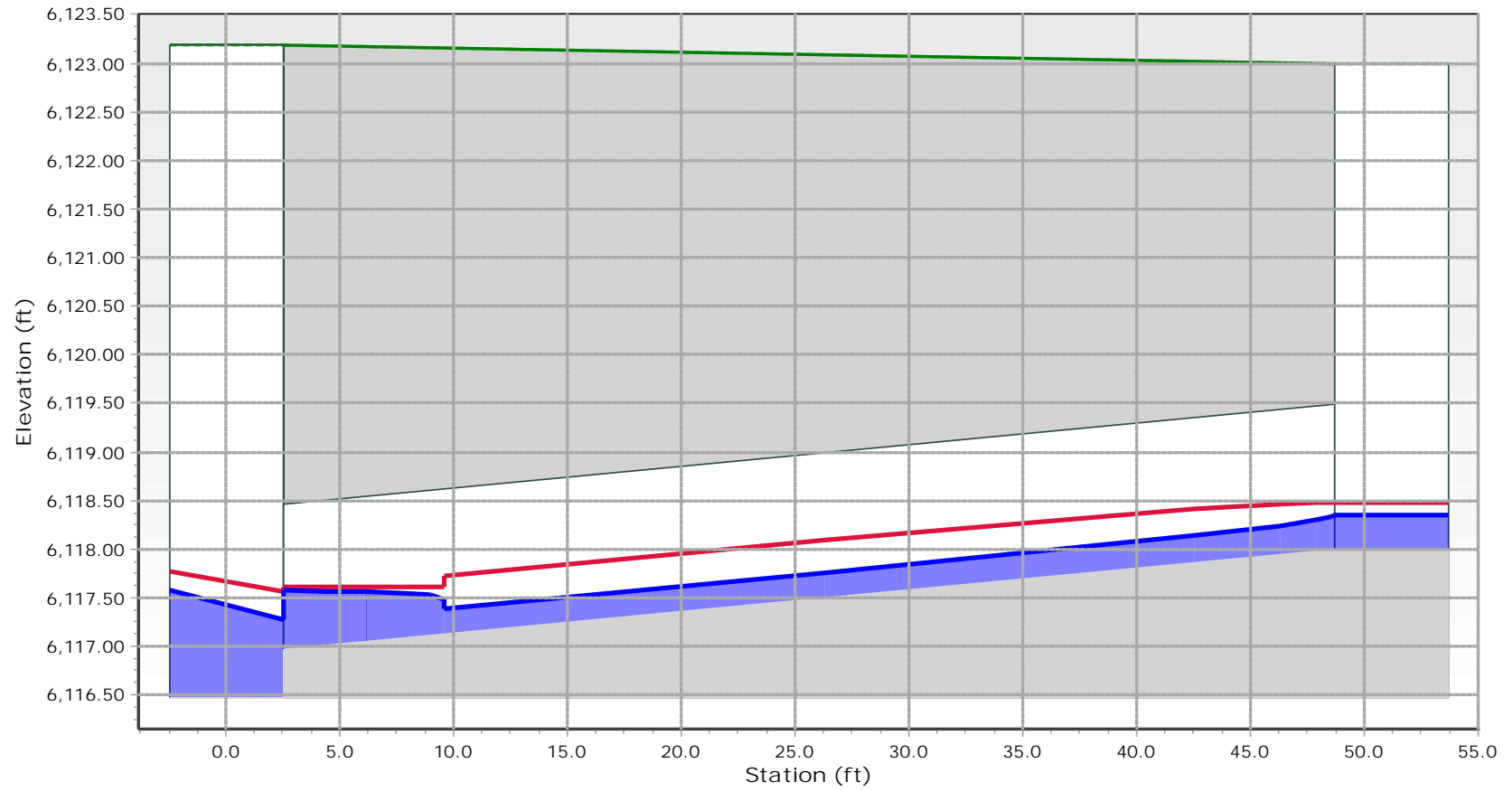




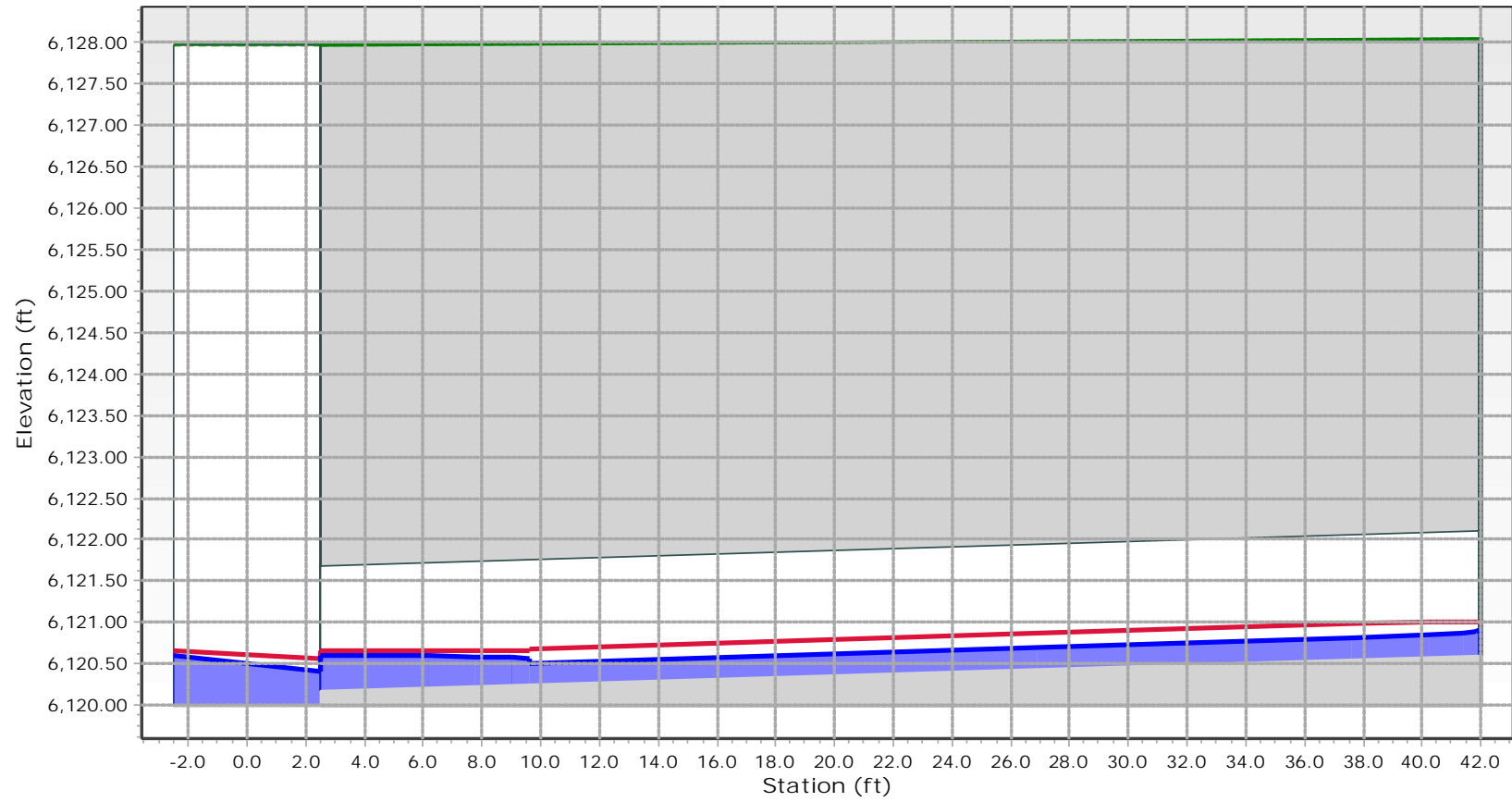
DP50 - 2-Year



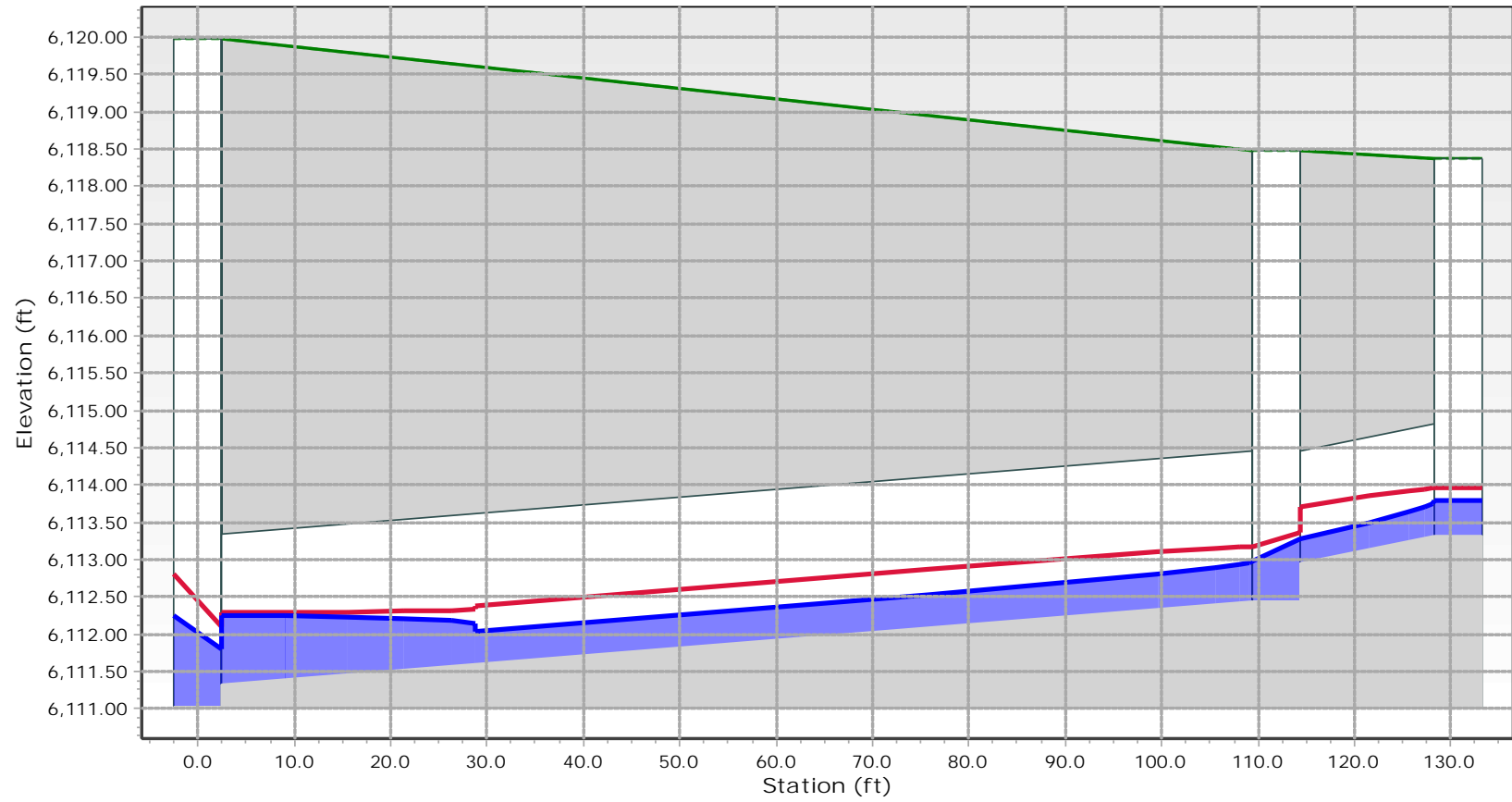
DP51 - 2-Year



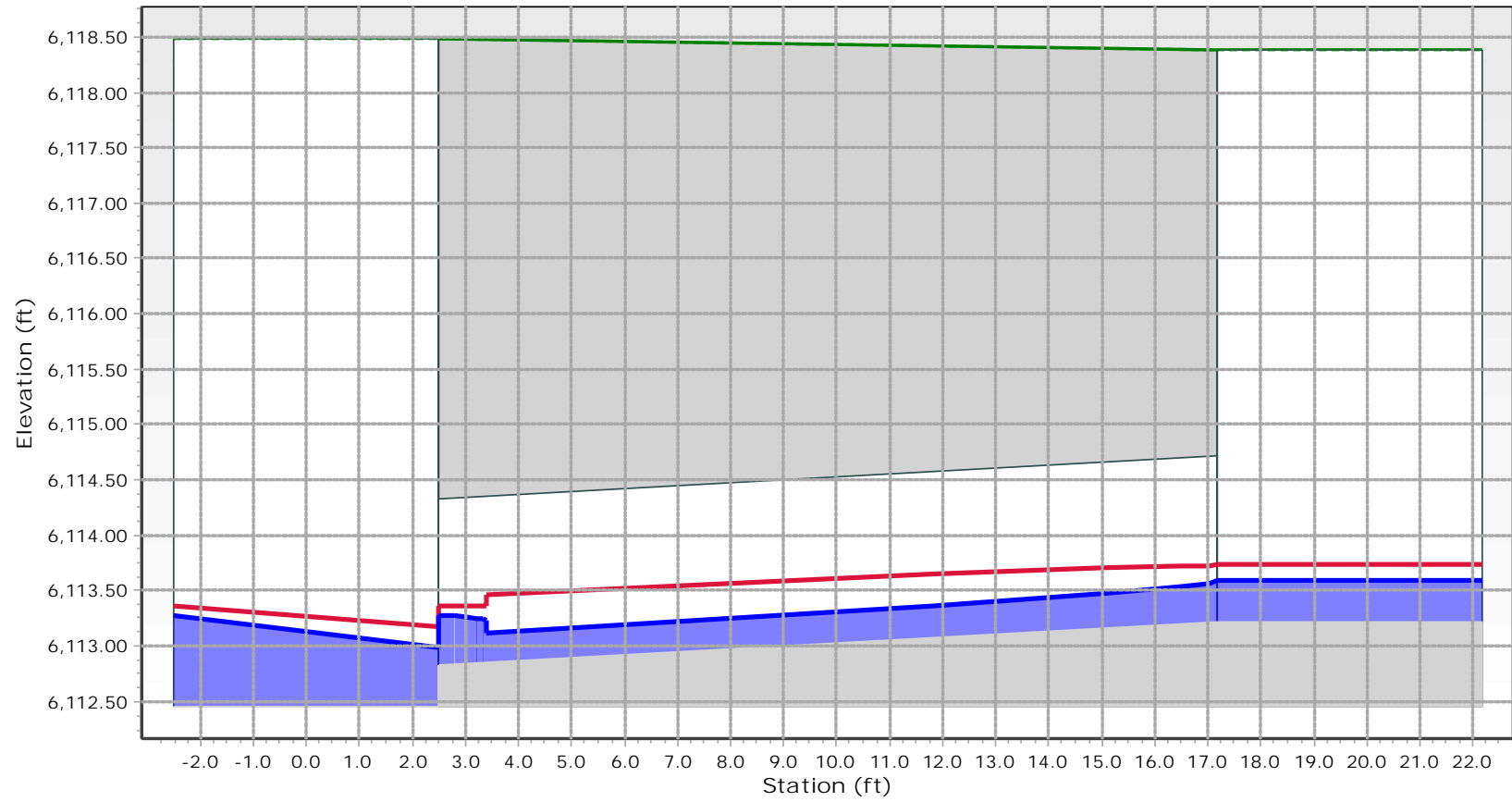
DP52 - 2-Year



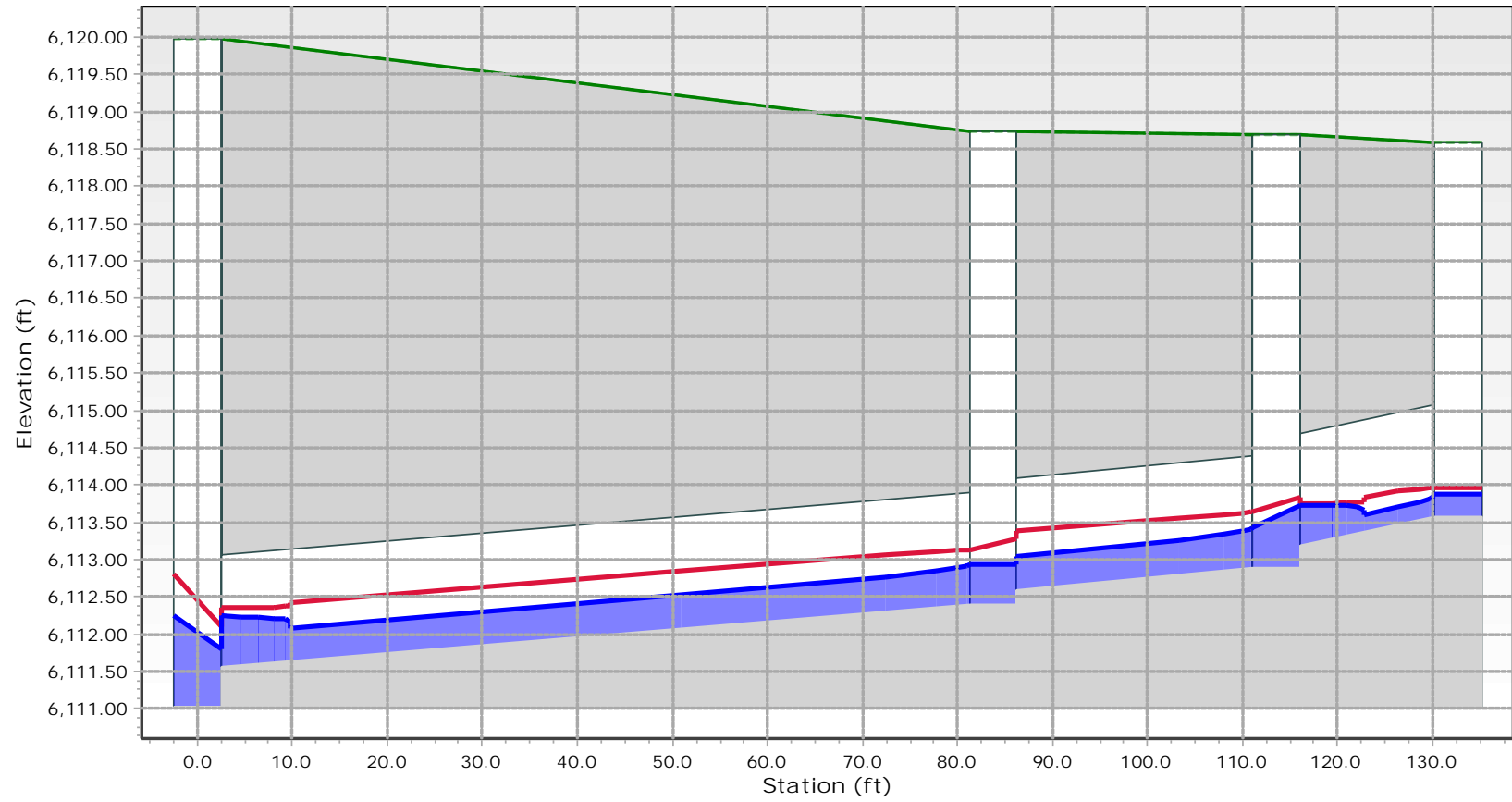
DP53 - 2-Year



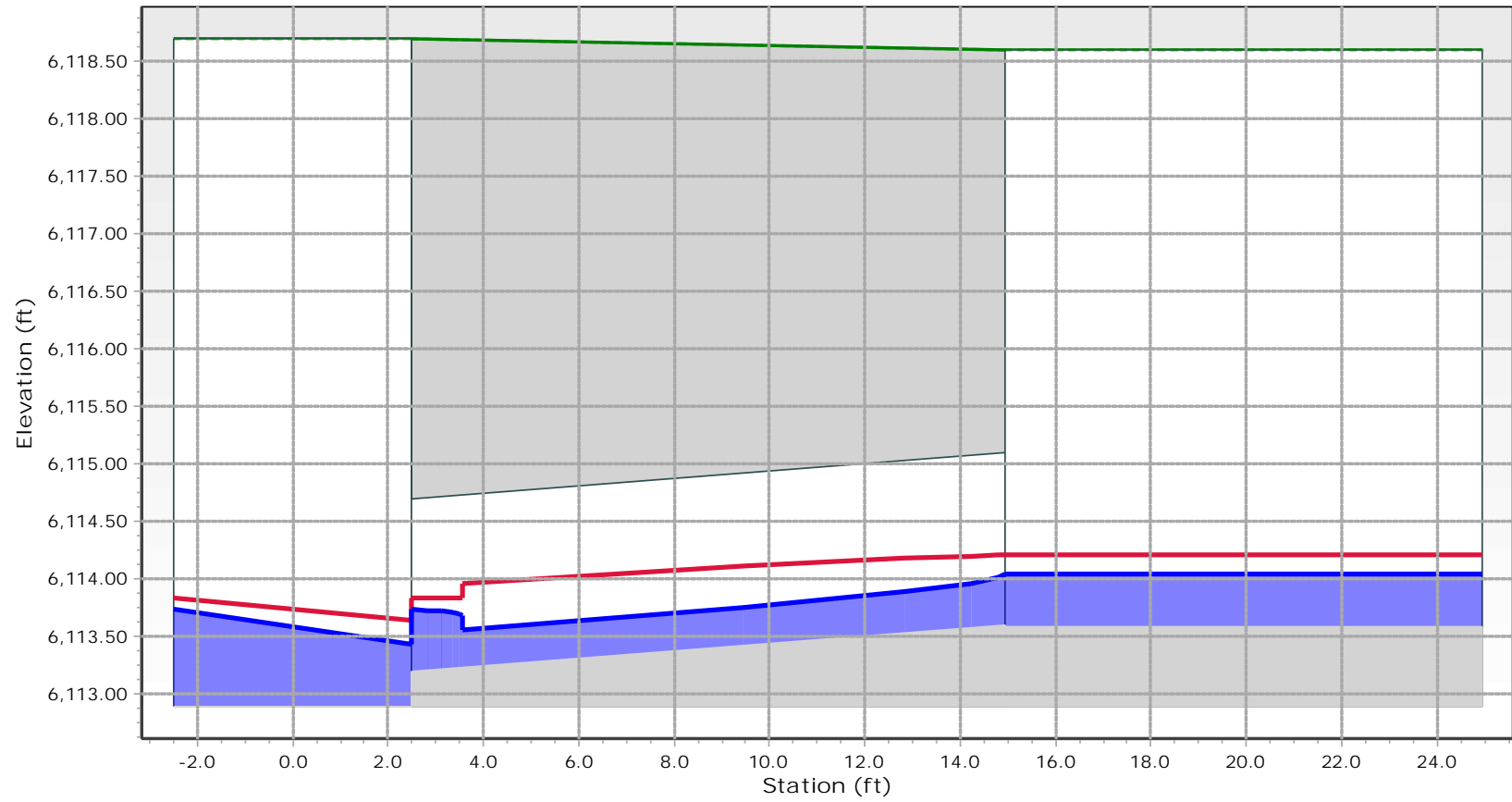
DP54 - 2-Year



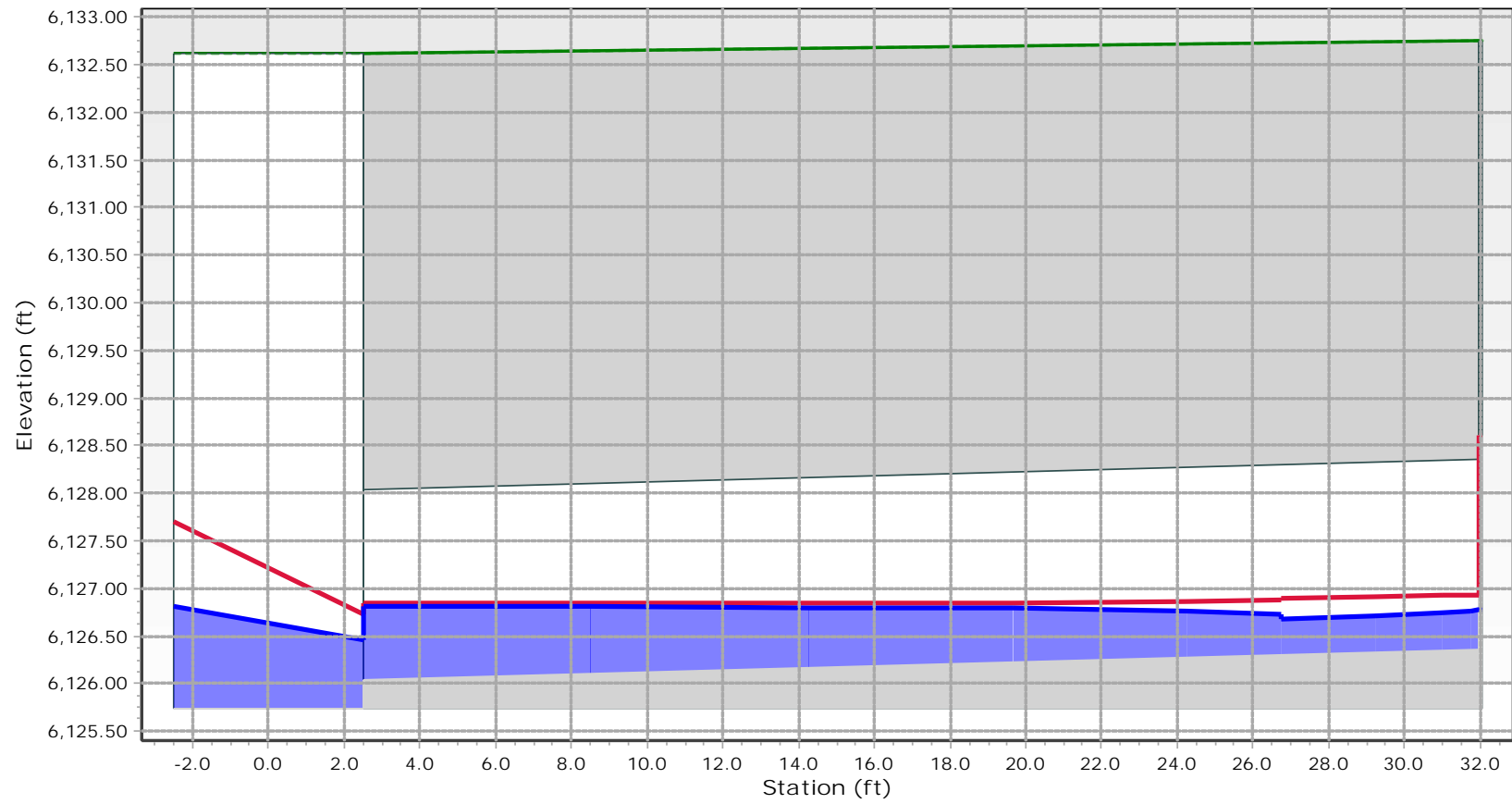
DP55 - 2-Year



DP56 - 2-Year

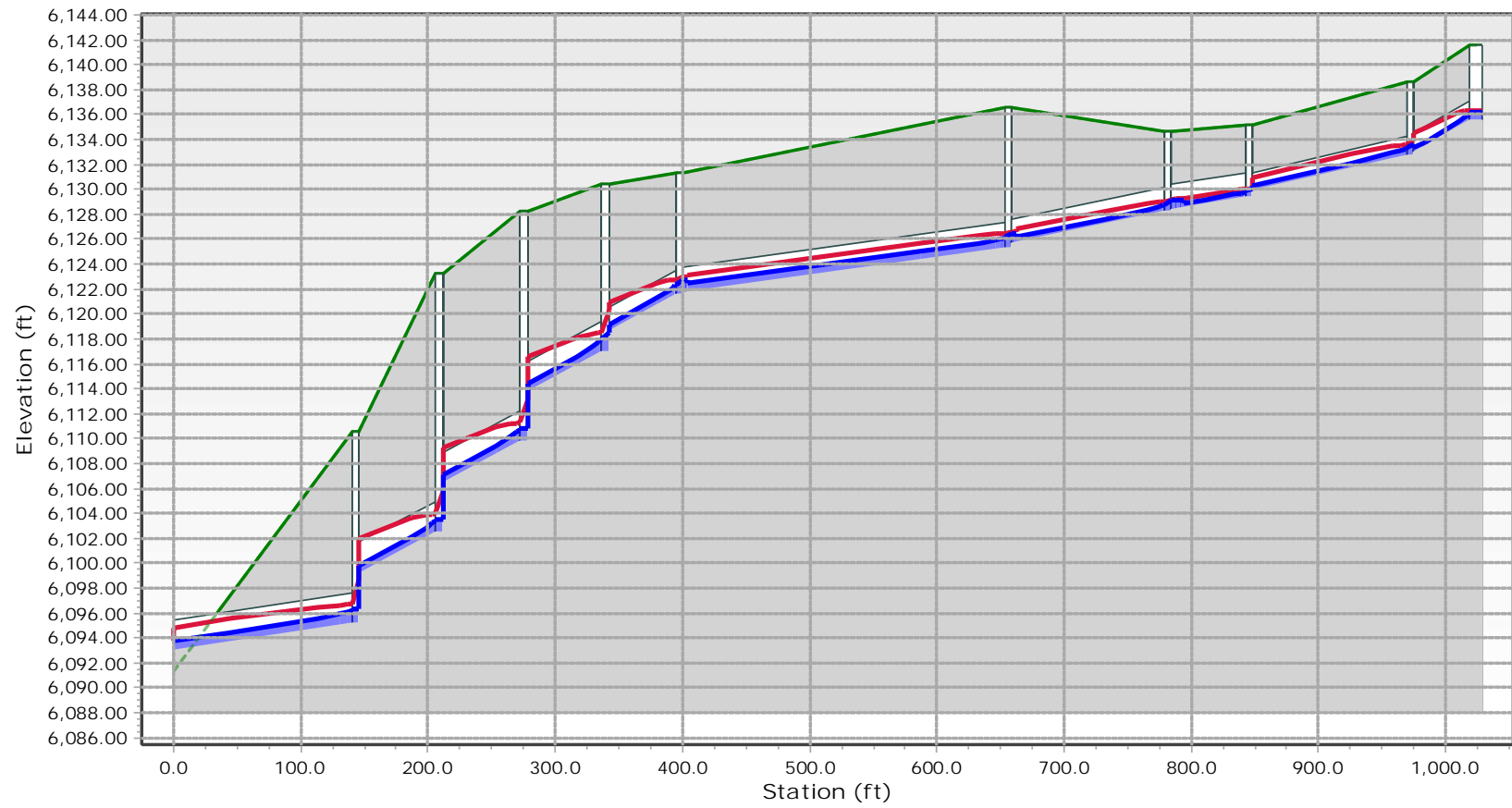


DP57 - 2-Year

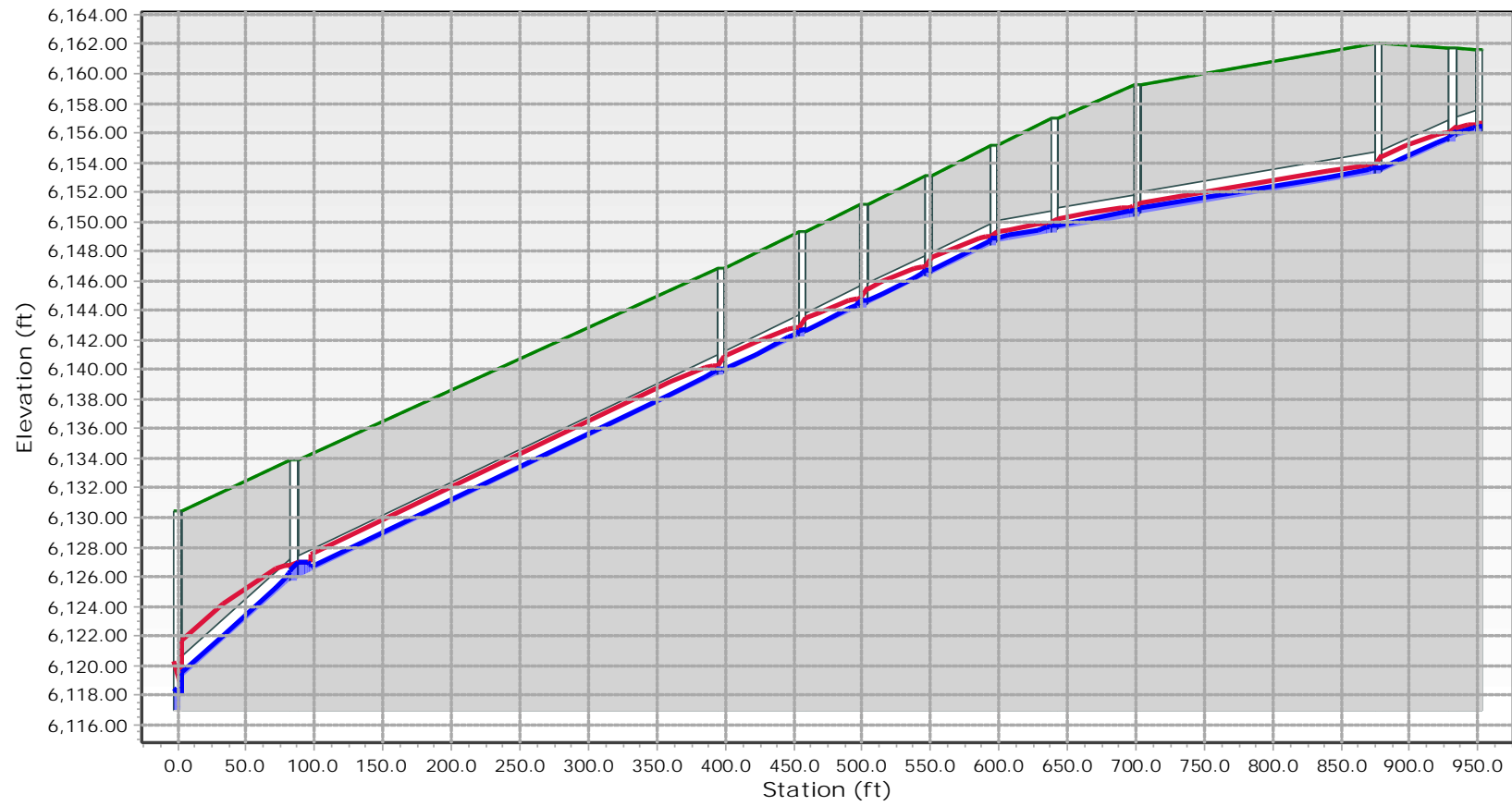




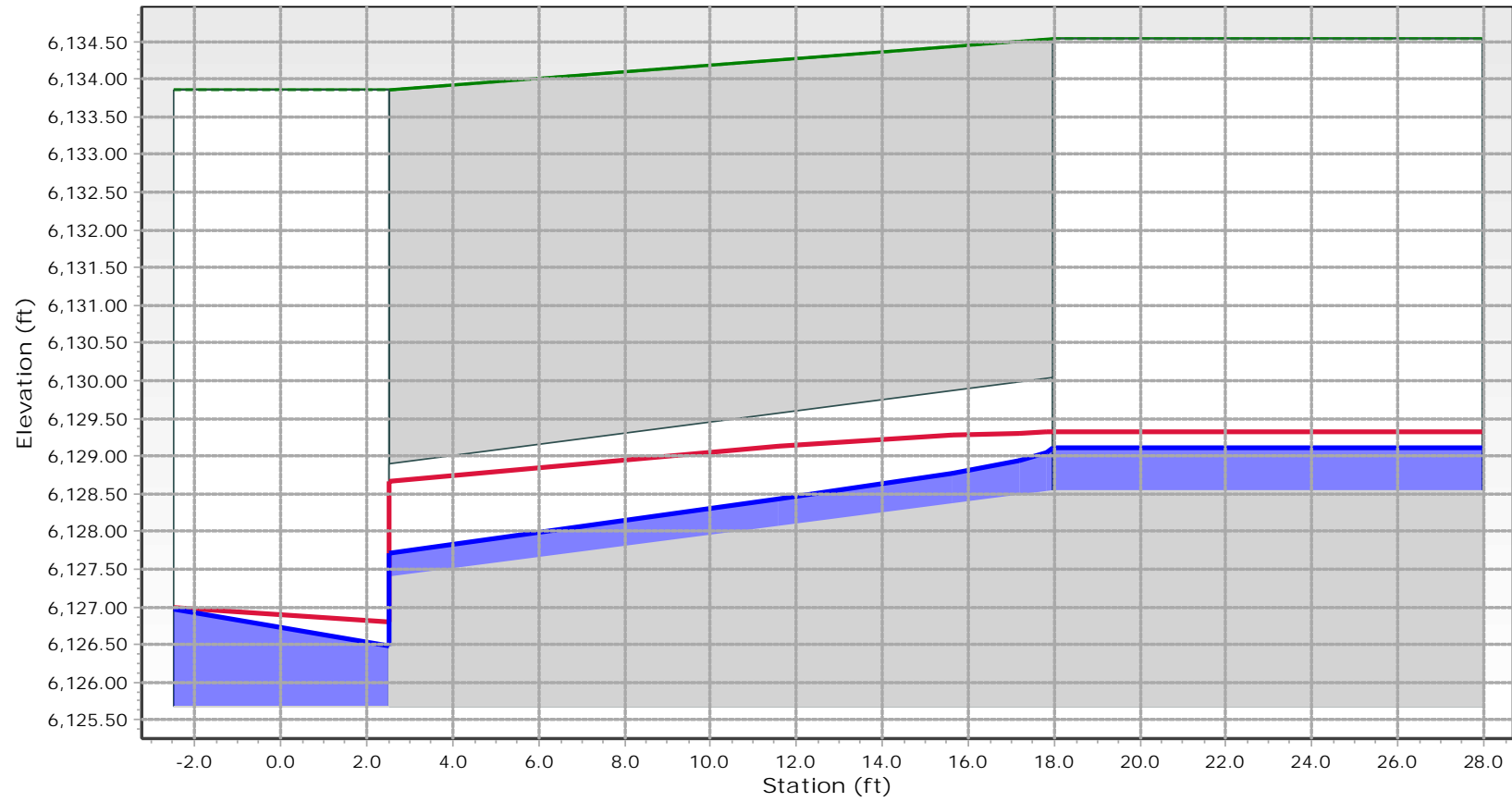
DP58 - 2-Year



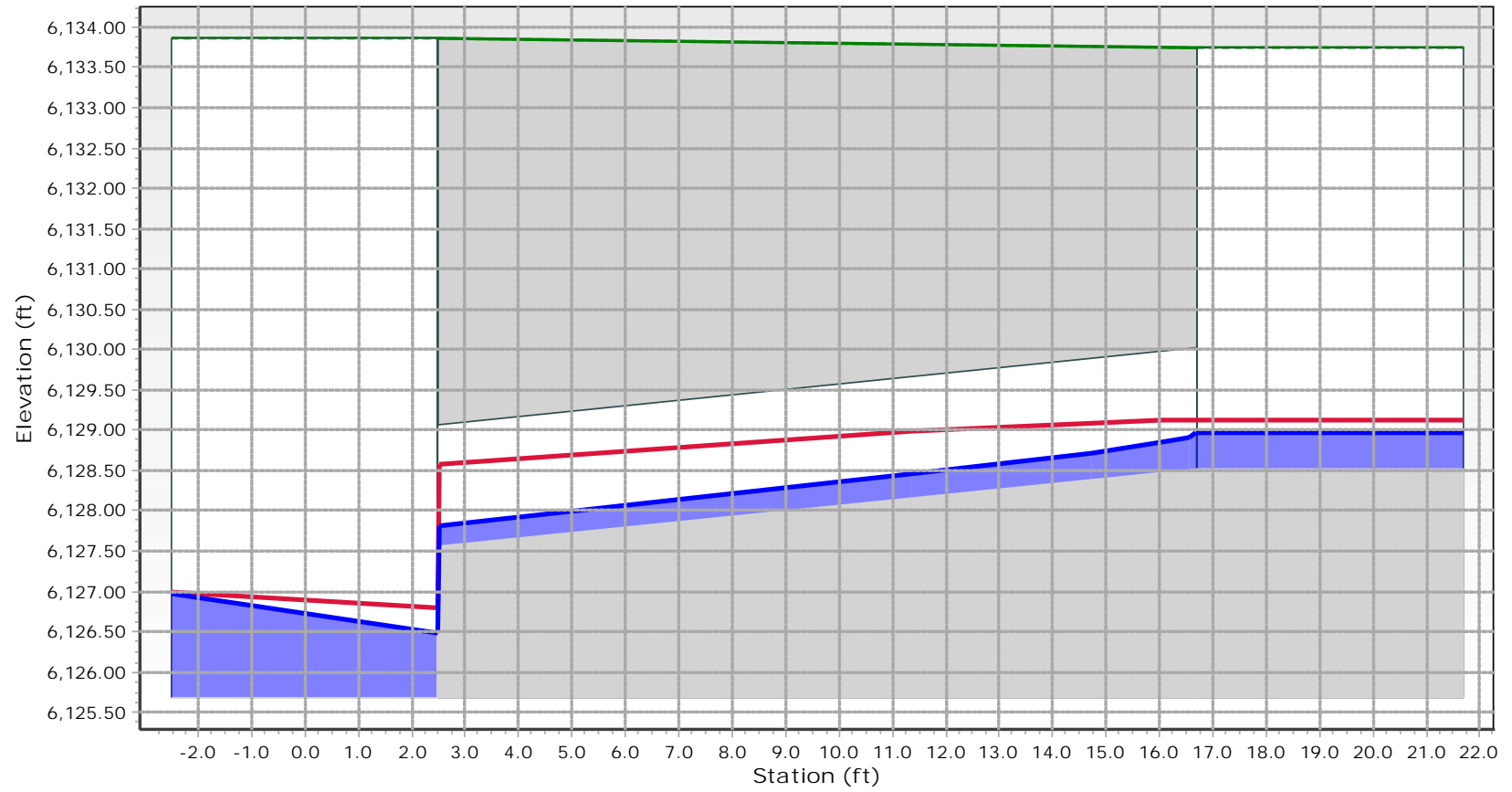
DP59 - 2-Year



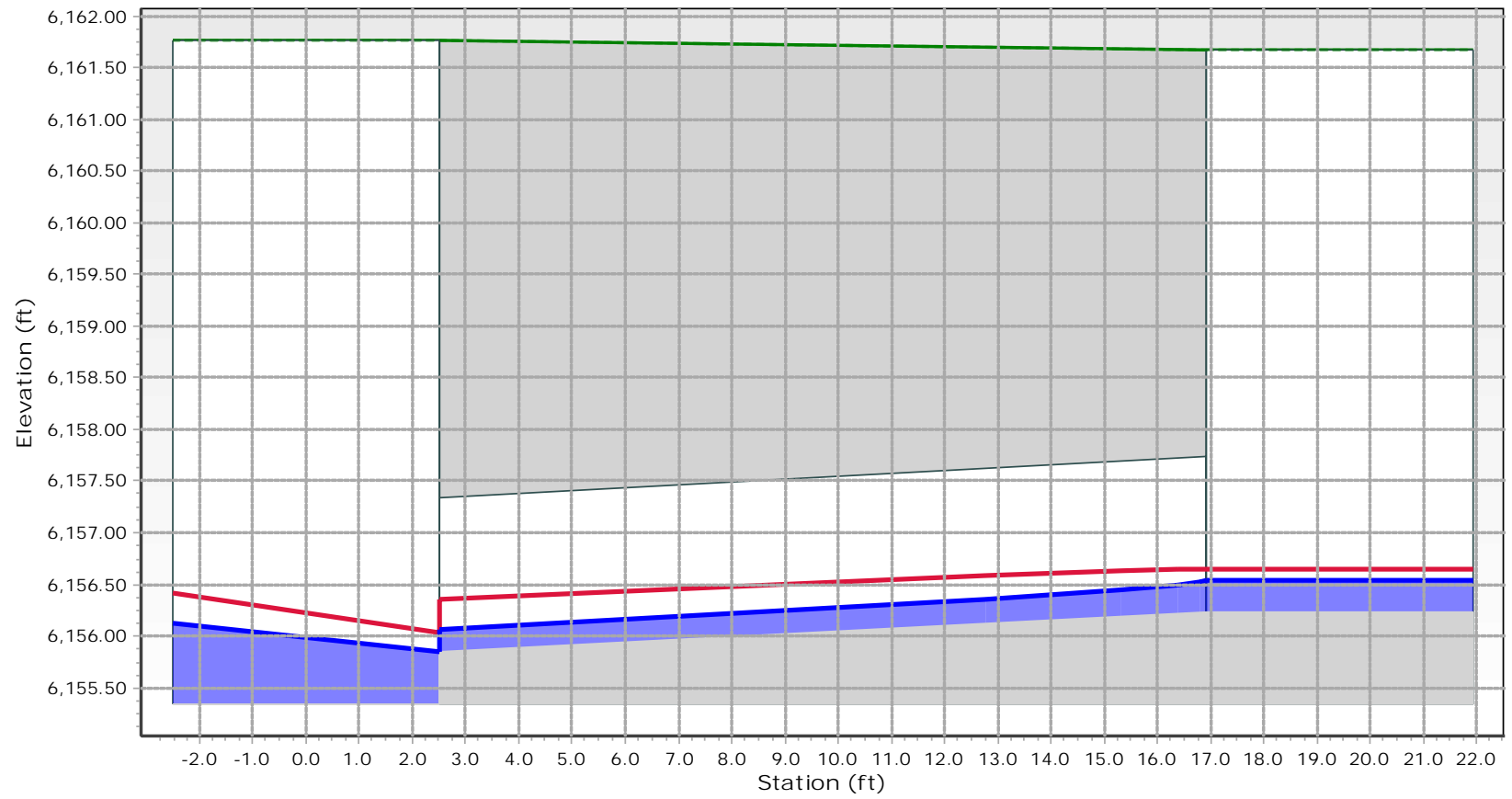
DP60 - 2-Year



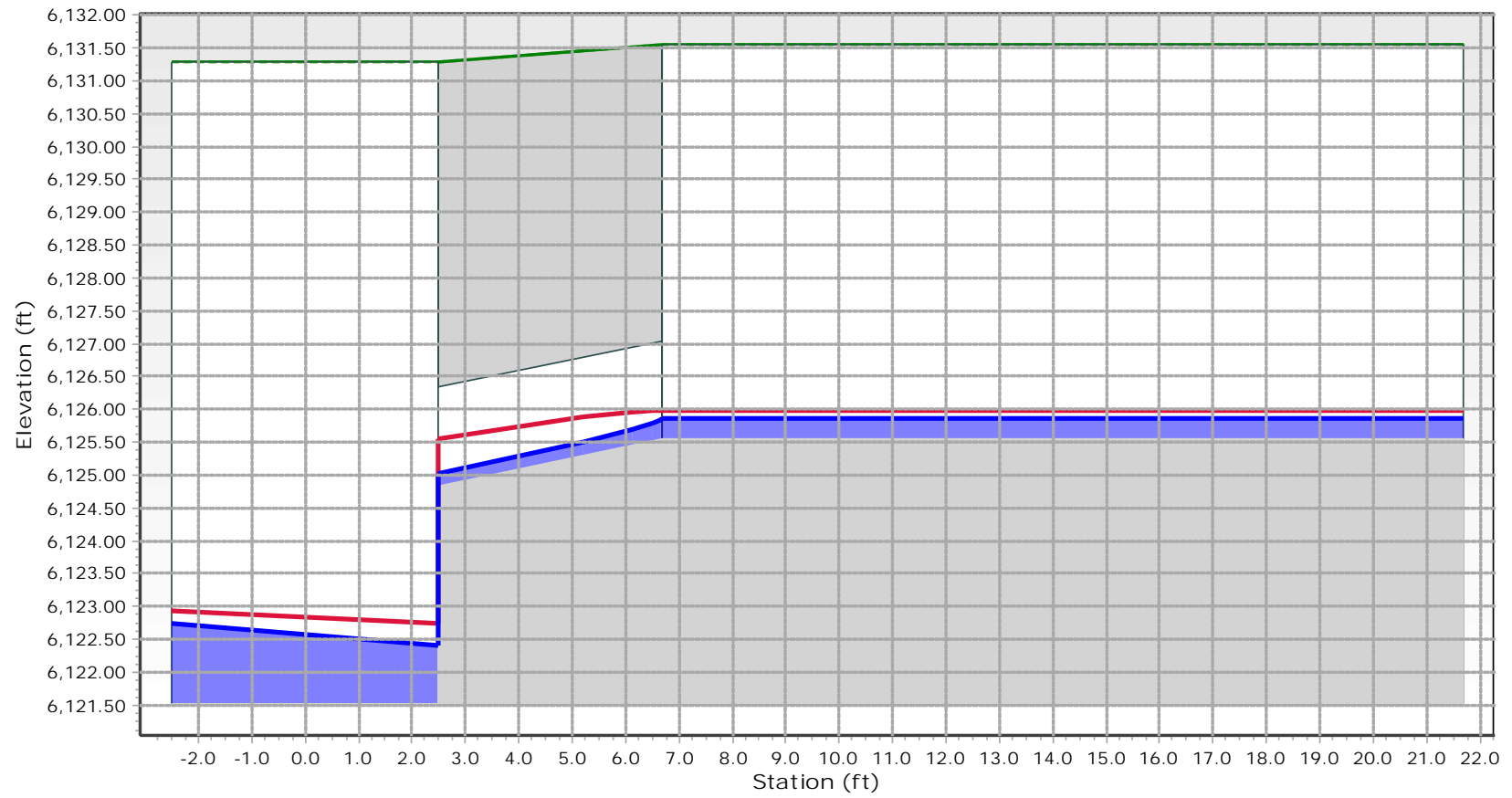
DP61 - 2-Year



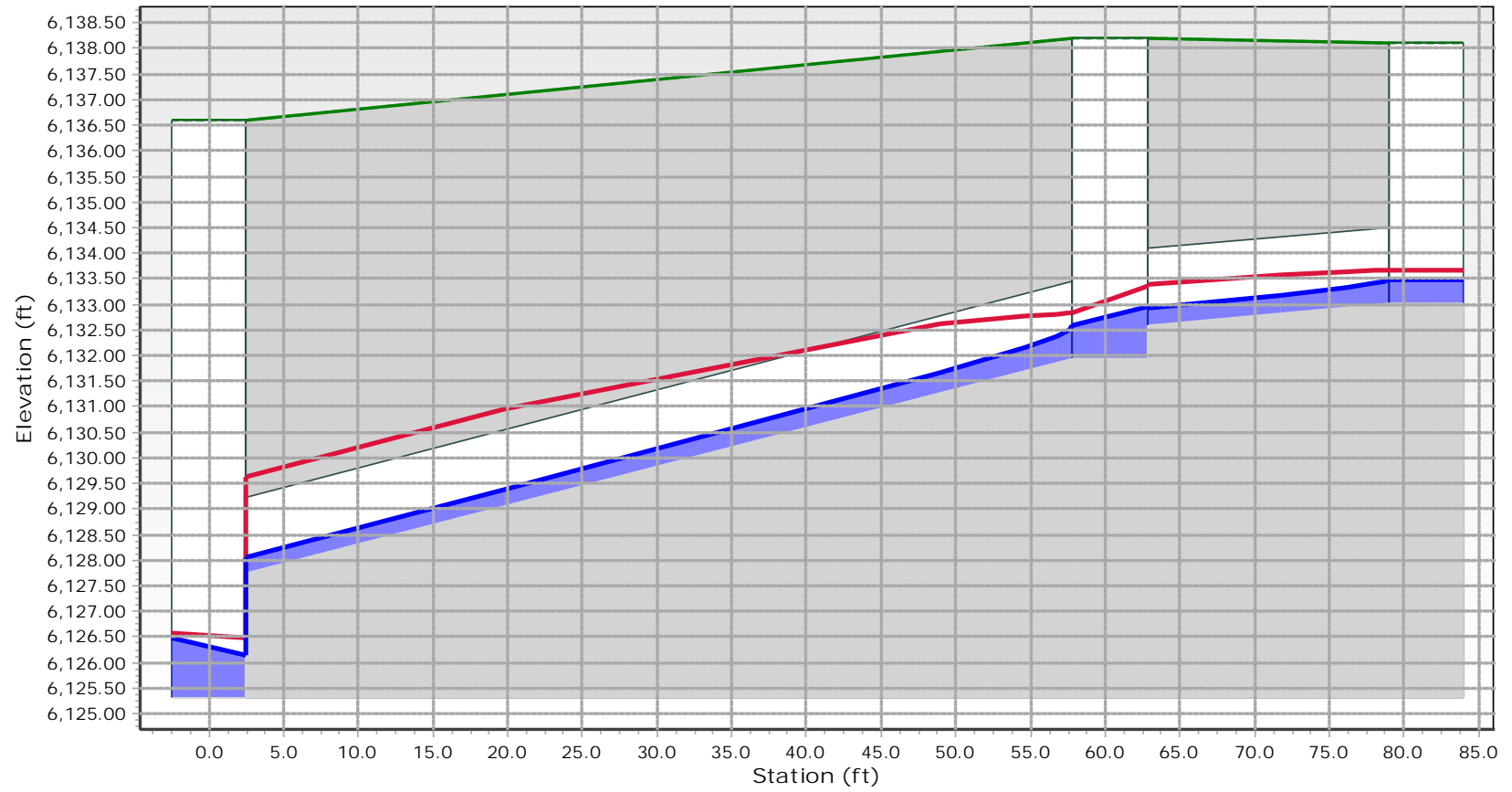
DP62 - 2-Year



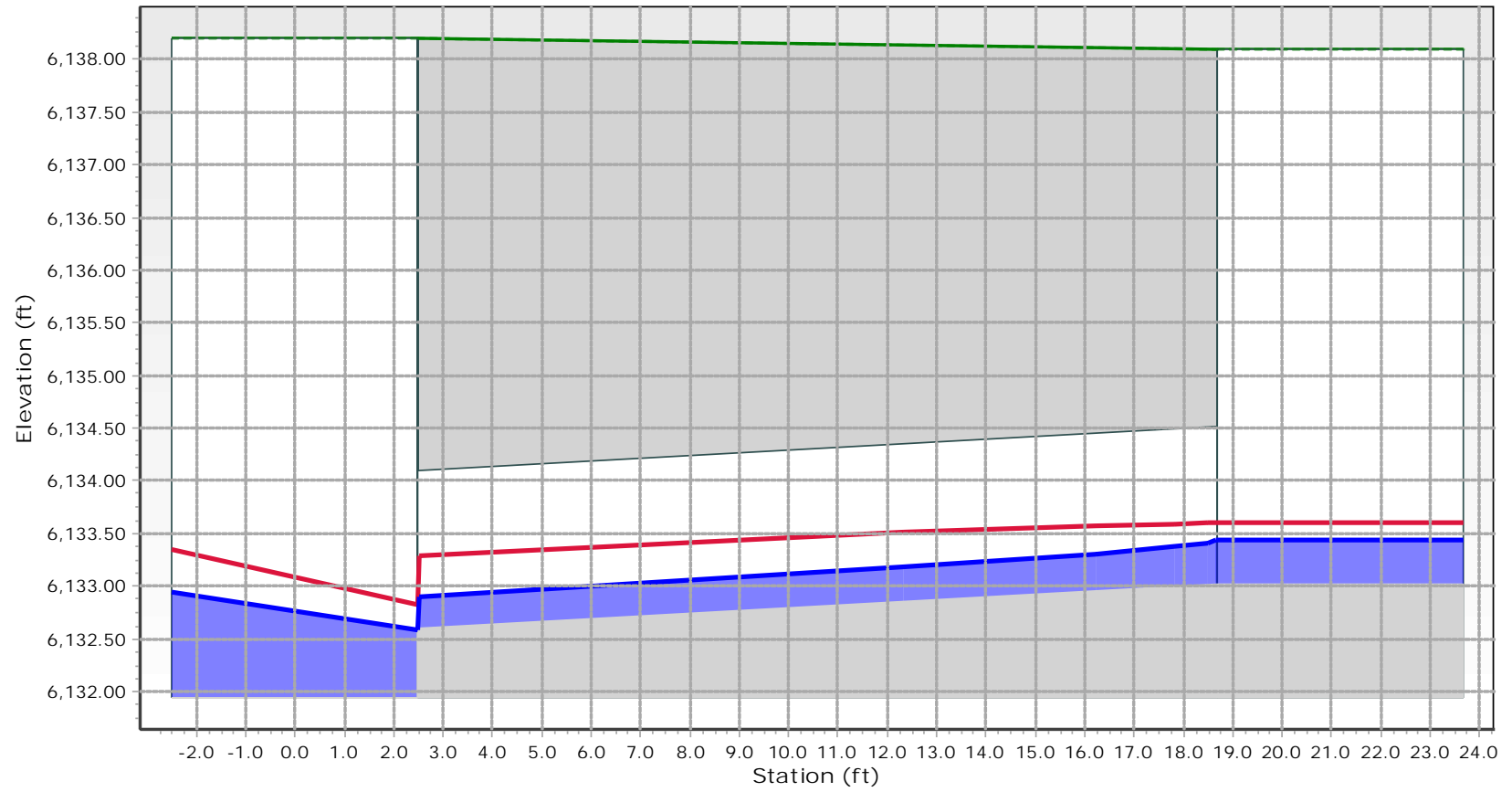
DP63 - 2-Year



DP64 - 2-Year

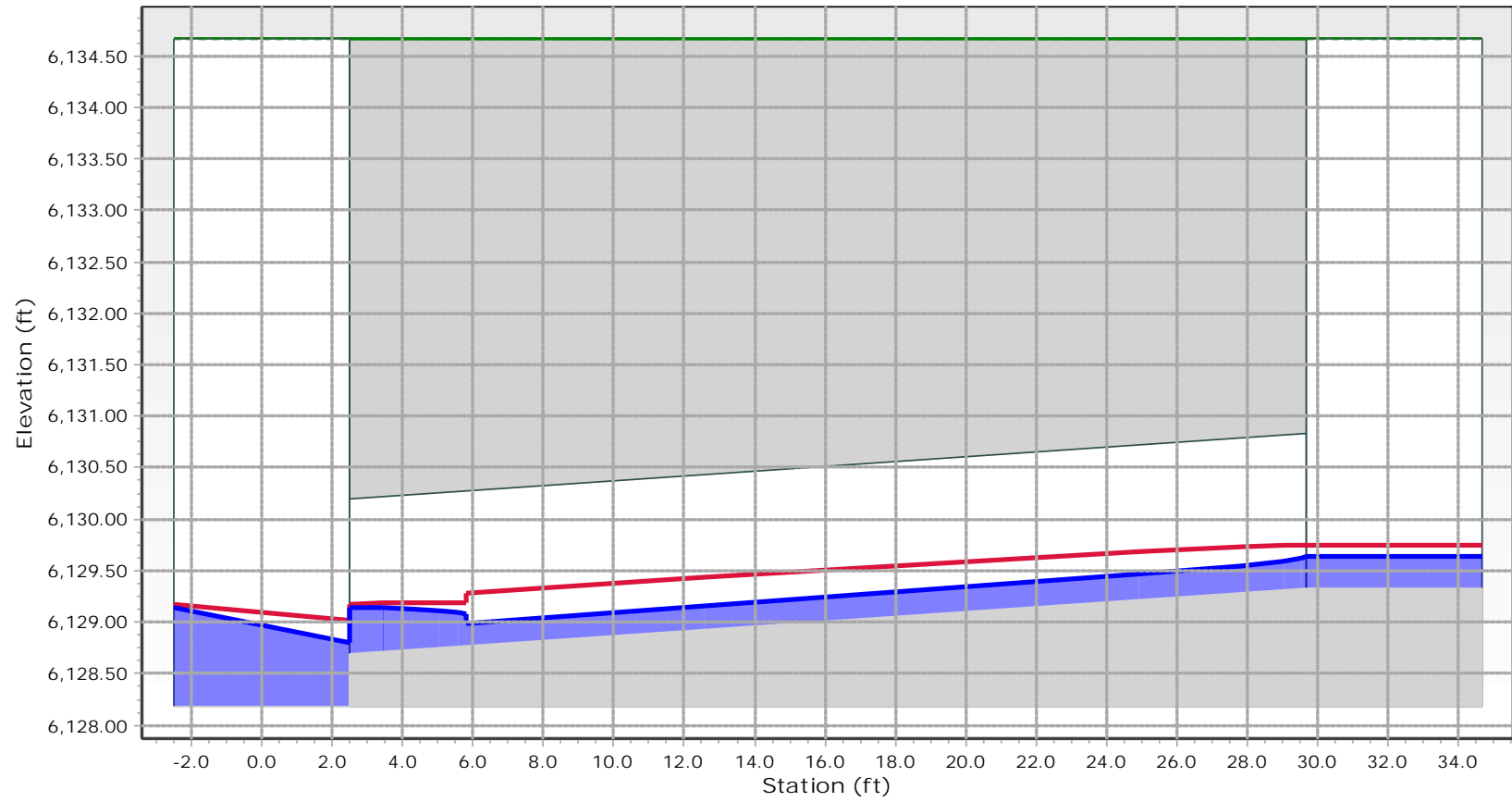


DP65 - 2-Year

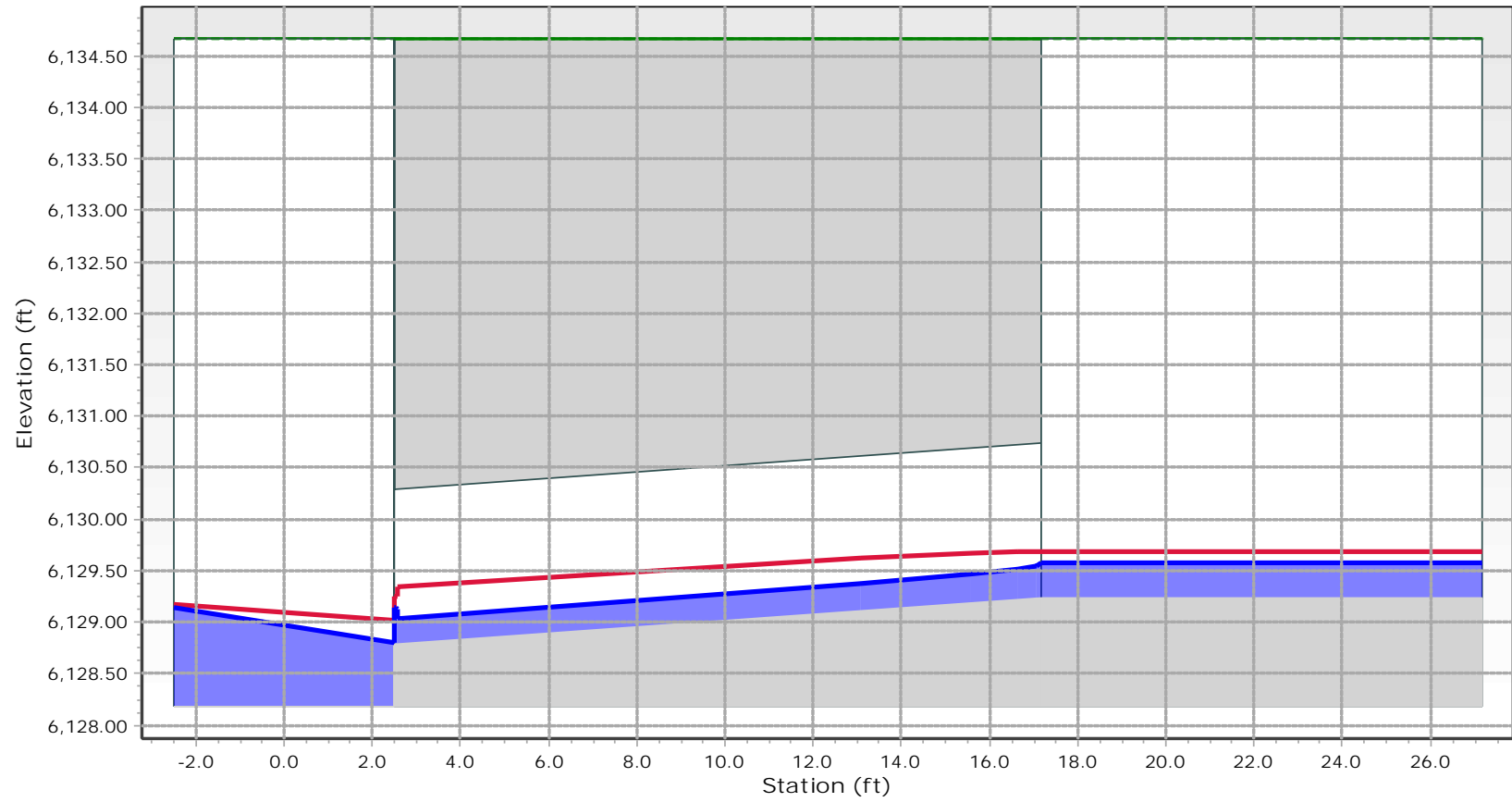




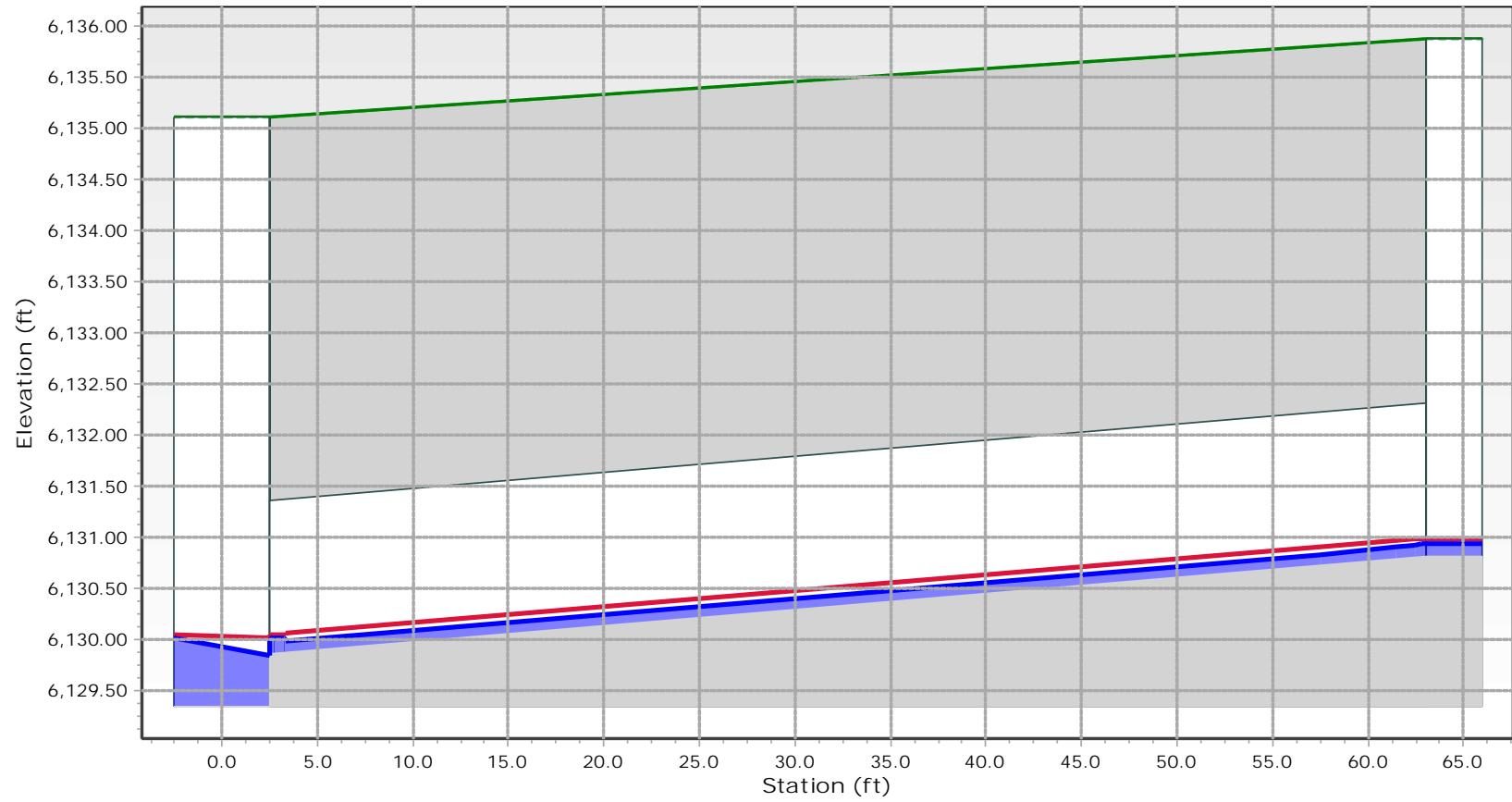
DP66 - 2-Year



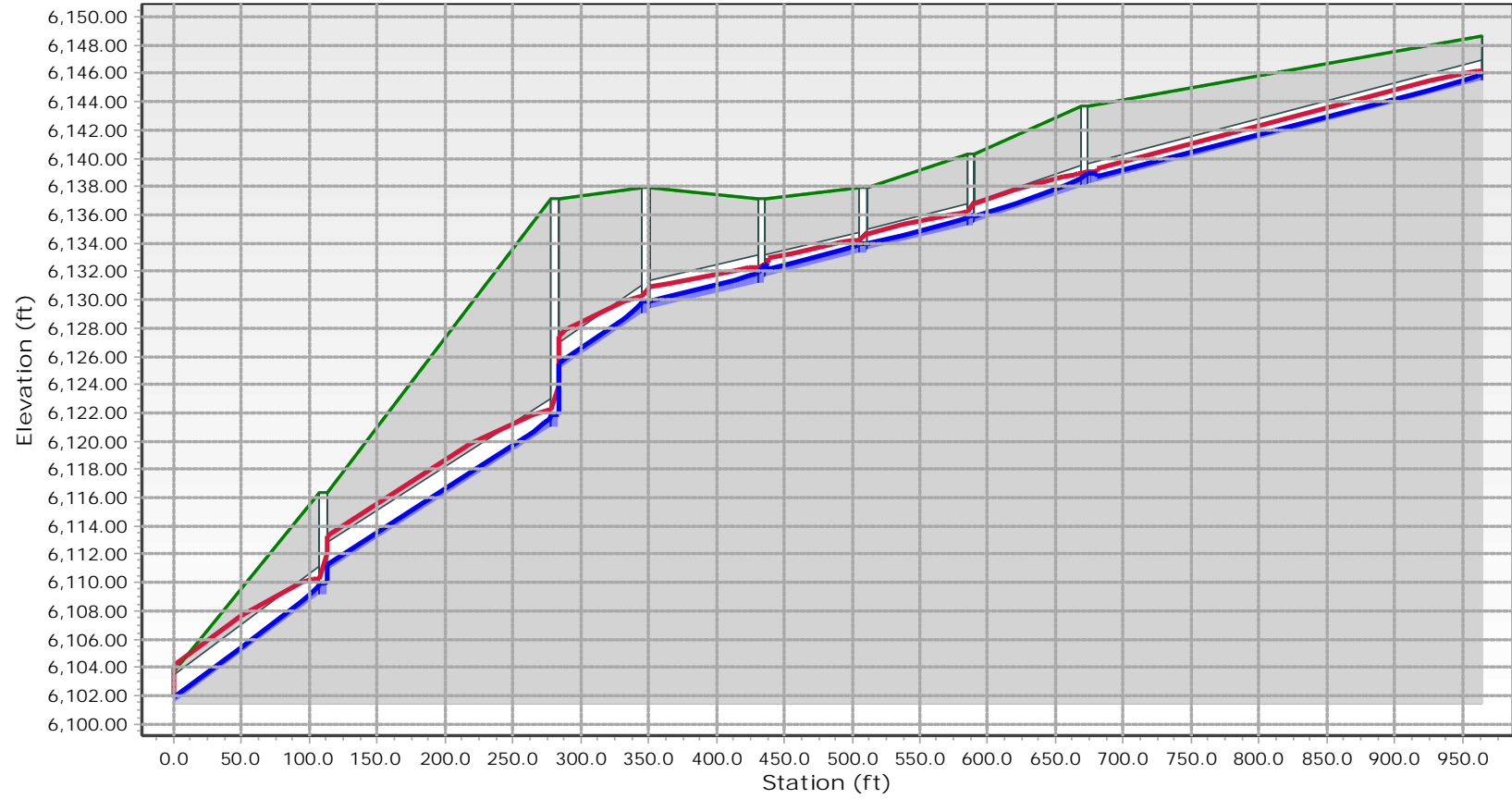
DP67 - 2-Year



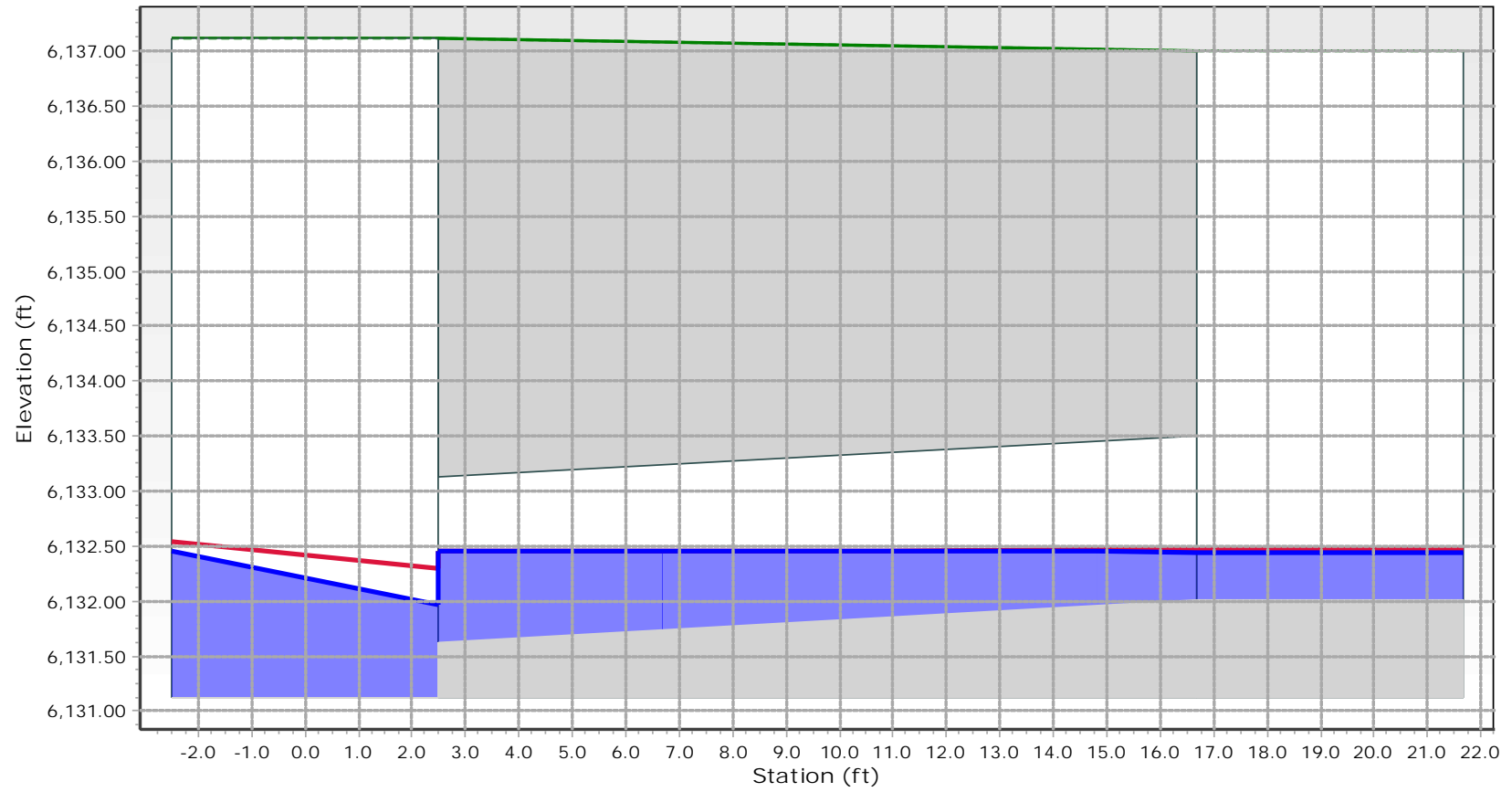
DP68 - 2-Year



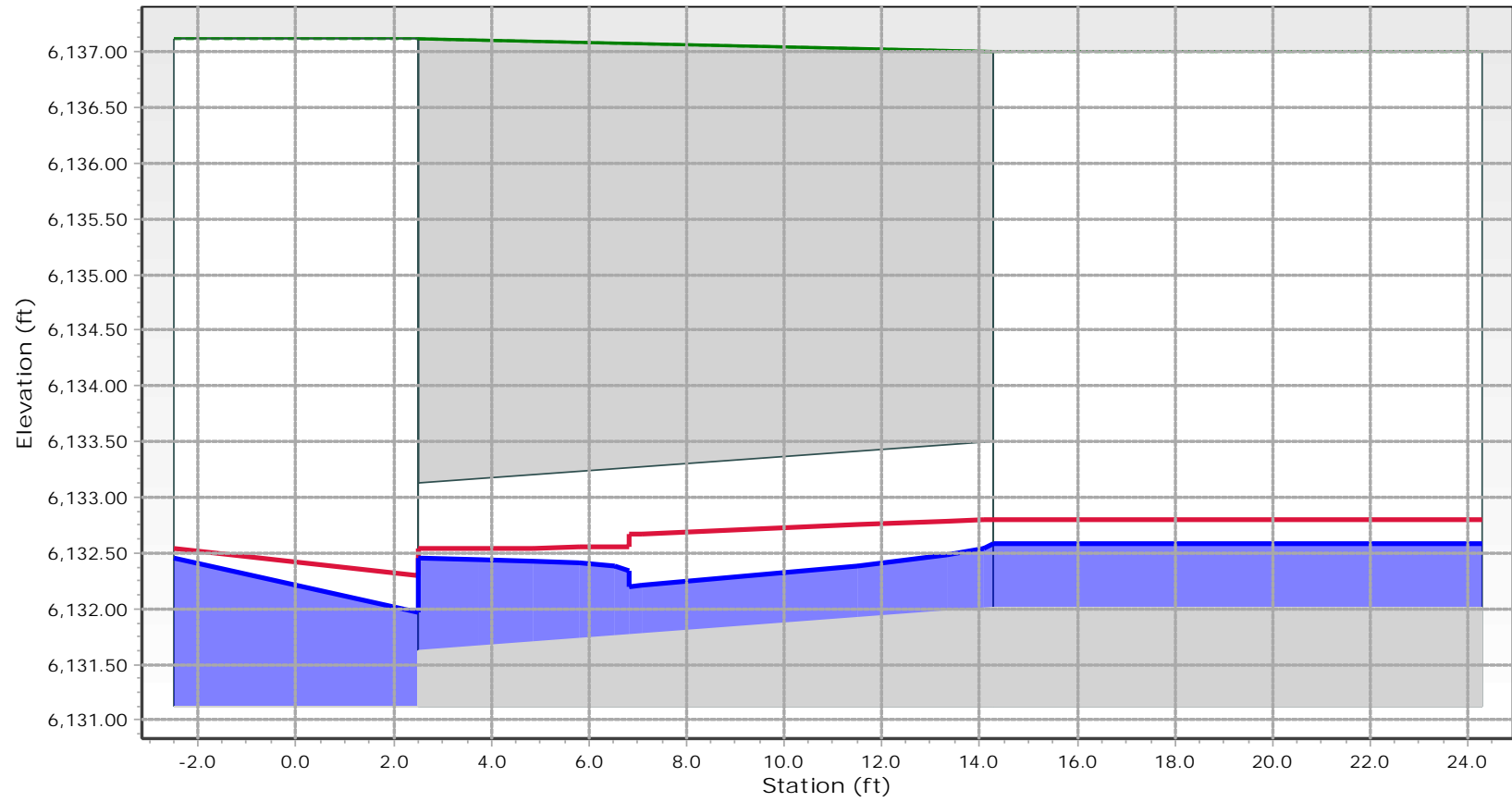
DP69 - 2-Year



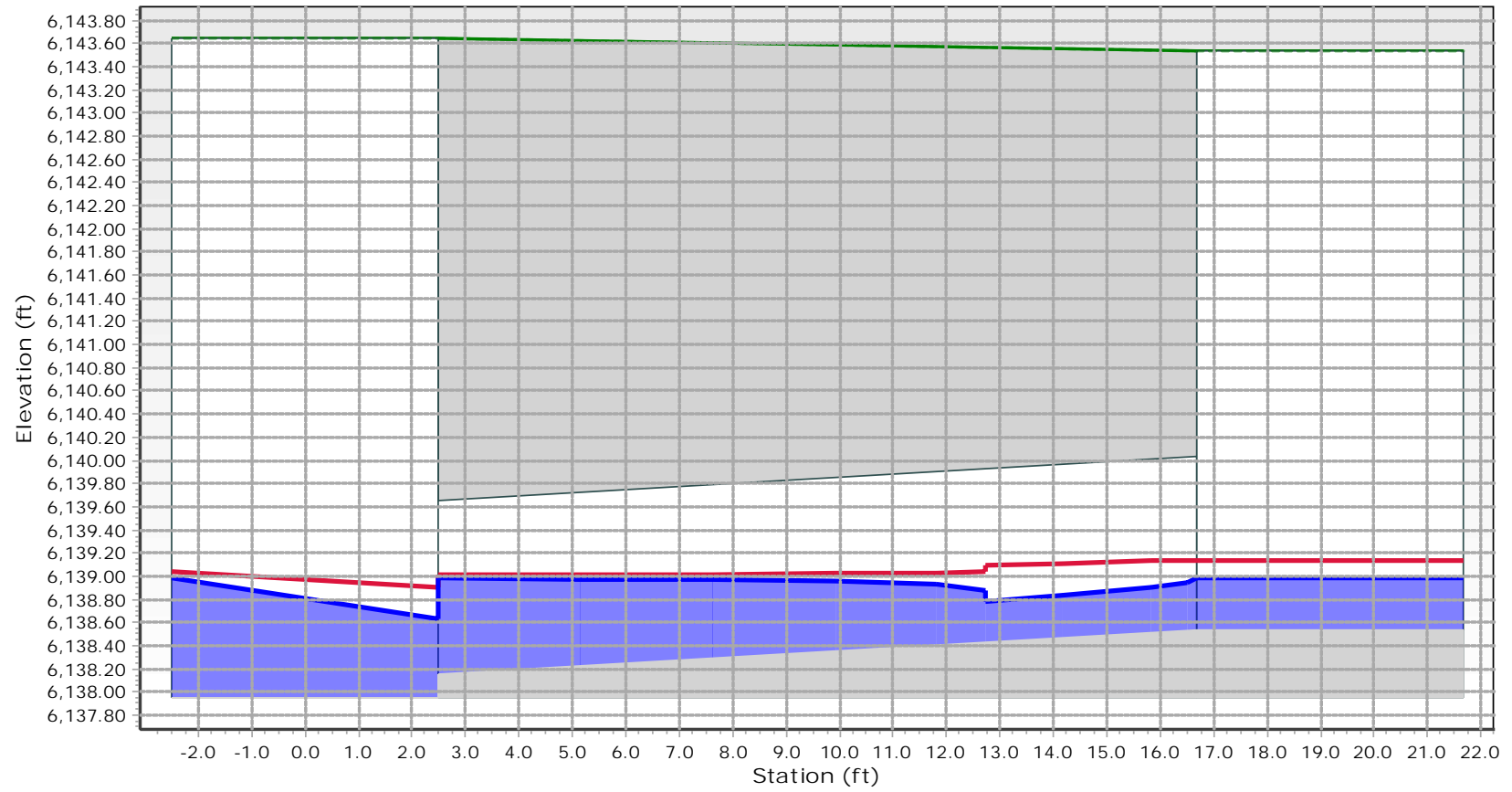
DP70 - 2-Year



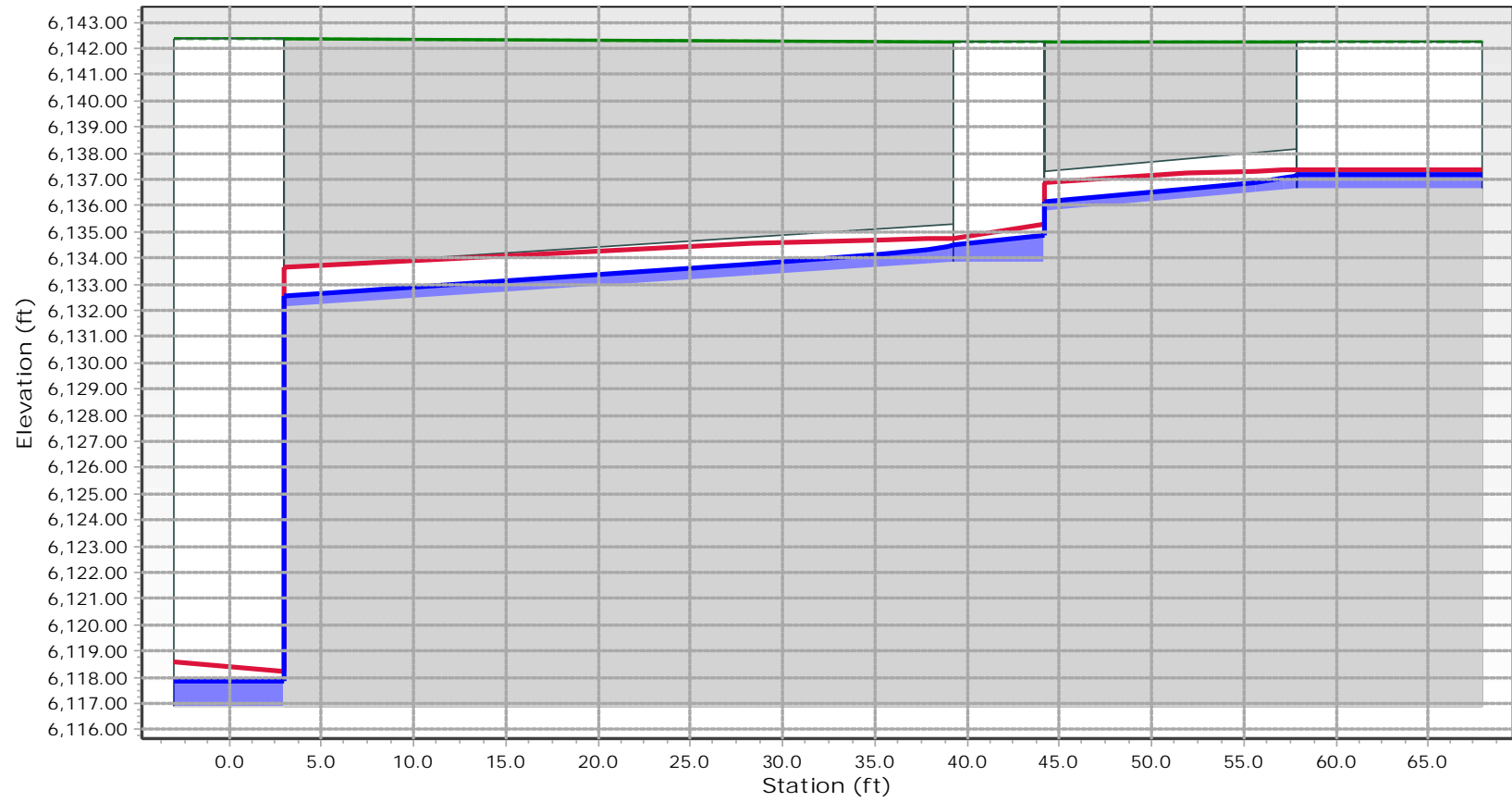
DP71 - 2-Year



DP72 - 2-Year

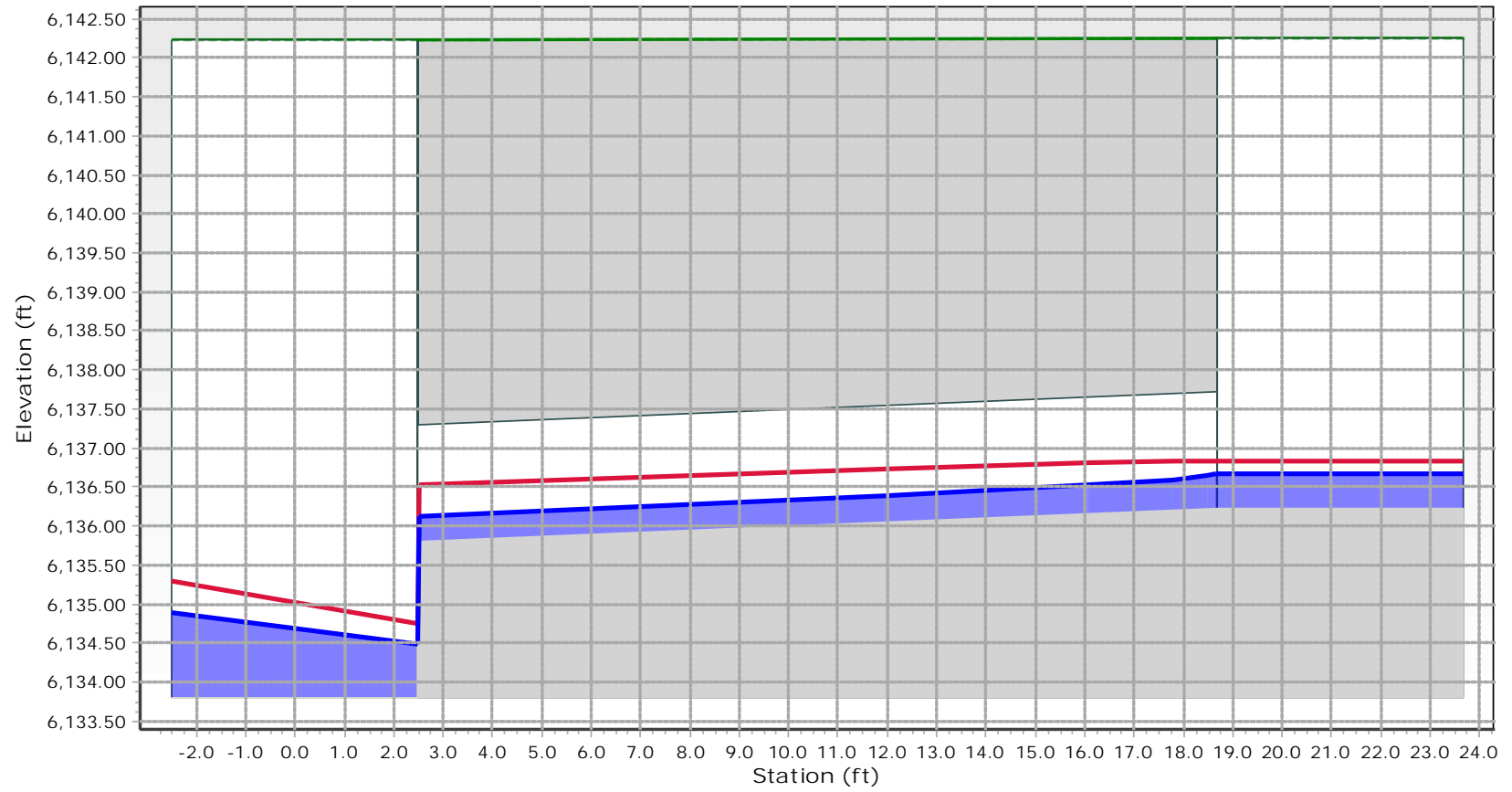


DP73 - 2-Year

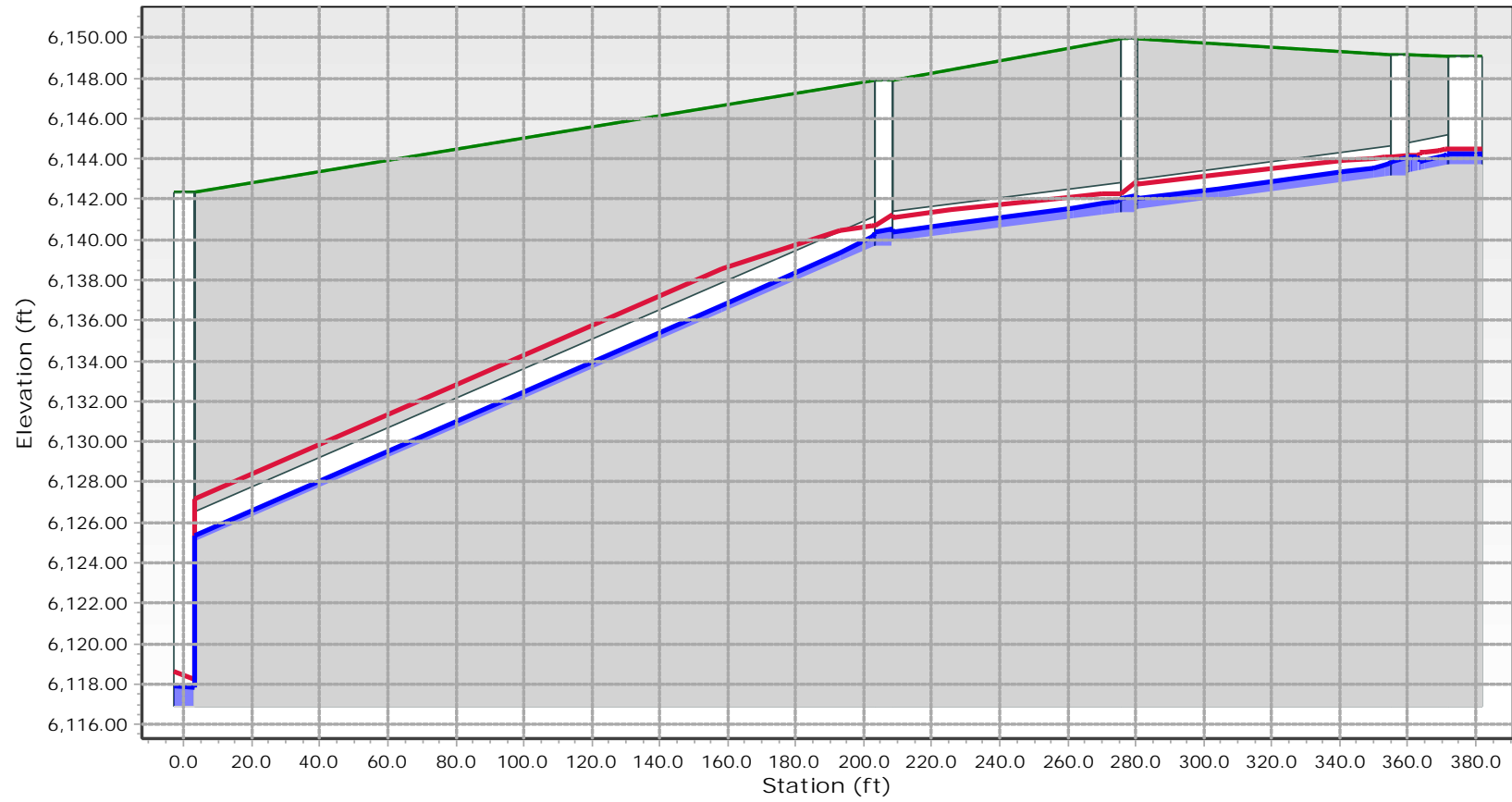




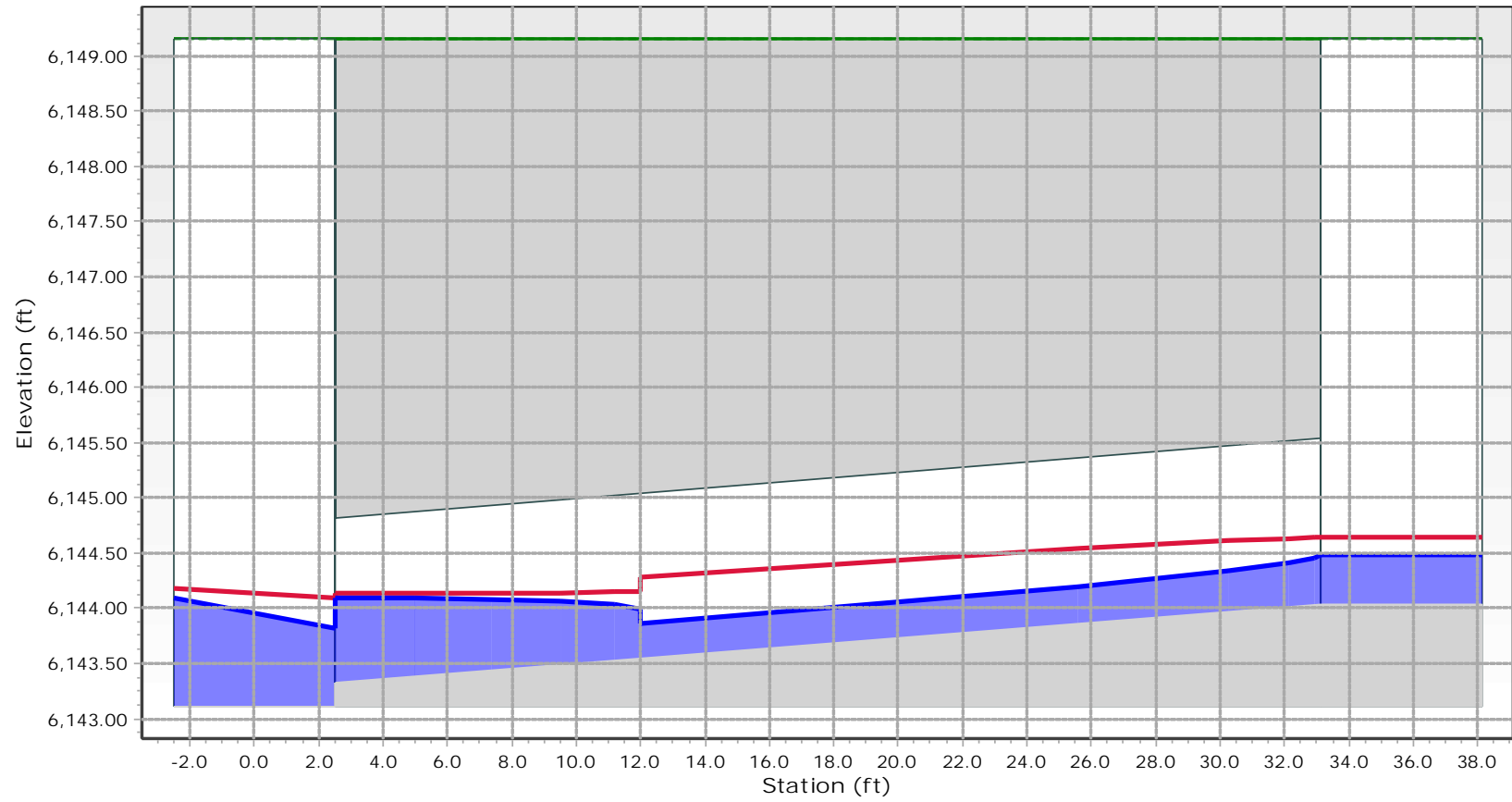
DP74 - 2-Year



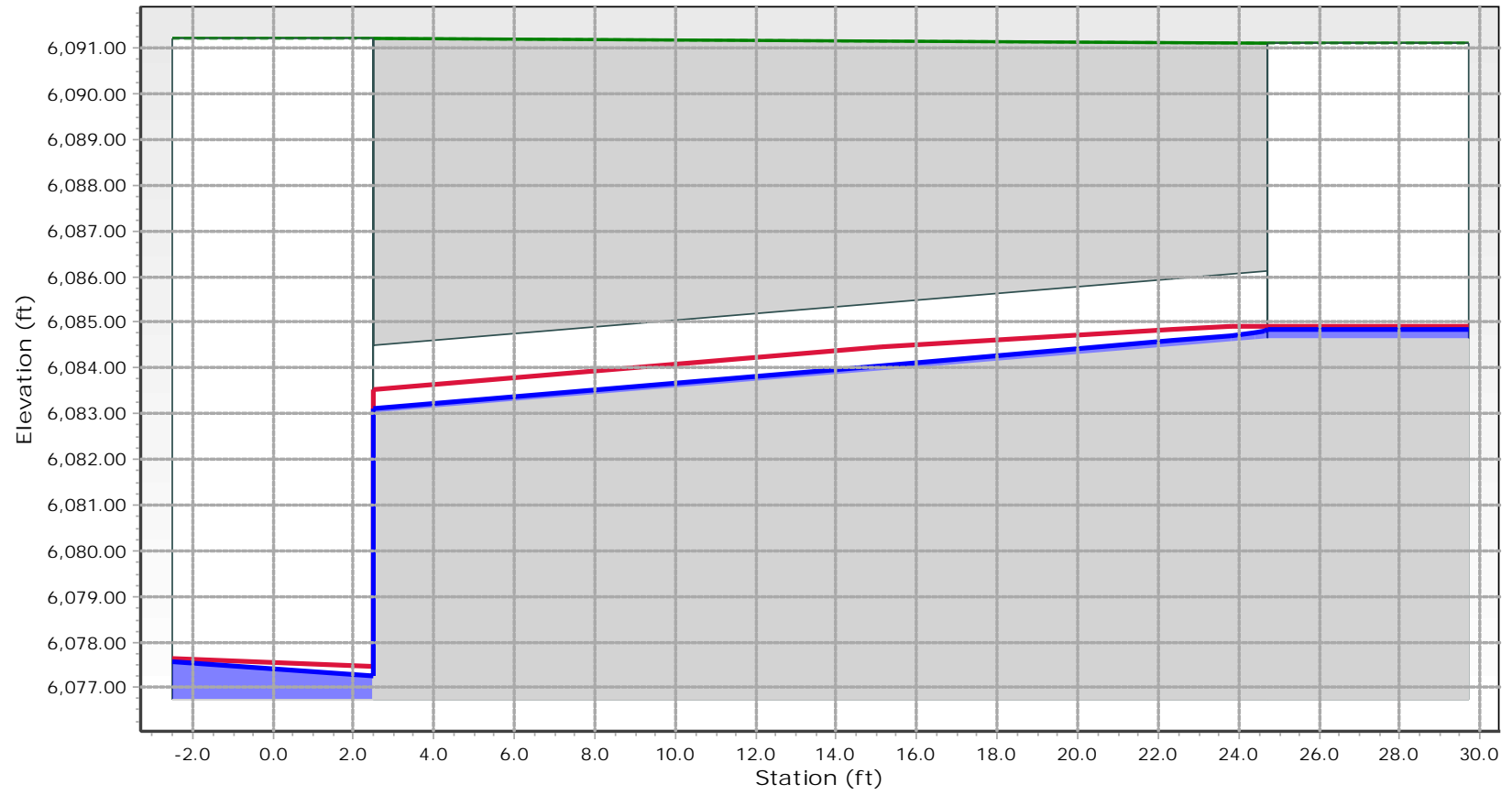
DP75 - 2-Year



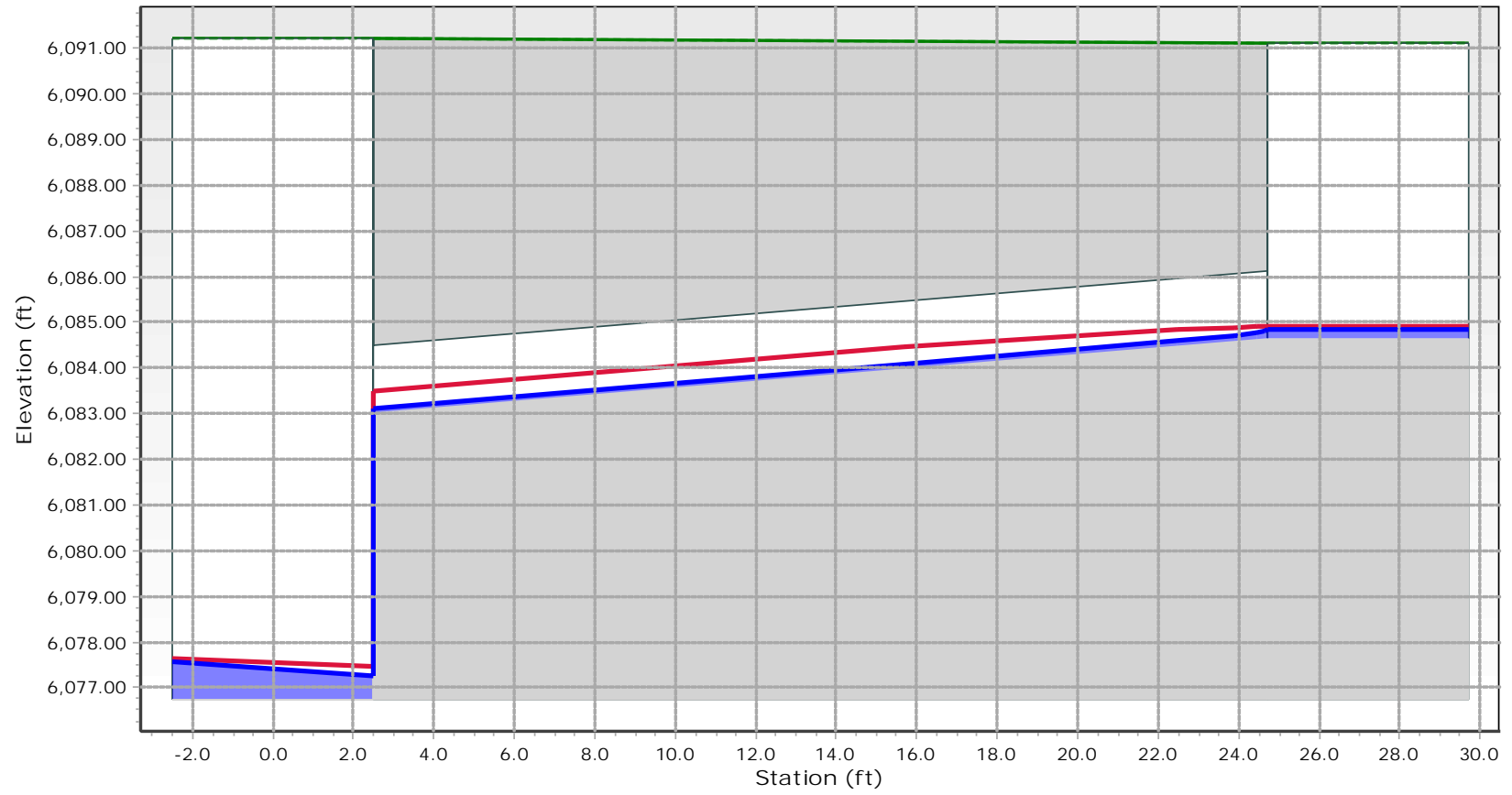
DP76 - 2-Year



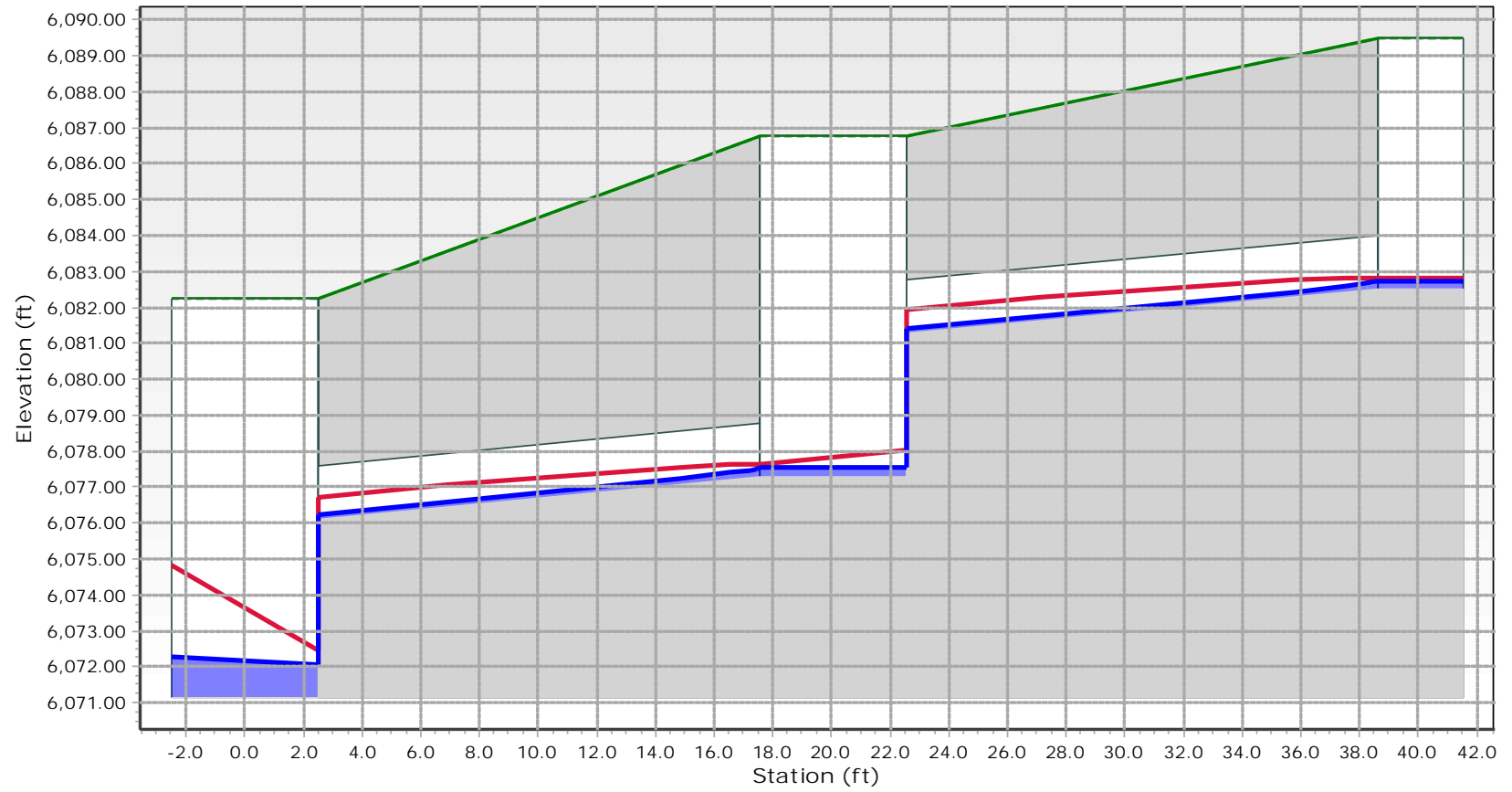
DP77 - 2-Year



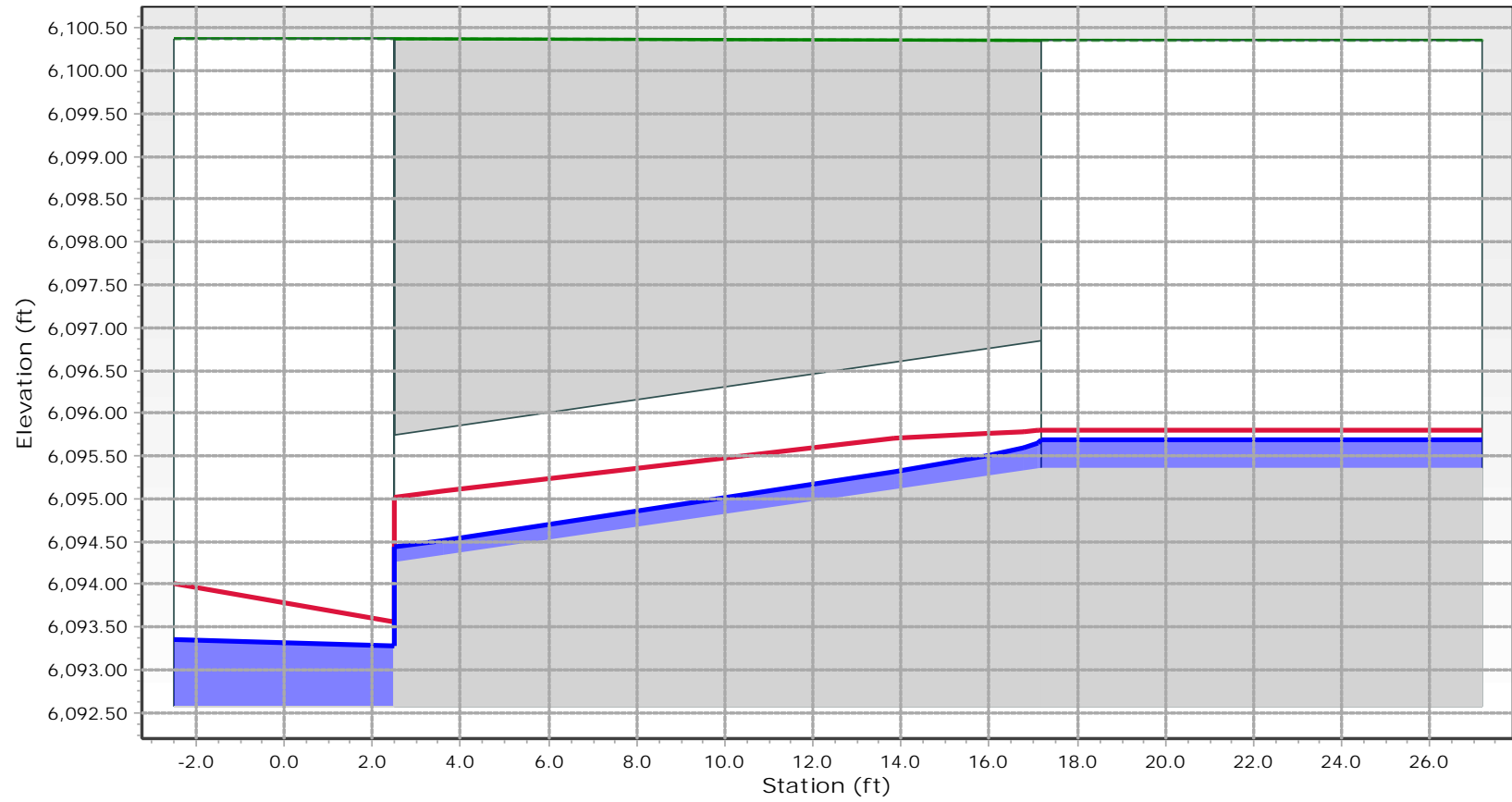
DP78 - 2-Year



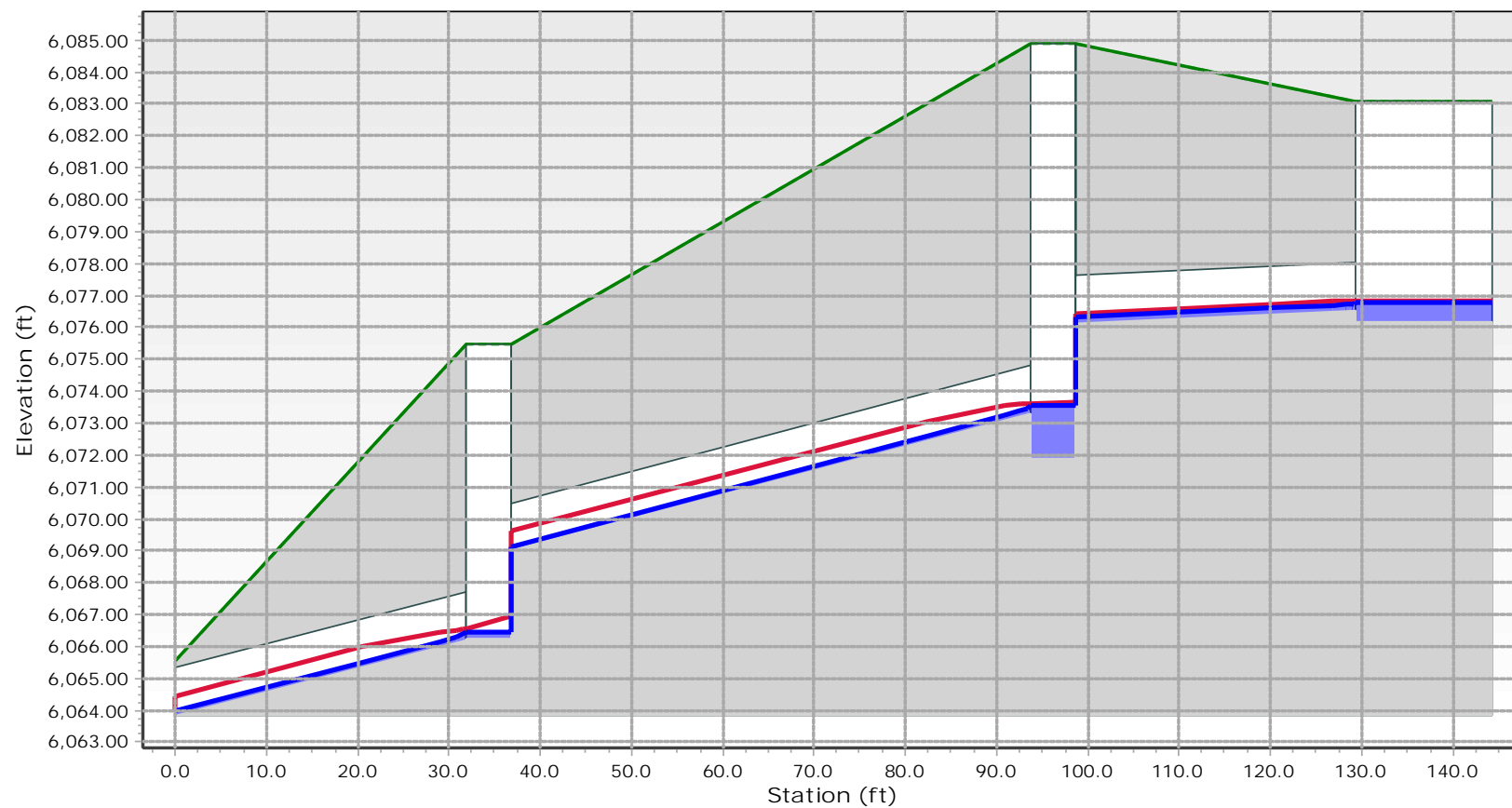
DP79 - 2-Year



DP80 - 2-Year

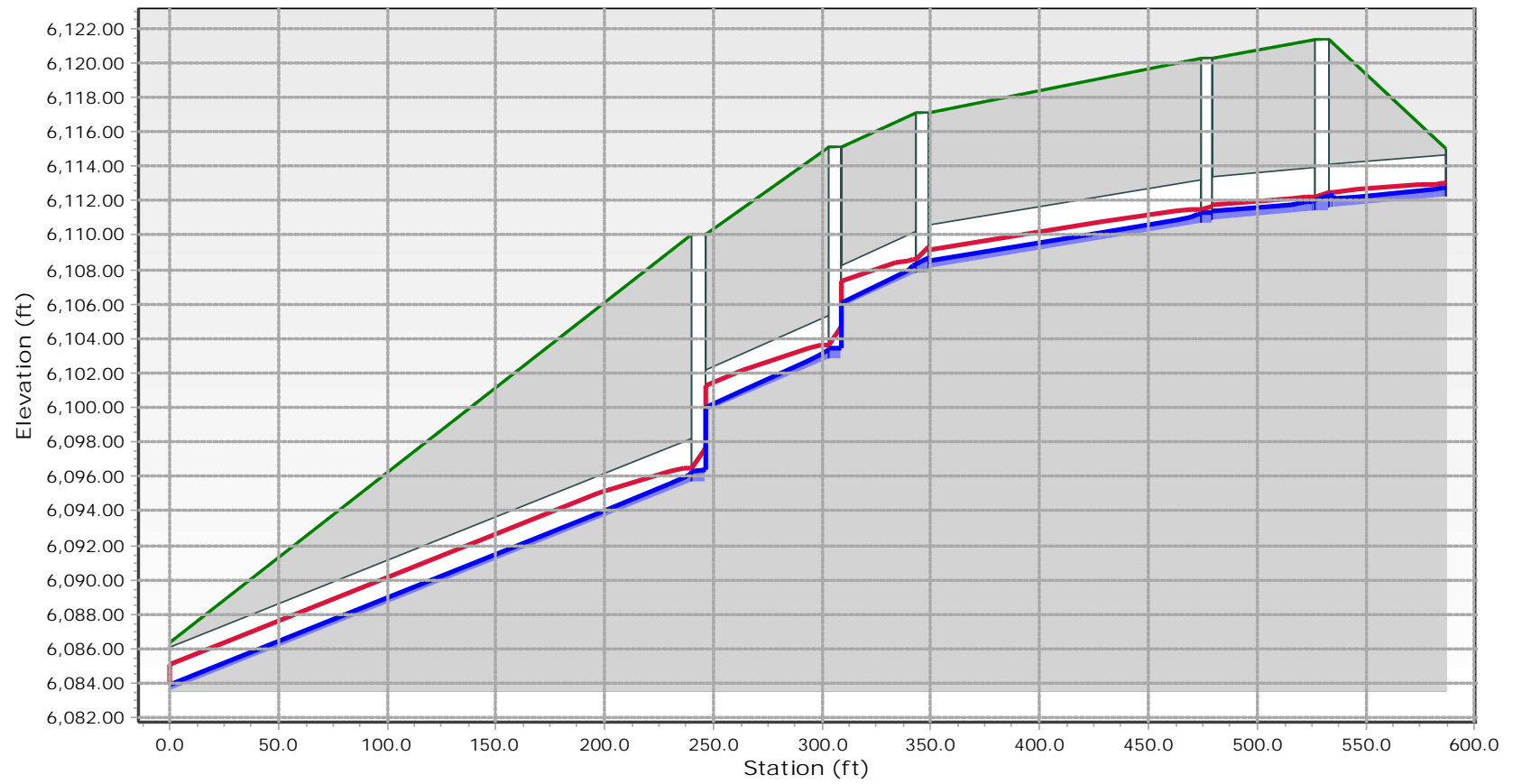


Pond C Outfall - 2-Year

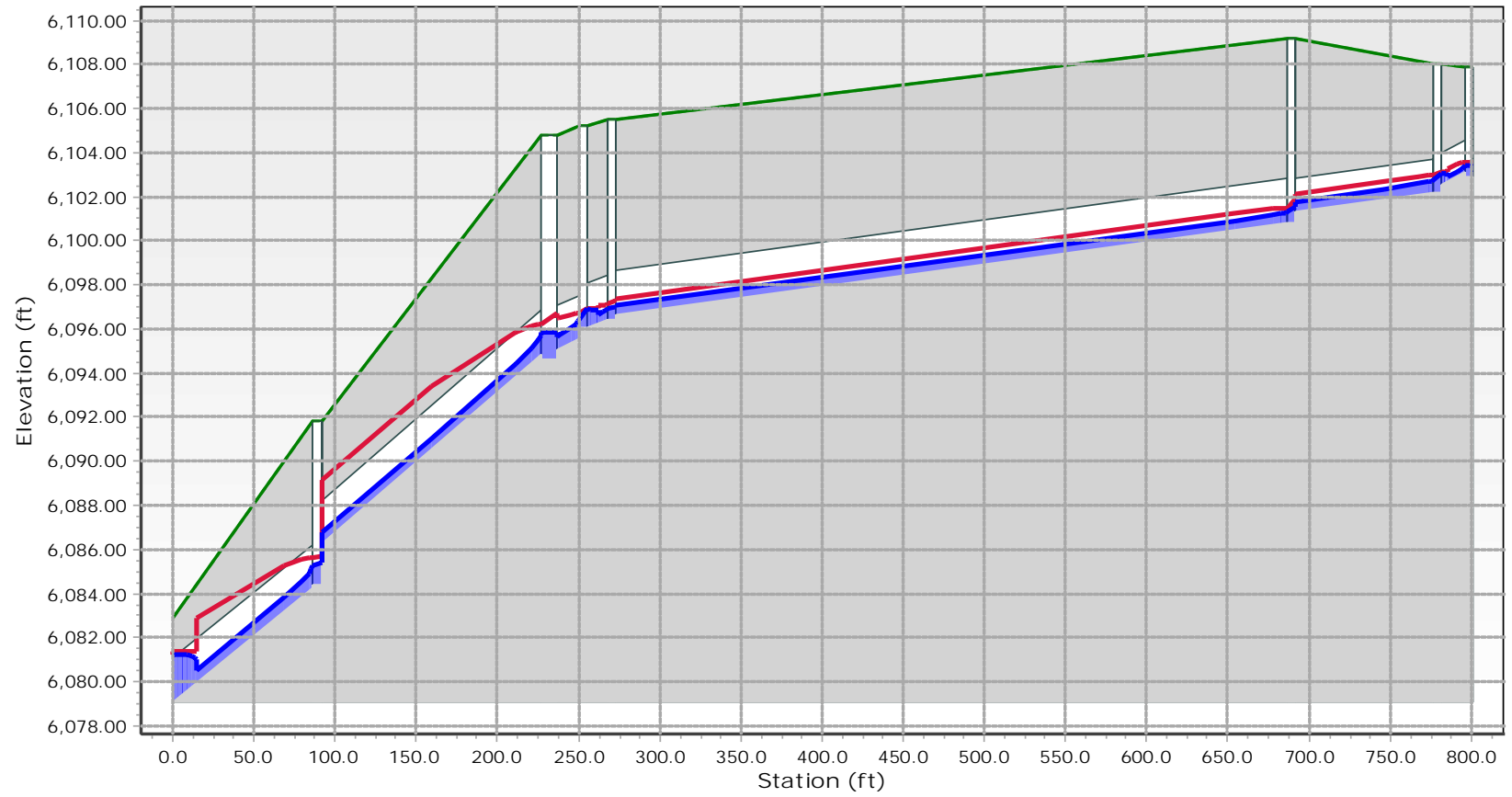




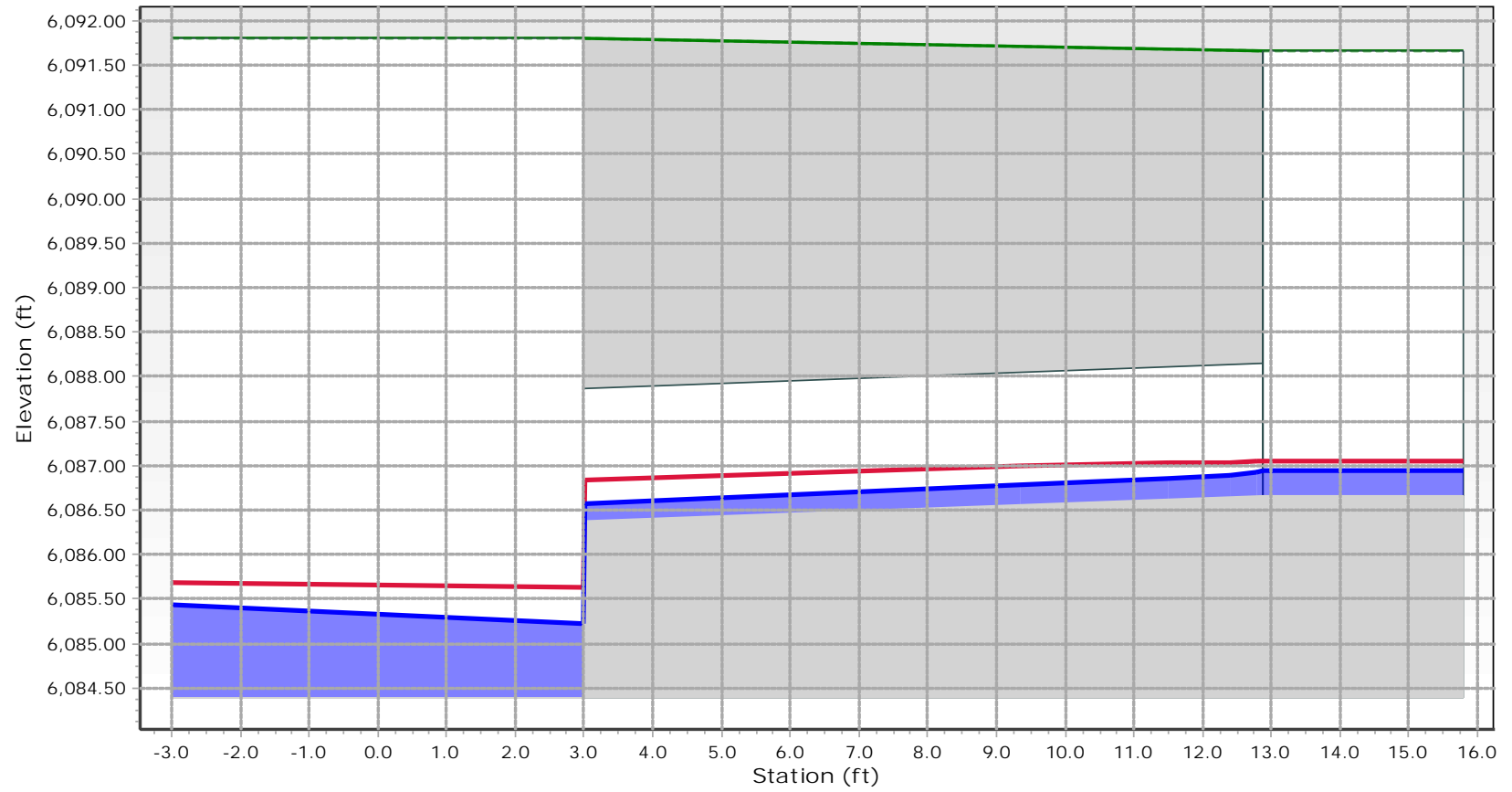
DP100 - 2-Year



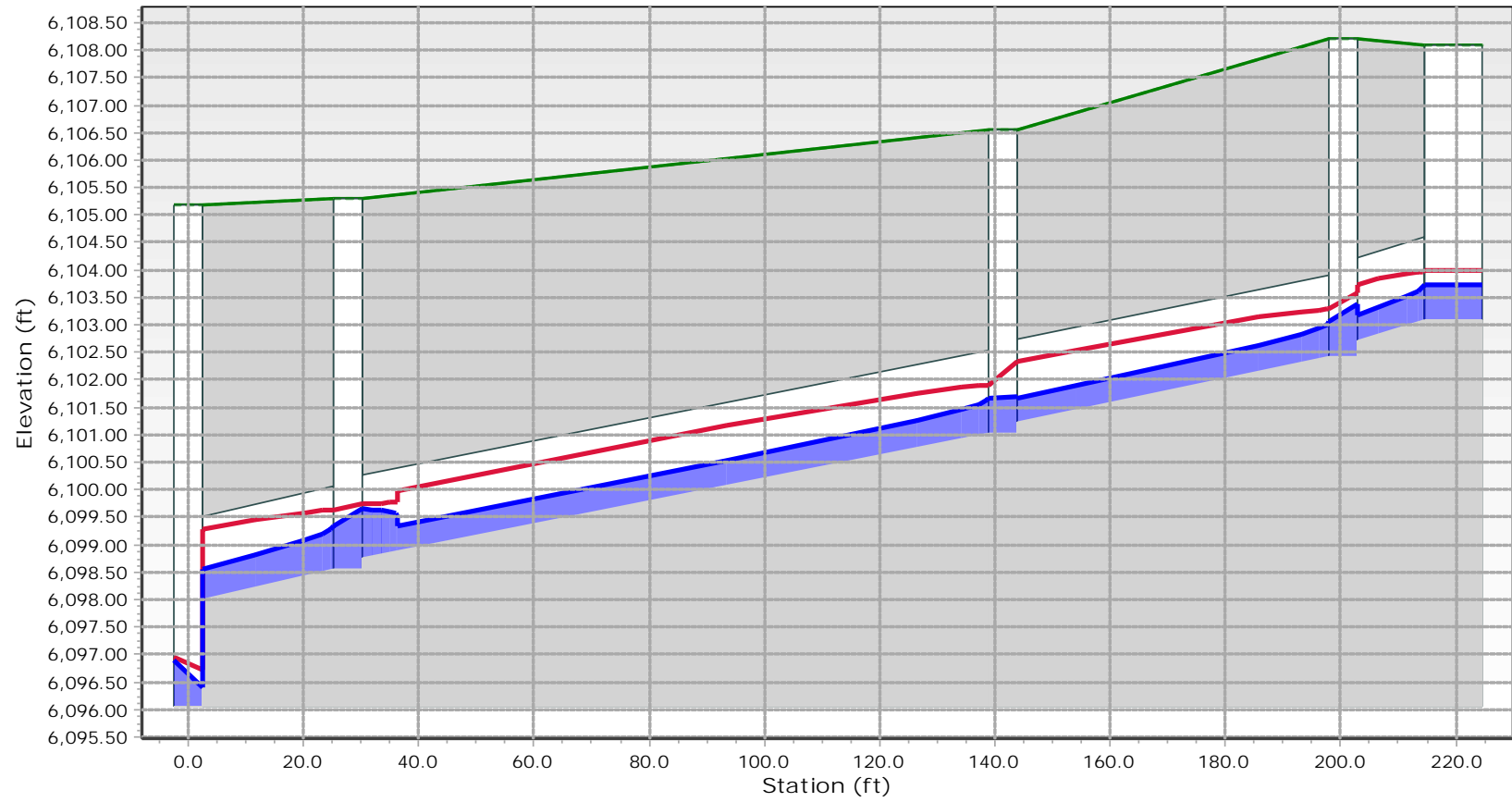
DP101 - 2-Year



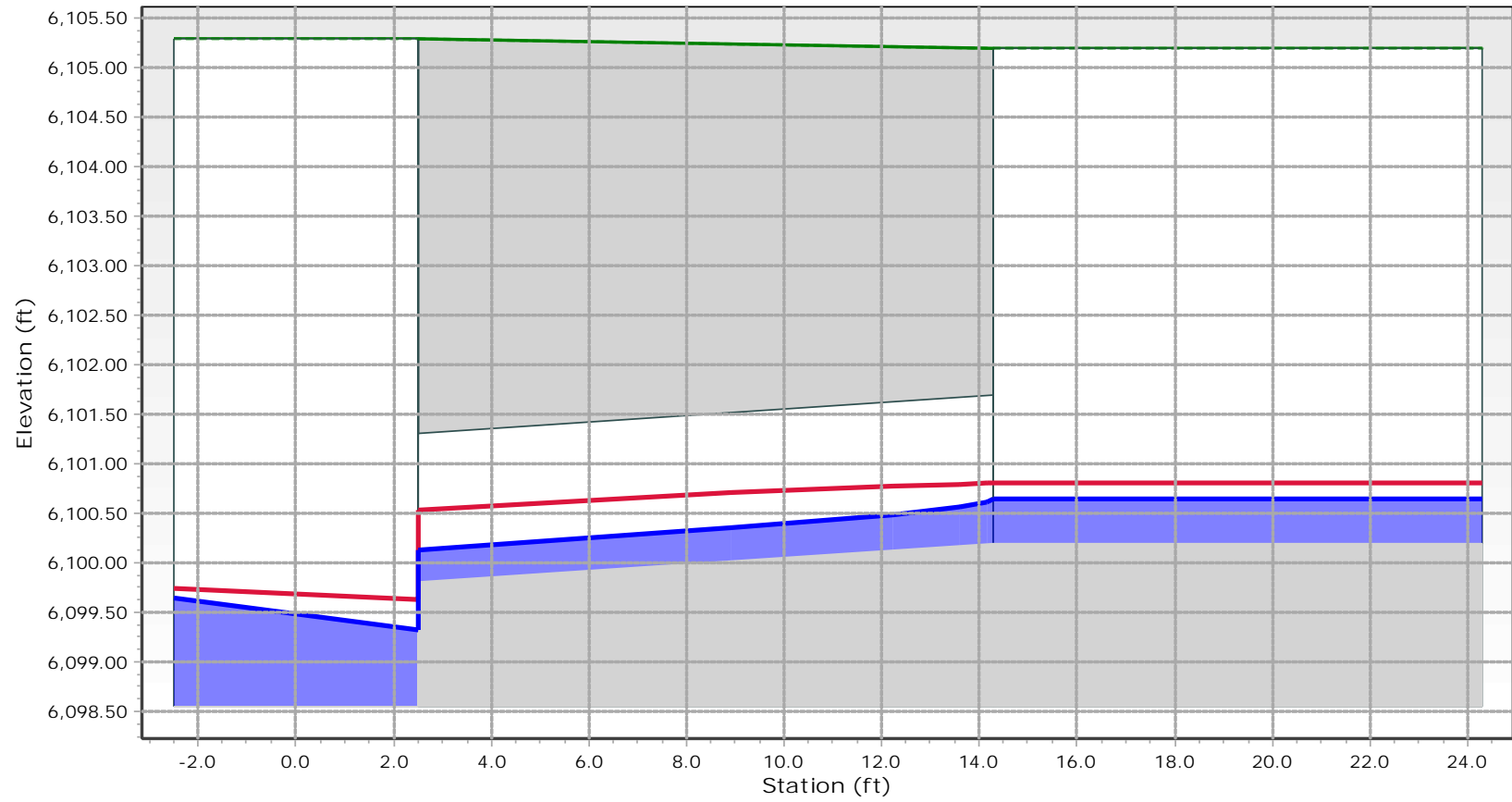
DP102 - 2-Year



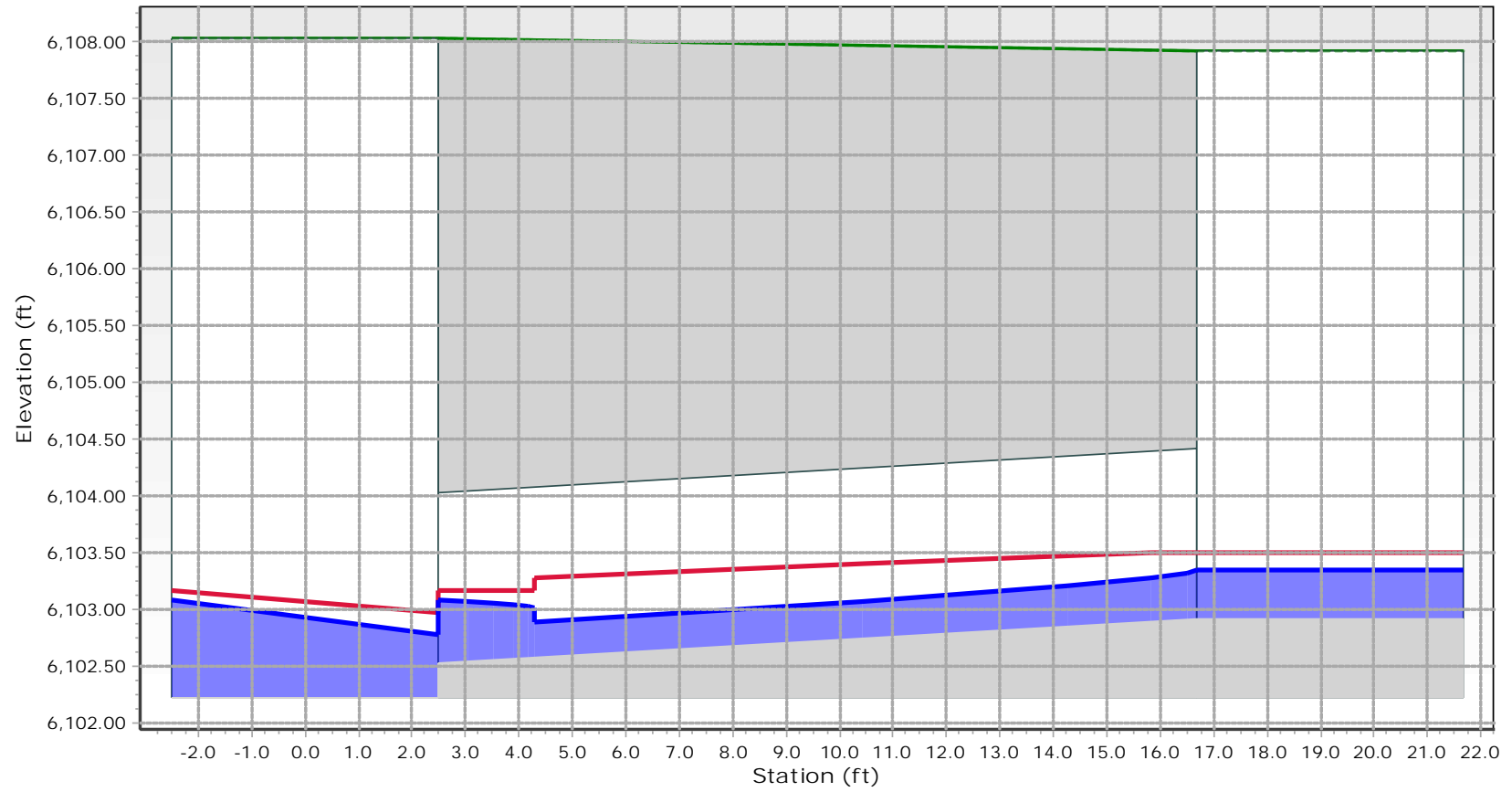
DP103 - 2-Year



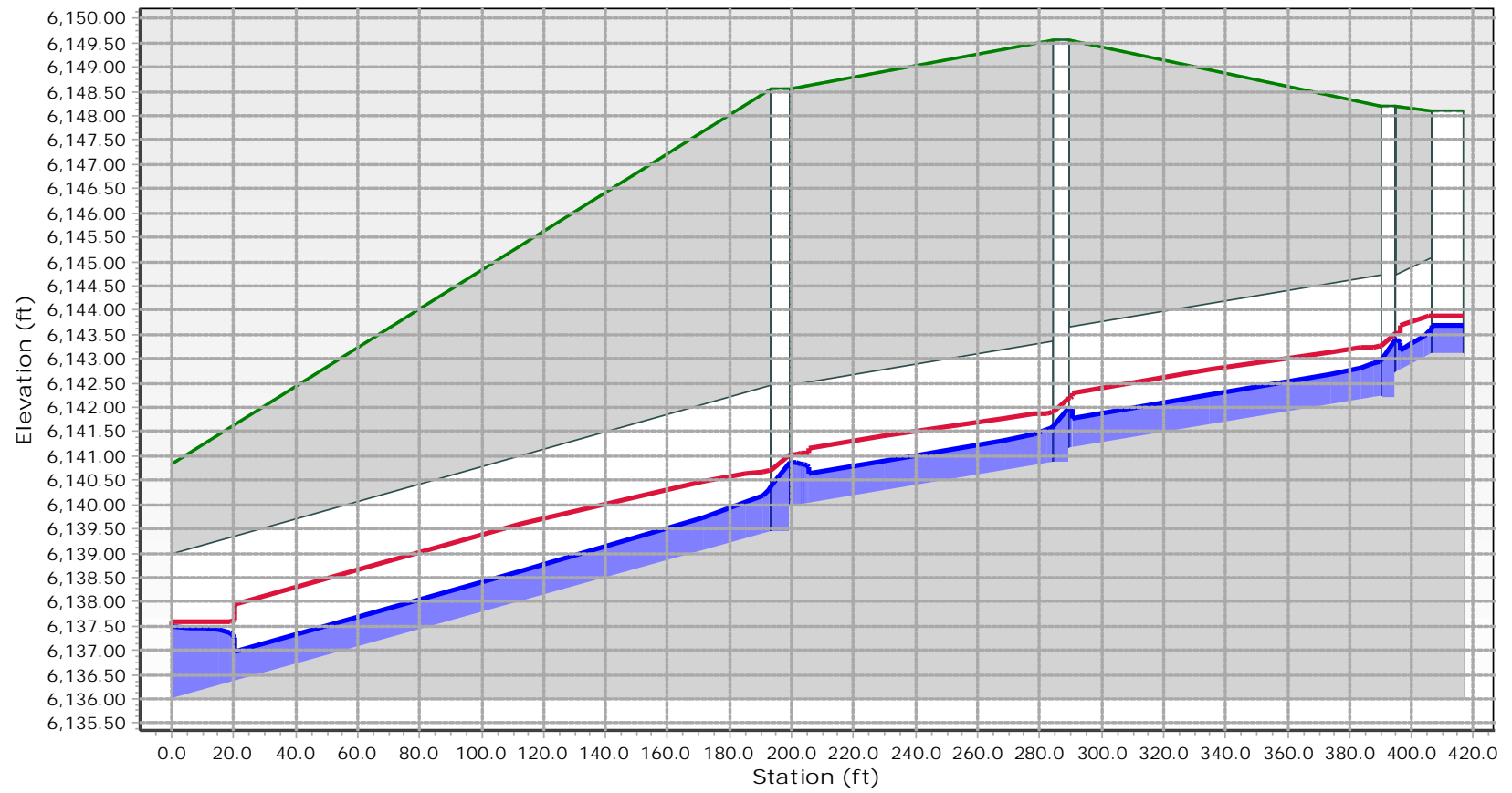
DP104 - 2-Year



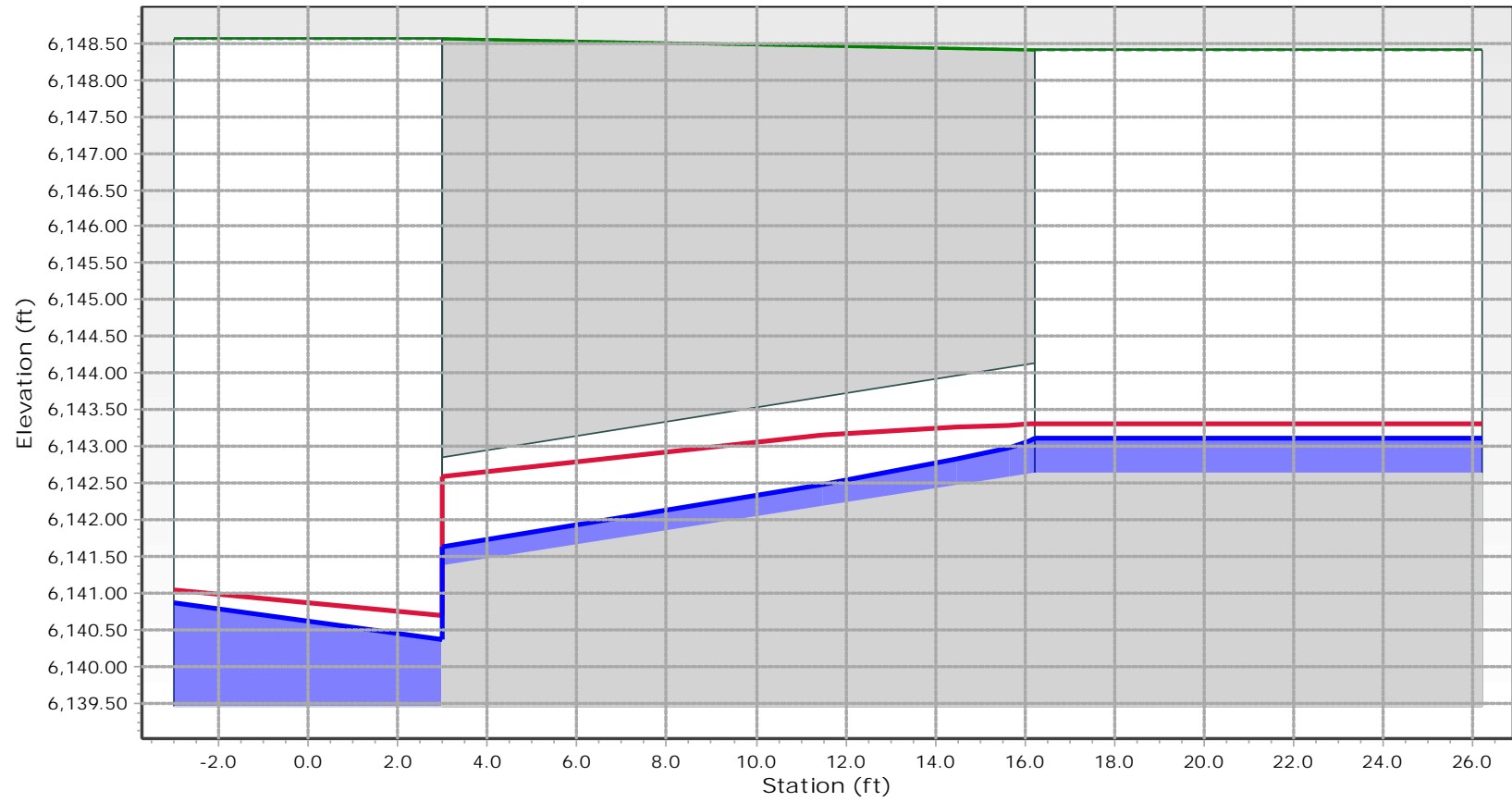
DP105 - 2-Year



DP120 - 2-Year

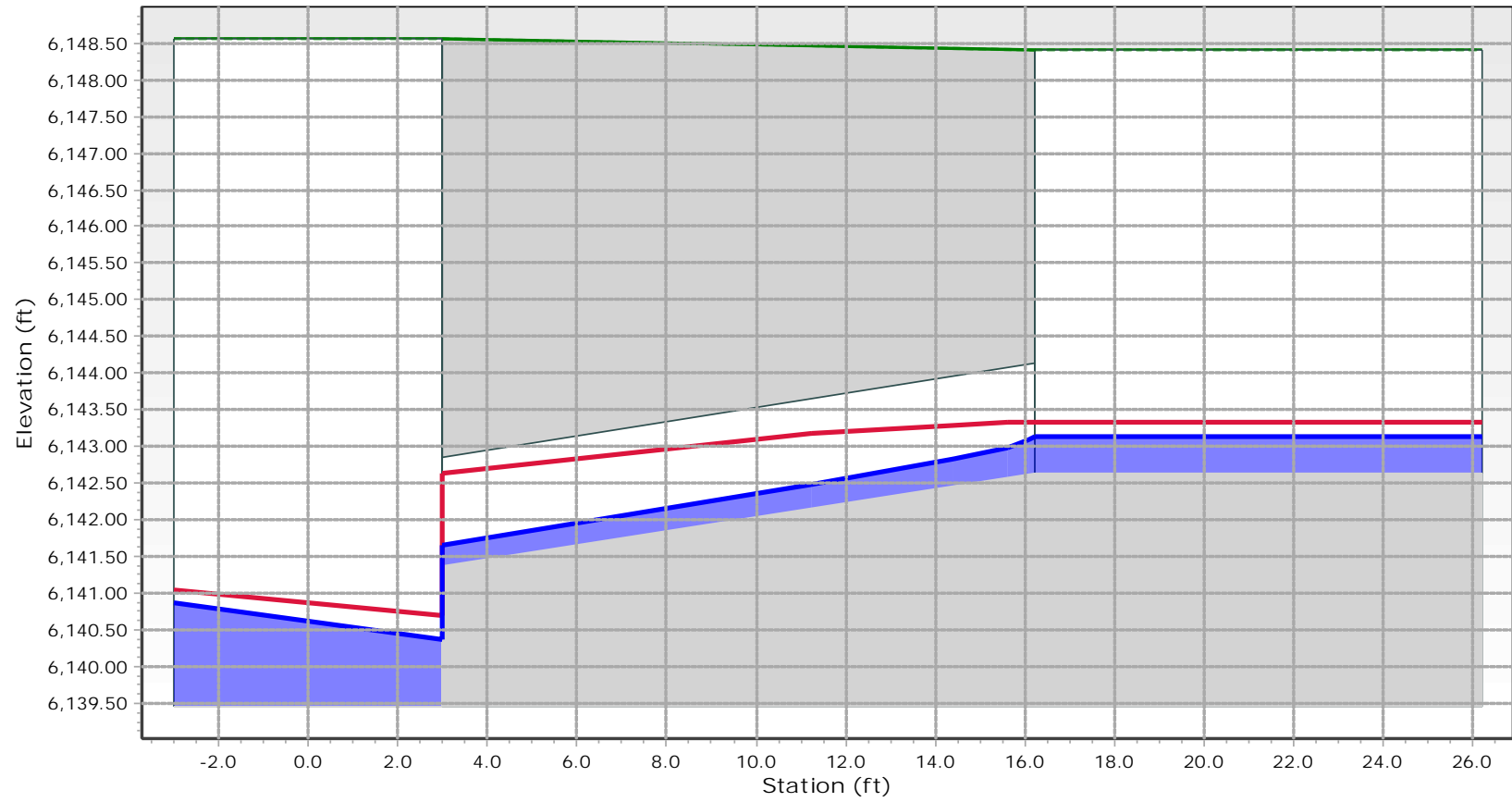


DP121 - 2-Year

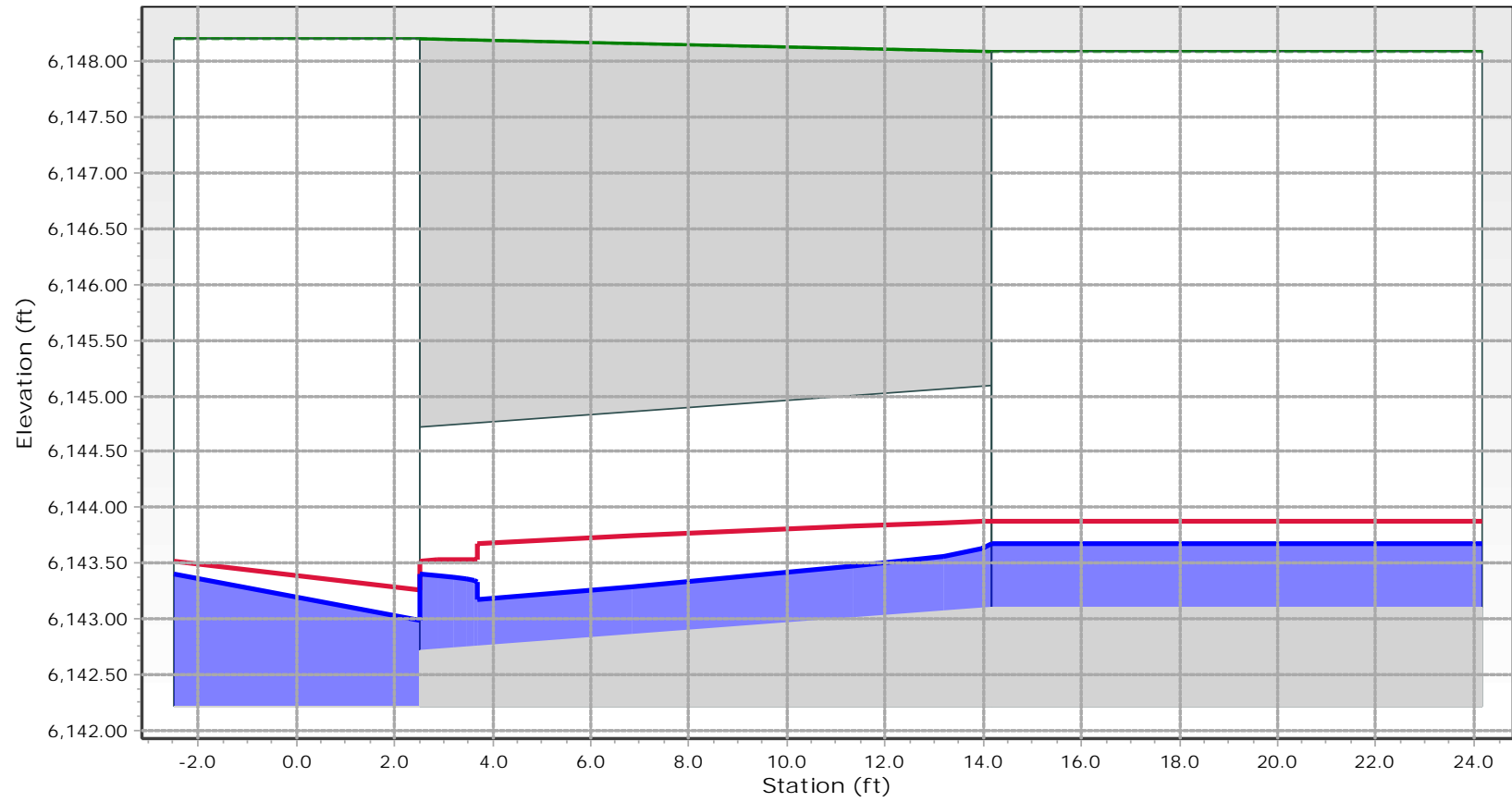




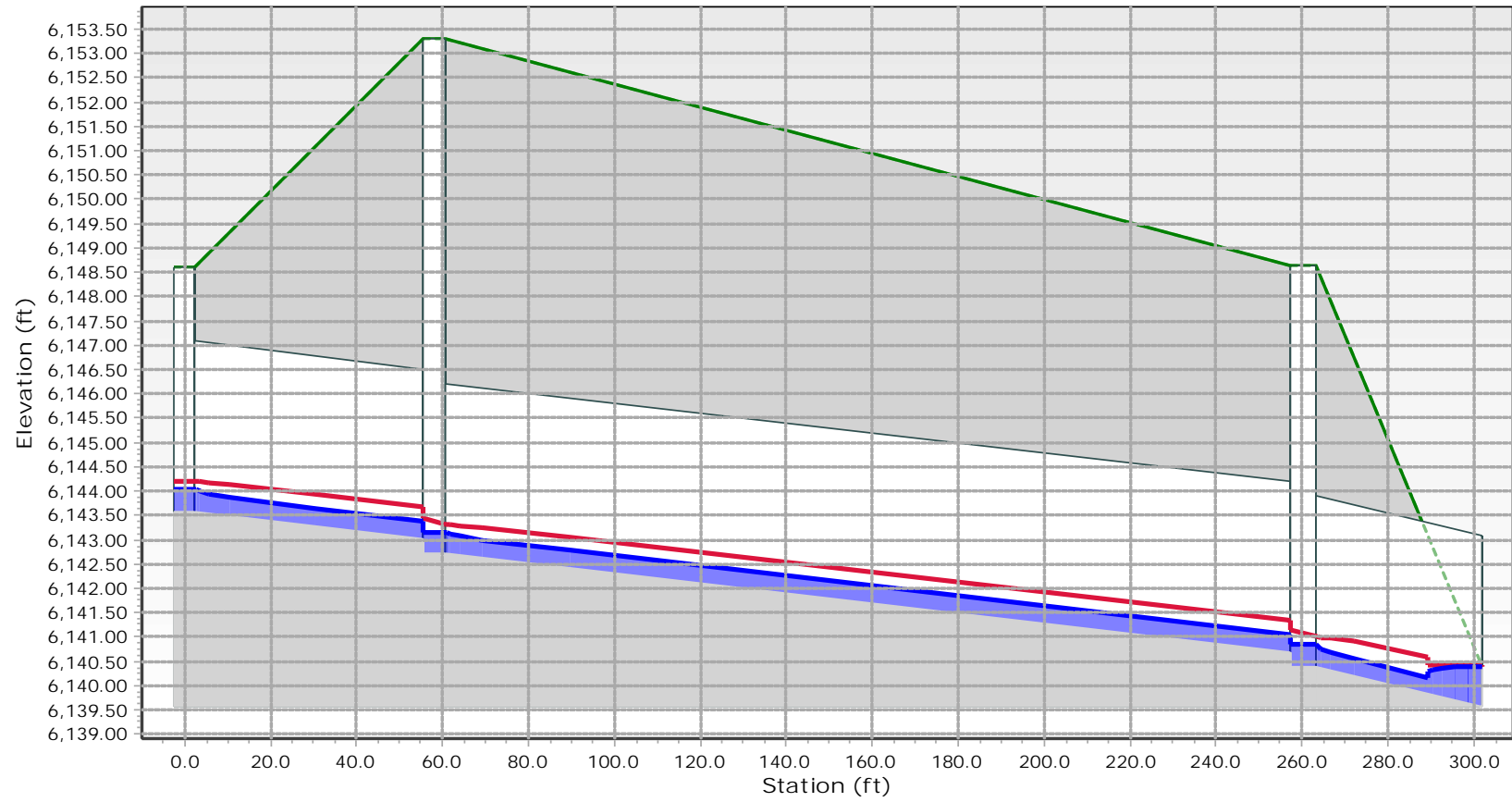
DP122 - 2-Year



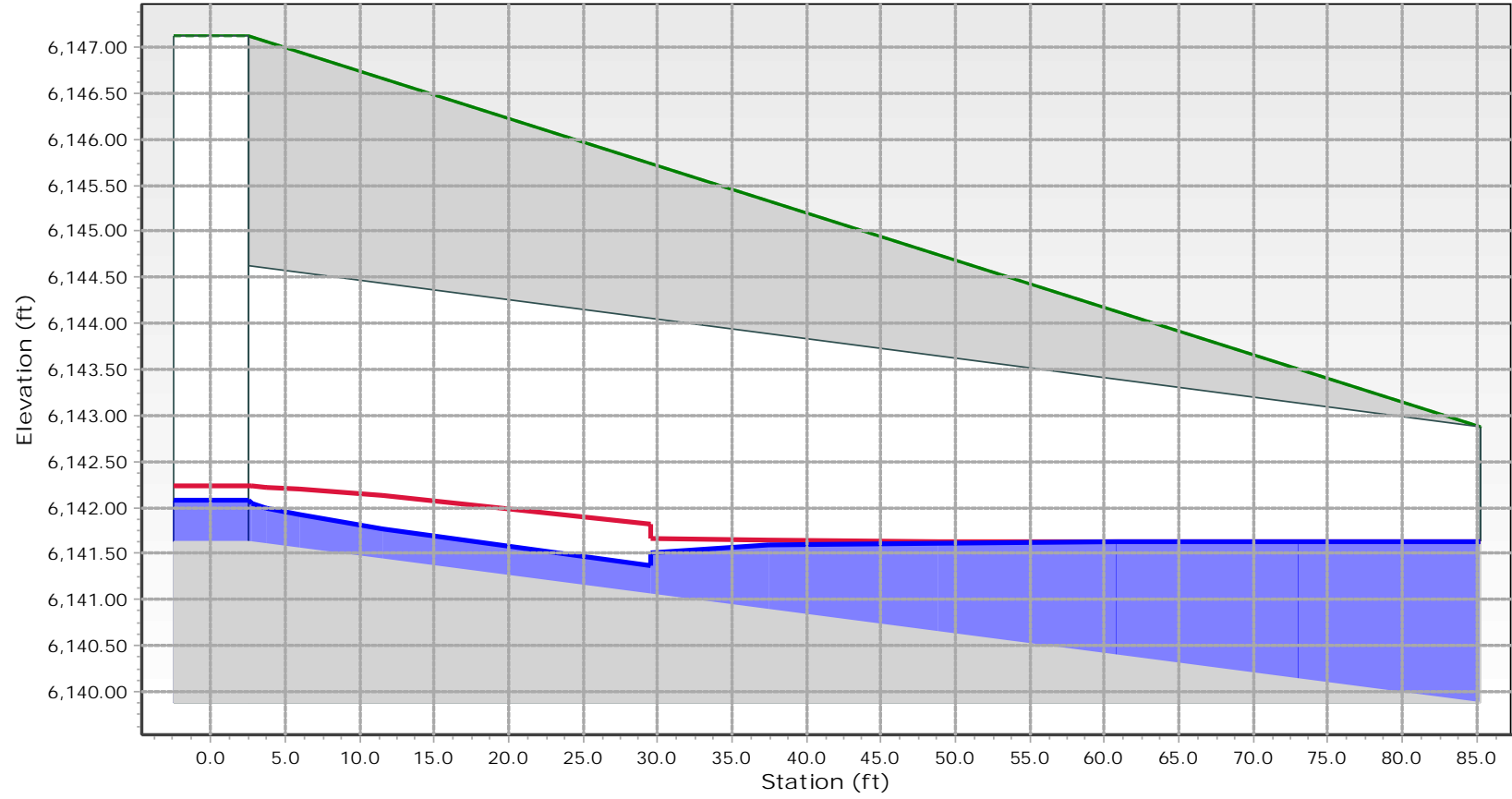
DP123 - 2-Year



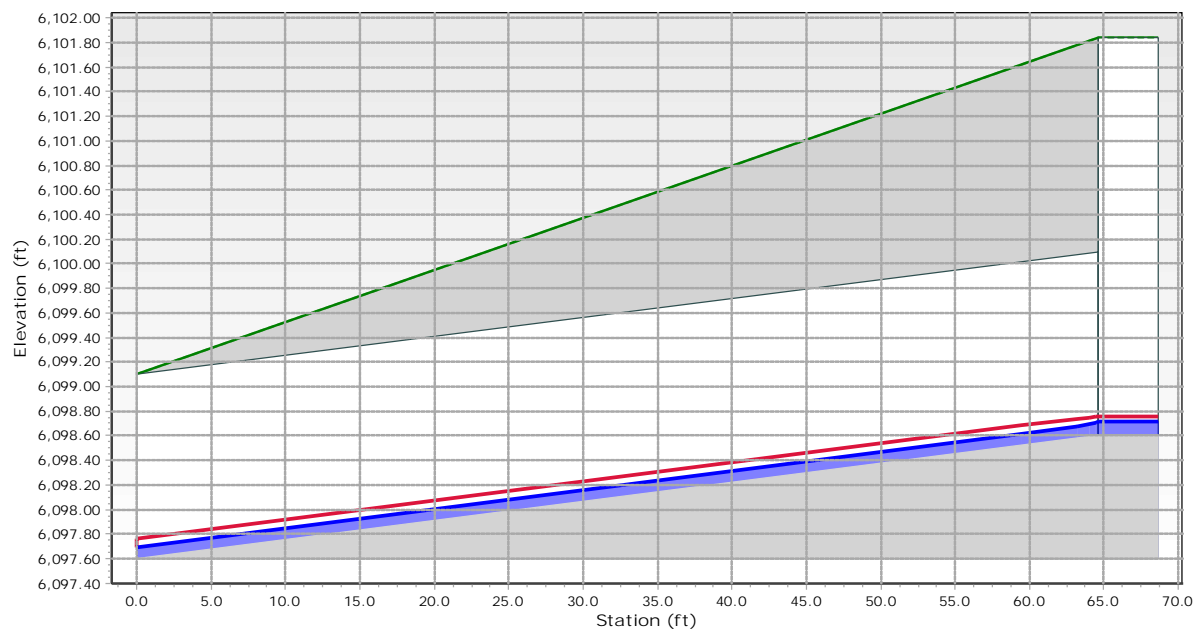
DP140 - 2-Year



DP20 E County Line Rd Crossing - 2-Year



Pond D Outfall - 2-Year



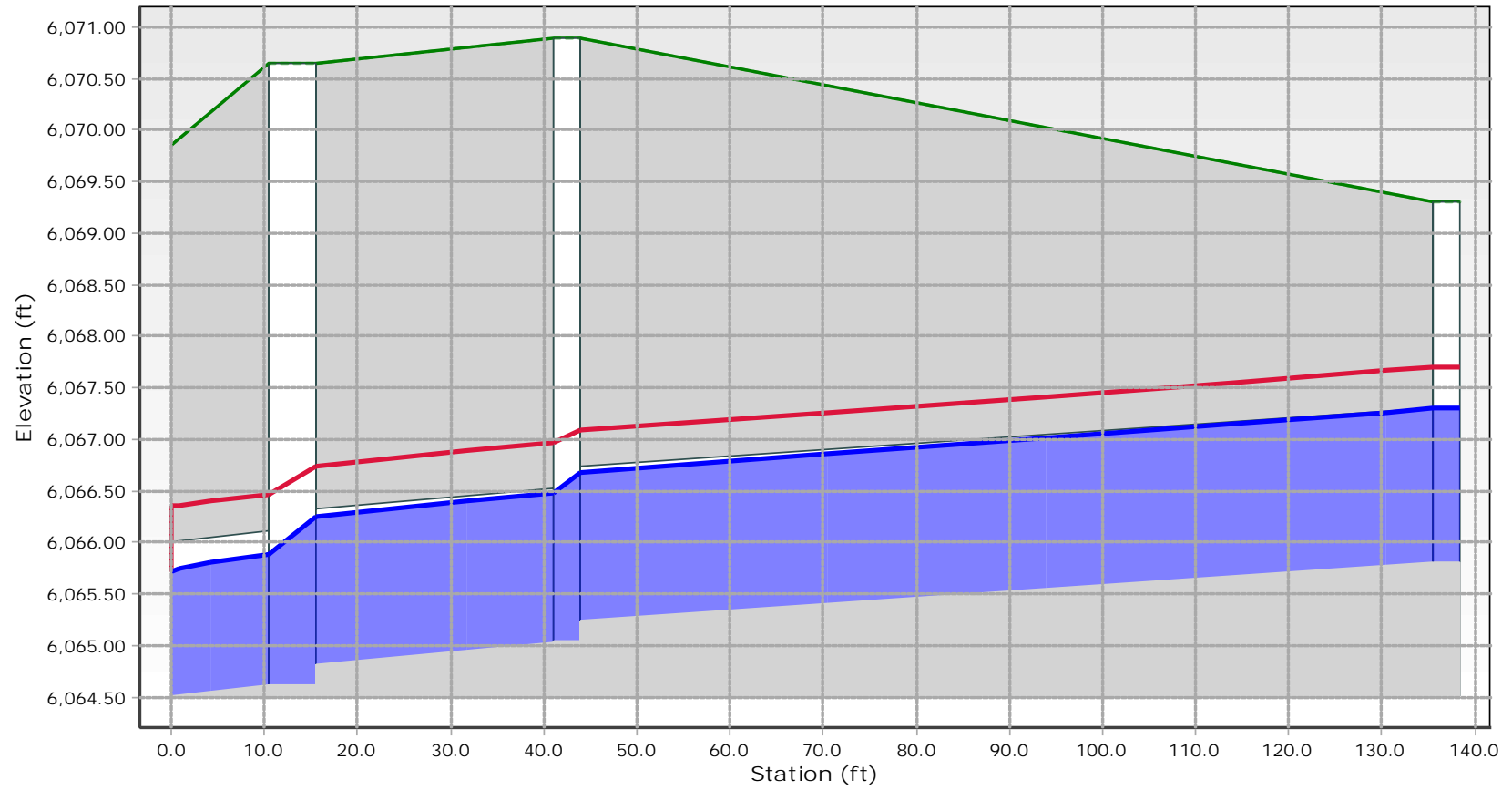




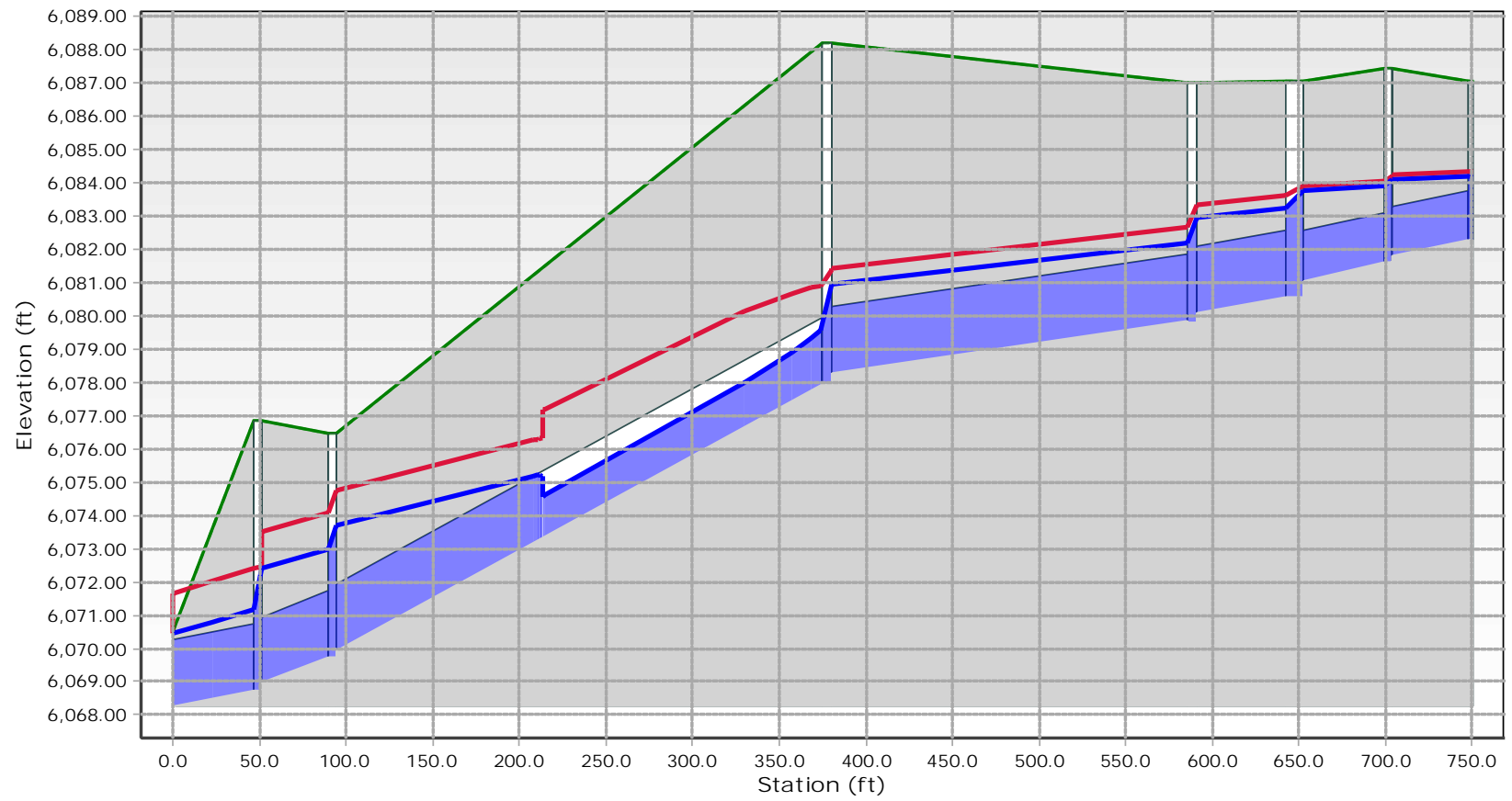




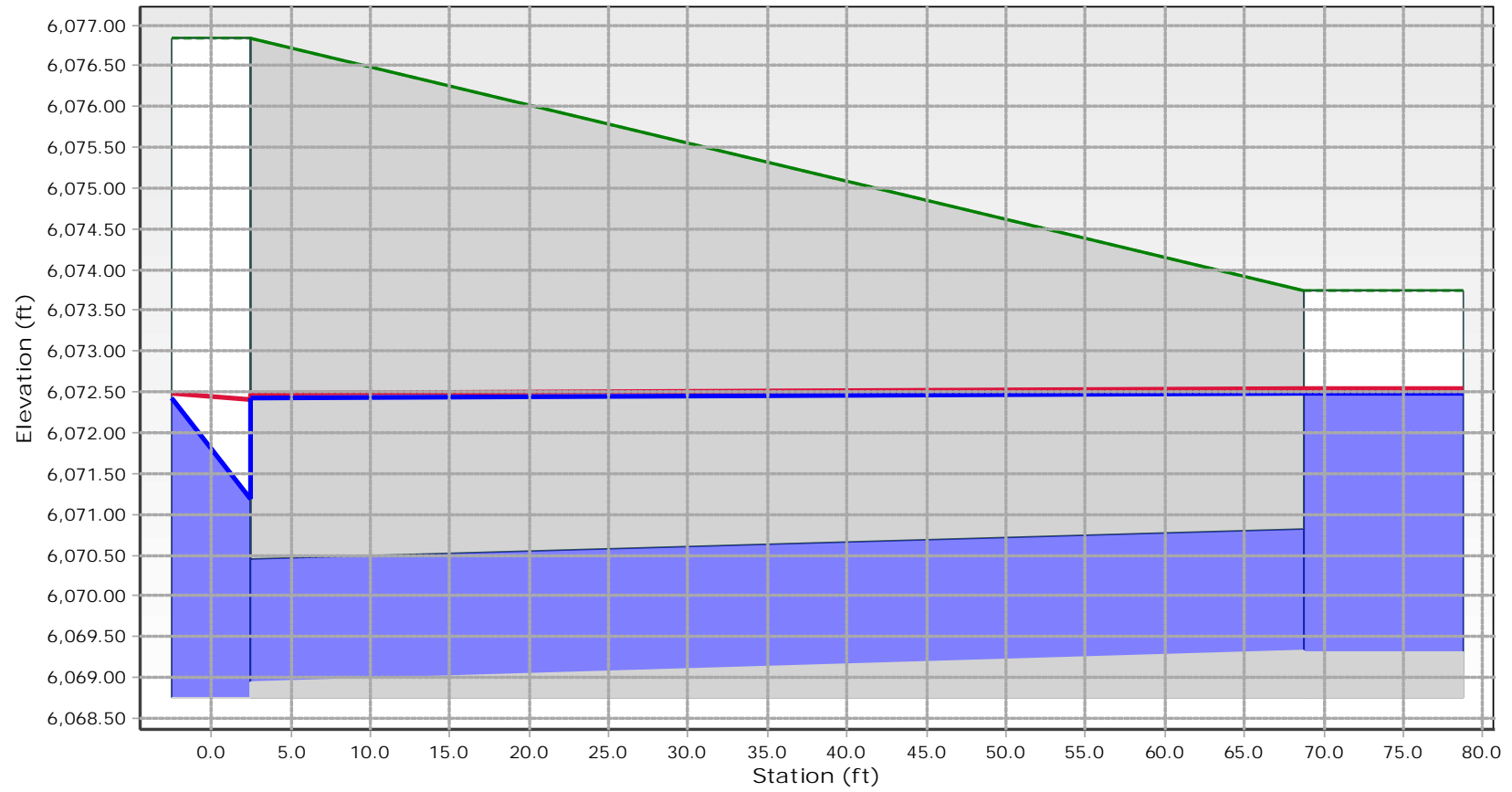
Pond A Outfall - 100-Year



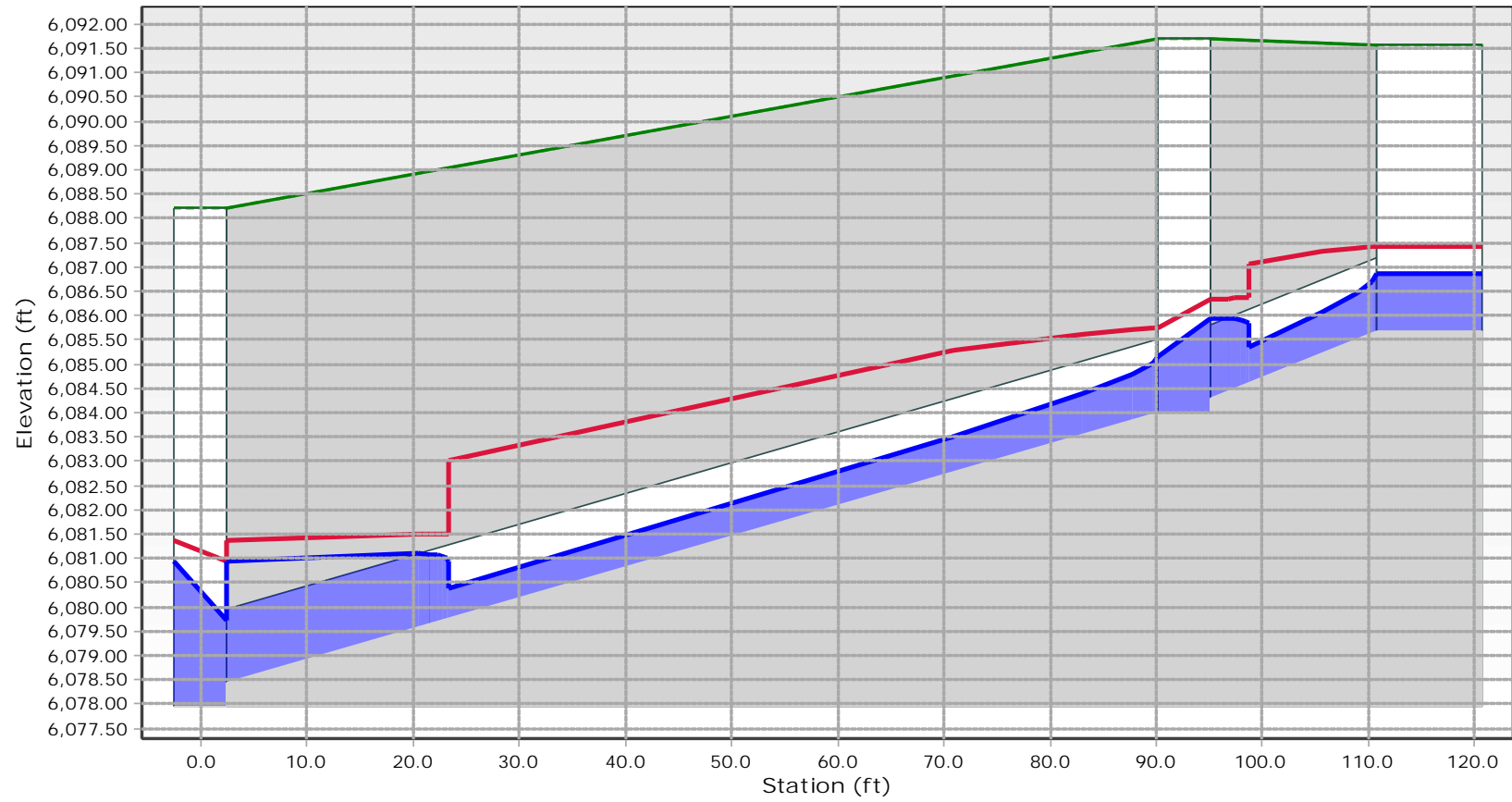
DP01 - 100-Year



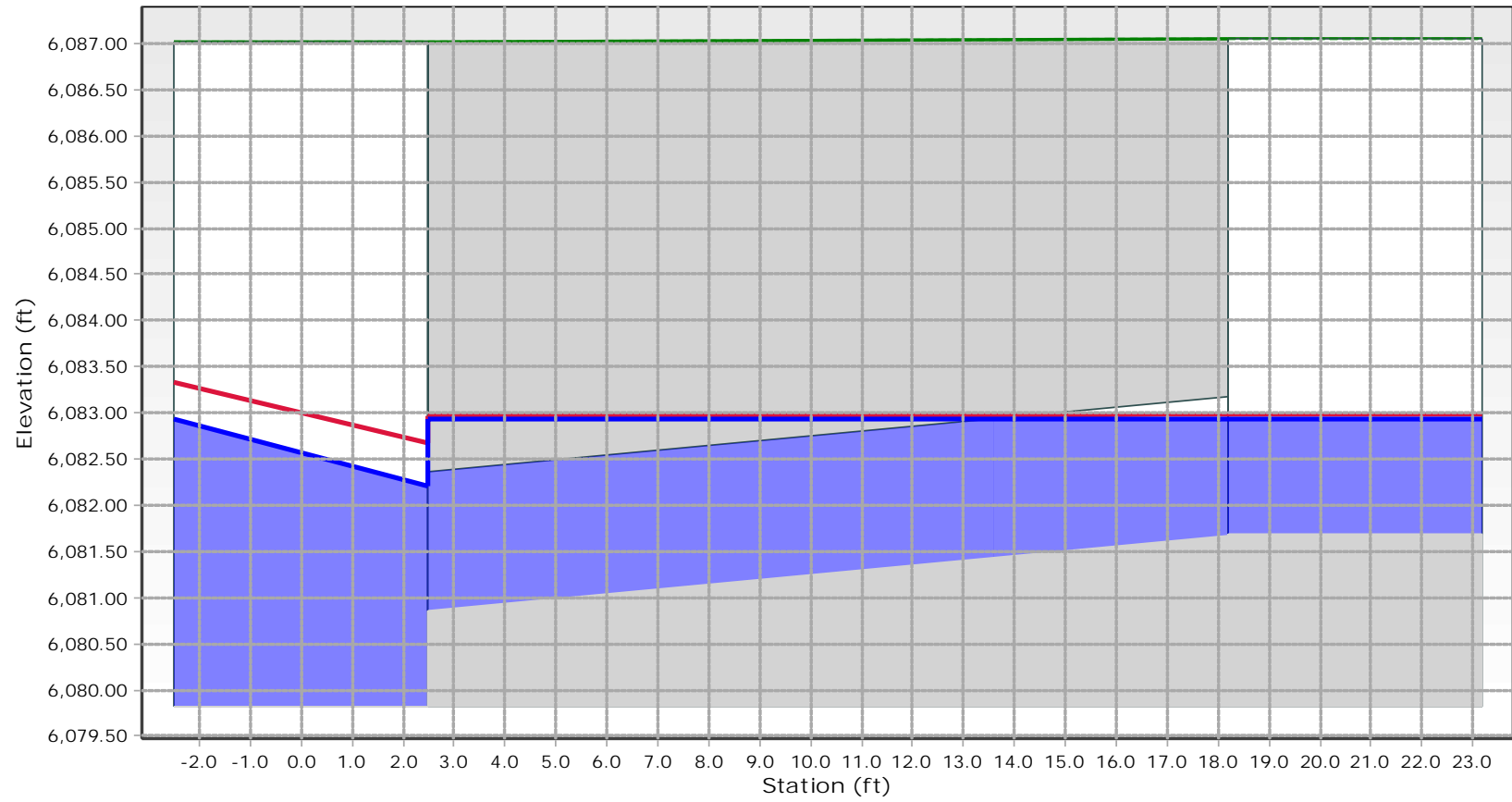
DP02 - 100-Year



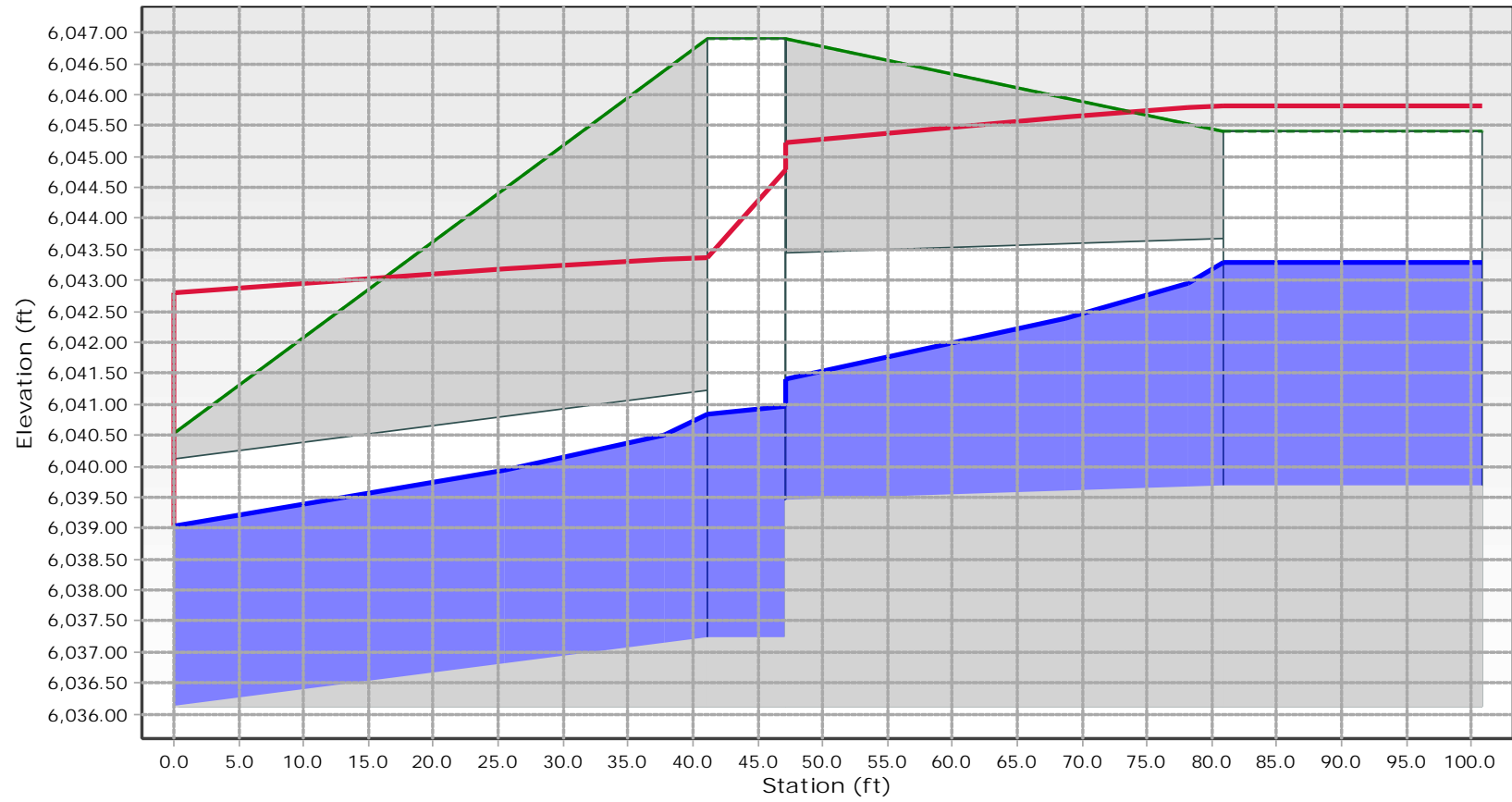
DP03 - 100-Year



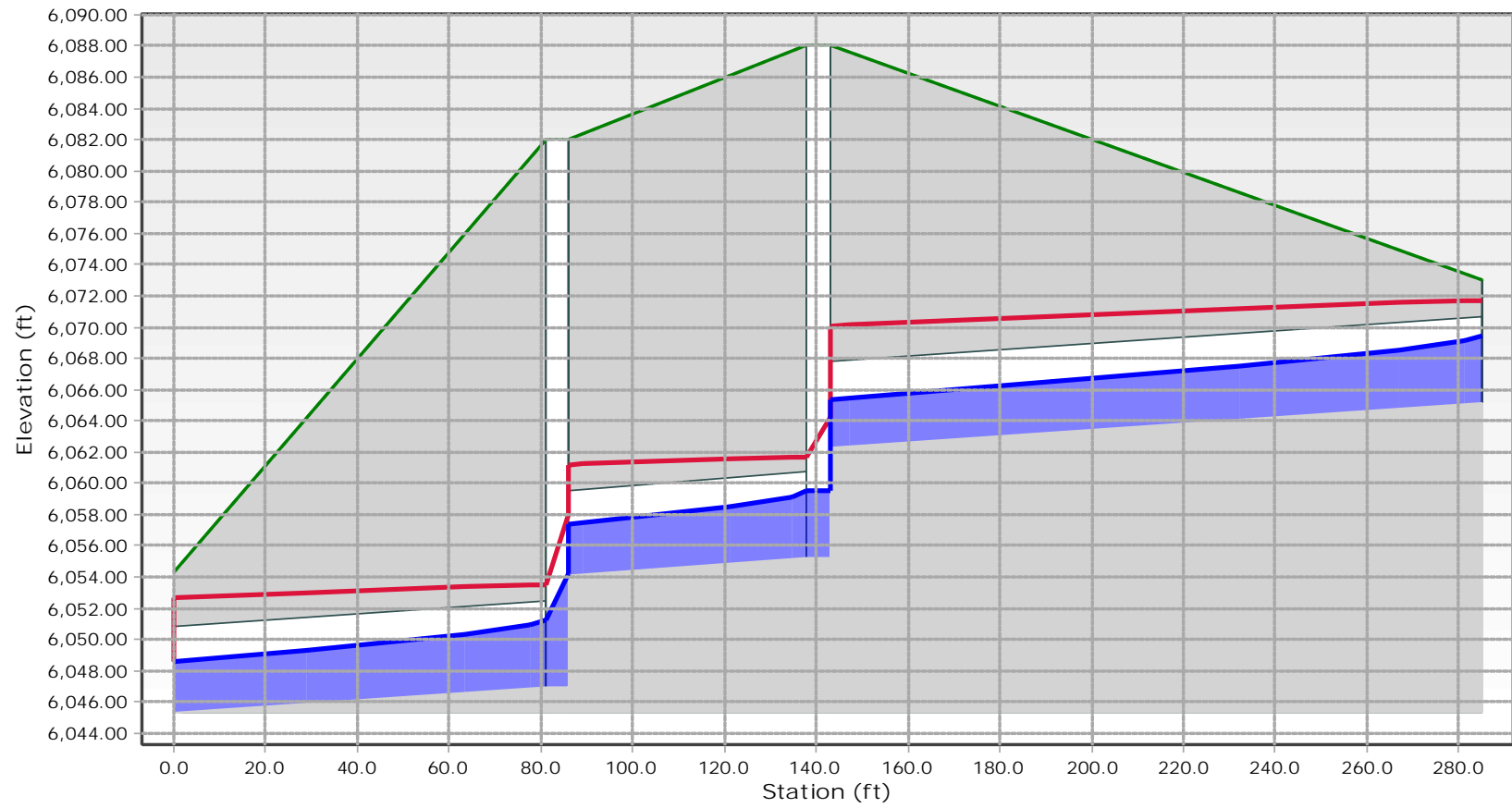
DP04 - 100-Year



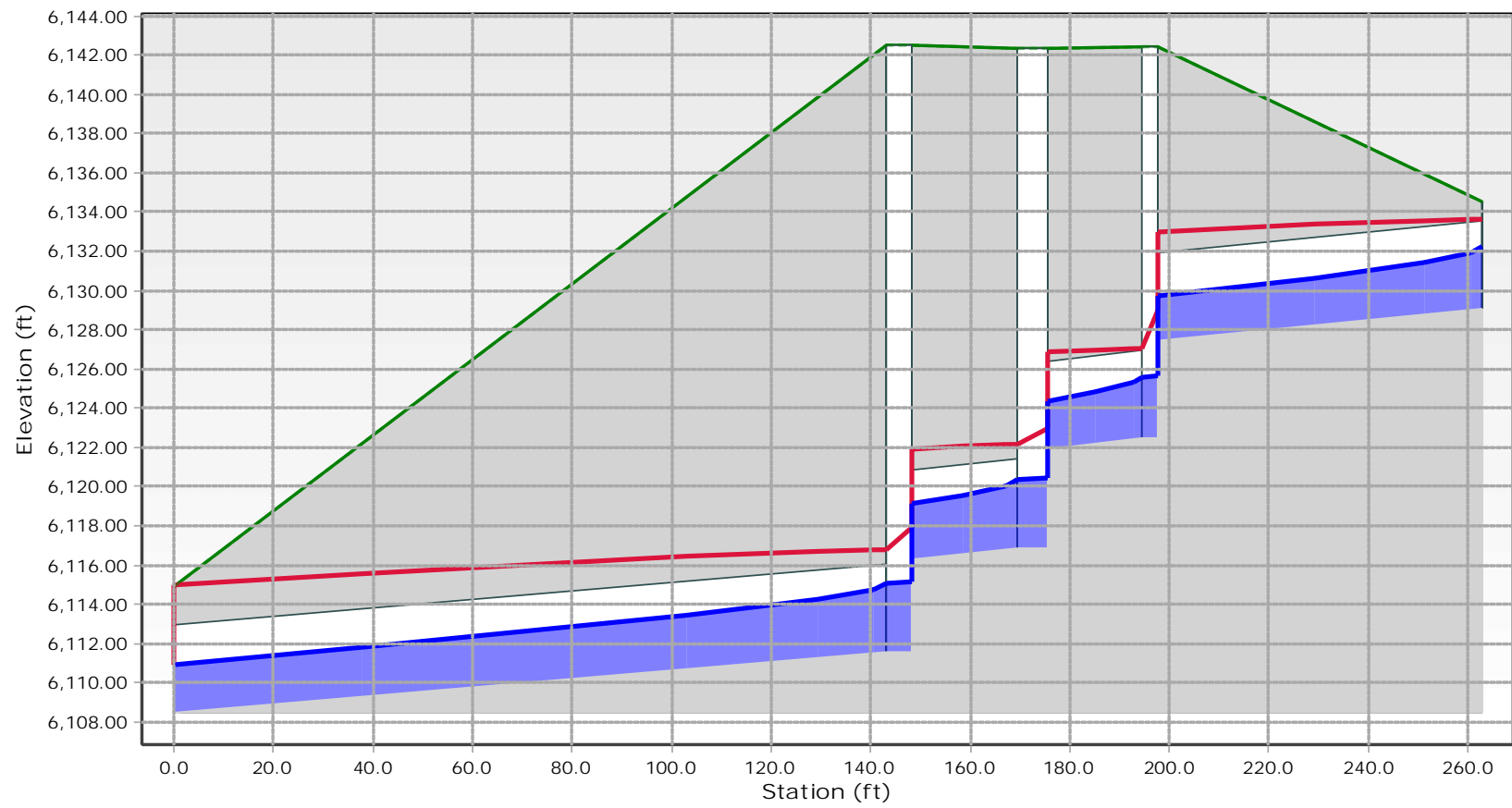
Pond B Outfall - 100-Year



DP20 North Culvert - 100-Year

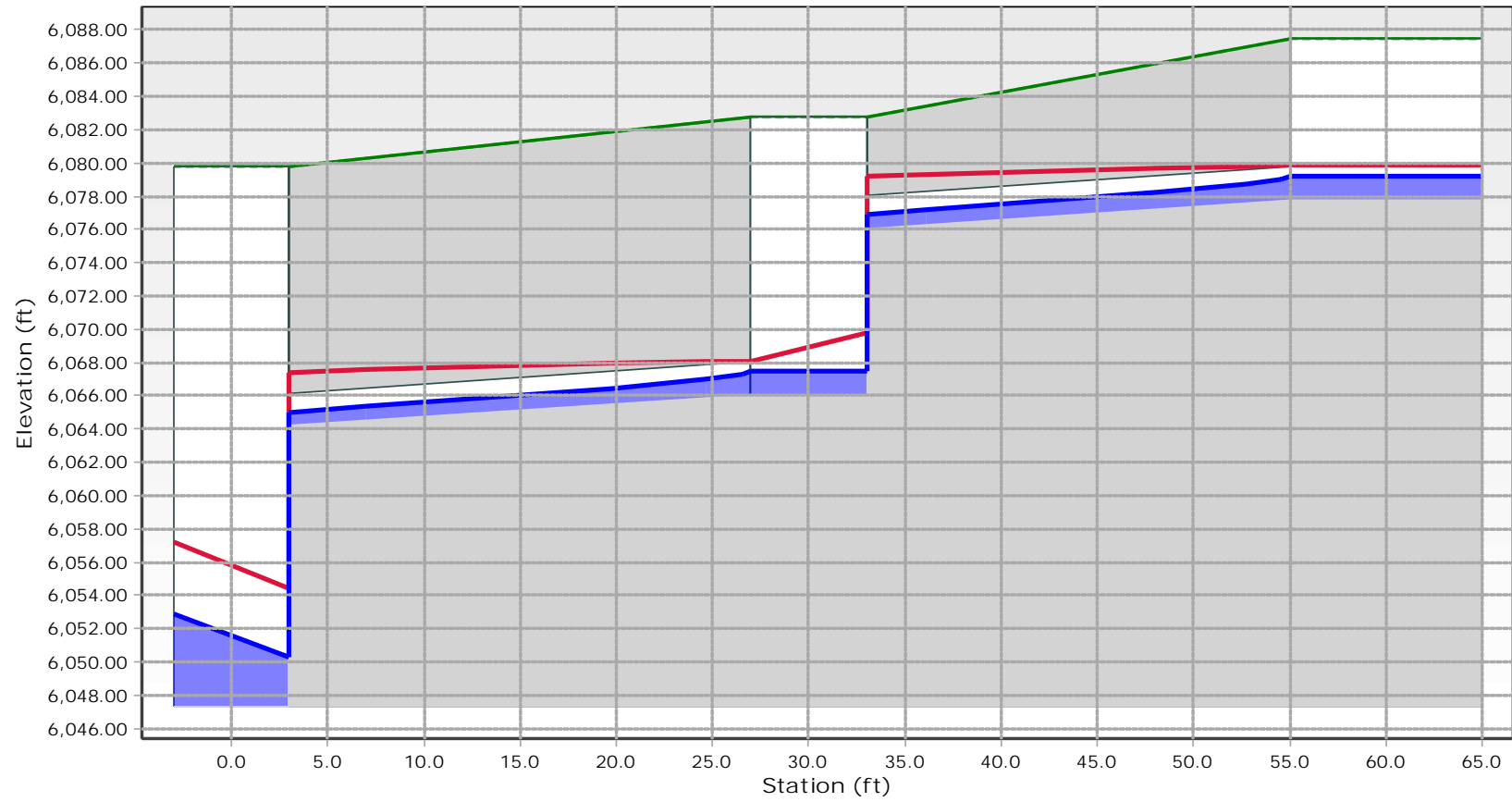


DP20 South Culvert - 100-Year

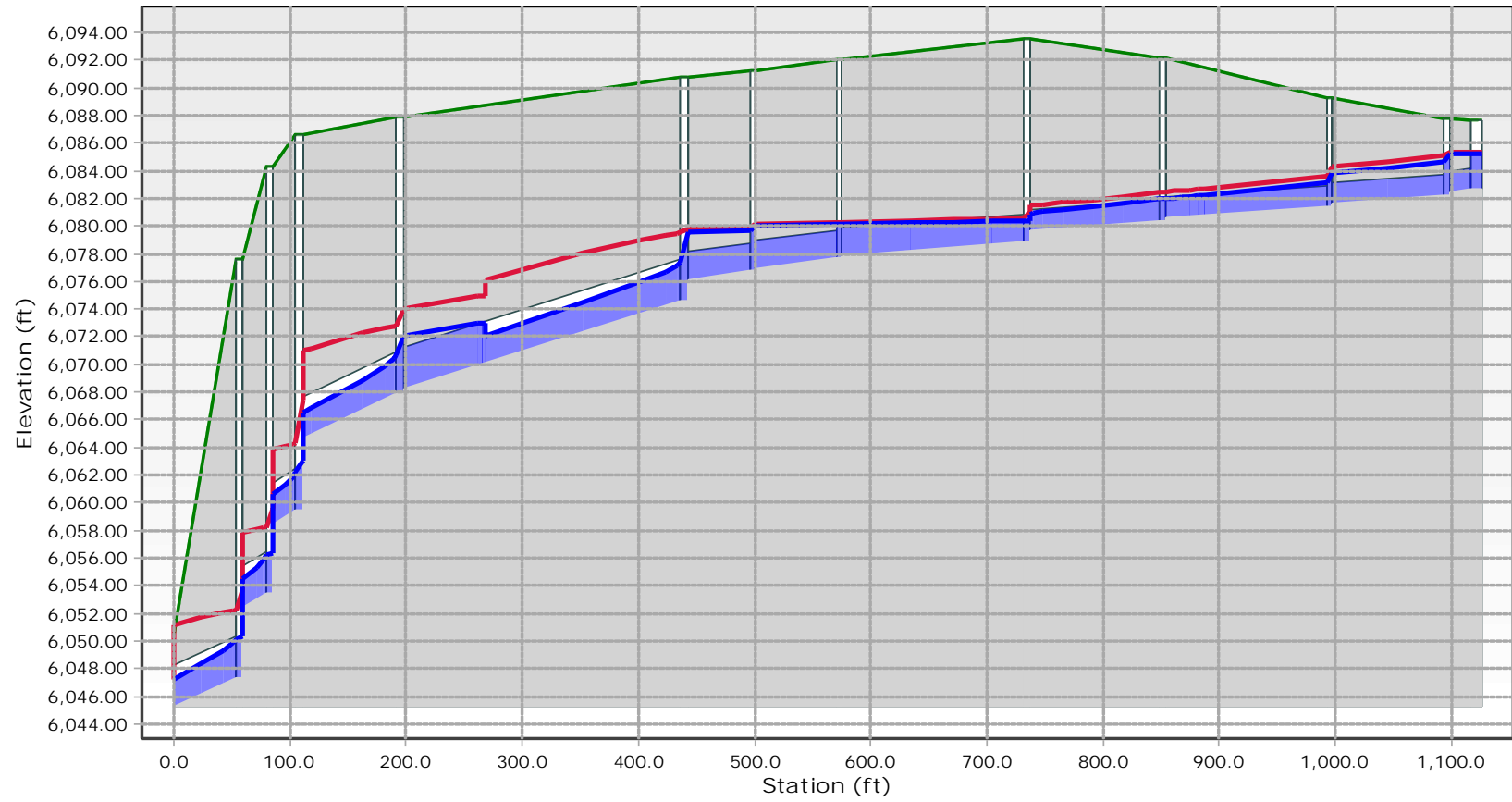




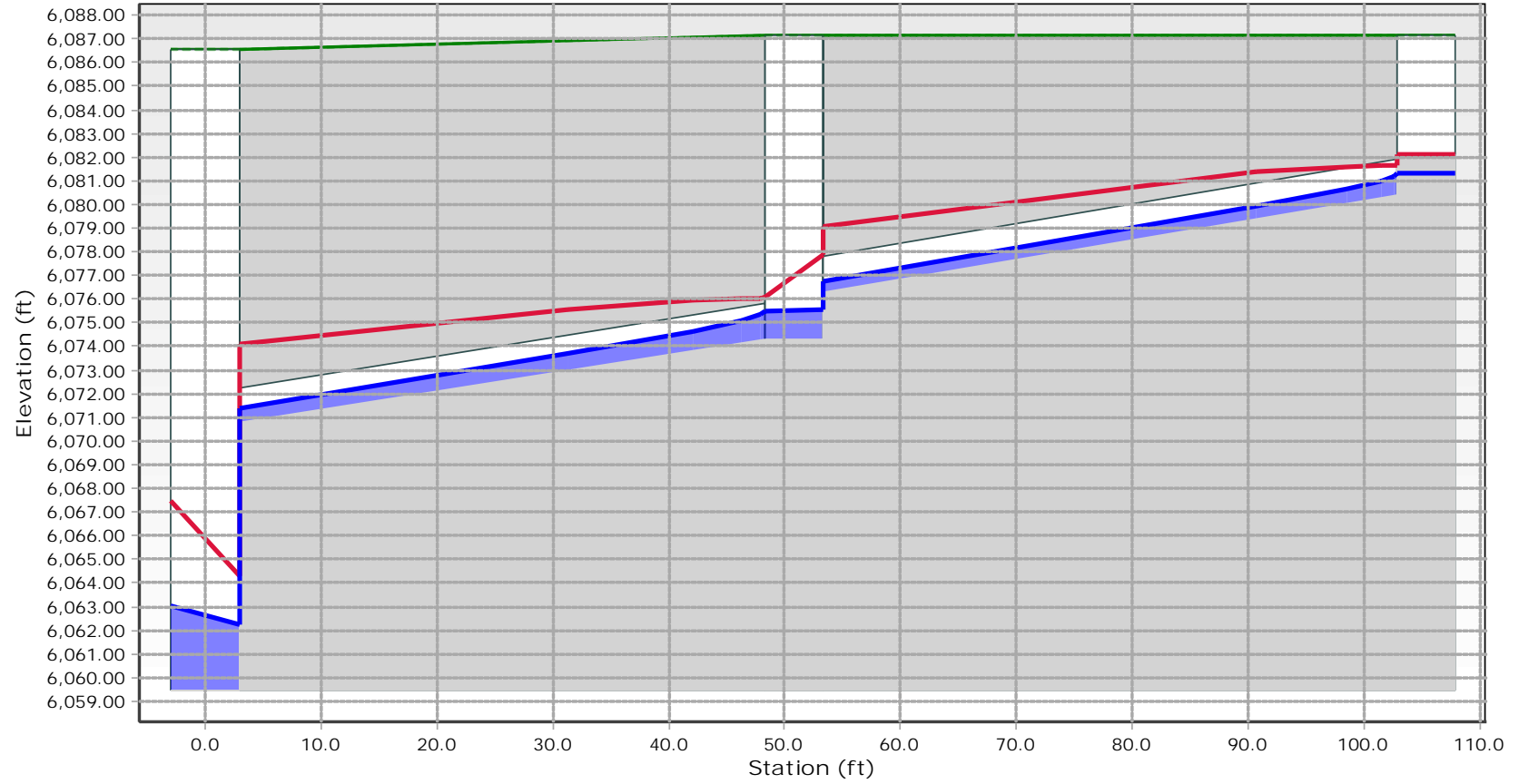
DP21 - 100-Year



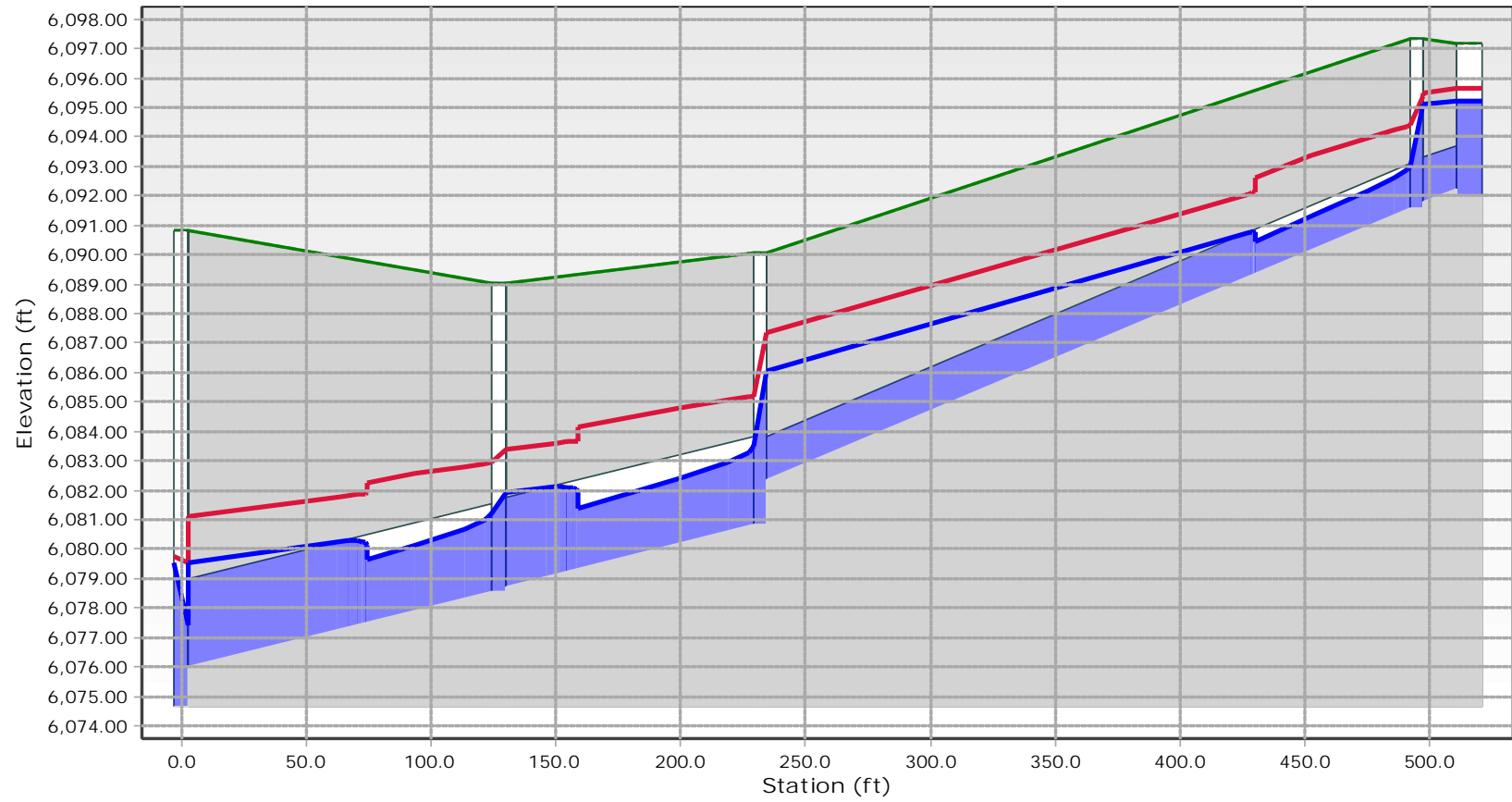
DP22 - 100-Year



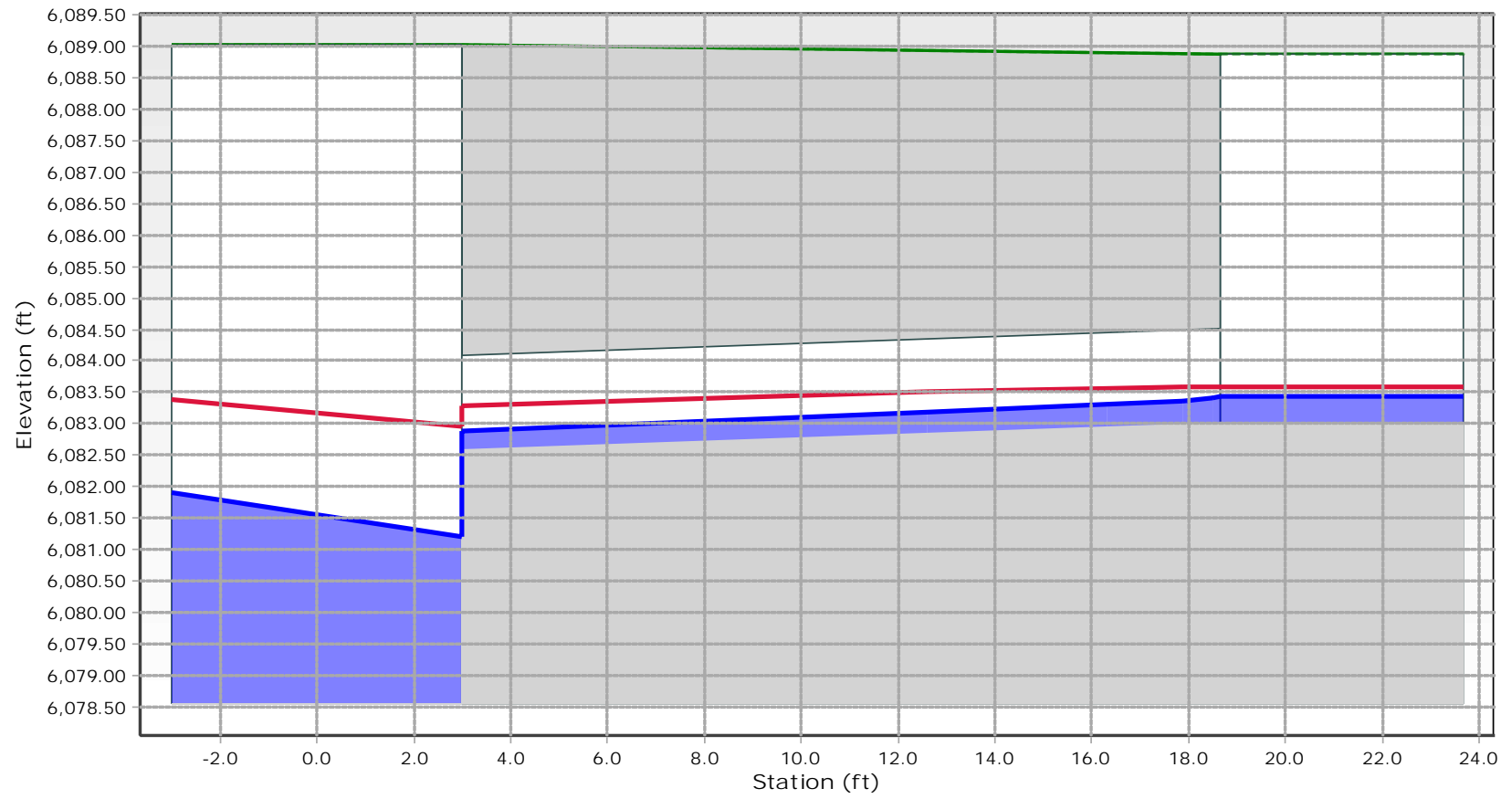
DP23 - 100-Year



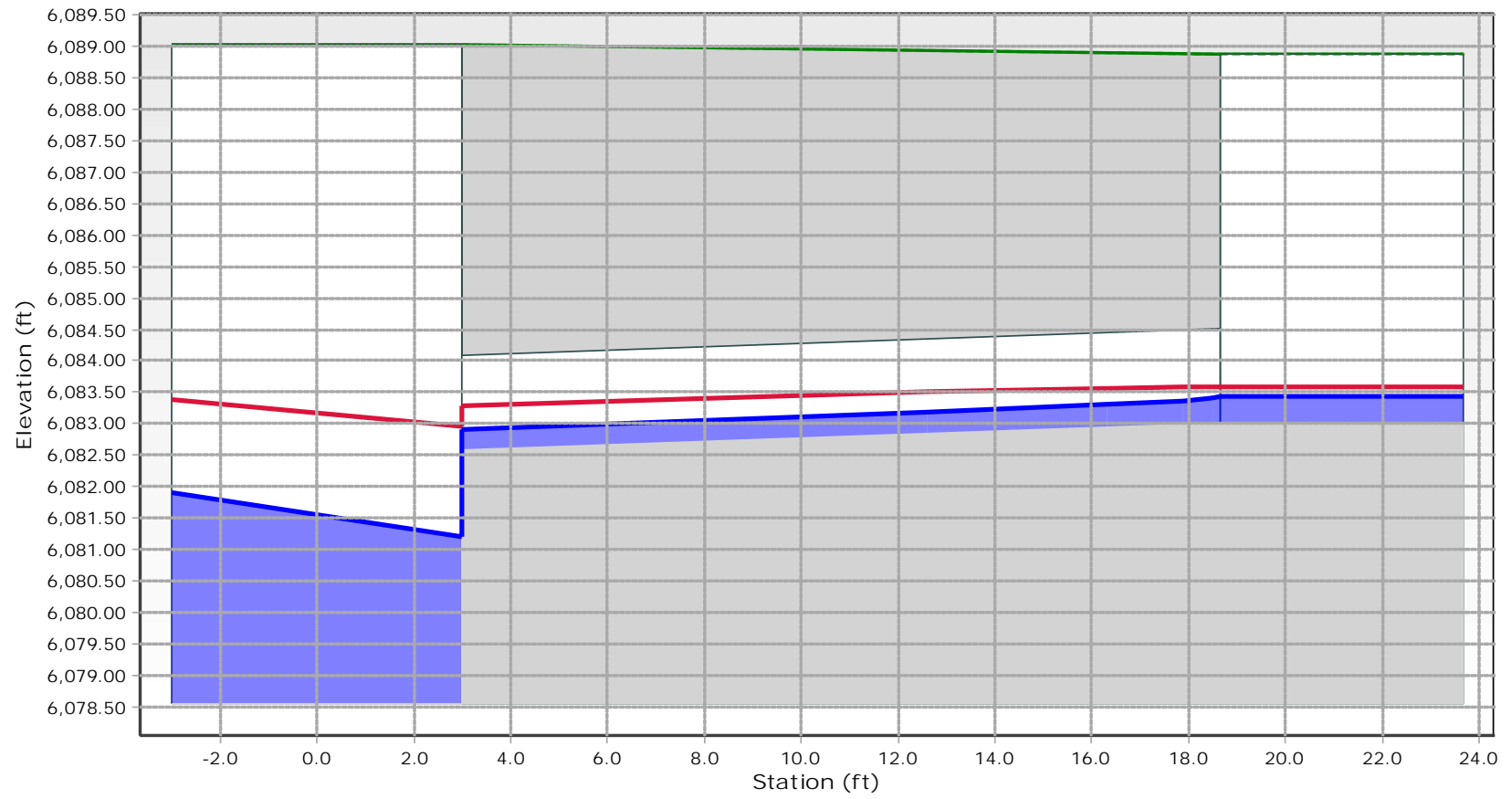
DP24 - 100-Year



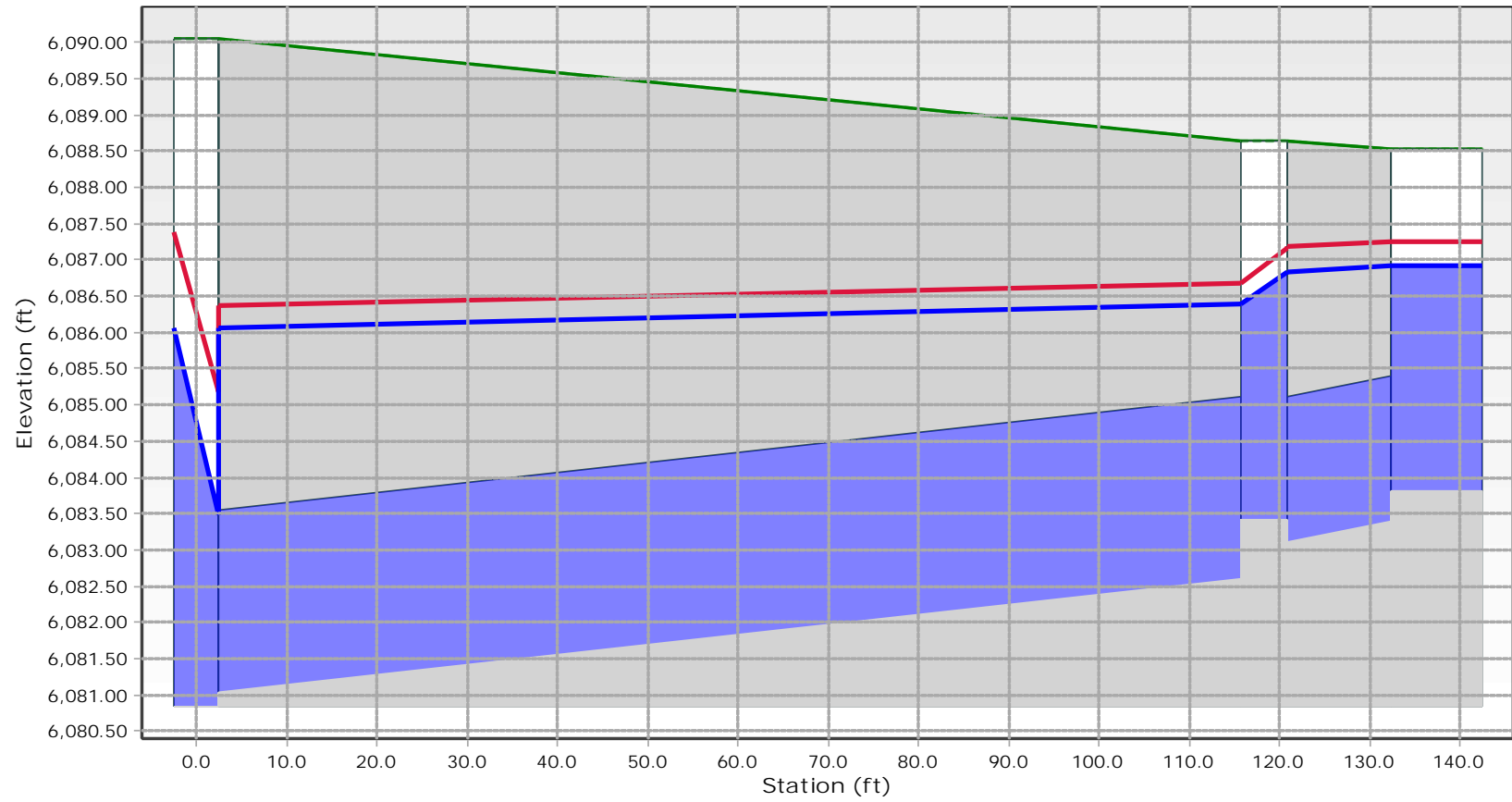
DP25 - 100-Year



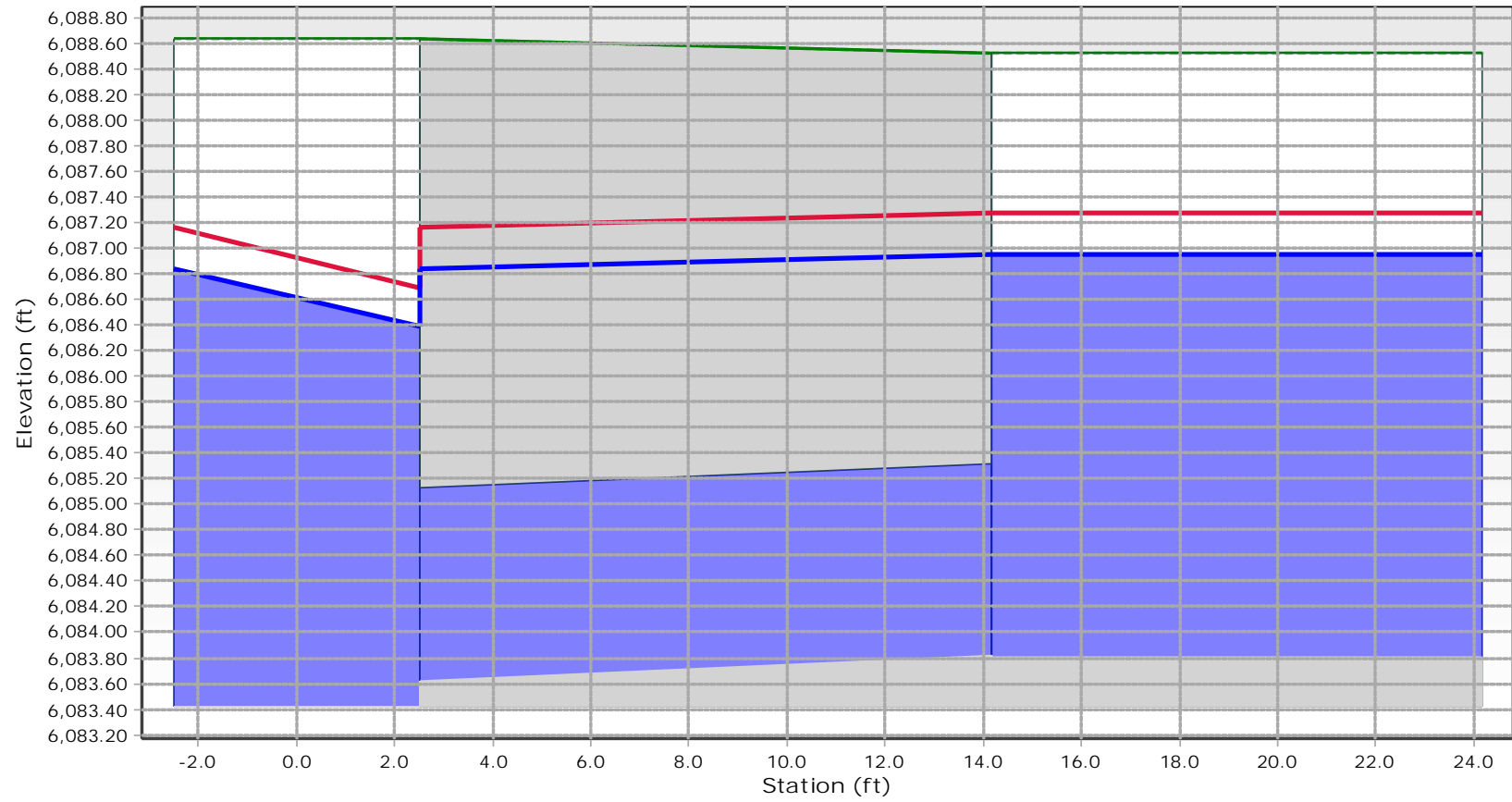
DP26 - 100-Year



DP27 - 100-Year

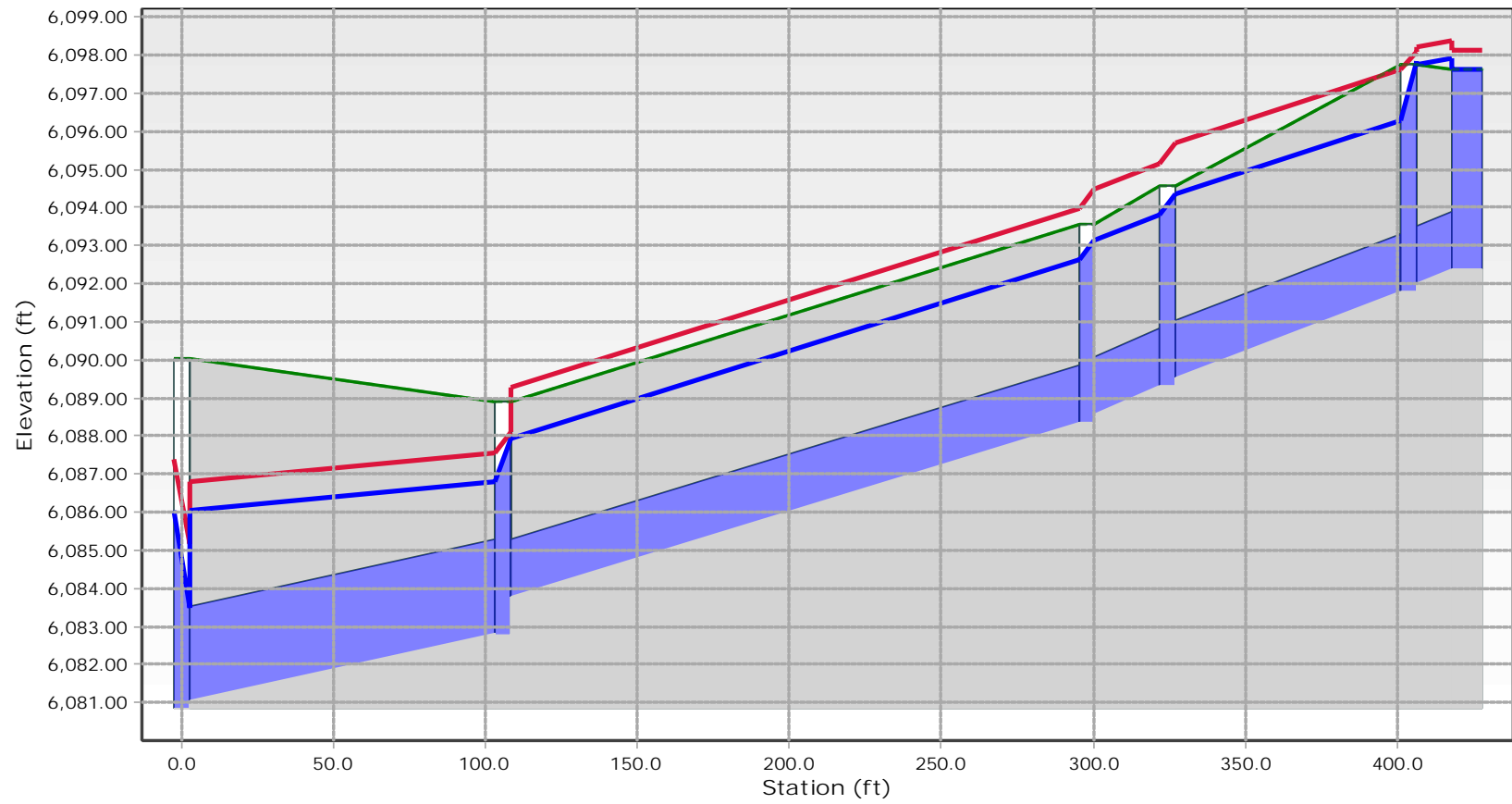


DP28 - 100-Year

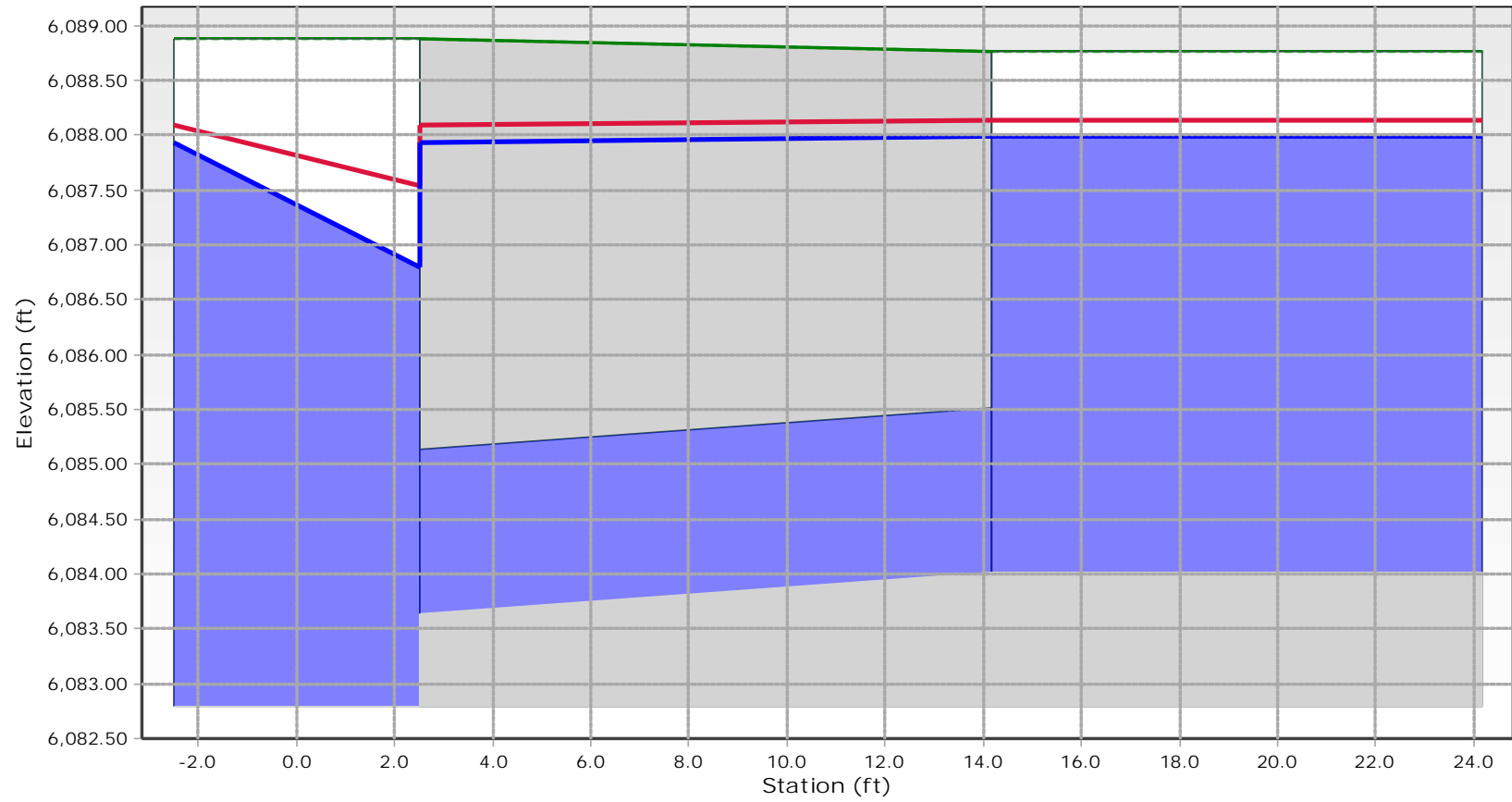




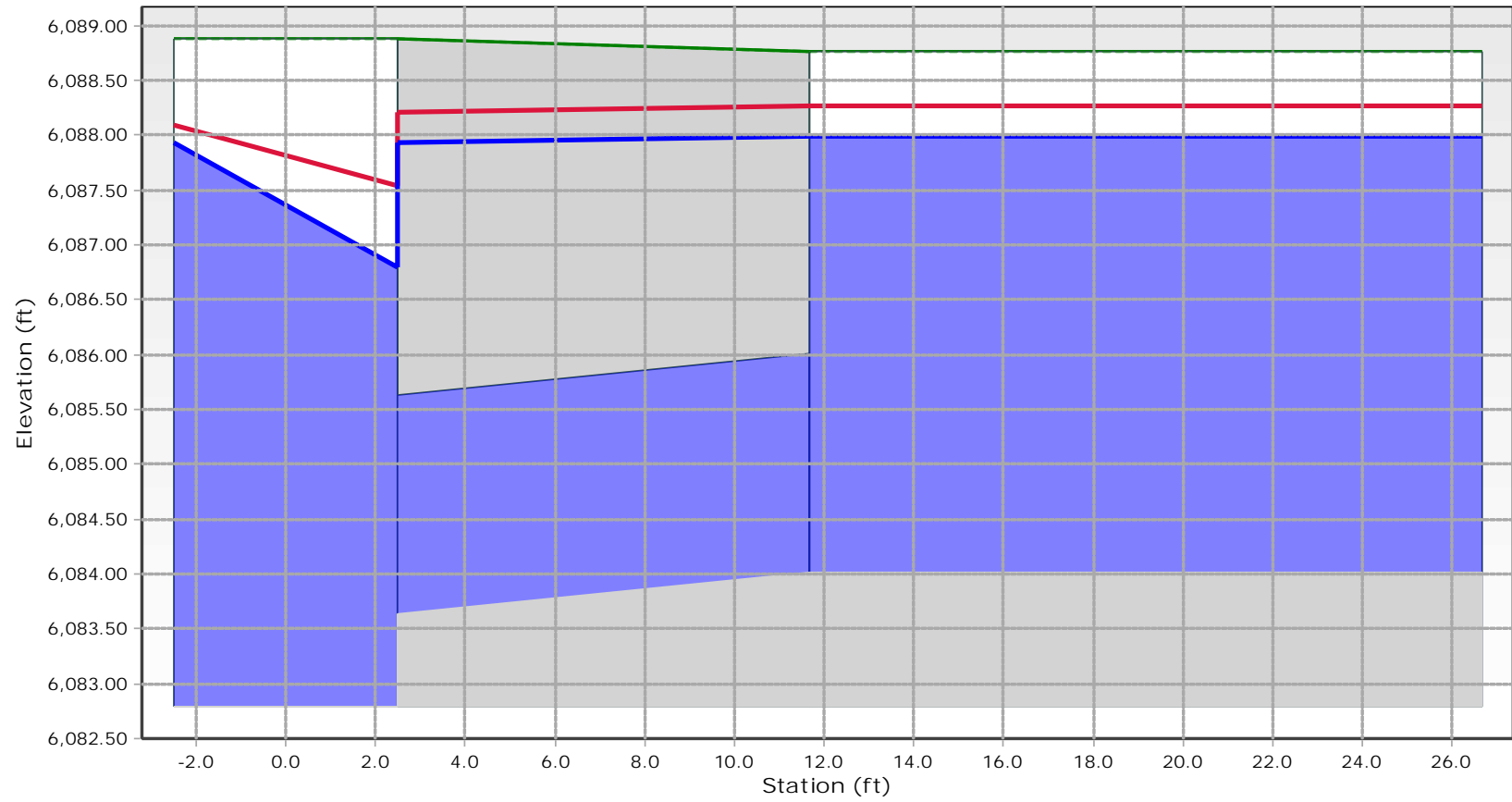
DP29 - 100-Year



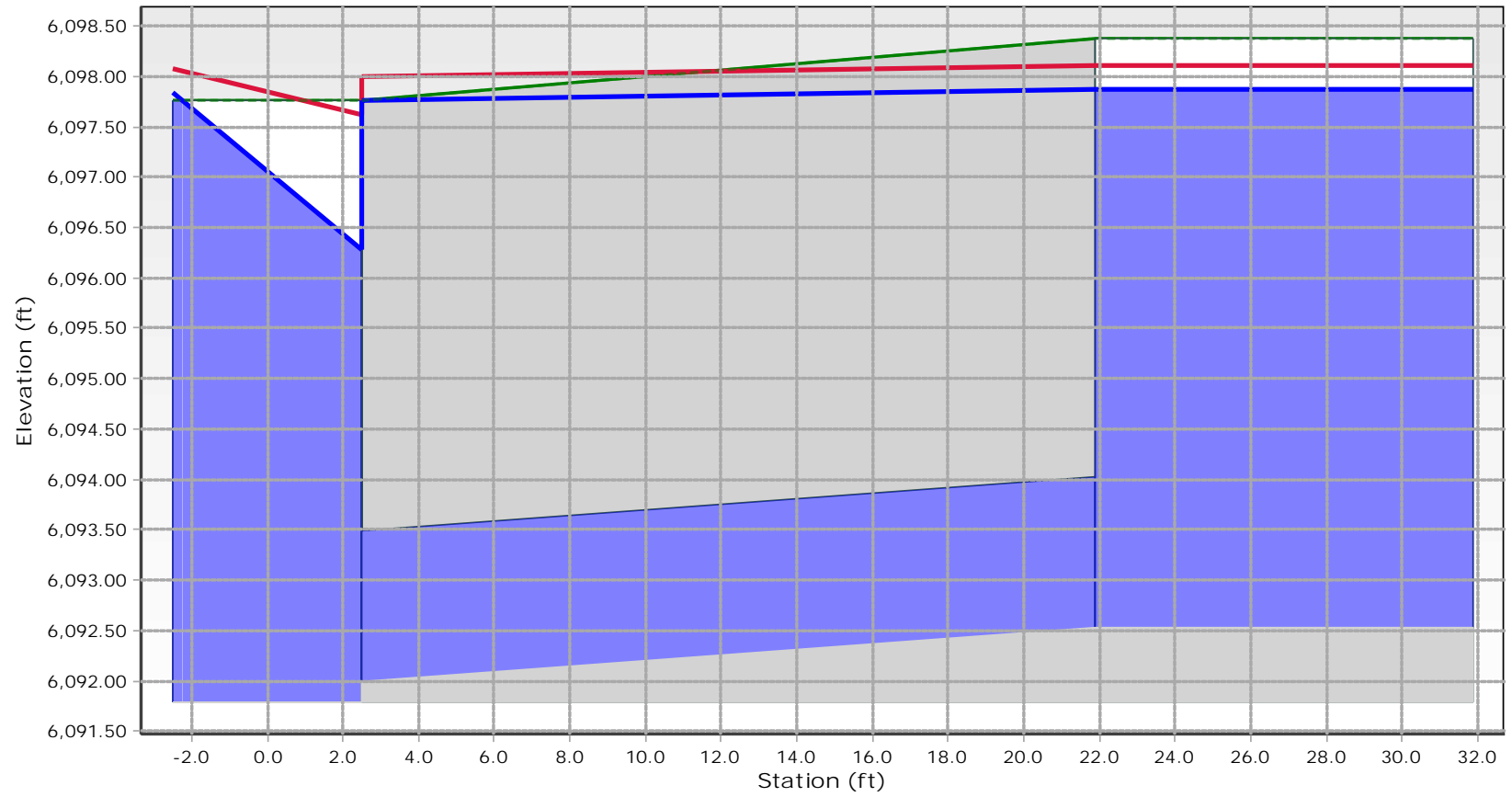
DP30 - 100-Year



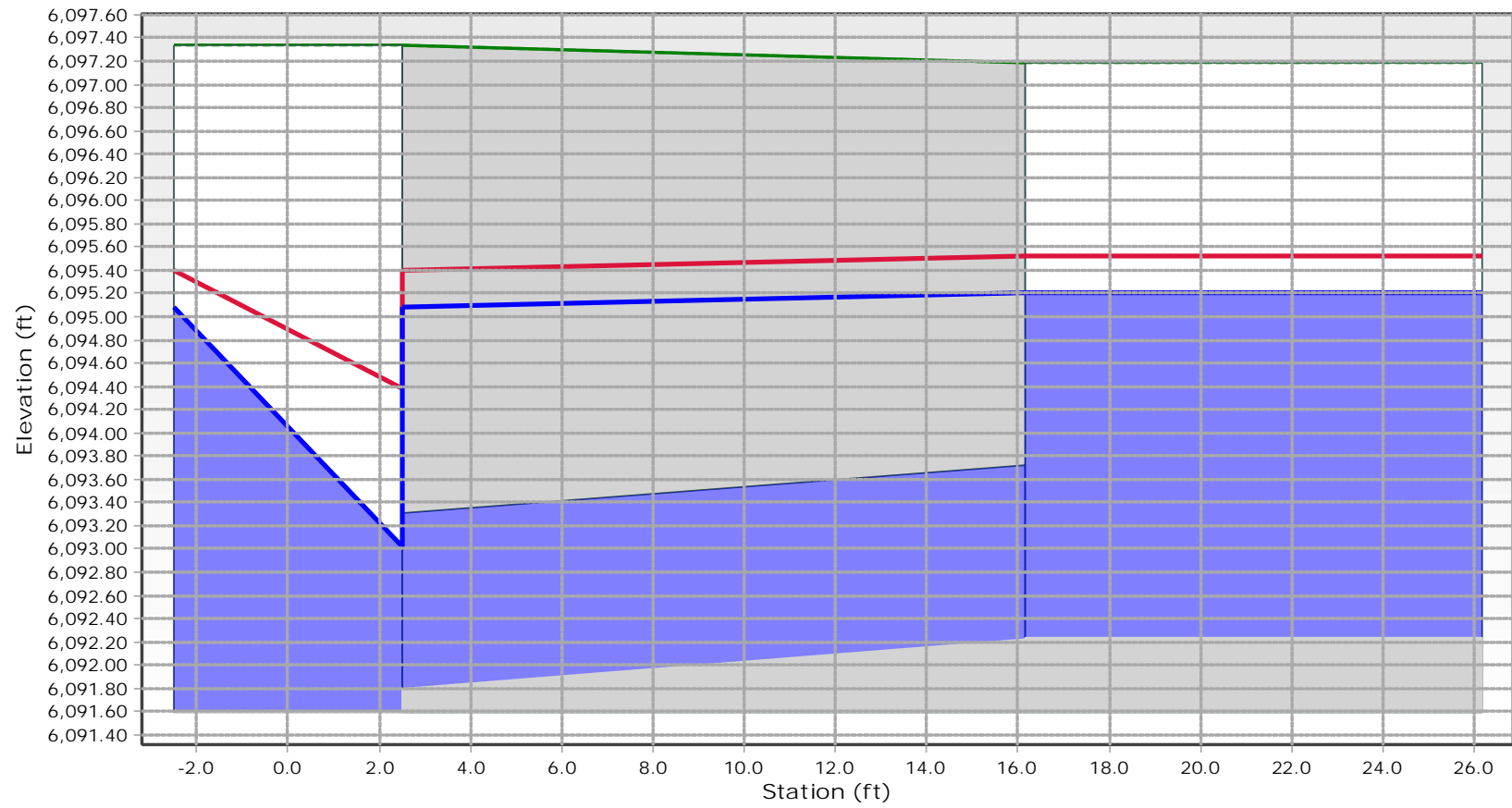
DP31 - 100-Year



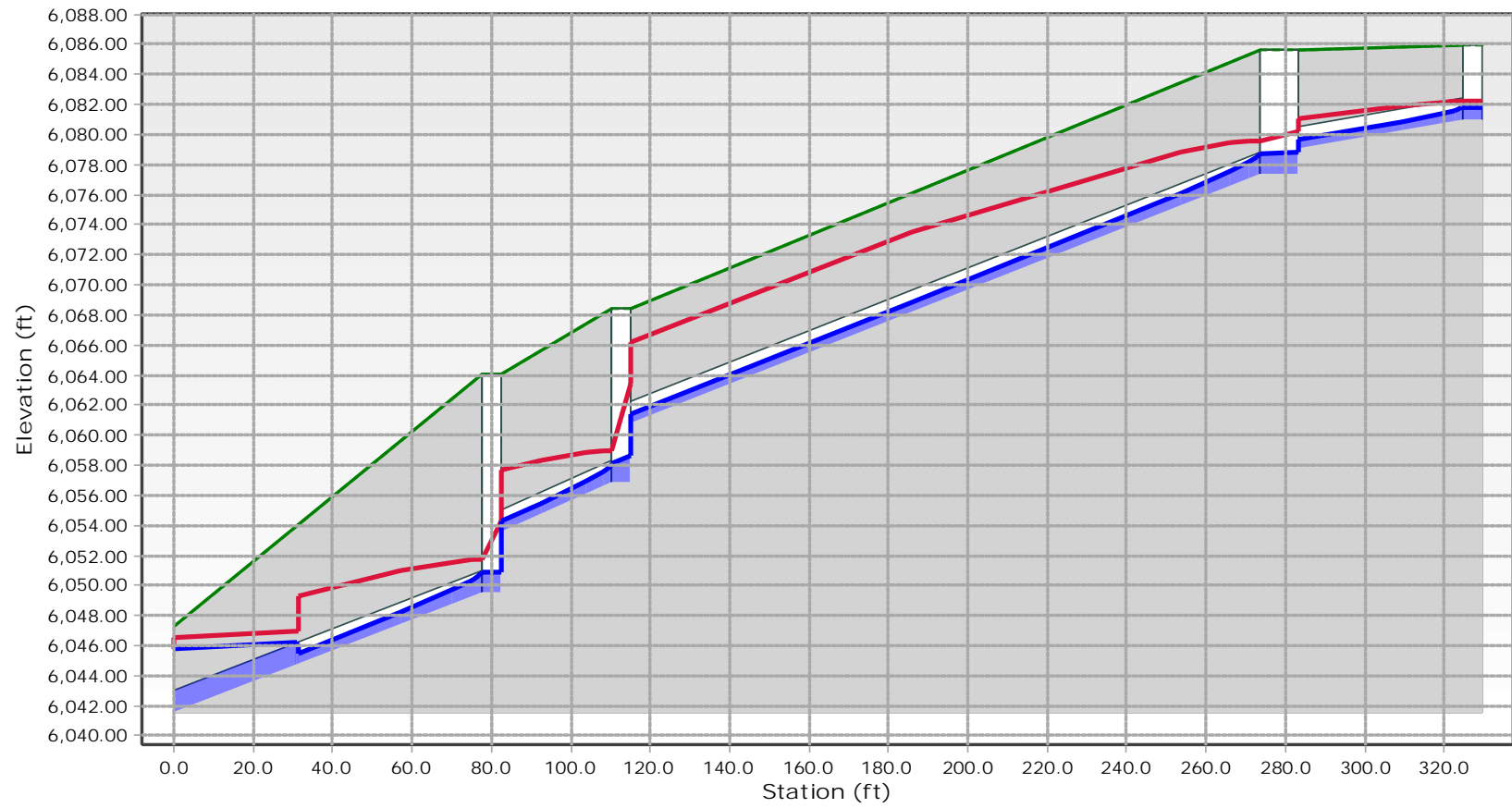
DP32 - 100-Year



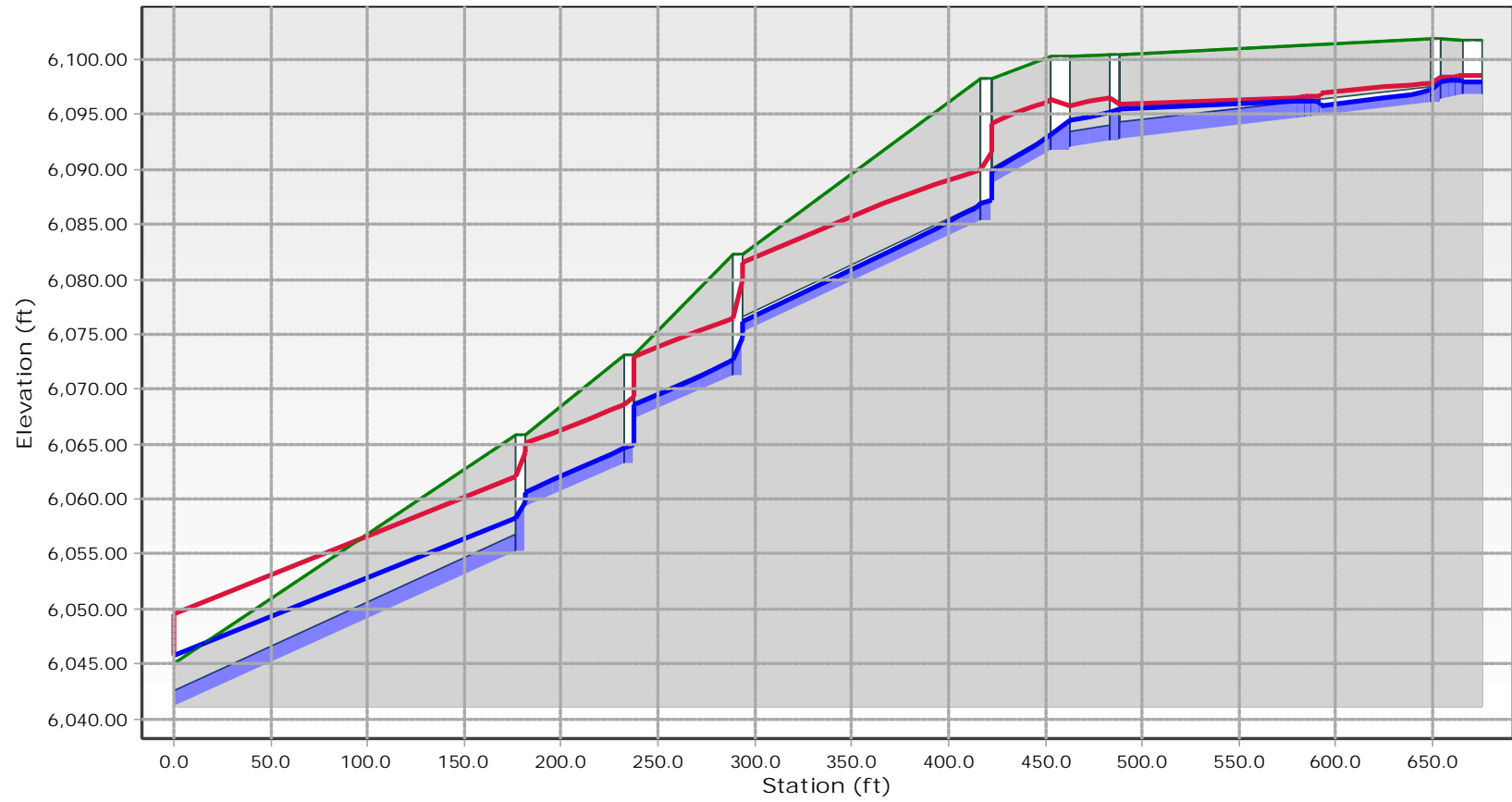
DP33 - 100-Year



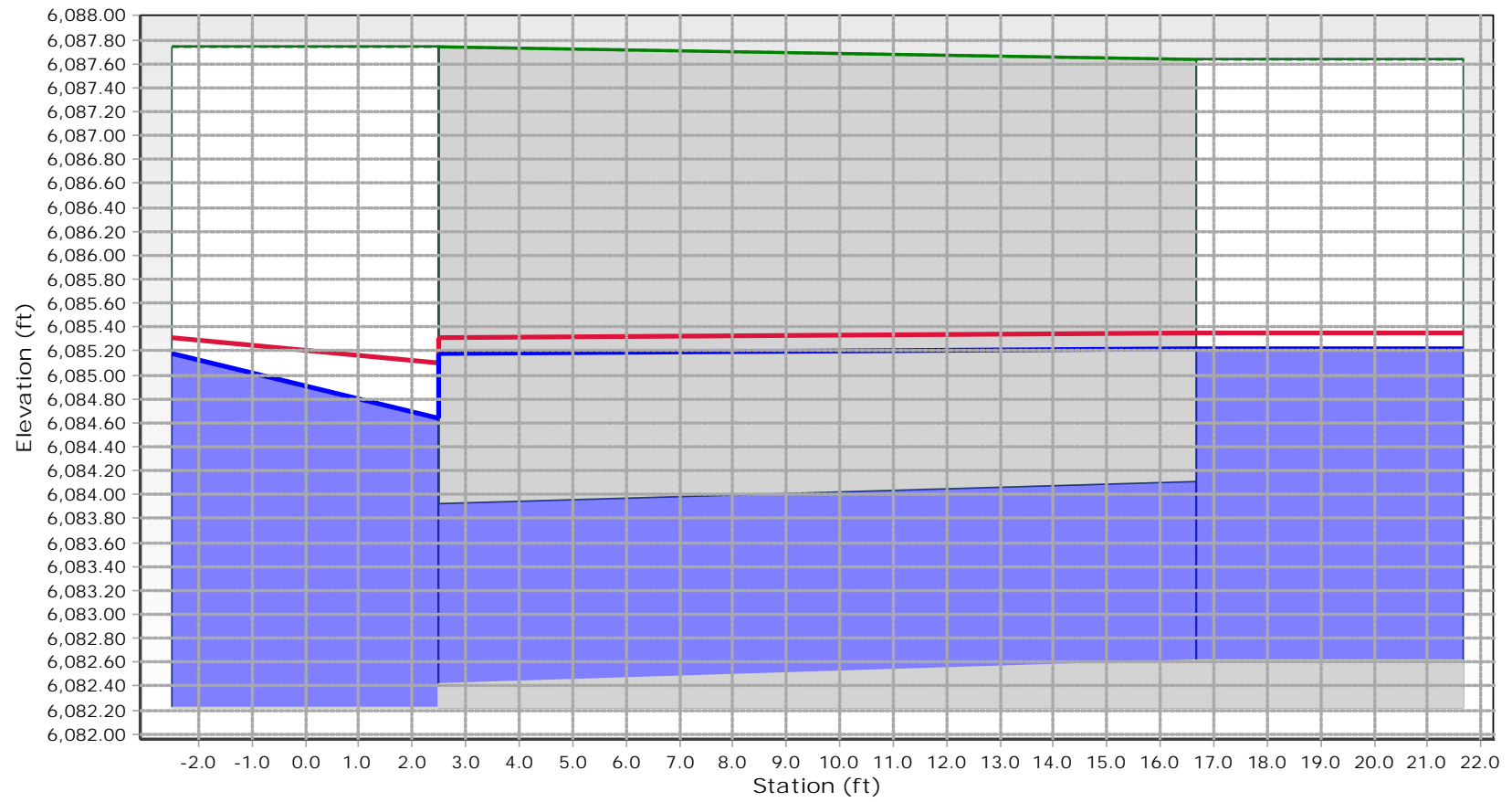
DP34 - 100-Year



DP35 - 100-Year

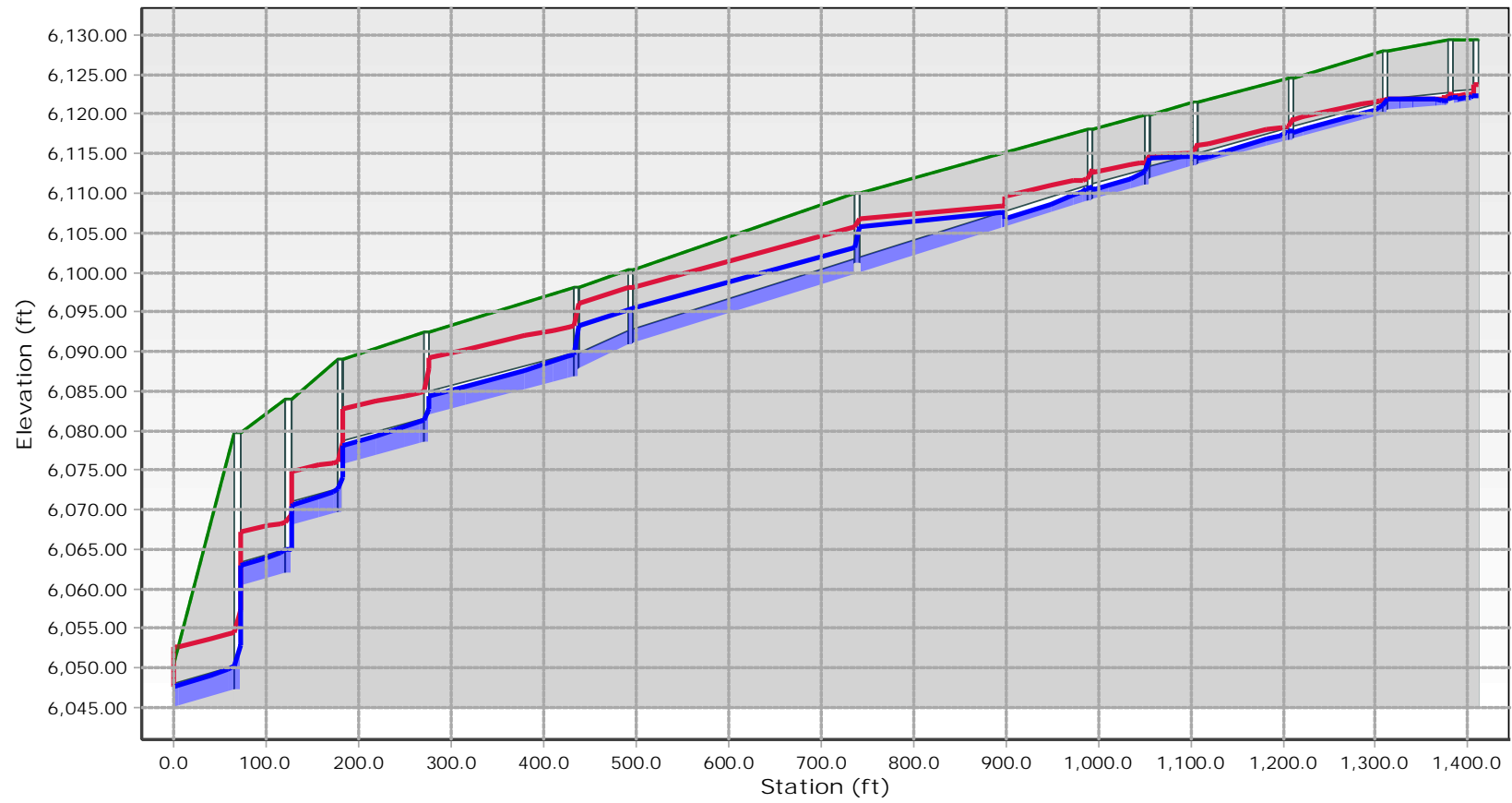


DP36 - 100-Year

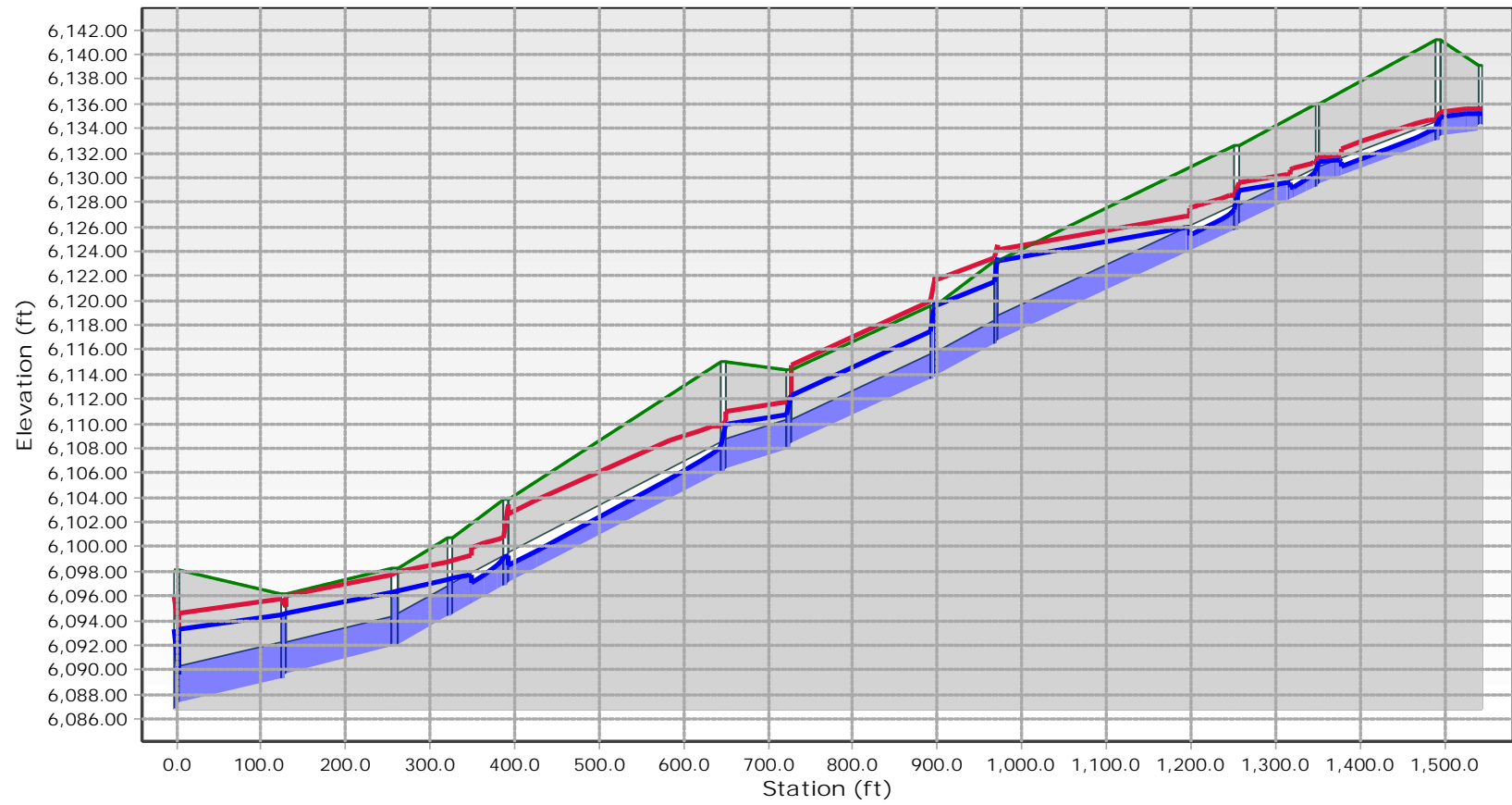




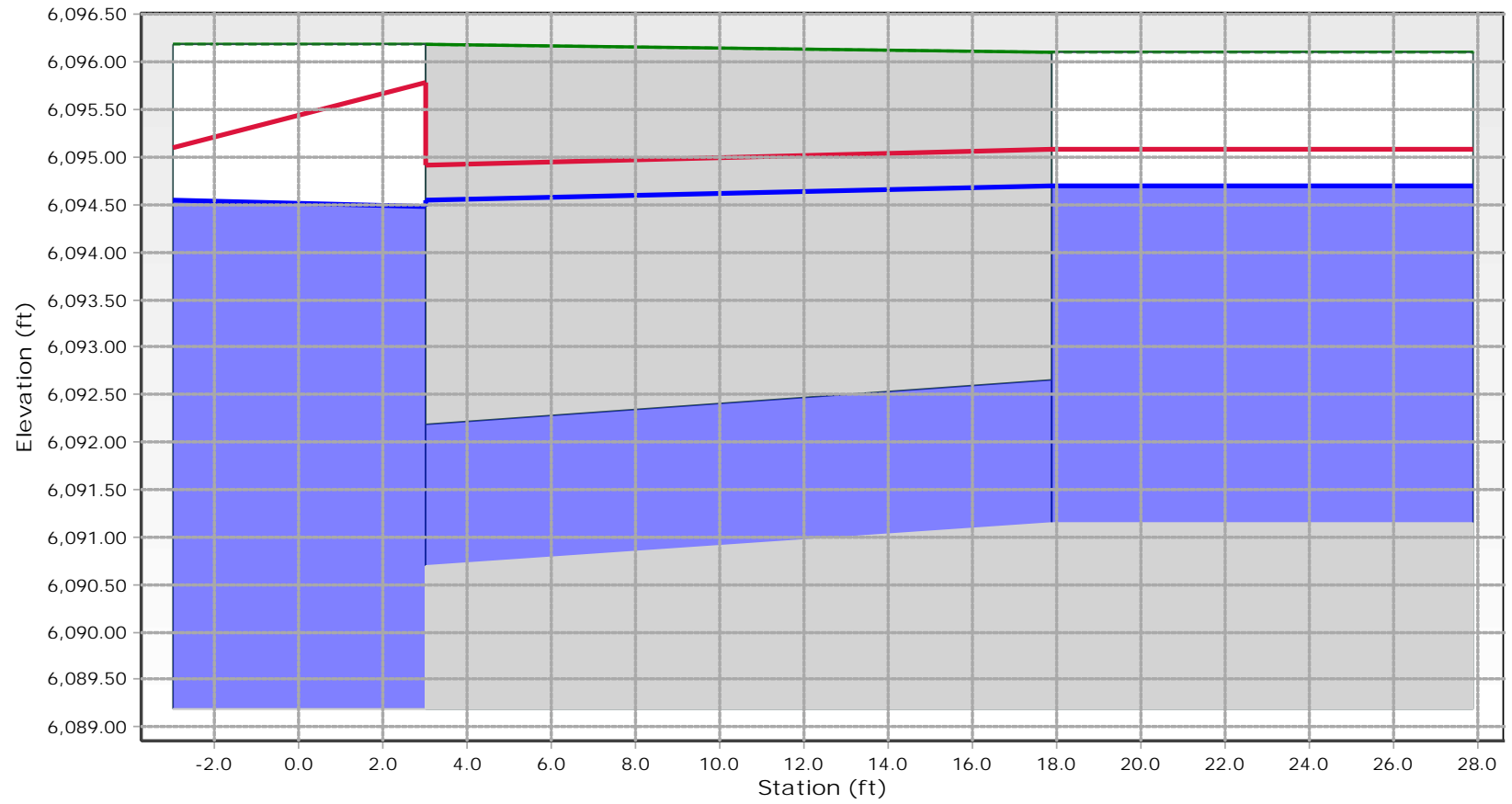
DP37 - 100-Year



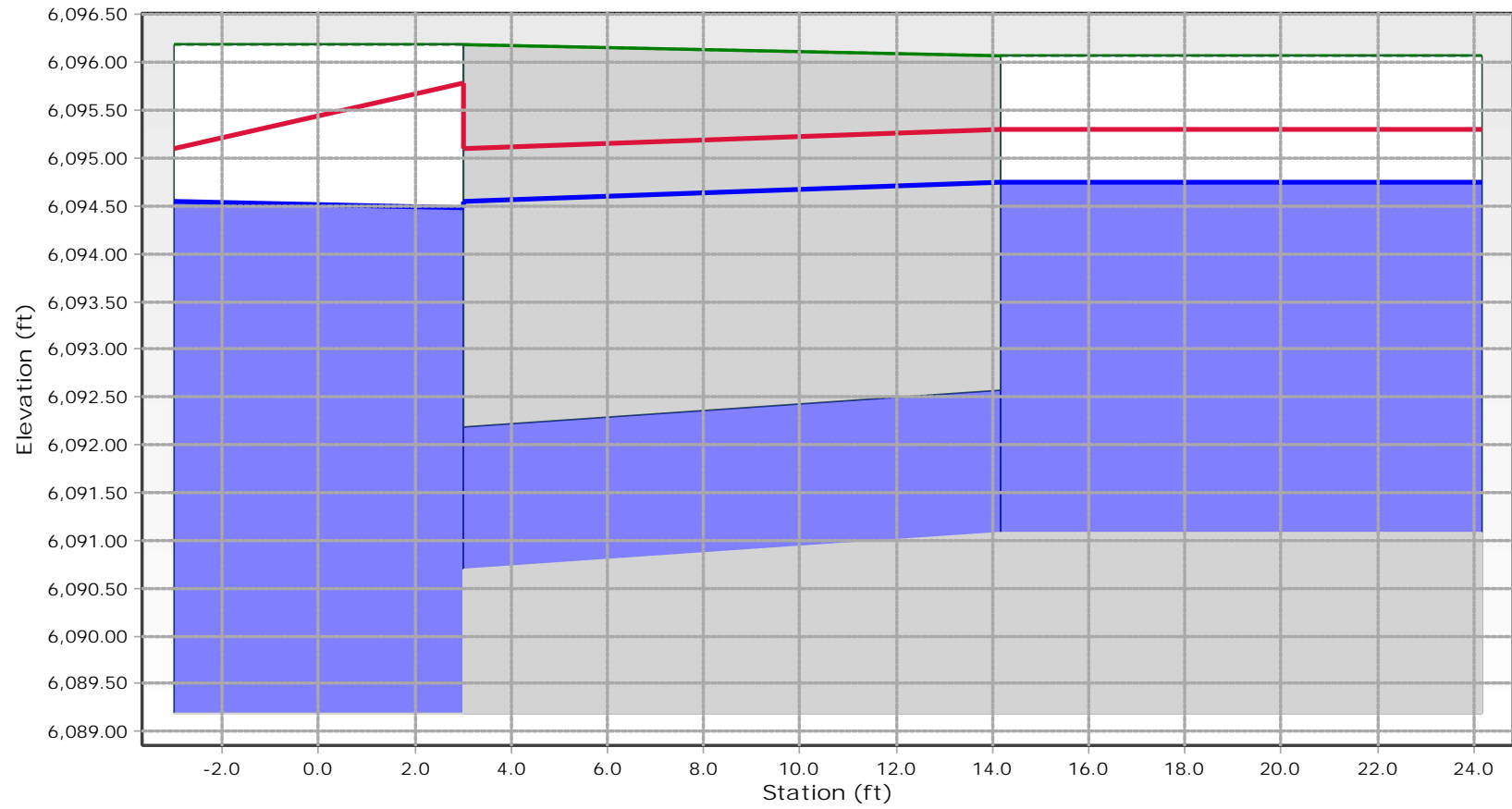
DP38 - 100-Year



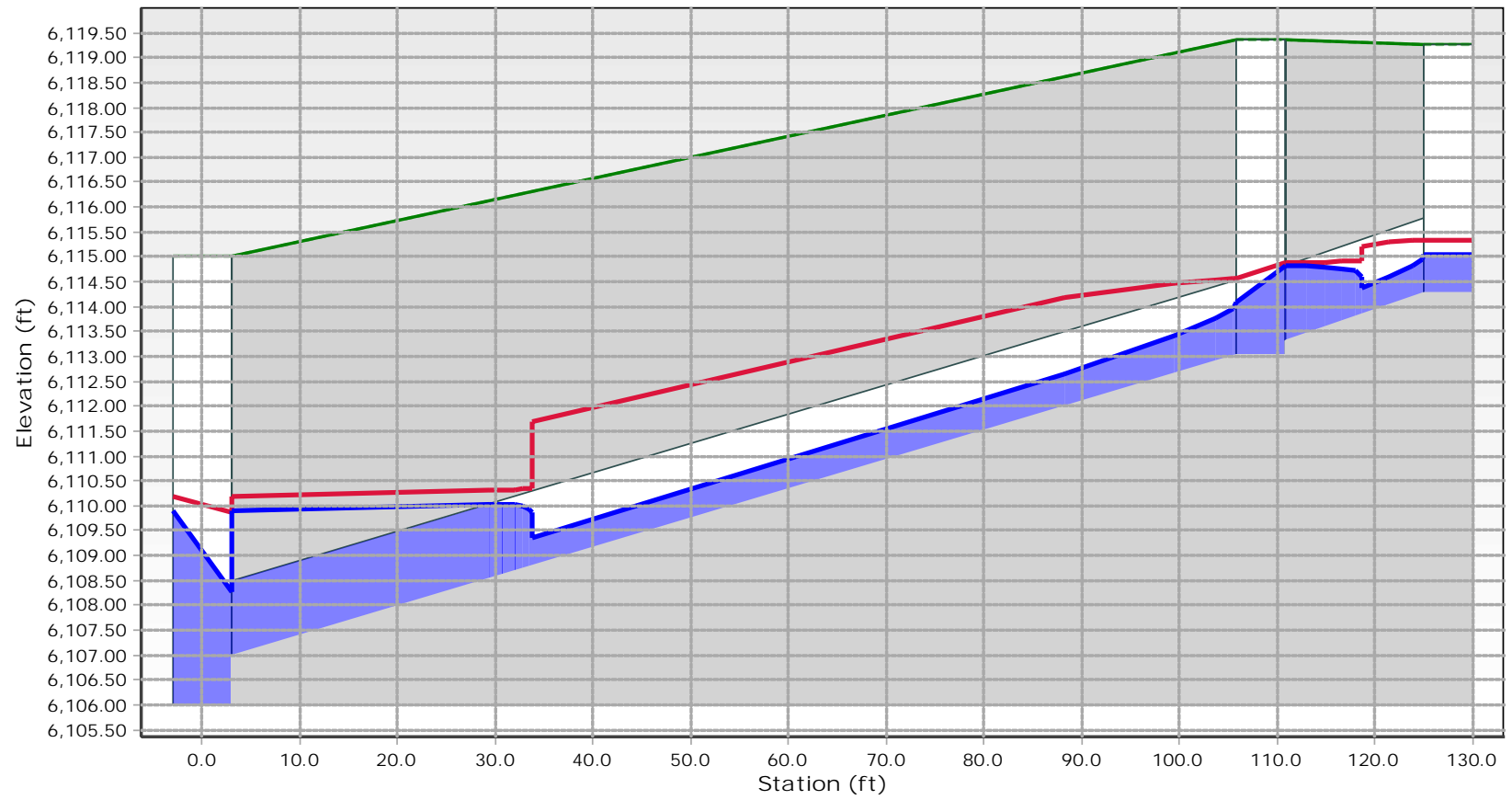
DP39 - 100-Year



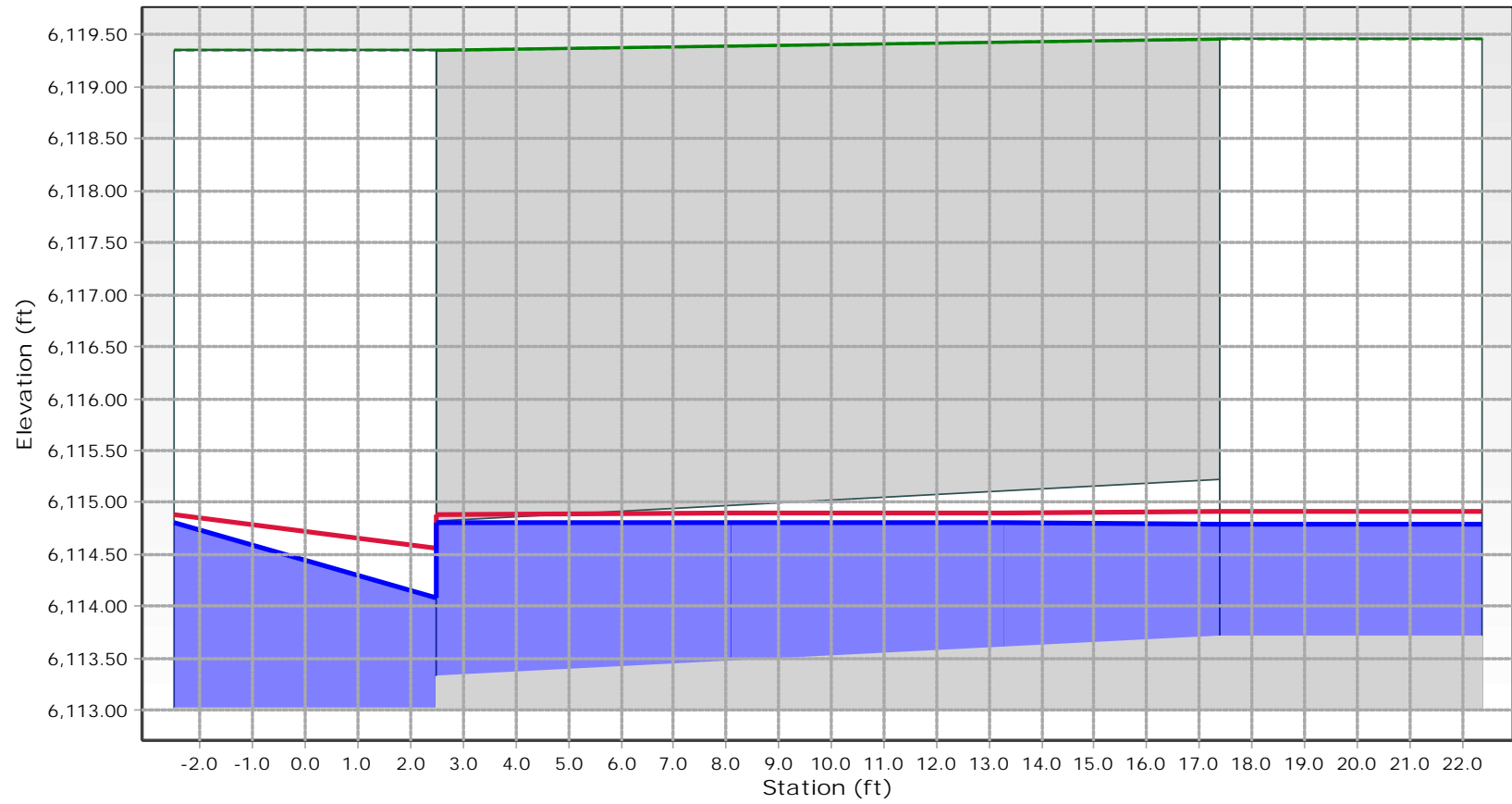
DP40 - 100-Year



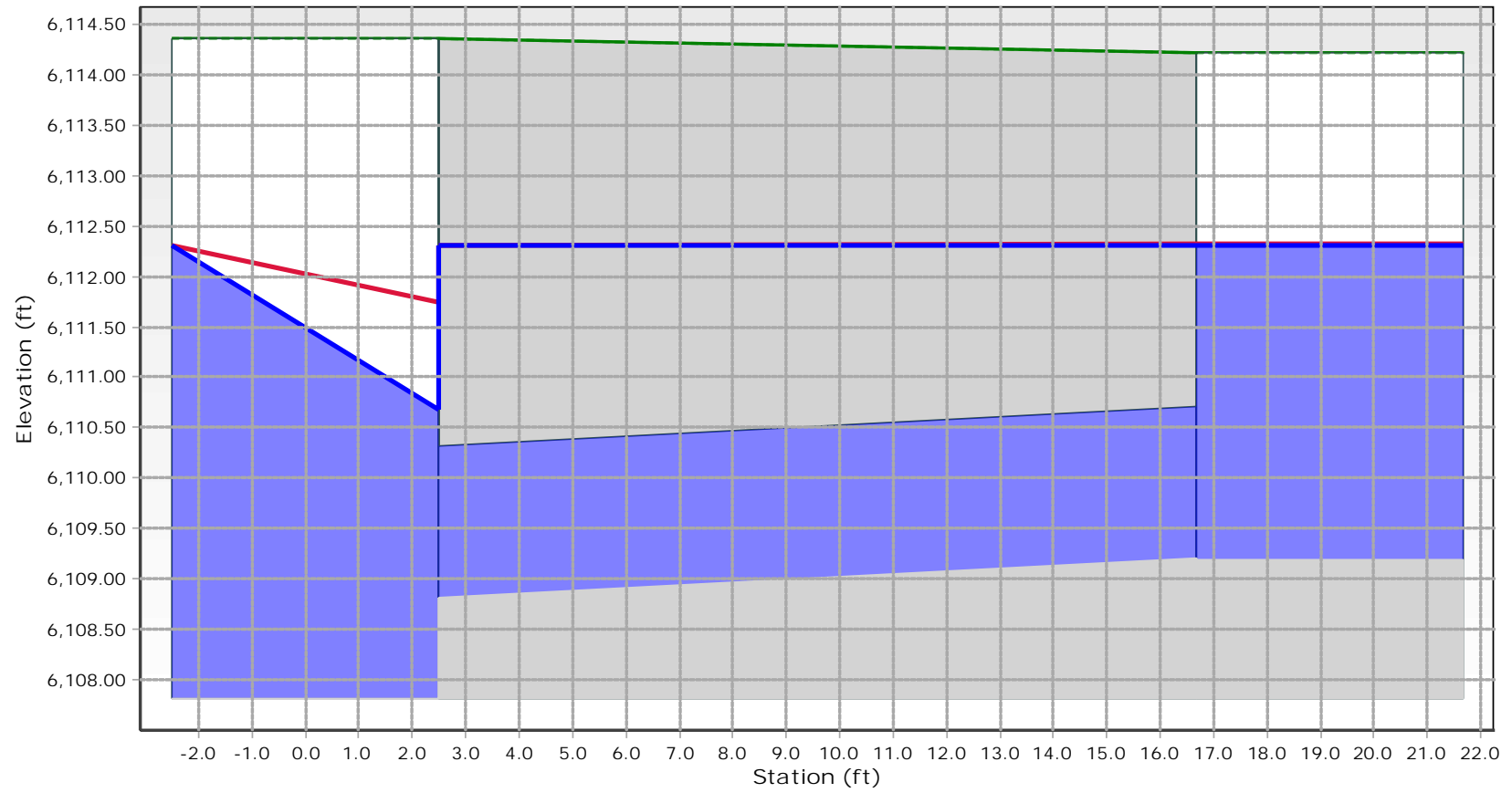
DP41 - 100-Year



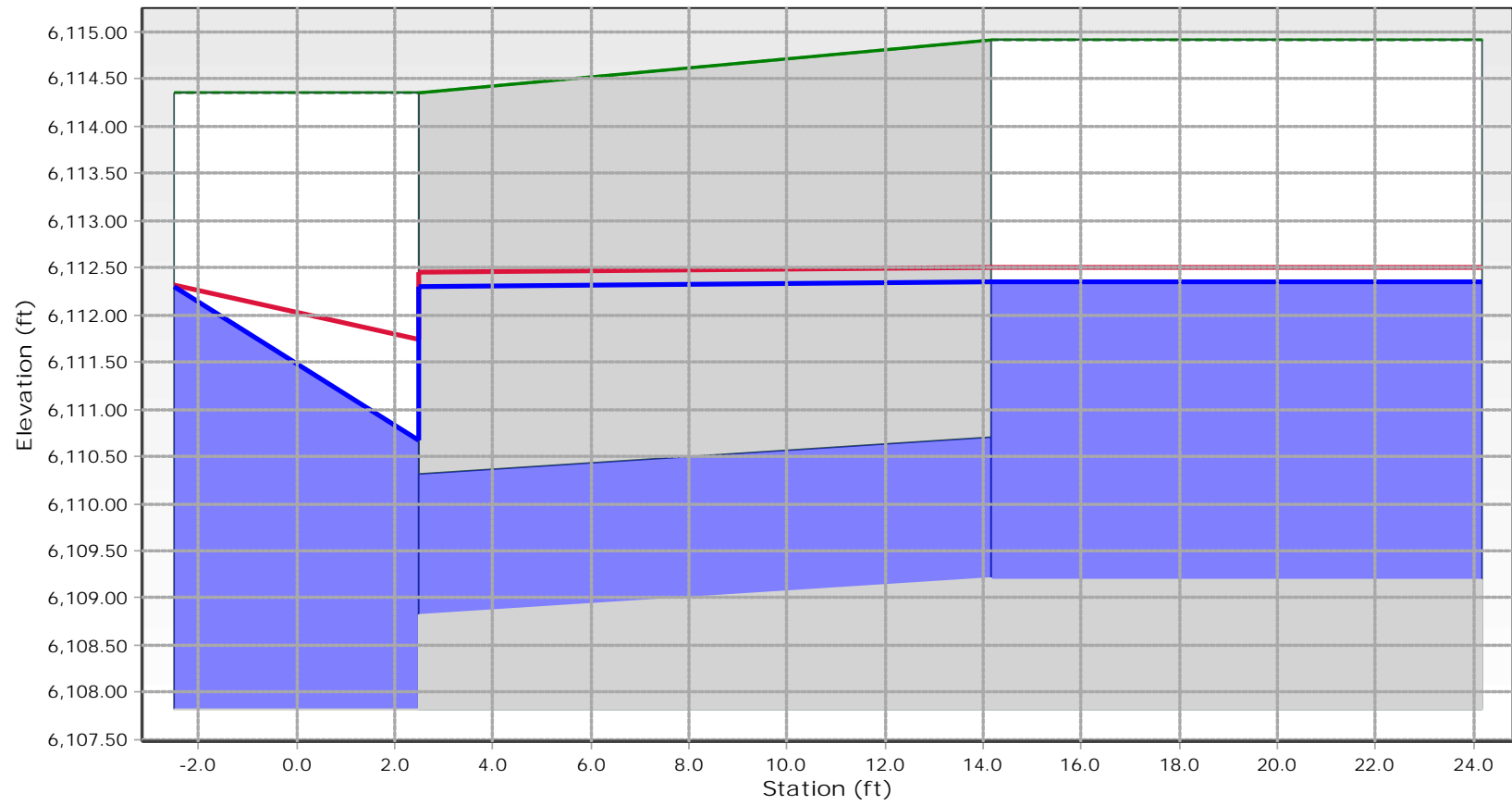
DP42 - 100-Year



DP43 - 100-Year

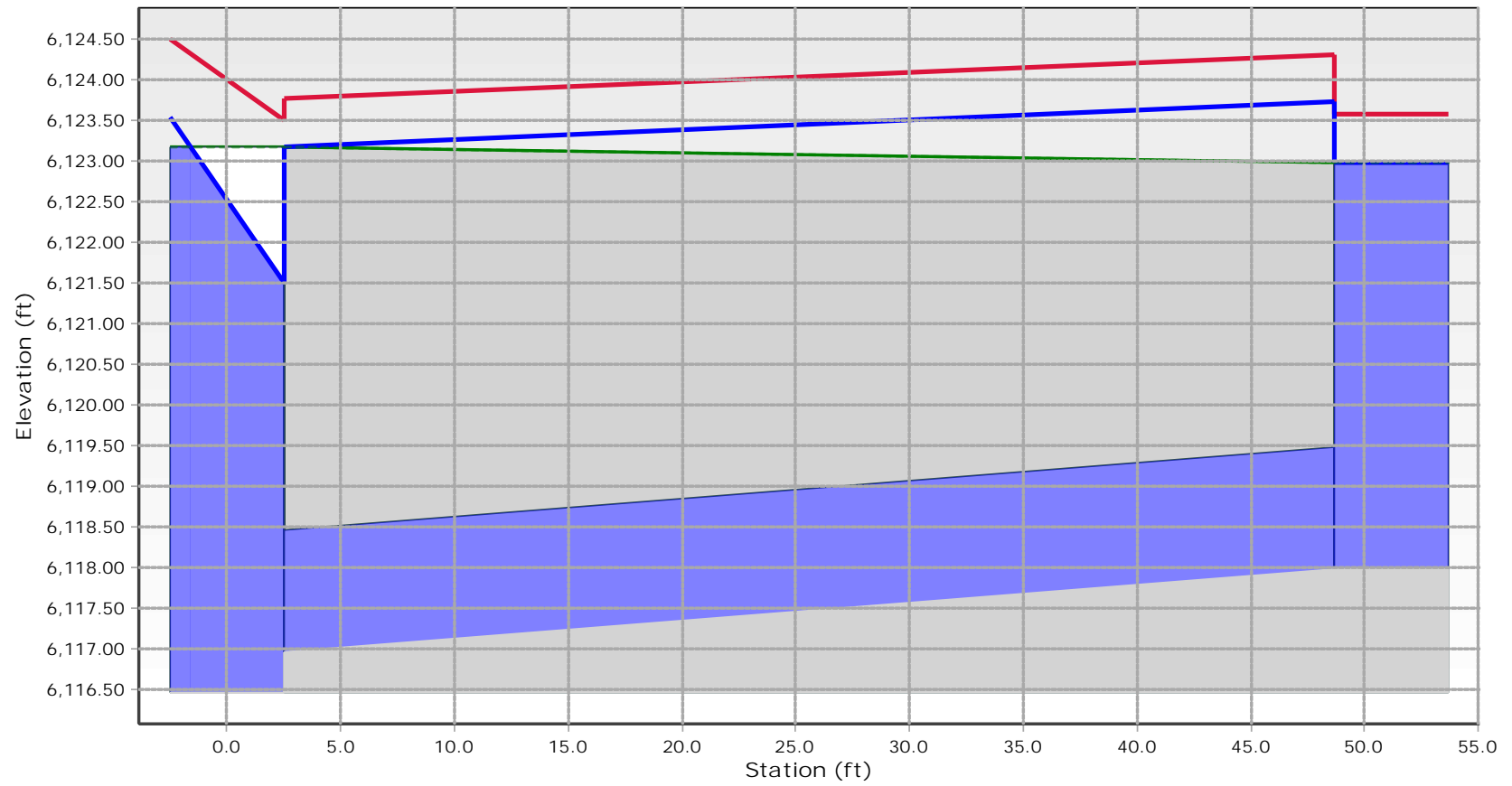


DP44 - 100-Year

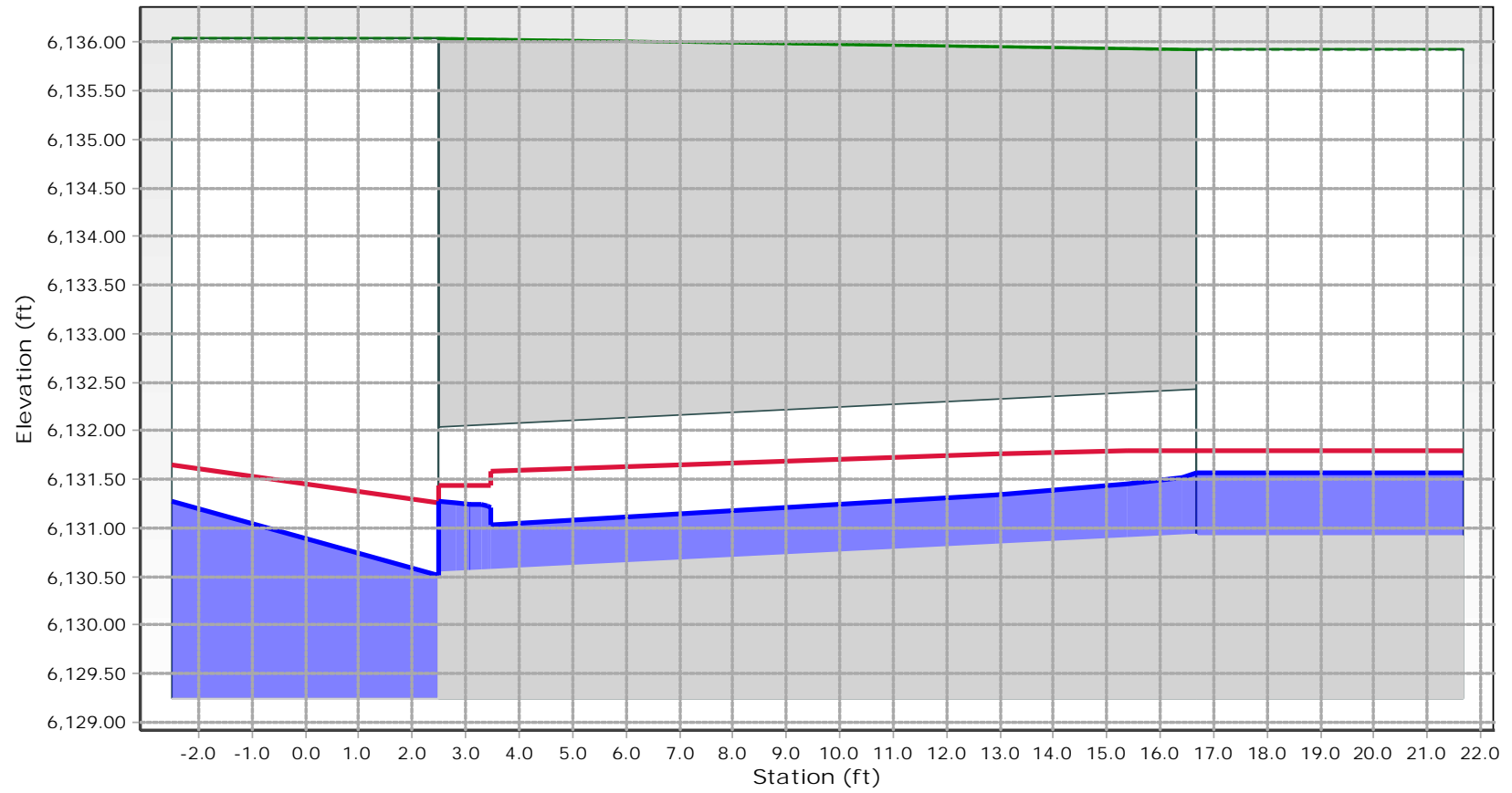




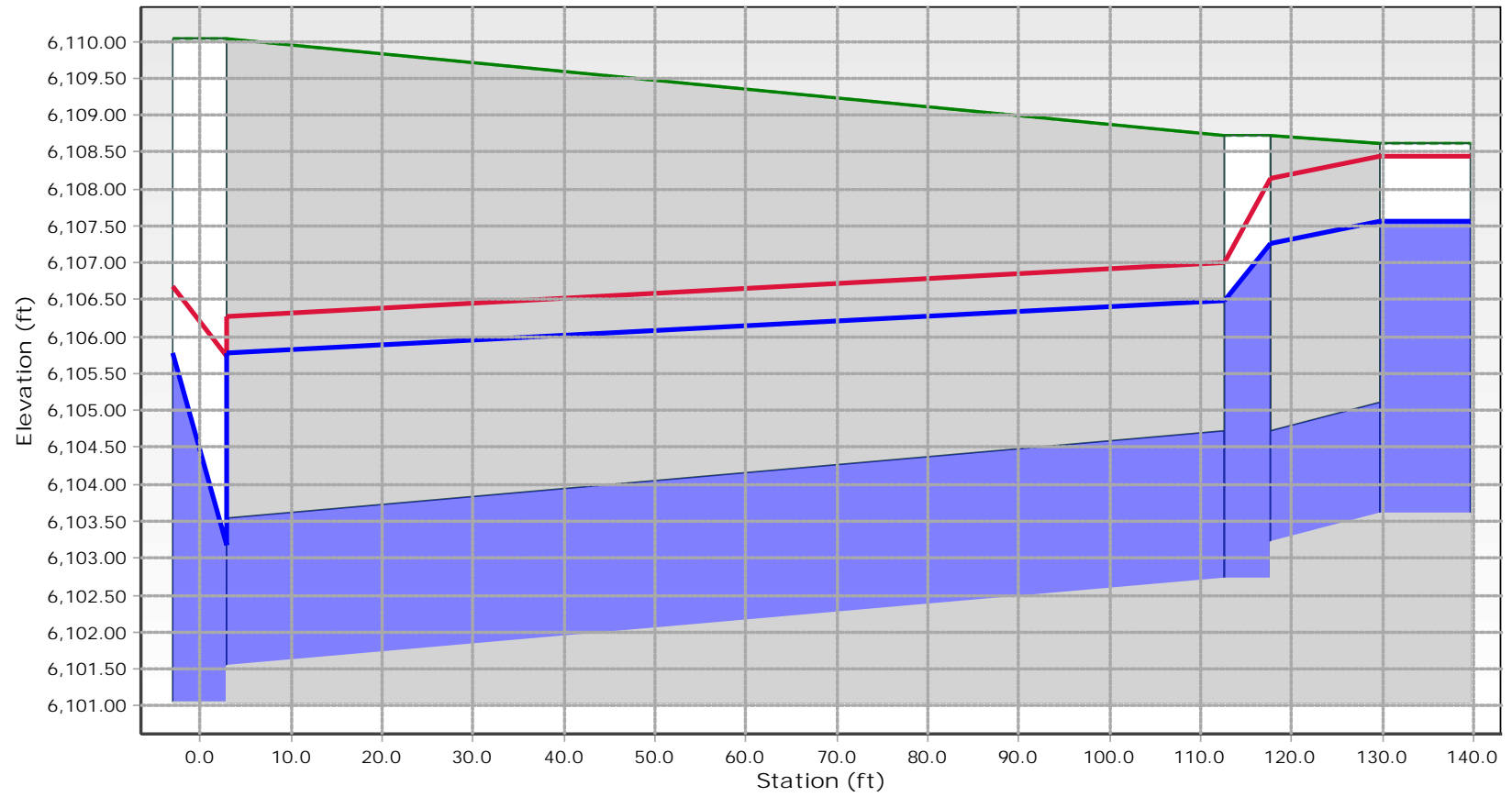
DP45 - 100-Year



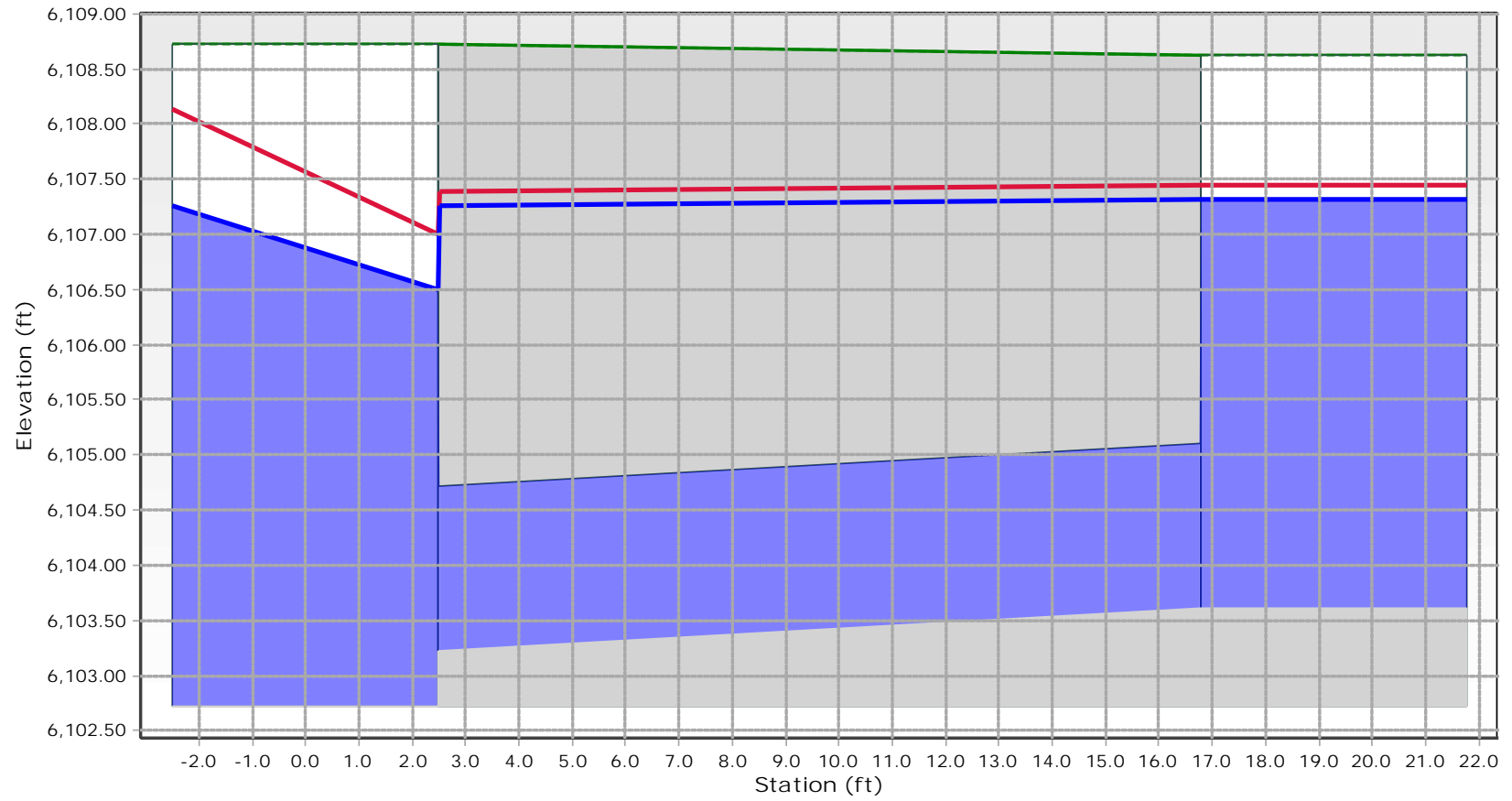
DP46 - 100-Year



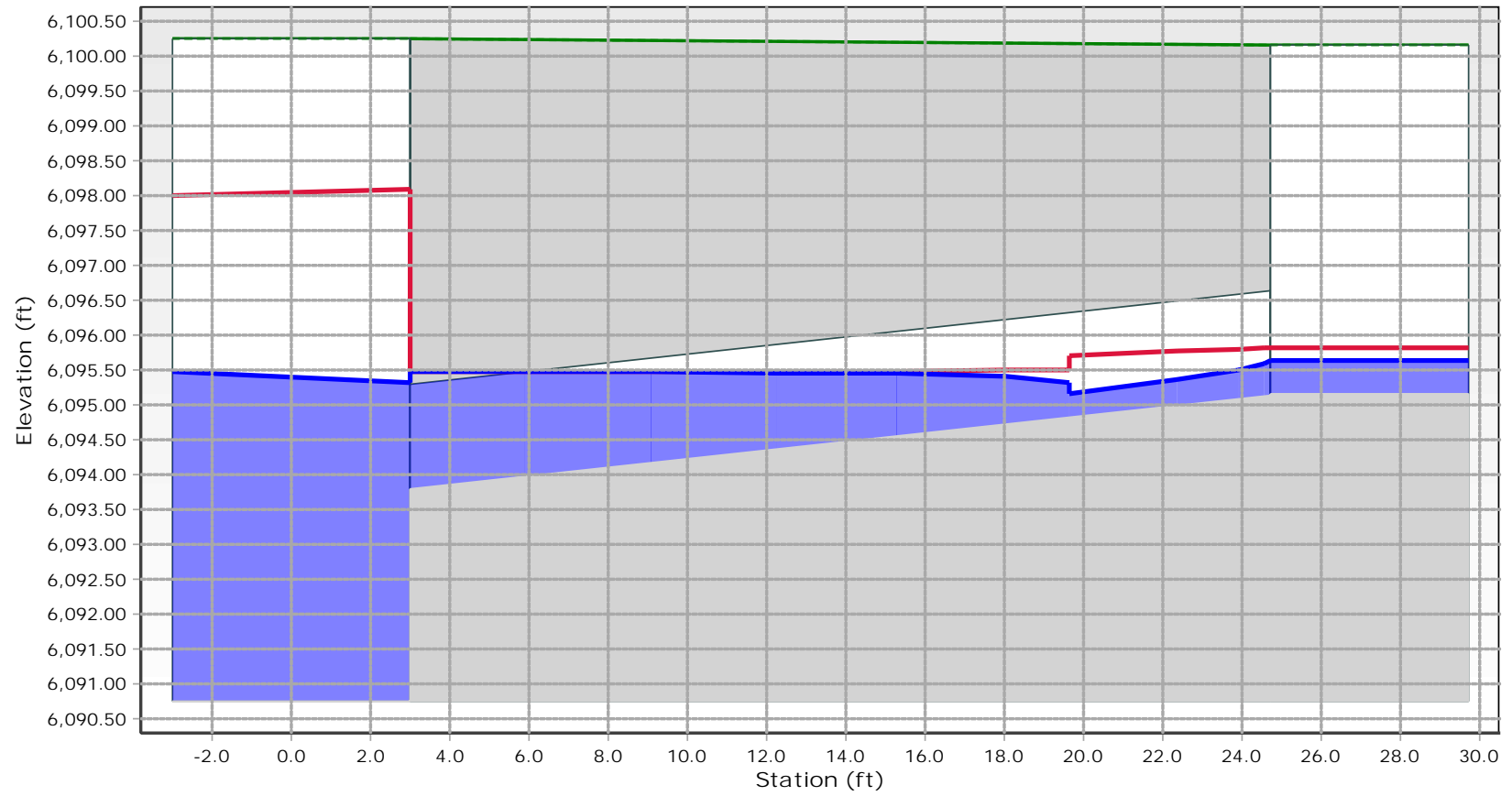
DP47 - 100-Year



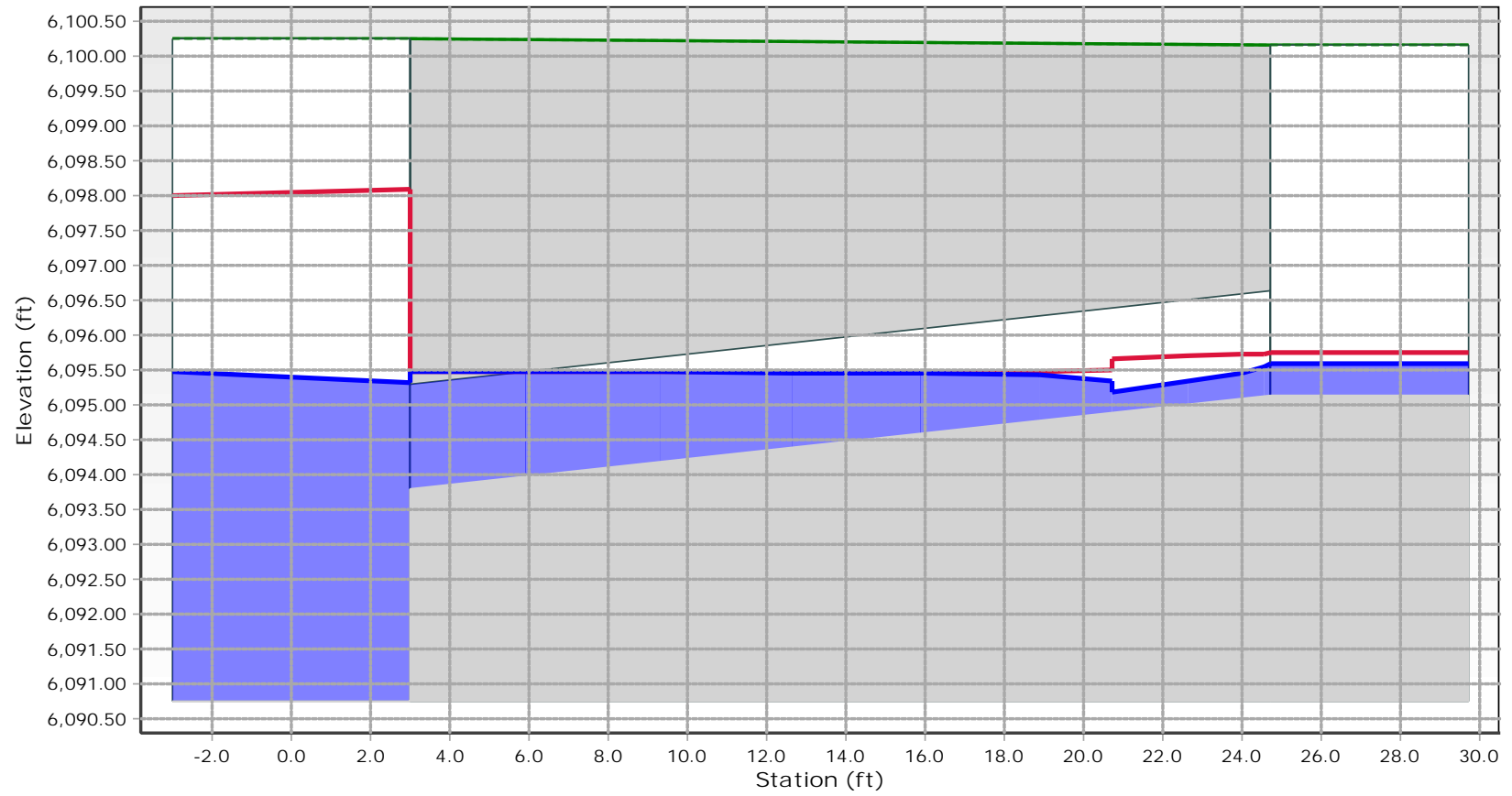
DP48 - 100-Year



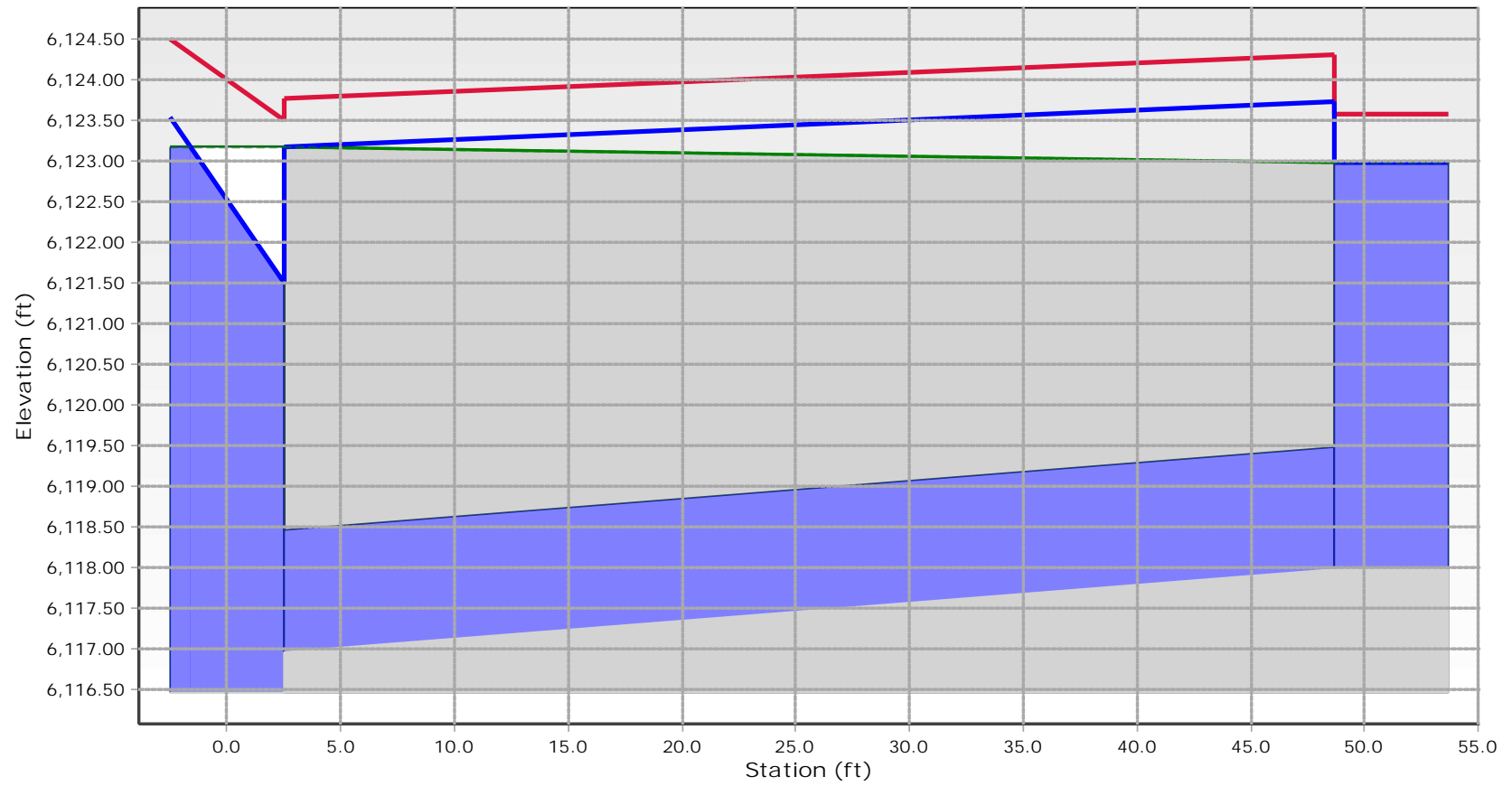
DP49 - 100-Year



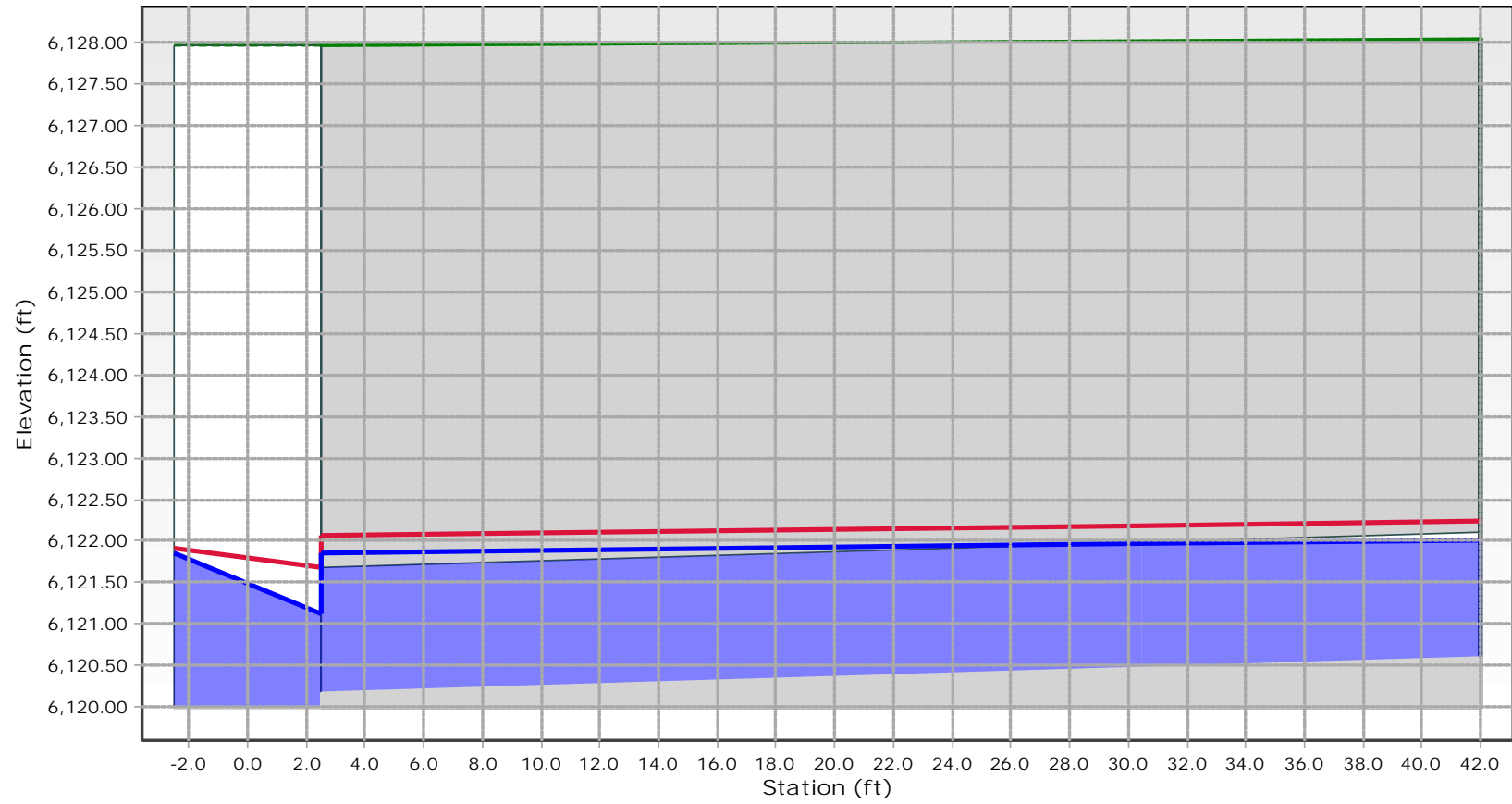
DP50 - 100-Year



DP51 - 100-Year

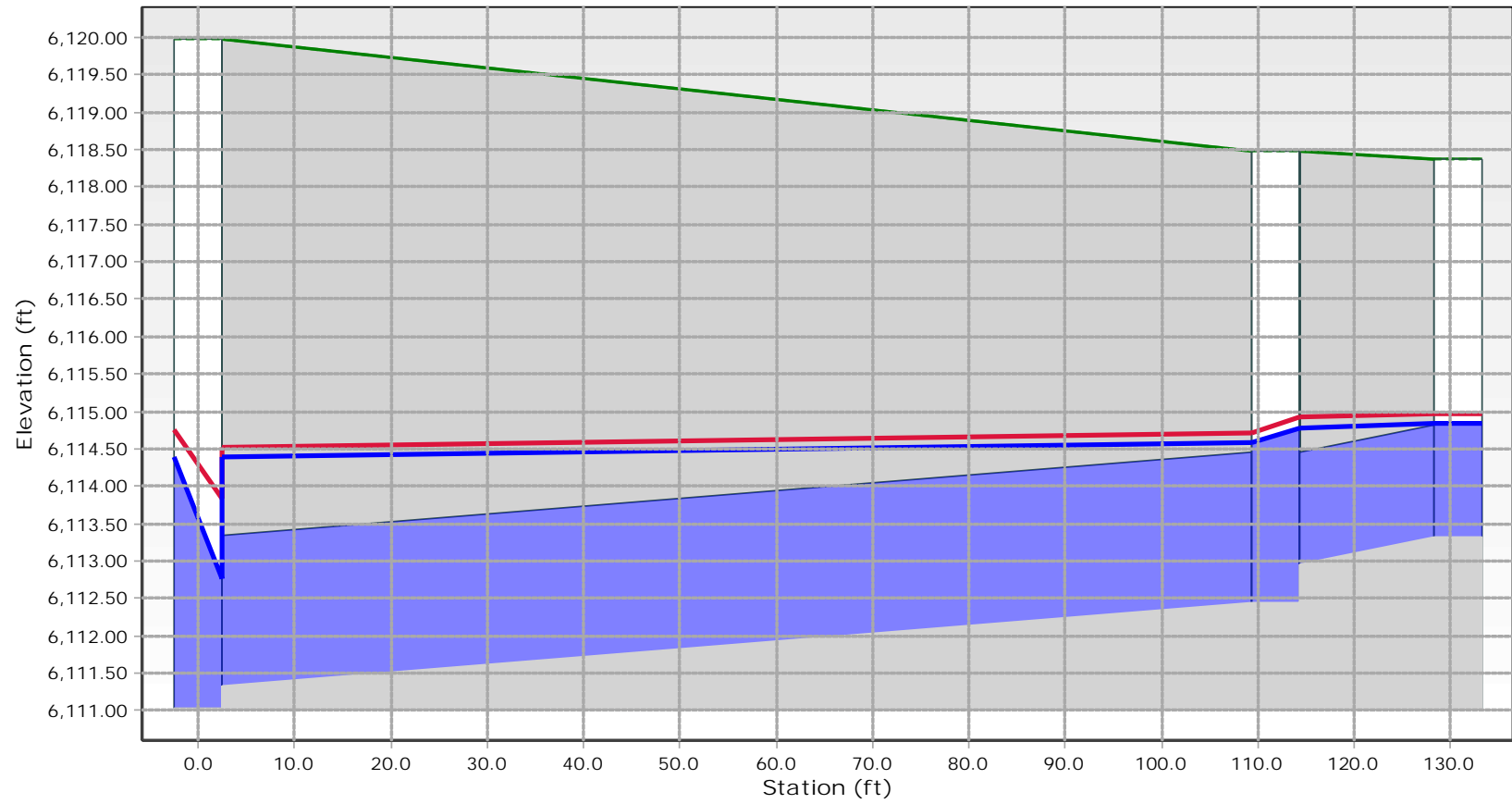


DP52 - 100-Year

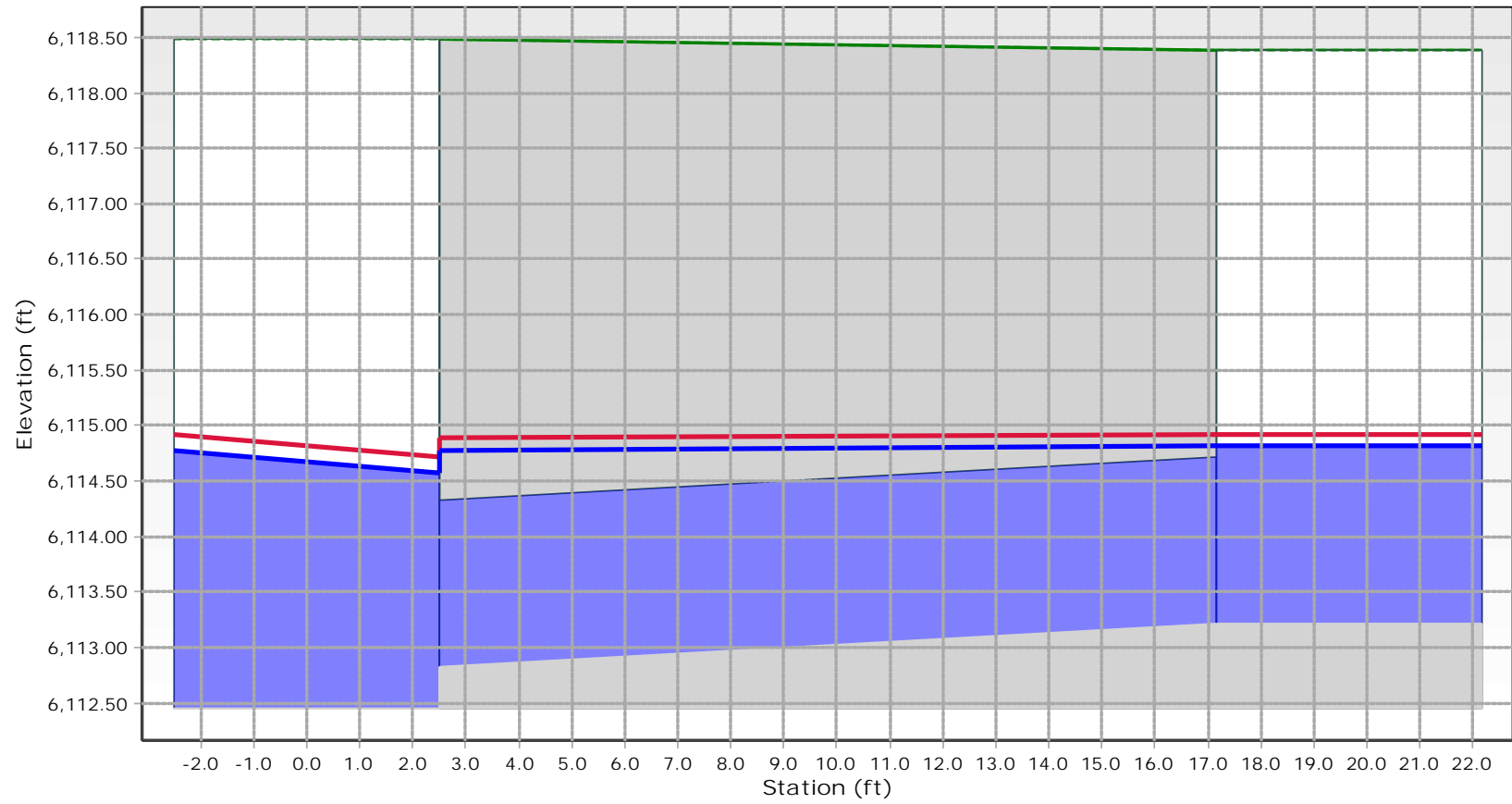




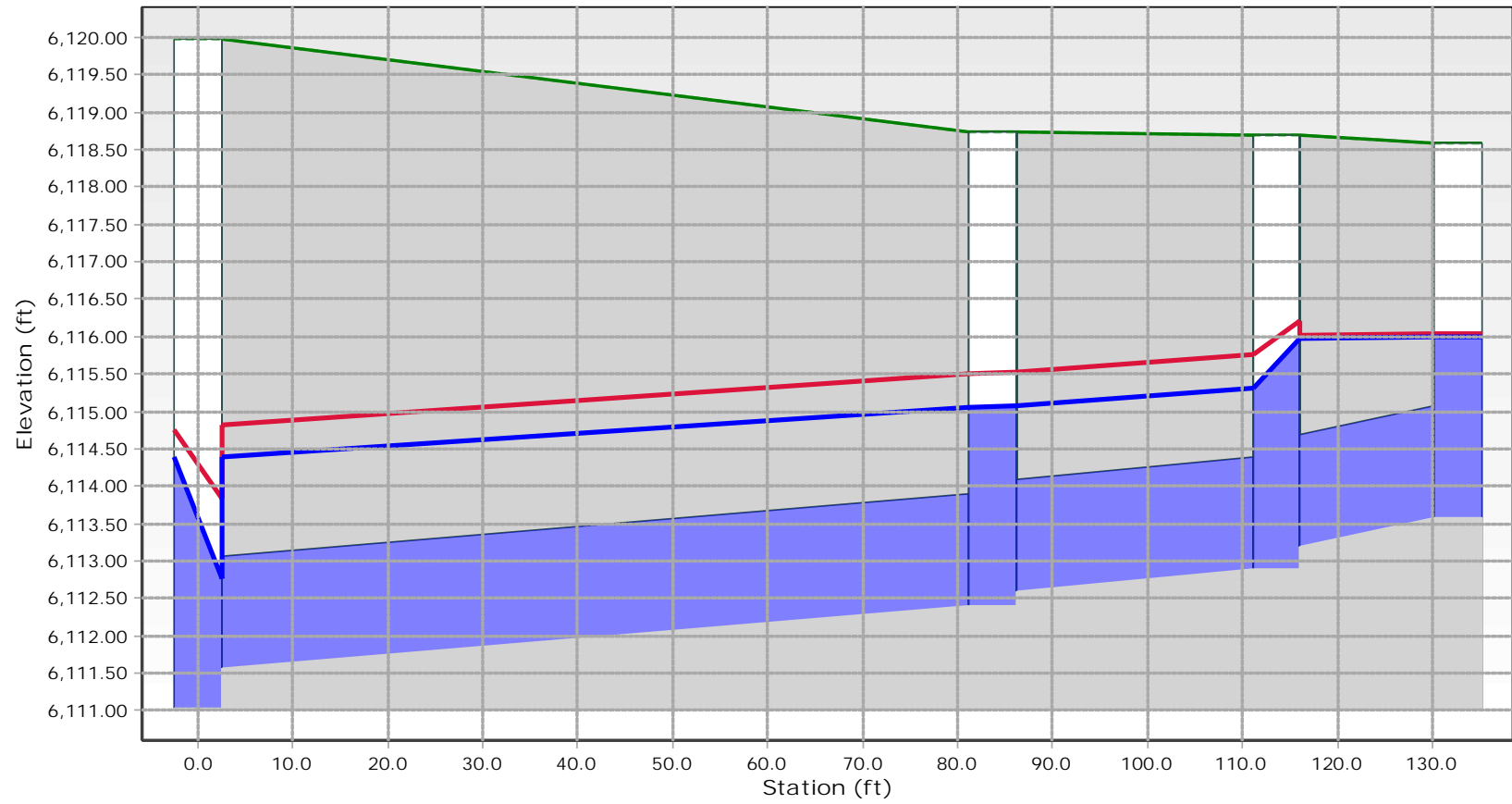
DP53 - 100-Year



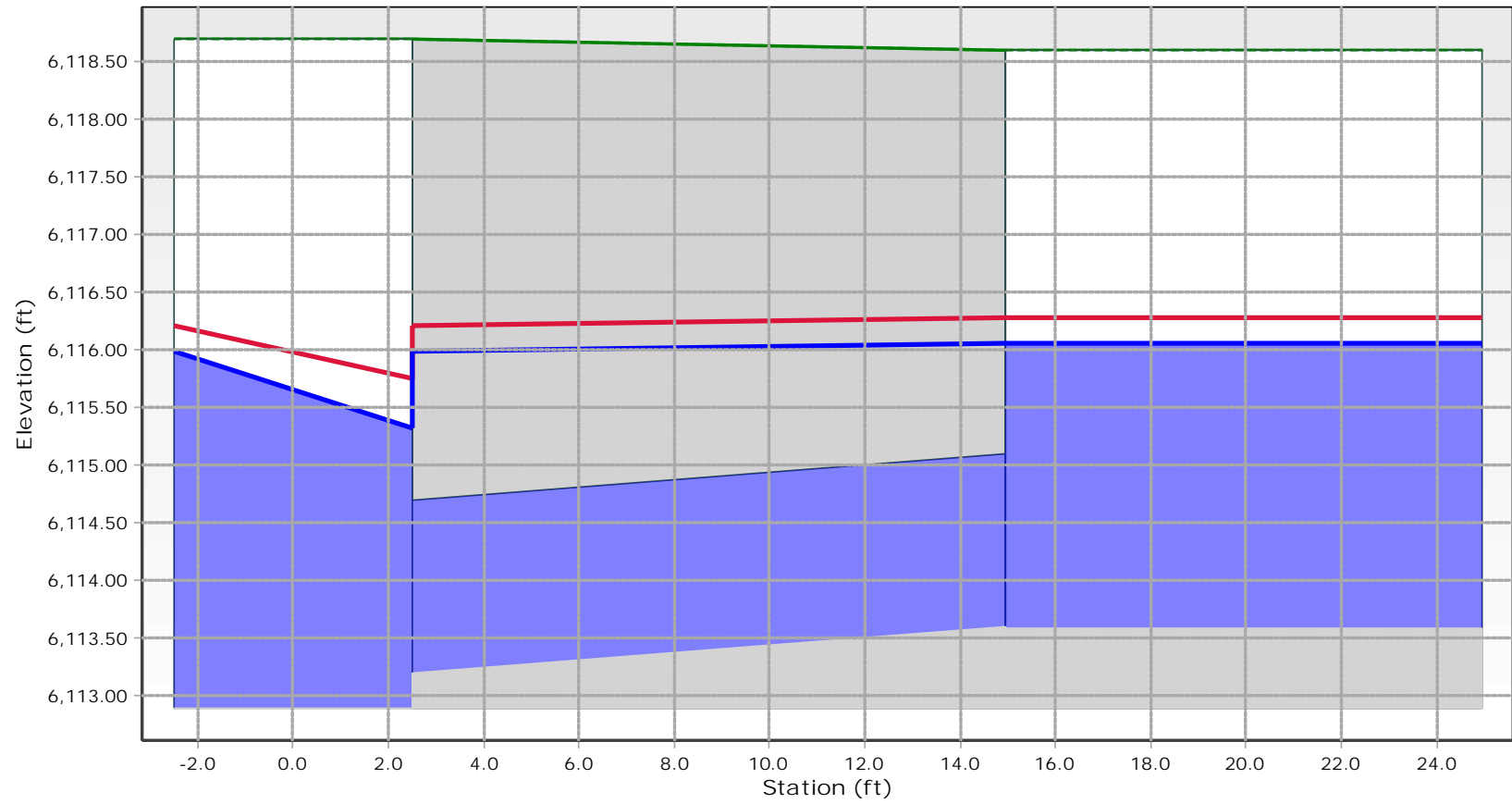
DP54 - 100-Year



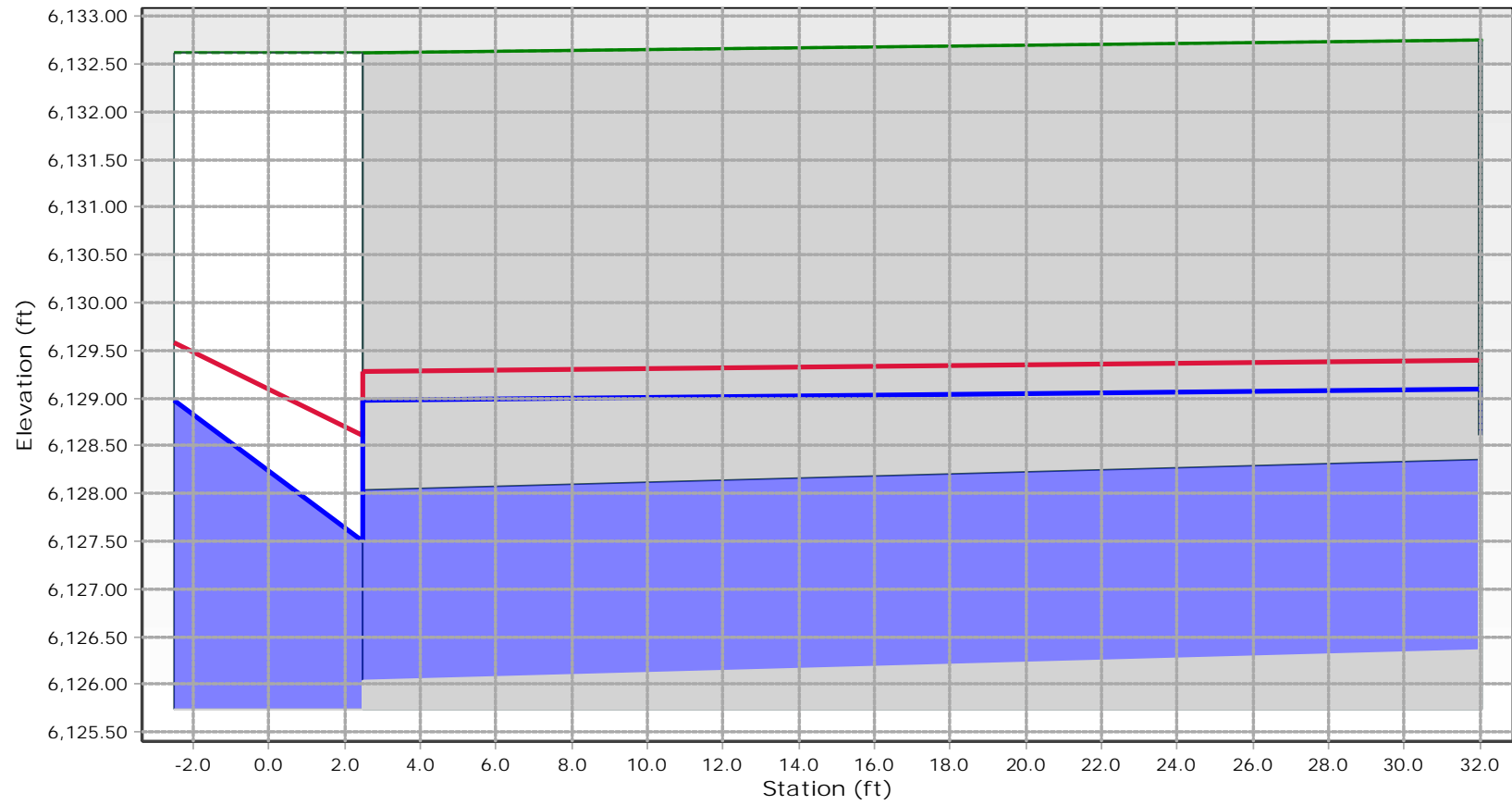
DP55 - 100-Year



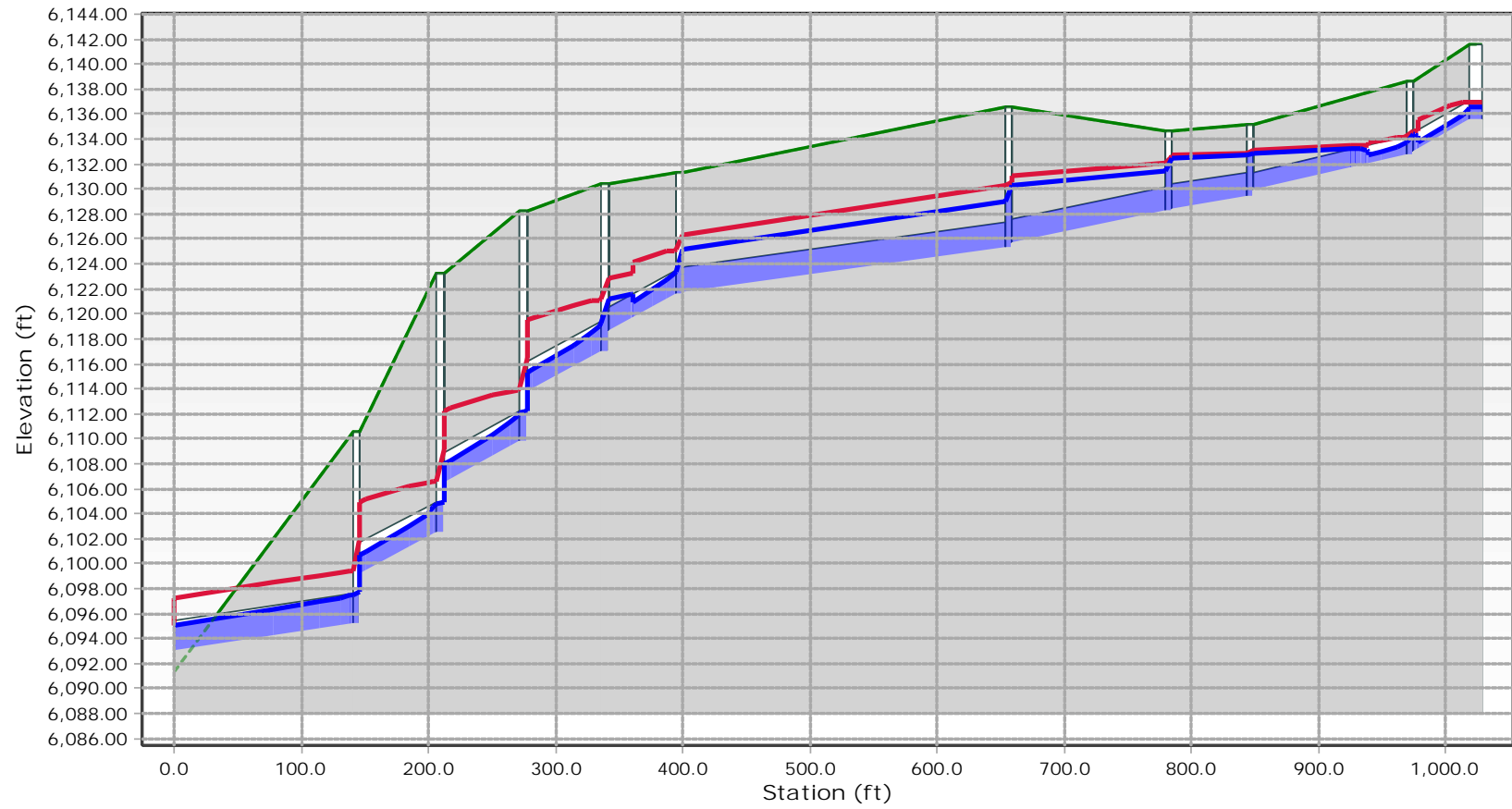
DP56 - 100-Year



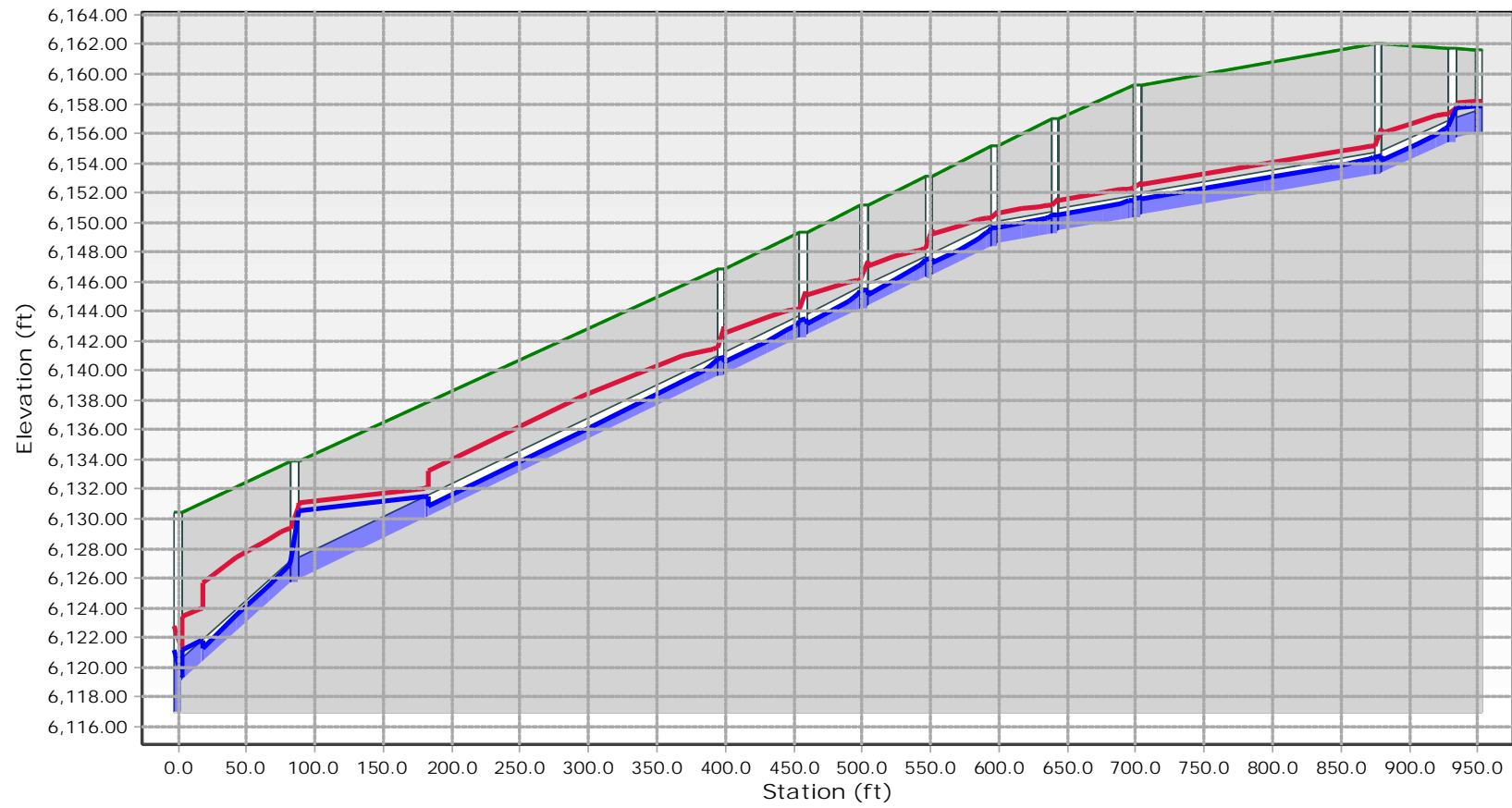
DP57 - 100-Year



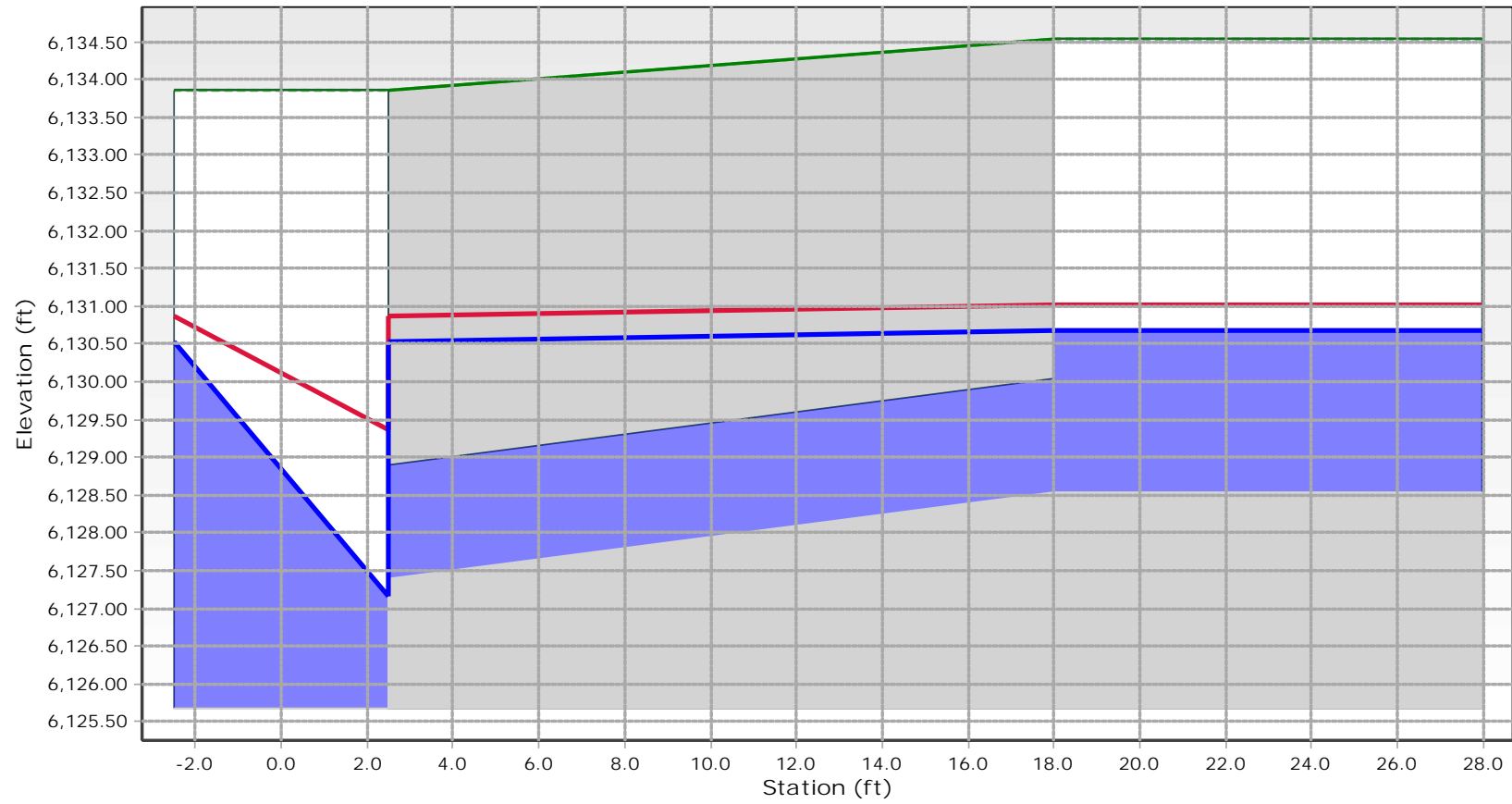
DP58 - 100-Year



DP59 - 100-Year

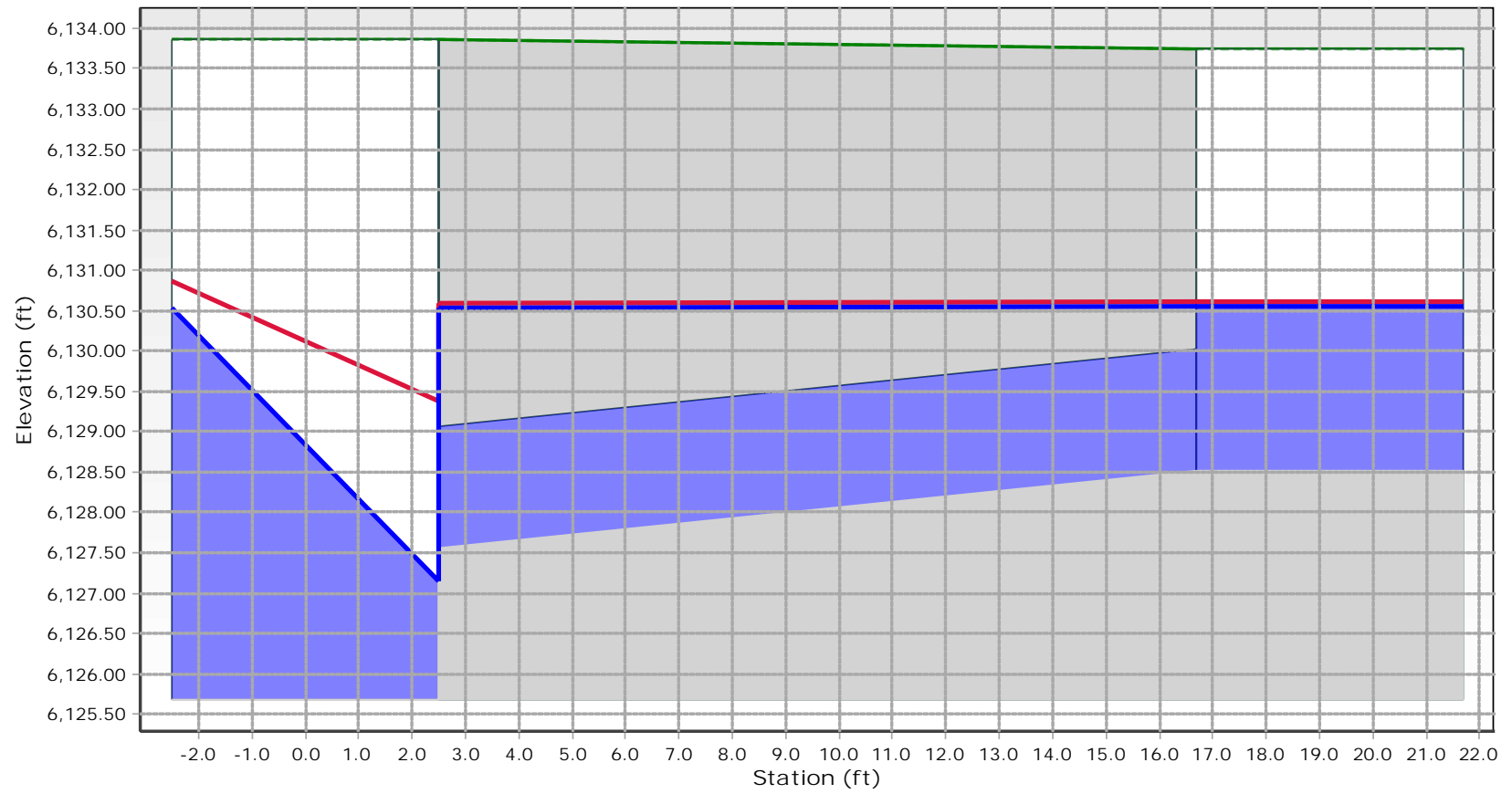


DP60 - 100-Year

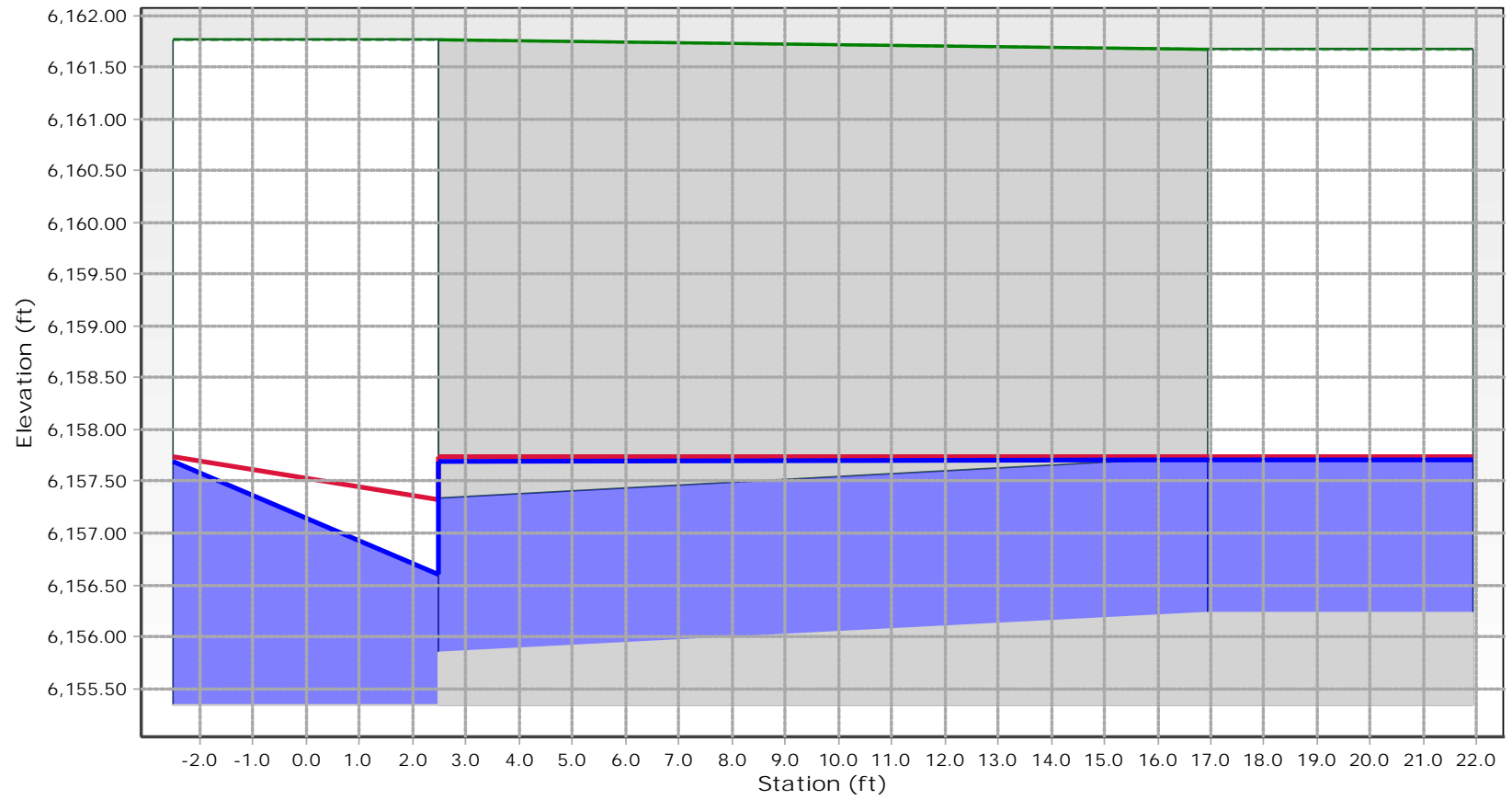




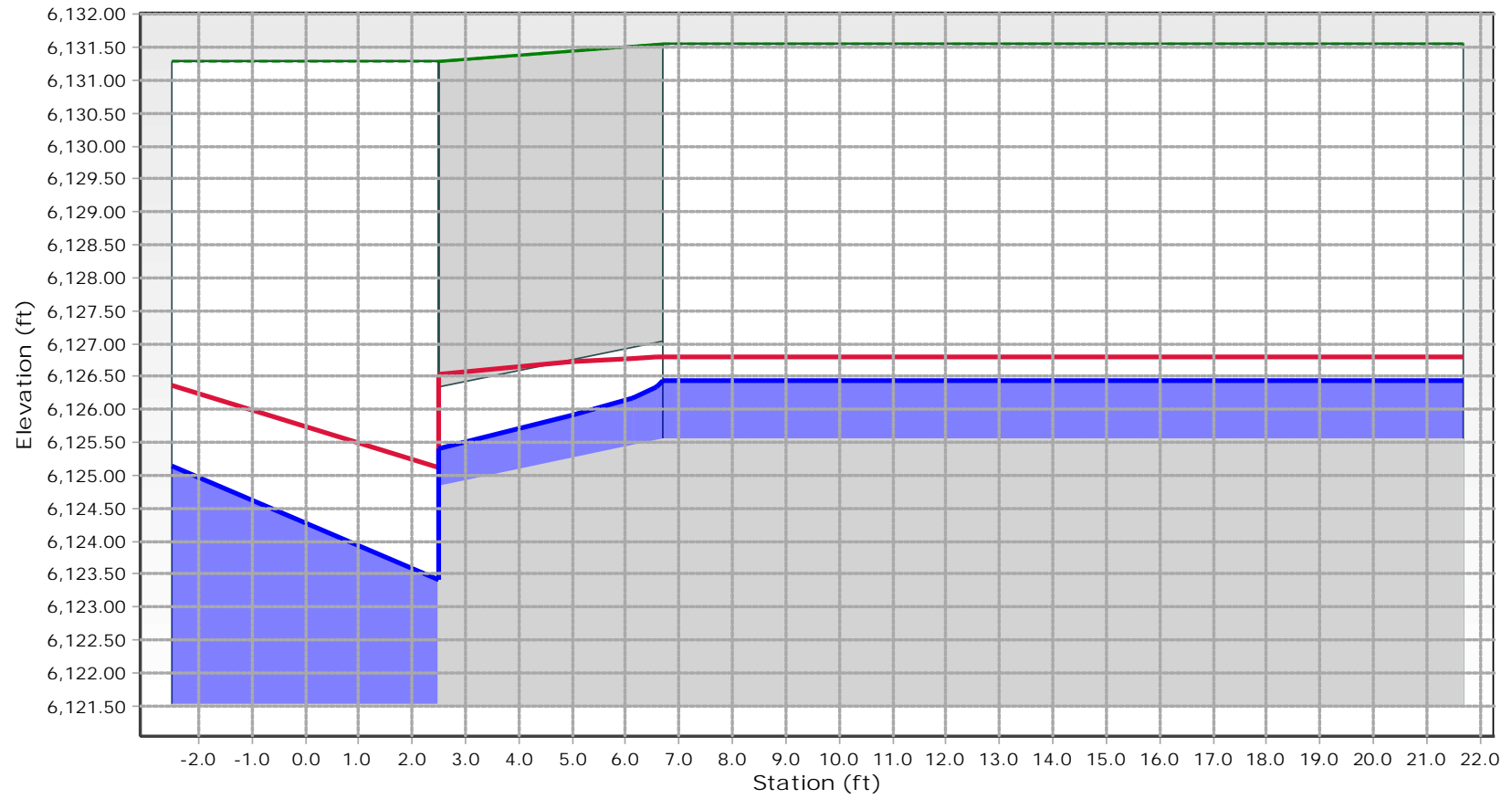
DP61 - 100-Year



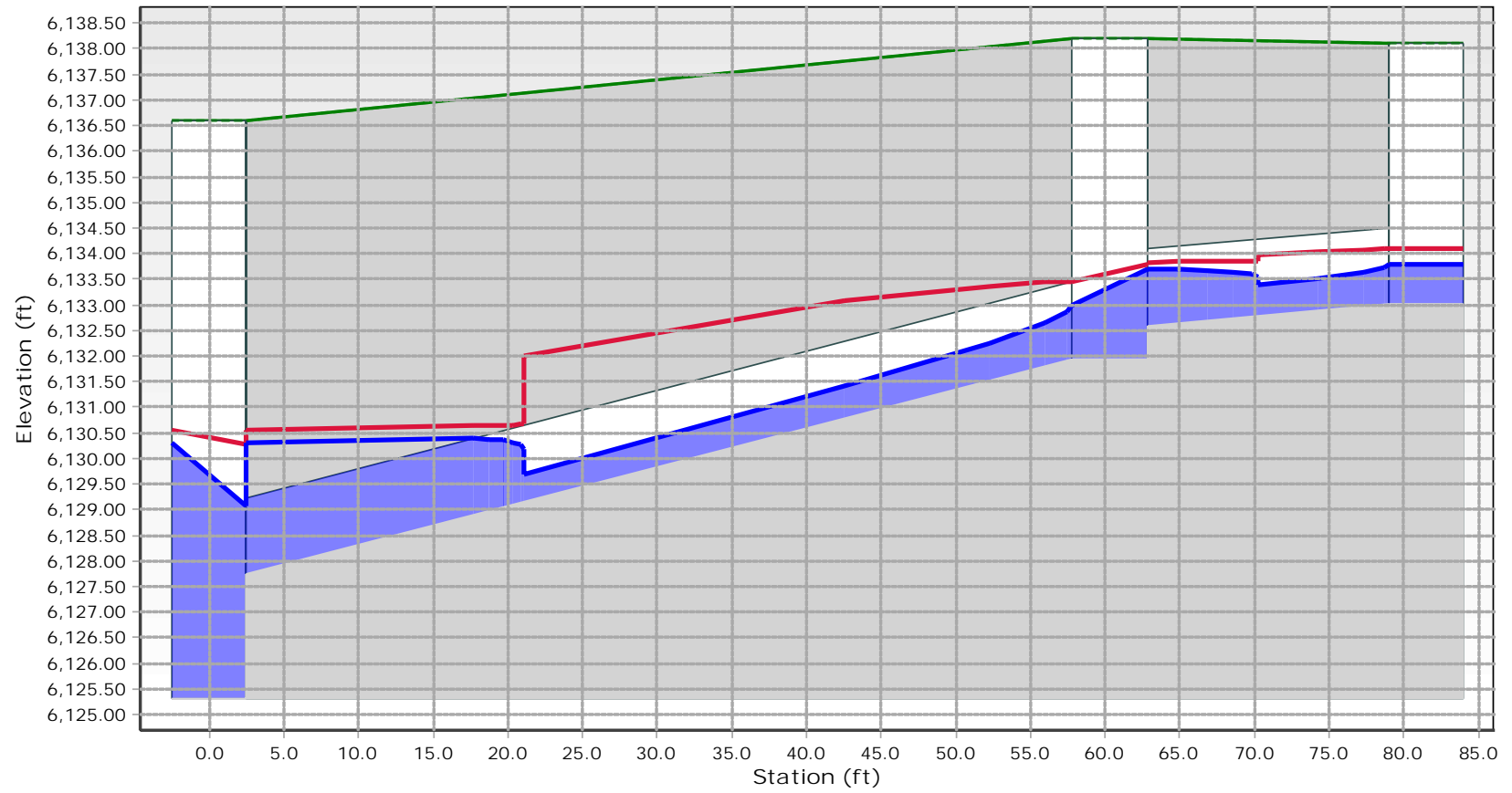
DP62 - 100-Year



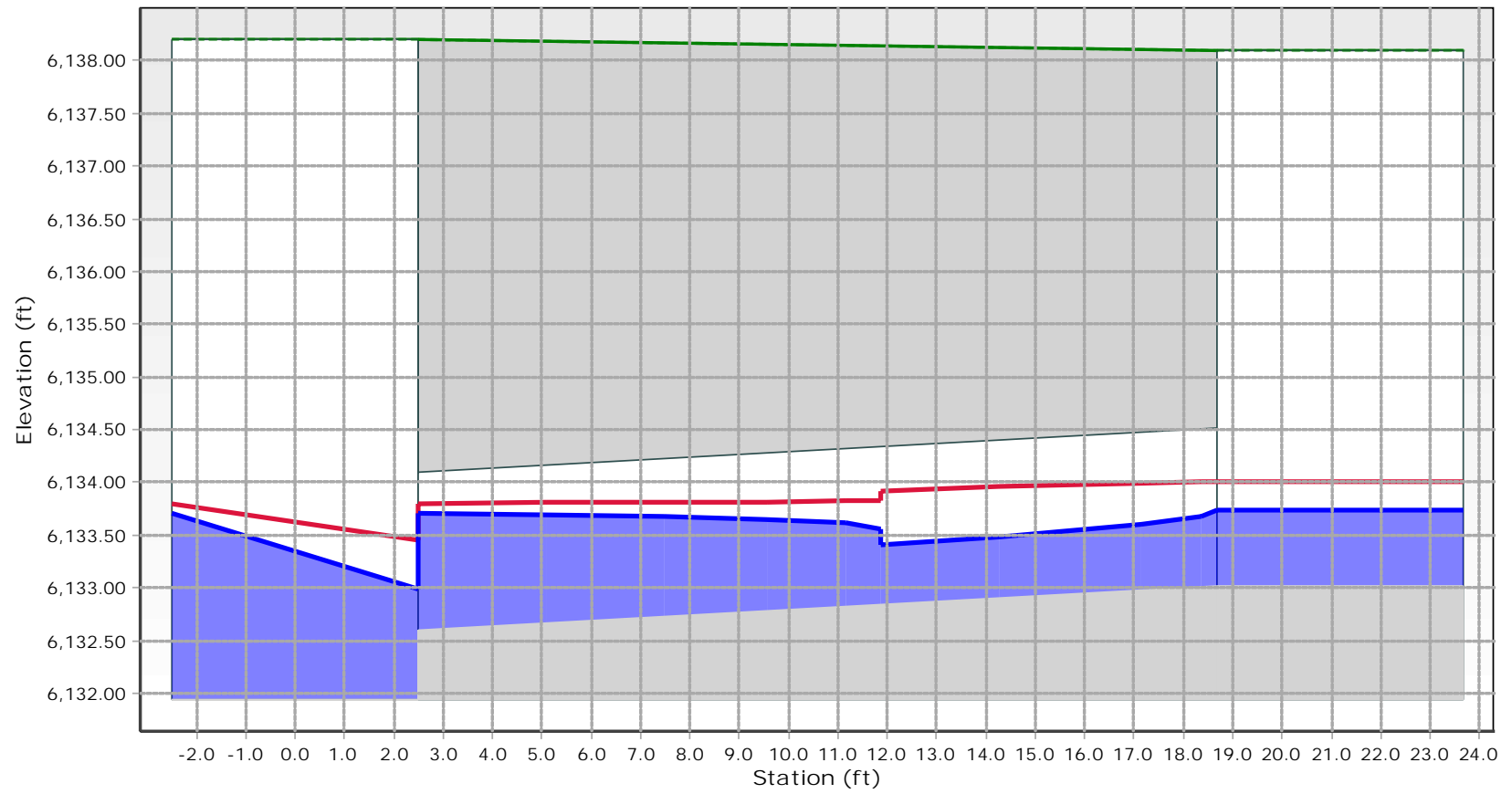
DP63 - 100-Year



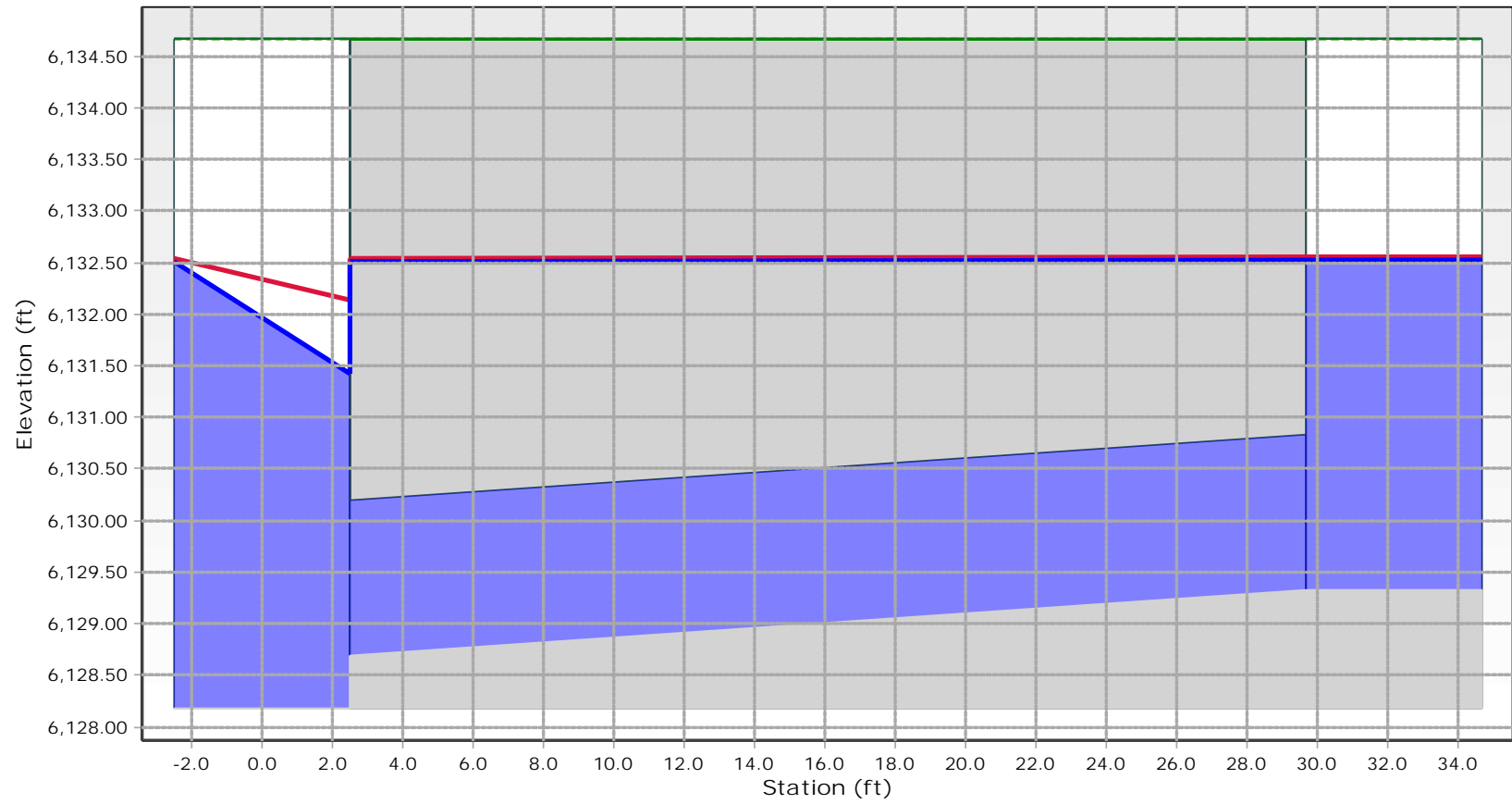
DP64 - 100-Year



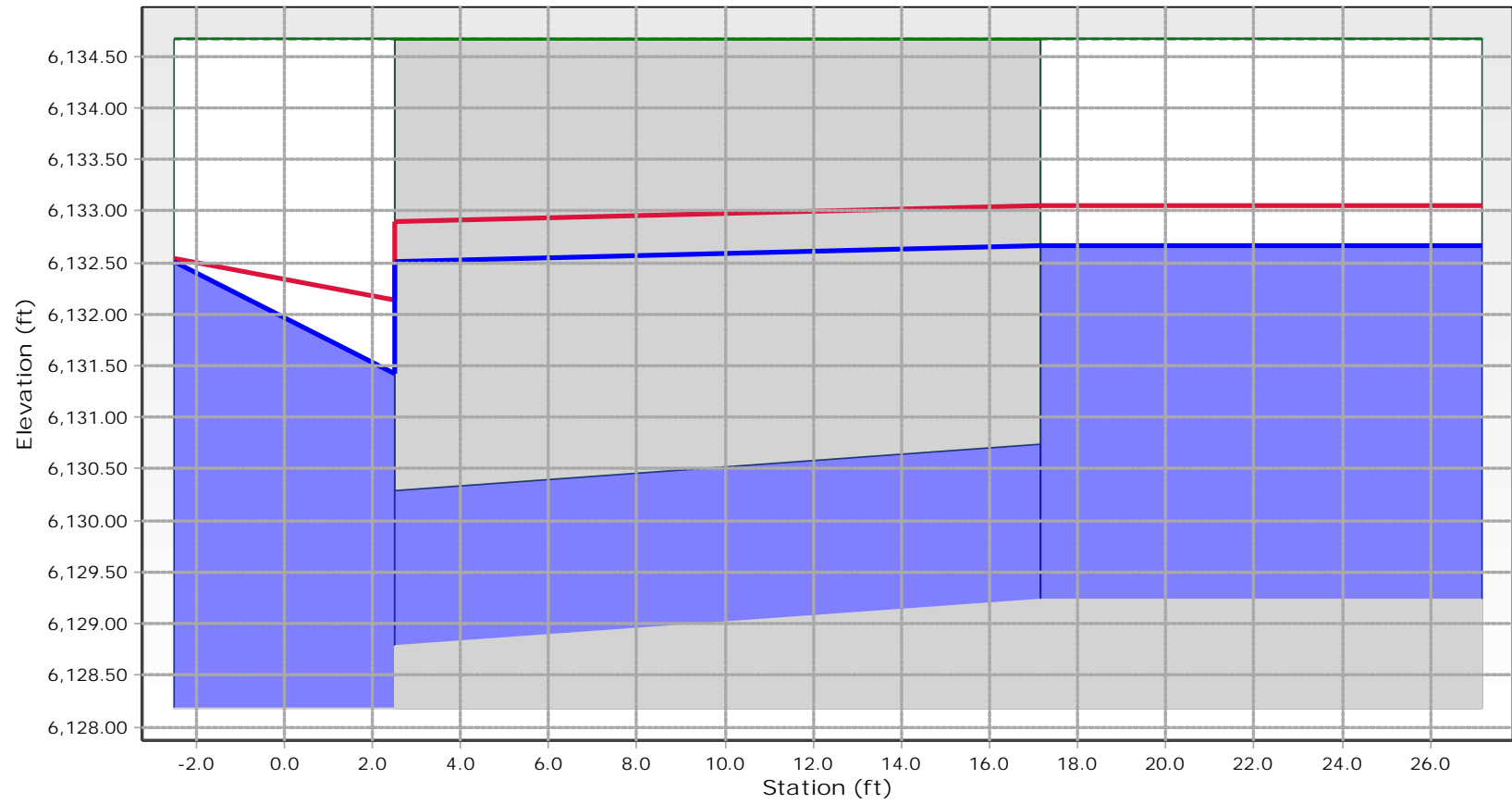
DP65 - 100-Year



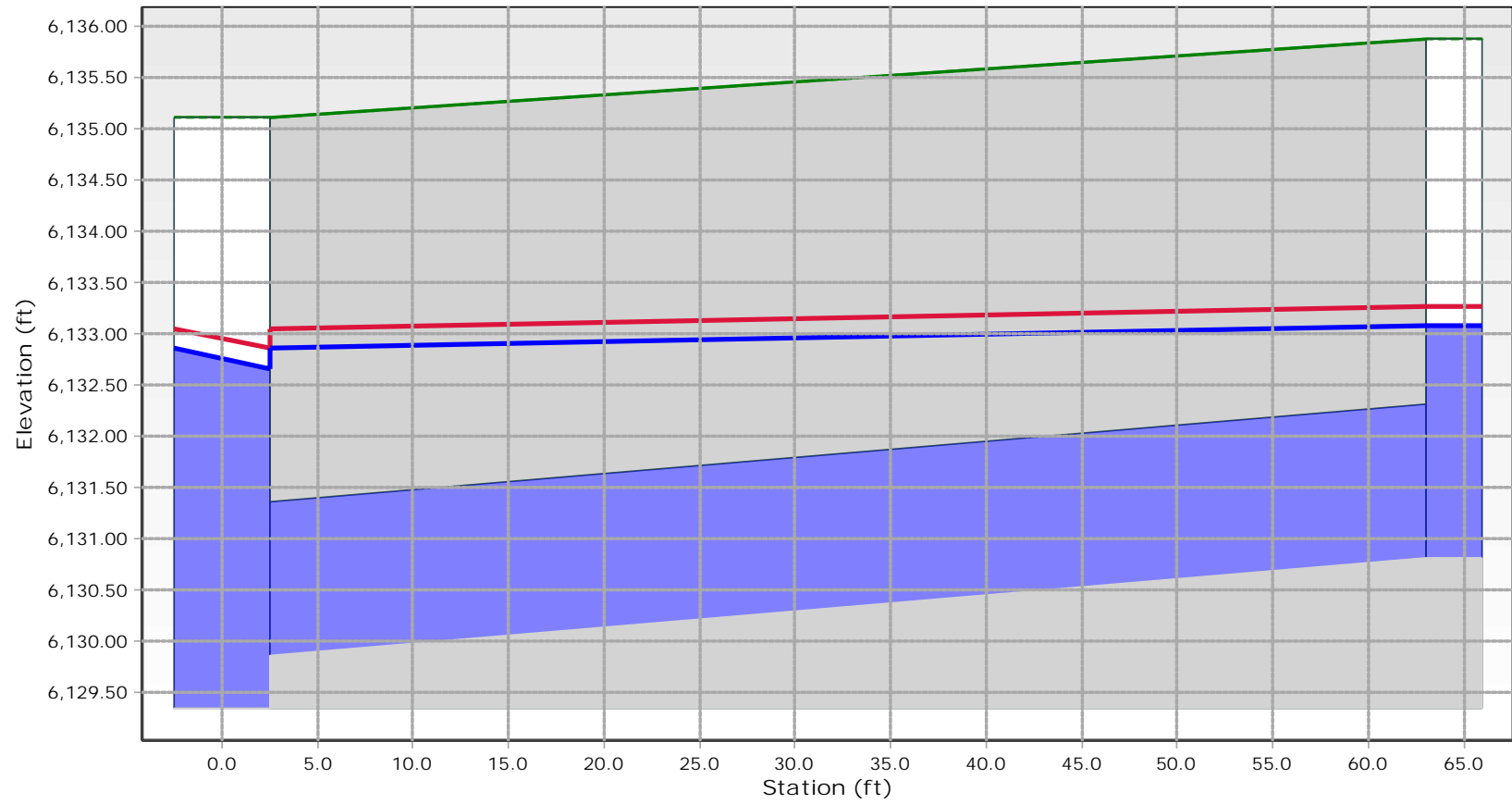
DP66 - 100-Year



DP67 - 100-Year

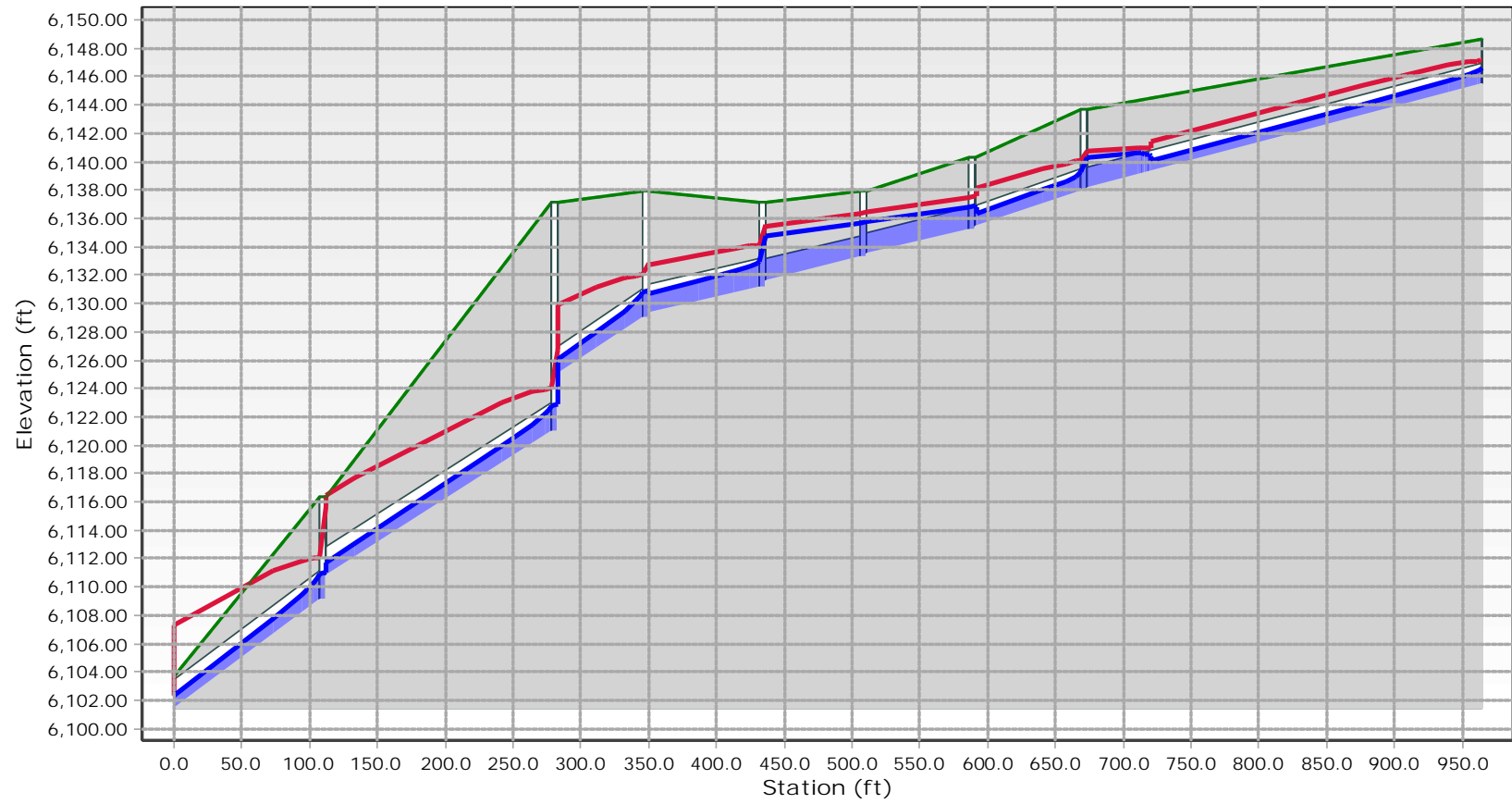


DP68 - 100-Year

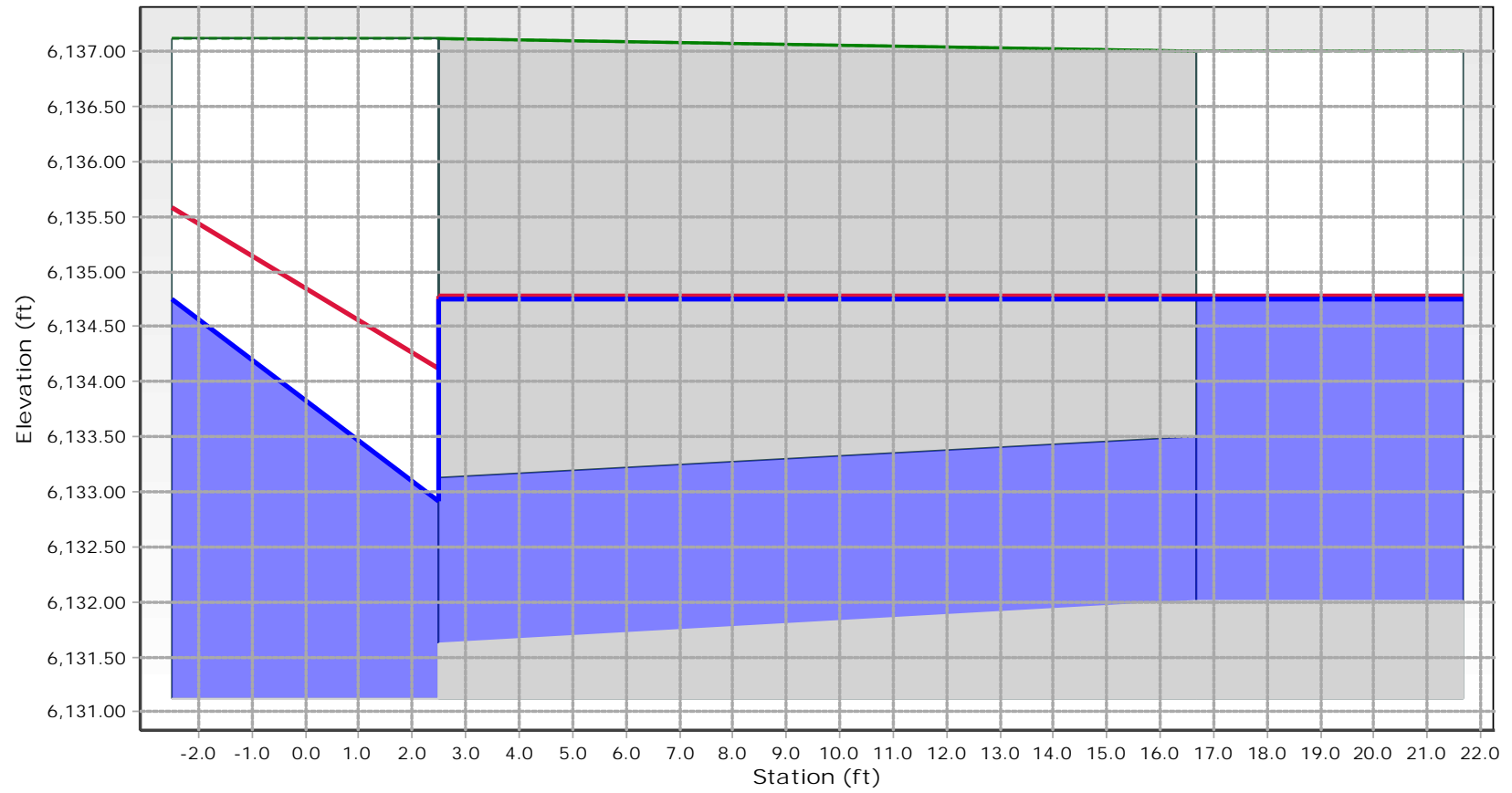




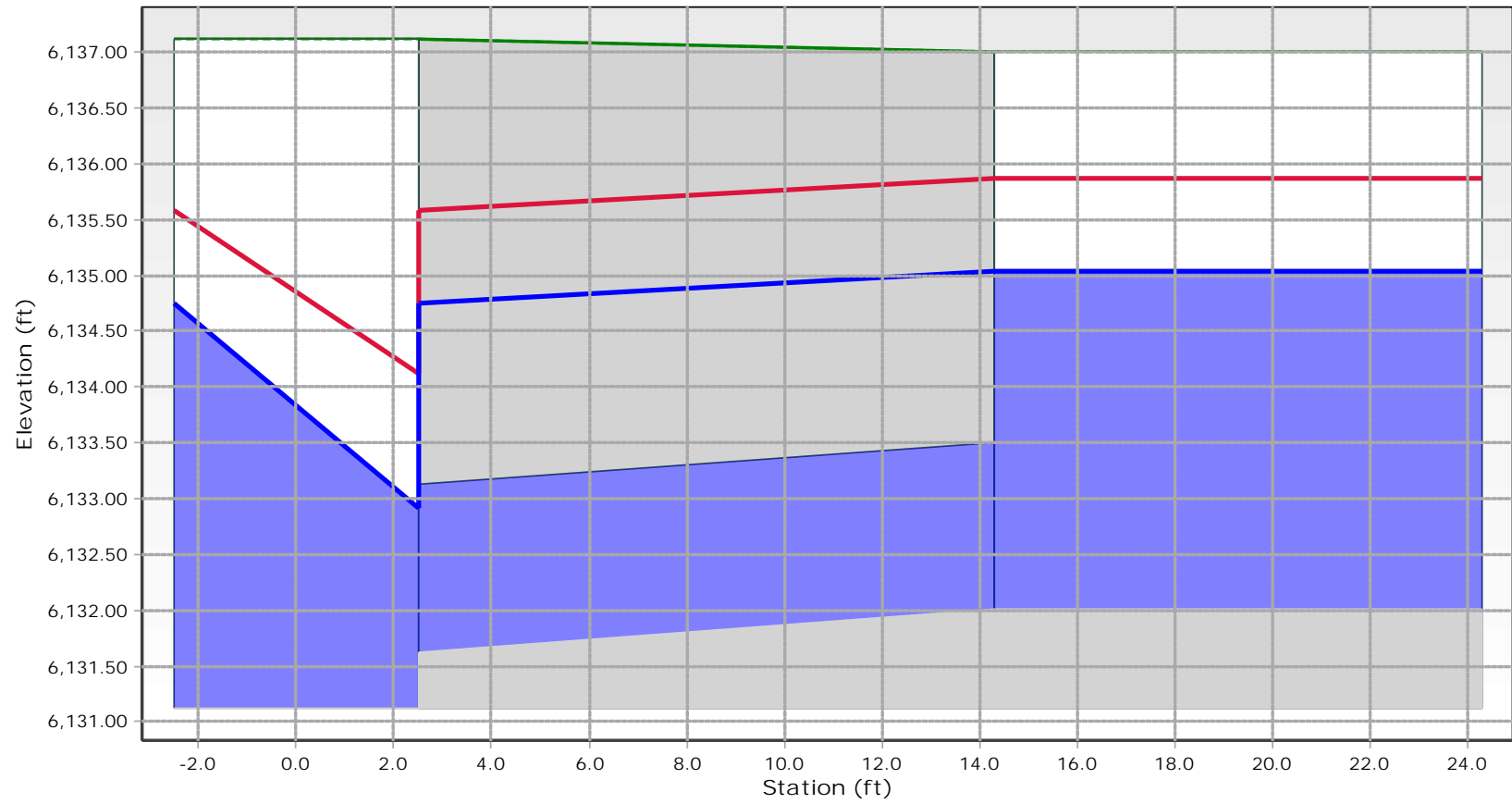
DP69 - 100-Year



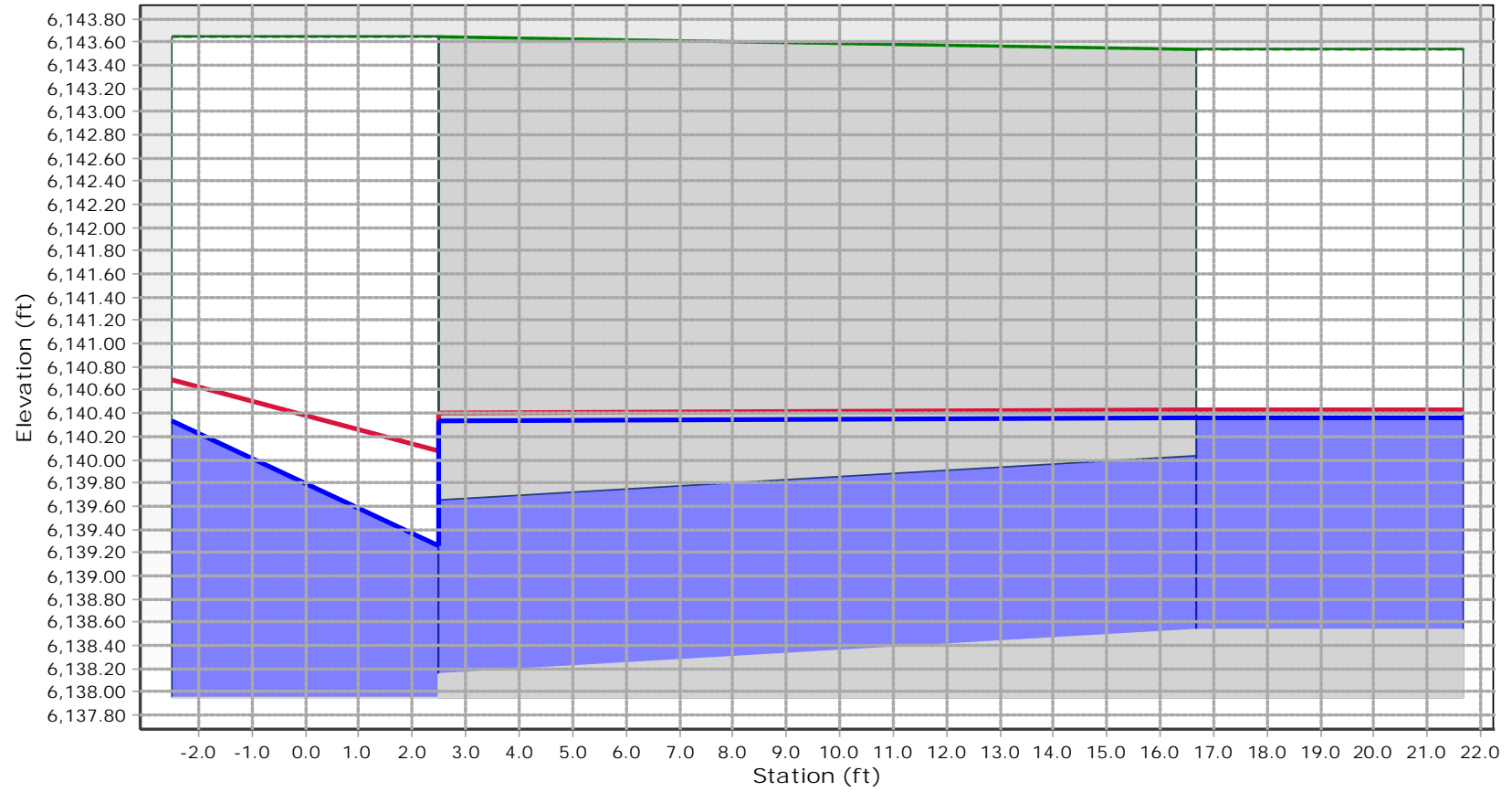
DP70 - 100-Year



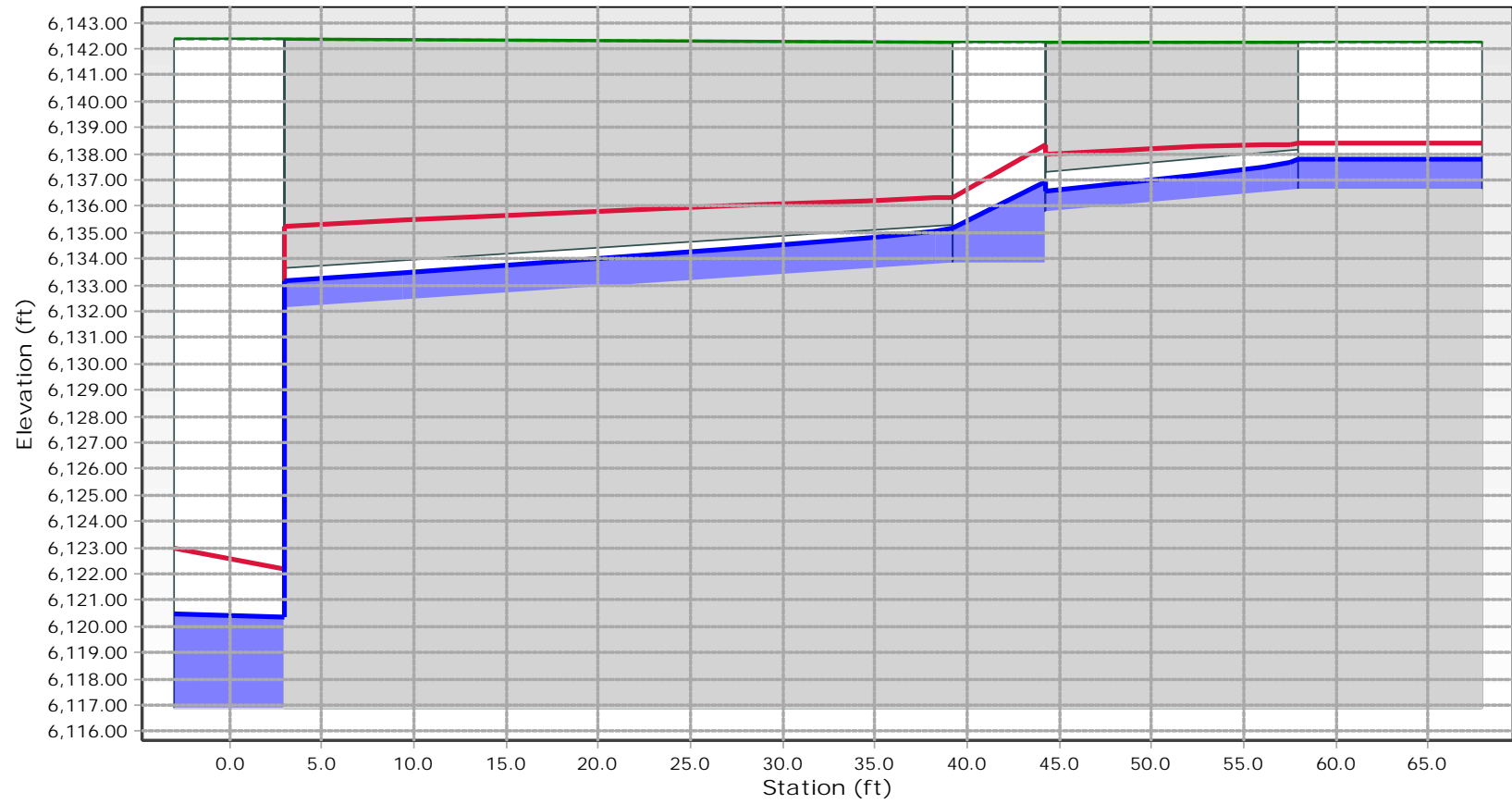
DP71 - 100-Year



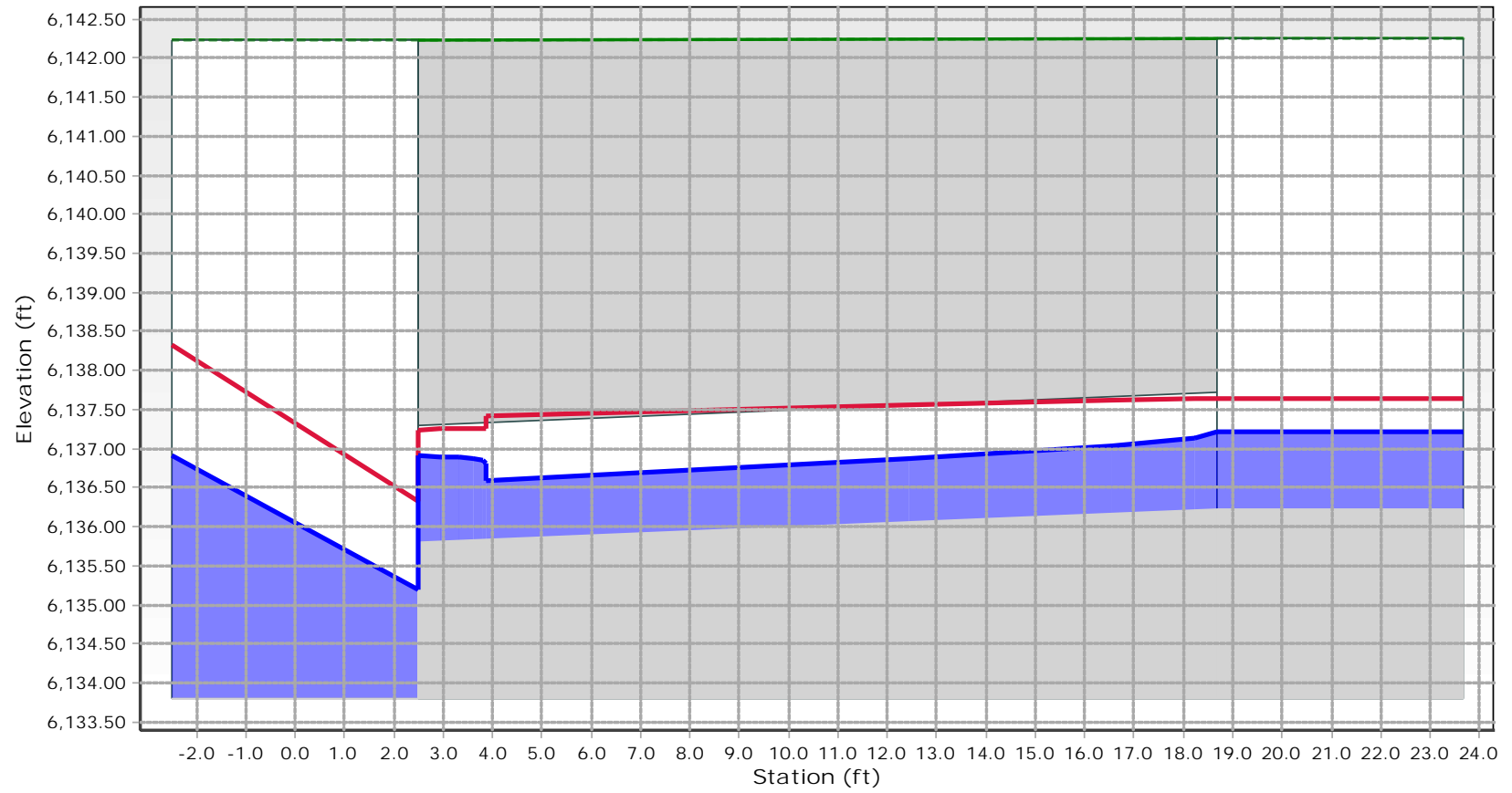
DP72 - 100-Year



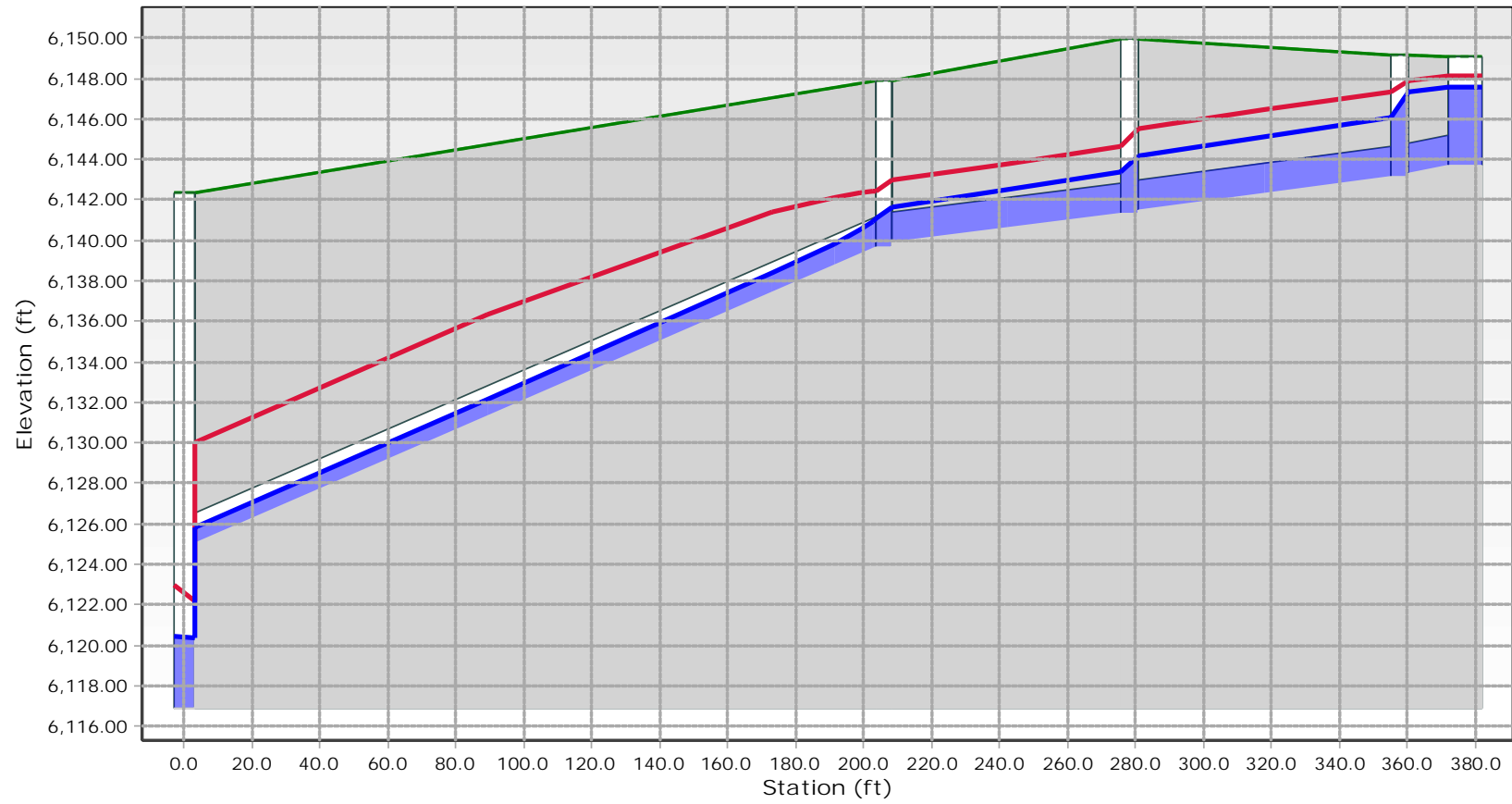
DP73 - 100-Year



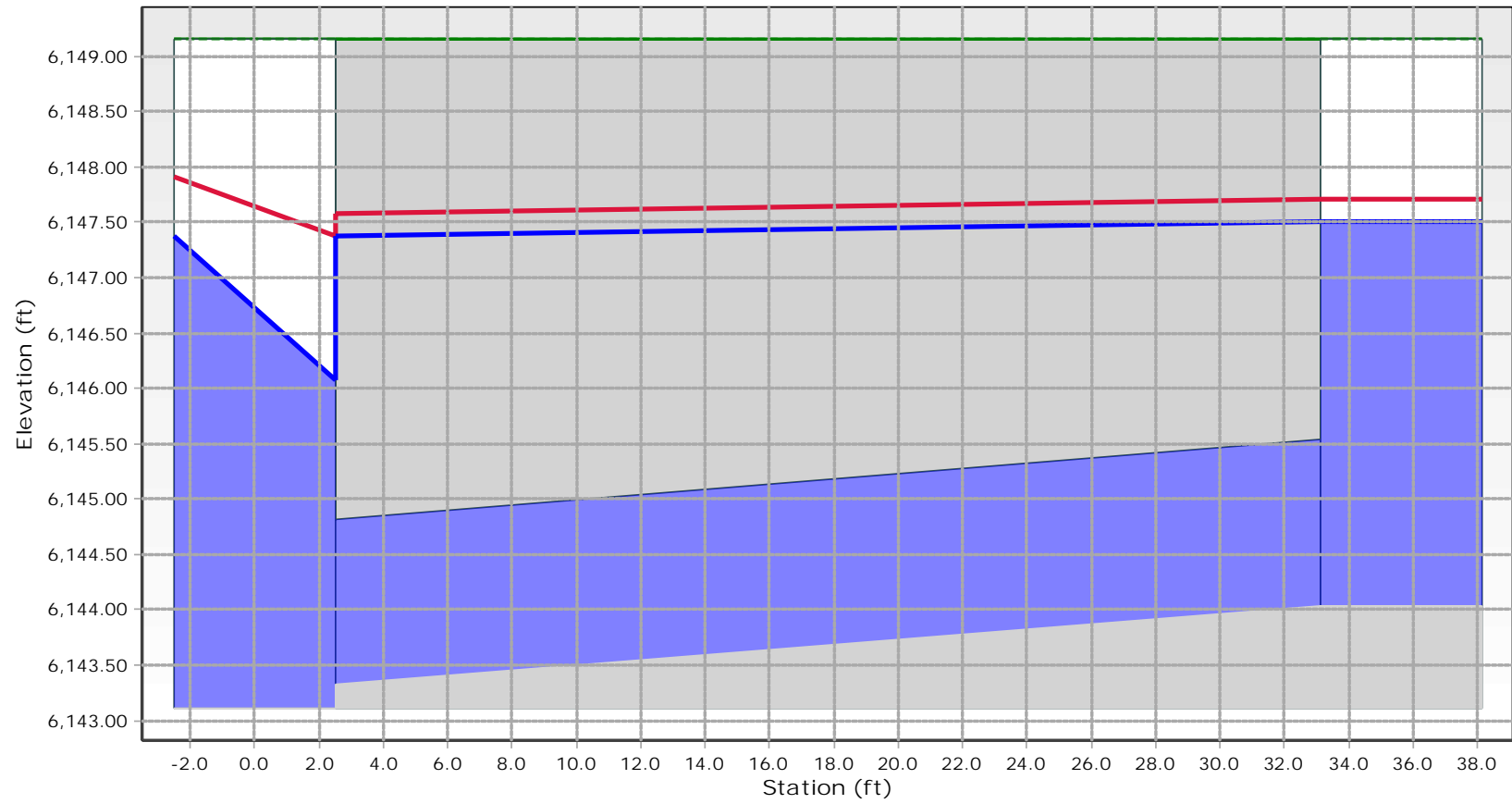
DP74 - 100-Year



DP75 - 100-Year

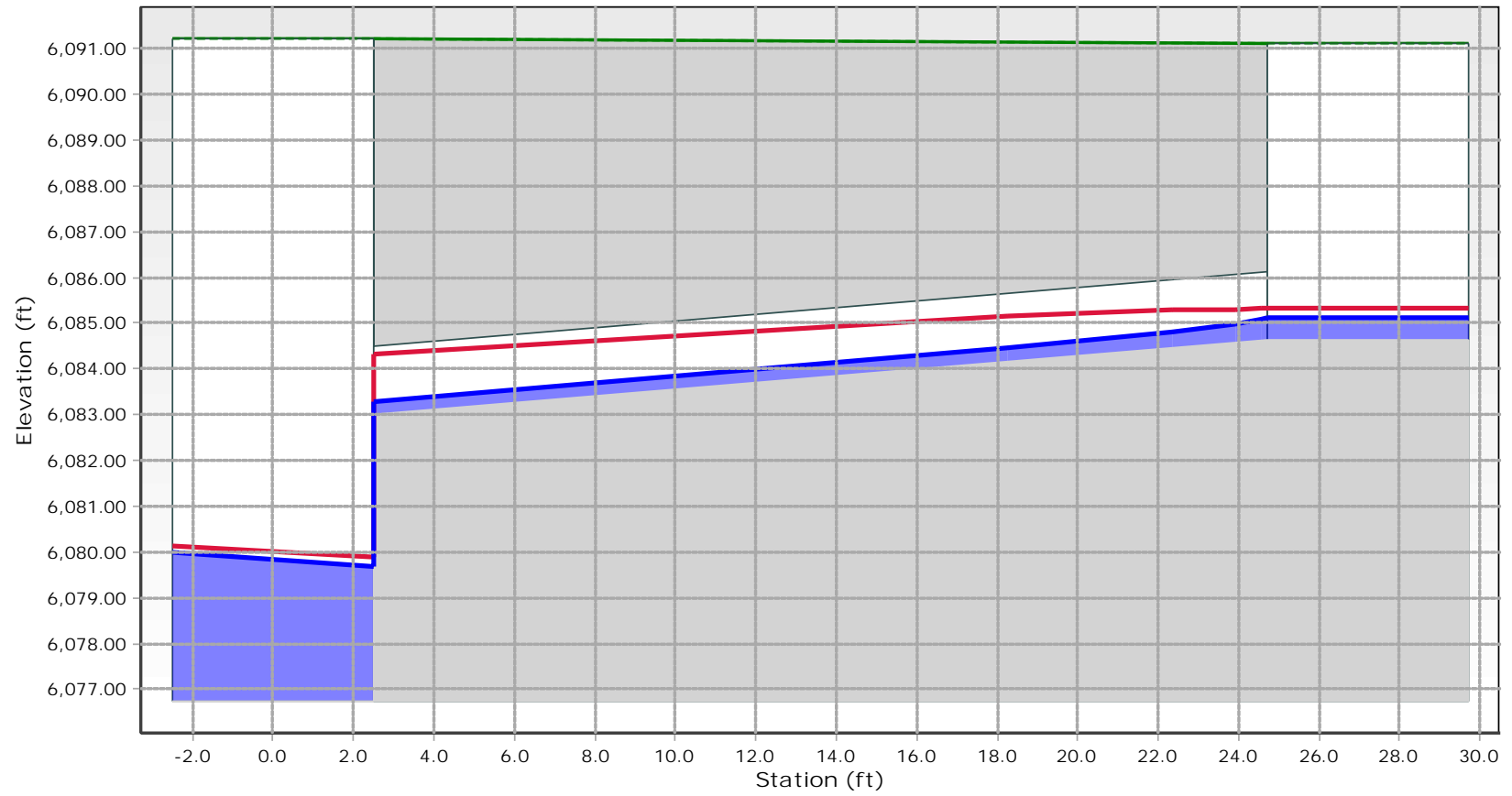


DP76 - 100-Year

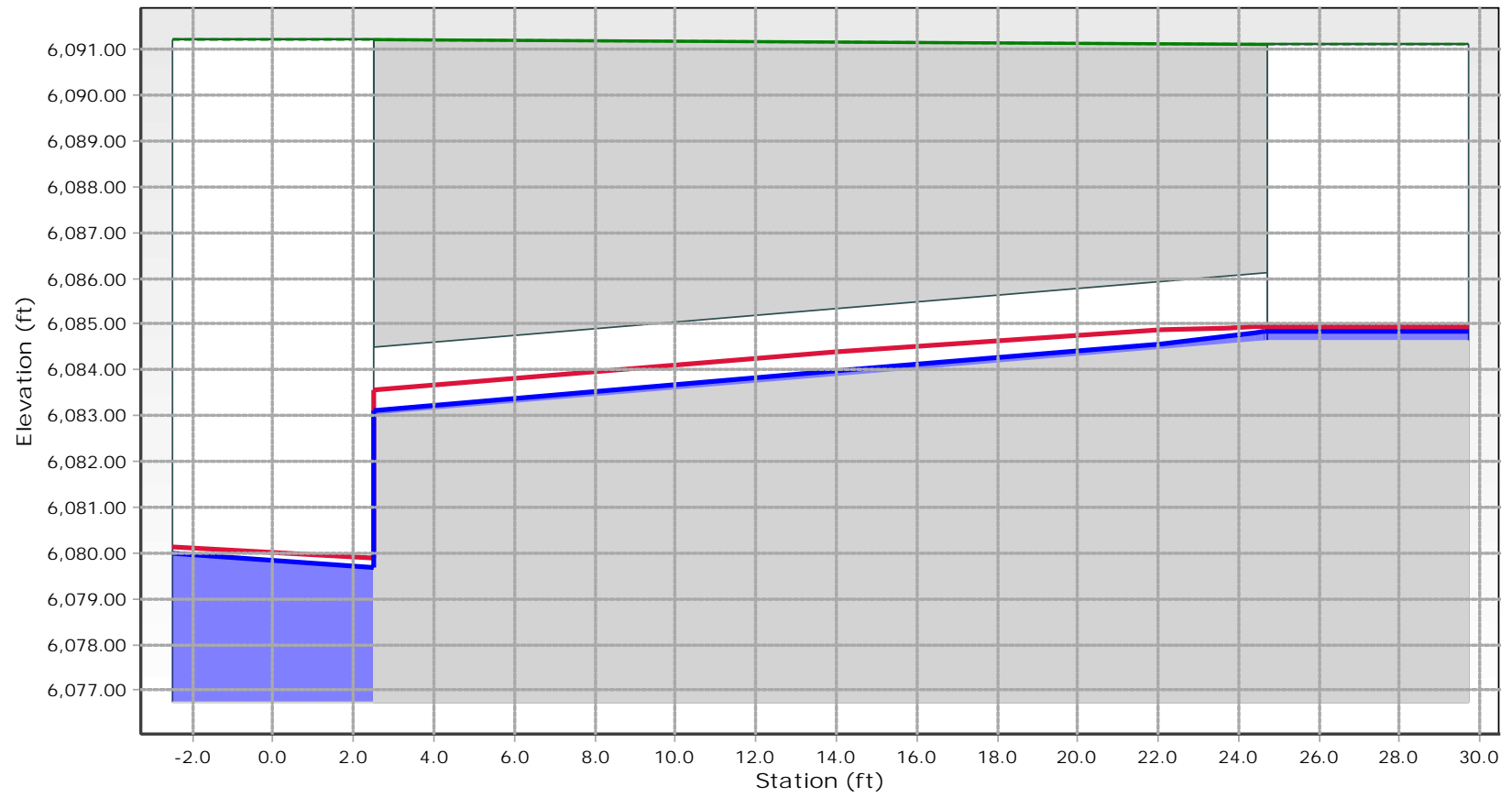




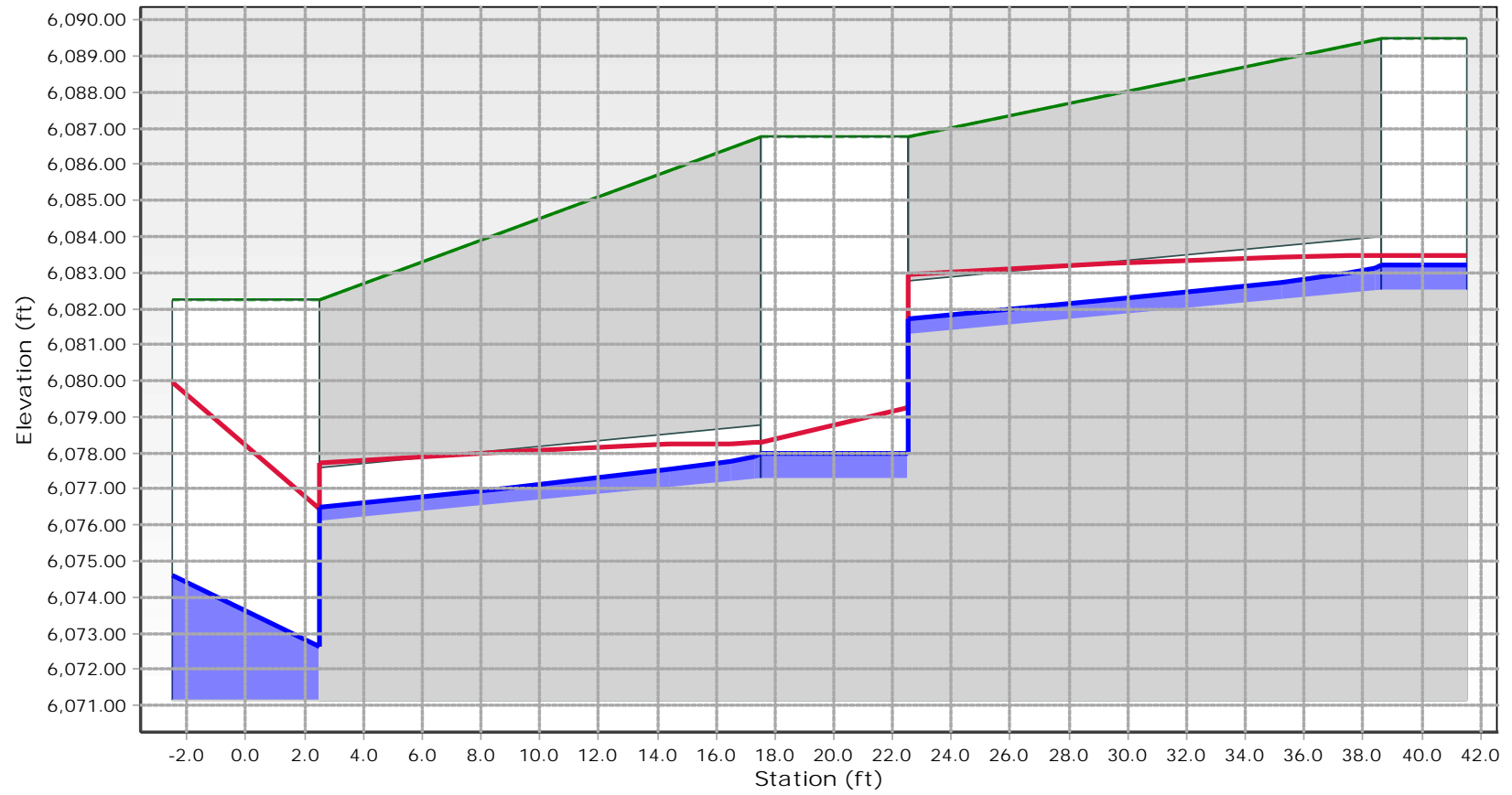
DP77 - 100-Year



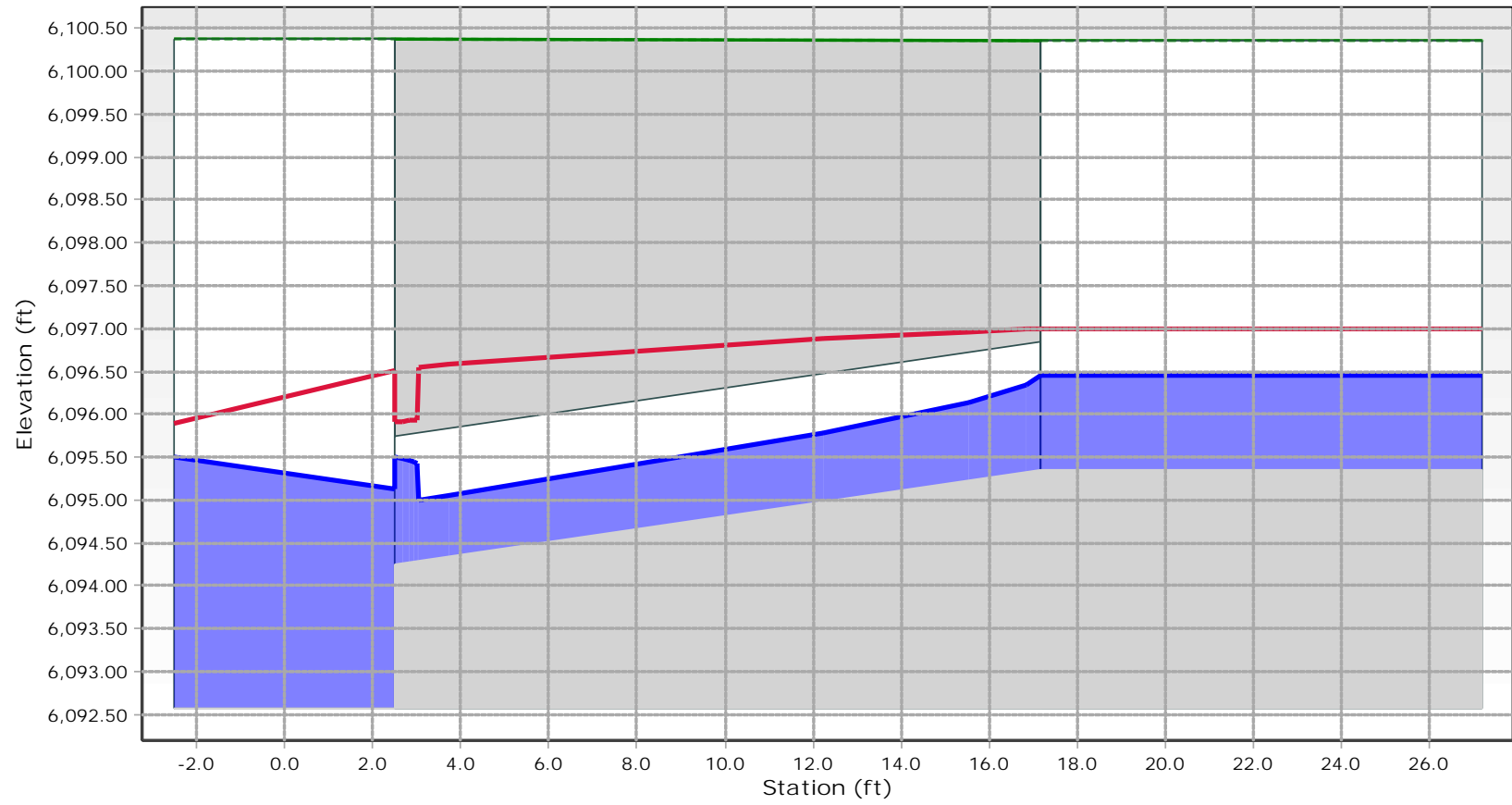
DP78 - 100-Year



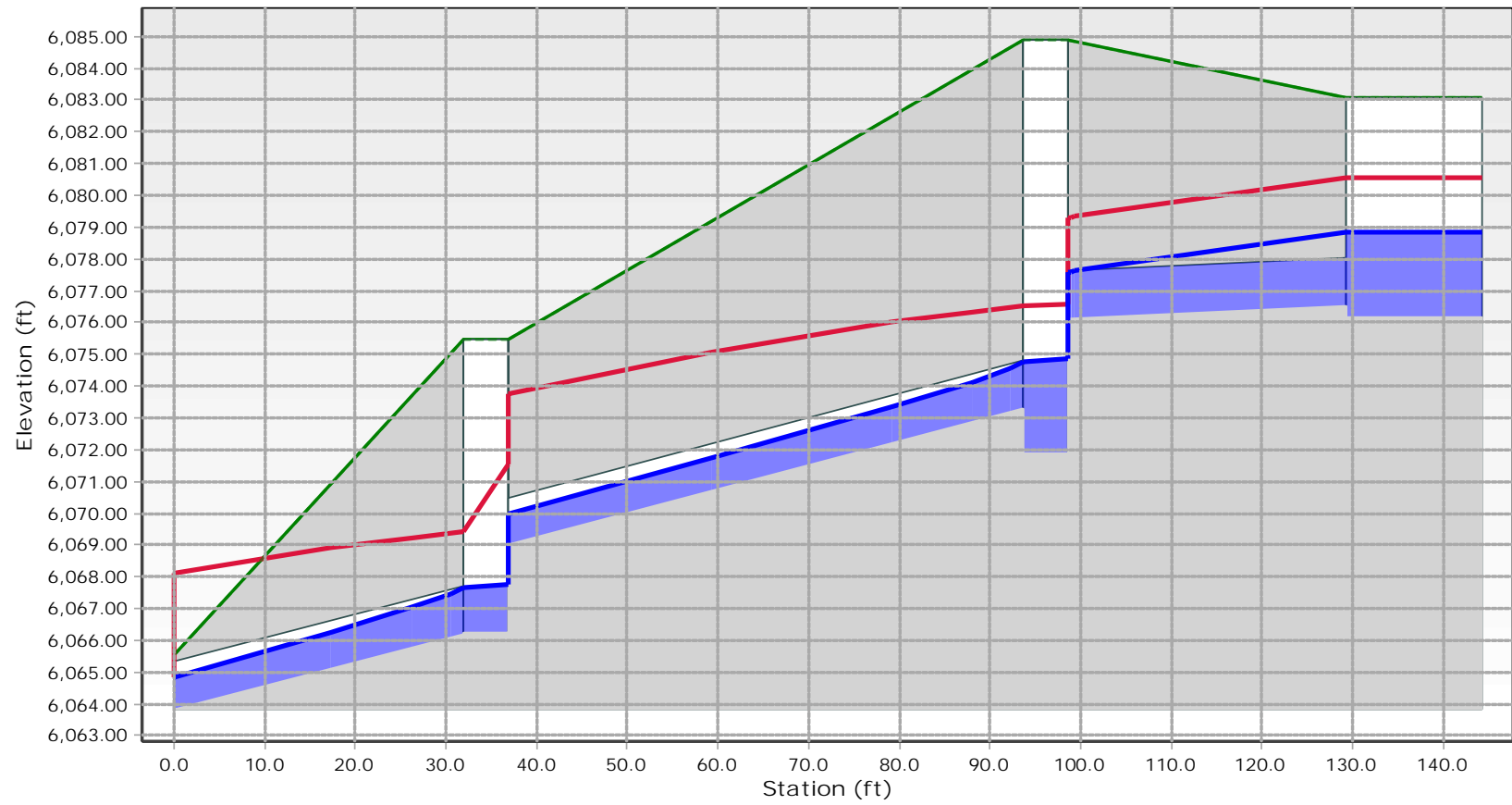
DP79 - 100-Year



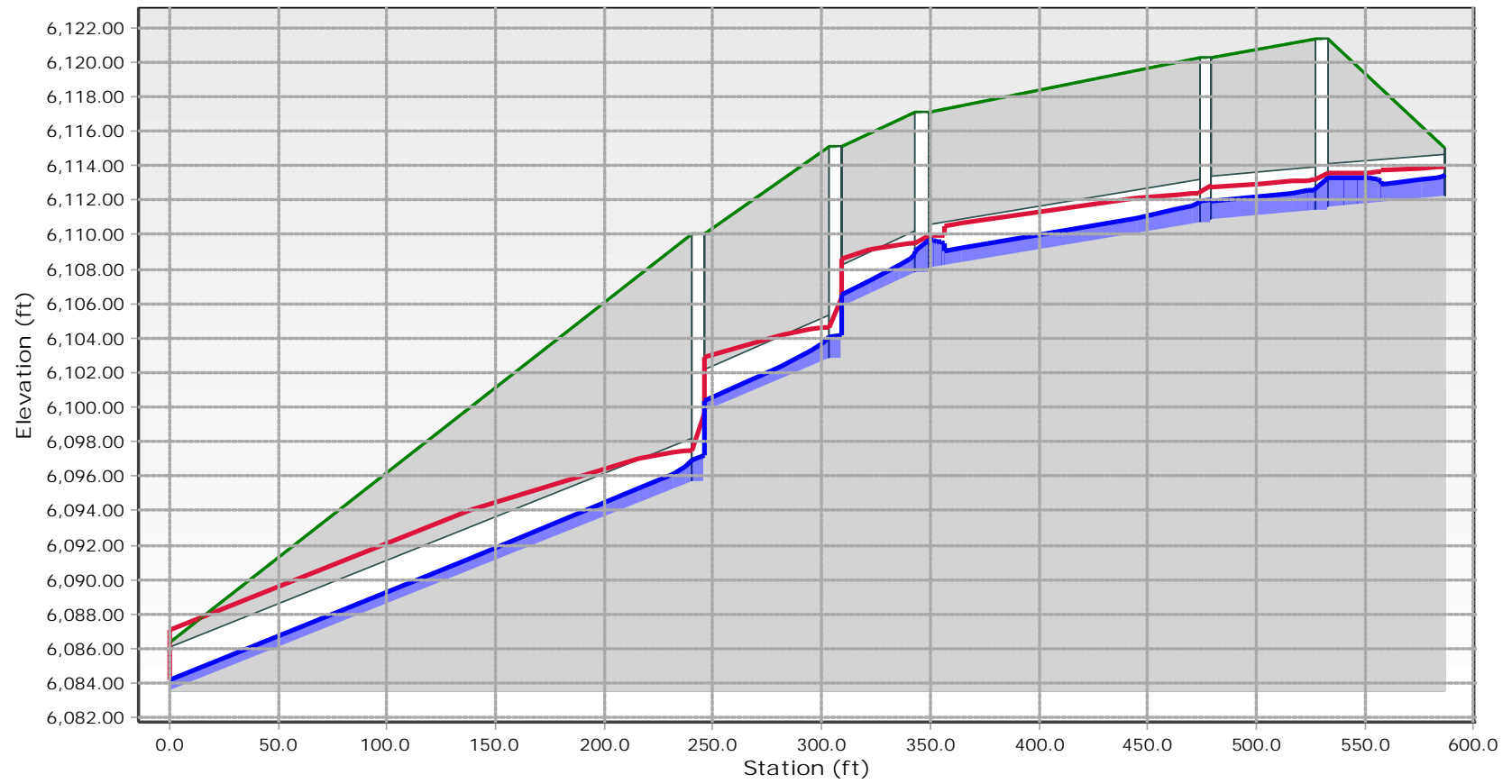
DP80 - 100-Year



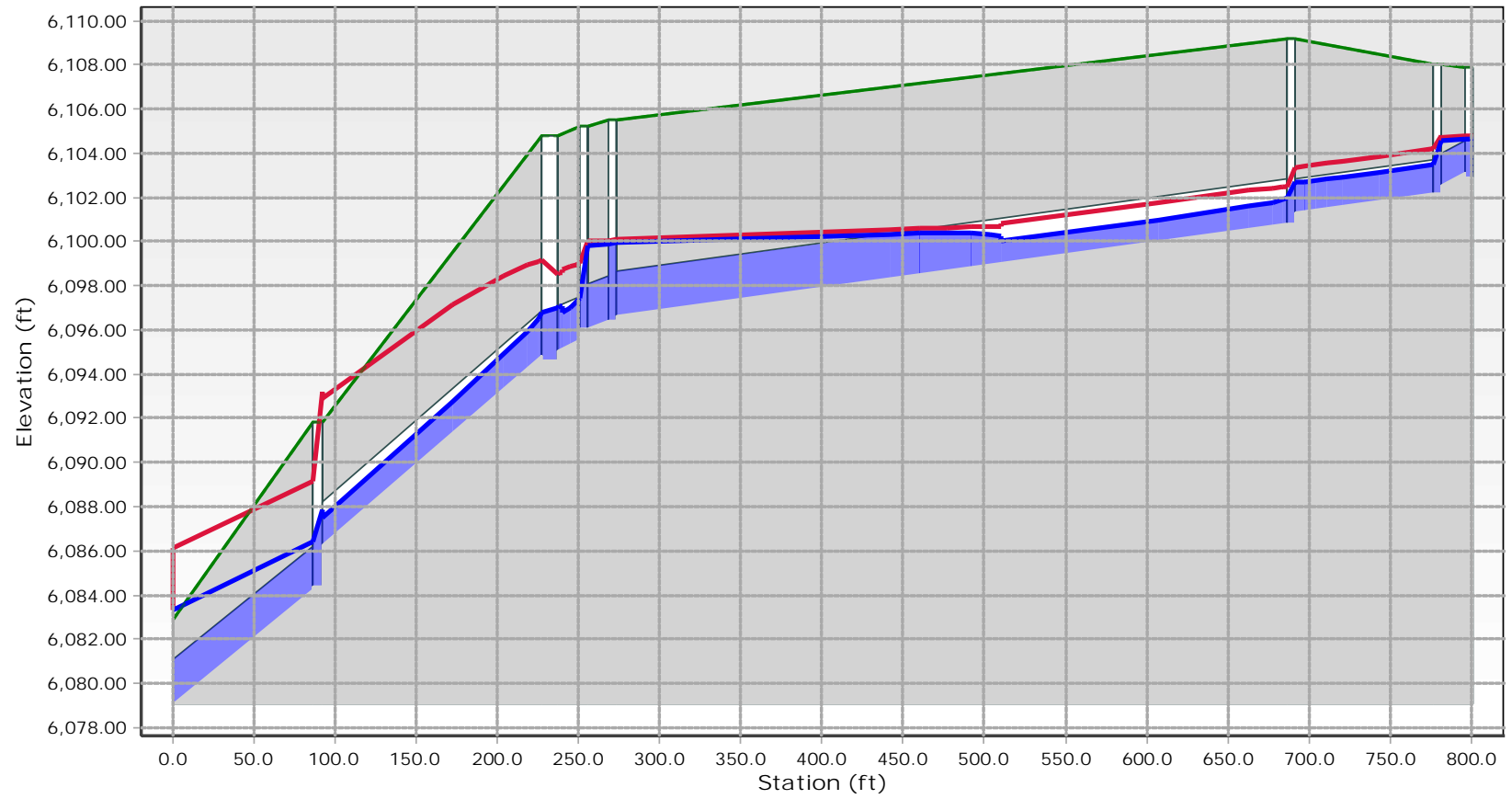
Pond C Outfall - 100-Year



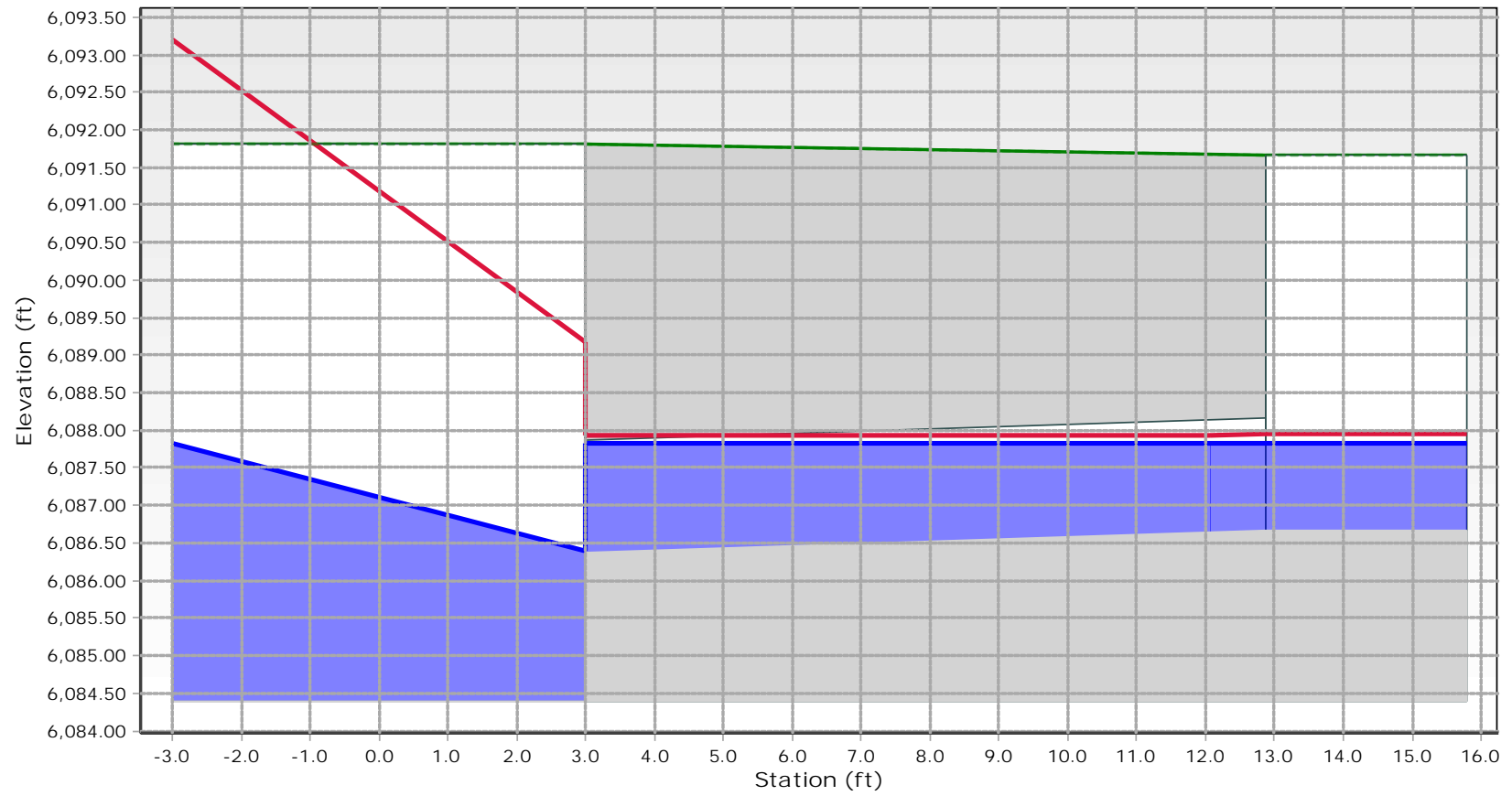
DP100 - 100-Year



DP101 - 100-Year

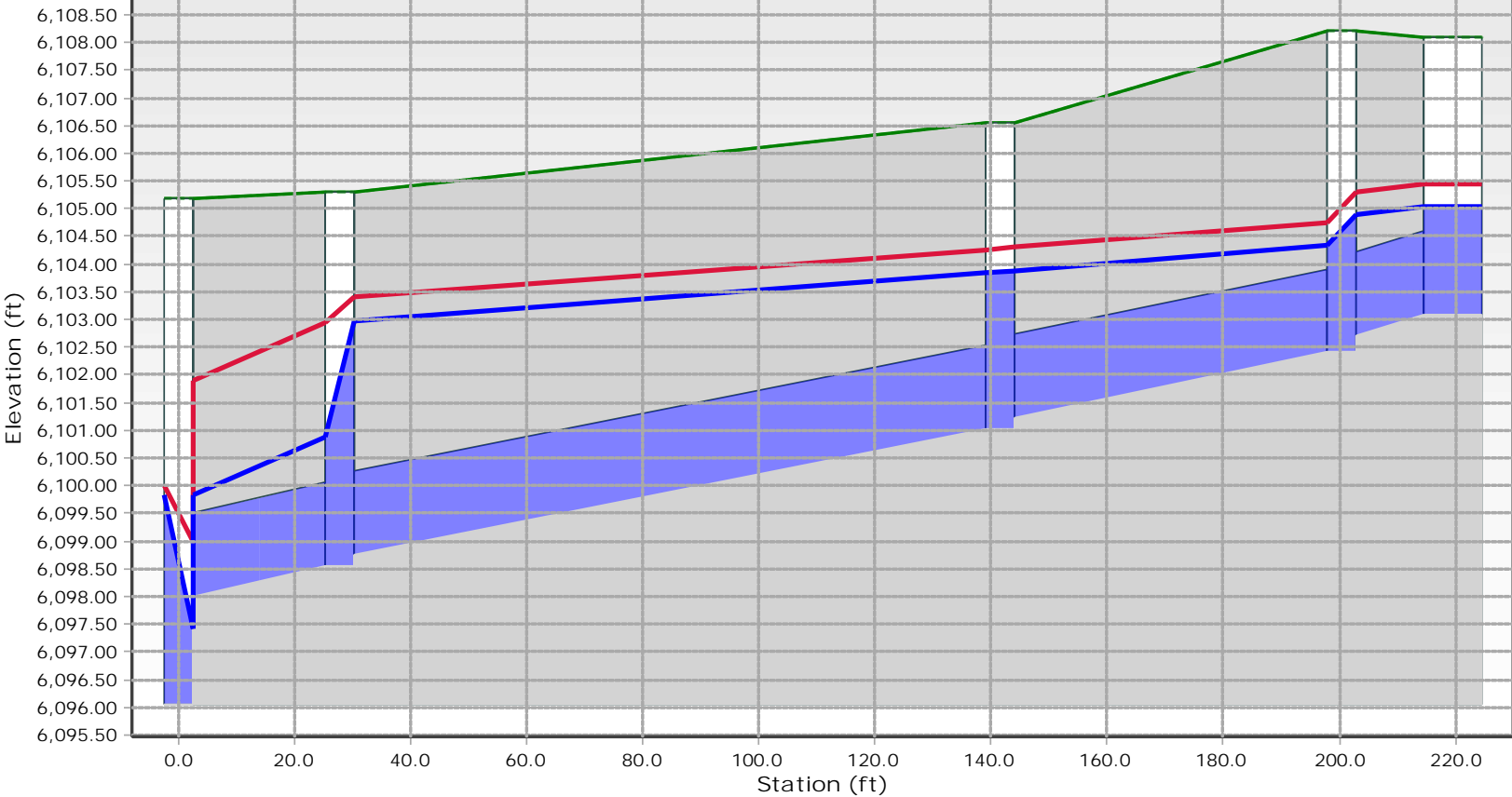


DP102 - 100-Year

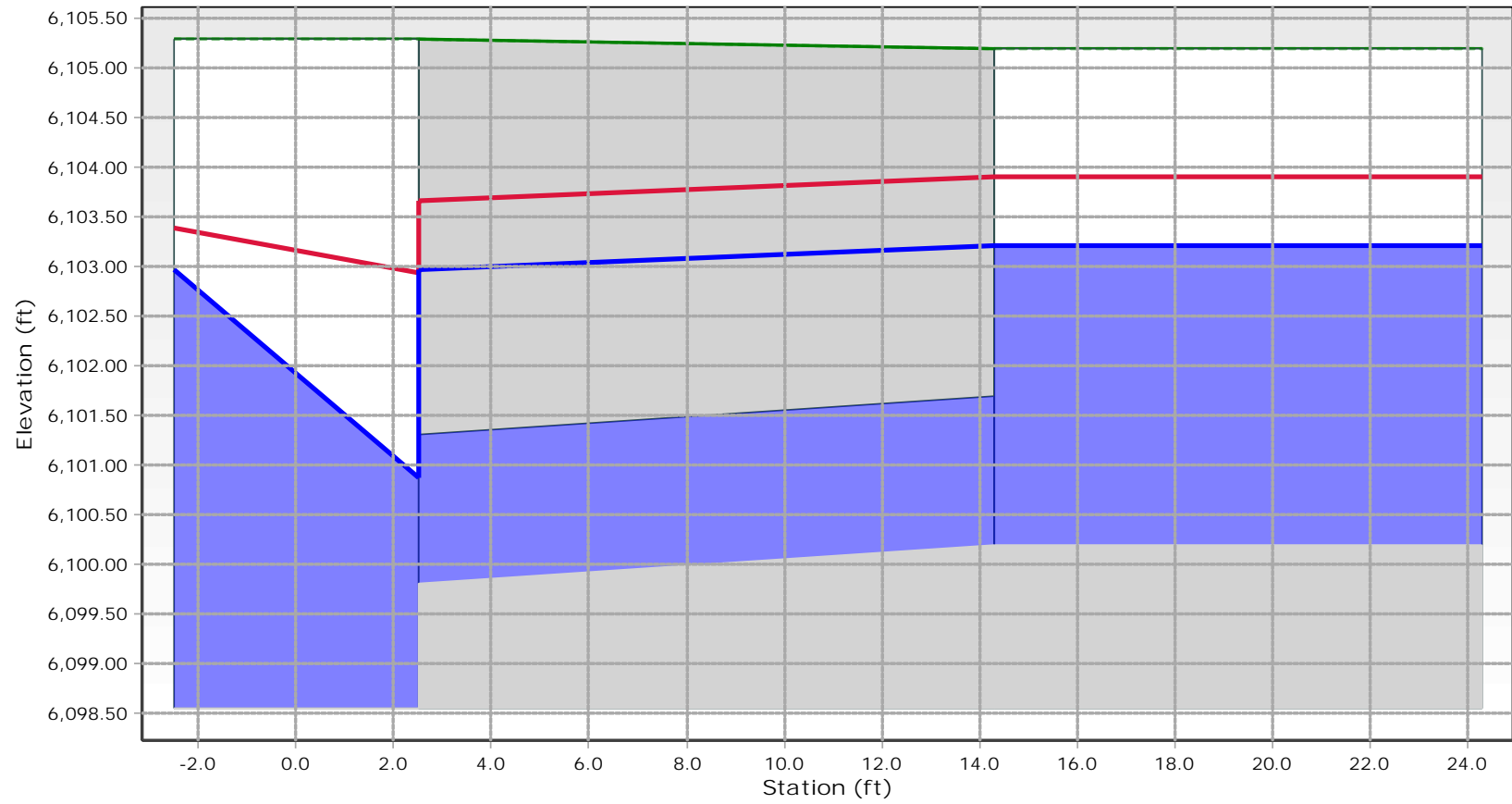




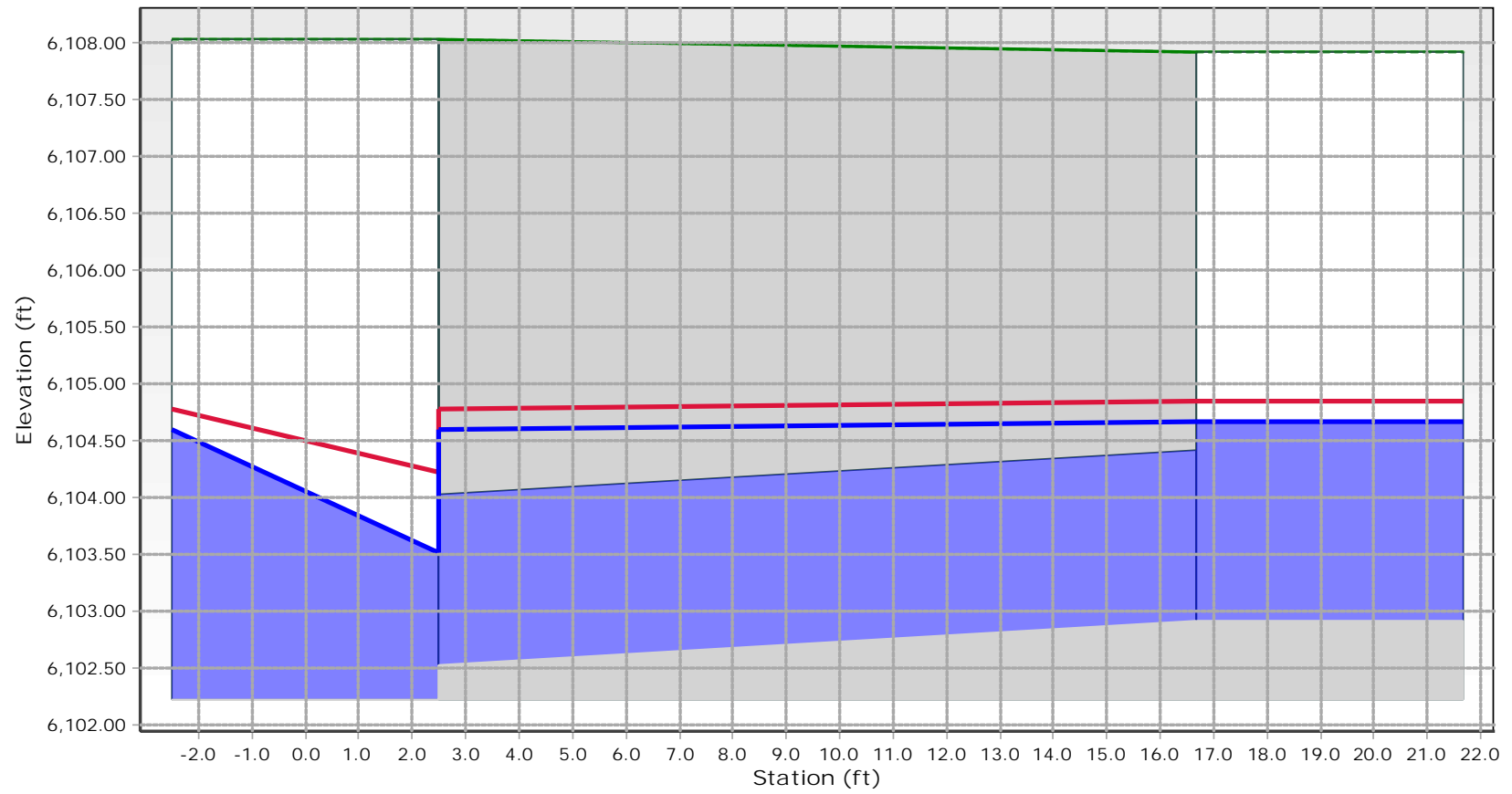
DP103 - 100-Year



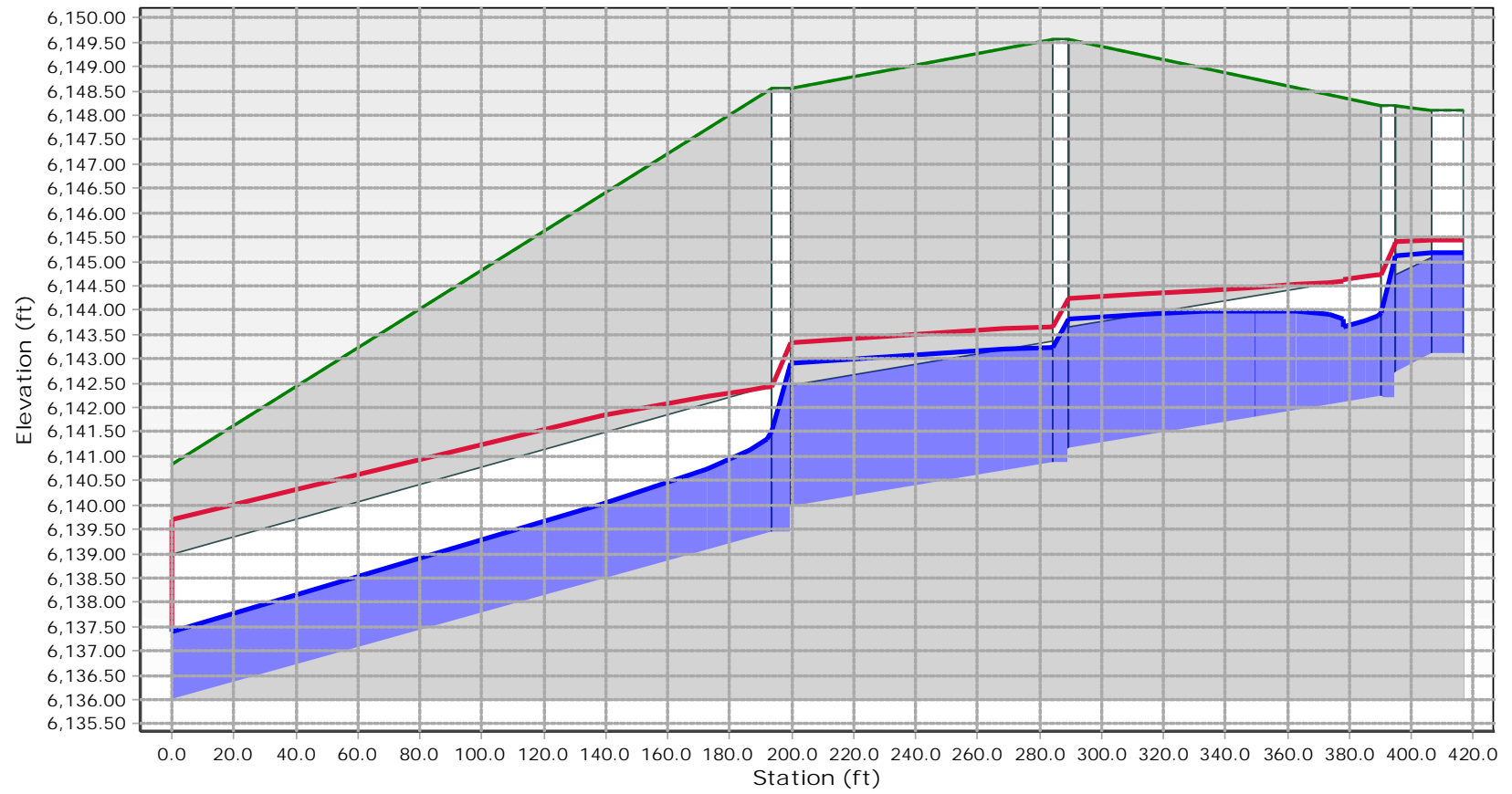
DP104 - 100-Year



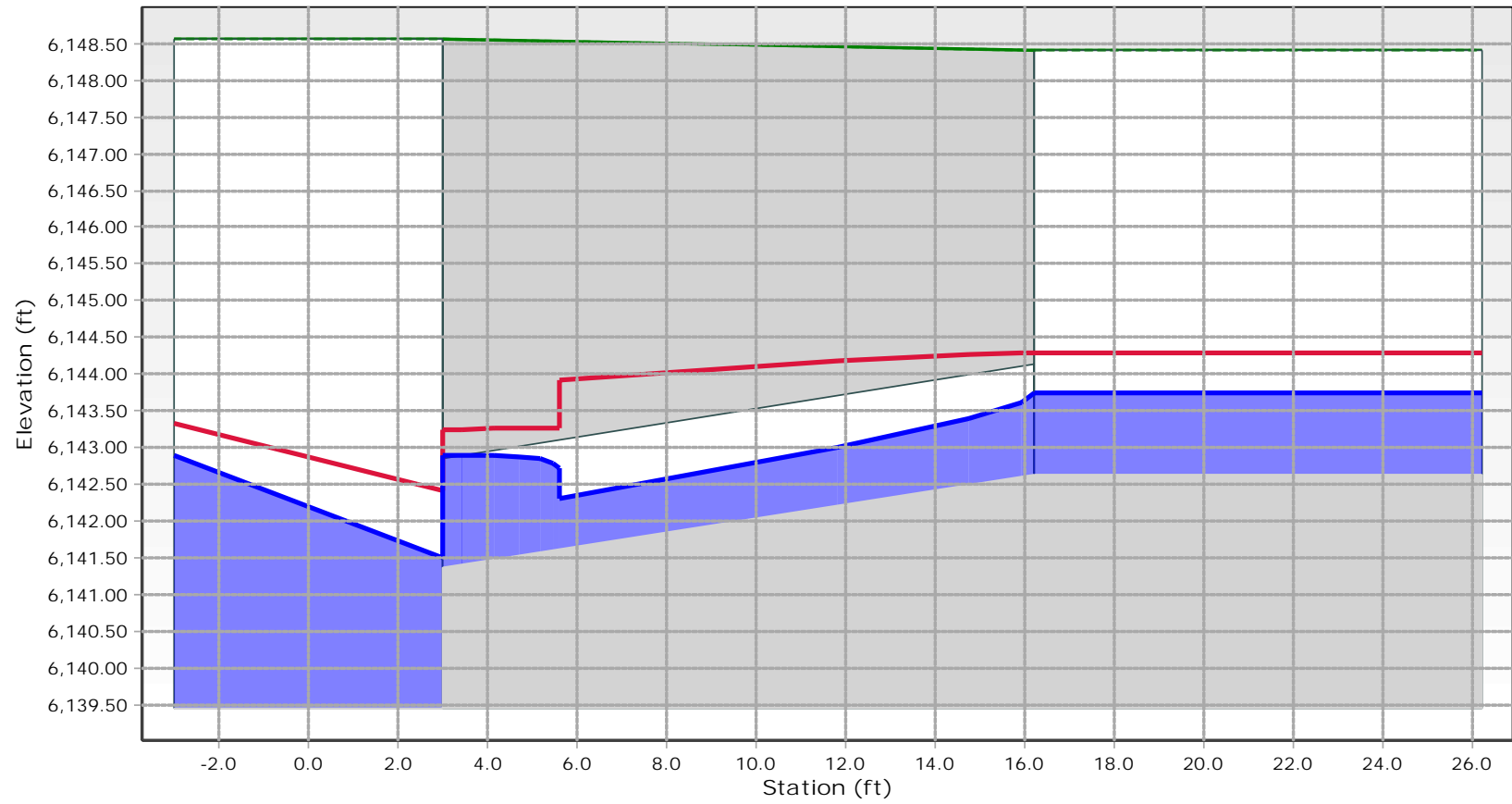
DP105 - 100-Year



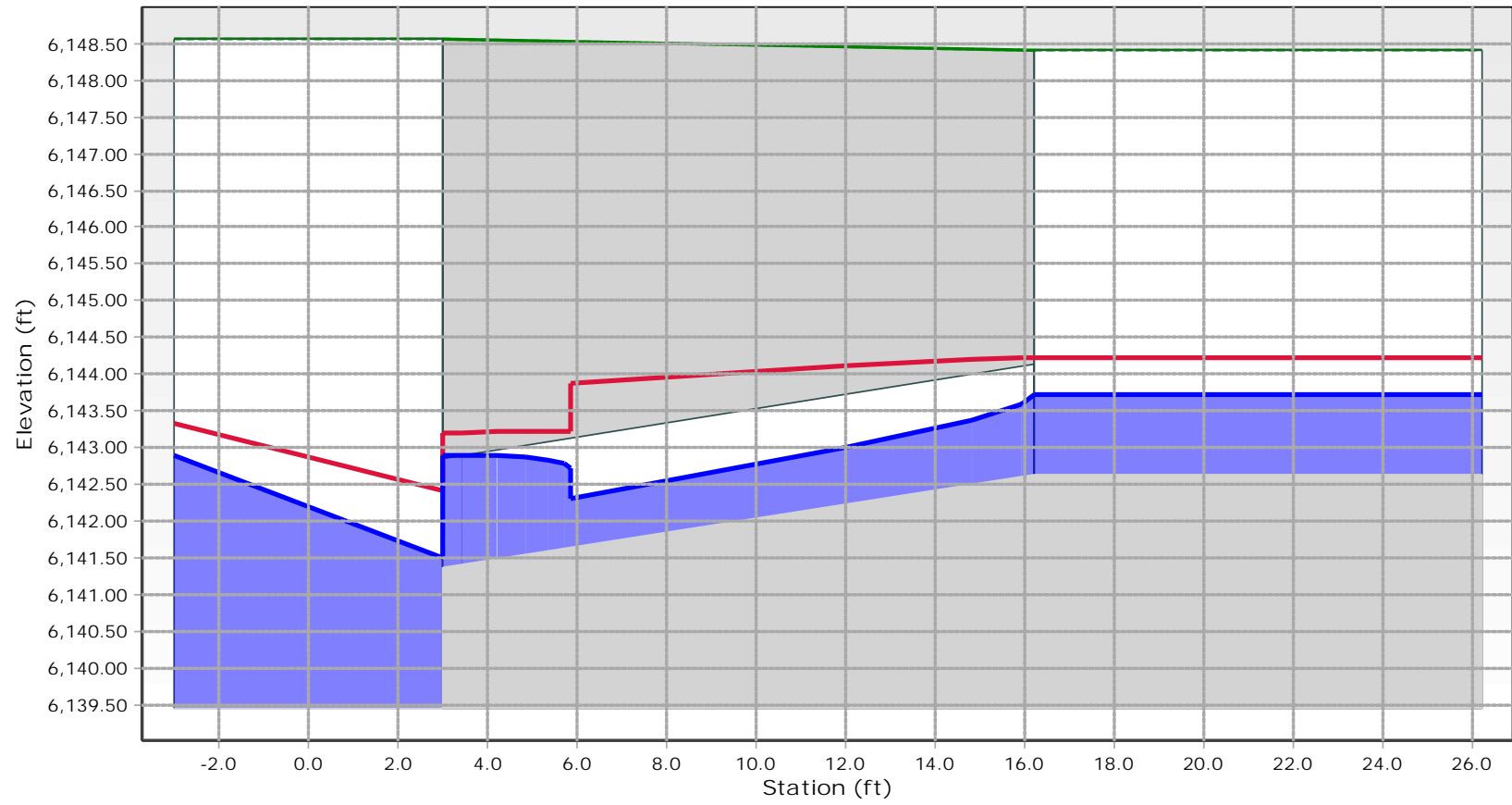
DP120 - 100-Year



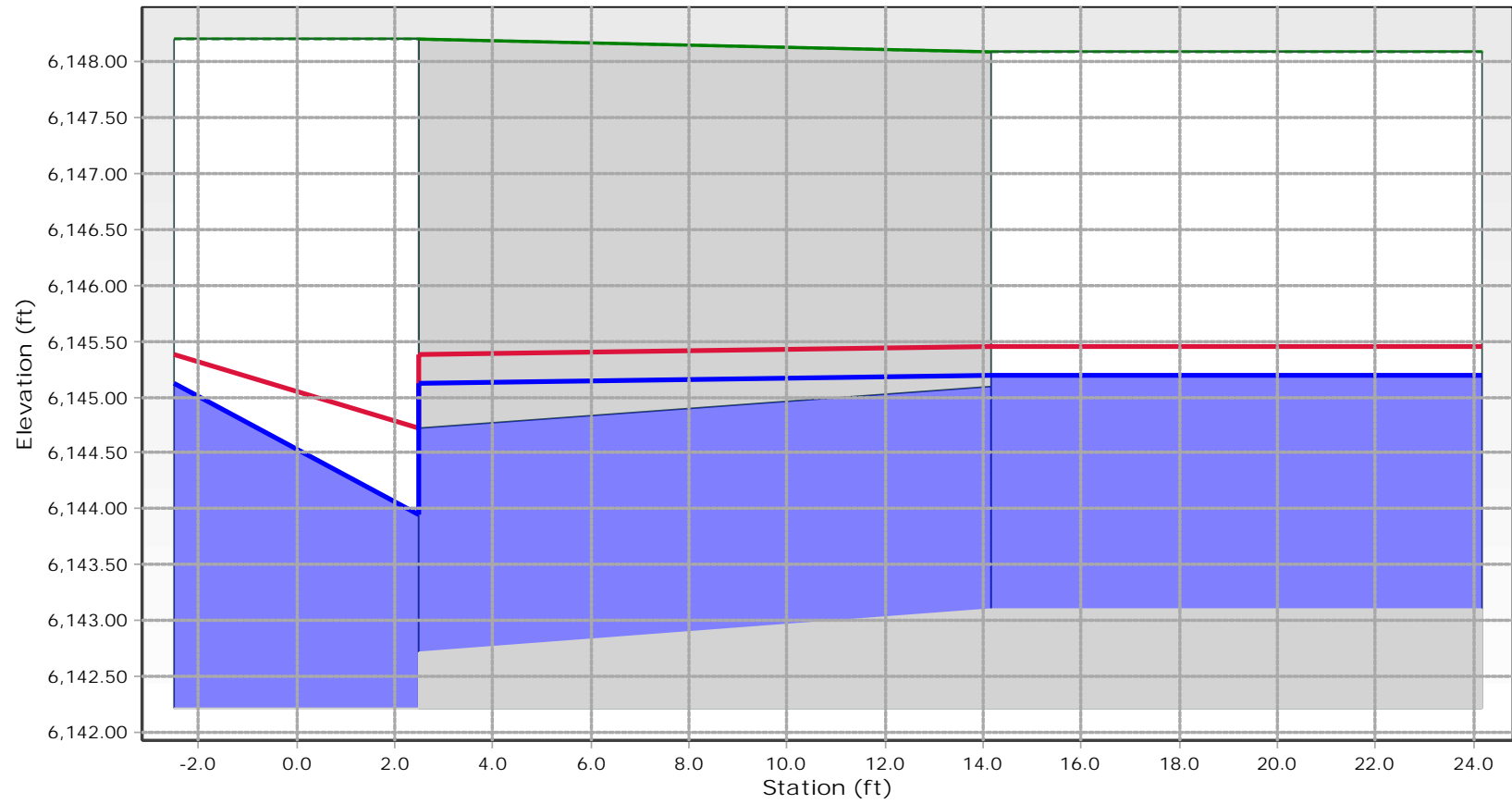
DP121 - 100-Year



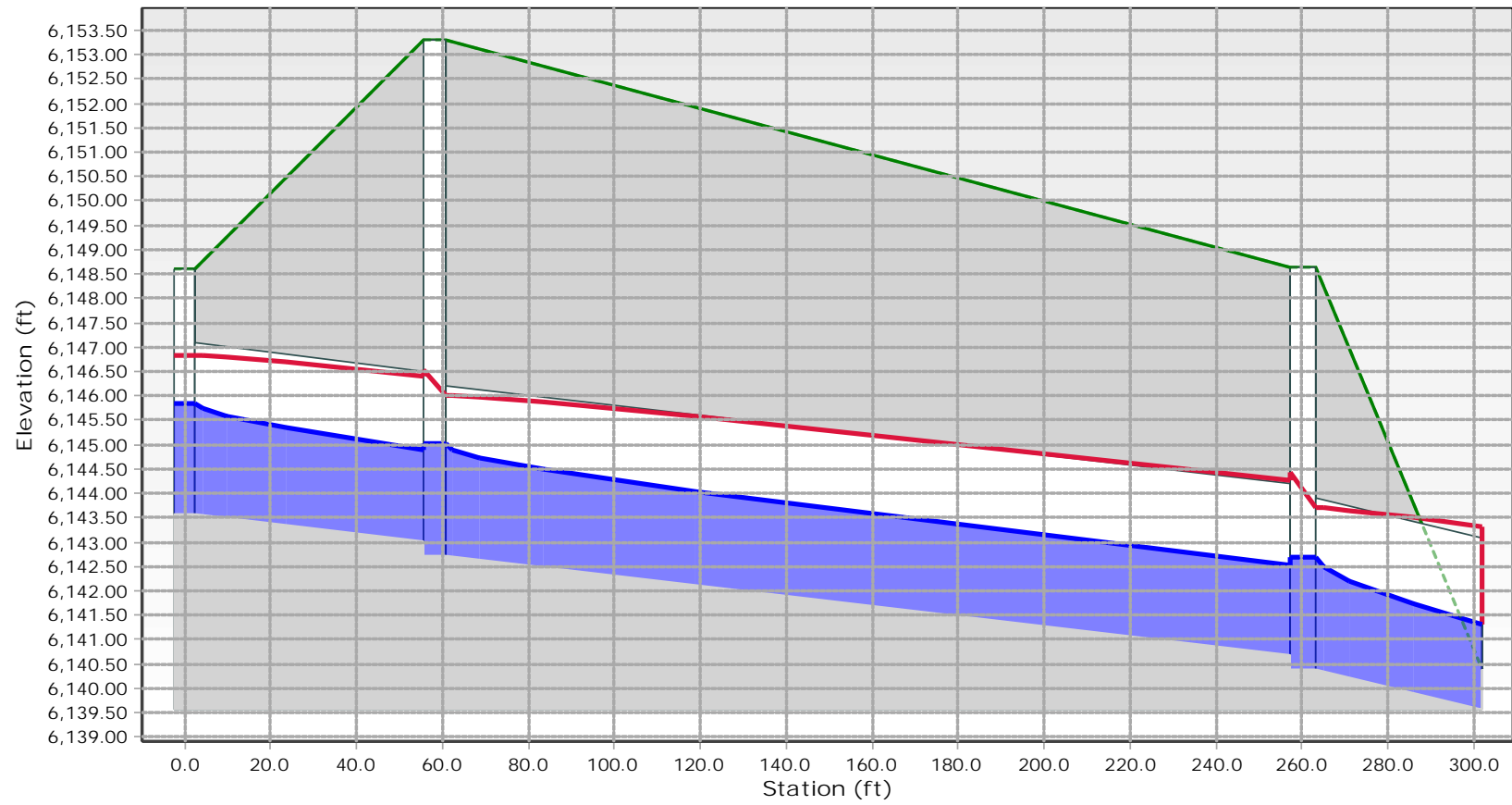
DP122 - 100-Year



DP123 - 100-Year

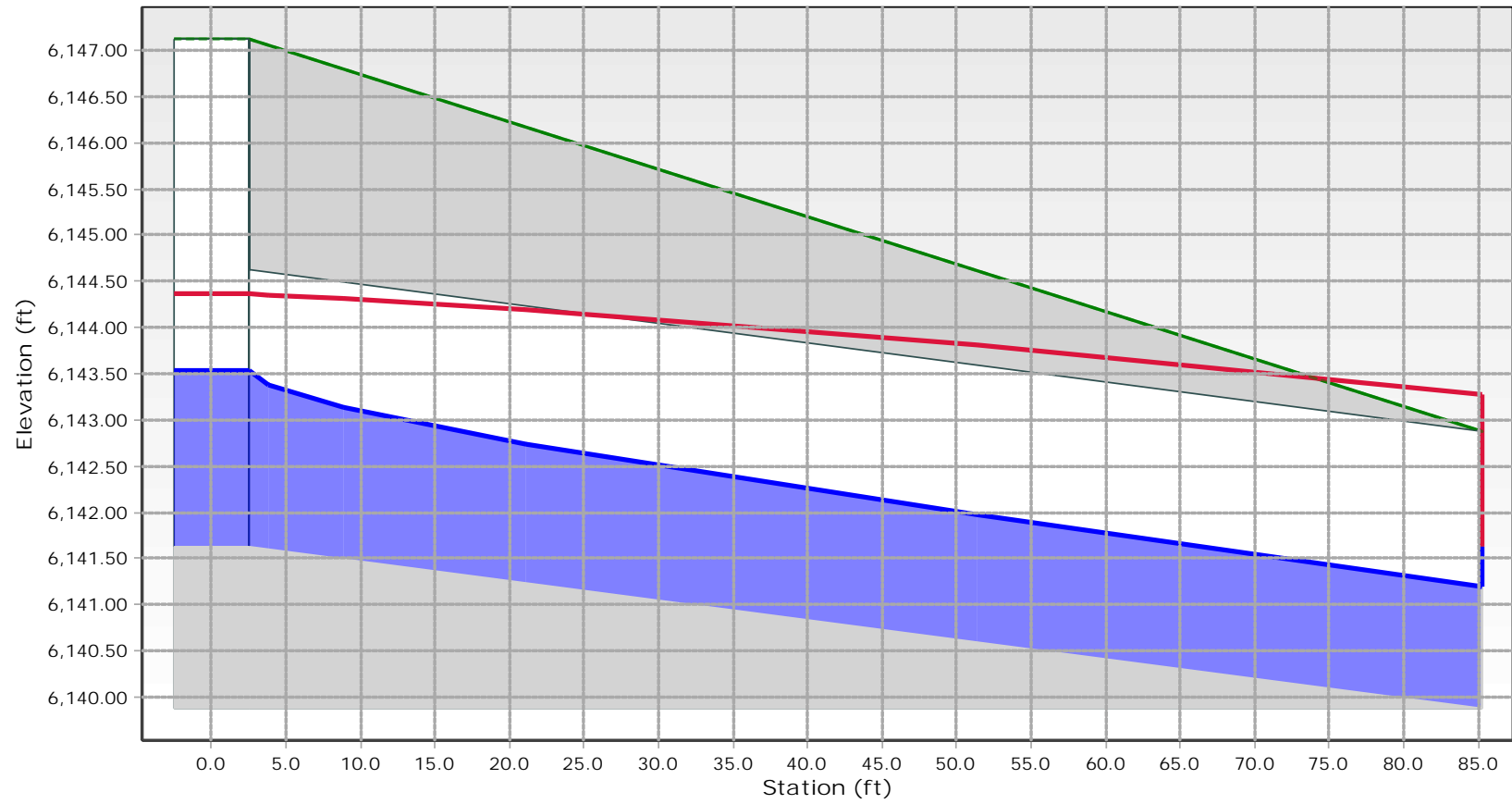


DP140 - 100-Year

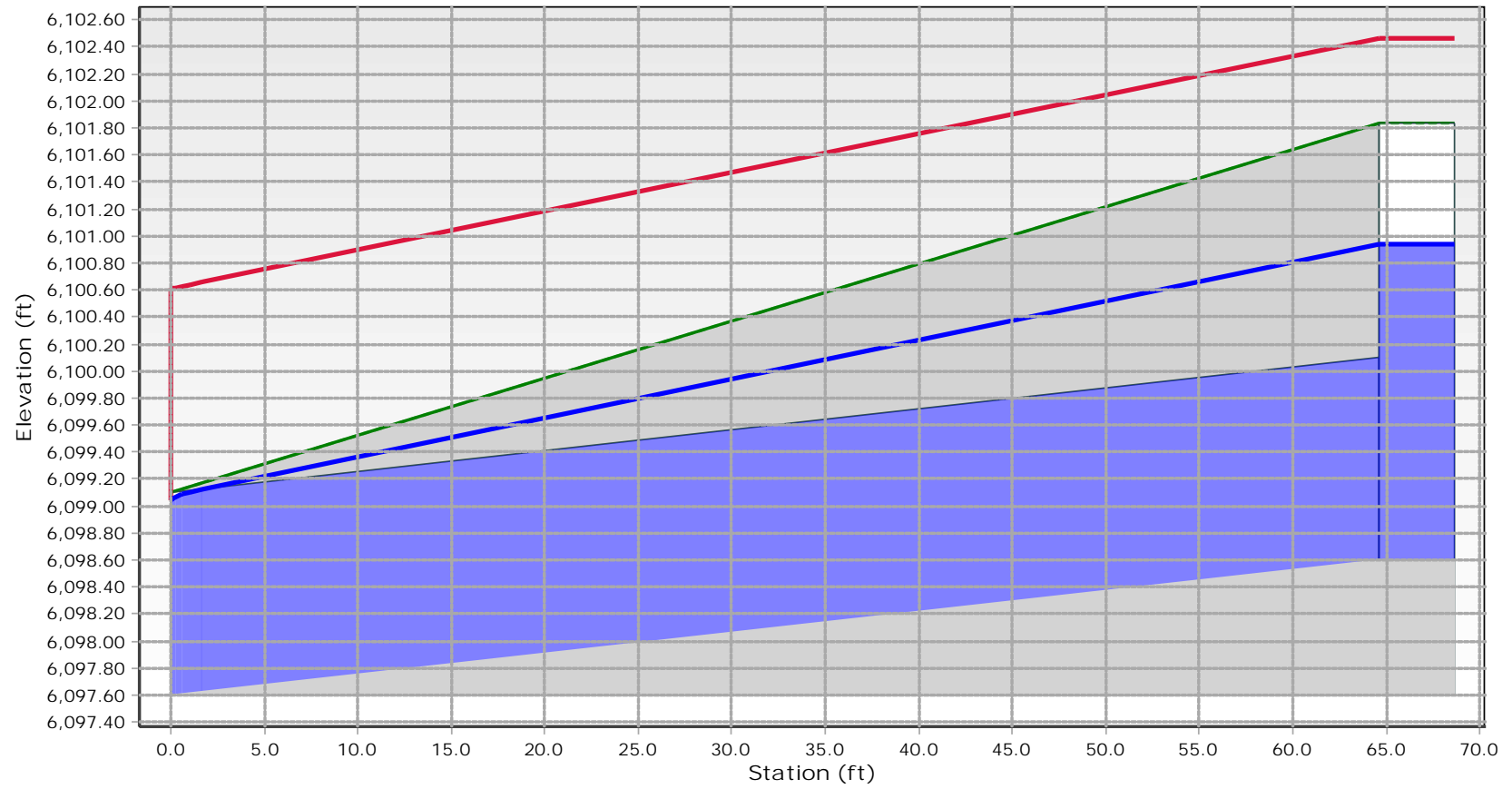




DP20 E County Line Rd Crossing - 100-Year

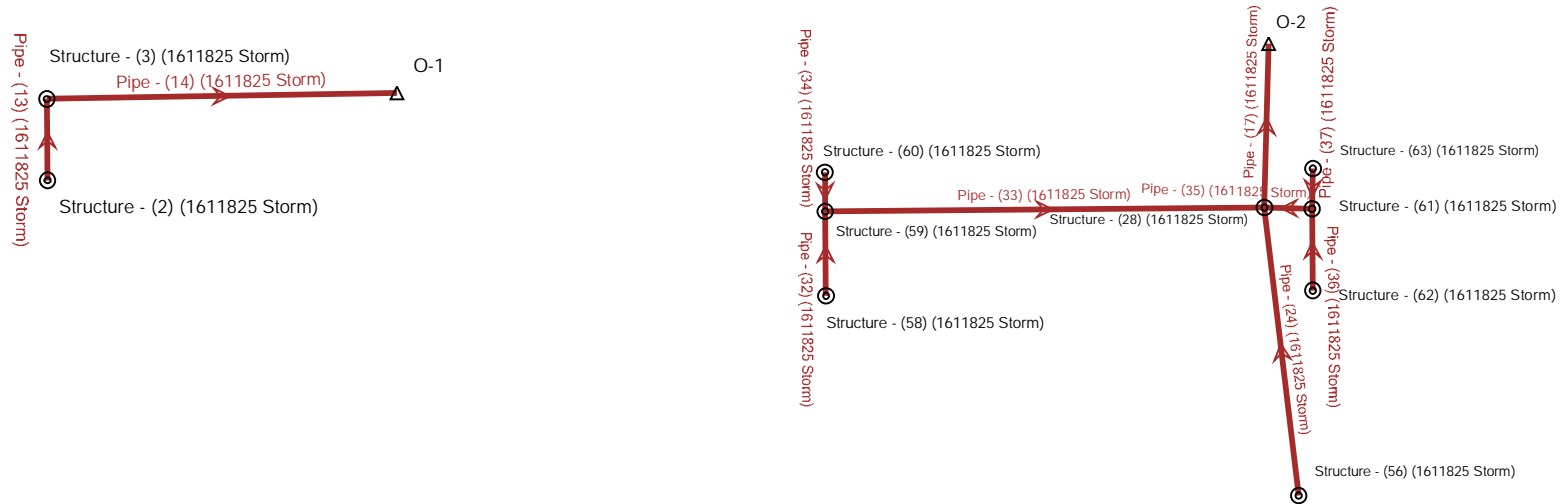


Pond D Outfall - 100-Year



COUNTY LINE ROAD  
ULTIMATE CONDITION STORMCAD

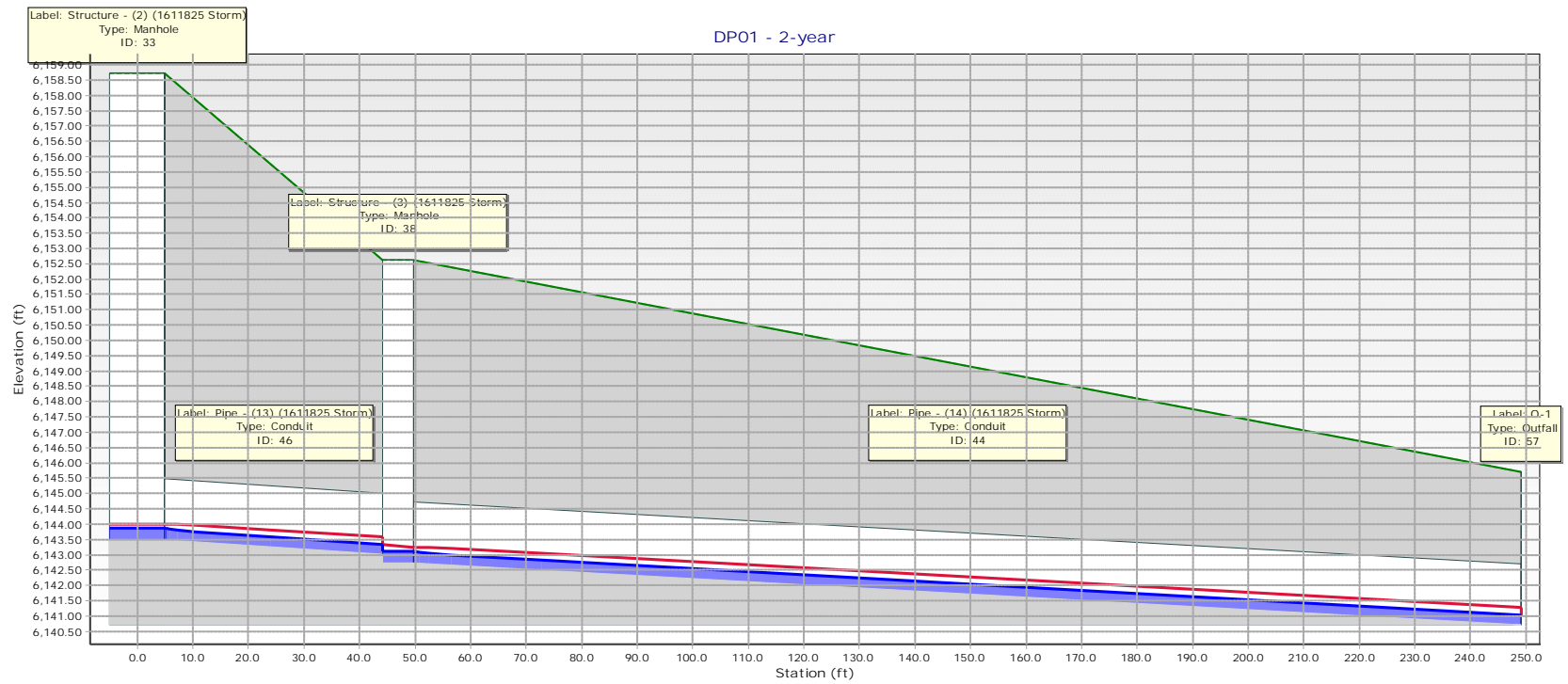
## Scenario: 100-year

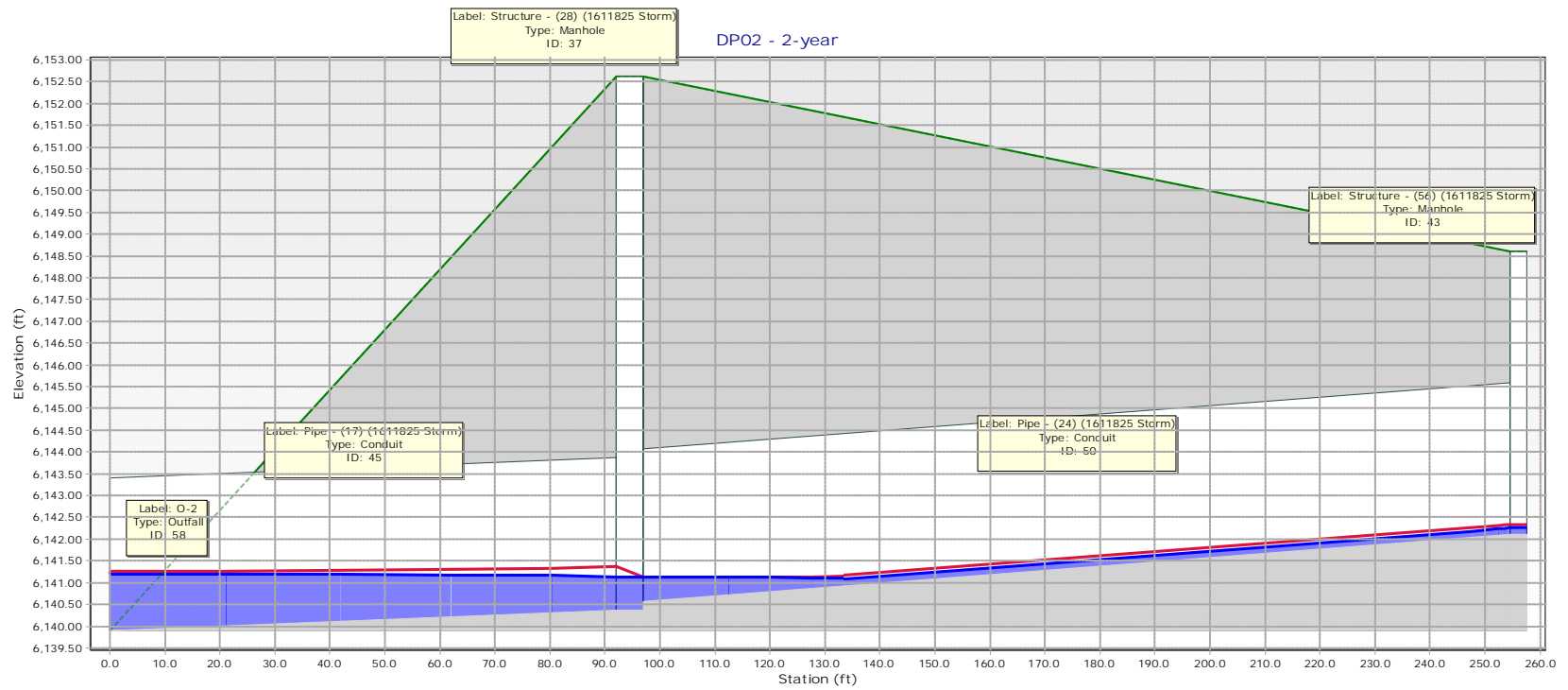


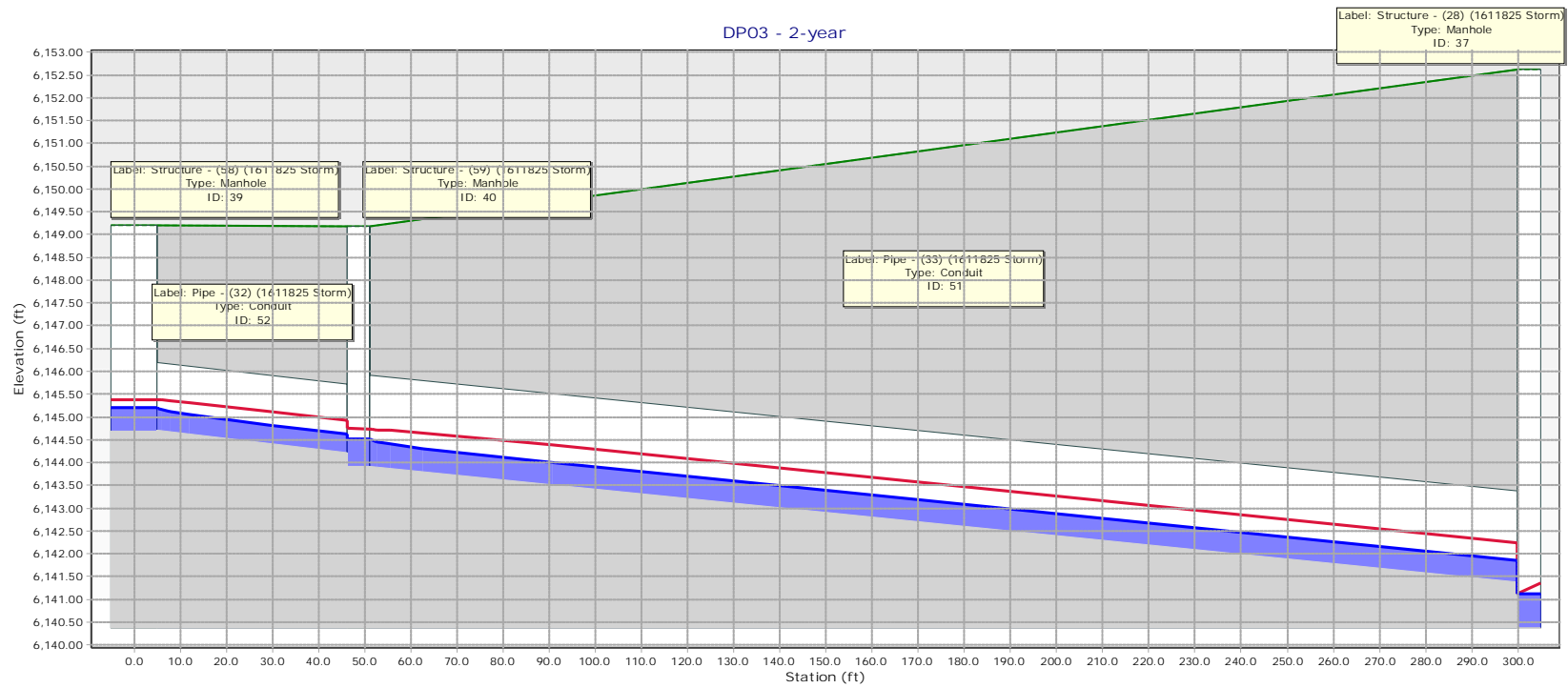
Scenario: 2-year  
Current Time Step: 0.000 h  
FlexTable: Conduit Table

Upstream Structure	Label	Flow (cfs)	Diameter (in)	Length (User Defined) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Velocity (ft/s)	Manning's n
Structure - (2) (1611825 Storm)	Pipe - (13) (1611825 Storm)	1.24	24.0	47.0	6,143.49	6,143.02	0.010	6,158.72	6,152.61	6,143.88	6,143.34	6,144.01	6,143.57	3.86	0.013
Structure - (3) (1611825 Storm)	Pipe - (14) (1611825 Storm)	1.30	24.0	202.2	6,142.72	6,140.71	0.010	6,152.61	6,145.71	6,143.12	6,141.04	6,143.25	6,141.27	3.90	0.013
Structure - (28) (1611825 Storm)	Pipe - (17) (1611825 Storm)	6.05	42.0	94.5	6,139.90	6,140.37	-0.005	6,139.90	6,152.62	6,141.12	6,141.20	6,141.37	6,141.25	4.50	0.013
Structure - (56) (1611825 Storm)	Pipe - (24) (1611825 Storm)	0.34	42.0	161.6	6,140.57	6,142.10	-0.009	6,152.62	6,148.60	6,142.27	6,141.12	6,142.33	6,141.13	2.37	0.013
Structure - (58) (1611825 Storm)	Pipe - (32) (1611825 Storm)	1.72	18.0	48.6	6,144.70	6,144.22	0.010	6,149.20	6,149.18	6,145.20	6,144.63	6,145.38	6,144.93	4.38	0.013
Structure - (59) (1611825 Storm)	Pipe - (33) (1611825 Storm)	2.96	24.0	253.8	6,143.91	6,141.37	0.010	6,149.18	6,152.62	6,144.51	6,141.86	6,144.73	6,142.25	4.98	0.013
Structure - (60) (1611825 Storm)	Pipe - (34) (1611825 Storm)	1.24	18.0	22.7	6,144.44	6,144.21	0.010	6,149.09	6,149.18	6,144.86	6,144.56	6,145.00	6,144.81	3.99	0.013
Structure - (61) (1611825 Storm)	Pipe - (35) (1611825 Storm)	2.75	18.0	27.6	6,141.57	6,142.12	-0.020	6,152.62	6,153.36	6,142.75	6,142.02	6,142.99	6,142.61	6.41	0.013
Structure - (62) (1611825 Storm)	Pipe - (36) (1611825 Storm)	1.50	18.0	47.2	6,142.62	6,143.57	-0.020	6,153.36	6,153.35	6,144.03	6,142.94	6,144.20	6,143.40	5.40	0.013
Structure - (63) (1611825 Storm)	Pipe - (37) (1611825 Storm)	1.25	18.0	23.1	6,142.62	6,143.08	-0.020	6,153.36	6,153.03	6,143.50	6,142.92	6,143.65	6,143.31	5.10	0.013

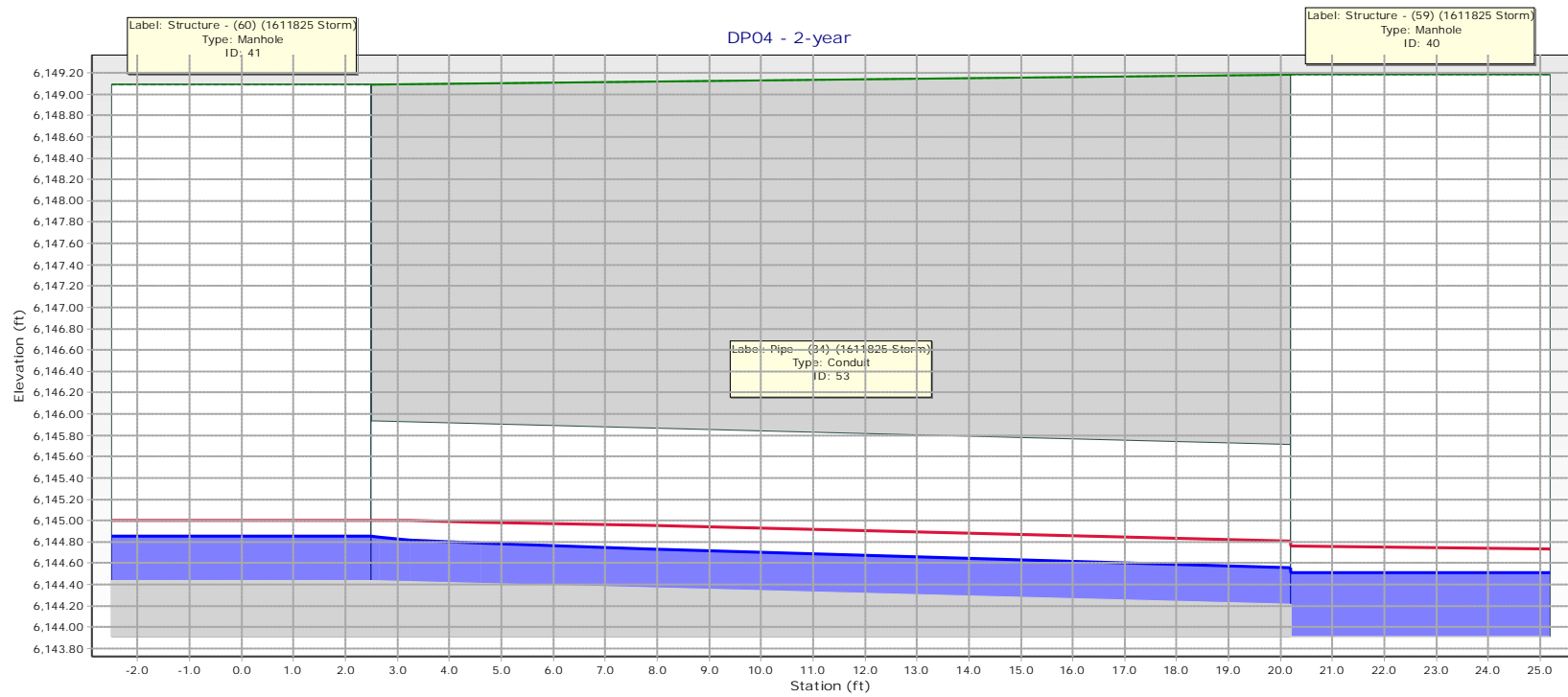
X:\1610000.all\1611825\StormCAD\1611825 StormCAD Model.stsw

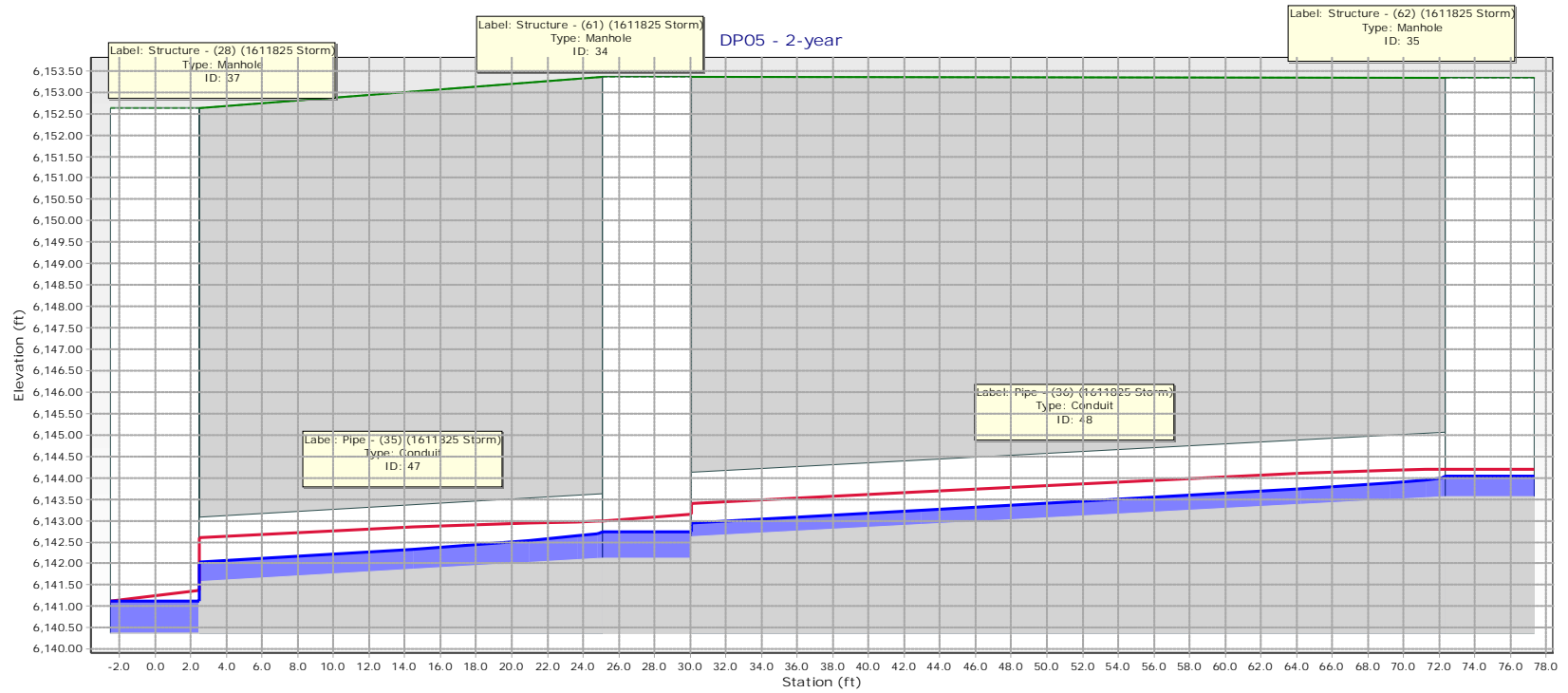


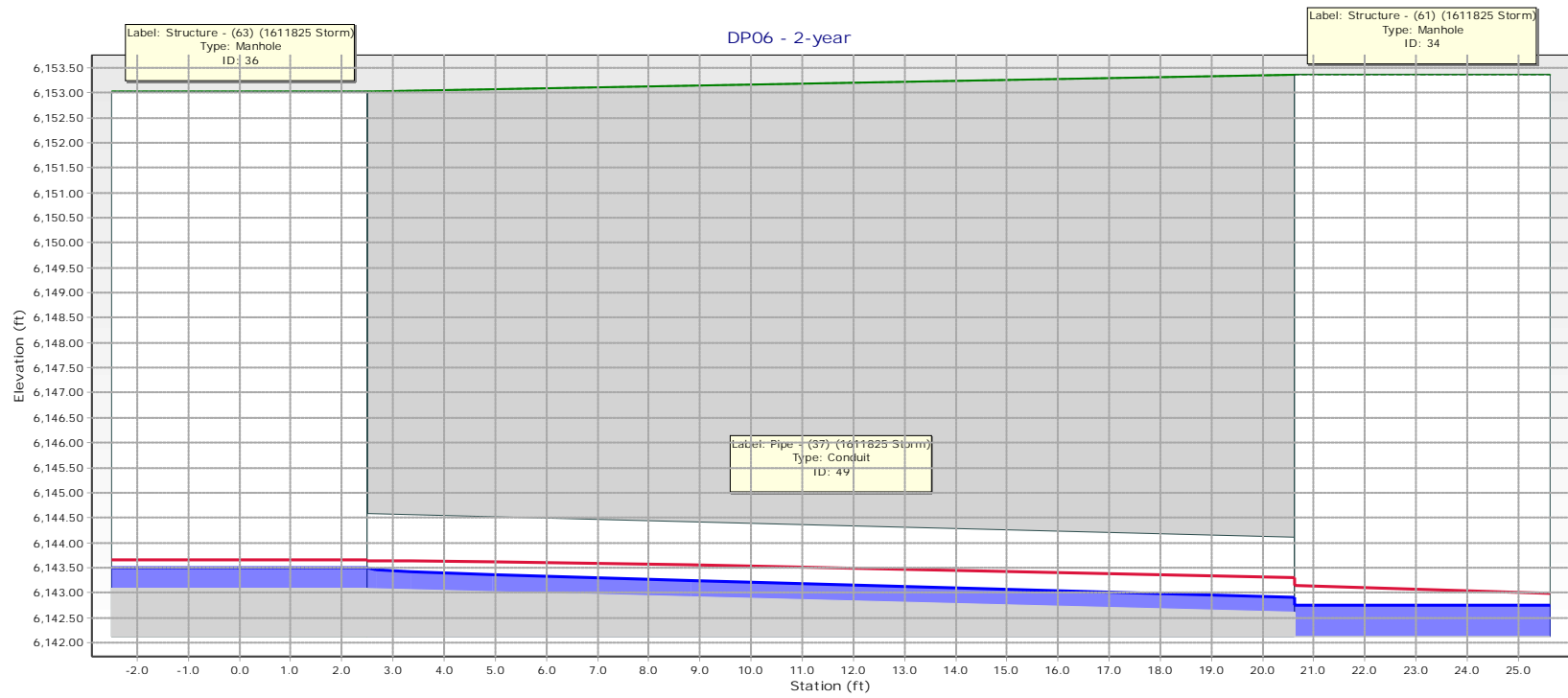








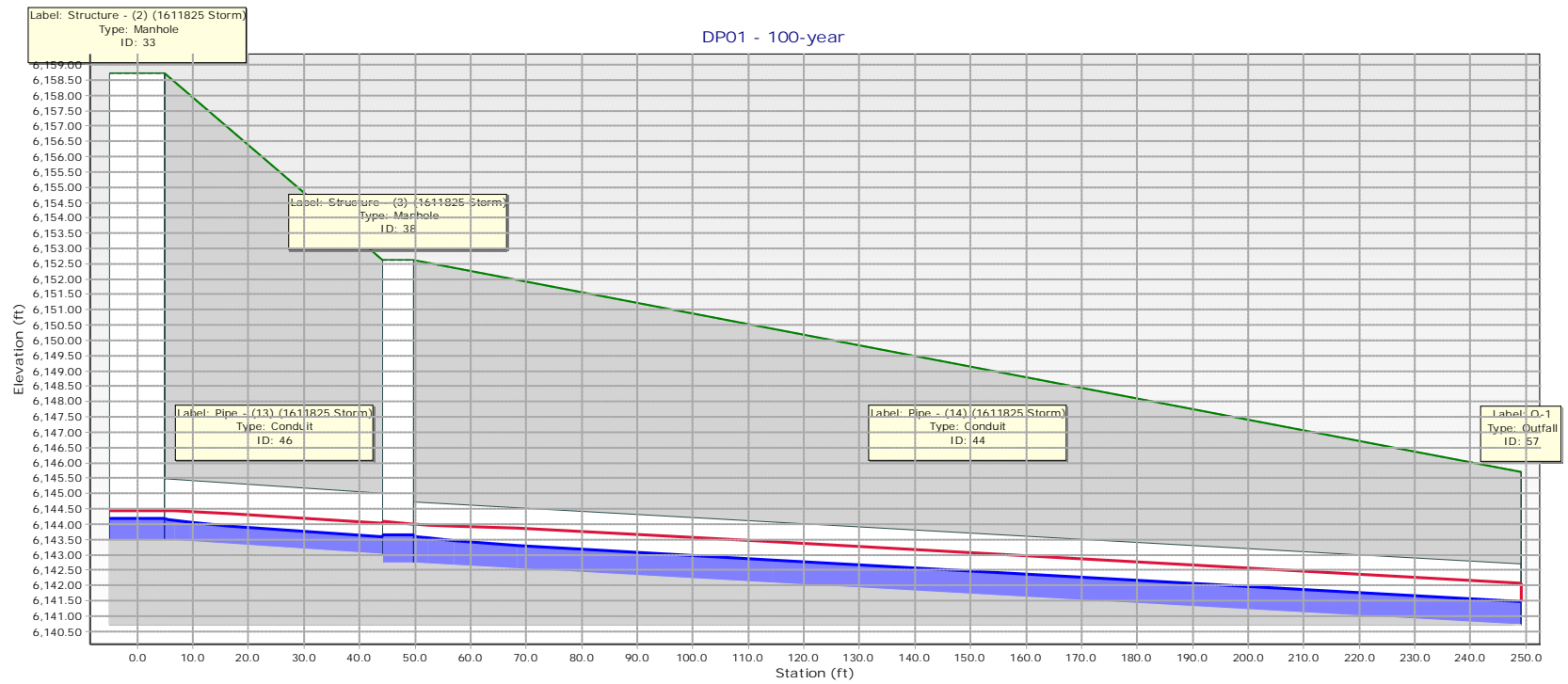


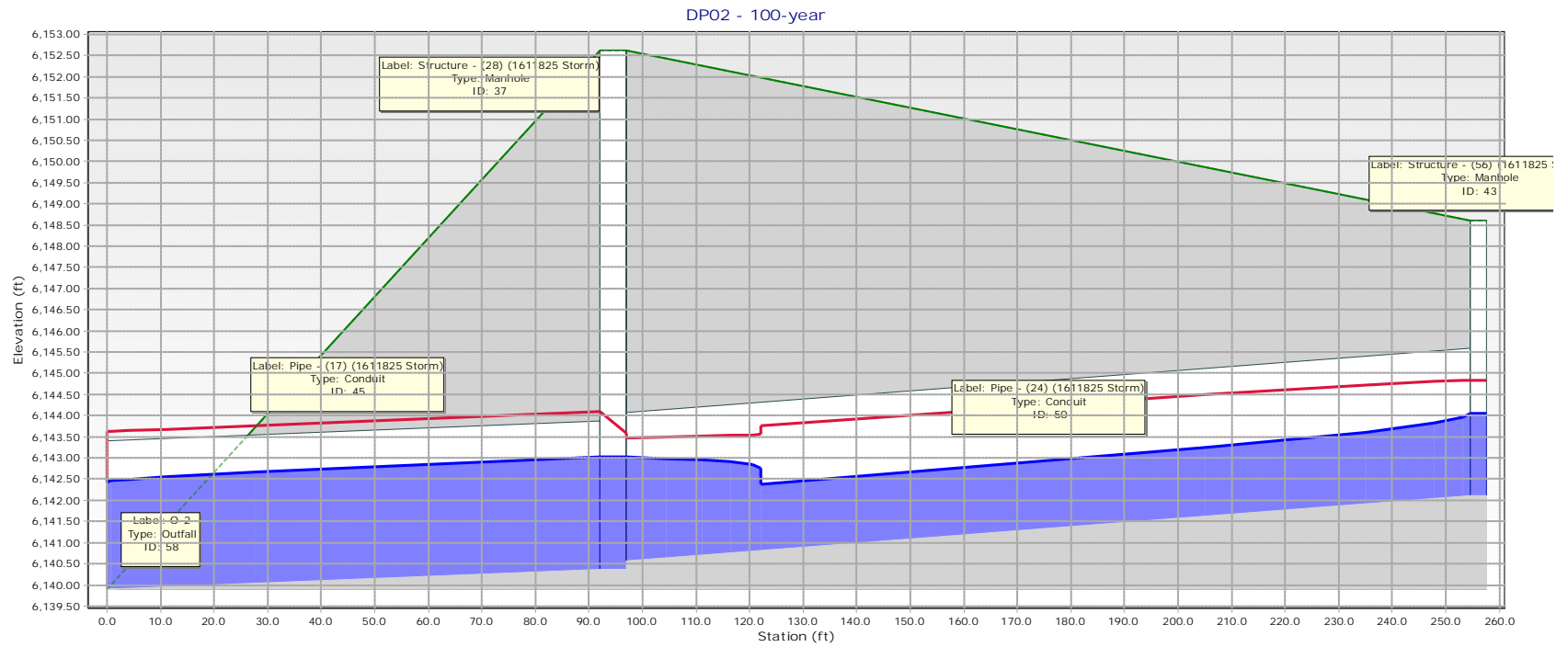


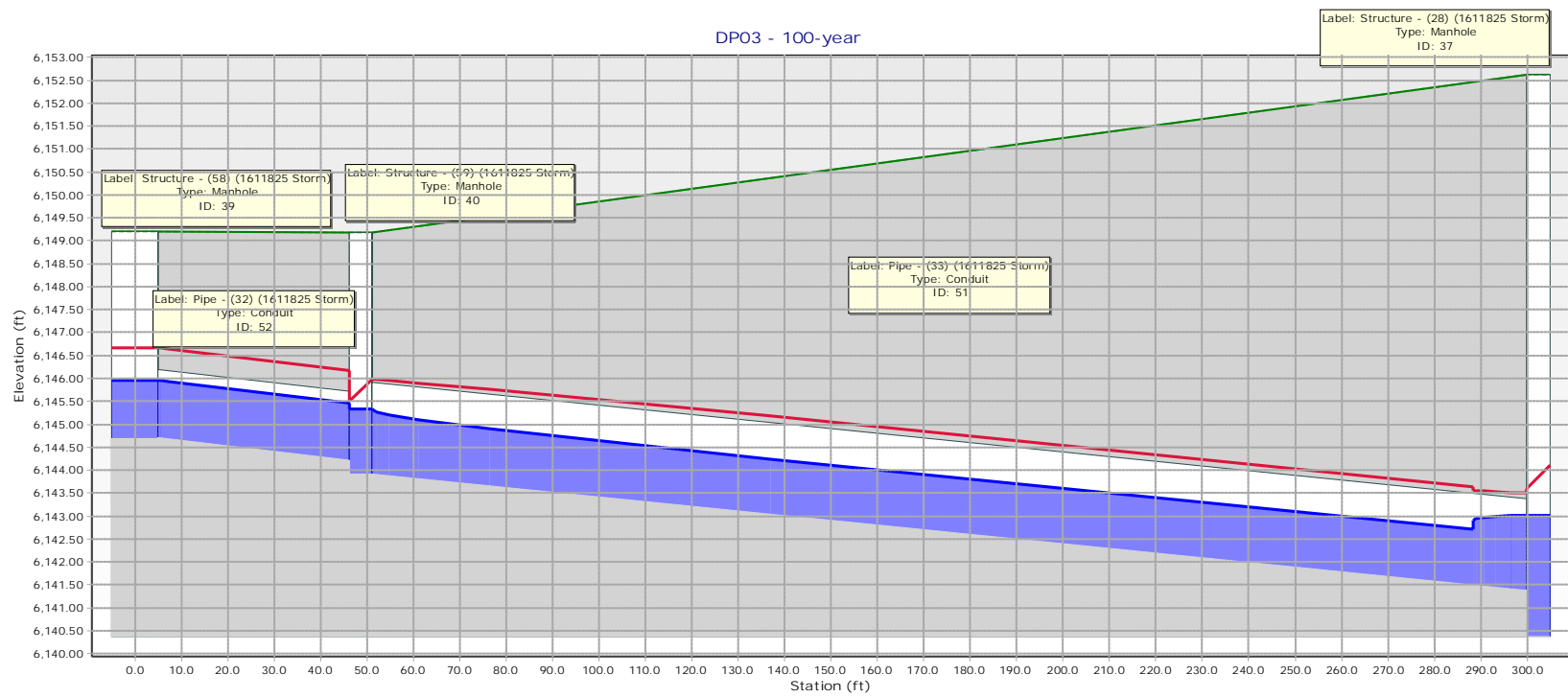
**Scenario: 100-year**  
**Current Time Step: 0.000 h**  
**FlexTable: Conduit Table**

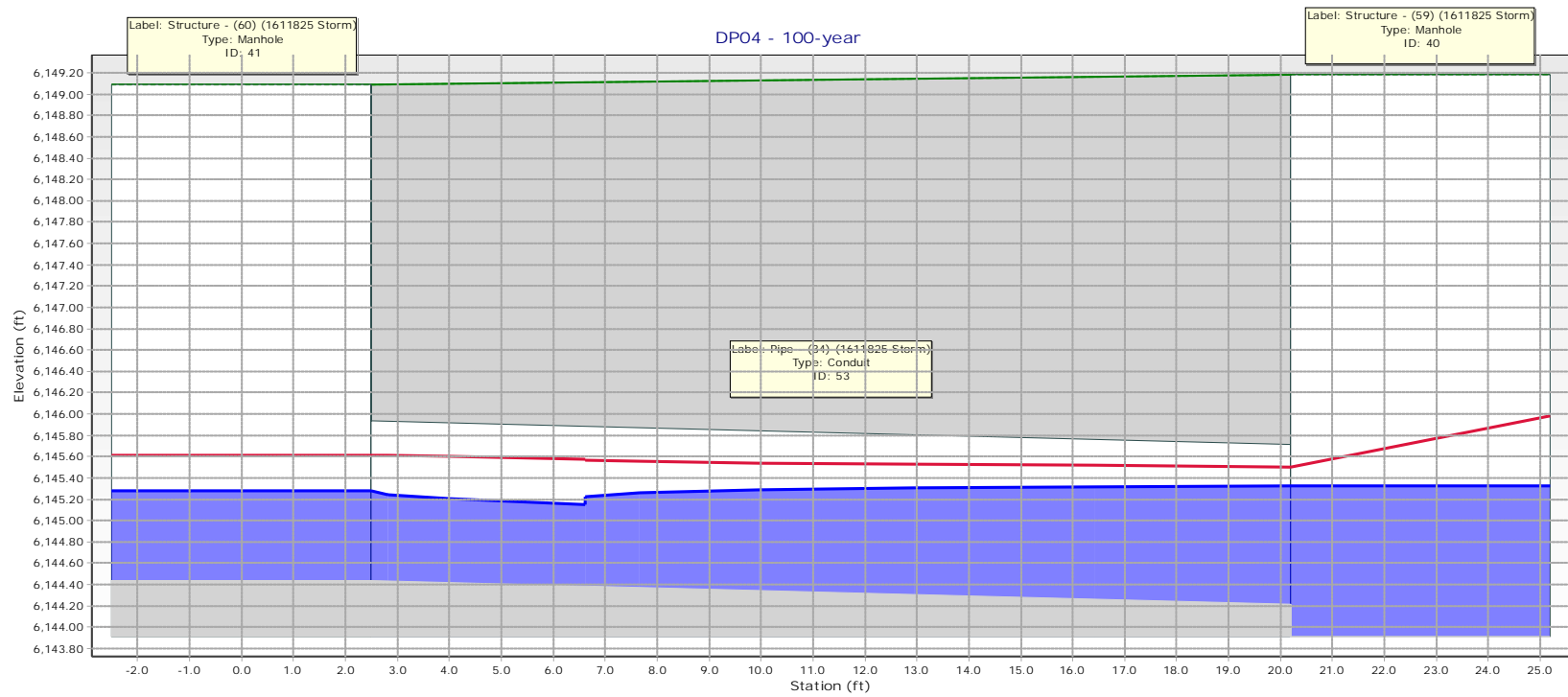
Upstream Structure	Label	Flow (cfs)	Diameter (in)	Length (User Defined) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Velocity (ft/s)	Manning's n
Structure - (2) (1611825 Storm)	Pipe - (13) (1611825 Storm)	3.95	24.0	47.0	6,143.49	6,143.02	0.010	6,158.72	6,152.61	6,144.19	6,143.59	6,144.44	6,144.04	5.41	0.013
Structure - (3) (1611825 Storm)	Pipe - (14) (1611825 Storm)	6.69	24.0	202.2	6,142.72	6,140.71	0.010	6,152.61	6,145.71	6,143.64	6,141.46	6,143.99	6,142.07	6.26	0.013
Structure - (28) (1611825 Storm)	Pipe - (17) (1611825 Storm)	65.21	42.0	94.5	6,139.90	6,140.37	-0.005	6,139.90	6,152.62	6,143.01	6,142.43	6,144.10	6,143.62	8.36	0.013
Structure - (56) (1611825 Storm)	Pipe - (24) (1611825 Storm)	39.22	42.0	161.6	6,140.57	6,142.10	-0.009	6,152.62	6,148.60	6,144.05	6,143.01	6,144.84	6,143.48	9.61	0.013
Structure - (58) (1611825 Storm)	Pipe - (32) (1611825 Storm)	10.66	18.0	48.6	6,144.70	6,144.22	0.010	6,149.20	6,149.18	6,148.96	6,148.46	6,149.53	6,149.03	6.03	0.013
Structure - (59) (1611825 Storm)	Pipe - (33) (1611825 Storm)	15.39	24.0	253.8	6,143.91	6,141.37	0.010	6,149.18	6,152.62	6,148.46	6,143.01	6,149.64	6,144.19	8.71	0.013
Structure - (60) (1611825 Storm)	Pipe - (34) (1611825 Storm)	4.73	18.0	22.7	6,144.44	6,144.21	0.010	6,149.09	6,149.18	6,148.51	6,148.46	6,148.62	6,148.57	2.68	0.013
Structure - (61) (1611825 Storm)	Pipe - (35) (1611825 Storm)	10.60	18.0	27.6	6,141.57	6,142.12	-0.020	6,152.62	6,153.36	6,143.37	6,143.01	6,144.08	6,143.59	9.11	0.013
Structure - (62) (1611825 Storm)	Pipe - (36) (1611825 Storm)	6.61	18.0	47.2	6,142.62	6,143.57	-0.020	6,153.36	6,153.35	6,144.56	6,143.34	6,145.00	6,144.31	8.18	0.013
Structure - (63) (1611825 Storm)	Pipe - (37) (1611825 Storm)	3.99	18.0	23.1	6,142.62	6,143.08	-0.020	6,153.36	6,153.03	6,143.84	6,143.18	6,144.15	6,143.86	7.11	0.013

X:\1610000.all\1611825\StormCAD\1611825 StormCAD Model.stsw

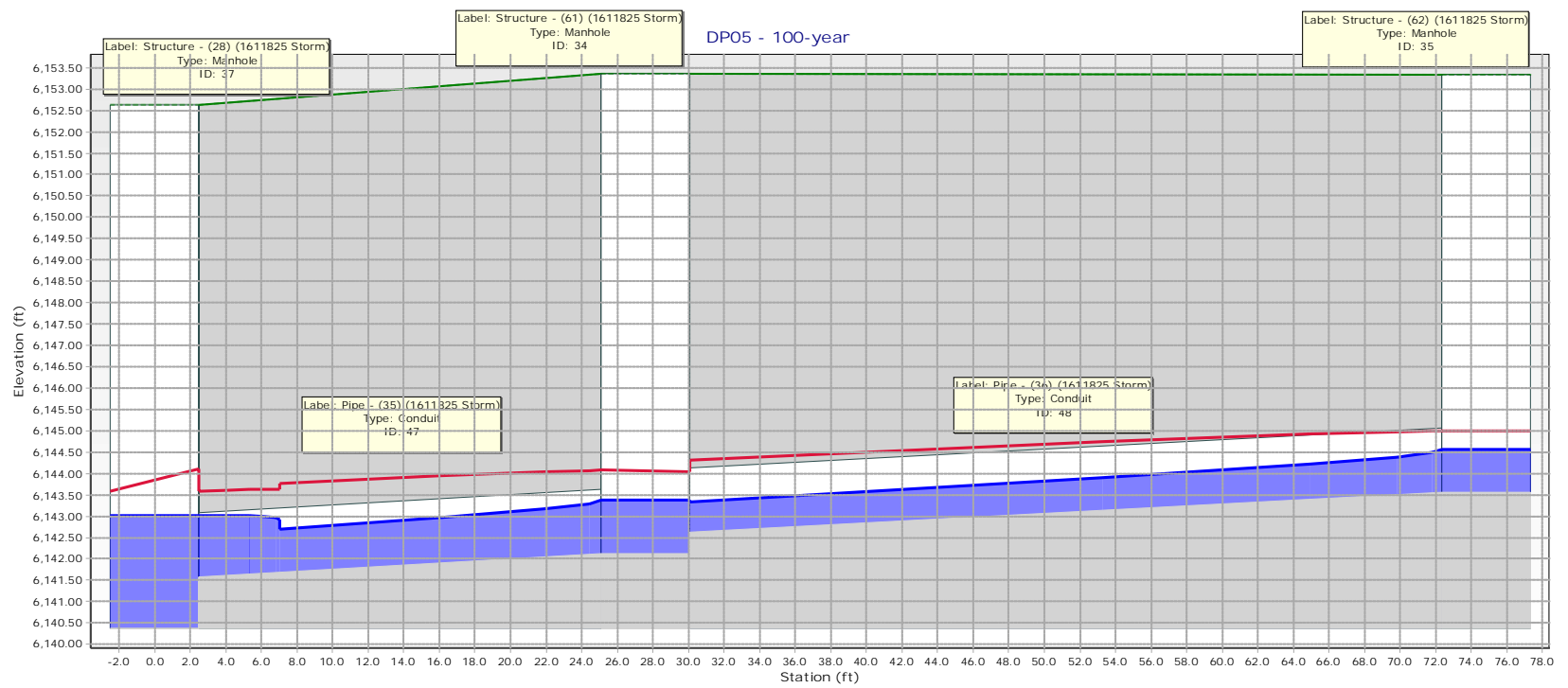


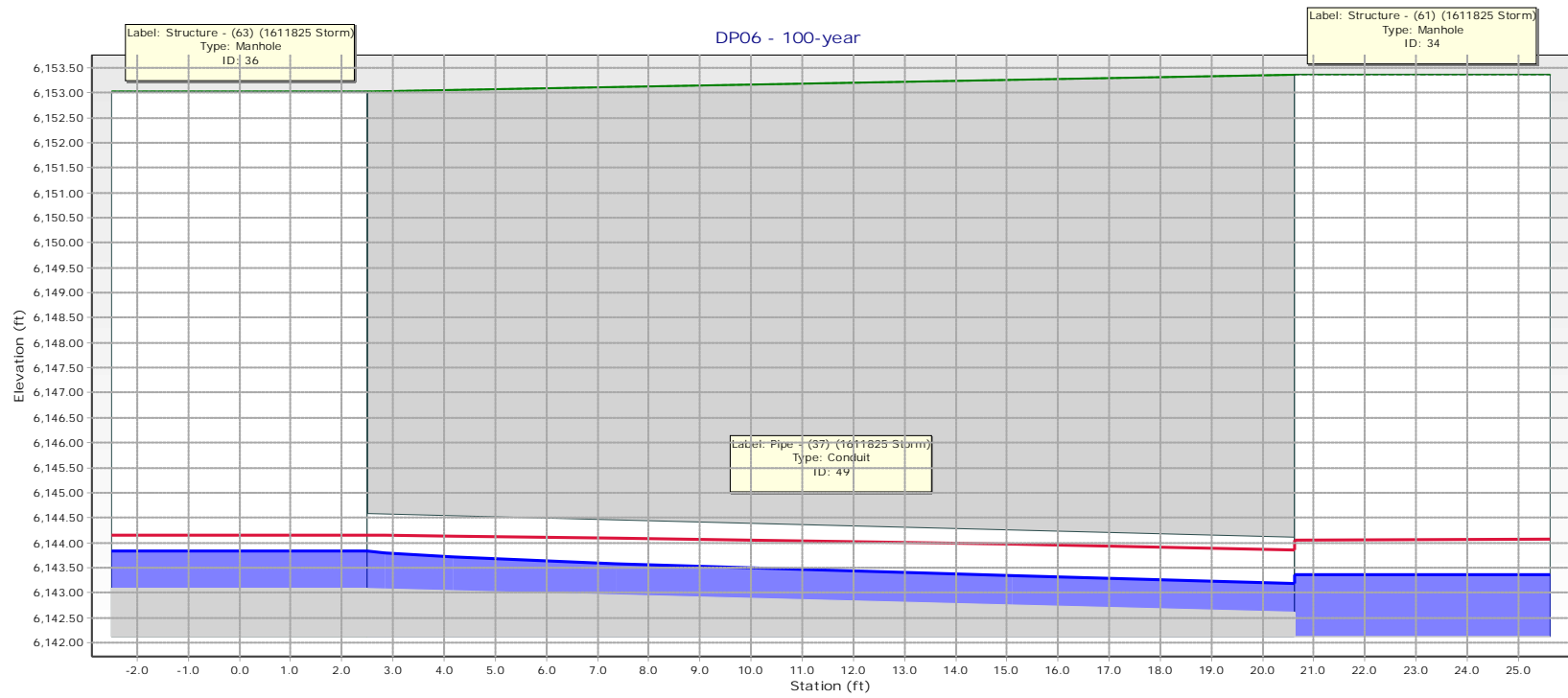












# Channel Report

## Swale B1 (2-Year)

### Triangular

Side Slopes (z:1) = 20.00, 10.00

Total Depth (ft) = 1.00

Invert Elev (ft) = 10.00

Slope (%) = 5.83

N-Value = 0.030

### Highlighted

Depth (ft) = 0.23

Q (cfs) = 2.070

Area (sqft) = 0.79

Velocity (ft/s) = 2.61

Wetted Perim (ft) = 6.92

Crit Depth, Yc (ft) = 0.26

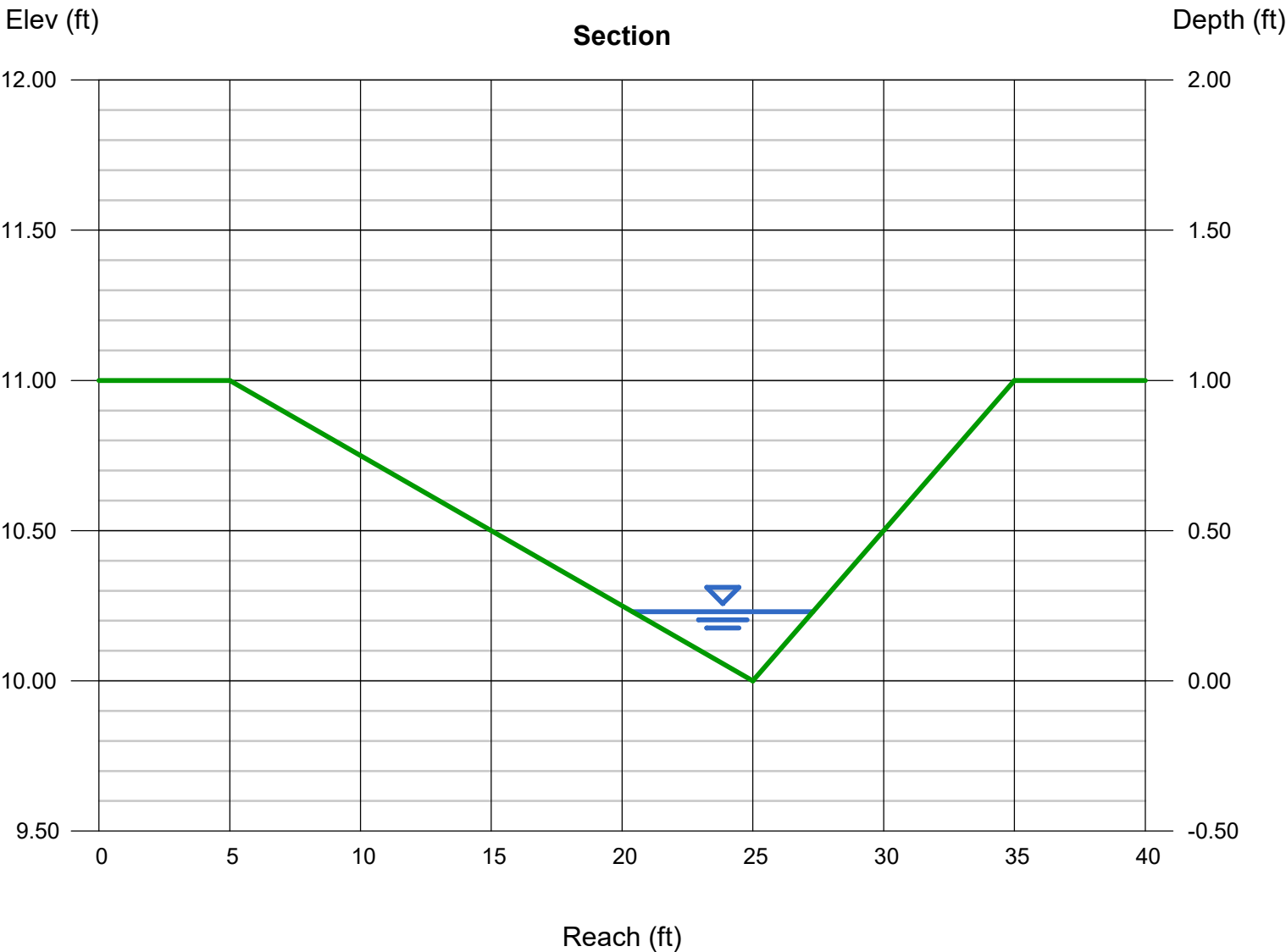
Top Width (ft) = 6.90

EGL (ft) = 0.34

### Calculations

Compute by: Known Q

Known Q (cfs) = 2.07



# Channel Report

## Swale B1 (100-Year)

### Triangular

Side Slopes (z:1) = 20.00, 10.00  
Total Depth (ft) = 1.00

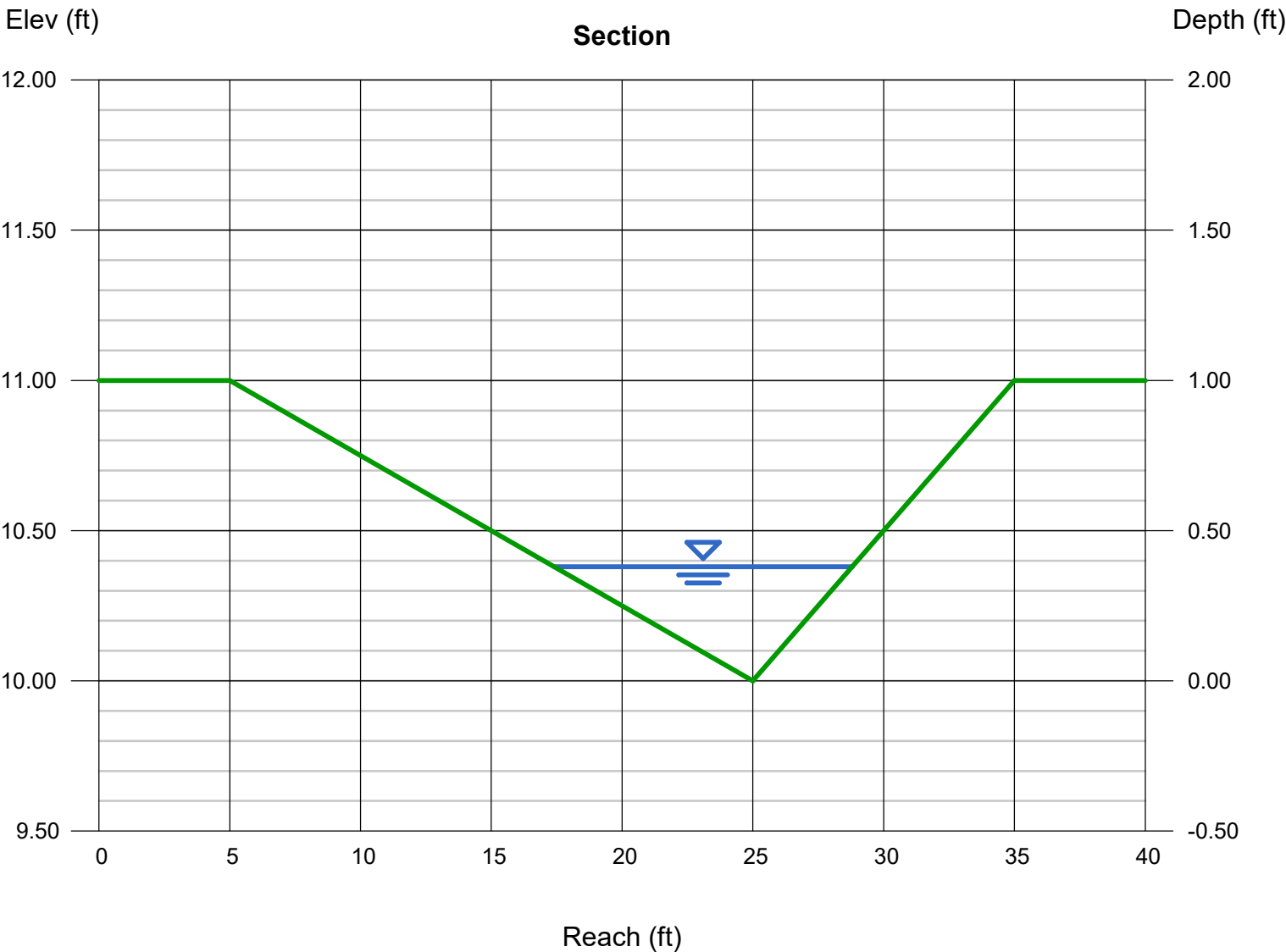
Invert Elev (ft) = 10.00  
Slope (%) = 5.83  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 8.20

### Highlighted

Depth (ft) = 0.38  
Q (cfs) = 8.200  
Area (sqft) = 2.17  
Velocity (ft/s) = 3.79  
Wetted Perim (ft) = 11.43  
Crit Depth, Yc (ft) = 0.46  
Top Width (ft) = 11.40  
EGL (ft) = 0.60



# Channel Report

## Swale B2 (2-Year)

### Triangular

Side Slopes (z:1) = 9.00, 11.00  
Total Depth (ft) = 2.20

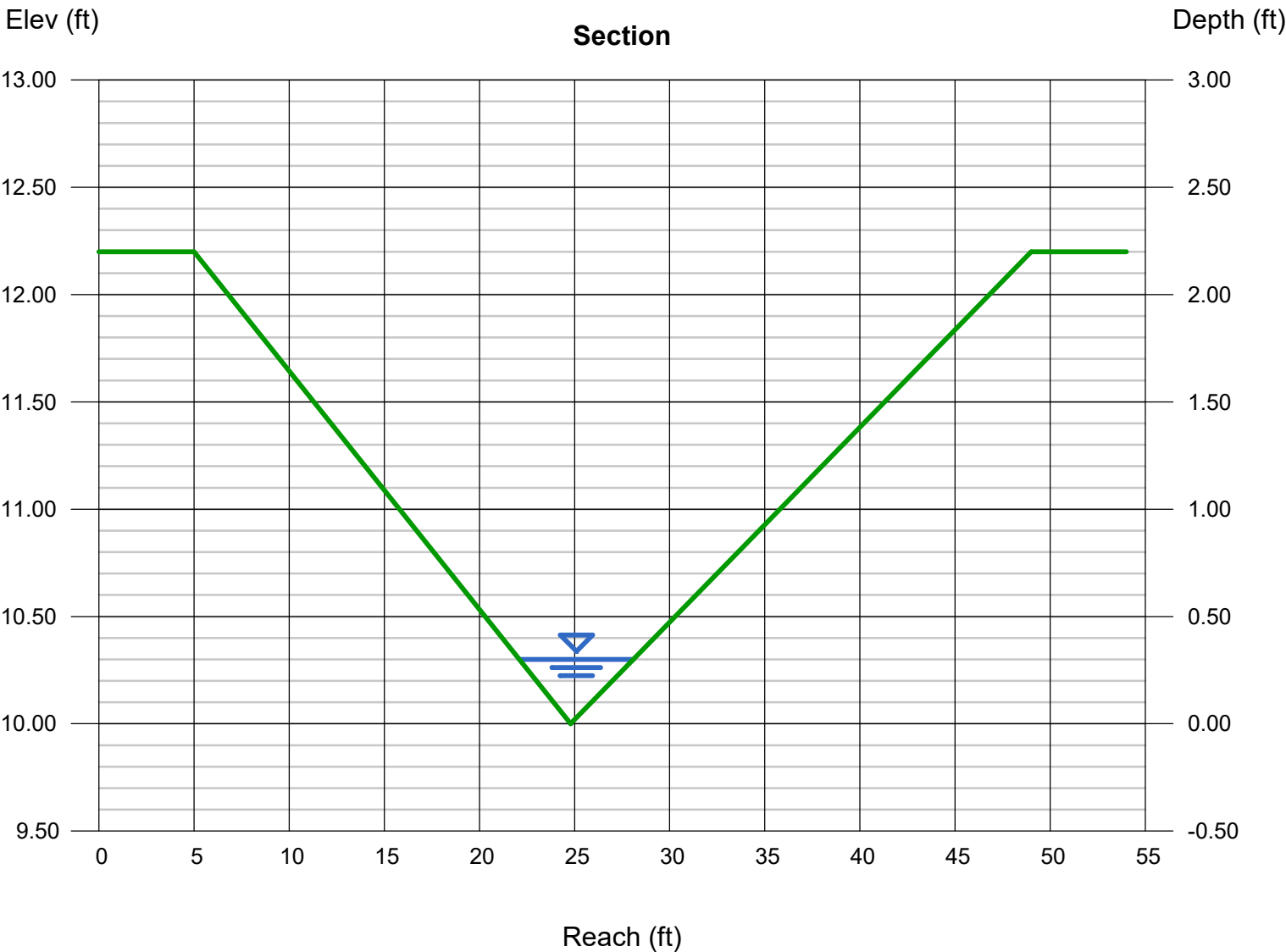
Invert Elev (ft) = 10.00  
Slope (%) = 3.97  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 2.33

### Highlighted

Depth (ft) = 0.30  
Q (cfs) = 2.330  
Area (sqft) = 0.90  
Velocity (ft/s) = 2.59  
Wetted Perim (ft) = 6.03  
Crit Depth, Yc (ft) = 0.33  
Top Width (ft) = 6.00  
EGL (ft) = 0.40



# Channel Report

## Swale B2 (100-Year)

### Triangular

Side Slopes (z:1) = 9.00, 11.00  
Total Depth (ft) = 2.20

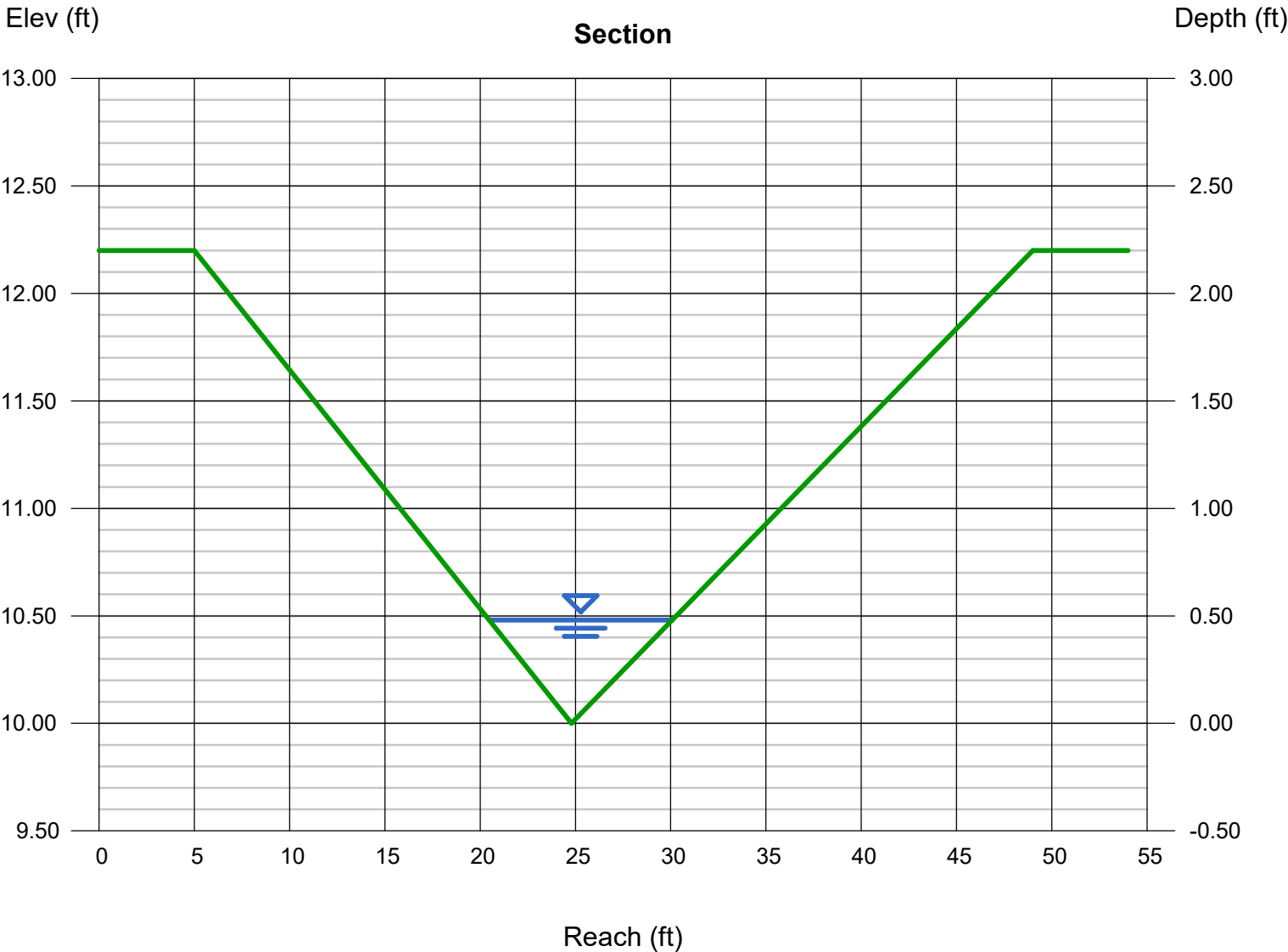
Invert Elev (ft) = 10.00  
Slope (%) = 3.97  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 8.53

### Highlighted

Depth (ft) = 0.48  
Q (cfs) = 8.530  
Area (sqft) = 2.30  
Velocity (ft/s) = 3.70  
Wetted Perim (ft) = 9.65  
Crit Depth, Yc (ft) = 0.54  
Top Width (ft) = 9.60  
EGL (ft) = 0.69



# Channel Report

## Swale B3A1 (2-Year)

### Triangular

Side Slopes (z:1) = 10.00, 4.25  
Total Depth (ft) = 1.80

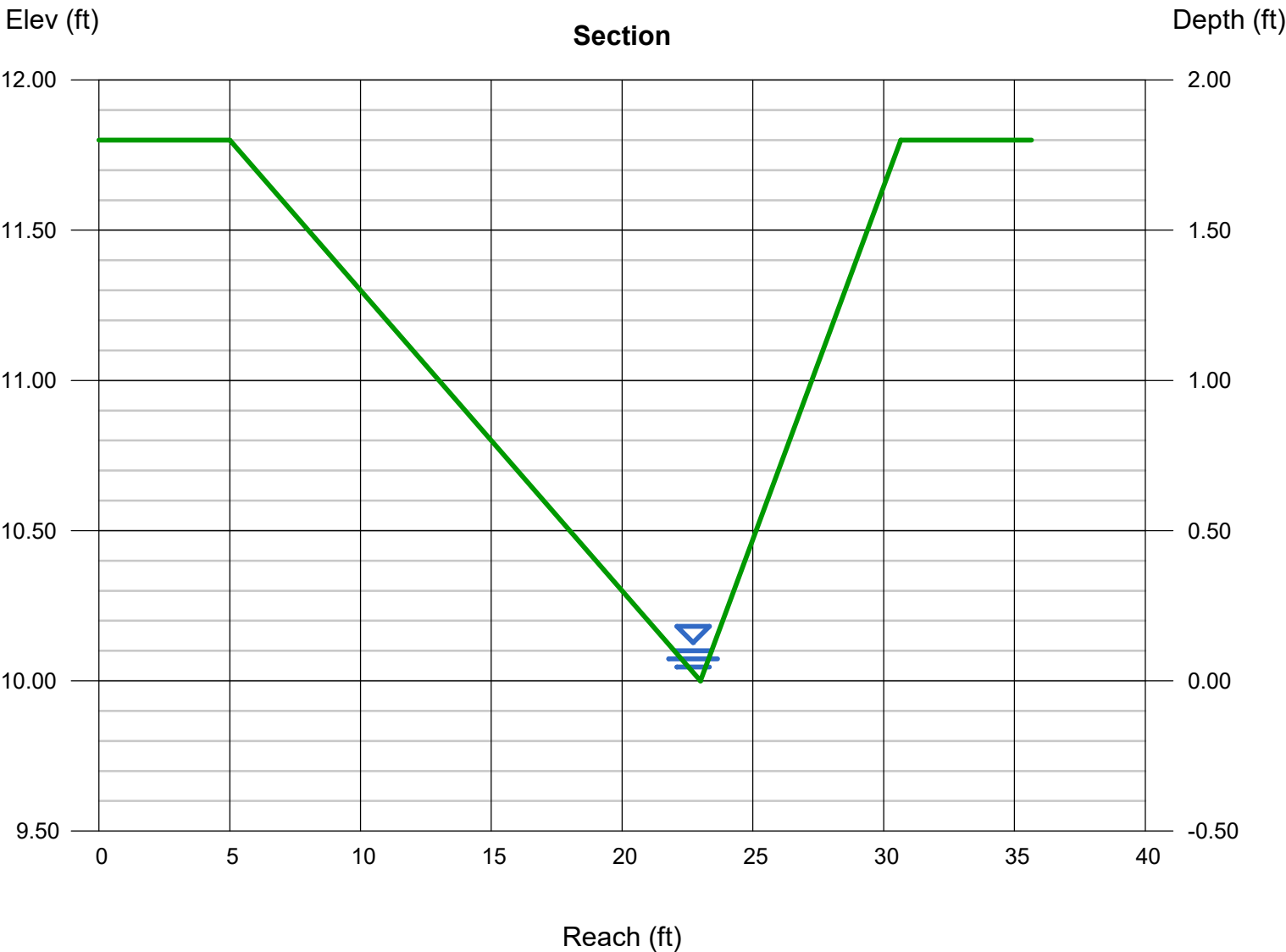
Invert Elev (ft) = 10.00  
Slope (%) = 5.40  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 0.11

### Highlighted

Depth (ft) = 0.10  
Q (cfs) = 0.110  
Area (sqft) = 0.07  
Velocity (ft/s) = 1.54  
Wetted Perim (ft) = 1.44  
Crit Depth, Yc (ft) = 0.11  
Top Width (ft) = 1.43  
EGL (ft) = 0.14



# Channel Report

## Swale B3A1 (100-Year)

### Triangular

Side Slopes (z:1) = 10.00, 4.25  
Total Depth (ft) = 1.80

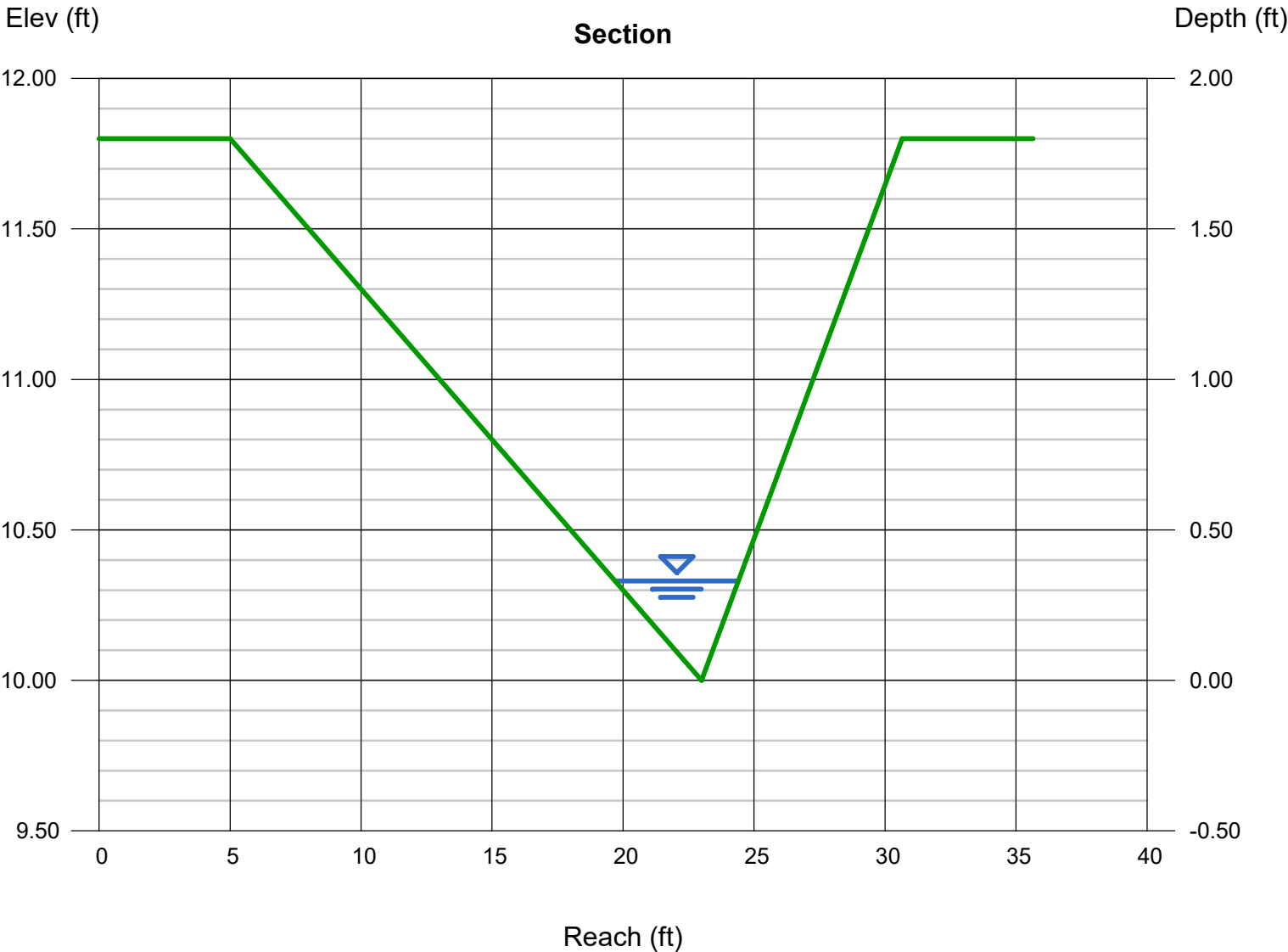
Invert Elev (ft) = 10.00  
Slope (%) = 5.40  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 2.60

### Highlighted

Depth (ft) = 0.33  
Q (cfs) = 2.600  
Area (sqft) = 0.78  
Velocity (ft/s) = 3.35  
Wetted Perim (ft) = 4.76  
Crit Depth, Yc (ft) = 0.39  
Top Width (ft) = 4.70  
EGL (ft) = 0.50





# Channel Report

## Swale B3A (2-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 3.30

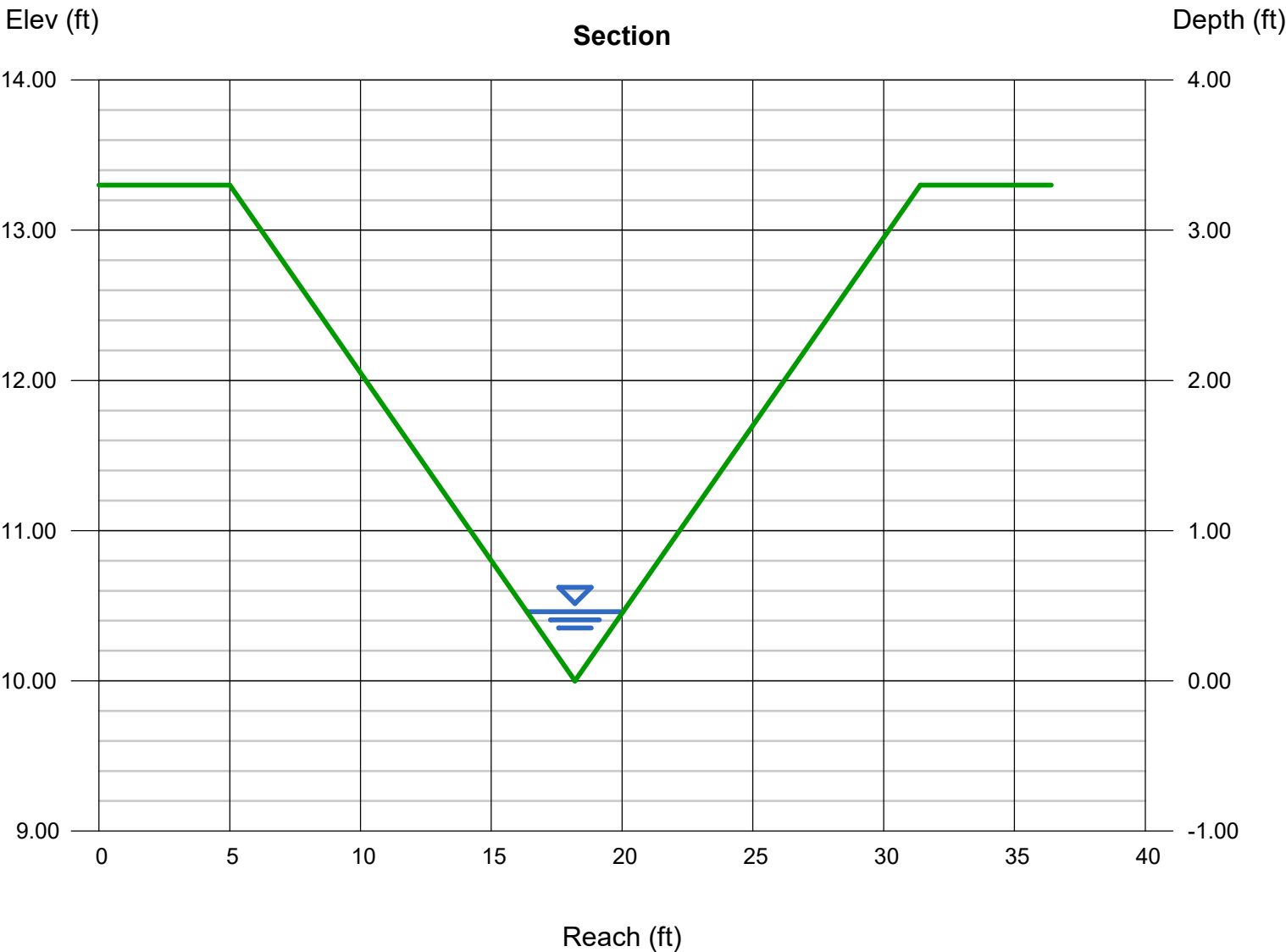
Invert Elev (ft) = 10.00  
Slope (%) = 2.43  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 2.29

### Highlighted

Depth (ft) = 0.46  
Q (cfs) = 2.290  
Area (sqft) = 0.85  
Velocity (ft/s) = 2.71  
Wetted Perim (ft) = 3.79  
Crit Depth, Yc (ft) = 0.46  
Top Width (ft) = 3.68  
EGL (ft) = 0.57



# Channel Report

## Swale B3A (100-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 3.30

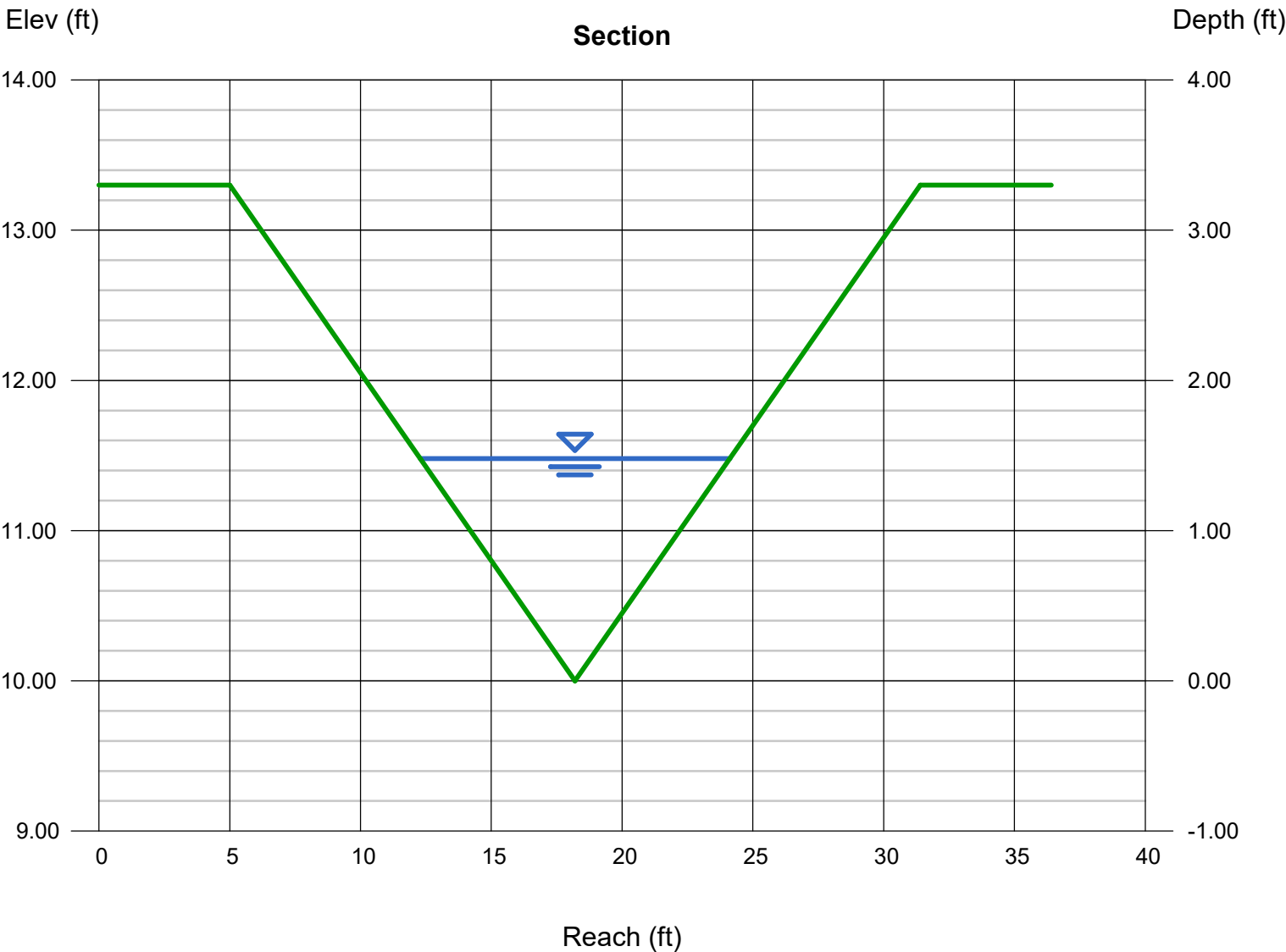
Invert Elev (ft) = 10.00  
Slope (%) = 2.43  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 53.84

### Highlighted

Depth (ft) = 1.48  
Q (cfs) = 53.84  
Area (sqft) = 8.76  
Velocity (ft/s) = 6.15  
Wetted Perim (ft) = 12.20  
Crit Depth, Yc (ft) = 1.63  
Top Width (ft) = 11.84  
EGL (ft) = 2.07



# Channel Report

## Swale B3A (Emergency Overflow)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 3.30

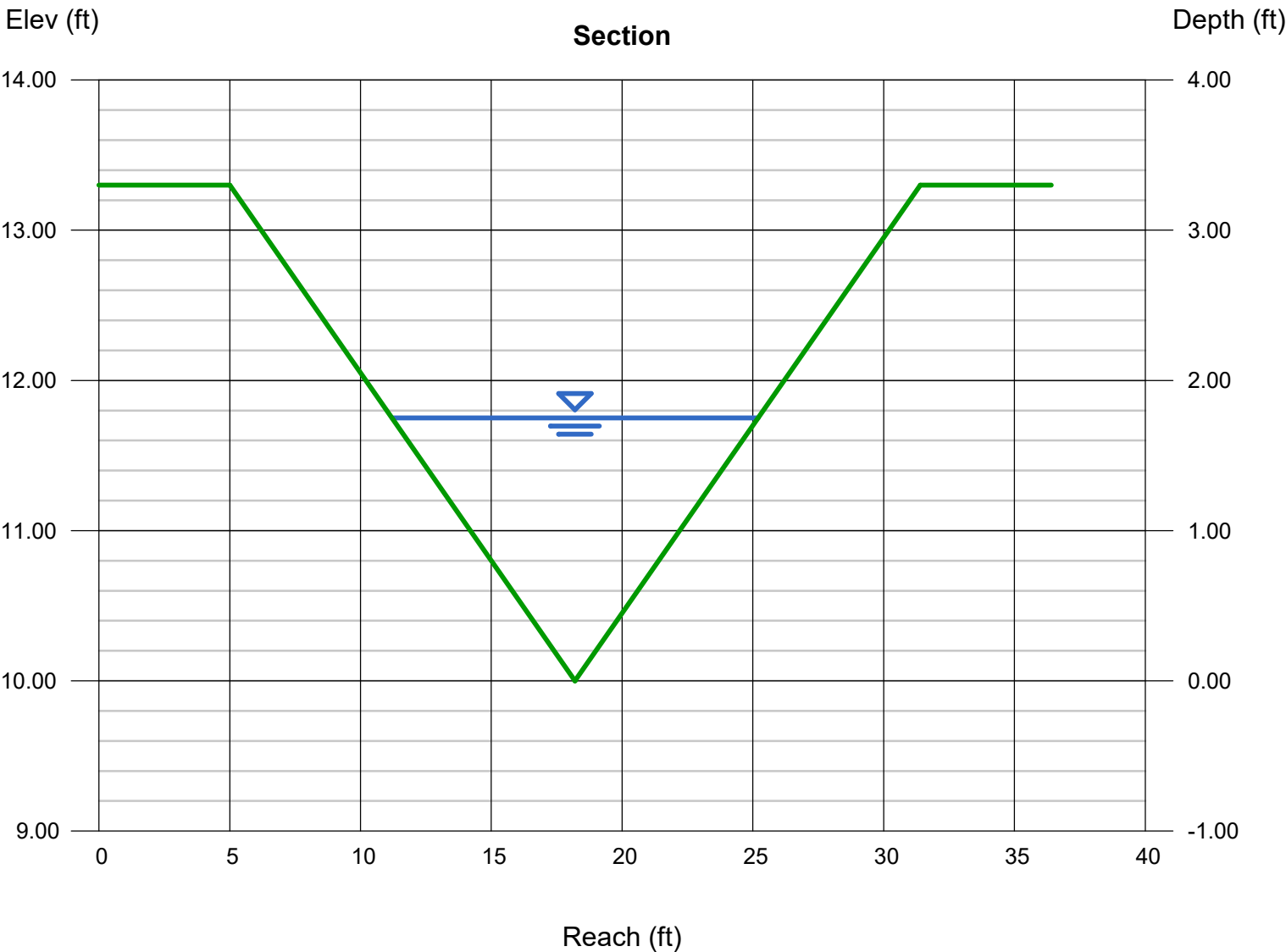
Invert Elev (ft) = 10.00  
Slope (%) = 2.43  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 84.20

### Highlighted

Depth (ft) = 1.75  
Q (cfs) = 84.20  
Area (sqft) = 12.25  
Velocity (ft/s) = 6.87  
Wetted Perim (ft) = 14.43  
Crit Depth, Yc (ft) = 1.95  
Top Width (ft) = 14.00  
EGL (ft) = 2.48



# Channel Report

## Swale B3B (2-Year)

### Triangular

Side Slopes (z:1) = 33.00, 6.00  
Total Depth (ft) = 1.30

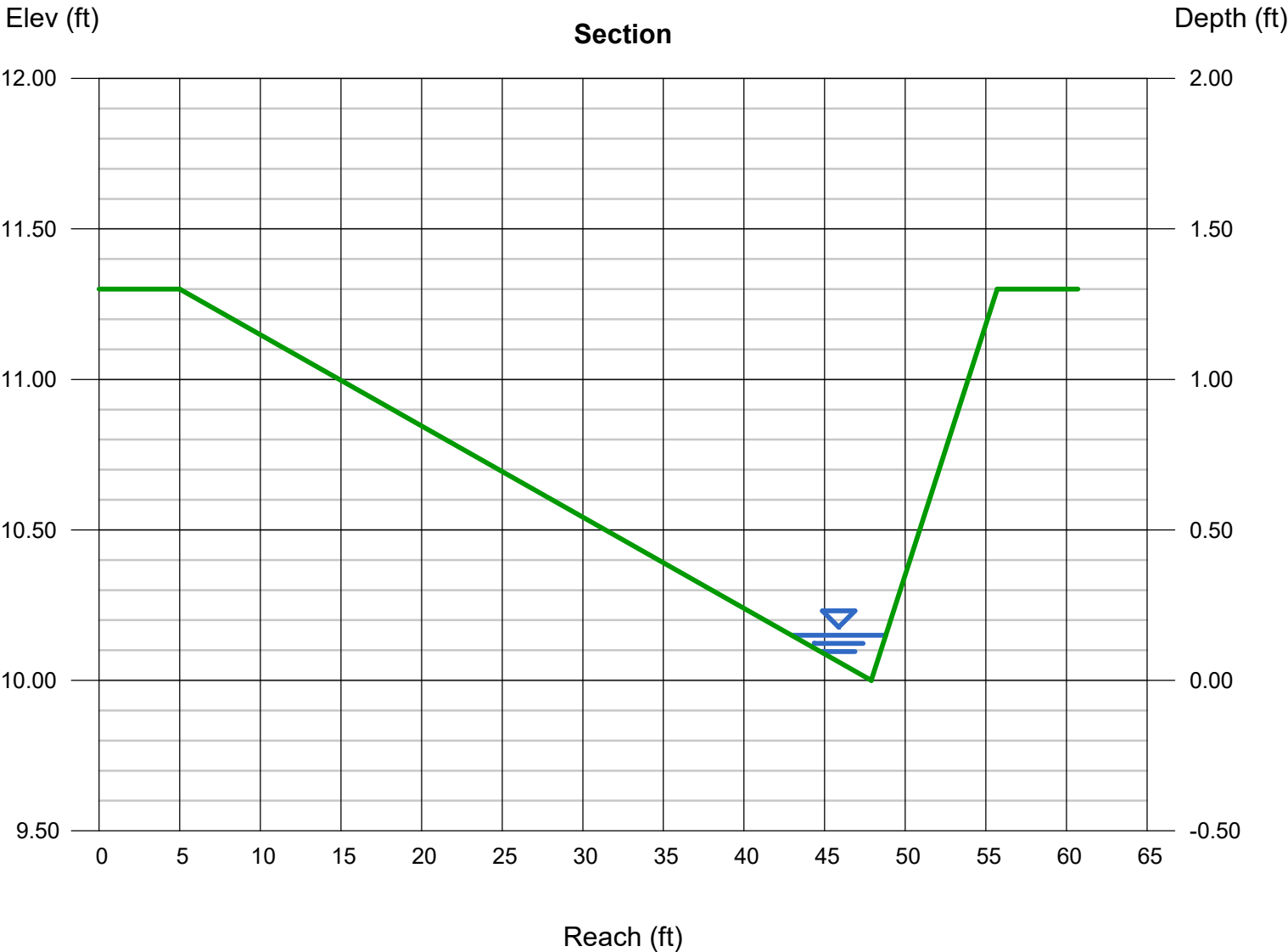
Invert Elev (ft) = 10.00  
Slope (%) = 5.80  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 0.90

### Highlighted

Depth (ft) = 0.15  
Q (cfs) = 0.900  
Area (sqft) = 0.44  
Velocity (ft/s) = 2.05  
Wetted Perim (ft) = 5.86  
Crit Depth, Yc (ft) = 0.17  
Top Width (ft) = 5.85  
EGL (ft) = 0.22



# Channel Report

## Swale B3B (100-Year)

### Triangular

Side Slopes (z:1) = 33.00, 6.00  
Total Depth (ft) = 1.30

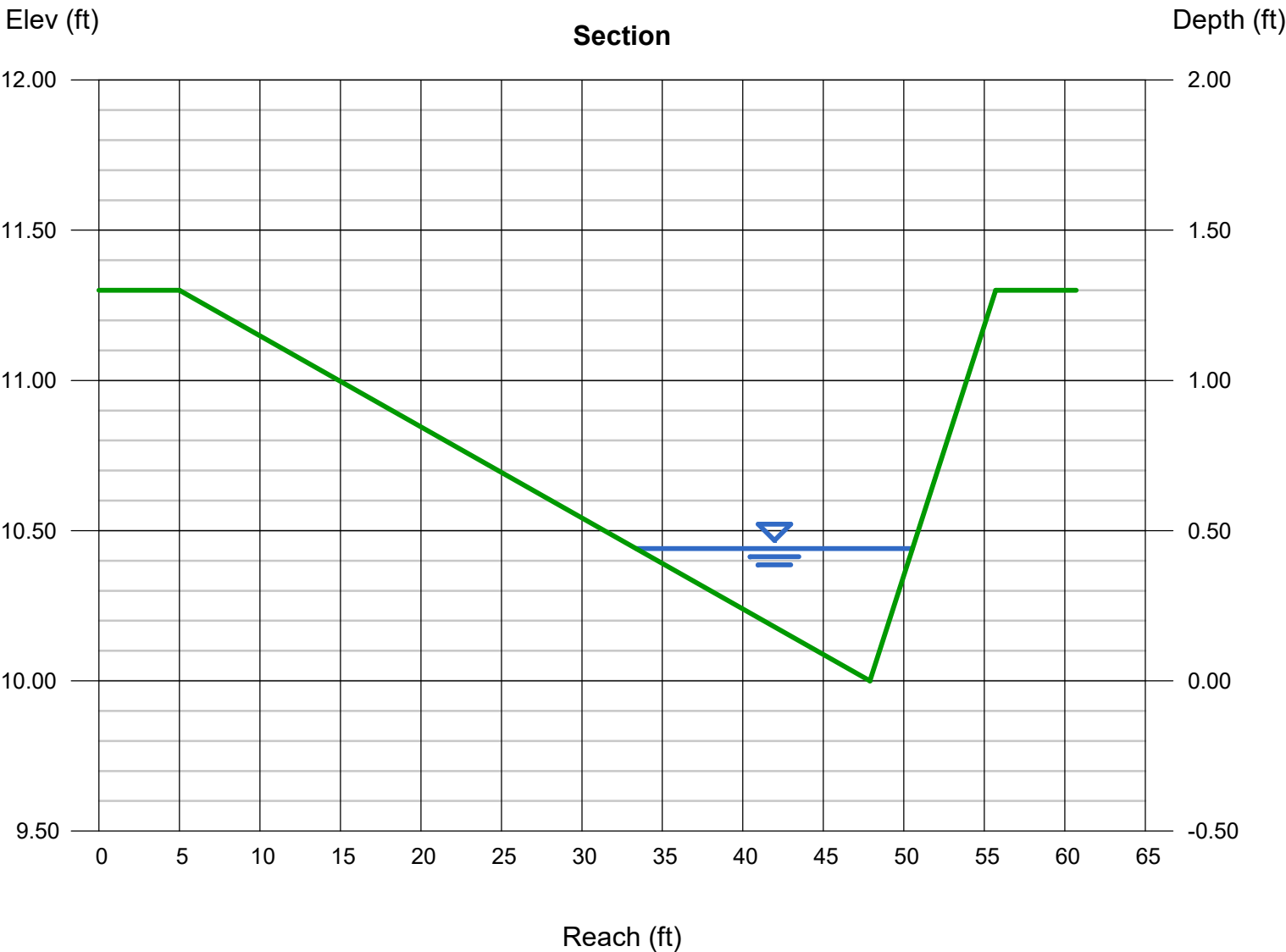
Invert Elev (ft) = 10.00  
Slope (%) = 5.80  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 16.27

### Highlighted

Depth (ft) = 0.44  
Q (cfs) = 16.27  
Area (sqft) = 3.78  
Velocity (ft/s) = 4.31  
Wetted Perim (ft) = 17.20  
Crit Depth, Yc (ft) = 0.54  
Top Width (ft) = 17.16  
EGL (ft) = 0.73



# Channel Report

## Swale B3C (2-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 2.50

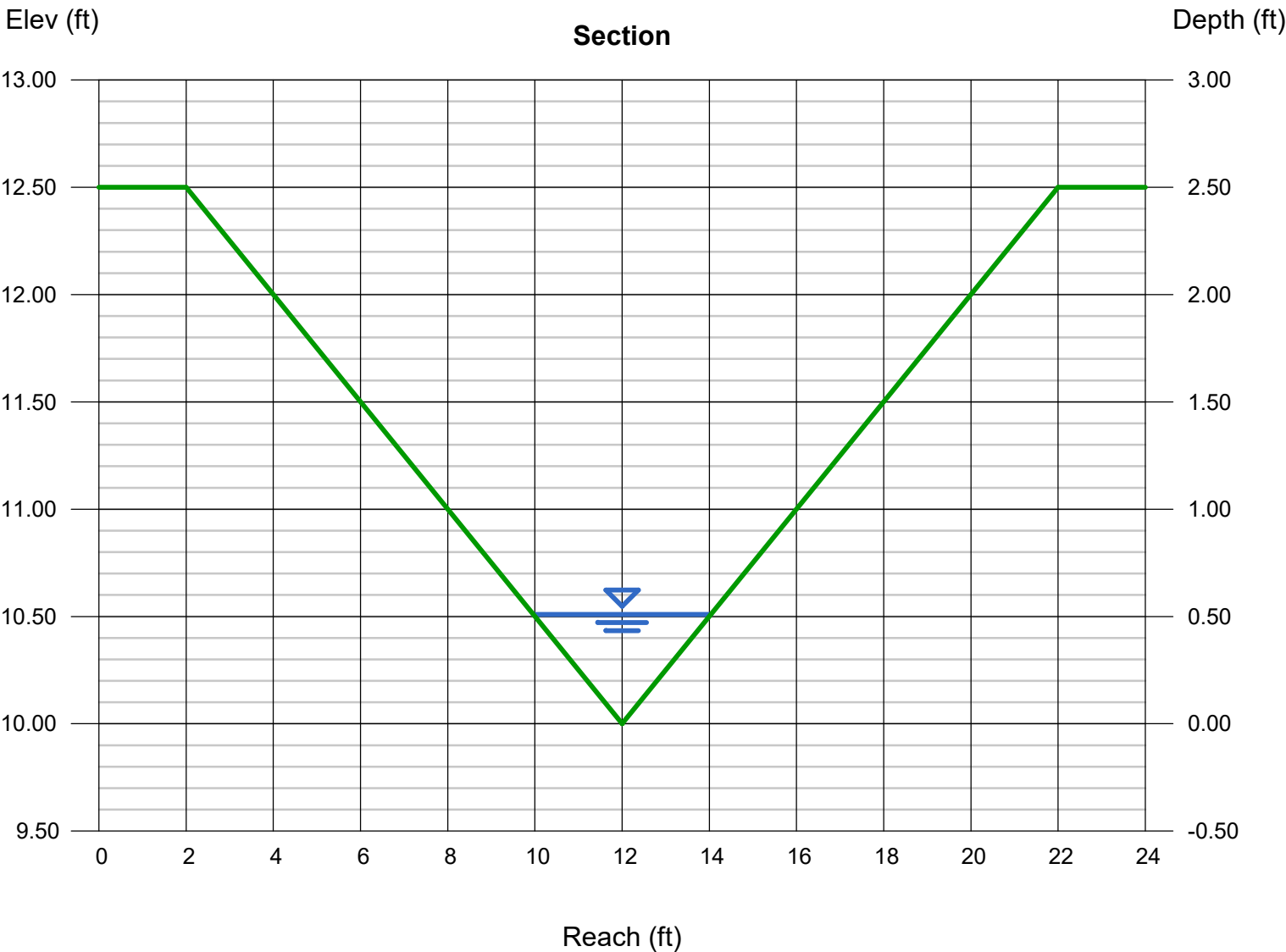
Invert Elev (ft) = 10.00  
Slope (%) = 2.09  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 2.81

### Highlighted

Depth (ft) = 0.51  
Q (cfs) = 2.810  
Area (sqft) = 1.04  
Velocity (ft/s) = 2.70  
Wetted Perim (ft) = 4.21  
Crit Depth, Yc (ft) = 0.50  
Top Width (ft) = 4.08  
EGL (ft) = 0.62



# Channel Report

## Swale B3C (100-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 5.00

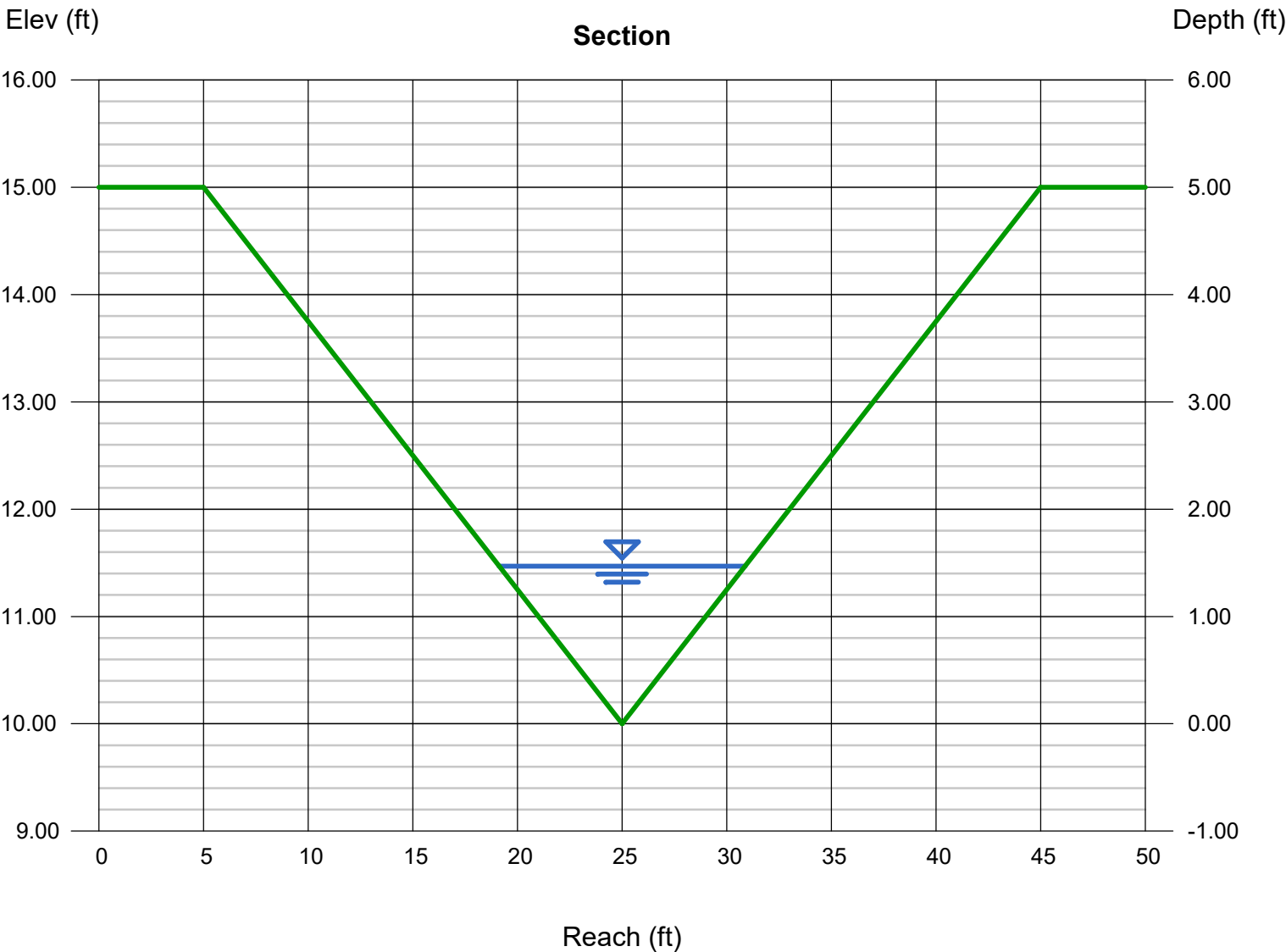
Invert Elev (ft) = 10.00  
Slope (%) = 2.00  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 47.58

### Highlighted

Depth (ft) = 1.47  
Q (cfs) = 47.58  
Area (sqft) = 8.64  
Velocity (ft/s) = 5.50  
Wetted Perim (ft) = 12.12  
Crit Depth, Yc (ft) = 1.55  
Top Width (ft) = 11.76  
EGL (ft) = 1.94



# Channel Report

## Swale B3C (Emergency)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 2.50

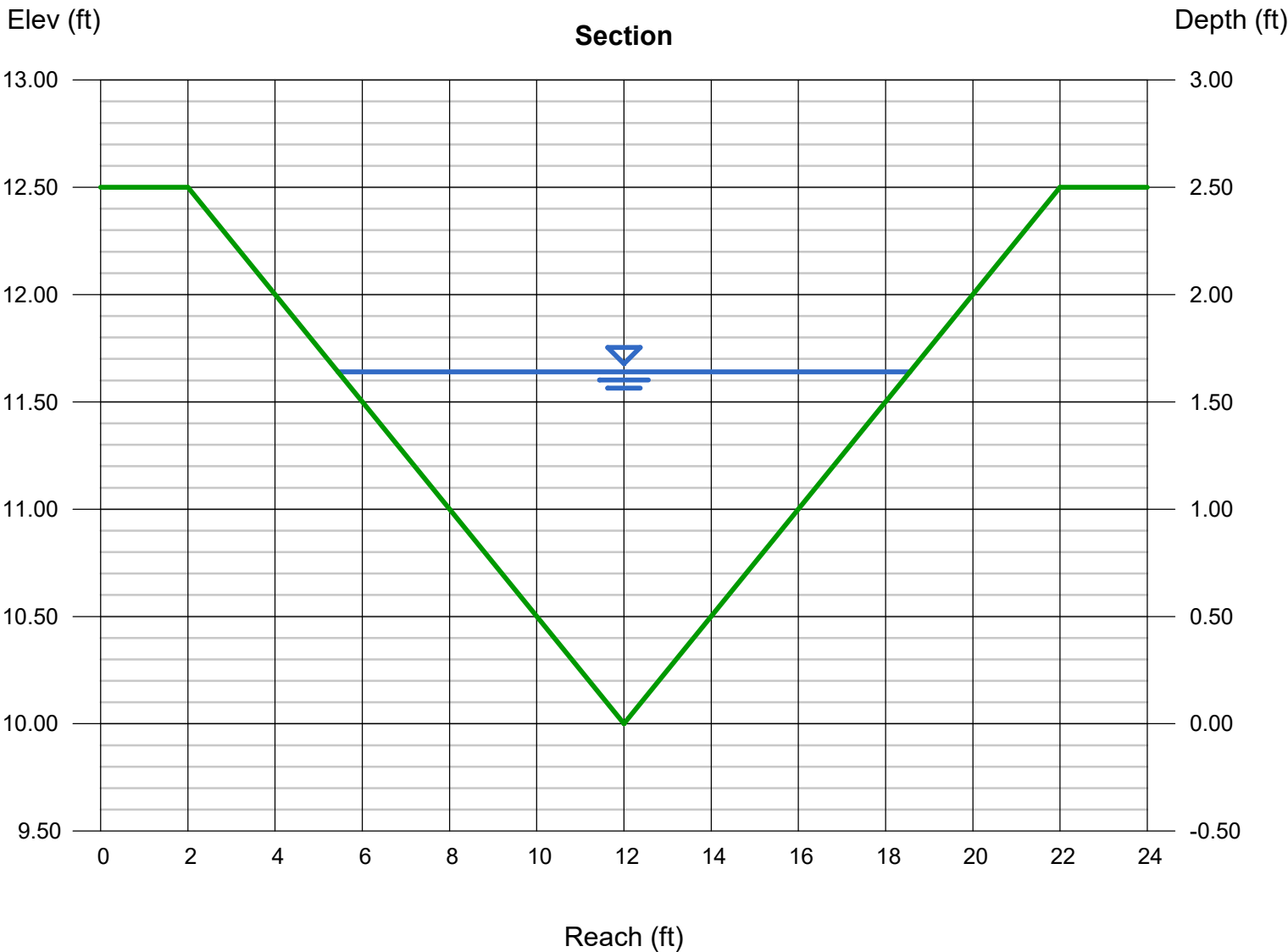
Invert Elev (ft) = 10.00  
Slope (%) = 2.09  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 65.33

### Highlighted

Depth (ft) = 1.64  
Q (cfs) = 65.33  
Area (sqft) = 10.76  
Velocity (ft/s) = 6.07  
Wetted Perim (ft) = 13.52  
Crit Depth, Yc (ft) = 1.76  
Top Width (ft) = 13.12  
EGL (ft) = 2.21





# Channel Report

## Swale A1 (2-Year)

### Triangular

Side Slopes (z:1) = 25.00, 12.50  
Total Depth (ft) = 1.00

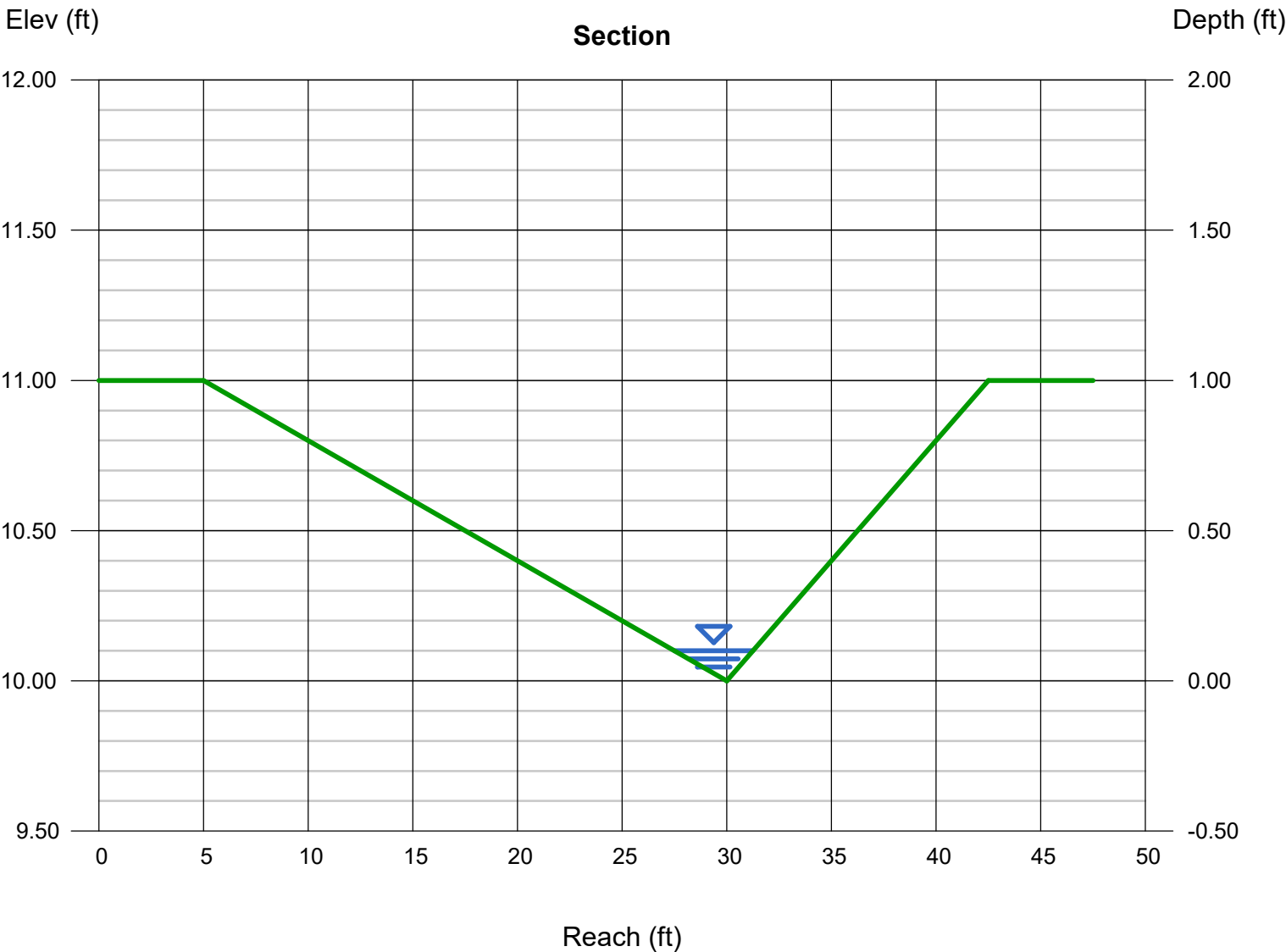
Invert Elev (ft) = 10.00  
Slope (%) = 4.33  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 0.22

### Highlighted

Depth (ft) = 0.10  
Q (cfs) = 0.220  
Area (sqft) = 0.19  
Velocity (ft/s) = 1.17  
Wetted Perim (ft) = 3.76  
Crit Depth, Yc (ft) = 0.10  
Top Width (ft) = 3.75  
EGL (ft) = 0.12



# Channel Report

## Swale A1 (100-Year)

### Triangular

Side Slopes (z:1) = 25.00, 12.50  
Total Depth (ft) = 1.00

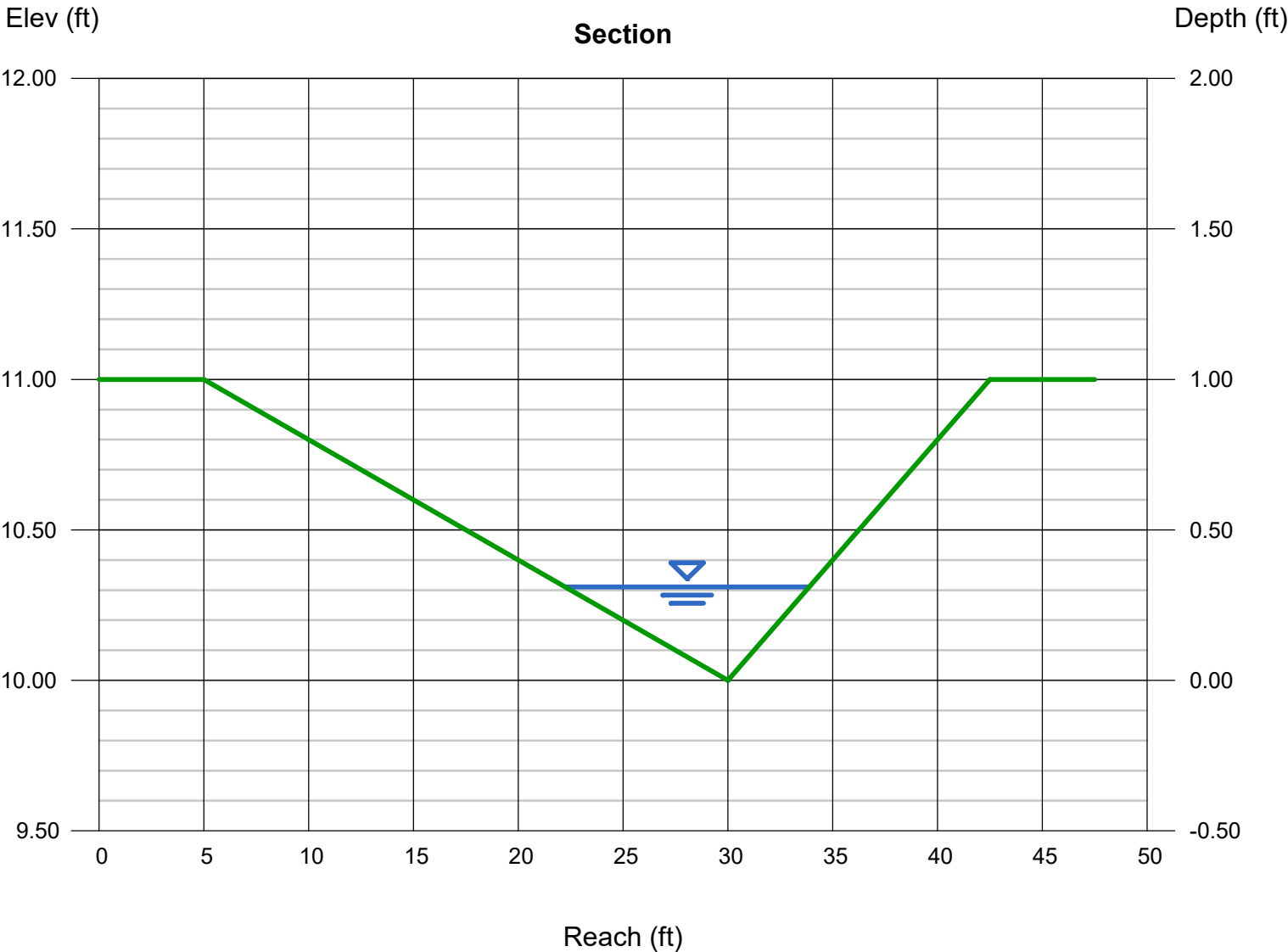
Invert Elev (ft) = 10.00  
Slope (%) = 4.33  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 4.91

### Highlighted

Depth (ft) = 0.31  
Q (cfs) = 4.910  
Area (sqft) = 1.80  
Velocity (ft/s) = 2.72  
Wetted Perim (ft) = 11.64  
Crit Depth, Yc (ft) = 0.34  
Top Width (ft) = 11.63  
EGL (ft) = 0.43



# Channel Report

## Swale B15 (2-Year)

### Triangular

Side Slopes (z:1) = 13.30, 5.00  
Total Depth (ft) = 2.70

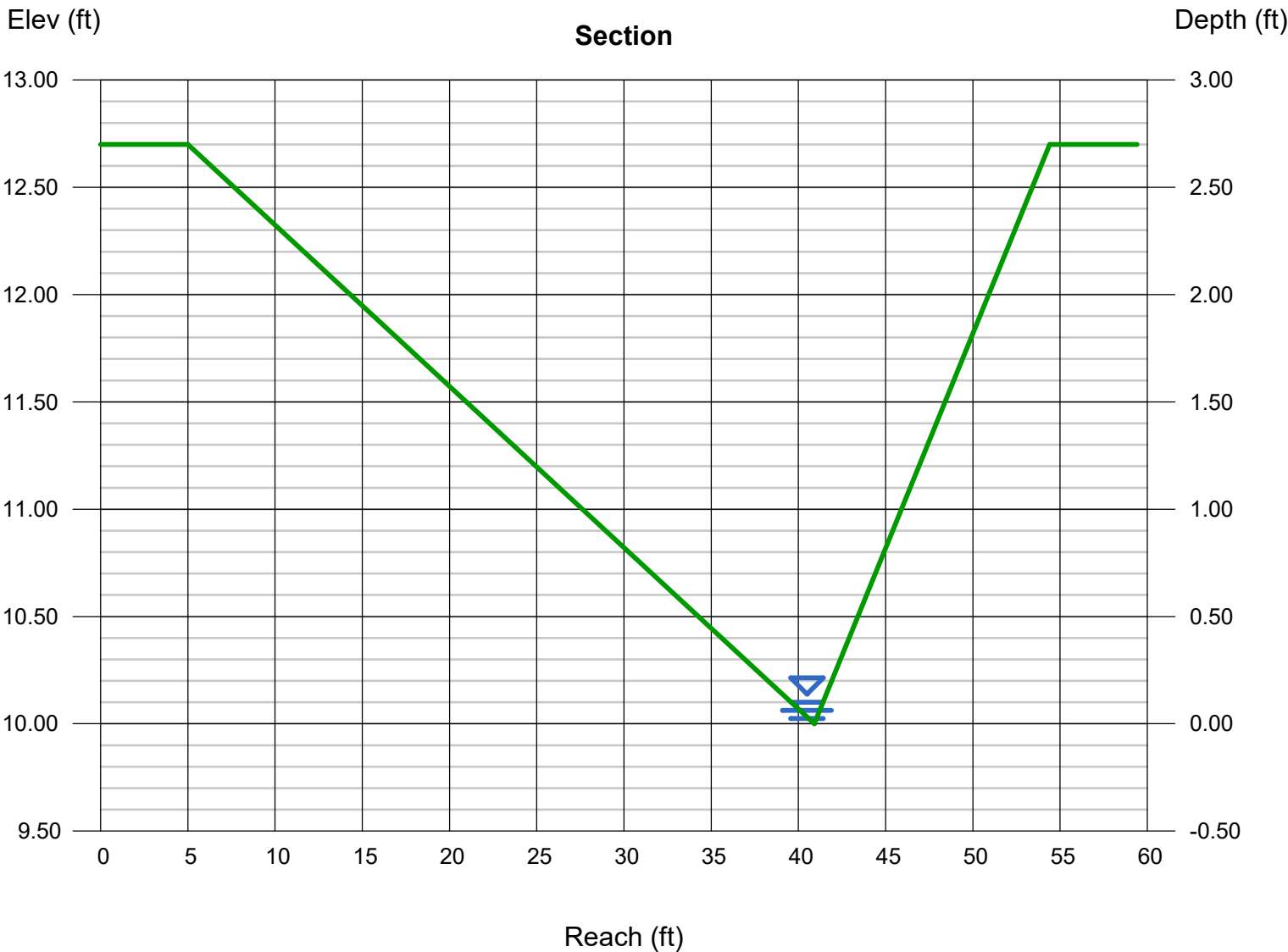
Invert Elev (ft) = 10.00  
Slope (%) = 4.57  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 0.12

### Highlighted

Depth (ft) = 0.10  
Q (cfs) = 0.120  
Area (sqft) = 0.09  
Velocity (ft/s) = 1.31  
Wetted Perim (ft) = 1.84  
Crit Depth, Yc (ft) = 0.11  
Top Width (ft) = 1.83  
EGL (ft) = 0.13



# Channel Report

## Swale B15 (100-Year)

### Triangular

Side Slopes (z:1) = 13.30, 5.00  
Total Depth (ft) = 2.70

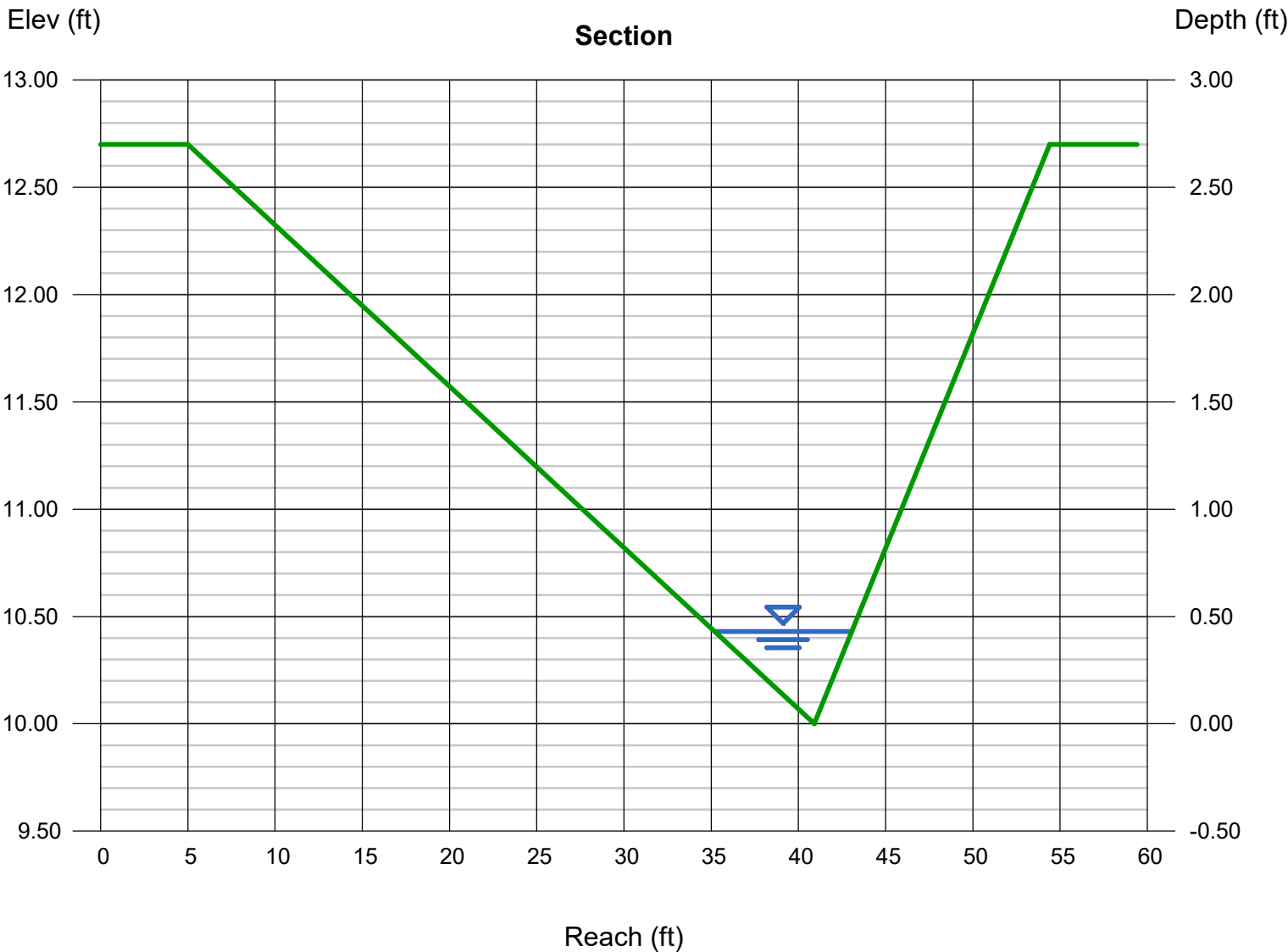
Invert Elev (ft) = 10.00  
Slope (%) = 4.57  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 6.05

### Highlighted

Depth (ft) = 0.43  
Q (cfs) = 6.050  
Area (sqft) = 1.69  
Velocity (ft/s) = 3.58  
Wetted Perim (ft) = 7.93  
Crit Depth, Yc (ft) = 0.49  
Top Width (ft) = 7.87  
EGL (ft) = 0.63



# Channel Report

## Swale B58A (2-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 1.25

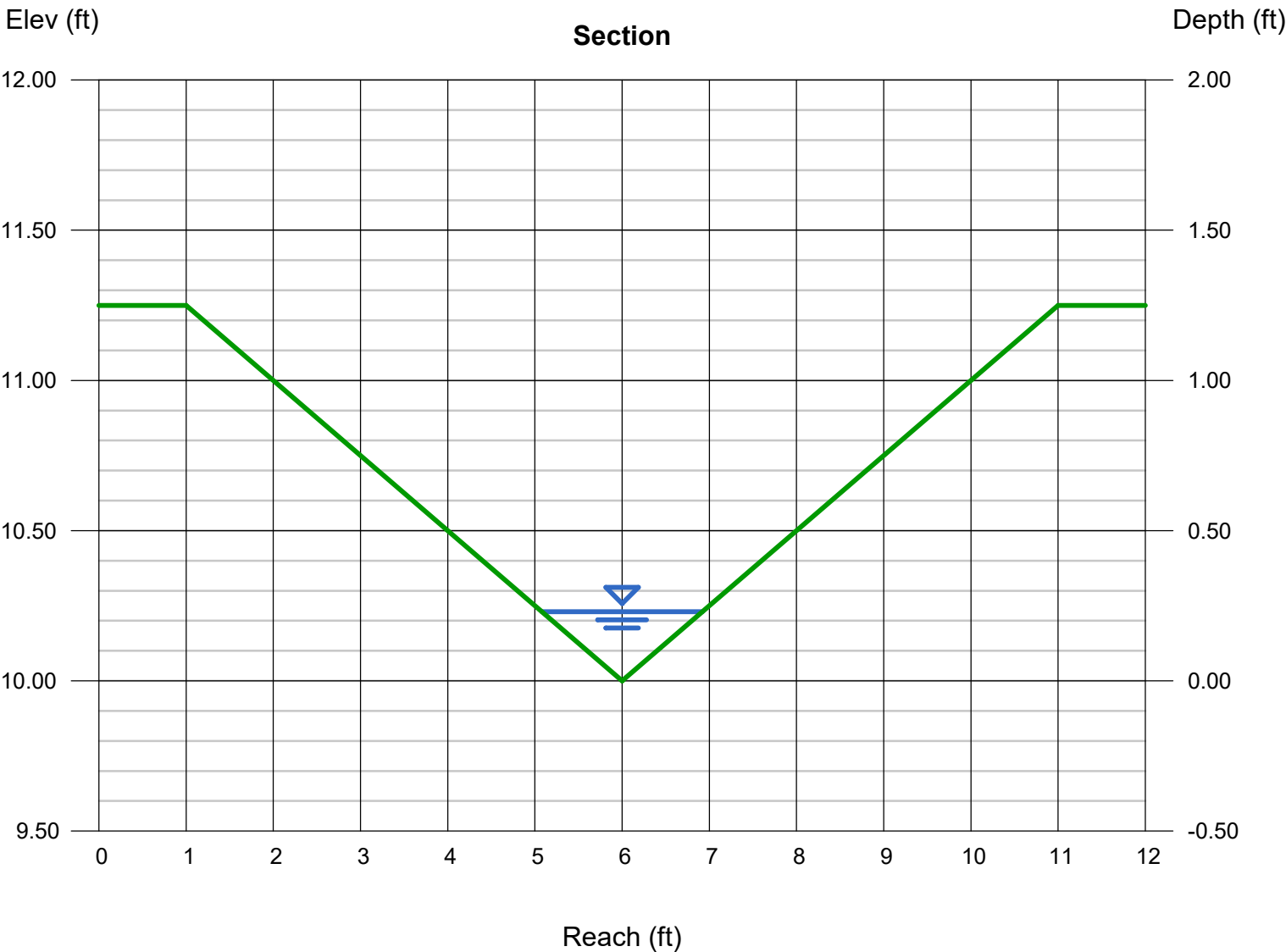
Invert Elev (ft) = 10.00  
Slope (%) = 4.29  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 0.48

### Highlighted

Depth (ft) = 0.23  
Q (cfs) = 0.480  
Area (sqft) = 0.21  
Velocity (ft/s) = 2.27  
Wetted Perim (ft) = 1.90  
Crit Depth, Yc (ft) = 0.25  
Top Width (ft) = 1.84  
EGL (ft) = 0.31



# Channel Report

## Swale B58A (100-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 1.25

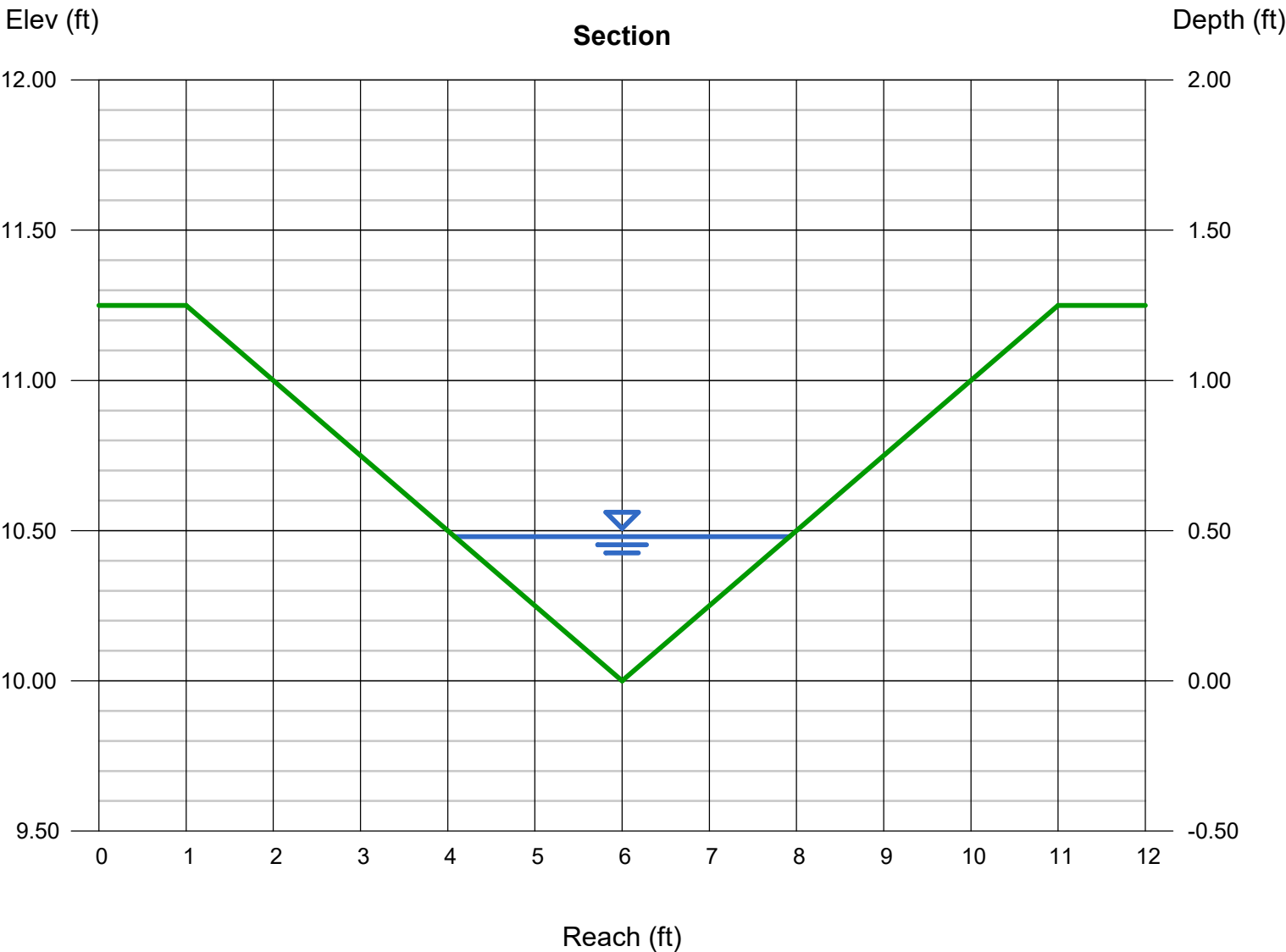
Invert Elev (ft) = 10.00  
Slope (%) = 4.29  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 3.50

### Highlighted

Depth (ft) = 0.48  
Q (cfs) = 3.500  
Area (sqft) = 0.92  
Velocity (ft/s) = 3.80  
Wetted Perim (ft) = 3.96  
Crit Depth, Yc (ft) = 0.55  
Top Width (ft) = 3.84  
EGL (ft) = 0.70



# Channel Report

## Swale C6 (2-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 1.25

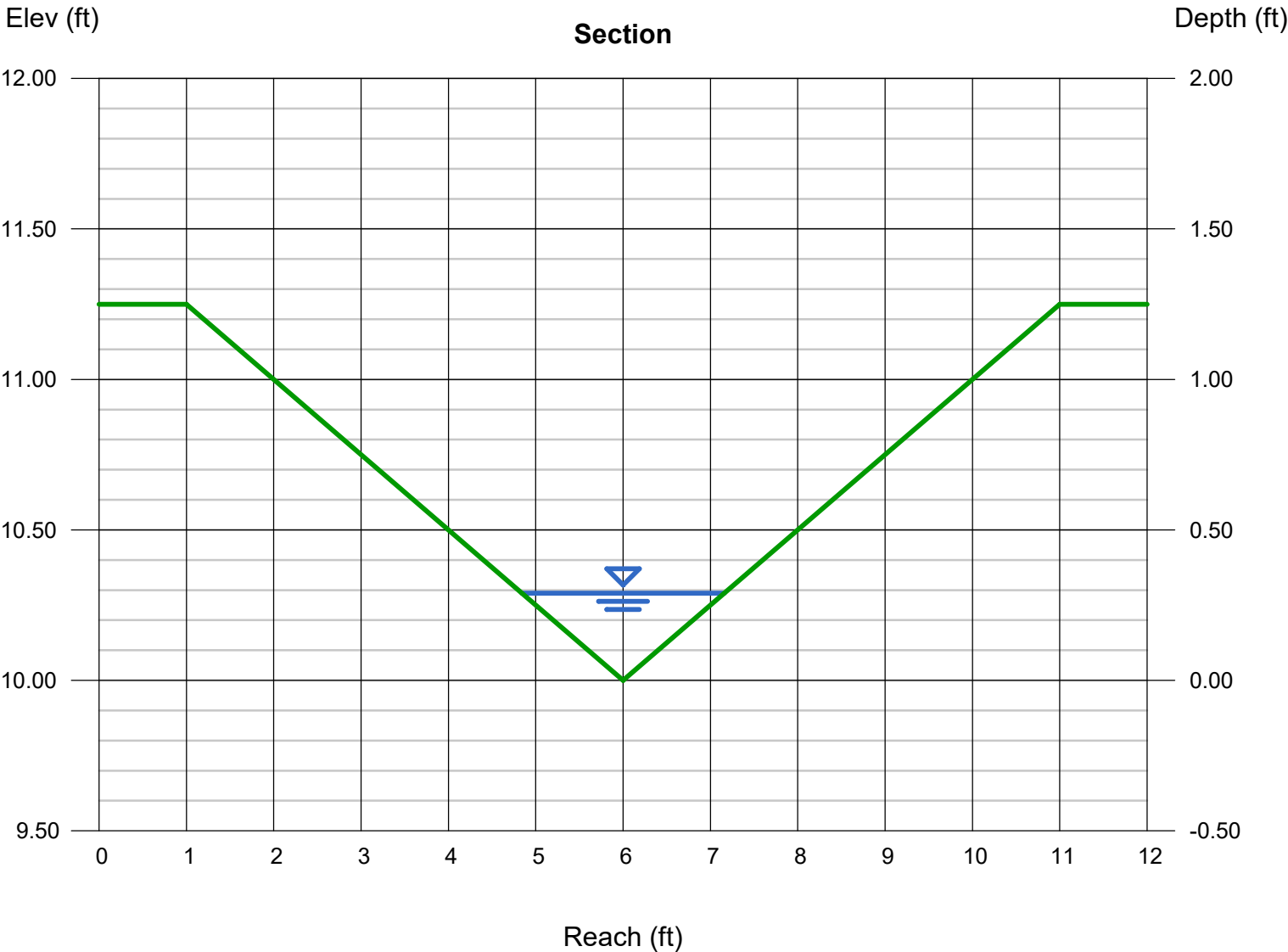
Invert Elev (ft) = 10.00  
Slope (%) = 2.00  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 0.60

### Highlighted

Depth (ft) = 0.29  
Q (cfs) = 0.600  
Area (sqft) = 0.34  
Velocity (ft/s) = 1.78  
Wetted Perim (ft) = 2.39  
Crit Depth, Yc (ft) = 0.27  
Top Width (ft) = 2.32  
EGL (ft) = 0.34



# Channel Report

## Swale C6 (100-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 1.25

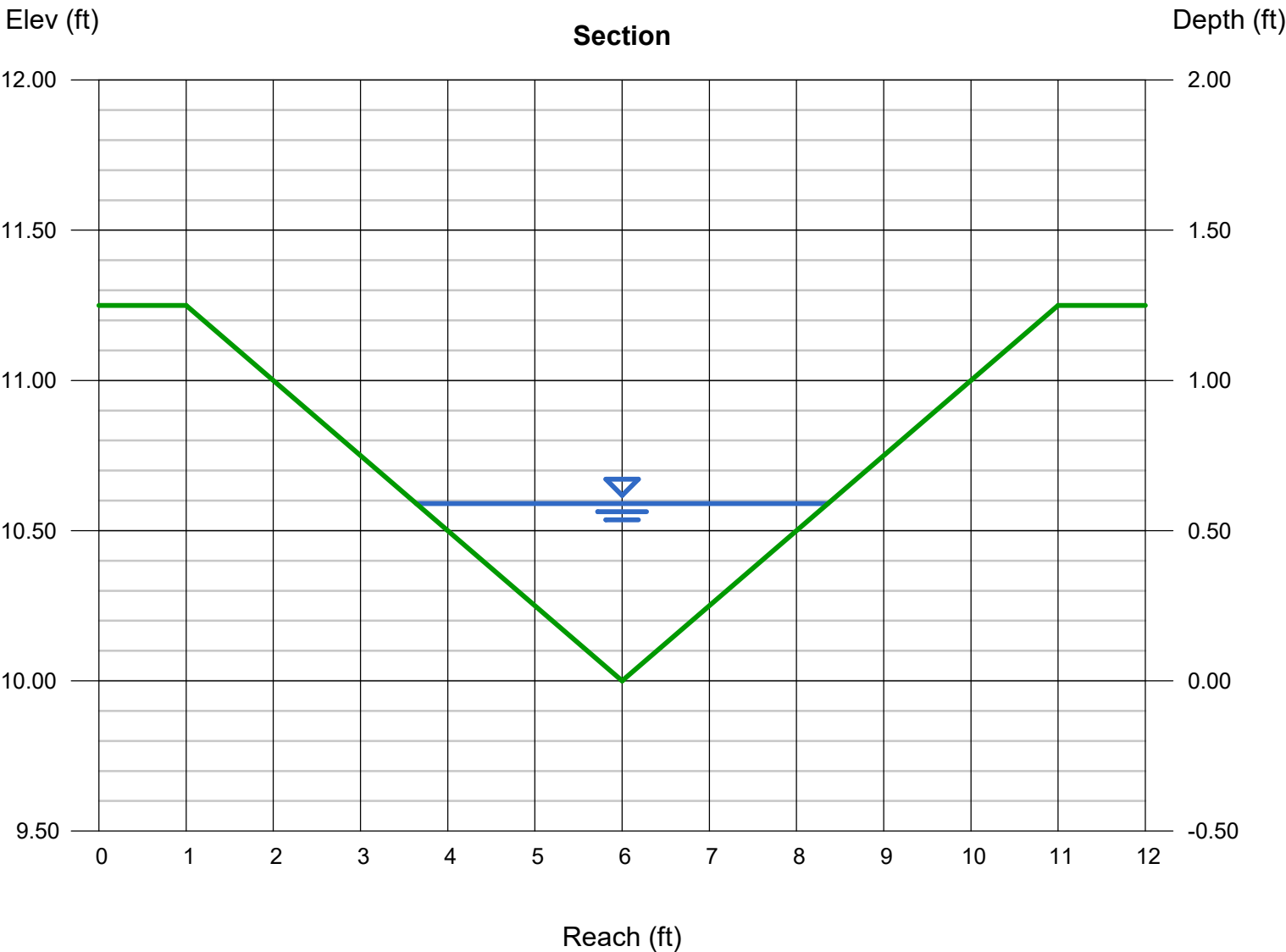
Invert Elev (ft) = 10.00  
Slope (%) = 2.00  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 4.12

### Highlighted

Depth (ft) = 0.59  
Q (cfs) = 4.120  
Area (sqft) = 1.39  
Velocity (ft/s) = 2.96  
Wetted Perim (ft) = 4.87  
Crit Depth, Yc (ft) = 0.59  
Top Width (ft) = 4.72  
EGL (ft) = 0.73





# Channel Report

## Temp Swale D4 (2-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 3.00

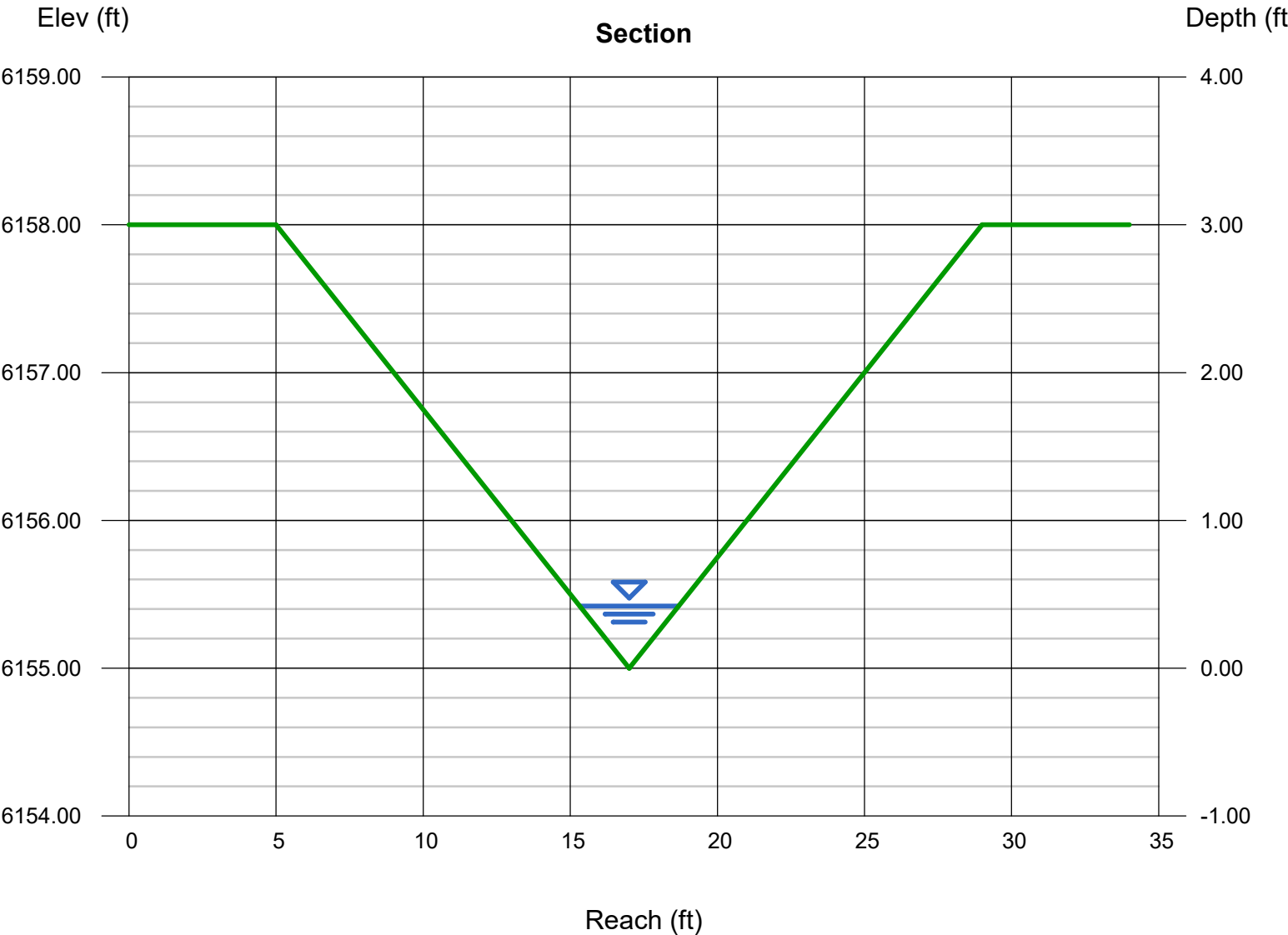
Invert Elev (ft) = 6155.00  
Slope (%) = 2.55  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 1.85

### Highlighted

Depth (ft) = 0.42  
Q (cfs) = 1.850  
Area (sqft) = 0.71  
Velocity (ft/s) = 2.62  
Wetted Perim (ft) = 3.46  
Crit Depth, Yc (ft) = 0.43  
Top Width (ft) = 3.36  
EGL (ft) = 0.53



# Channel Report

## Temp Swale D4 (100-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 3.00

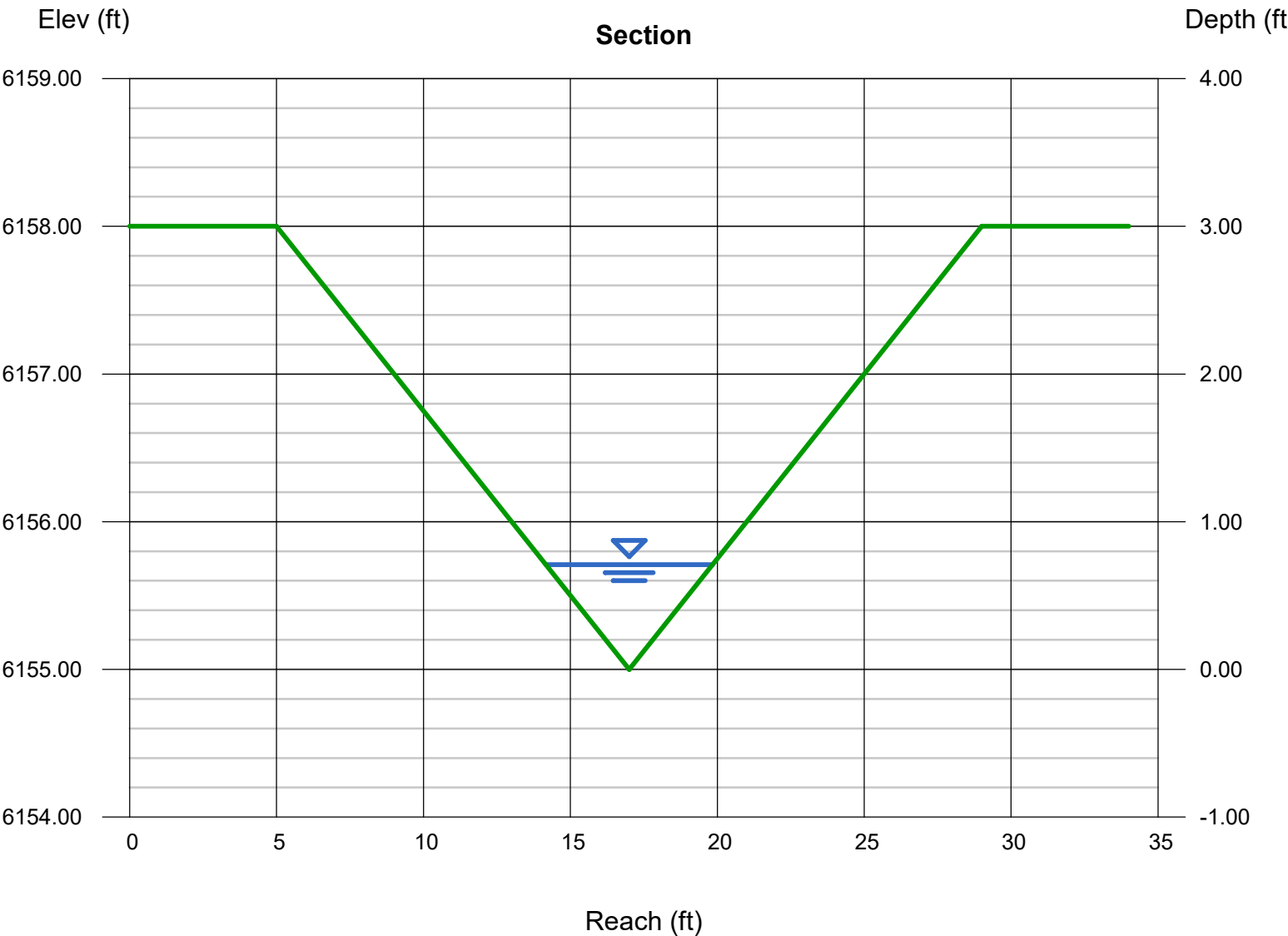
Invert Elev (ft) = 6155.00  
Slope (%) = 2.55  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 7.81

### Highlighted

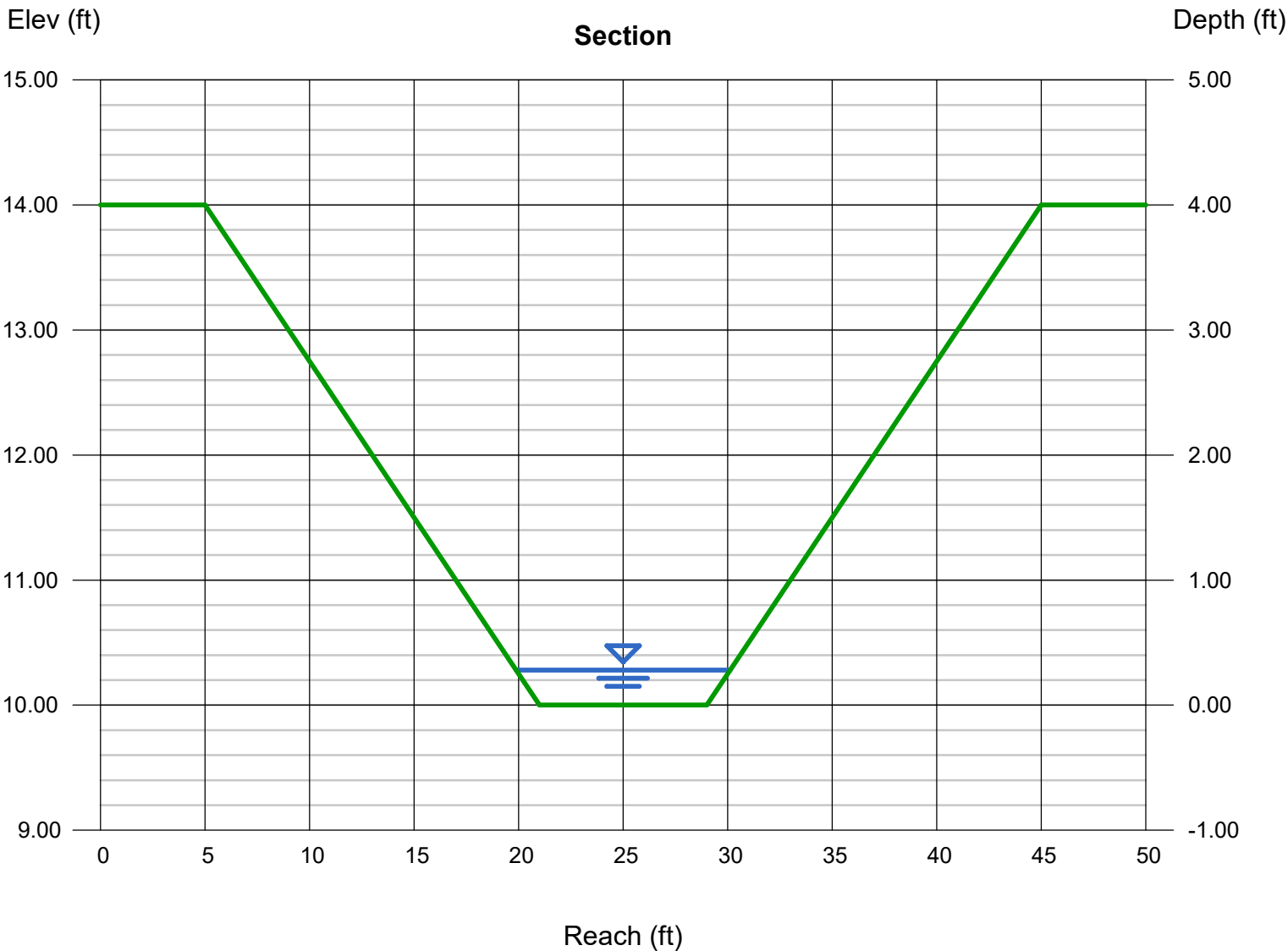
Depth (ft) = 0.71  
Q (cfs) = 7.810  
Area (sqft) = 2.02  
Velocity (ft/s) = 3.87  
Wetted Perim (ft) = 5.85  
Crit Depth, Yc (ft) = 0.75  
Top Width (ft) = 5.68  
EGL (ft) = 0.94



# Channel Report

## Swale D5 (2-Year)

<b>Trapezoidal</b>		<b>Highlighted</b>	
Bottom Width (ft)	= 8.00	Depth (ft)	= 0.28
Side Slopes (z:1)	= 4.00, 4.00	Q (cfs)	= 8.120
Total Depth (ft)	= 4.00	Area (sqft)	= 2.55
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 3.18
Slope (%)	= 2.97	Wetted Perim (ft)	= 10.31
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.31
<b>Calculations</b>		Top Width (ft)	= 10.24
Compute by:	Known Q	EGL (ft)	= 0.44
Known Q (cfs)	= 8.12		



# Channel Report

## Swale D5 (100-Year)

### Trapezoidal

Bottom Width (ft) = 8.00  
Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 4.00  
Invert Elev (ft) = 10.00  
Slope (%) = 2.97  
N-Value = 0.030

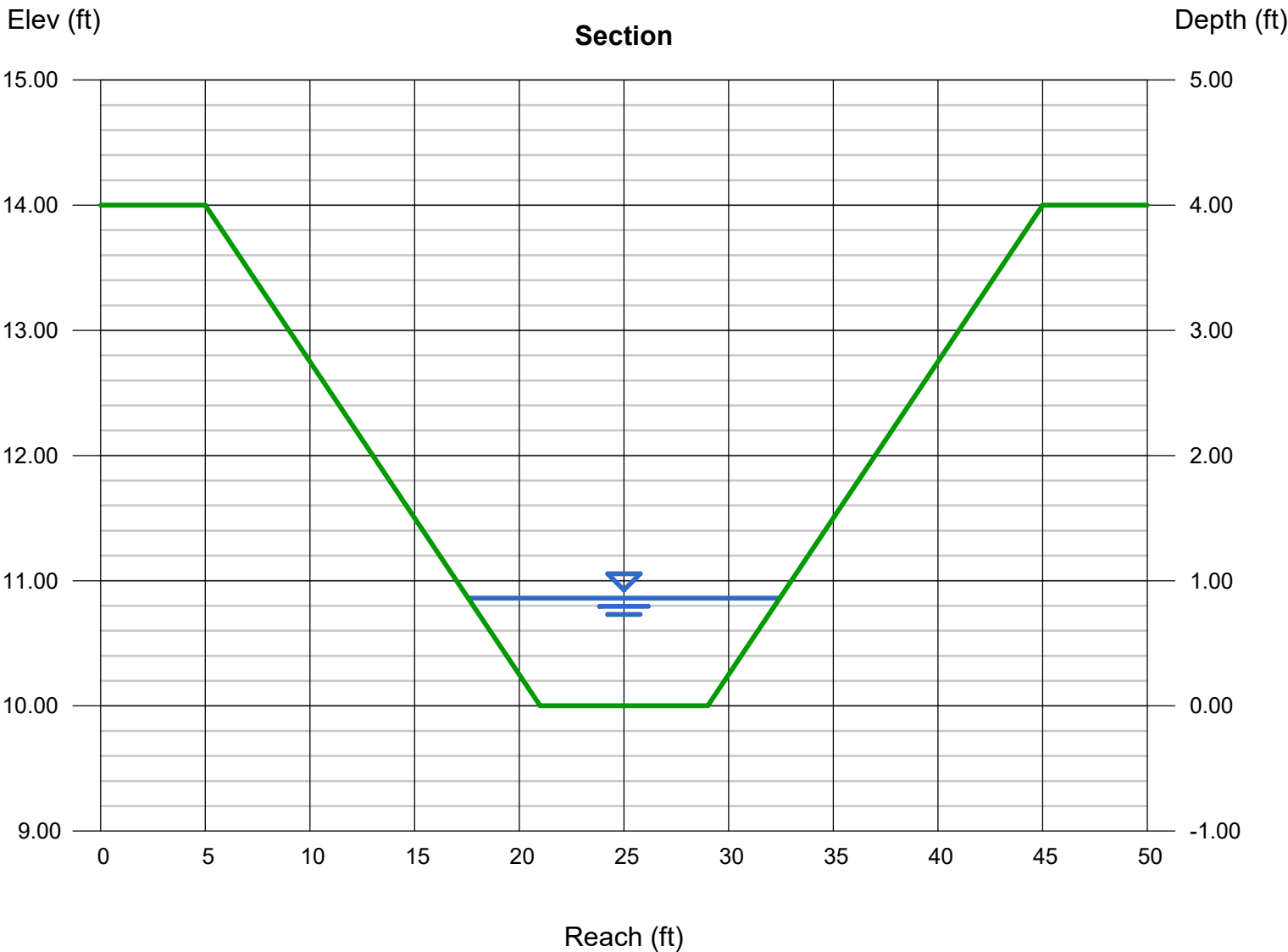
### Calculations

Compute by: Known Q  
Known Q (cfs) = 61.88

### Highlighted

Depth (ft) = 0.86  
Q (cfs) = 61.88  
Area (sqft) = 9.84  
Velocity (ft/s) = 6.29  
Wetted Perim (ft) = 15.09  
Crit Depth, Yc (ft) = 1.03  
Top Width (ft) = 14.88  
EGL (ft) = 1.48

Potential need for erosion protection will be evaluated with the FDR/CD's.



# Design Procedure Form: Grass Swale (GS)

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

**Designer:** AM  
**Company:** JR Engineering  
**Date:** April 16, 2024  
**Project:** Trails at Overland Ranch  
**Location:** Aurora

1. Design Discharge for 2-Year Return Period	$Q_2 =$ <input type="text" value="0.20"/> cfs
2. Hydraulic Residence Time A) : Length of Grass Swale B) Calculated Residence Time (based on design velocity below)	$L_S =$ <input type="text" value="60.0"/> ft $T_{HR} =$ <input type="text" value="1.5"/> minutes
3. Longitudinal Slope (vertical distance per unit horizontal) A) Available Slope (based on site constraints) B) Design Slope	$S_{avail} =$ <input type="text" value="0.020"/> ft / ft $S_D =$ <input type="text" value="0.020"/> ft / ft
4. Swale Geometry A) Channel Side Slopes ( $Z = 4$ min., horiz. distance per unit vertical) B) Bottom Width of Swale (enter 0 for triangular section)	$Z =$ <input type="text" value="4.00"/> ft / ft $W_B =$ <input type="text" value="0.00"/> ft
5. Vegetation A) Type of Planting (seed vs. sod, affects vegetal retardance factor)	Choose One <input type="text"/> <input checked="" type="radio"/> Grass From Seed <input type="radio"/> Grass From Sod
6. Design Velocity (0.2 ft / s maximum for desirable 5-minute residence time)	$V_2 =$ <input type="text" value="0.69"/> ft / s
7. Design Flow Depth (1 foot maximum) A) Flow Area B) Top Width of Swale C) Froude Number (0.50 maximum) D) Hydraulic Radius E) Velocity-Hydraulic Radius Product for Vegetal Retardance F) Manning's n (based on SCS vegetal retardance curve E for seeded grass) G) Cumulative Height of Grade Control Structures Required	$D_2 =$ <input type="text" value="0.27"/> ft $A_2 =$ <input type="text" value="0.3"/> sq ft $W_T =$ <input type="text" value="2.2"/> ft $F =$ <input type="text" value="0.33"/> $R_H =$ <input type="text" value="0.13"/> $VR =$ <input type="text" value="0.09"/> $n =$ <input type="text" value="0.080"/> $H_D =$ <input type="text" value="0.00"/> ft
8. Underdrain (Is an underdrain necessary?)	Choose One <input type="text"/> <input type="radio"/> YES <input checked="" type="radio"/> NO
9. Soil Preparation (Describe soil amendment)	<input type="text"/> <input type="text"/> <input type="text"/>
10. Irrigation	Choose One <input type="text"/> <input checked="" type="radio"/> Temporary <input type="radio"/> Permanent

Notes: Temporary grass swale to treat 0.14 acres of Basin OS3 in the temporary condition.

# Channel Report

## Temp Grass Buffer OS3 (2-Year)

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 0.50

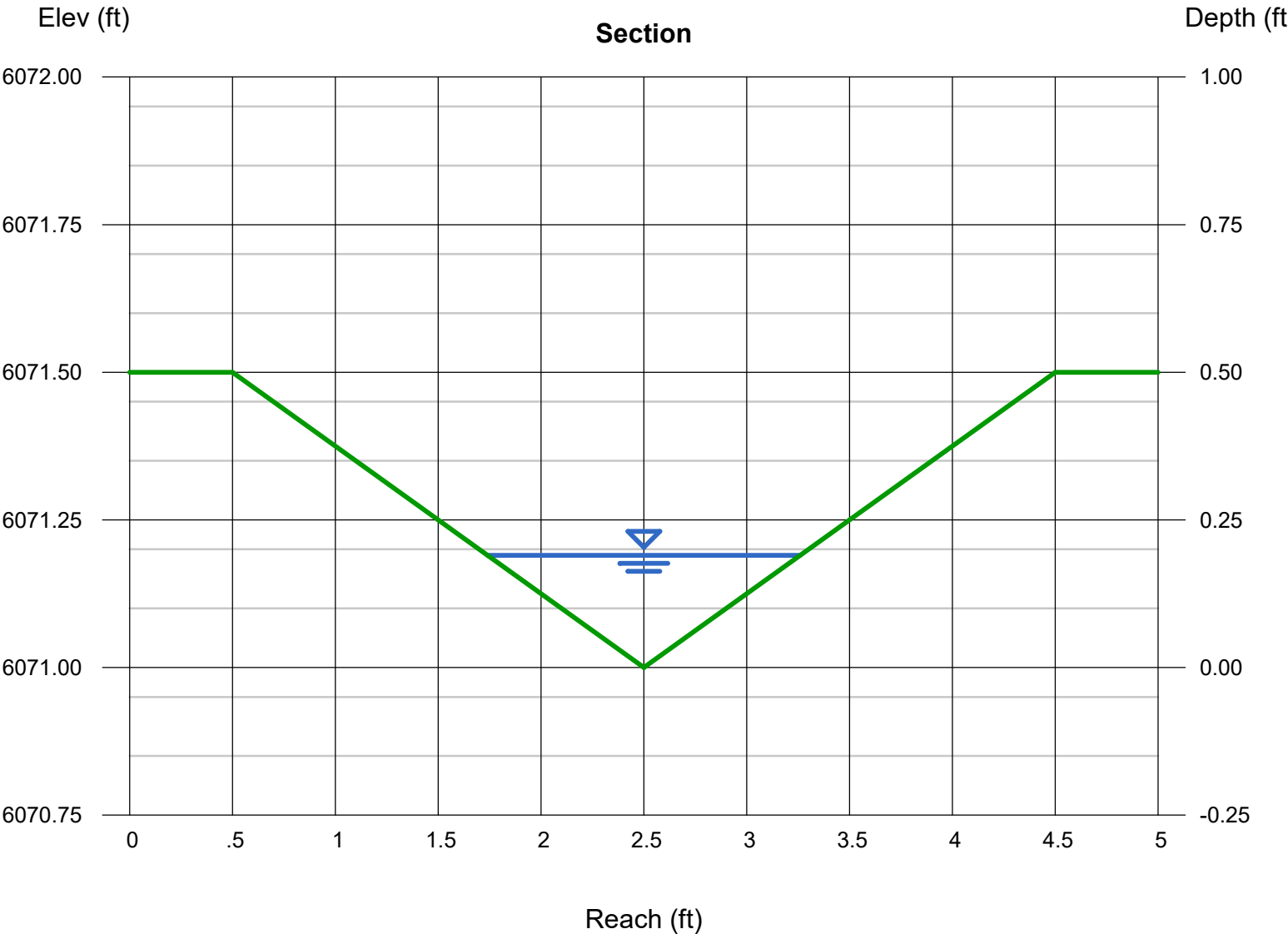
Invert Elev (ft) = 6071.00  
Slope (%) = 2.00  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 0.20

### Highlighted

Depth (ft) = 0.19  
Q (cfs) = 0.200  
Area (sqft) = 0.14  
Velocity (ft/s) = 1.39  
Wetted Perim (ft) = 1.57  
Crit Depth, Yc (ft) = 0.18  
Top Width (ft) = 1.52  
EGL (ft) = 0.22



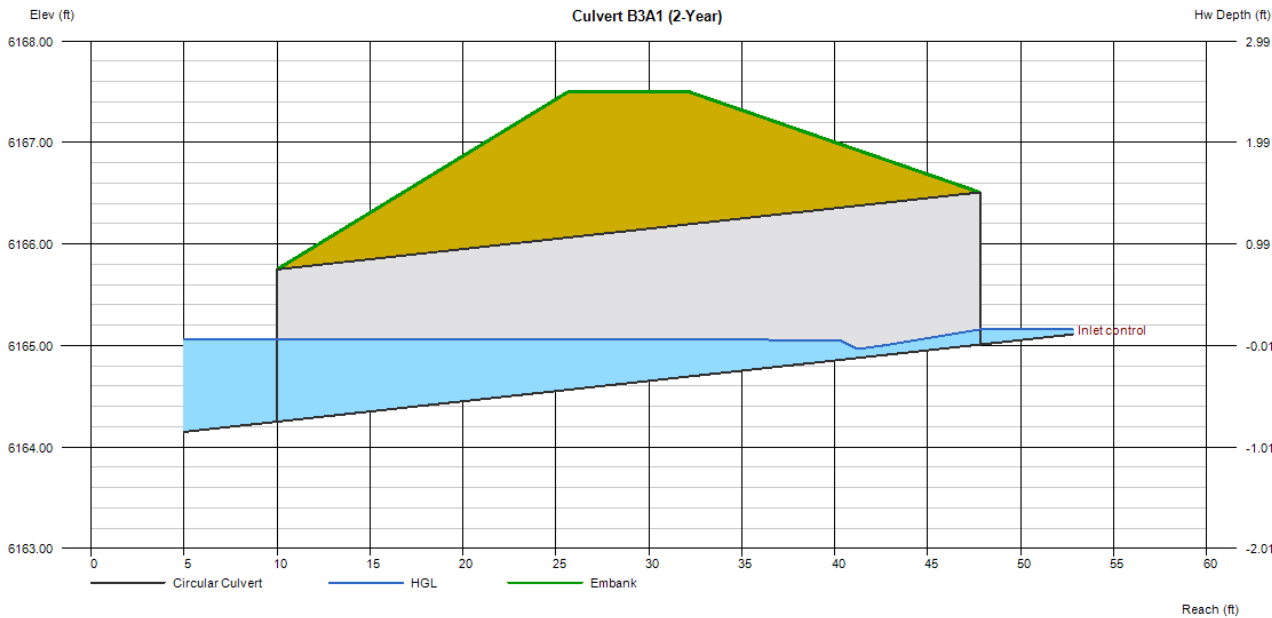
# Culvert Report

## Culvert B3A1 (2-Year)

Invert Elev Dn (ft)	=	6164.25
Pipe Length (ft)	=	37.80
Slope (%)	=	2.01
Invert Elev Up (ft)	=	6165.01
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment	
Top Elevation (ft)	= 6167.50
Top Width (ft)	= 6.50
Crest Width (ft)	= 13.50

Calculations	
Qmin (cfs)	= 0.11
Qmax (cfs)	= 2.60
Tailwater Elev (ft)	= (dc+D)/2
Highlighted	
Qtotal (cfs)	= 0.11
Qpipe (cfs)	= 0.11
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 0.11
Veloc Up (ft/s)	= 1.63
HGL Dn (ft)	= 6165.06
HGL Up (ft)	= 6165.13
Hw Elev (ft)	= 6165.16
Hw/D (ft)	= 0.10
Flow Regime	= Inlet Control



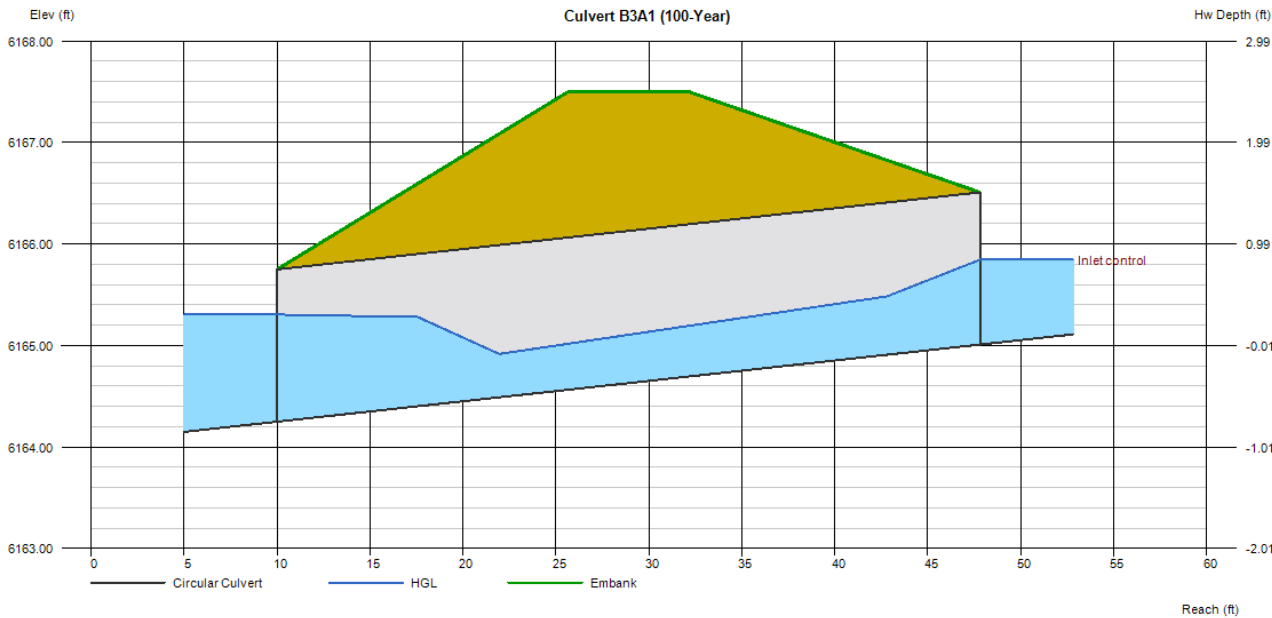
# Culvert Report

## Culvert B3A1 (100-Year)

Invert Elev Dn (ft)	= 6164.25
Pipe Length (ft)	= 37.80
Slope (%)	= 2.01
Invert Elev Up (ft)	= 6165.01
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

<b>Embankment</b>	
Top Elevation (ft)	= 6167.50
Top Width (ft)	= 6.50
Crest Width (ft)	= 13.50

<b>Calculations</b>	
Qmin (cfs)	= 0.11
Qmax (cfs)	= 2.60
Tailwater Elev (ft)	= (dc+D)/2
<b>Highlighted</b>	
Qtotal (cfs)	= 2.60
Qpipe (cfs)	= 2.60
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 1.96
Veloc Up (ft/s)	= 3.85
HGL Dn (ft)	= 6165.31
HGL Up (ft)	= 6165.62
Hw Elev (ft)	= 6165.85
Hw/D (ft)	= 0.56
Flow Regime	= Inlet Control





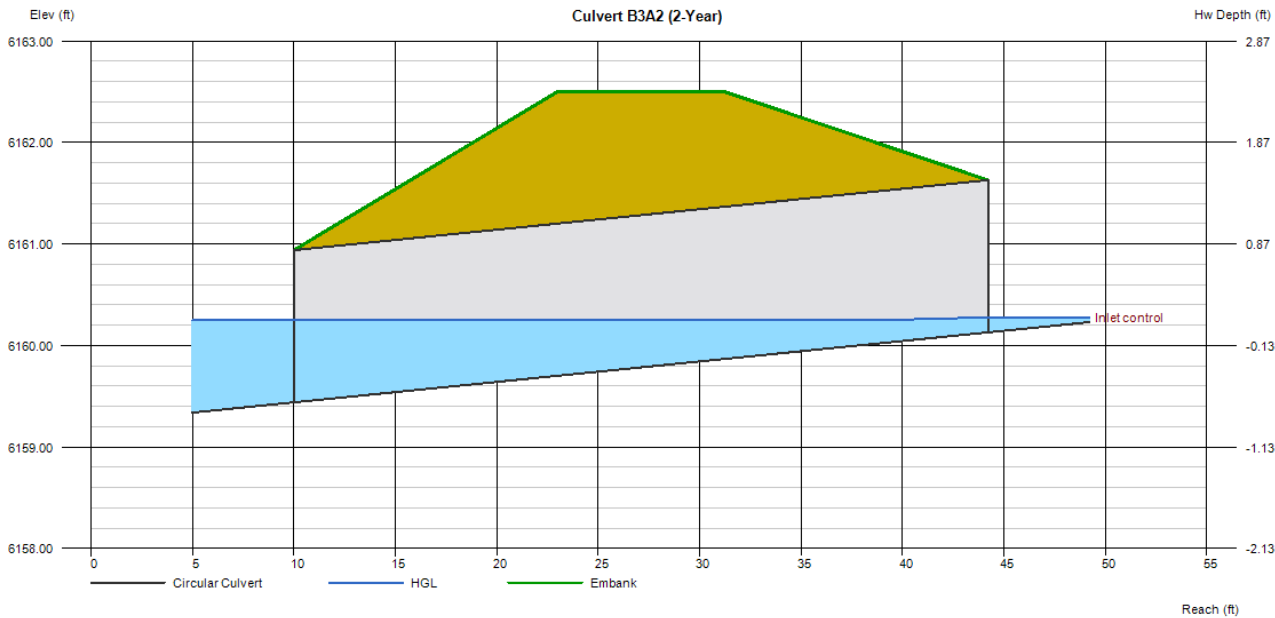
# Culvert Report

## Culvert B3A2 (2-Year)

Invert Elev Dn (ft)	= 6159.44
Pipe Length (ft)	= 34.22
Slope (%)	= 2.02
Invert Elev Up (ft)	= 6160.13
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

<b>Embankment</b>	
Top Elevation (ft)	= 6162.50
Top Width (ft)	= 8.25
Crest Width (ft)	= 13.50

<b>Calculations</b>	
Qmin (cfs)	= 0.11
Qmax (cfs)	= 2.60
Tailwater Elev (ft)	= (dc+D)/2
<b>Highlighted</b>	
Qtotal (cfs)	= 0.11
Qpipe (cfs)	= 0.11
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 0.11
Veloc Up (ft/s)	= 1.63
HGL Dn (ft)	= 6160.25
HGL Up (ft)	= 6160.25
Hw Elev (ft)	= 6160.28
Hw/D (ft)	= 0.10
Flow Regime	= Inlet Control



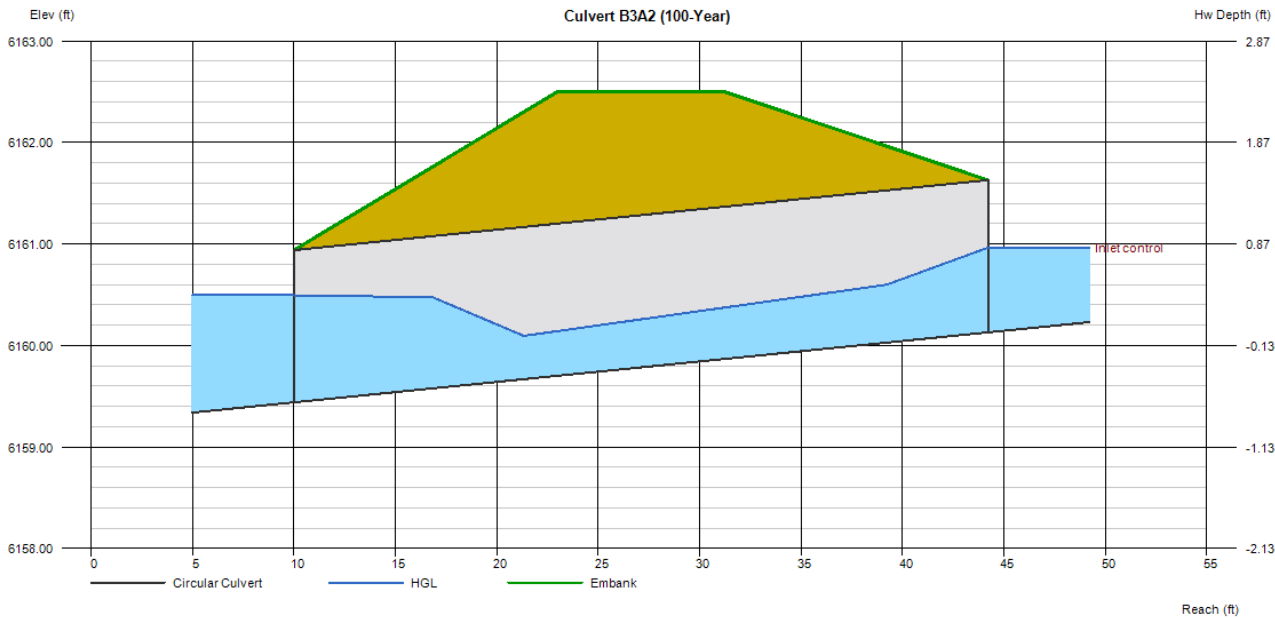
# Culvert Report

## Culvert B3A2 (100-Year)

Invert Elev Dn (ft)	= 6159.44
Pipe Length (ft)	= 34.22
Slope (%)	= 2.02
Invert Elev Up (ft)	= 6160.13
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

<b>Embankment</b>	
Top Elevation (ft)	= 6162.50
Top Width (ft)	= 8.25
Crest Width (ft)	= 13.50

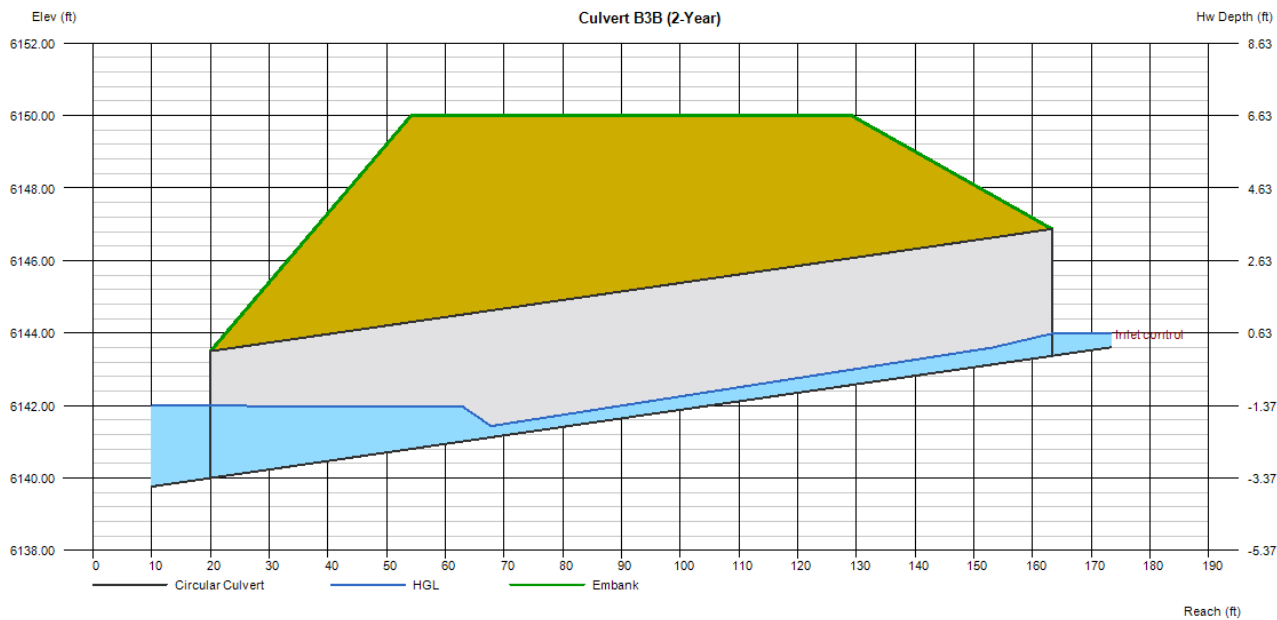
<b>Calculations</b>	
Qmin (cfs)	= 0.11
Qmax (cfs)	= 2.60
Tailwater Elev (ft)	= (dc+D)/2
<b>Highlighted</b>	
Qtotat (cfs)	= 2.60
Qpipe (cfs)	= 2.60
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 1.96
Veloc Up (ft/s)	= 3.85
HGL Dn (ft)	= 6160.50
HGL Up (ft)	= 6160.74
Hw Elev (ft)	= 6160.97
Hw/D (ft)	= 0.56
Flow Regime	= Inlet Control



# Culvert Report

## Culvert B3B (2-Year)

Invert Elev Dn (ft)	= 6140.00	<b>Calculations</b>	
Pipe Length (ft)	= 143.31	Qmin (cfs)	= 2.66
Slope (%)	= 2.35	Qmax (cfs)	= 61.80
Invert Elev Up (ft)	= 6143.37	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 42.0		
Shape	= Circular	<b>Highlighted</b>	
Span (in)	= 42.0	Qtotal (cfs)	= 2.66
No. Barrels	= 1	Qpipe (cfs)	= 2.66
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 0.47
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 3.28
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 6141.99
		HGL Up (ft)	= 6143.86
		Hw Elev (ft)	= 6143.98
		Hw/D (ft)	= 0.18
		Flow Regime	= Inlet Control
<b>Embankment</b>			
Top Elevation (ft)	= 6150.00		
Top Width (ft)	= 75.00		
Crest Width (ft)	= 27.00		



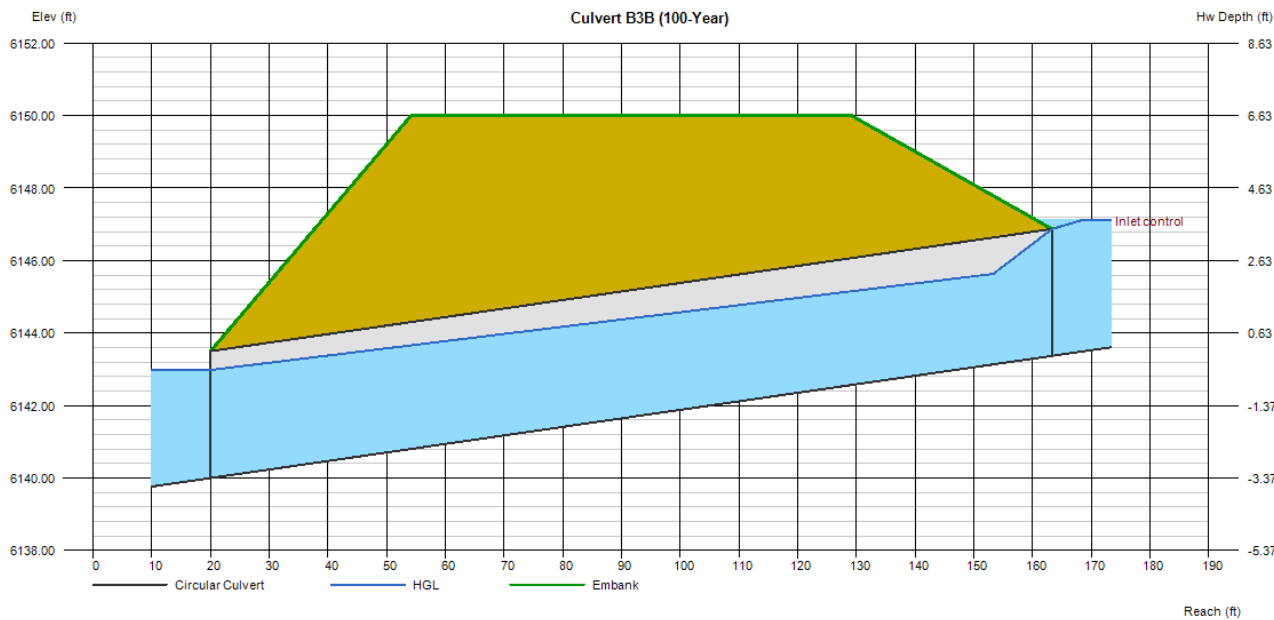
# Culvert Report

## Culvert B3B (100-Year)

Invert Elev Dn (ft)	= 6140.00
Pipe Length (ft)	= 143.31
Slope (%)	= 2.35
Invert Elev Up (ft)	= 6143.37
Rise (in)	= 42.0
Shape	= Circular
Span (in)	= 42.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

<b>Embankment</b>	
Top Elevation (ft)	= 6150.00
Top Width (ft)	= 75.00
Crest Width (ft)	= 27.00

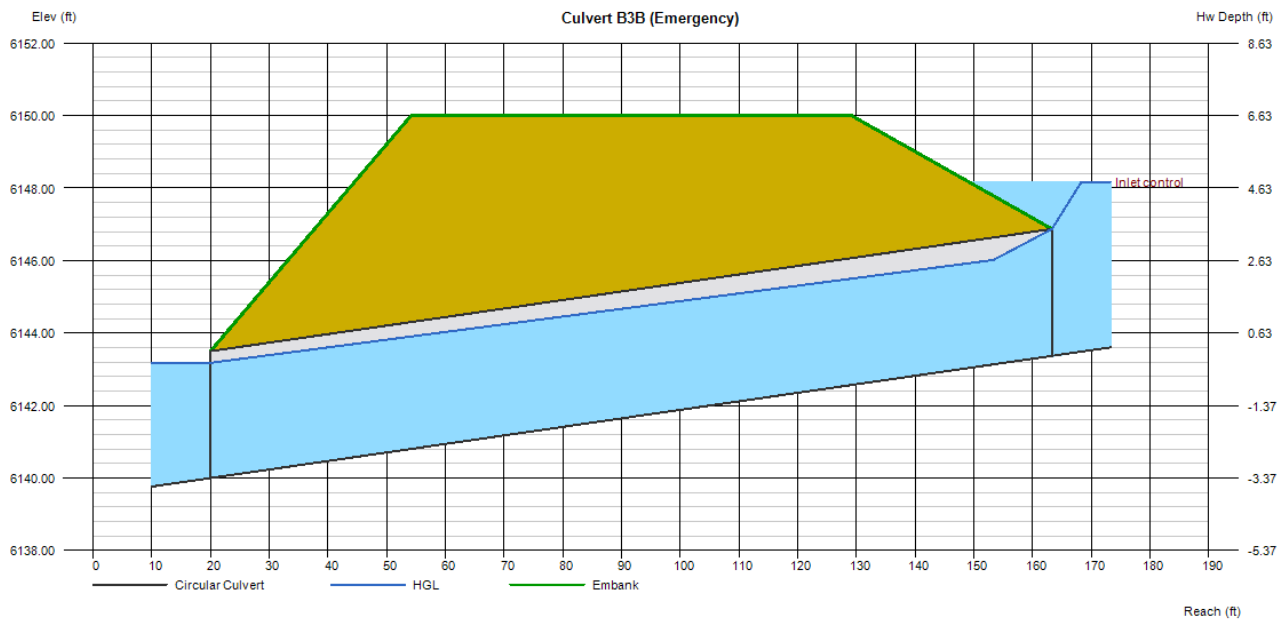
<b>Calculations</b>	
Qmin (cfs)	= 2.66
Qmax (cfs)	= 61.80
Tailwater Elev (ft)	= (dc+D)/2
<b>Highlighted</b>	
Qtotal (cfs)	= 61.80
Qpipe (cfs)	= 61.80
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 7.08
Veloc Up (ft/s)	= 8.55
HGL Dn (ft)	= 6142.98
HGL Up (ft)	= 6145.83
Hw Elev (ft)	= 6147.11
Hw/D (ft)	= 1.07
Flow Regime	= Inlet Control



# Culvert Report

## Culvert B3B (Emergency)

Invert Elev Dn (ft)	= 6140.00	Calculations	
Pipe Length (ft)	= 143.31	Qmin (cfs)	= 2.66
Slope (%)	= 2.35	Qmax (cfs)	= 84.21
Invert Elev Up (ft)	= 6143.37	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 42.0		
Shape	= Circular	Highlighted	
Span (in)	= 42.0	Qtotal (cfs)	= 84.20
No. Barrels	= 1	Qpipe (cfs)	= 84.20
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 9.17
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 10.01
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 6143.18
		HGL Up (ft)	= 6146.23
		Hw Elev (ft)	= 6148.17
		Hw/D (ft)	= 1.37
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 6150.00		
Top Width (ft)	= 75.00		
Crest Width (ft)	= 27.00		



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Friday, Oct 13 2023

## Culvert B3C (2-Year)

Invert Elev Dn (ft) = 6133.90  
Pipe Length (ft) = 49.25  
Slope (%) = 2.50  
Invert Elev Up (ft) = 6135.13  
Rise (in) = 18.0  
Shape = Circular  
Span (in) = 18.0  
No. Barrels = 1  
n-Value = 0.012  
Culvert Type = Circular Concrete  
Culvert Entrance = Groove end projecting (C)  
Coeff. K,M,c,Y,k = 0.0045, 2, 0.0317, 0.69, 0.2

### Embankment

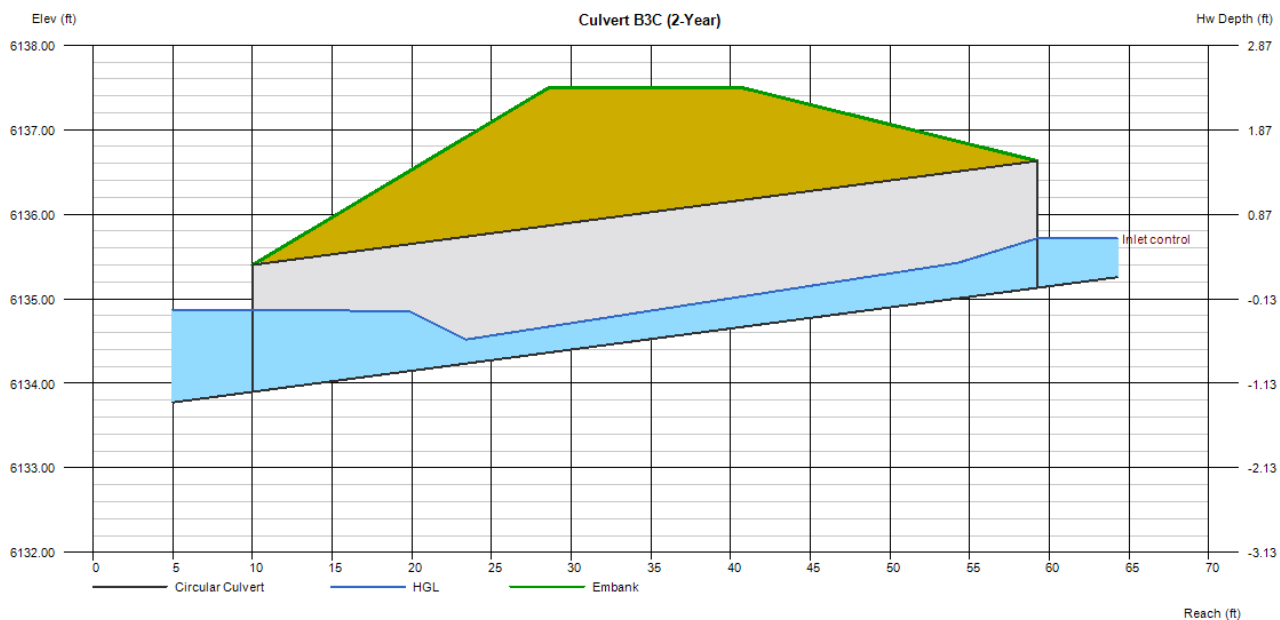
Top Elevation (ft) = 6137.50  
Top Width (ft) = 12.00  
Crest Width (ft) = 12.00

### Calculations

Qmin (cfs) = 1.39  
Qmax (cfs) = 22.46  
Tailwater Elev (ft) = (dc+D)/2

### Highlighted

Qtotal (cfs) = 1.39  
Qpipe (cfs) = 1.39  
Qovertop (cfs) = 0.00  
Veloc Dn (ft/s) = 1.15  
Veloc Up (ft/s) = 3.20  
HGL Dn (ft) = 6134.87  
HGL Up (ft) = 6135.57  
Hw Elev (ft) = 6135.72  
Hw/D (ft) = 0.39  
Flow Regime = Inlet Control



### Culvert B3C (100-Year)

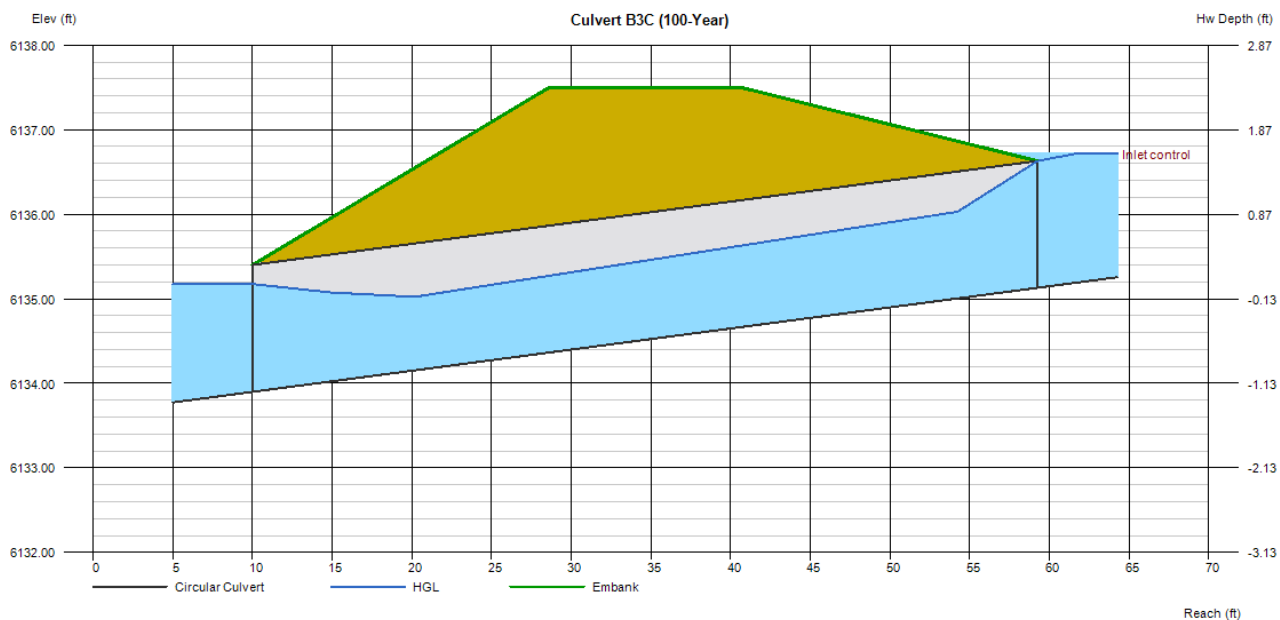
**Embankment**  
Top Elevation (ft) = 6137.50  
Top Width (ft) = 12.00  
Crest Width (ft) = 12.00

## Calculations

Qmin (cfs) = 1.39  
Qmax (cfs) = 7.34  
Tailwater Elev (ft) = (dc+D)/2

## Highlighted

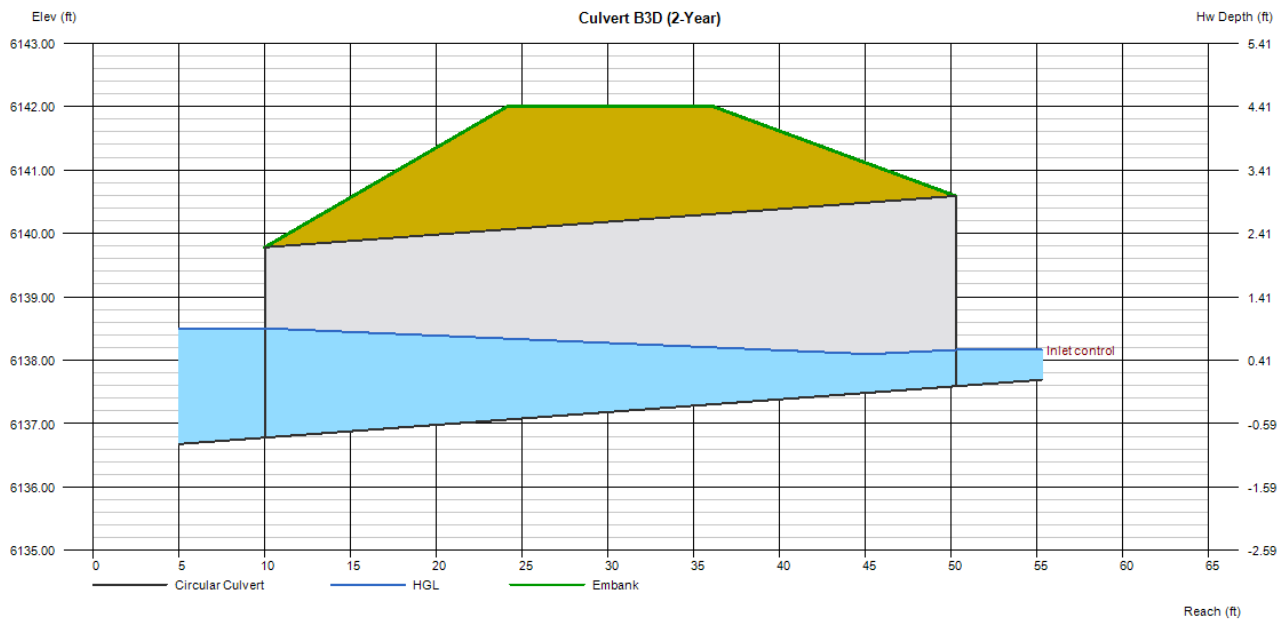
Qtotal (cfs)	= 7.34
Qpipe (cfs)	= 7.34
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 4.59
Veloc Up (ft/s)	= 5.56
HGL Dn (ft)	= 6135.17
HGL Up (ft)	= 6136.18
Hw Elev (ft)	= 6136.72
Hw/D (ft)	= 1.06
Flow Regime	= Inlet Control



# Culvert Report

## Culvert B3D (2-Year)

Invert Elev Dn (ft)	= 6136.78	<b>Calculations</b>	
Pipe Length (ft)	= 40.25	Qmin (cfs)	= 2.09
Slope (%)	= 2.01	Qmax (cfs)	= 34.46
Invert Elev Up (ft)	= 6137.59	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 36.0		
Shape	= Circular	<b>Highlighted</b>	
Span (in)	= 36.0	Qtotal (cfs)	= 2.09
No. Barrels	= 1	Qpipe (cfs)	= 2.09
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 0.50
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 3.16
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 6138.50
		HGL Up (ft)	= 6138.04
		Hw Elev (ft)	= 6138.16
		Hw/D (ft)	= 0.19
		Flow Regime	= Inlet Control
<b>Embankment</b>			
Top Elevation (ft)	= 6142.00		
Top Width (ft)	= 12.00		
Crest Width (ft)	= 12.00		





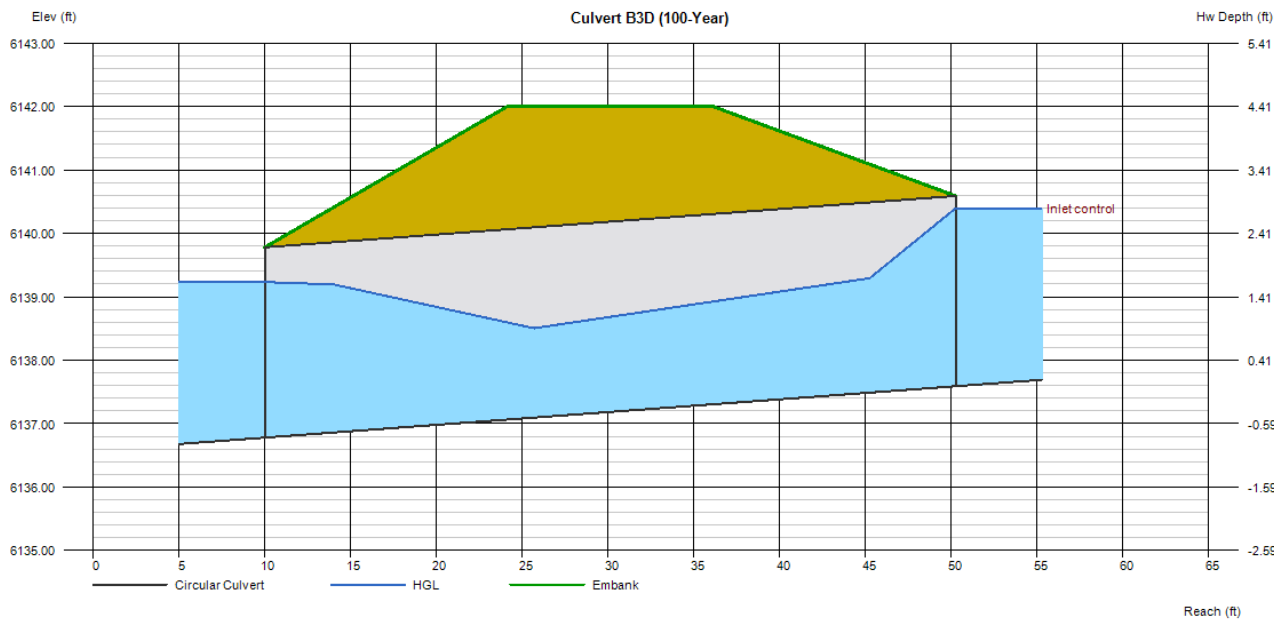
# Culvert Report

## Culvert B3D (100-Year)

Invert Elev Dn (ft)	= 6136.78
Pipe Length (ft)	= 40.25
Slope (%)	= 2.01
Invert Elev Up (ft)	= 6137.59
Rise (in)	= 36.0
Shape	= Circular
Span (in)	= 36.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

<b>Embankment</b>	
Top Elevation (ft)	= 6142.00
Top Width (ft)	= 12.00
Crest Width (ft)	= 12.00

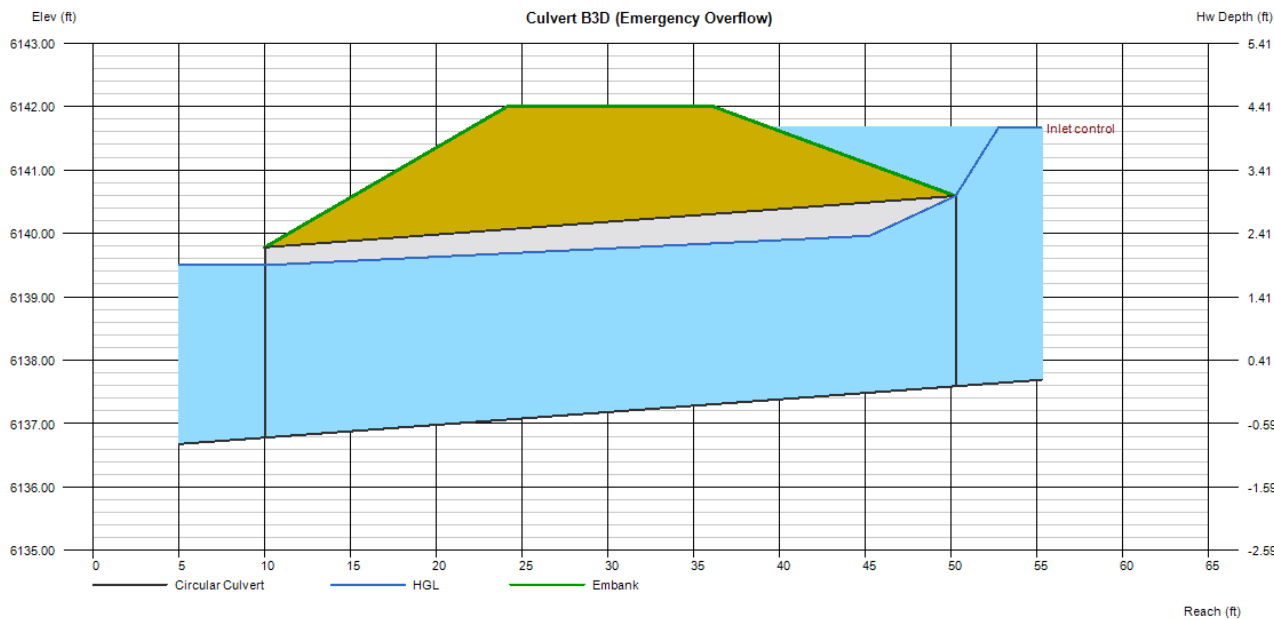
<b>Calculations</b>	
Qmin (cfs)	= 2.09
Qmax (cfs)	= 34.46
Tailwater Elev (ft)	= (dc+D)/2
<b>Highlighted</b>	
Qtotal (cfs)	= 34.46
Qpipe (cfs)	= 34.46
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 5.57
Veloc Up (ft/s)	= 7.28
HGL Dn (ft)	= 6139.23
HGL Up (ft)	= 6139.50
Hw Elev (ft)	= 6140.40
Hw/D (ft)	= 0.94
Flow Regime	= Inlet Control



# Culvert Report

## Culvert B3D (Emergency Overflow)

Invert Elev Dn (ft)	= 6136.78	<b>Calculations</b>	
Pipe Length (ft)	= 40.25	Qmin (cfs)	= 2.53
Slope (%)	= 2.01	Qmax (cfs)	= 56.67
Invert Elev Up (ft)	= 6137.59	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 36.0		
Shape	= Circular	<b>Highlighted</b>	
Span (in)	= 36.0	Qtotal (cfs)	= 56.67
No. Barrels	= 1	Qpipe (cfs)	= 56.67
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 8.42
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 9.21
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 6139.50
		HGL Up (ft)	= 6140.03
		Hw Elev (ft)	= 6141.67
		Hw/D (ft)	= 1.36
		Flow Regime	= Inlet Control
<b>Embankment</b>			
Top Elevation (ft)	= 6142.00		
Top Width (ft)	= 12.00		
Crest Width (ft)	= 12.00		



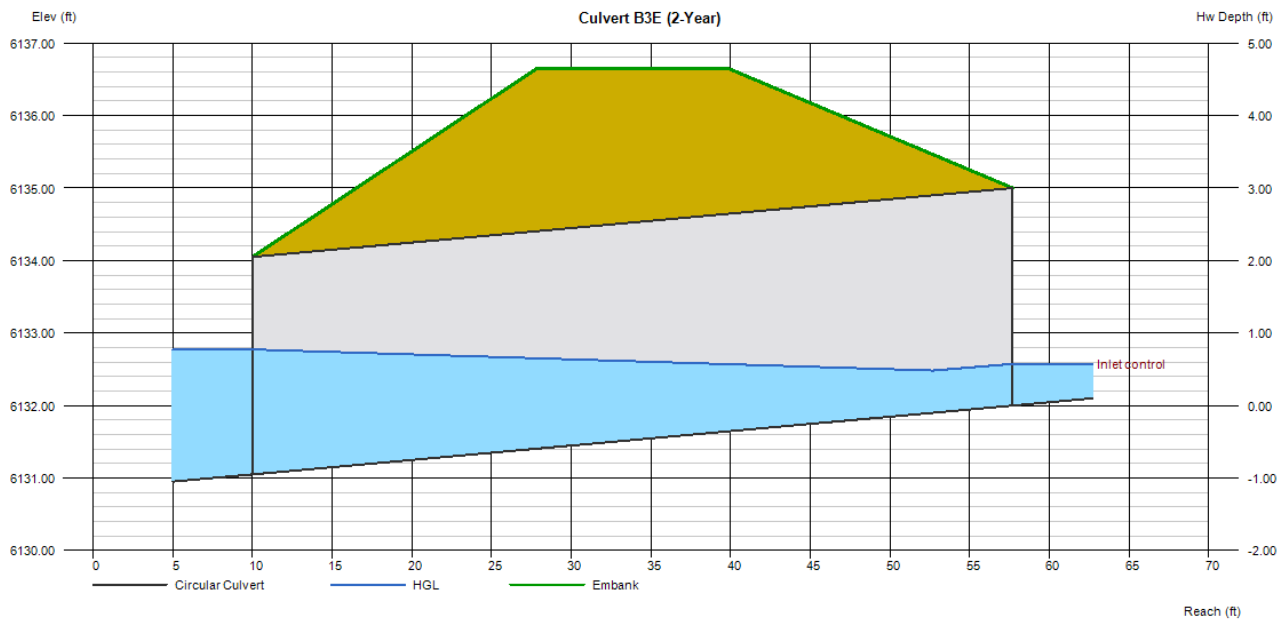
# Culvert Report

## Culvert B3E (2-Year)

Invert Elev Dn (ft)	= 6131.05
Pipe Length (ft)	= 47.70
Slope (%)	= 1.99
Invert Elev Up (ft)	= 6132.00
Rise (in)	= 36.0
Shape	= Circular
Span (in)	= 36.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

<b>Embankment</b>	
Top Elevation (ft)	= 6136.65
Top Width (ft)	= 12.00
Crest Width (ft)	= 12.00

<b>Calculations</b>	
Qmin (cfs)	= 2.09
Qmax (cfs)	= 34.46
Tailwater Elev (ft)	= (dc+D)/2
<b>Highlighted</b>	
Qtotal (cfs)	= 2.09
Qpipe (cfs)	= 2.09
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 0.50
Veloc Up (ft/s)	= 3.16
HGL Dn (ft)	= 6132.77
HGL Up (ft)	= 6132.45
Hw Elev (ft)	= 6132.57
Hw/D (ft)	= 0.19
Flow Regime	= Inlet Control



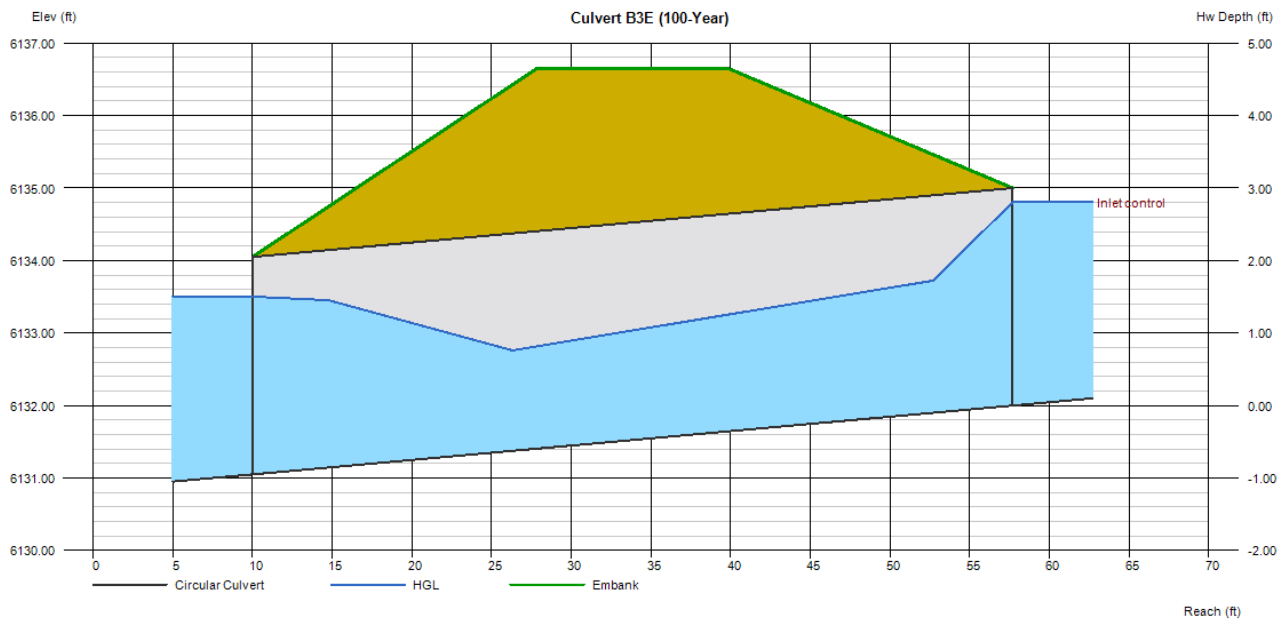
# Culvert Report

## Culvert B3E (100-Year)

Invert Elev Dn (ft)	= 6131.05
Pipe Length (ft)	= 47.70
Slope (%)	= 1.99
Invert Elev Up (ft)	= 6132.00
Rise (in)	= 36.0
Shape	= Circular
Span (in)	= 36.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

<b>Embankment</b>	
Top Elevation (ft)	= 6136.65
Top Width (ft)	= 12.00
Crest Width (ft)	= 12.00

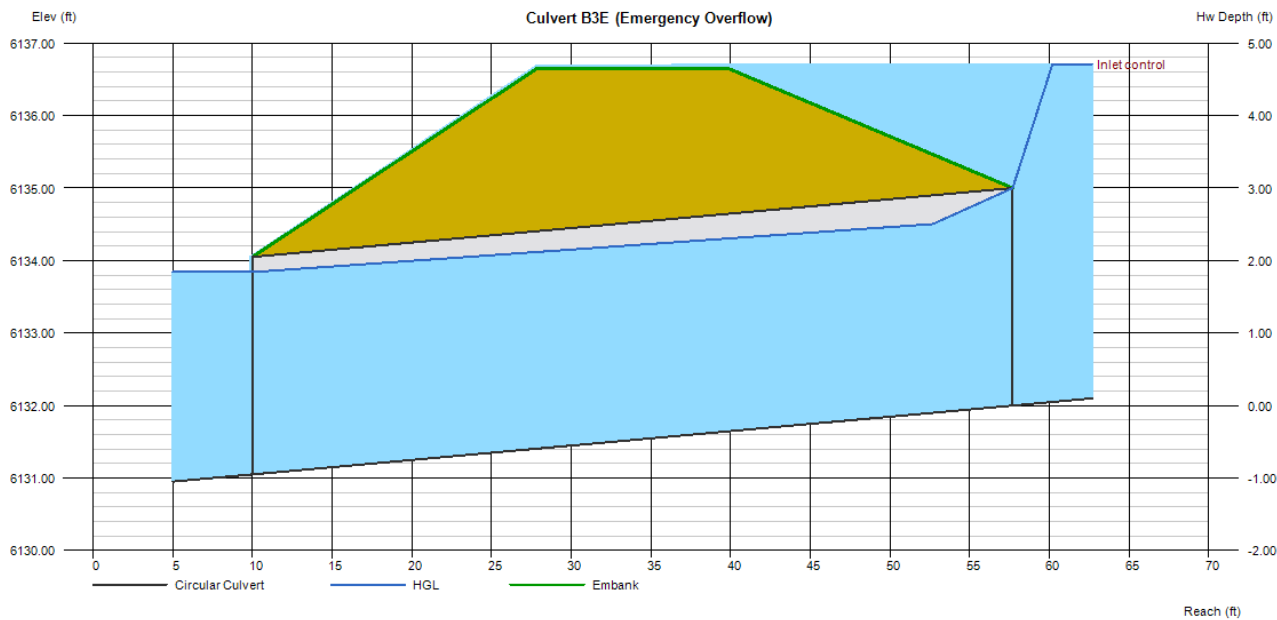
<b>Calculations</b>	
Qmin (cfs)	= 2.09
Qmax (cfs)	= 34.46
Tailwater Elev (ft)	= (dc+D)/2
<b>Highlighted</b>	
Qtotal (cfs)	= 34.46
Qpipe (cfs)	= 34.46
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 5.57
Veloc Up (ft/s)	= 7.28
HGL Dn (ft)	= 6133.50
HGL Up (ft)	= 6133.91
Hw Elev (ft)	= 6134.81
Hw/D (ft)	= 0.94
Flow Regime	= Inlet Control



# Culvert Report

## Culvert B3E (Emergency Overflow)

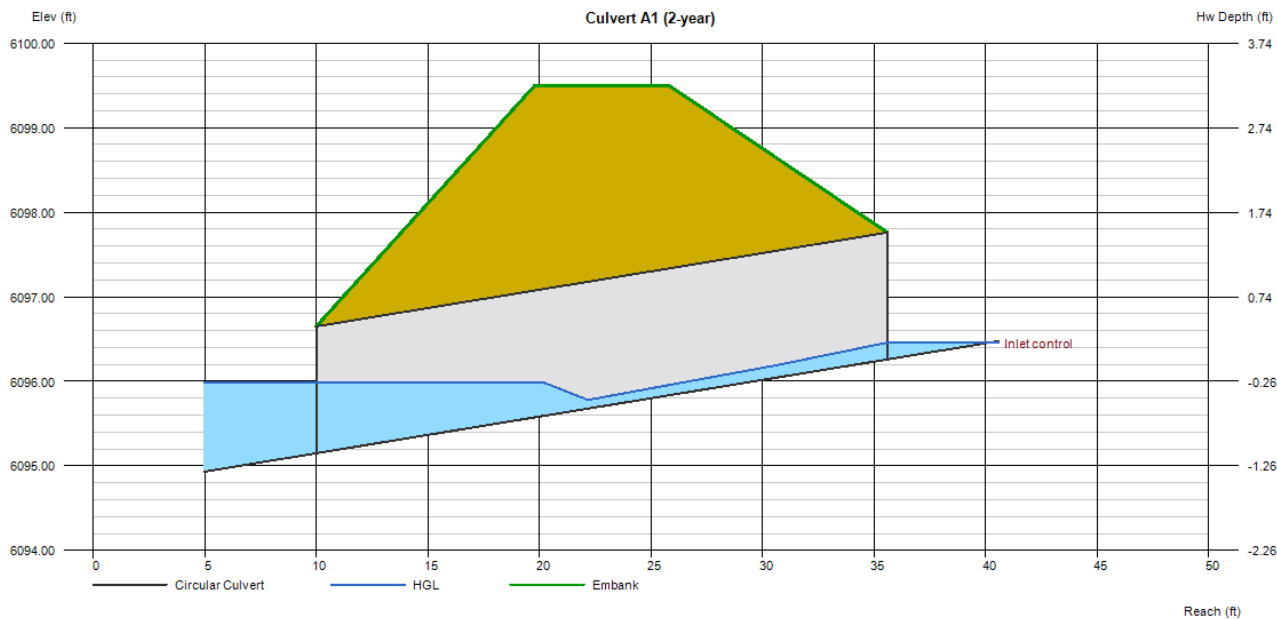
Invert Elev Dn (ft)	= 6131.05	<b>Calculations</b>	
Pipe Length (ft)	= 47.70	Qmin (cfs)	= 3.81
Slope (%)	= 1.99	Qmax (cfs)	= 65.33
Invert Elev Up (ft)	= 6132.00	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 36.0		
Shape	= Circular	<b>Highlighted</b>	
Span (in)	= 36.0	Qtotal (cfs)	= 65.33
No. Barrels	= 1	Qpipe (cfs)	= 64.89
n-Value	= 0.012	Qovertop (cfs)	= 0.44
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 9.47
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 10.03
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 6133.84
		HGL Up (ft)	= 6134.58
		Hw Elev (ft)	= 6136.71
		Hw/D (ft)	= 1.57
		Flow Regime	= Inlet Control
<b>Embankment</b>			
Top Elevation (ft)	= 6136.65		
Top Width (ft)	= 12.00		
Crest Width (ft)	= 12.00		



# Culvert Report

## Culvert A1 (2-year)

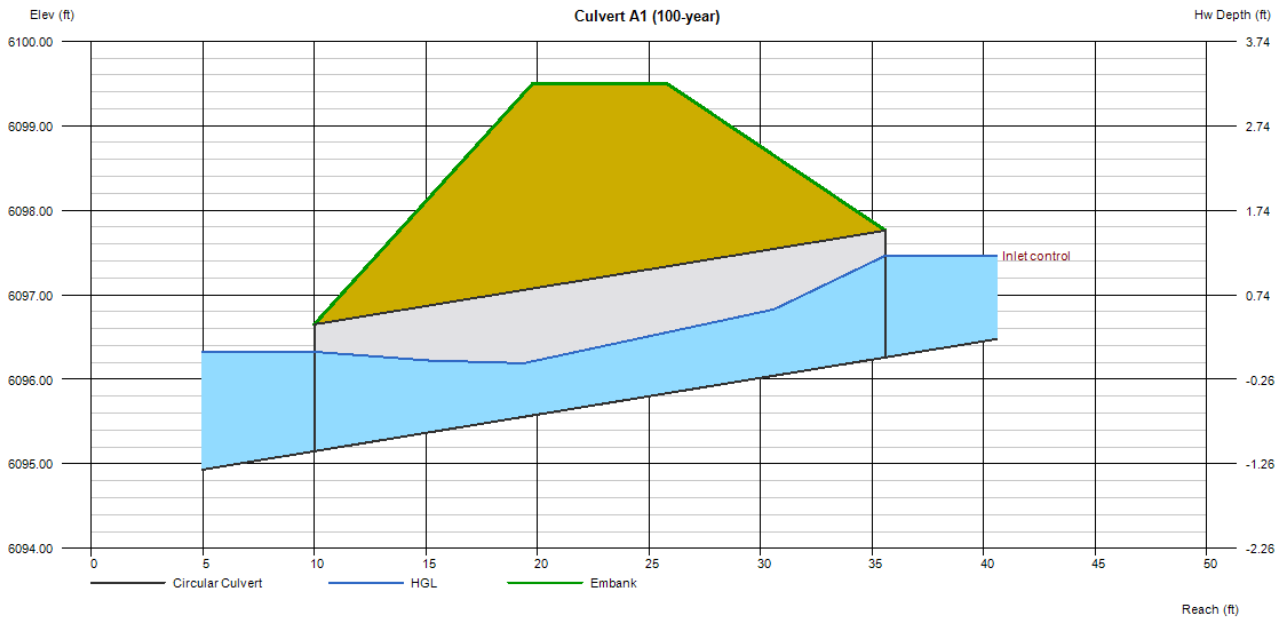
Invert Elev Dn (ft)	= 6095.15	<b>Calculations</b>	
Pipe Length (ft)	= 25.60	Qmin (cfs)	= 0.22
Slope (%)	= 4.34	Qmax (cfs)	= 4.91
Invert Elev Up (ft)	= 6096.26	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 18.0		
Shape	= Circular	<b>Highlighted</b>	
Span (in)	= 18.0	Qtotat (cfs)	= 0.22
No. Barrels	= 1	Qpipe (cfs)	= 0.22
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 0.22
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 1.95
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 6095.99
		HGL Up (ft)	= 6096.43
		Hw Elev (ft)	= 6096.46
		Hw/D (ft)	= 0.13
		Flow Regime	= Inlet Control
<b>Embankment</b>			
Top Elevation (ft)	= 6099.50		
Top Width (ft)	= 6.00		
Crest Width (ft)	= 9.80		



# Culvert Report

## Culvert A1 (100-year)

Invert Elev Dn (ft)	= 6095.15	<b>Calculations</b>	
Pipe Length (ft)	= 25.60	Qmin (cfs)	= 0.22
Slope (%)	= 4.34	Qmax (cfs)	= 4.91
Invert Elev Up (ft)	= 6096.26	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 18.0		
Shape	= Circular	<b>Highlighted</b>	
Span (in)	= 18.0	Qtotal (cfs)	= 4.91
No. Barrels	= 1	Qpipe (cfs)	= 4.91
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 3.30
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 4.74
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 6096.33
		HGL Up (ft)	= 6097.11
		Hw Elev (ft)	= 6097.46
		Hw/D (ft)	= 0.80
		Flow Regime	= Inlet Control
<b>Embankment</b>			
Top Elevation (ft)	= 6099.50		
Top Width (ft)	= 6.00		
Crest Width (ft)	= 9.80		



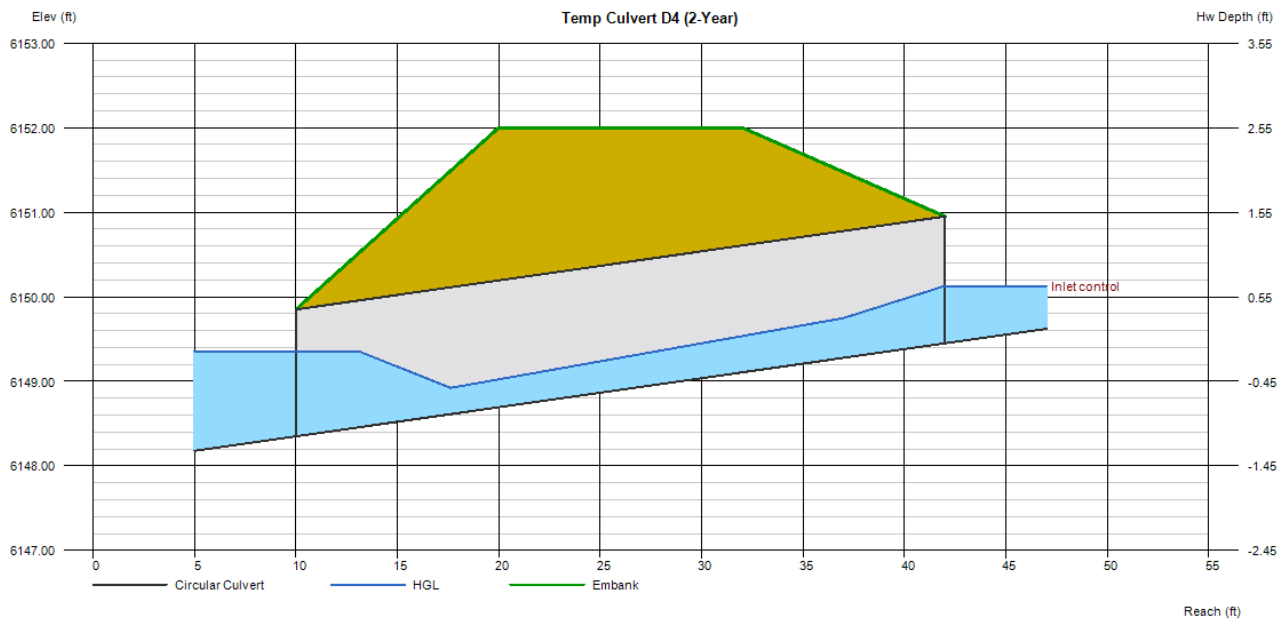
# Culvert Report

## Temp Culvert D4 (2-Year)

Invert Elev Dn (ft)	= 6148.35
Pipe Length (ft)	= 32.00
Slope (%)	= 3.44
Invert Elev Up (ft)	= 6149.45
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

<b>Embankment</b>	
Top Elevation (ft)	= 6152.00
Top Width (ft)	= 12.00
Crest Width (ft)	= 10.00

<b>Calculations</b>	
Qmin (cfs)	= 1.85
Qmax (cfs)	= 7.81
Tailwater Elev (ft)	= (dc+D)/2
<b>Highlighted</b>	
Qtotal (cfs)	= 1.85
Qpipe (cfs)	= 1.85
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 1.47
Veloc Up (ft/s)	= 3.48
HGL Dn (ft)	= 6149.36
HGL Up (ft)	= 6149.96
Hw Elev (ft)	= 6150.13
Hw/D (ft)	= 0.45
Flow Regime	= Inlet Control

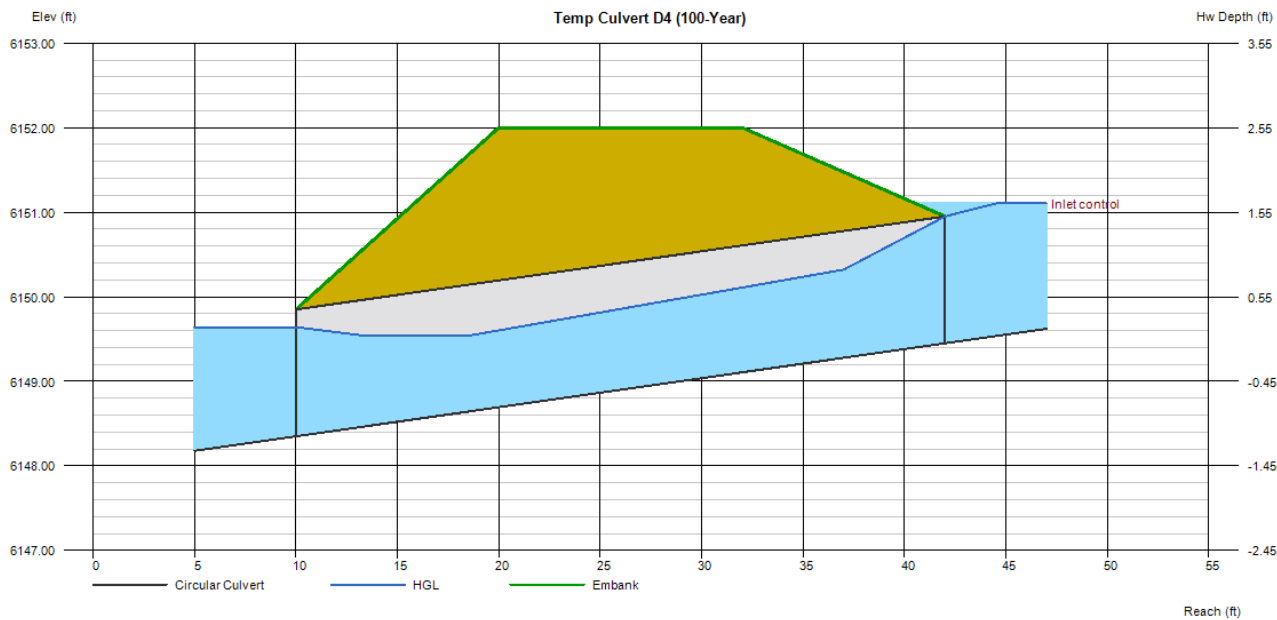




# Culvert Report

## Temp Culvert D4 (100-Year)

Invert Elev Dn (ft)	= 6148.35	Calculations	
Pipe Length (ft)	= 32.00	Qmin (cfs)	= 1.85
Slope (%)	= 3.44	Qmax (cfs)	= 7.81
Invert Elev Up (ft)	= 6149.45	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 18.0		
Shape	= Circular	Highlighted	
Span (in)	= 18.0	Qtotal (cfs)	= 7.81
No. Barrels	= 1	Qpipe (cfs)	= 7.81
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 4.83
Culvert Entrance	= Groove end projecting (C)	Veloc Up (ft/s)	= 5.72
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 6149.64
		HGL Up (ft)	= 6150.53
		Hw Elev (ft)	= 6151.10
		Hw/D (ft)	= 1.10
		Flow Regime	= Inlet Control
Embankment			
Top Elevation (ft)	= 6152.00		
Top Width (ft)	= 12.00		
Crest Width (ft)	= 10.00		



# Channel Report

## Emergency Overflow Section A-A

### Trapezoidal

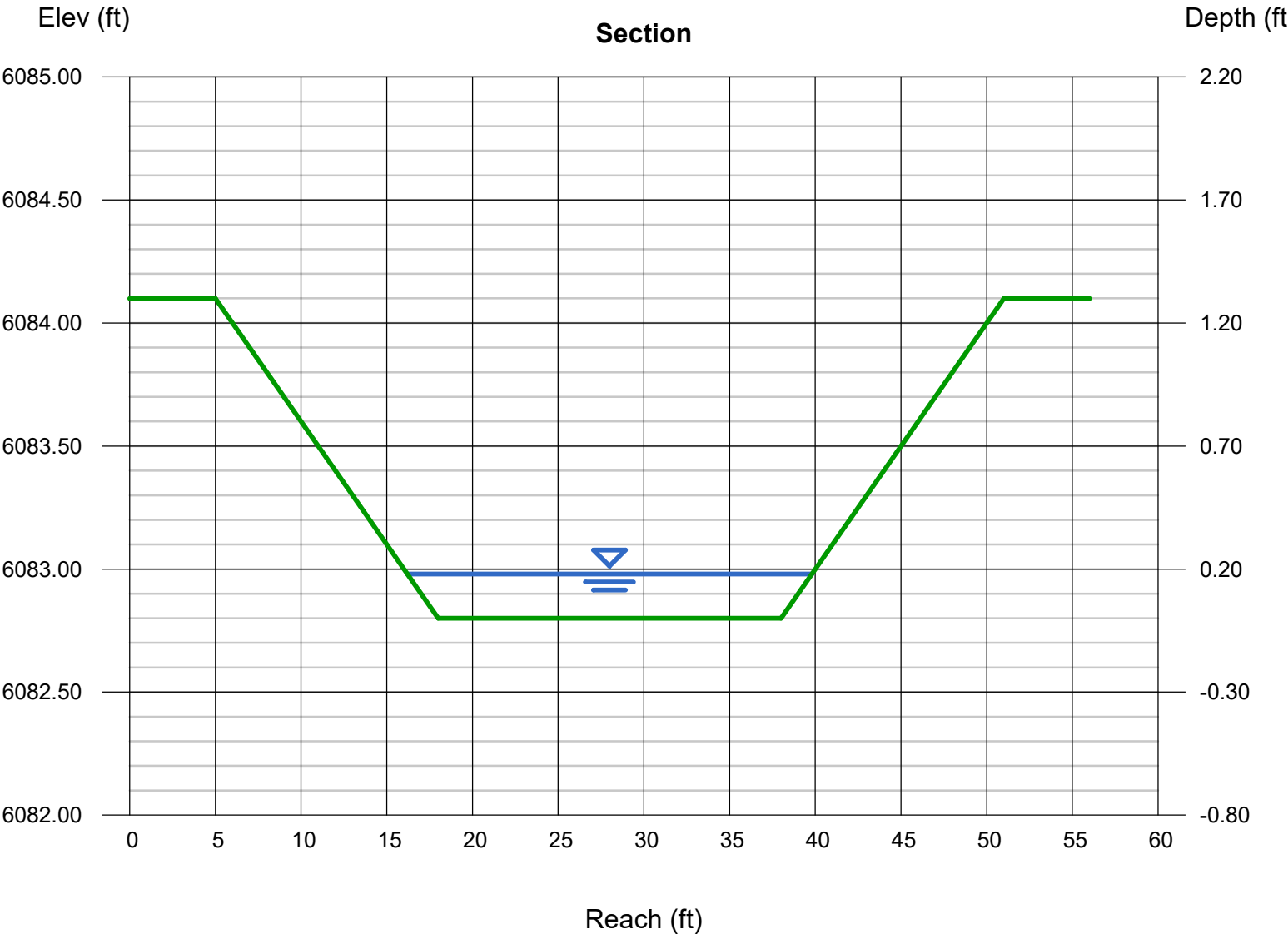
Bottom Width (ft) = 20.00  
Side Slopes (z:1) = 10.00, 10.00  
Total Depth (ft) = 1.30  
Invert Elev (ft) = 6082.80  
Slope (%) = 5.00  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 12.45

### Highlighted

Depth (ft) = 0.18  
Q (cfs) = 12.45  
Area (sqft) = 3.92  
Velocity (ft/s) = 3.17  
Wetted Perim (ft) = 23.62  
Crit Depth, Yc (ft) = 0.23  
Top Width (ft) = 23.60  
EGL (ft) = 0.34



# Channel Report

## Emergency Overflow Section B-B

### Trapezoidal

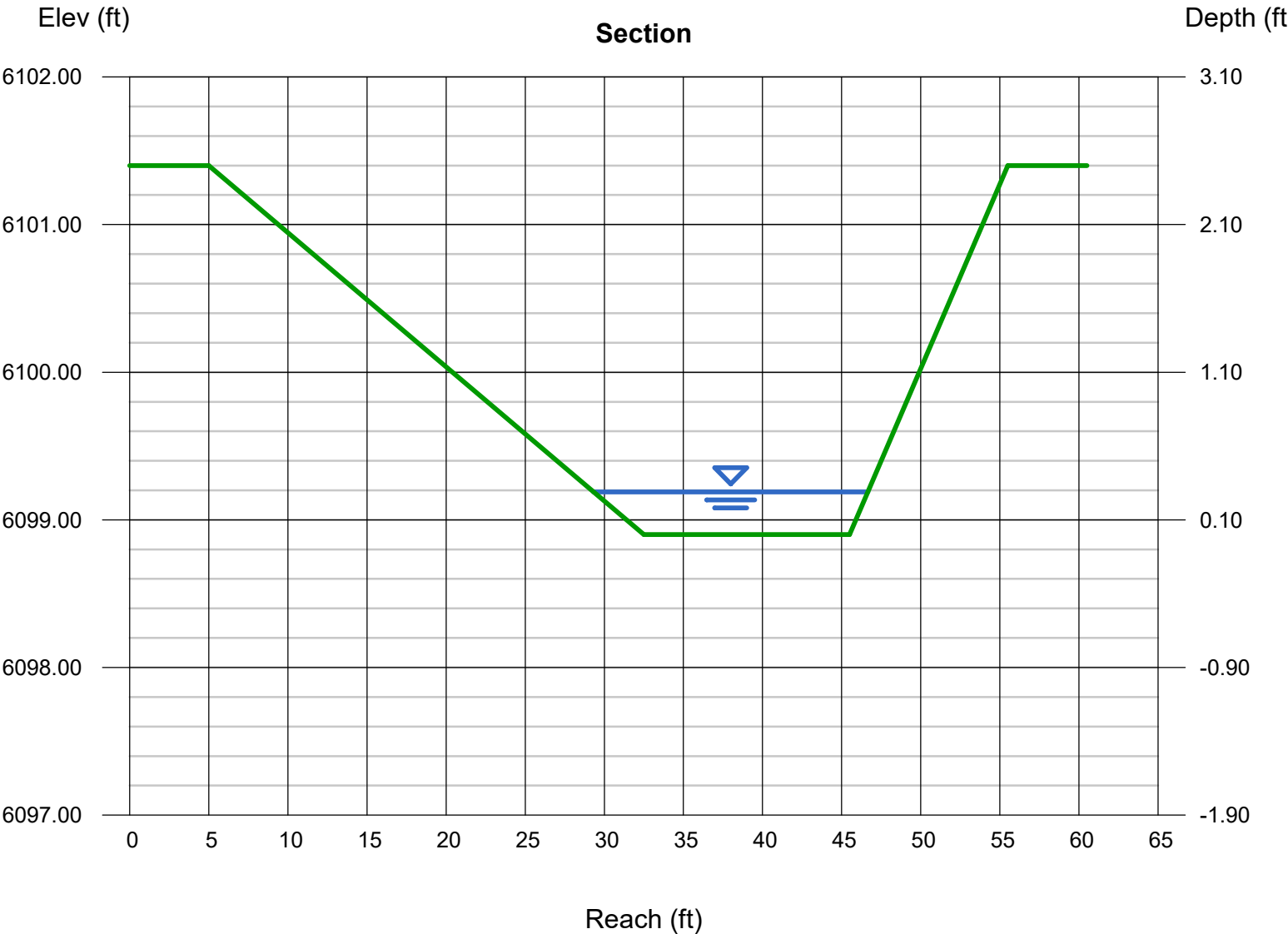
Bottom Width (ft) = 13.00  
Side Slopes (z:1) = 11.00, 4.00  
Total Depth (ft) = 2.50  
Invert Elev (ft) = 6098.90  
Slope (%) = 9.00  
N-Value = 0.030

### Calculations

Compute by: Known Q  
Known Q (cfs) = 24.90

### Highlighted

Depth (ft) = 0.29  
Q (cfs) = 24.90  
Area (sqft) = 4.40  
Velocity (ft/s) = 5.66  
Wetted Perim (ft) = 17.40  
Crit Depth, Yc (ft) = 0.45  
Top Width (ft) = 17.35  
EGL (ft) = 0.79



# Channel Report

## Emergency Overflow Section C-C

### Trapezoidal

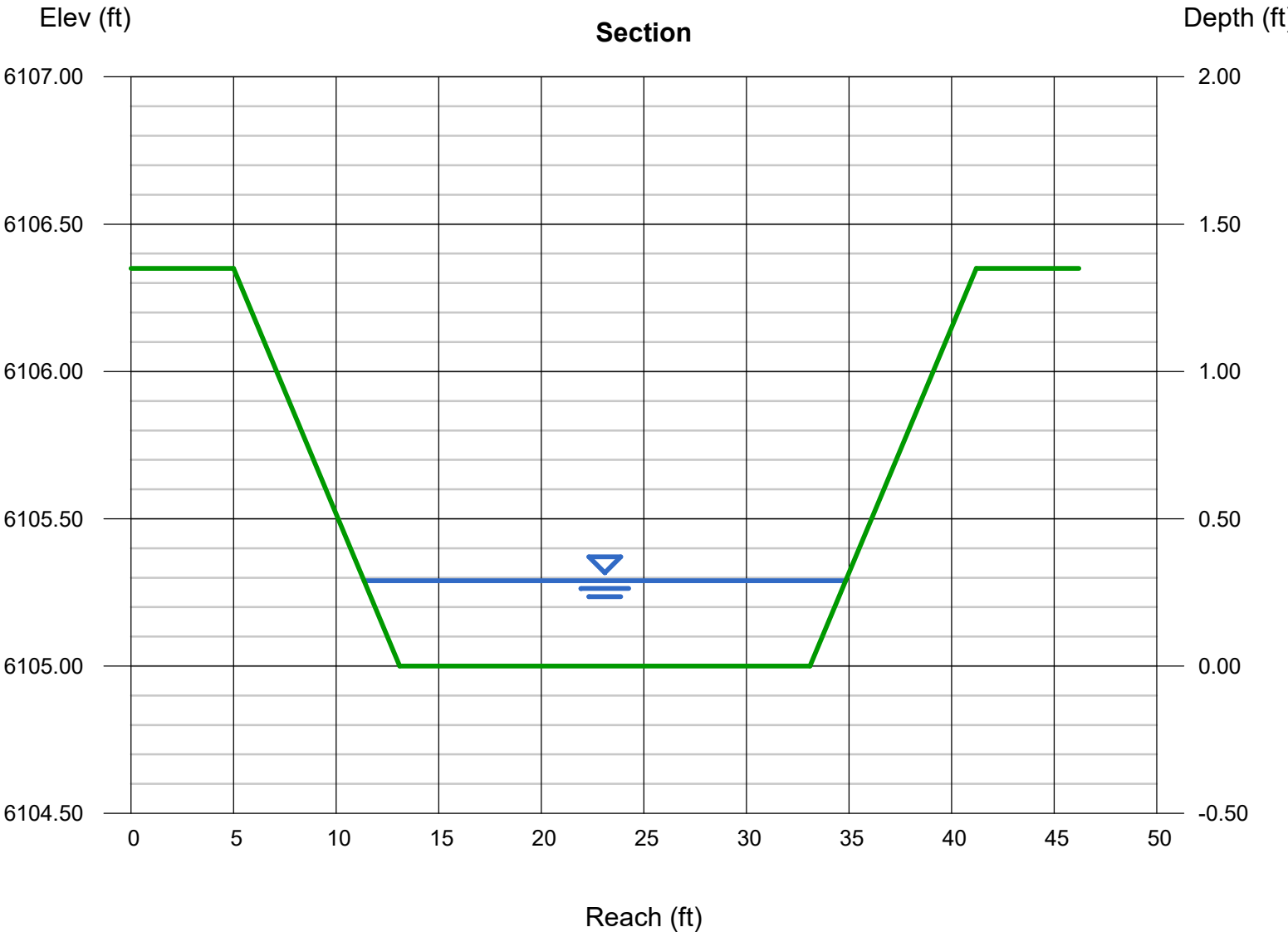
Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 6.00, 6.00
Total Depth (ft)	= 1.35
Invert Elev (ft)	= 6105.00
Slope (%)	= 10.00
N-Value	= 0.030

### Highlighted

Depth (ft)	= 0.29
Q (cfs)	= 38.77
Area (sqft)	= 6.30
Velocity (ft/s)	= 6.15
Wetted Perim (ft)	= 23.53
Crit Depth, Yc (ft)	= 0.47
Top Width (ft)	= 23.48
EGL (ft)	= 0.88

### Calculations

Compute by:	Known Q
Known Q (cfs)	= 38.77



## Worksheet for DP 4 & 5 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	15.35 cfs
Crest Elevation	6,142.60 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	25.0 ft
Results	
Headwater Elevation	6,142.95 ft
Headwater Height Above Crest	0.35 ft
Flow Area	8.7 ft <sup>2</sup>
Velocity	1.77 ft/s
Wetted Perimeter	25.7 ft
Top Width	25.00 ft

## Worksheet for DP 6 & 7 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	16.89 cfs
Crest Elevation	6,149.10 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,149.40 ft
Headwater Height Above Crest	0.30 ft
Flow Area	10.3 ft <sup>2</sup>
Velocity	1.65 ft/s
Wetted Perimeter	34.6 ft
Top Width	34.00 ft

## Worksheet for DP 10 & 11 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	15.13 cfs
Crest Elevation	6,137.10 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,137.38 ft
Headwater Height Above Crest	0.28 ft
Flow Area	9.5 ft <sup>2</sup>
Velocity	1.59 ft/s
Wetted Perimeter	34.6 ft
Top Width	34.00 ft

## Worksheet for DP 12 & 13 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	11.33 cfs
Crest Elevation	6,161.90 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,162.13 ft
Headwater Height Above Crest	0.23 ft
Flow Area	7.9 ft <sup>2</sup>
Velocity	1.44 ft/s
Wetted Perimeter	34.5 ft
Top Width	34.00 ft



## Worksheet for DP 16 & 17 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	11.24 cfs
Crest Elevation	6,134.90 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	60.0 ft
Results	
Headwater Elevation	6,135.06 ft
Headwater Height Above Crest	0.16 ft
Flow Area	9.4 ft <sup>2</sup>
Velocity	1.19 ft/s
Wetted Perimeter	60.3 ft
Top Width	60.00 ft

## Worksheet for DP 28 & 29 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	18.50 cfs
Crest Elevation	6,089.00 ft
Weir Coefficient	3.00 ft <sup>^(1/2)</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,089.32 ft
Headwater Height Above Crest	0.32 ft
Flow Area	10.9 ft <sup>2</sup>
Velocity	1.70 ft/s
Wetted Perimeter	34.6 ft
Top Width	34.00 ft

## Worksheet for DP 30 & 31 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	22.75 cfs
Crest Elevation	6,089.00 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,089.37 ft
Headwater Height Above Crest	0.37 ft
Flow Area	12.5 ft <sup>2</sup>
Velocity	1.82 ft/s
Wetted Perimeter	34.7 ft
Top Width	34.00 ft

## Worksheet for DP 32 & 33 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	2.60 cfs
Crest Elevation	6,089.00 ft
Weir Coefficient	3.00 ft <sup>^(1/2)</sup> /s
Crest Length	38.0 ft
Results	
Headwater Elevation	6,089.08 ft
Headwater Height Above Crest	0.08 ft
Flow Area	3.1 ft <sup>2</sup>
Velocity	0.85 ft/s
Wetted Perimeter	38.2 ft
Top Width	38.00 ft

## Worksheet for DP 34 & 35 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	1.20 cfs
Crest Elevation	6,090.84 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	50.0 ft
Results	
Headwater Elevation	6,090.88 ft
Headwater Height Above Crest	0.04 ft
Flow Area	2.0 ft <sup>2</sup>
Velocity	0.60 ft/s
Wetted Perimeter	50.1 ft
Top Width	50.00 ft

## Worksheet for DP 36 & 37 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	12.86 cfs
Crest Elevation	6,085.80 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	30.0 ft
Results	
Headwater Elevation	6,086.07 ft
Headwater Height Above Crest	0.27 ft
Flow Area	8.2 ft <sup>2</sup>
Velocity	1.57 ft/s
Wetted Perimeter	30.5 ft
Top Width	30.00 ft

## Worksheet for DP 38 & 39 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	9.10 cfs
Crest Elevation	6,087.50 ft
Weir Coefficient	3.00 ft <sup>^(1/2)</sup> /s
Crest Length	50.0 ft
Results	
Headwater Elevation	6,087.65 ft
Headwater Height Above Crest	0.15 ft
Flow Area	7.7 ft <sup>2</sup>
Velocity	1.18 ft/s
Wetted Perimeter	50.3 ft
Top Width	50.00 ft

## Worksheet for DP 43 & 44 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	6.93 cfs
Crest Elevation	6,113.65 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,113.82 ft
Headwater Height Above Crest	0.17 ft
Flow Area	5.7 ft <sup>2</sup>
Velocity	1.22 ft/s
Wetted Perimeter	34.3 ft
Top Width	34.00 ft



## Worksheet for DP 47 & 48 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	19.22 cfs
Crest Elevation	6,096.30 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,096.63 ft
Headwater Height Above Crest	0.33 ft
Flow Area	11.2 ft <sup>2</sup>
Velocity	1.72 ft/s
Wetted Perimeter	34.7 ft
Top Width	34.00 ft

## Worksheet for DP 51 & 52 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	10.00 cfs
Crest Elevation	6,118.70 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,118.91 ft
Headwater Height Above Crest	0.21 ft
Flow Area	7.2 ft <sup>2</sup>
Velocity	1.38 ft/s
Wetted Perimeter	34.4 ft
Top Width	34.00 ft

## Worksheet for DP 53 & 54 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	9.40 cfs
Crest Elevation	6,118.70 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,118.90 ft
Headwater Height Above Crest	0.20 ft
Flow Area	6.9 ft <sup>2</sup>
Velocity	1.36 ft/s
Wetted Perimeter	34.4 ft
Top Width	34.00 ft

## Worksheet for DP 55 & 56 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	18.33 cfs
Crest Elevation	6,108.60 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,108.92 ft
Headwater Height Above Crest	0.32 ft
Flow Area	10.8 ft <sup>2</sup>
Velocity	1.69 ft/s
Wetted Perimeter	34.6 ft
Top Width	34.00 ft

## Worksheet for DP 57 & 58 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	18.36 cfs
Crest Elevation	6,100.60 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	30.0 ft
Results	
Headwater Elevation	6,100.95 ft
Headwater Height Above Crest	0.35 ft
Flow Area	10.4 ft <sup>2</sup>
Velocity	1.77 ft/s
Wetted Perimeter	30.7 ft
Top Width	30.00 ft

## Worksheet for DP 72 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	6.53 cfs
Crest Elevation	6,087.30 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	40.0 ft
Results	
Headwater Elevation	6,087.44 ft
Headwater Height Above Crest	0.14 ft
Flow Area	5.7 ft <sup>2</sup>
Velocity	1.14 ft/s
Wetted Perimeter	40.3 ft
Top Width	40.00 ft

## Worksheet for DP 73 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	9.20 cfs
Crest Elevation	6,087.30 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	76.0 ft
Results	
Headwater Elevation	6,087.42 ft
Headwater Height Above Crest	0.12 ft
Flow Area	8.9 ft <sup>2</sup>
Velocity	1.03 ft/s
Wetted Perimeter	76.2 ft
Top Width	76.00 ft

## Worksheet for DP 81 & 82 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	11.42 cfs
Crest Elevation	6,107.80 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,108.03 ft
Headwater Height Above Crest	0.23 ft
Flow Area	7.9 ft <sup>2</sup>
Velocity	1.45 ft/s
Wetted Perimeter	34.5 ft
Top Width	34.00 ft



## Worksheet for DP 83 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	11.34 cfs
Crest Elevation	6,104.90 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	30.0 ft
Results	
Headwater Elevation	6,105.15 ft
Headwater Height Above Crest	0.25 ft
Flow Area	7.5 ft <sup>2</sup>
Velocity	1.50 ft/s
Wetted Perimeter	30.5 ft
Top Width	30.00 ft

## Worksheet for DP 85 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	20.76 cfs
Crest Elevation	6,105.30 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	30.0 ft
Results	
Headwater Elevation	6,105.68 ft
Headwater Height Above Crest	0.38 ft
Flow Area	11.3 ft <sup>2</sup>
Velocity	1.84 ft/s
Wetted Perimeter	30.8 ft
Top Width	30.00 ft

## Worksheet for DP 91 & 92 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	25.70 cfs
Crest Elevation	6,148.50 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	34.0 ft
Results	
Headwater Elevation	6,148.90 ft
Headwater Height Above Crest	0.40 ft
Flow Area	13.6 ft <sup>2</sup>
Velocity	1.89 ft/s
Wetted Perimeter	34.8 ft
Top Width	34.00 ft

## Worksheet for DP 93 & 94 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	16.14 cfs
Crest Elevation	6,148.50 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	38.0 ft
Results	
Headwater Elevation	6,148.77 ft
Headwater Height Above Crest	0.27 ft
Flow Area	10.3 ft <sup>2</sup>
Velocity	1.56 ft/s
Wetted Perimeter	38.5 ft
Top Width	38.00 ft

## County Line Ultimate Condition Overflow

### Worksheet for DP C4 & C5 SUMP

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	12.53 cfs
Crest Elevation	6,149.15 ft
Weir Coefficient	3.00 ft <sup>1/2</sup> /s
Crest Length	20.0 ft
Results	
Headwater Elevation	6,149.50 ft
Headwater Height Above Crest	0.35 ft
Flow Area	7.0 ft <sup>2</sup>
Velocity	1.78 ft/s
Wetted Perimeter	20.7 ft
Top Width	20.00 ft

# Crossing Properties

Name: Crossing 1 (SWMM Node 1)

Parameter	Value	Units
<b>DISCHARGE DATA</b>		
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	20.200	cfs
Design Flow	117.660	cfs
Maximum Flow	175.000	cfs
<b>TAILWATER DATA</b>		
Channel Type	Triangular Channel	
Side Slope (H:V)	4.000	:1
Channel Slope	0.0350	ft/ft
Manning's n (channel)	0.030	
Channel Invert Elevation	6109.860	ft
Rating Curve	View...	
<b>ROADWAY DATA</b>		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	53.000	ft
Crest Length	-50.000	ft
Crest Elevation	6142.410	ft
Roadway Surface	Paved	
Top Width	74.000	ft

# Culvert Properties

Culvert 1

Add Culvert

Duplicate Culvert

Delete Culvert

Parameter	Value	Units
<b>CULVERT DATA</b>		
Name	Culvert 1	
Shape	Circular	
Material	Concrete	
Diameter	4.500	ft
Embedment Depth	0.000	in
Manning's n	0.012	
Culvert Type	Straight	
Inlet Configuration	Grooved End Projecting (Ke=0.2)	
Inlet Depression?	No	
<b>SITE DATA</b>		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.000	ft
Inlet Elevation	6129.470	ft
Outlet Station	259.500	ft
Outlet Elevation	6109.860	ft
Number of Barrels	1	
Computed Culvert Slope	0.075568	ft/ft

# Crossing Properties

Name: Crossing 2 (SWMM Node 4)

Parameter	Value	Units
<b>DISCHARGE DATA</b>		
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	84.090	cfs
Design Flow	209.300	cfs
Maximum Flow	483.700	cfs
<b>TAILWATER DATA</b>		
Channel Type	Trapezoidal Channel	
Bottom Width	40.000	ft
Side Slope (H:V)	4.000	:1
Channel Slope	0.0050	ft/ft
Manning's n (channel)	0.030	
Channel Invert Elevation	6045.800	ft
Rating Curve	View...	
<b>ROADWAY DATA</b>		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	61.000	ft
Crest Length	-32.000	ft
Crest Elevation	6087.280	ft
Roadway Surface	Paved	
Top Width	100.000	ft

# Culvert Properties

Culvert 2

Add Culvert

Duplicate Culvert

Delete Culvert

Parameter	Value	Units
<b>CULVERT DATA</b>		
Name	Culvert 2	
Shape	Circular	
Material	Concrete	
Diameter	5.500	ft
Embedment Depth	0.000	in
Manning's n	0.012	
Culvert Type	Straight	
Inlet Configuration	Square Edge with Headwall (Ke=0.5)	
Inlet Depression?	No	
<b>SITE DATA</b>		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.000	ft
Inlet Elevation	6058.010	ft
Outlet Station	287.000	ft
Outlet Elevation	6045.800	ft
Number of Barrels	1	
Computed Culvert Slope	0.042544	ft/ft

## Culvert Crossing: Crossing 1 (SWMM Node 1)

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Crossing Summary Table

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6131.11	20.20	20.20	0.00	1
6131.68	35.68	35.68	0.00	1
6132.24	51.16	51.16	0.00	1
6132.72	66.64	66.64	0.00	1
6133.15	82.12	82.12	0.00	1
6133.58	97.60	97.60	0.00	1
6134.15	117.66	117.66	0.00	1
6134.49	128.56	128.56	0.00	1
6135.01	144.04	144.04	0.00	1
6135.58	159.52	159.52	0.00	1
6136.23	175.00	175.00	0.00	1
6142.41	281.76	281.76	0.00	Overtopping

# Culvert Crossing: Crossing 1 (SWMM Node 1)

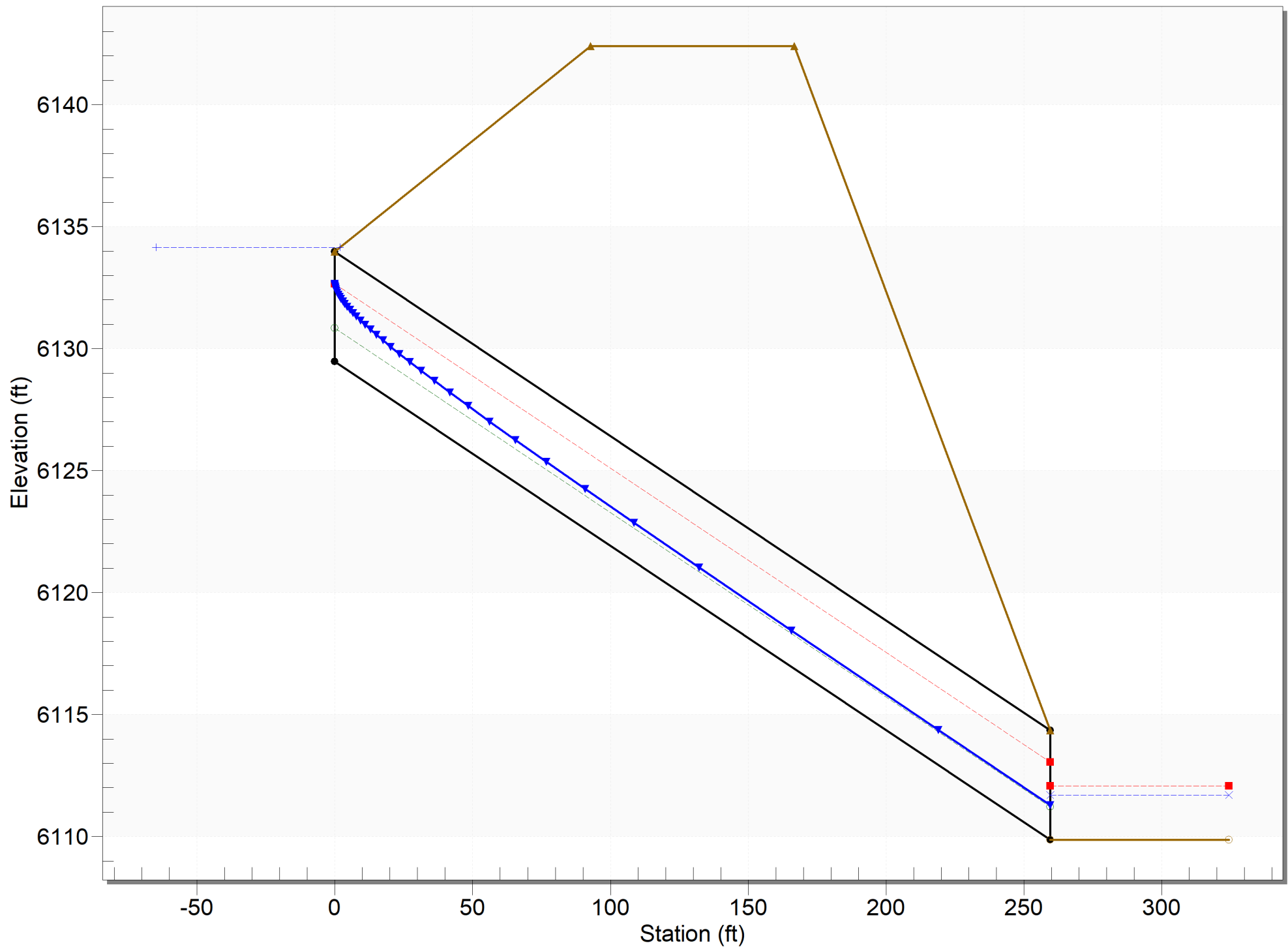
Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
20.20	20.20	6131.11	1.64	0.0*	1-S2n	0.57	1.28	0.57	0.95	17.22	5.55
35.68	35.68	6131.68	2.21	0.0*	1-S2n	0.75	1.72	0.75	1.18	20.43	6.39
51.16	51.16	6132.24	2.77	0.0*	1-S2n	0.90	2.07	0.90	1.35	22.69	7.00
66.64	66.64	6132.72	3.25	0.0*	1-S2n	1.02	2.38	1.05	1.49	23.78	7.47
82.12	82.12	6133.15	3.68	0.0*	1-S2n	1.14	2.65	1.17	1.61	25.09	7.87
97.60	97.60	6133.58	4.11	0.0*	1-S2n	1.24	2.90	1.29	1.72	26.04	8.22
117.66	117.66	6134.15	4.68	0.0*	5-S2n	1.37	3.19	1.42	1.85	27.20	8.61
128.56	128.56	6134.49	5.02	0.0*	5-S2n	1.43	3.34	1.49	1.91	27.83	8.81
144.04	144.04	6135.01	5.54	0.0*	5-S2n	1.52	3.53	1.60	1.99	28.45	9.06
159.52	159.52	6135.58	6.11	0.0*	5-S2n	1.60	3.69	1.69	2.07	29.13	9.30
175.00	175.00	6136.23	6.76	0.0*	5-S2n	1.68	3.84	1.79	2.14	29.66	9.51



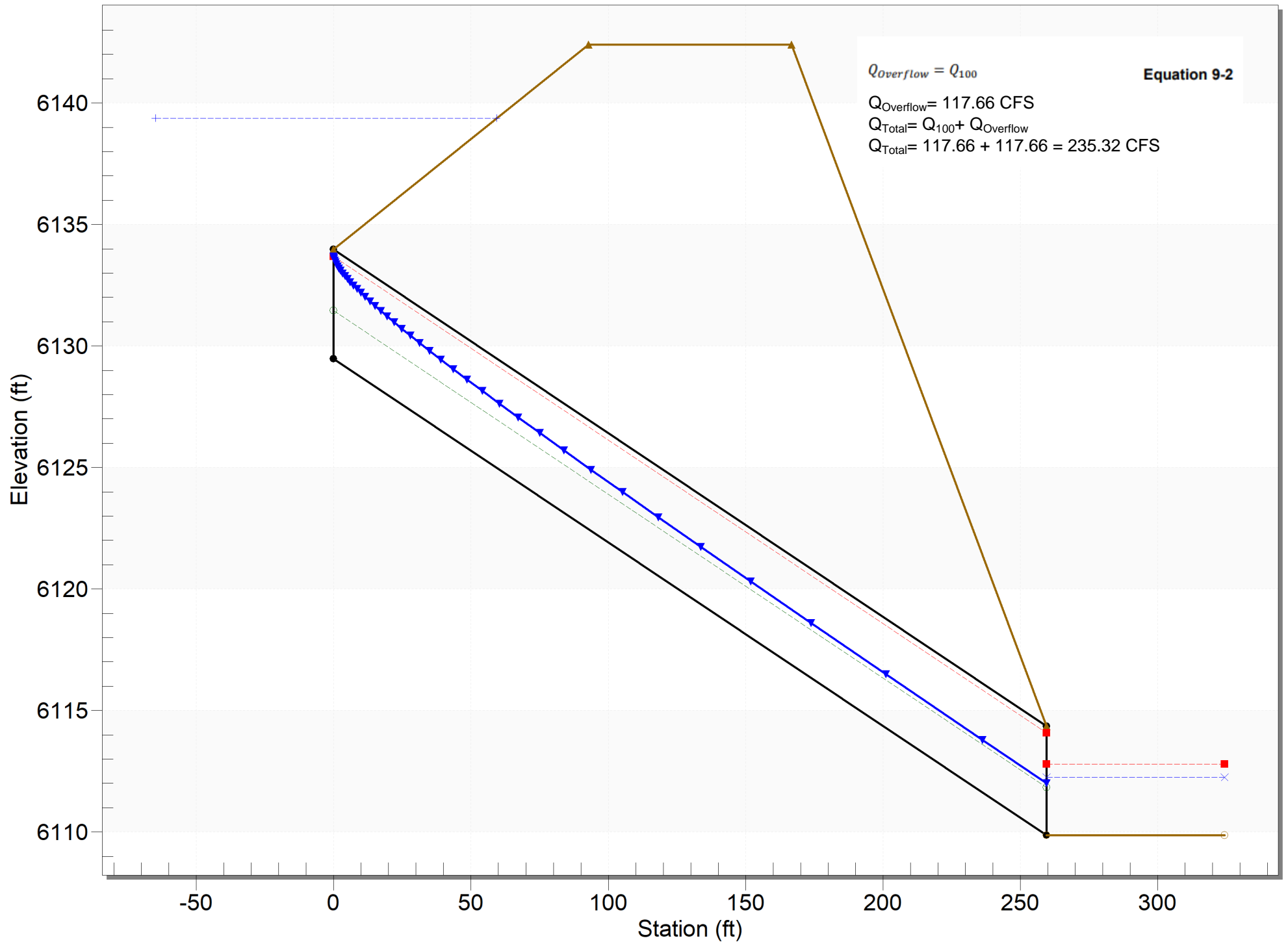
# Crossing - Crossing 1 (SWMM Node 1), Design Discharge - 117.7 cfs

Culvert - Culvert 1, Culvert Discharge - 117.7 cfs



# Crossing - Crossing 1 (Emergency Overflow)(SWMM Node 1), Design Discharge - 235.3 cfs

Culvert - Culvert 1, Culvert Discharge - 235.3 cfs



## Culvert Crossing: Crossing 2 (SWMM Node 4)

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Crossing Summary Table

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6061.57	84.09	84.09	0.00	1
6062.55	124.05	124.05	0.00	1
6063.50	164.01	164.01	0.00	1
6064.69	209.30	209.30	0.00	1
6065.76	243.93	243.93	0.00	1
6067.21	283.89	283.89	0.00	1
6068.91	323.86	323.86	0.00	1
6070.86	363.82	363.82	0.00	1
6073.05	403.78	403.78	0.00	1
6075.49	443.74	443.74	0.00	1
6078.27	483.70	483.70	0.00	1
6087.28	595.32	595.32	0.00	Overtopping

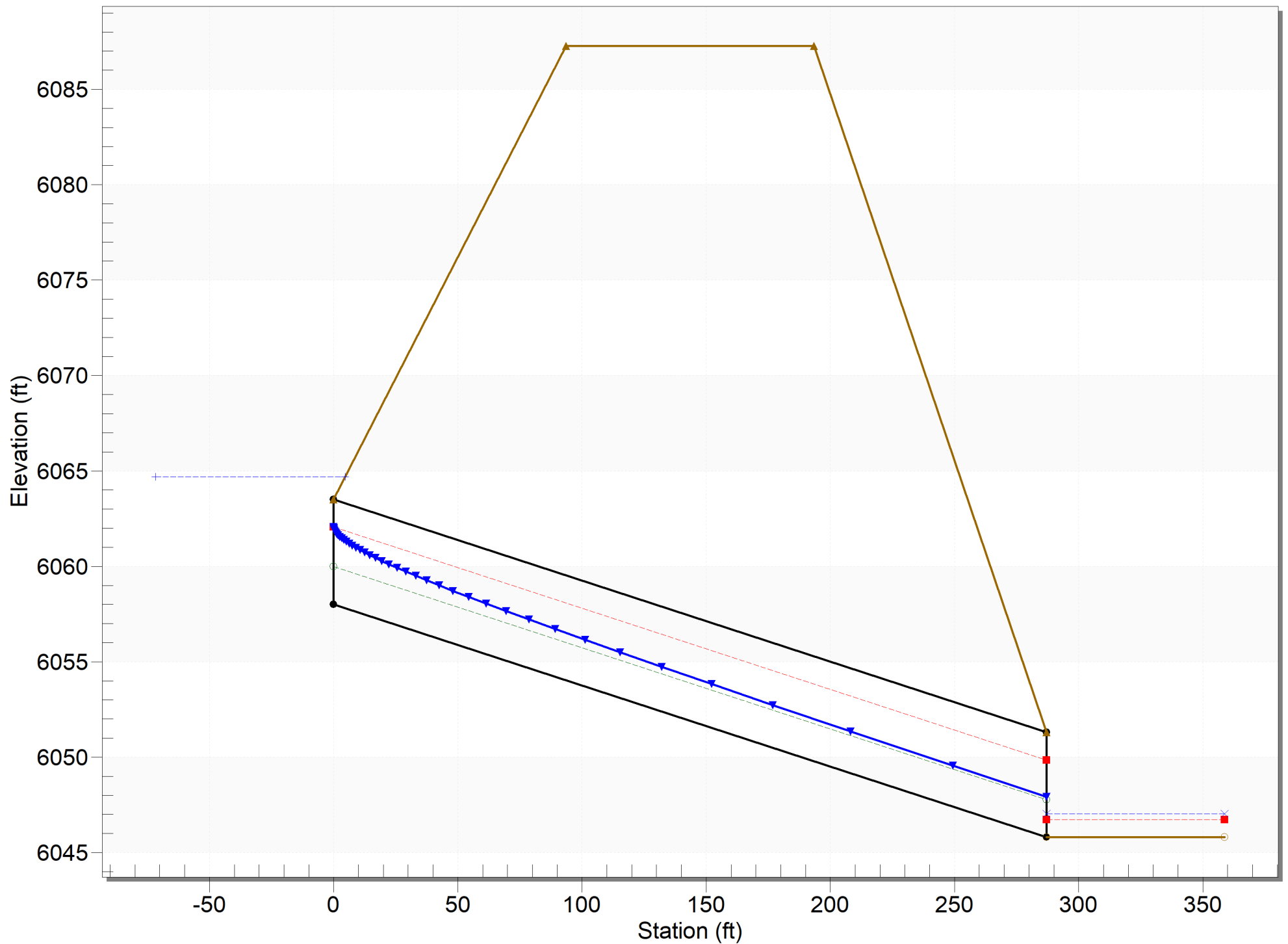
# Culvert Crossing: Crossing 2 (SWMM Node 4)

Culvert Summary Table - Culvert 2

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
84.09	84.09	6061.57	3.56	0.0*	1-S2n	1.24	2.52	1.27	0.73	20.19	2.70
124.05	124.05	6062.55	4.54	0.0*	1-S2n	1.51	3.09	1.57	0.91	22.17	3.11
164.01	164.01	6063.50	5.49	0.0*	1-S2n	1.74	3.58	1.83	1.08	23.63	3.44
209.30	209.30	6064.69	6.68	0.0*	5-S2n	1.98	4.05	2.12	1.24	24.82	3.75
243.93	243.93	6065.76	7.75	0.0*	5-S2n	2.15	4.36	2.32	1.36	25.60	3.96
283.89	283.89	6067.21	9.20	0.0*	5-S2n	2.34	4.66	2.55	1.48	26.38	4.18
323.86	323.86	6068.91	10.90	0.0*	5-S2n	2.52	4.90	2.76	1.60	27.08	4.37
363.82	363.82	6070.86	12.85	1.40	5-S2n	2.70	5.08	2.97	1.71	27.75	4.55
403.78	403.78	6073.05	15.04	3.39	5-S2n	2.87	5.20	3.18	1.81	28.38	4.71
443.74	443.74	6075.49	17.48	5.43	5-S2n	3.04	5.03	3.37	1.91	29.05	4.86
483.70	483.70	6078.27	20.26	7.99	5-S2n	3.21	5.50	3.60	2.01	29.36	5.00

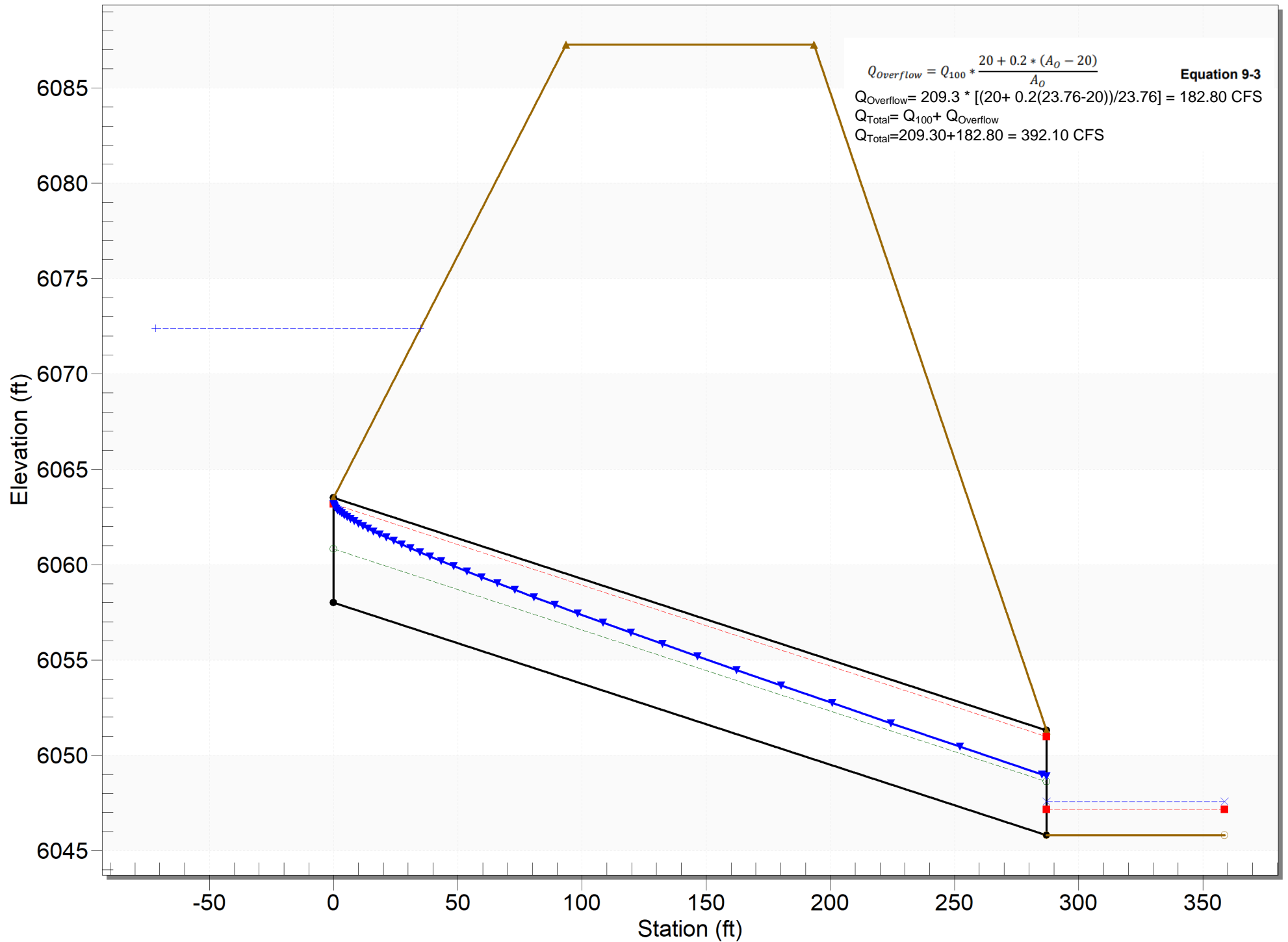
# Crossing - Crossing 2 (SWMM Node 4), Design Discharge - 209.3 cfs

Culvert - Culvert 2, Culvert Discharge - 209.3 cfs



# Crossing - Crossing 2 (Emergency Overflow)(SWMM Node 4), Design Discharge - 392.1 cfs

Culvert - Culvert 2, Culvert Discharge - 392.1 cfs



**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">A1</a>	<a href="#">A2</a>	<a href="#">A3</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	STREET	STREET
Hydraulic Condition	Swale	In Sump	In Sump
Inlet Type	CDOT Type C	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

User-Defined Design Flows			
Minor $Q_{Known}$ (cfs)	0.2	1.5	0.7
Major $Q_{Known}$ (cfs)	4.9	10.9	2.7
Bypass (Carry-Over) Flow from Upstream <a href="#">Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.</a>			
Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Watershed Characteristics			
Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			
Watershed Profile			
Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			
Minor Storm Rainfall Input			
Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			
Major Storm Rainfall Input			
Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	0.2	1.5	0.7
Major Total Design Peak Flow, $Q$ (cfs)	4.9	10.9	2.7
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	N/A	N/A

# INLET MANAGEMENT

Worksheet Protected

INLET NAME	A4	A5	B1
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

### User-Defined Design Flows

Minor $Q_{known}$ (cfs)	2.6	0.8	2.1
Major $Q_{known}$ (cfs)	15.5	3.1	8.2

### Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

### Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

### Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

### Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

### Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	2.6	0.8	2.1
Major Total Design Peak Flow, $Q$ (cfs)	15.5	3.1	8.2
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	0.0	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	6.7	0.0	N/A



**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<b>B2</b>	<b>B4</b>	<b>B5</b>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	2.3	2.1	1.4
Major $Q_{known}$ (cfs)	8.5	9.5	6.5

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	2.3	2.1	1.4
Major Total Design Peak Flow, $Q$ (cfs)	8.5	9.5	6.5
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B6</a>	<a href="#">B7</a>	<a href="#">B8</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	AREA
Hydraulic Condition	In Sump	In Sump	Swale
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type C

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.4	2.2	2.0
Major $Q_{known}$ (cfs)	6.5	10.4	8.5

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.4	2.2	2.0
Major Total Design Peak Flow, $Q$ (cfs)	6.5	10.4	8.5
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	0.0

# INLET MANAGEMENT

Worksheet Protected

INLET NAME	B9	B10	B11
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

### User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.4	2.3	0.5
Major $Q_{known}$ (cfs)	6.7	12.9	2.2

### Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

### Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

### Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

### Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

### Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.4	2.3	0.5
Major Total Design Peak Flow, $Q$ (cfs)	6.7	12.9	2.2
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	3.0	N/A	N/A

# INLET MANAGEMENT

Worksheet Protected

INLET NAME	B12	B13	B14
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

### User-Defined Design Flows

Minor $Q_{known}$ (cfs)	0.7	1.3	2.6
Major $Q_{known}$ (cfs)	3.1	9.9	9.2

### Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

### Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

### Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

### Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

### Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	0.7	1.3	2.6
Major Total Design Peak Flow, $Q$ (cfs)	3.1	9.9	9.2
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	2.4

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<b>B15</b>	<b>B16</b>	<b>B17</b>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	STREET	STREET
Hydraulic Condition	Swale	In Sump	In Sump
Inlet Type	CDOT Type C	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	0.1	0.8	0.7
Major $Q_{known}$ (cfs)	5.9	8.8	2.4

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	0.1	0.8	0.7
Major Total Design Peak Flow, $Q$ (cfs)	5.9	8.8	2.4
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	N/A	N/A

## INLET MANAGEMENT

Worksheet Protected

INLET NAME	<b>B18</b>	<b>B19</b>	<b>B20</b>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.6	1.3	0.8
Major $Q_{known}$ (cfs)	8.2	6.0	5.3

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.6	1.3	0.8
Major Total Design Peak Flow, $Q$ (cfs)	8.2	6.0	5.3
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	4.2	2.5	0.0

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B21</a>	<a href="#">B22</a>	<a href="#">B24</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	2.2	1.4	2.6
Major $Q_{known}$ (cfs)	11.1	6.3	13.2

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	2.2	1.4	2.6
Major Total Design Peak Flow, $Q$ (cfs)	11.1	6.3	13.2
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	2.9	2.7	4.1

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B25</a>	<a href="#">B26</a>	<a href="#">B27</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	2.1	2.6	1.6
Major $Q_{known}$ (cfs)	10.3	15.4	8.1

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	2.1	2.6	1.6
Major Total Design Peak Flow, $Q$ (cfs)	10.3	15.4	8.1
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	2.3	5.8	1.2



**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B28</a>	<a href="#">B29</a>	<a href="#">B30</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.4	1.2	1.9
Major $Q_{known}$ (cfs)	13.2	5.3	14.7

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.4	1.2	1.9
Major Total Design Peak Flow, $Q$ (cfs)	13.2	5.3	14.7
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B31</a>	<a href="#">B32</a>	<a href="#">B33</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.7	0.3	0.3
Major $Q_{known}$ (cfs)	8.1	1.3	1.3

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.7	0.3	0.3
Major Total Design Peak Flow, $Q$ (cfs)	8.1	1.3	1.3
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B34</a>	<a href="#">B35</a>	<a href="#">B36</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.0	1.2	1.2
Major $Q_{known}$ (cfs)	5.1	5.1	5.7

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.0	1.2	1.2
Major Total Design Peak Flow, $Q$ (cfs)	5.1	5.1	5.7
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B37</a>	<a href="#">B33A</a>	<a href="#">B33B</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.5	0.4	0.3
Major $Q_{known}$ (cfs)	7.2	1.8	0.4

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.5	0.4	0.3
Major Total Design Peak Flow, $Q$ (cfs)	7.2	1.8	0.4
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B38</a>	<a href="#">B39</a>	<a href="#">B3A</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	AREA
Hydraulic Condition	In Sump	In Sump	Swale
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT TYPE D (Parallel)

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.0	0.8	0.1
Major $Q_{known}$ (cfs)	4.6	3.9	2.6

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.0	0.8	0.1
Major Total Design Peak Flow, $Q$ (cfs)	4.6	3.9	2.6
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	0.0

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<b>B41</b>	<b>B42</b>	<b>B43A</b>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

User-Defined Design Flows			
Minor $Q_{Known}$ (cfs)	0.9	2.4	1.0
Major $Q_{Known}$ (cfs)	3.9	11.3	5.2
Bypass (Carry-Over) Flow from Upstream <a href="#">Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.</a>			
Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Watershed Characteristics			
Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			
Watershed Profile			
Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			
Minor Storm Rainfall Input			
Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			
Major Storm Rainfall Input			
Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	0.9	2.4	1.0
Major Total Design Peak Flow, $Q$ (cfs)	3.9	11.3	5.2
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	1.0	0.7	0.1

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<b>B43</b>	<b>B44</b>	<b>B45</b>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	0.6	0.4	1.6
Major $Q_{known}$ (cfs)	5.4	1.4	8.0

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	0.6	0.4	1.6
Major Total Design Peak Flow, $Q$ (cfs)	5.4	1.4	8.0
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	4.0

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<b>B46</b>	<b>B47</b>	<b>B48</b>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.7	2.1	1.4
Major $Q_{known}$ (cfs)	7.3	10.4	8.7

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.7	2.1	1.4
Major Total Design Peak Flow, $Q$ (cfs)	7.3	10.4	8.7
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	3.5	N/A	N/A



**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B50</a>	<a href="#">B51</a>	<a href="#">B52</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	0.8	1.5	1.0
Major $Q_{known}$ (cfs)	3.0	5.4	4.6

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	0.8	1.5	1.0
Major Total Design Peak Flow, $Q$ (cfs)	3.0	5.4	4.6
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B53</a>	<a href="#">B54</a>	<a href="#">B55</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.4	0.6	2.8
Major $Q_{known}$ (cfs)	6.6	2.8	13.2

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.4	0.6	2.8
Major Total Design Peak Flow, $Q$ (cfs)	6.6	2.8	13.2
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<b>B56</b>	<b>B57</b>	<b>B59</b>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.2	0.8	2.8
Major $Q_{known}$ (cfs)	5.1	7.9	13.9

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.2	0.8	2.8
Major Total Design Peak Flow, $Q$ (cfs)	5.1	7.9	13.9
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	5.2

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">B58</a>	<a href="#">B58A</a>	<a href="#">B39A</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	AREA	STREET
Hydraulic Condition	In Sump	Swale	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type C	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	2.5	0.5	0.3
Major $Q_{known}$ (cfs)	10.2	3.5	1.4

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	2.5	0.5	0.3
Major Total Design Peak Flow, $Q$ (cfs)	10.2	3.5	1.4
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	0.0	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	0.0	0.0

# INLET MANAGEMENT

Worksheet Protected

INLET NAME	<a href="#">B39B</a>	<a href="#">B61</a>	<a href="#">C1</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

### User-Defined Design Flows

Minor $Q_{known}$ (cfs)	0.5	4.4	0.9
Major $Q_{known}$ (cfs)	1.7	15.2	5.3

### Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

### Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

### Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

### Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

### Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	0.5	4.4	0.9
Major Total Design Peak Flow, $Q$ (cfs)	1.7	15.2	5.3
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.0	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	0.1	N/A	N/A

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	C2	C3	C4
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.3	1.4	2.8
Major $Q_{known}$ (cfs)	6.1	11.7	14.6

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.3	1.4	2.8
Major Total Design Peak Flow, $Q$ (cfs)	6.1	11.7	14.6
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	5.4

## INLET MANAGEMENT

Worksheet Protected

INLET NAME	<b>C5</b>	<b>C6</b>	<b>D1</b>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	AREA	STREET
Hydraulic Condition	In Sump	Swale	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type C	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.9	0.1	2.7
Major $Q_{known}$ (cfs)	9.0	4.1	12.8

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.9	0.1	2.7
Major Total Design Peak Flow, $Q$ (cfs)	9.0	4.1	12.8
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	0.0	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	0.0	N/A

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">D2</a>	<a href="#">D3</a>	<a href="#">D4</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	2.8	1.7	1.9
Major $Q_{known}$ (cfs)	12.9	8.3	7.8

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

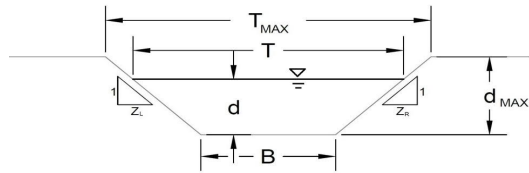
## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	2.8	1.7	1.9
Major Total Design Peak Flow, $Q$ (cfs)	12.9	8.3	7.8
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A



## AREA INLET IN A SWALE

A1



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

## Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

Soil Type:	Max. Velocity ( $V_{MAX}$ )	Max Froude No. ( $F_{MAX}$ )
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

A, B, C, D, or E =

B	
n =	see details below
$S_0$ =	0.0400 ft/ft
B =	0.00 ft
Z1 =	4.00 ft/ft
Z2 =	4.00 ft/ft

Choose One:

- ☐ Non-Cohesive  
☐ Cohesive  
☐ Paved

Maximum Allowable Top Width of Channel for Minor &amp; Major Storm

Maximum Allowable Water Depth in Channel for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX}$ =	35.00	35.00	ft
$d_{MAX}$ =	1.00	1.50	ft

## Allowable Channel Capacity Based On Channel Geometry

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow}$ =	2.3	16.6	cfs
$d_{allow}$ =	1.00	1.50	ft

## Water Depth in Channel Based On Design Peak Flow

Design Peak Flow

Water Depth

$Q_o$ =	0.2	4.9	cfs
d =	0.43	1.22	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

## AREA INLET IN A SWALE

A1

## Inlet Design Information (Input)

Type of Inlet

CDOT Type C

Inlet Type =

CDOT Type C

Angle of Inclined Grate (must be  $\leq 30$  degrees)

Width of Grate

Length of Grate

Open Area Ratio

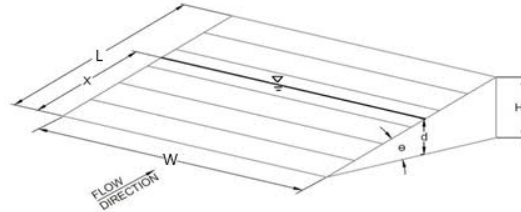
Height of Inclined Grate

Clogging Factor

Grate Discharge Coefficient

Orifice Coefficient

Weir Coefficient

 $\theta =$  0.00 degrees $W =$  3.00 ft $L =$  3.00 ft $A_{\text{RATIO}} =$  0.70 $H_b =$  0.00 ft $C_f =$  0.50 $C_d =$  0.96 $C_o =$  0.64 $C_w =$  2.05

Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)

Total Inlet Interception Capacity (assumes clogged condition)

Bypassed Flow

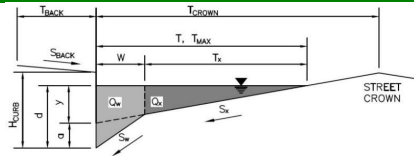
Capture Percentage =  $Q_a/Q_o$ 

	MINOR	MAJOR	
$d =$	0.43	1.22	
$Q_a =$	5.2	17.9	cfs
$Q_b =$	0.0	0.0	cfs
$C\% =$	100	100	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: **A2****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	14.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	25.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	25.0	25.0	ft
$d_{MAX}$ =	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

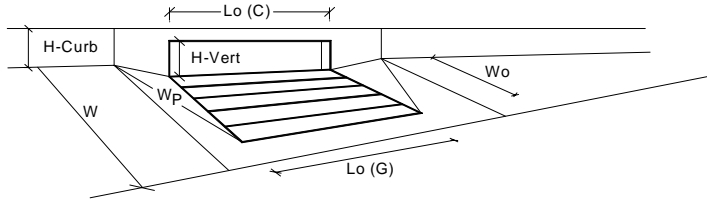
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

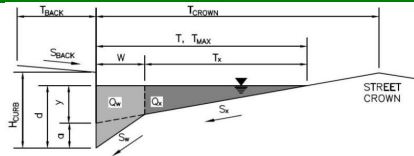


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.5	6.7	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.13	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.74	0.98	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.5	11.2	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.5	10.9	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: **A3****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	14.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	25.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	25.0	25.0	ft
$d_{MAX}$ =	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

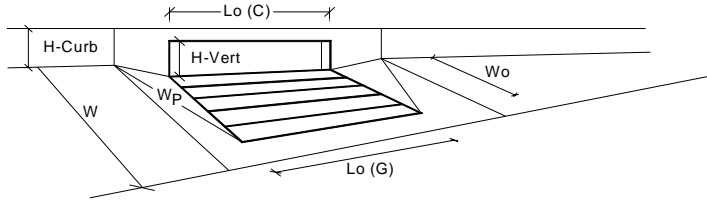
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

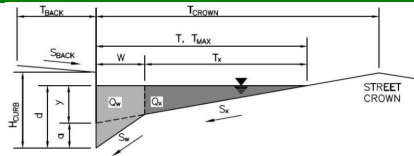


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local}$ =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		$N_o$ =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.1	4.6	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		$L_o$ (G) =	N/A	N/A	feet
Width of a Unit Grate		$W_o$ =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		$A_{ratio}$ =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_r$ (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w$ (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o$ (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		$L_o$ (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		$H_{vert}$ =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		$H_{throat}$ =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		$W_p$ =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_r$ (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w$ (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o$ (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		$d_{Grate}$ =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		$d_{Curb}$ =	0.09	0.21	ft
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb}$ =	0.95	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_a$ =	0.7	2.7	cfs
		$Q_{PEAK REQUIRED}$ =	0.7	2.7	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: **A4****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	10.5	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	44.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_o =$	0.040	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	22.0	22.0	ft
$d_{MAX} =$	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

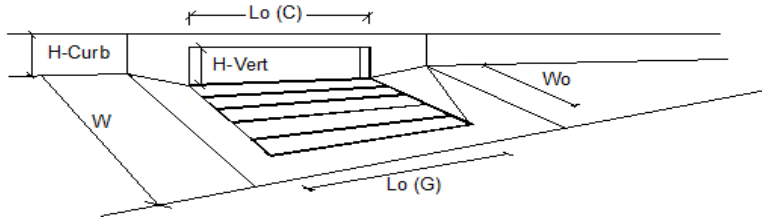
	Minor Storm	Major Storm	
$Q_{allow} =$	16.3	41.8	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.60 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 15.54 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$No$ =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q$ =	2.6	8.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b$ =	0.0	6.7	cfs
Capture Percentage = $Q_i/Q_a$		$C\%$ =	100	57	%

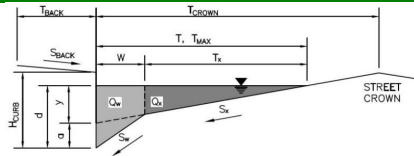


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: A5

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	17.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	33.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	24.0	24.0	ft
$d_{MAX}$ =	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

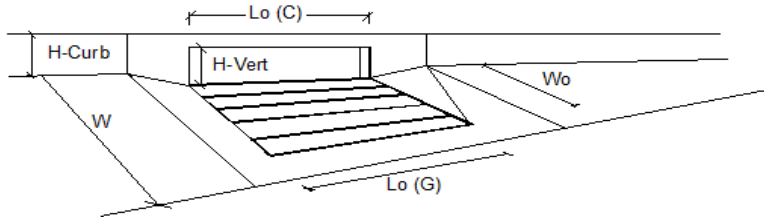
	Minor Storm	Major Storm	
$Q_{allow}$ =	16.3	52.8	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.81 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.11 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



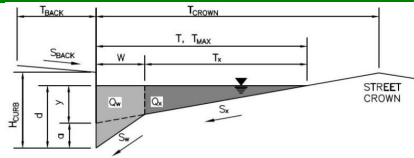
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q$ =	0.8	3.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	0.0	cfs
Capture Percentage = $Q_i/Q_o$		$C\%$ =	100	100	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B1

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	18.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	32.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	23.0	23.0	ft
$d_{MAX} =$	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

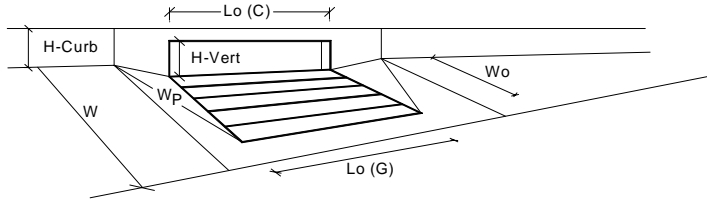
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



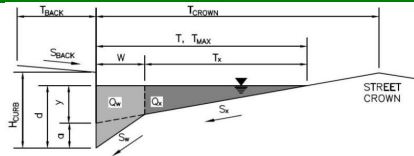
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local}$ =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		$N_o$ =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.8	6.0	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		$L_o$ (G) =	N/A	N/A	feet
Width of a Unit Grate		$W_o$ =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		$A_{ratio}$ =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_r$ (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w$ (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o$ (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		$L_o$ (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		$H_{vert}$ =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		$H_{throat}$ =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		$W_p$ =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_r$ (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w$ (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o$ (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		$d_{Grate}$ =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		$d_{Curb}$ =	0.15	0.34	ft
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb}$ =	0.77	0.94	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_a$ =	2.2	8.5	cfs
		$Q_{PEAK REQUIRED}$ =	2.1	8.2	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B2

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	18.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	32.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	23.0	32.0	ft
$d_{MAX}$ =	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

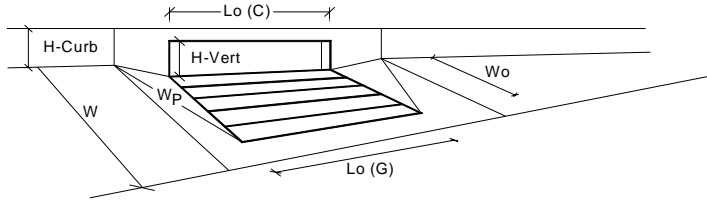
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

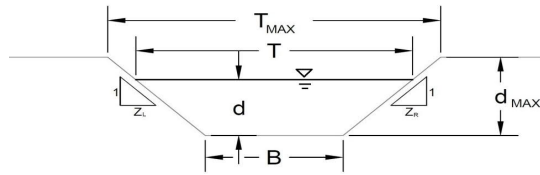
MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.9	6.1	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.16	0.34	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.78	0.94	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	2.3	8.5	cfs
		Q <sub>PEAK REQUIRED</sub> =	2.3	8.5	cfs

## AREA INLET IN A SWALE

B3A



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

**Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)**

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

Soil Type:	Max. Velocity ( $V_{MAX}$ )	Max Froude No. ( $F_{MAX}$ )
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

A, B, C, D, or E =

n =	0.030
$S_0$ =	0.0500 ft/ft
B =	0.00 ft
Z1 =	10.00 ft/ft
Z2 =	4.50 ft/ft

Choose One:

- ☐ Non-Cohesive  
☒ Cohesive  
☐ Paved

Maximum Allowable Top Width of Channel for Minor &amp; Major Storm

Maximum Allowable Water Depth in Channel for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX}$ =	14.00	18.00	ft
$d_{MAX}$ =	1.00	1.20	ft

**Allowable Channel Capacity Based On Channel Geometry**

MINOR STORM Allowable Capacity is based on Top Width Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow}$ =	45.9	81.9	cfs
$d_{allow}$ =	0.97	1.20	ft

**Water Depth in Channel Based On Design Peak Flow**

Design Peak Flow

Water Depth

$Q_o$ =	0.1	2.6	cfs
d =	0.10	0.33	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

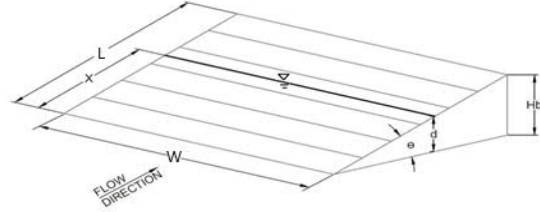
MHFD-Inlet, Version 5.03 (August 2023)

## AREA INLET IN A SWALE

B3A

Inlet Design Information (Input)	
Type of Inlet	CDOT TYPE D (Parallel)
Inlet Type = CDOT TYPE D (Parallel)	
Angle of Inclined Grate (must be $\leq 30$ degrees)	$\theta = 0.00$ degrees
Width of Grate	$W = 6.00$ ft
Length of Grate	$L = 3.00$ ft
Open Area Ratio	$A_{\text{RATIO}} = 0.70$
Height of Inclined Grate	$H_B = 0.00$ ft
Clogging Factor	$C_f = 0.38$
Grate Discharge Coefficient	$C_d = 0.76$
Orifice Coefficient	$C_o = 0.50$
Weir Coefficient	$C_w = 1.62$



	MINOR	MAJOR	
$d =$	0.10	0.33	
$Q_a =$	0.8	4.8	cfs
$Q_b =$	0.0	0.0	cfs
$C\% =$	100	100	%

Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	
Total Inlet Interception Capacity (assumes clogged condition)	
Bypassed Flow	
Capture Percentage = $Q_a/Q_o$	

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

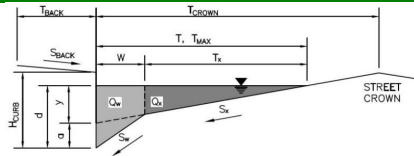


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B4

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 19.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	19.0	19.0	ft
$d_{MAX} =$	6.0	12.0	inches

☐ ☐

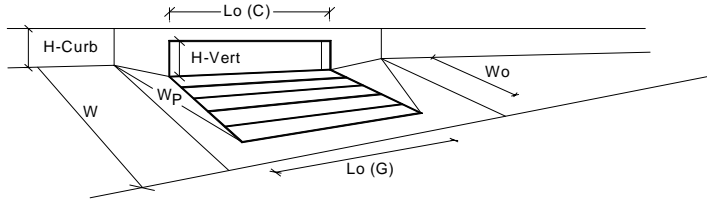
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



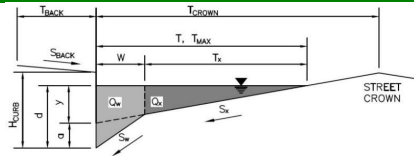
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.8	6.3	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.15	0.36	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.77	0.95	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	2.2	9.6	cfs
		Q <sub>PEAK REQUIRED</sub> =	2.1	9.5	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B5

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	19.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_w$ =	0.083	ft/ft
$S_o$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	19.0	19.0	ft
$d_{MAX}$ =	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

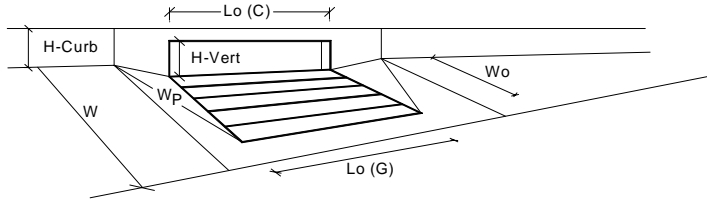
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



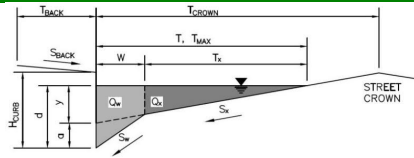
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.7	6.5	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.14	0.38	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.4	6.5	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.4	6.5	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B6

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

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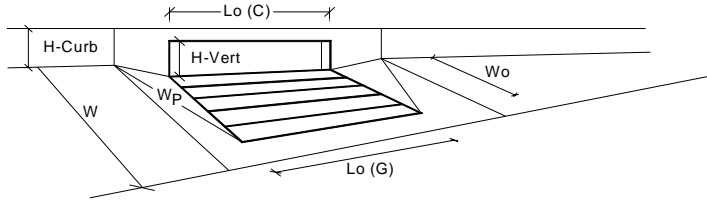
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



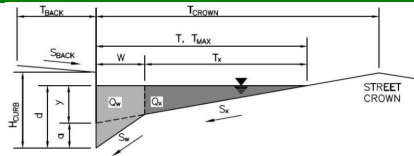
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.7	6.5	inches
<b>Grate Information</b>			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>			MINOR	MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			MINOR	MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.14	0.38	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.4	6.5	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.4	6.5	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B7

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

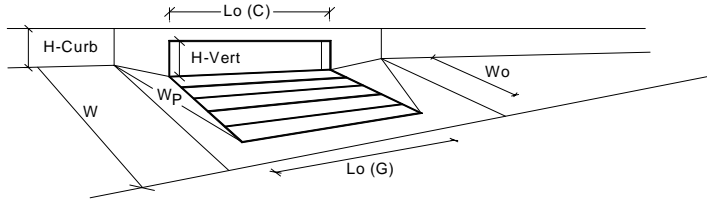
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

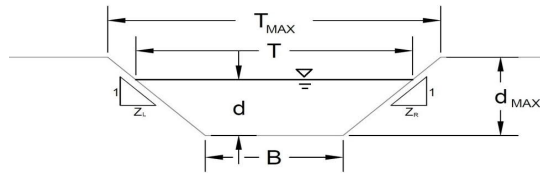


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.9	6.6	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.16	0.38	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.78	0.97	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	2.2	10.4	cfs
		Q <sub>PEAK REQUIRED</sub> =	2.2	10.4	cfs



## AREA INLET IN A SWALE

B8



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

**Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)**

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

Soil Type:	Max. Velocity ( $V_{MAX}$ )	Max Froude No. ( $F_{MAX}$ )
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

A, B, C, D, or E =

n =	0.030
$S_0$ =	0.0100 ft/ft
B =	0.00 ft
Z1 =	4.00 ft/ft
Z2 =	4.00 ft/ft

Choose One:

- ☒ Non-Cohesive  
☐ Cohesive  
☐ Paved

Maximum Allowable Top Width of Channel for Minor &amp; Major Storm

Maximum Allowable Water Depth in Channel for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX}$ =	8.00	16.00	ft
$d_{MAX}$ =	1.00	2.00	ft

**Allowable Channel Capacity Based On Channel Geometry**

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow}$ =	12.3	77.9	cfs
$d_{allow}$ =	1.00	2.00	ft

**Water Depth in Channel Based On Design Peak Flow**

Design Peak Flow

Water Depth

$Q_o$ =	2.0	8.5	cfs
d =	0.50	0.87	ft

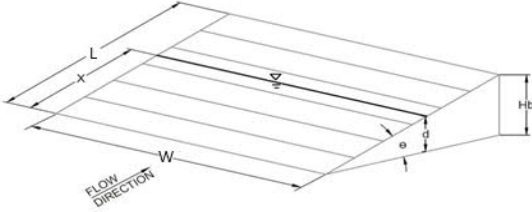
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

MHFD-Inlet, Version 5.03 (August 2023)

## AREA INLET IN A SWALE

B8

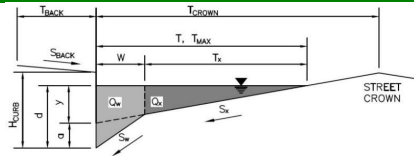
Inlet Design Information (Input)																					
Type of Inlet	CDOT Type C																				
Inlet Type =	CDOT Type C																				
Angle of Inclined Grate (must be $\leq 30$ degrees)	$\theta = 0.00$ degrees																				
Width of Grate	$W = 3.00$ ft																				
Length of Grate	$L = 3.00$ ft																				
Open Area Ratio	$A_{RATIO} = 0.70$																				
Height of Inclined Grate	$H_B = 0.00$ ft																				
Clogging Factor	$C_f = 0.50$																				
Grate Discharge Coefficient	$C_d = 0.96$																				
Orifice Coefficient	$C_o = 0.64$																				
Weir Coefficient	$C_w = 2.05$																				
																					
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	<table border="1"> <thead> <tr> <th></th> <th>MINOR</th> <th>MAJOR</th> <th></th> </tr> </thead> <tbody> <tr> <td><math>d =</math></td> <td>0.50</td> <td>0.87</td> <td></td> </tr> <tr> <td><math>Q_a =</math></td> <td>6.6</td> <td>15.0</td> <td>cfs</td> </tr> <tr> <td><math>Q_b =</math></td> <td>0.0</td> <td>0.0</td> <td>cfs</td> </tr> <tr> <td><math>C\% =</math></td> <td>100</td> <td>100</td> <td>%</td> </tr> </tbody> </table>		MINOR	MAJOR		$d =$	0.50	0.87		$Q_a =$	6.6	15.0	cfs	$Q_b =$	0.0	0.0	cfs	$C\% =$	100	100	%
	MINOR	MAJOR																			
$d =$	0.50	0.87																			
$Q_a =$	6.6	15.0	cfs																		
$Q_b =$	0.0	0.0	cfs																		
$C\% =$	100	100	%																		
Total Inlet Interception Capacity (assumes clogged condition)																					
Bypassed Flow																					
Capture Percentage = $Q_a/Q_o$																					

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B9

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_o =$	0.032	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

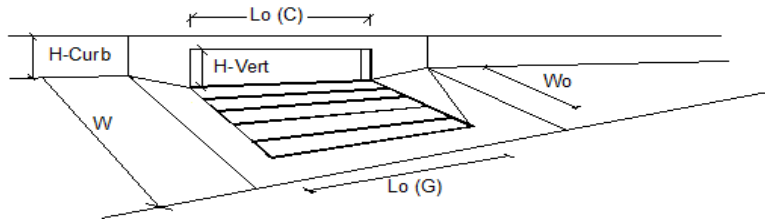
	Minor Storm	Major Storm	
$Q_{allow} =$	19.2	20.9	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.41 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.66 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet Version 5.03 (August 2023)



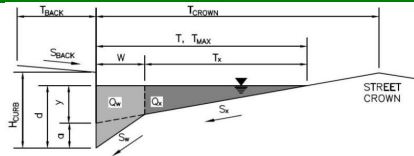
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$N_0$ =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_0$ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_0$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q$ =	1.4	3.671	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b$ =	0.0	3.0	cfs
Capture Percentage = $Q_i/Q_a$		$C\%$ =	100	55	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B10

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

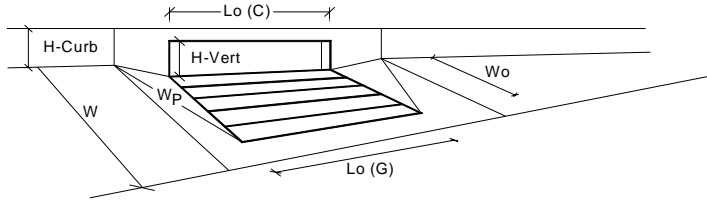
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



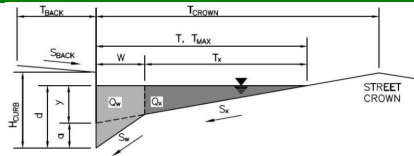
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.9	7.2	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.16	0.43	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.78	0.99	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	2.3	12.9	cfs
		Q <sub>PEAK REQUIRED</sub> =	2.3	12.9	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B11

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

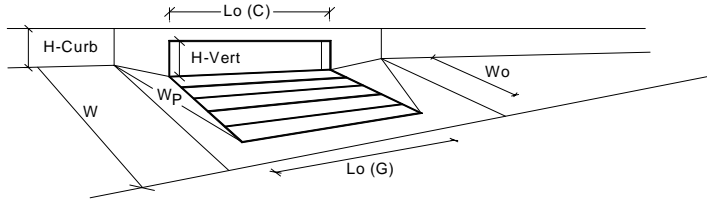
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	2.9	4.2	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.07	0.19	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.92	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.5	2.2	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.5	2.2	cfs

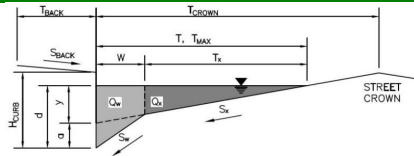


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B12

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

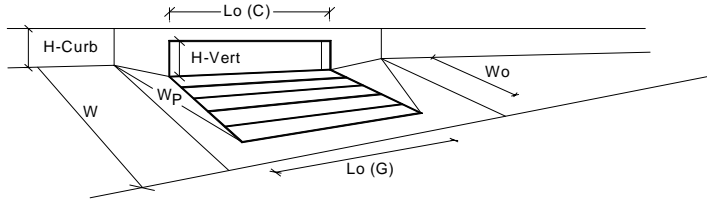
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



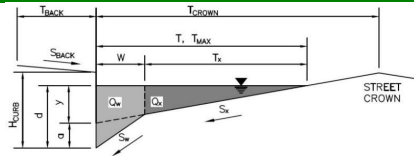
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.1	4.7	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.09	0.23	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.94	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.7	3.1	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.7	3.1	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B13

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

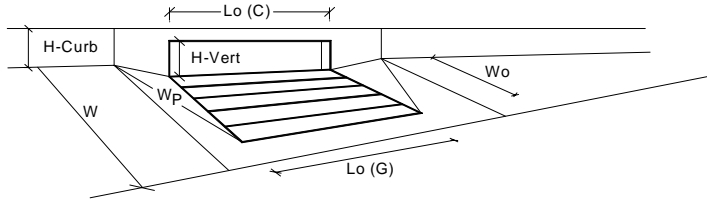
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



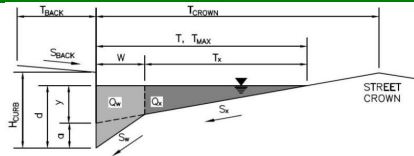
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.5	8.1	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.13	0.51	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.99	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.3	10.0	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.3	9.9	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B14

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	6.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	44.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	34.0	34.0	ft
$d_{MAX}$ =	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

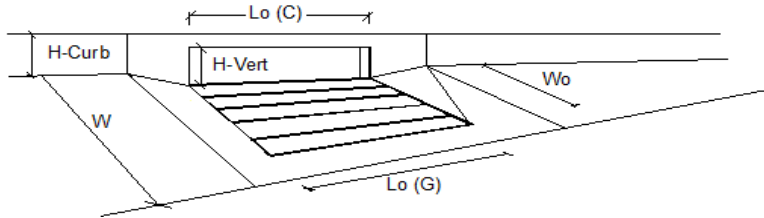
	Minor Storm	Major Storm	
$Q_{allow}$ =	16.3	132.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.55 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 9.15 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

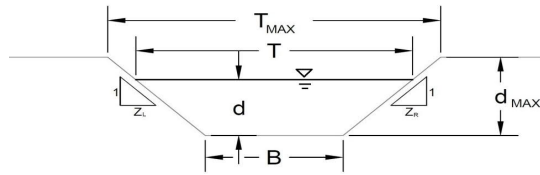
MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>f</sub> (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>f</sub> (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	2.6	6.771	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =	0.0	2.4	cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>a</sub>		C% =	100	74	%

## AREA INLET IN A SWALE

B15



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

**Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)**

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

Soil Type:	Max. Velocity ( $V_{MAX}$ )	Max Froude No. ( $F_{MAX}$ )
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

A, B, C, D, or E =

B
n = see details below
$S_0$ = 0.0450 ft/ft
B = 0.00 ft
Z1 = 5.00 ft/ft
Z2 = 10.00 ft/ft

Choose One:

- ☒ Non-Cohesive  
☐ Cohesive  
☐ Paved

Maximum Allowable Top Width of Channel for Minor &amp; Major Storm

Maximum Allowable Water Depth in Channel for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX}$ =	15.00	30.00	ft
$d_{MAX}$ =	1.00	2.00	ft

**Allowable Channel Capacity Based On Channel Geometry**

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow}$ =	4.8	152.2	cfs
$d_{allow}$ =	1.00	2.00	ft

**Water Depth in Channel Based On Design Peak Flow**

Design Peak Flow

Water Depth

$Q_o$ =	0.1	5.9	cfs
d =	0.25	1.06	ft

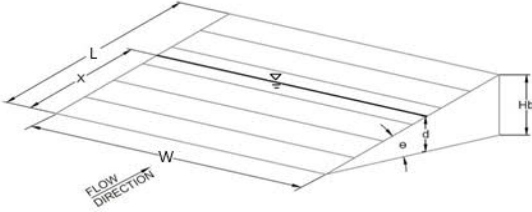
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

MHFD-Inlet, Version 5.03 (August 2023)

## AREA INLET IN A SWALE

B15

Inlet Design Information (Input)																					
Type of Inlet	CDOT Type C																				
Inlet Type =	CDOT Type C																				
Angle of Inclined Grate (must be $\leq 30$ degrees)	$\theta = 0.00$ degrees																				
Width of Grate	$W = 3.00$ ft																				
Length of Grate	$L = 3.00$ ft																				
Open Area Ratio	$A_{RATIO} = 0.70$																				
Height of Inclined Grate	$H_B = 0.00$ ft																				
Clogging Factor	$C_f = 0.50$																				
Grate Discharge Coefficient	$C_d = 0.96$																				
Orifice Coefficient	$C_o = 0.64$																				
Weir Coefficient	$C_w = 2.05$																				
																					
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)																					
Total Inlet Interception Capacity (assumes clogged condition)																					
Bypassed Flow																					
Capture Percentage = $Q_a/Q_o$																					
	<table border="1"> <thead> <tr> <th></th> <th>MINOR</th> <th>MAJOR</th> <th></th> </tr> </thead> <tbody> <tr> <td><math>d =</math></td> <td>0.25</td> <td>1.06</td> <td></td> </tr> <tr> <td><math>Q_a =</math></td> <td>2.4</td> <td>16.7</td> <td>cfs</td> </tr> <tr> <td><math>Q_b =</math></td> <td>0.0</td> <td>0.0</td> <td>cfs</td> </tr> <tr> <td><math>C\% =</math></td> <td>100</td> <td>100</td> <td>%</td> </tr> </tbody> </table>		MINOR	MAJOR		$d =$	0.25	1.06		$Q_a =$	2.4	16.7	cfs	$Q_b =$	0.0	0.0	cfs	$C\% =$	100	100	%
	MINOR	MAJOR																			
$d =$	0.25	1.06																			
$Q_a =$	2.4	16.7	cfs																		
$Q_b =$	0.0	0.0	cfs																		
$C\% =$	100	100	%																		

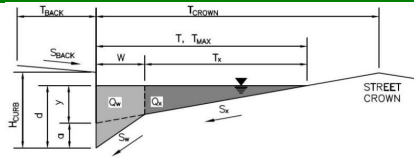


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B16

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	25.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	14.0	25.0	ft
$d_{MAX}$ =	5.4	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

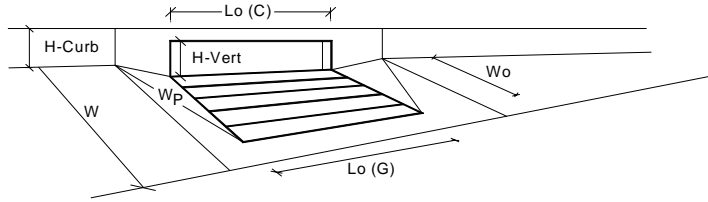
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



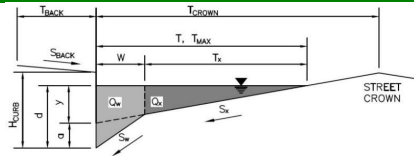
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.0	6.1	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.09	0.35	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.69	0.94	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.8	8.8	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.8	8.8	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B17

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	25.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	25.0	ft
$d_{MAX} =$	5.4	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

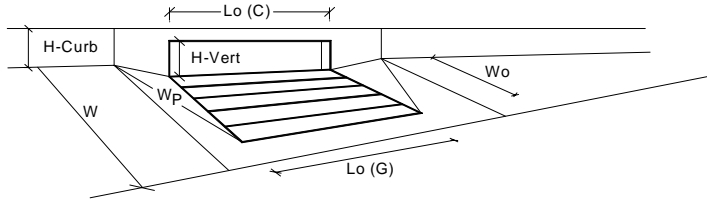
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



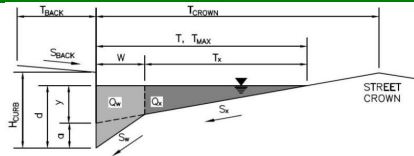
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.1	4.4	inches
<b>Grate Information</b>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.09	0.20	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.94	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.7	2.4	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.7	2.4	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B18

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	19.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	19.0	19.0	ft
$d_{MAX}$ =	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

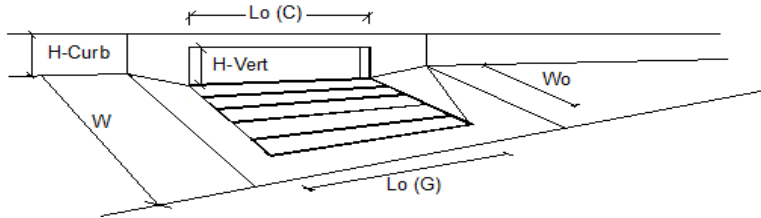
	Minor Storm	Major Storm	
$Q_{allow}$ =	18.0	31.9	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.64 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.21 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



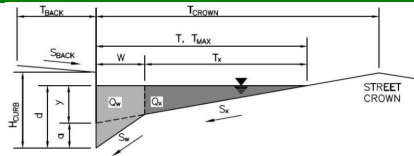
Design Information (Input)		MINOR		MAJOR
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0 inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$N_o$ =	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	5.00	5.00 ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$		MINOR		MAJOR
Total Inlet Interception Capacity		$Q$ =	1.613	4.042 cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	4.2 cfs
Capture Percentage = $Q_i/Q_o$		$C\%$ =	98	49 %

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B19

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	19.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.038	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	19.0	19.0	ft
$d_{MAX}$ =	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

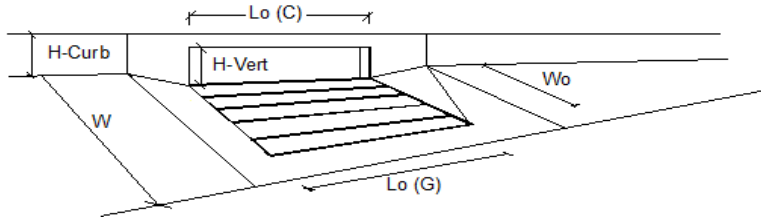
	Minor Storm	Major Storm	
$Q_{allow}$ =	18.3	31.1	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.31 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.00 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>f</sub> (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>f</sub> (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity					
Total Inlet Interception Capacity		Q =	1.3	3.510	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =	0.0	2.5	cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>a</sub>		C% =	100	59	%

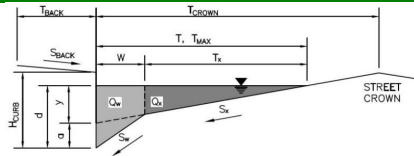


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B20

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_o =$	0.018	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

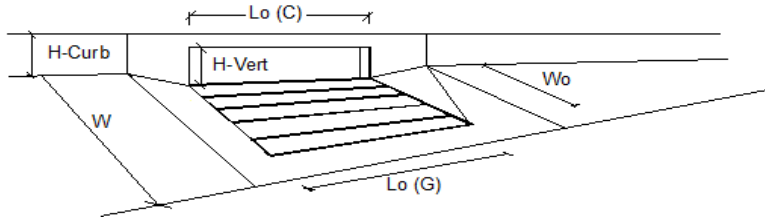
	Minor Storm	Major Storm	
$Q_{allow} =$	15.6	15.6	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.76 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.29 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



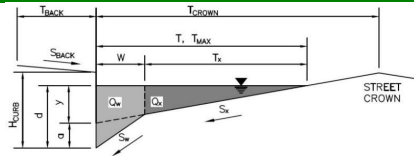
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$					
Total Inlet Interception Capacity		$Q$ =	0.8	5.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	0.0	cfs
Capture Percentage = $Q_i/Q_o$		$C\%$ =	100	100	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B21

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	17.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	17.0	17.0	ft
$d_{MAX}$ =	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

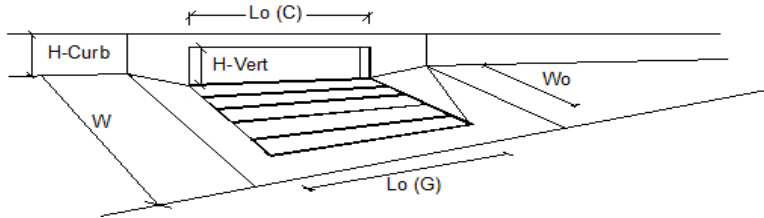
	Minor Storm	Major Storm	
$Q_{allow}$ =	18.0	23.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.24 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 11.13 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



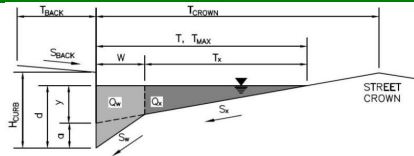
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q$ =	2.2	8.262	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b$ =	0.0	2.9	cfs
Capture Percentage = $Q_i/Q_a$		$C\%$ =	100	74	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B22

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_o =$	0.040	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

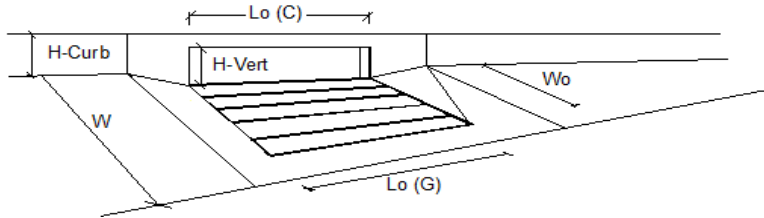
	Minor Storm	Major Storm	
$Q_{allow} =$	18.0	23.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.40 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.29 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



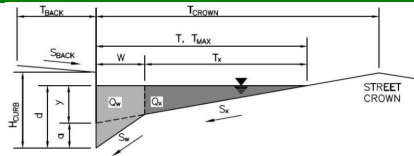
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$No$ =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q$ =	1.4	3.593	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	2.7	cfs
Capture Percentage = $Q_i/Q_o$		$C\%$ =	100	57	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B24

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 19.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_o = 0.053$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	19.0	19.0	ft
$d_{MAX} =$	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

$Q_{allow} =$

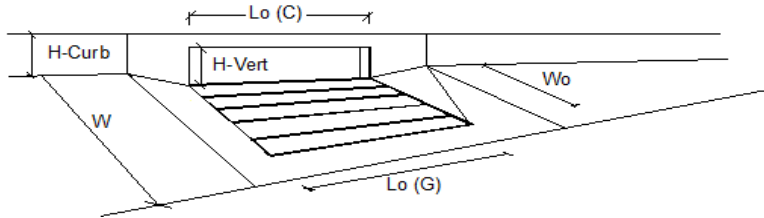
Minor Storm	Major Storm	
16.6	36.7	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.55 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 13.18 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q$ =	2.6	9.052	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b$ =	0.0	4.1	cfs
Capture Percentage = $Q_i/Q_a$		$C\%$ =	100	69	%

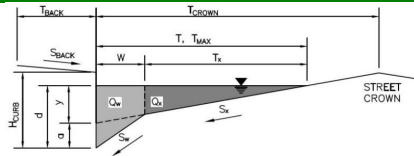


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B25

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$	=	15.0	ft
$S_{BACK}$	=	0.020	ft/ft
$n_{BACK}$	=	0.016	

$H_{CURB}$	=	4.00	inches
$T_{CROWN}$	=	19.0	ft
$W$	=	2.00	ft
$S_x$	=	0.020	ft/ft
$S_W$	=	0.083	ft/ft
$S_o$	=	0.053	ft/ft
$n_{STREET}$	=	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm		
$T_{MAX}$	=	19.0	19.0	ft
$d_{MAX}$	=	6.0	12.0	inches
		<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

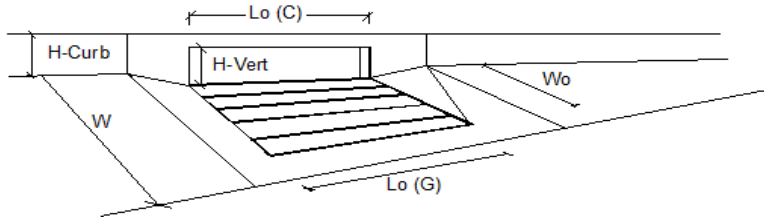
	Minor Storm	Major Storm		
$Q_{allow}$	=	16.6	36.7	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.07 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 10.25 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



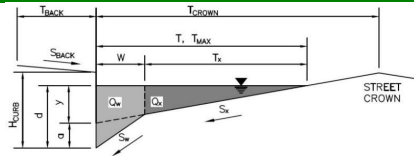
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q$ =	2.1	7.965	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	2.3	cfs
Capture Percentage = $Q_i/Q_o$		$C\%$ =	100	78	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B26

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	17.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	17.0	17.0	ft
$d_{MAX}$ =	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

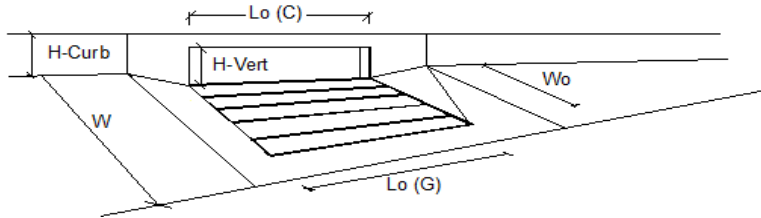
	Minor Storm	Major Storm	
$Q_{allow}$ =	18.0	23.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.57 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 15.40 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



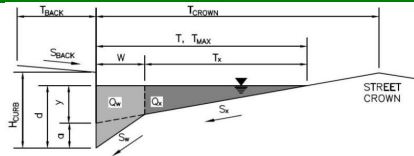
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$No$ =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q$ =	2.6	9.633	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b$ =	0.0	5.8	cfs
Capture Percentage = $Q_i/Q_a$		$C\%$ =	100	63	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B27

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	17.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	17.0	17.0	ft
$d_{MAX}$ =	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

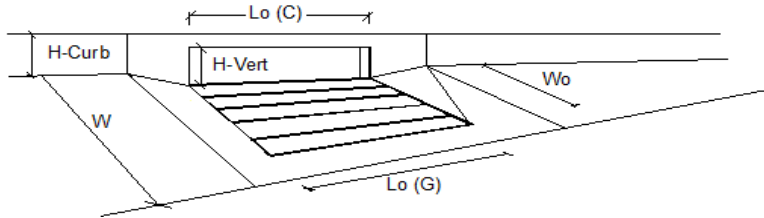
	Minor Storm	Major Storm	
$Q_{allow}$ =	18.0	23.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.59 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.08 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



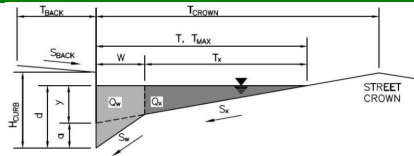
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$					
Total Inlet Interception Capacity		$Q$ =	1.6	6.921	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	1.2	cfs
Capture Percentage = $Q_i/Q_o$		$C\%$ =	100	86	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B28

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

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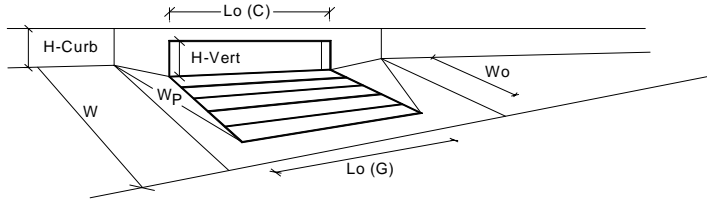
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.4	6.7	inches
<b>Grate Information</b>			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>			MINOR	MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			MINOR	MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.12	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.58	0.83	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q <sub>a</sub> =	1.5	13.2	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>PEAK REQUIRED</sub> =	1.4	13.2	cfs

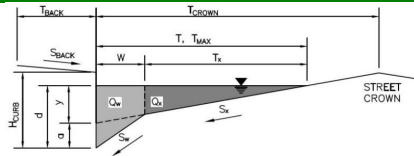


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B29

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

☐ ☐

MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

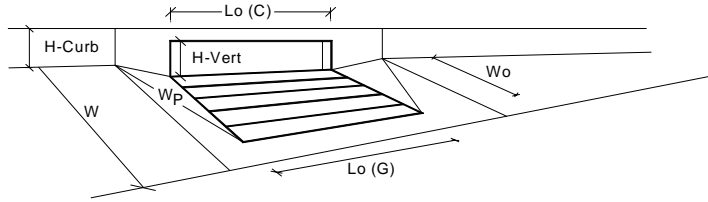
$Q_{allow} =$ 

Minor Storm	Major Storm
SUMP	SUMP

cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



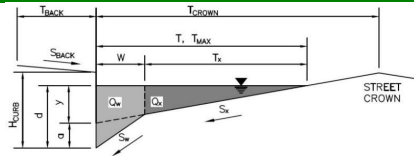
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.3	5.1	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.11	0.26	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.72	0.88	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.2	5.3	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.2	5.3	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B30

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

☐ ☐

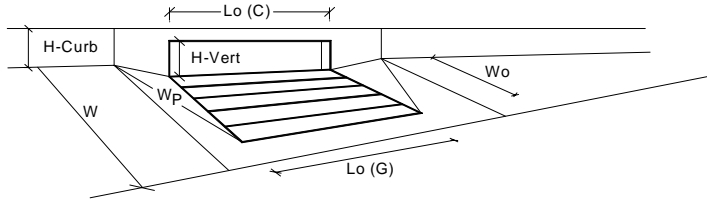
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



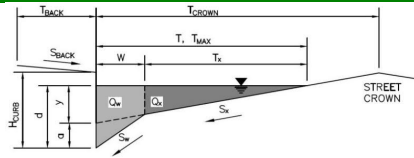
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.7	7.6	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.15	0.47	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.76	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.9	14.7	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.9	14.7	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B31

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

☐ ☐

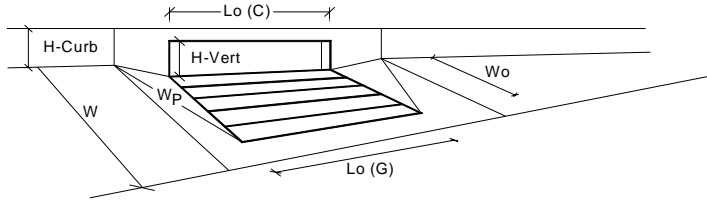
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



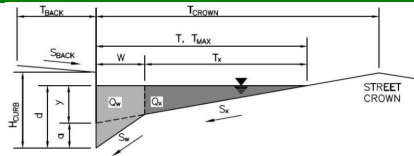
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.6	5.9	inches
<b>Grate Information</b>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.13	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.75	0.93	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>		MINOR		MAJOR	
		Q <sub>a</sub> =	1.7	8.1	cfs
<b>Inlet Capacity IS GOOD for Minor and Major Storms (&gt;Q Peak)</b>		Q <sub>PEAK REQUIRED</sub> =	1.7	8.1	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B32

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 19.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	19.0	19.0	ft
$d_{MAX} =$	6.0	12.0	inches

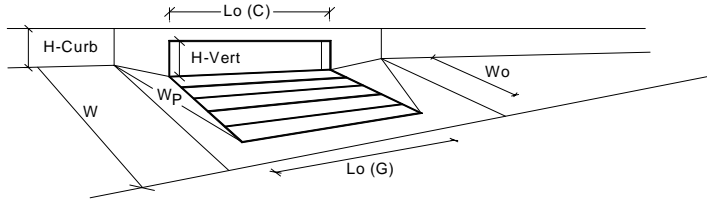
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	2.7	3.6	inches
<b>Grate Information</b>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.06	0.13	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.89	0.99	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.3	1.3	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.3	1.3	cfs

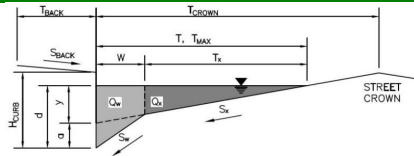


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B33

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	19.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	19.0	19.0	ft
$d_{MAX}$ =	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

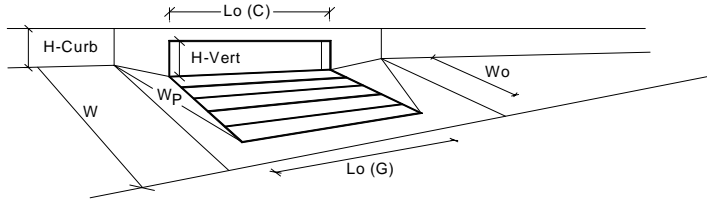
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



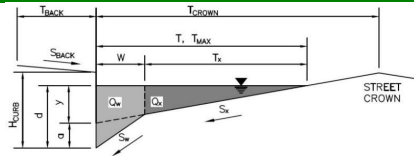
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	2.7	3.6	inches
<b>Grate Information</b>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.06	0.13	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.89	0.99	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.3	1.3	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.3	1.3	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B34

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

☐ ☐

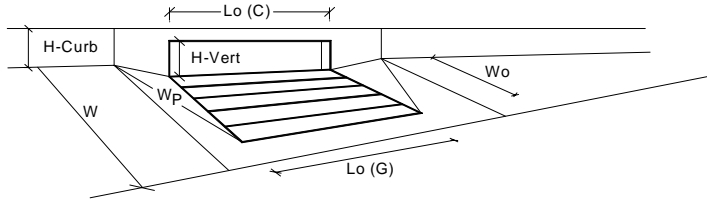
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



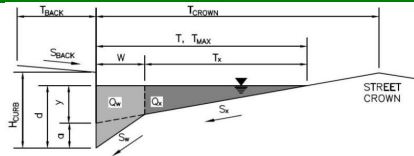
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.2	5.1	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.10	0.25	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.70	0.87	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.0	5.2	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.0	5.1	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B35

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

☐ ☐

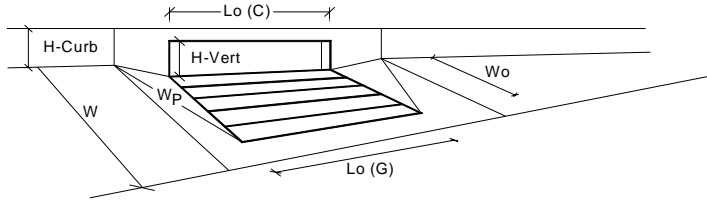
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



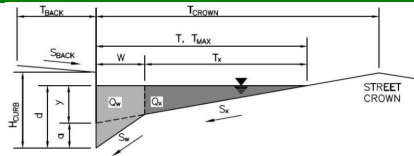
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.5	5.9	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.12	0.32	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.98	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.2	5.1	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.2	5.1	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B36

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

☐ ☐

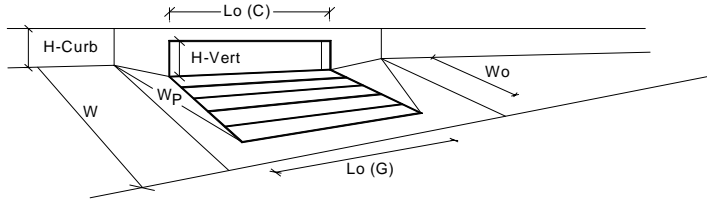
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local}$ =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		$N_o$ =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.5	6.2	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		$L_o$ (G) =	N/A	N/A	feet
Width of a Unit Grate		$W_o$ =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		$A_{ratio}$ =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_r$ (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w$ (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o$ (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		$L_o$ (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		$H_{vert}$ =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		$H_{throat}$ =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		$W_p$ =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_r$ (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w$ (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o$ (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		$d_{Grate}$ =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		$d_{Curb}$ =	0.13	0.35	ft
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb}$ =	0.99	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_a$ =	1.2	5.7	cfs
		$Q_{PEAK REQUIRED}$ =	1.2	5.7	cfs

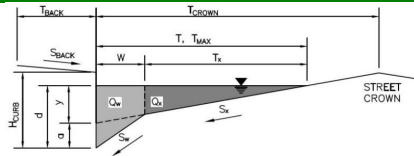


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B37

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	17.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	17.0	17.0	ft
$d_{MAX}$ =	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

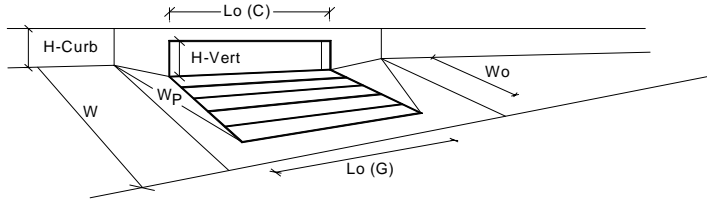
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



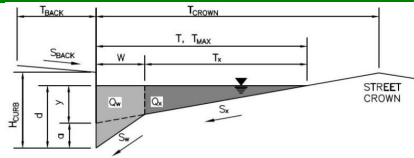
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local}$ =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		$N_o$ =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.5	5.7	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		$L_o$ (G) =	N/A	N/A	feet
Width of a Unit Grate		$W_o$ =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		$A_{ratio}$ =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_r$ (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w$ (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o$ (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		$L_o$ (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		$H_{vert}$ =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		$H_{throat}$ =	6.00	6.00	inches
Angle of Throat		$\Theta$ =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		$W_p$ =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_r$ (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w$ (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o$ (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		$d_{Grate}$ =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		$d_{Curb}$ =	0.12	0.31	ft
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb}$ =	0.74	0.92	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_a$ =	1.5	7.2	cfs
		$Q_{PEAK REQUIRED}$ =	1.5	7.2	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B33A

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	17.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	25.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	16.0	25.0	ft
$d_{MAX}$ =	5.4	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

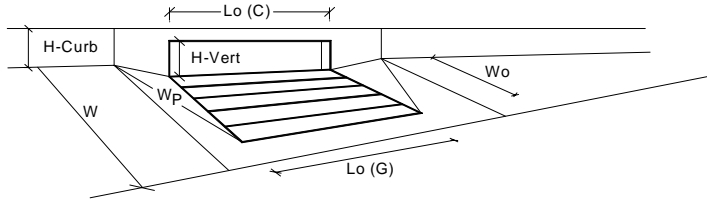
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



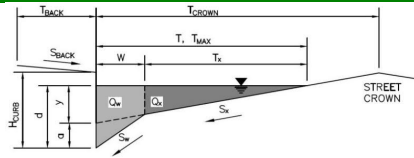
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	2.7	4.0	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.06	0.16	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.90	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.4	1.8	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.4	1.8	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B33B

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	17.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	25.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	25.0	ft
$d_{MAX} =$	5.4	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

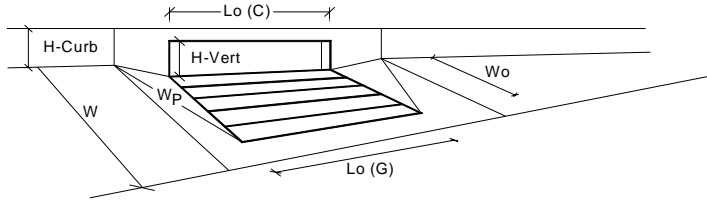
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



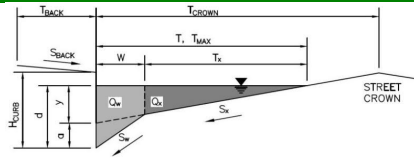
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local}$ =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		$N_o$ =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	2.6	2.8	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		$L_o$ (G) =	N/A	N/A	feet
Width of a Unit Grate		$W_o$ =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		$A_{ratio}$ =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_f$ (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w$ (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o$ (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		$L_o$ (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		$H_{vert}$ =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		$H_{throat}$ =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		$W_p$ =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_f$ (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w$ (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o$ (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		$d_{Grate}$ =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		$d_{Curb}$ =	0.05	0.06	ft
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb}$ =	0.89	0.91	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_a$ =	0.3	0.4	cfs
		$Q_{PEAK REQUIRED}$ =	0.3	0.4	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B38

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	10.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	25.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	16.0	25.0	ft
$d_{MAX}$ =	5.4	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

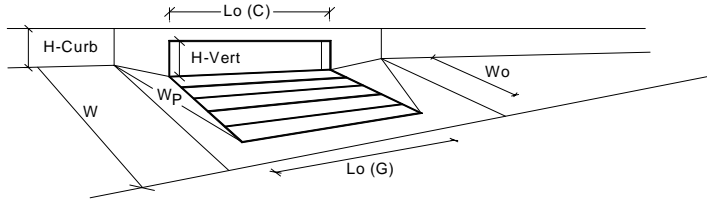
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local}$ =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		$N_o$ =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.4	5.9	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		$L_o$ (G) =	N/A	N/A	feet
Width of a Unit Grate		$W_o$ =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		$A_{ratio}$ =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_r$ (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w$ (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o$ (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		$L_o$ (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		$H_{vert}$ =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		$H_{throat}$ =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		$W_p$ =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_r$ (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w$ (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o$ (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		$d_{Grate}$ =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		$d_{Curb}$ =	0.11	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb}$ =	0.97	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_a$ =	1.0	5.2	cfs
		$Q_{PEAK REQUIRED}$ =	1.0	4.6	cfs

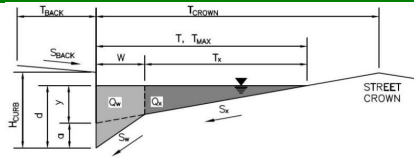


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B39

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	10.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	25.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_y =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	25.0	ft
$d_{MAX} =$	5.4	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

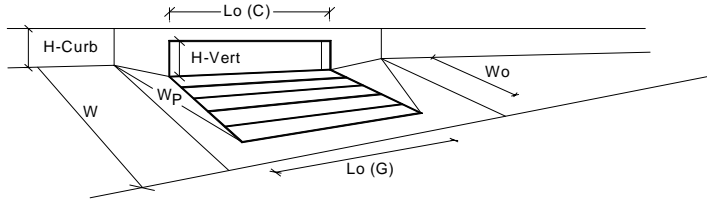
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



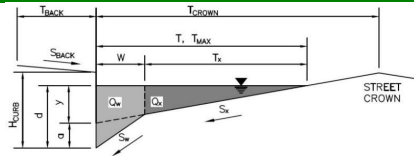
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.2	5.2	inches
<b>Grate Information</b>			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>			MINOR	MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			MINOR	MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.10	0.27	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.95	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q <sub>a</sub> =	0.8	3.9	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>PEAK REQUIRED</sub> =	0.8	3.9	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B41

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.036	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

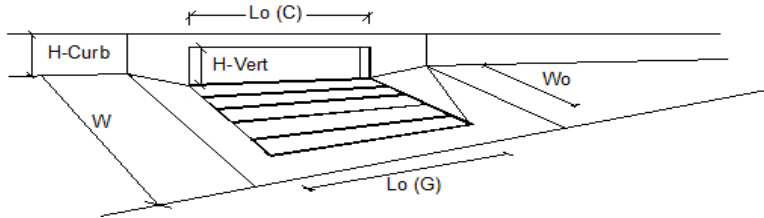
	Minor Storm	Major Storm	
$Q_{allow} =$	18.6	22.1	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.88 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.85 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



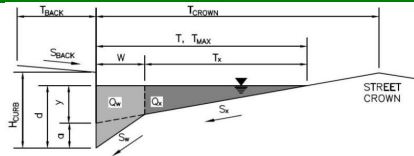
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$No$ =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q$ =	0.9	2.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	1.0	cfs
Capture Percentage = $Q_i/Q_o$		$C\%$ =	100	73	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B42

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	17.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	17.0	17.0	ft
$d_{MAX}$ =	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

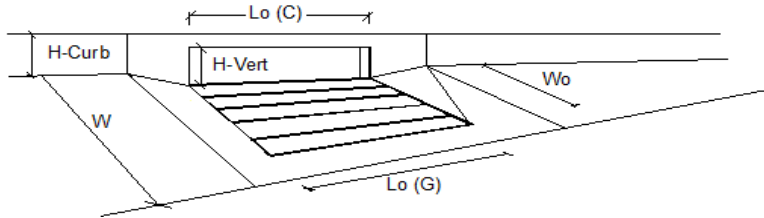
	Minor Storm	Major Storm	
$Q_{allow}$ =	18.0	23.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.44 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 11.30 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



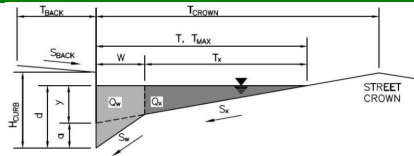
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>f</sub> (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>f</sub> (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	2.4	10.633	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =	0.0	0.7	cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>a</sub>		C% =	100	94	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B43A

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_o = 0.040$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

$Q_{allow} =$

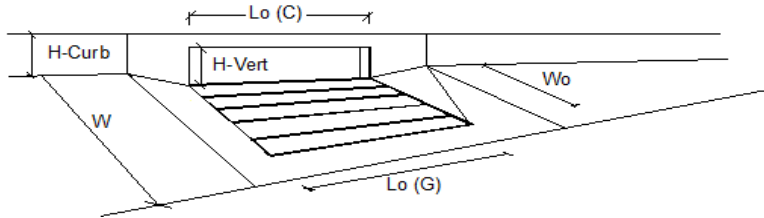
Minor Storm	Major Storm	
18.0	23.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.01 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.20 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		Type =		
Total Number of Units in the Inlet (Grate or Curb Opening)		$a_{LOCAL}$ =	5.0	5.0 inches
Length of a Single Unit Inlet (Grate or Curb Opening)		No =	1	1
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$L_o$ =	10.00	10.00 ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$W_o$ =	N/A	N/A ft
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (G)$ =	N/A	N/A
		$C_f (C)$ =	0.10	0.10
Street Hydraulics: OK - Q < Allowable Street Capacity		MINOR		MAJOR
Total Inlet Interception Capacity		Q =	1.010	5.098 cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b$ =	0.0	0.1 cfs
Capture Percentage = $Q_i/Q_a$		C% =	100	98 %

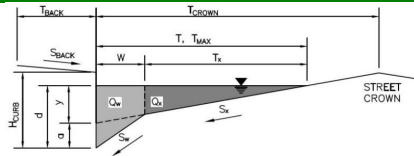


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B43

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	17.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	17.0	17.0	ft
$d_{MAX}$ =	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

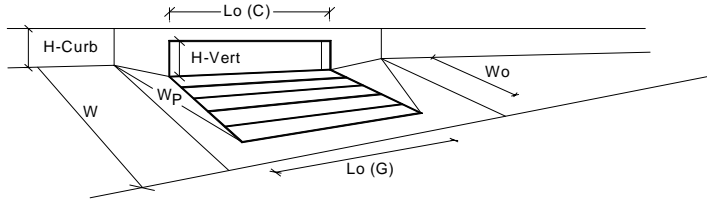
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



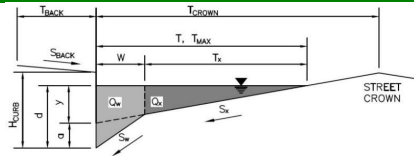
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	2.8	5.1	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.07	0.26	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.66	0.88	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.6	5.5	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.6	5.4	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B44

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

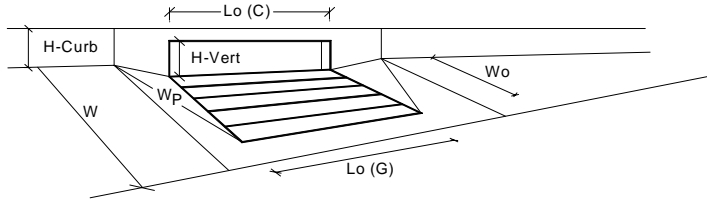
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



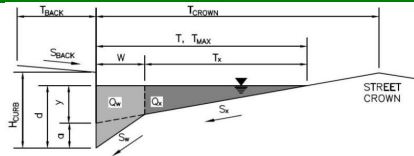
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	2.7	3.6	inches
<b>Grate Information</b>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.06	0.13	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.90	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>		MINOR		MAJOR	
		Q <sub>a</sub> =	0.4	1.4	cfs
<b>Inlet Capacity IS GOOD for Minor and Major Storms (&gt;Q Peak)</b>		Q <sub>PEAK REQUIRED</sub> =	0.4	1.4	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B45

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	17.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	17.0	17.0	ft
$d_{MAX}$ =	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

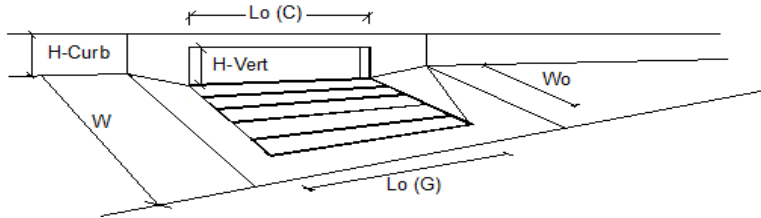
	Minor Storm	Major Storm	
$Q_{allow}$ =	18.0	23.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.59 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.95 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



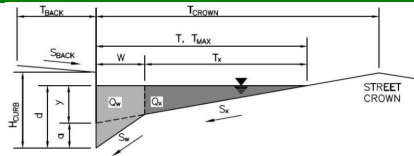
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	1.6	3.984	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	4.0	cfs
Capture Percentage = $Q_i/Q_o$		C% =	99	50	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B46

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	17.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_0$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	17.0	17.0	ft
$d_{MAX}$ =	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

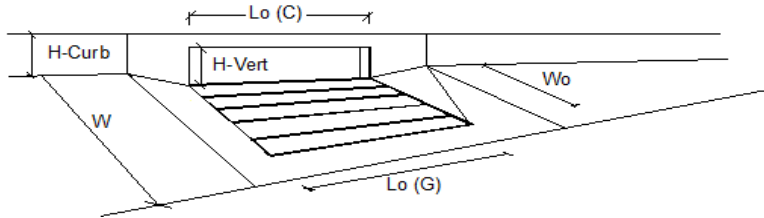
	Minor Storm	Major Storm	
$Q_{allow}$ =	18.0	23.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.71 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.34 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q$ =	1.7	3.849	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	3.5	cfs
Capture Percentage = $Q_i/Q_o$		$C\%$ =	98	52	%

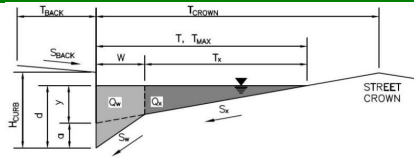


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B47

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

☐ ☐

MINOR STORM Allowable Capacity is not applicable to Sump Condition

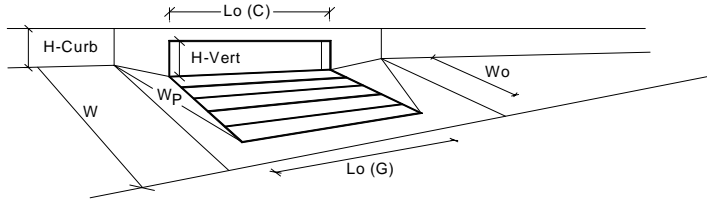
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

Warning 02

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



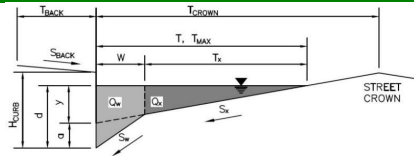
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.8	6.5	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.15	0.38	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.77	0.96	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	2.2	10.4	cfs
		Q <sub>PEAK REQUIRED</sub> =	2.1	10.4	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B48

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

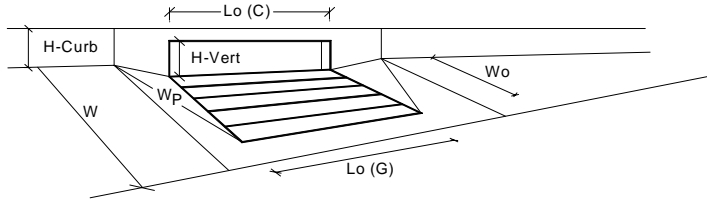
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



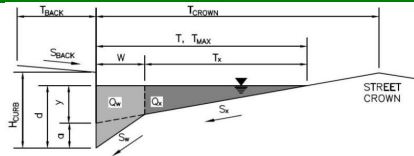
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.5	6.1	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.12	0.34	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.73	0.94	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.4	8.7	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.4	8.7	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B50

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$	=	17.0	ft
$S_{BACK}$	=	0.020	ft/ft
$n_{BACK}$	=	0.016	

$H_{CURB}$	=	6.00	inches
$T_{CROWN}$	=	25.0	ft
$W$	=	2.00	ft
$S_x$	=	0.020	ft/ft
$S_w$	=	0.083	ft/ft
$S_o$	=	0.000	ft/ft
$n_{STREET}$	=	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$	16.0	25.0	ft
$d_{MAX}$	5.4	12.0	inches

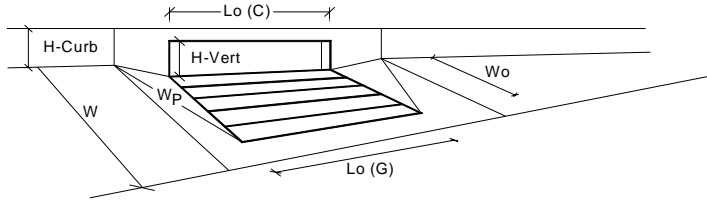
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



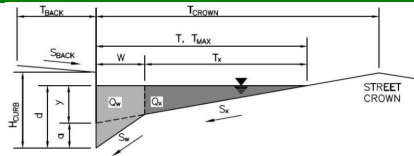
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.2	4.7	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.10	0.23	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.96	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.8	3.0	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.8	3.0	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B51

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_0 = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

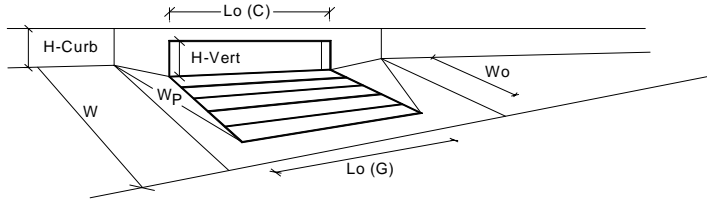
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.7	6.0	inches
<b>Grate Information</b>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.14	0.34	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.5	5.4	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.5	5.4	cfs

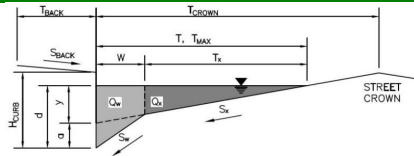


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B52

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

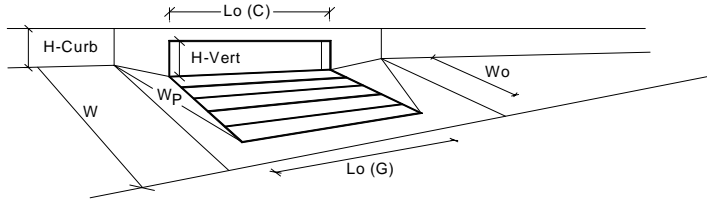
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



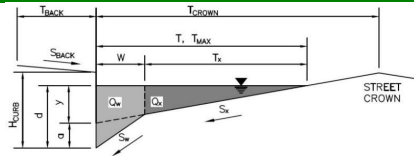
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.4	5.6	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.11	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.97	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.0	4.6	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.0	4.6	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B53

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is not applicable to Sump Condition

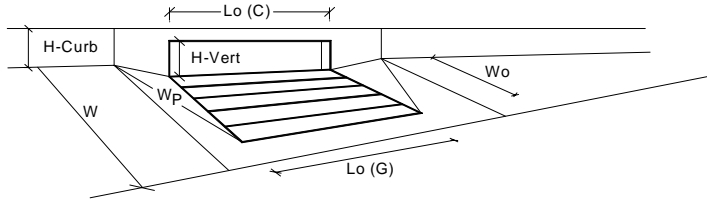
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

$Q_{allow} =$ 

Minor Storm	Major Storm	
SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



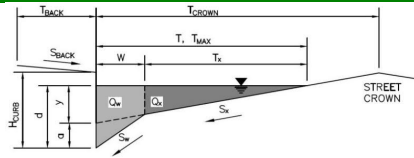
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.5	5.5	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.12	0.29	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.73	0.91	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.4	6.7	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.4	6.6	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B54

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_0 = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

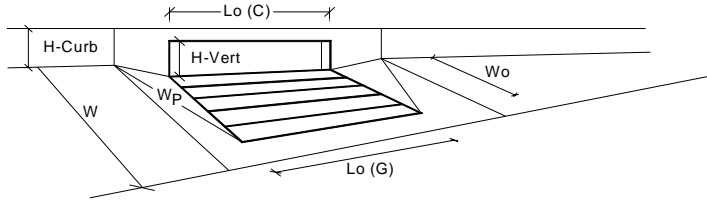
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



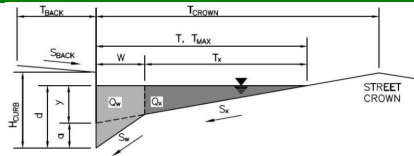
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.0	4.6	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.08	0.21	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.93	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.6	2.8	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.6	2.8	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B55

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

MINOR STORM Allowable Capacity is not applicable to Sump Condition

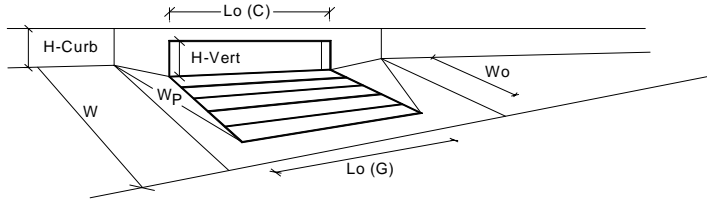
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

Warning 02

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.2	7.2	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.18	0.44	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.80	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	2.8	13.3	cfs
		Q <sub>PEAK REQUIRED</sub> =	2.8	13.2	cfs

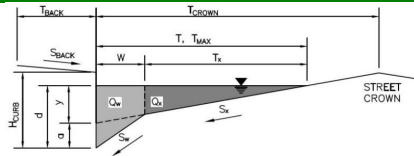


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B56

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

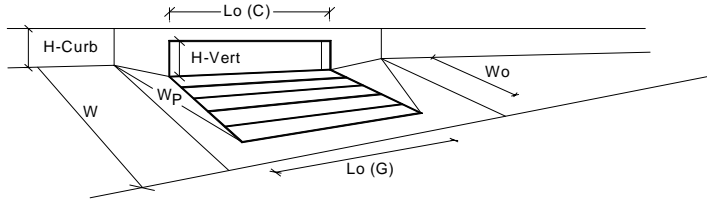
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



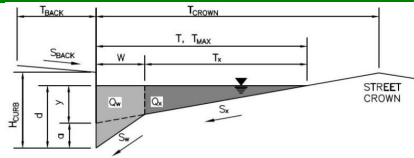
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.5	5.9	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.12	0.32	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.98	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.2	5.1	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.2	5.1	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B57

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	15.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	4.00	inches
$T_{CROWN}$ =	17.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	17.0	17.0	ft
$d_{MAX}$ =	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

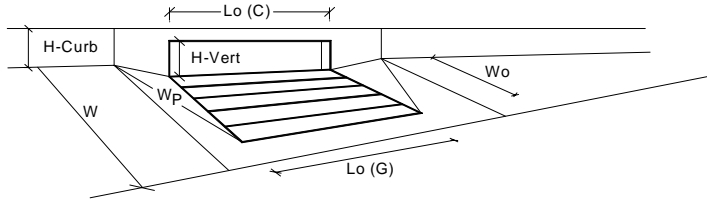
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



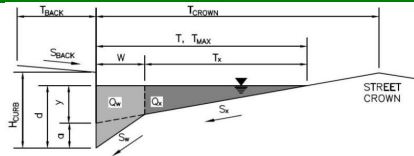
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.0	5.9	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.09	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.69	0.93	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.8	8.1	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.8	7.9	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B59

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_o =$	0.010	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

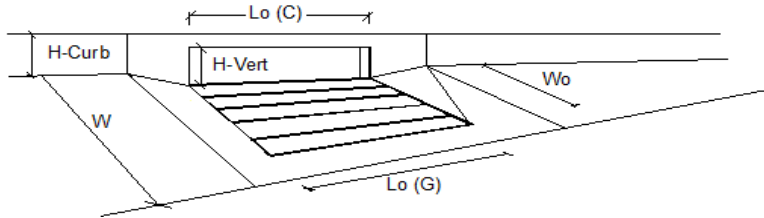
	Minor Storm	Major Storm	
$Q_{allow} =$	11.7	138.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.78 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 13.91 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



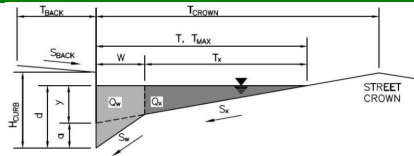
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>f</sub> (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>f</sub> (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity		MINOR		MAJOR	
Total Inlet Interception Capacity		Q =	2.8	8.714	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =	0.0	5.2	cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>a</sub>		C% =	100	63	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B58

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

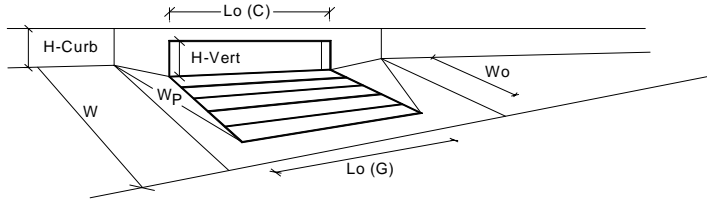
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

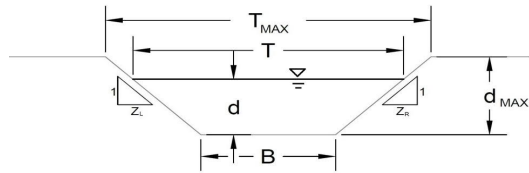


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.0	6.5	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.17	0.38	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.79	0.96	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	2.5	10.2	cfs
		Q <sub>PEAK REQUIRED</sub> =	2.5	10.2	cfs



## AREA INLET IN A SWALE

B58A



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

## Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

Soil Type:	Max. Velocity ( $V_{MAX}$ )	Max Froude No. ( $F_{MAX}$ )
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

A, B, C, D, or E =

C
see details below
$S_0 = 0.0429$ ft/ft
$B = 0.00$ ft
$Z_1 = 4.00$ ft/ft
$Z_2 = 4.00$ ft/ft

Choose One:

- ☐ Non-Cohesive  
☐ Cohesive  
☐ Paved

Maximum Allowable Top Width of Channel for Minor &amp; Major Storm

Maximum Allowable Water Depth in Channel for Minor &amp; Major Storm

	Minor Storm	Major Storm
$T_{MAX} =$	8.00	11.50
$d_{MAX} =$	1.00	1.50

## Allowable Channel Capacity Based On Channel Geometry

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Top Width Criterion

	Minor Storm	Major Storm
$Q_{allow} =$	10.1	48.0
$d_{allow} =$	1.00	1.44

## Water Depth in Channel Based On Design Peak Flow

Design Peak Flow

Water Depth

$Q_o =$	0.5	3.5
$d =$	0.61	0.83

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

MHFD-Inlet, Version 5.03 (August 2023)

## AREA INLET IN A SWALE

B58A

### Inlet Design Information (Input)

Type of Inlet

CDOT Type C

Inlet Type =

CDOT Type C

Angle of Inclined Grate (must be  $\leq 30$  degrees)

Width of Grate

Length of Grate

Open Area Ratio

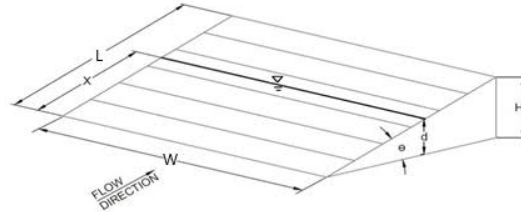
Height of Inclined Grate

Clogging Factor

Grate Discharge Coefficient

Orifice Coefficient

Weir Coefficient



θ = 0.00 degrees

W = 3.00 ft

L = 3.00 ft

A<sub>RATIO</sub> = 0.70

H<sub>B</sub> = 0.00 ft

C<sub>f</sub> = 0.50

C<sub>d</sub> = 0.96

C<sub>o</sub> = 0.64

C<sub>w</sub> = 2.05

Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)

Total Inlet Interception Capacity (assumes clogged condition)

Bypassed Flow

Capture Percentage =  $Q_a/Q_o$

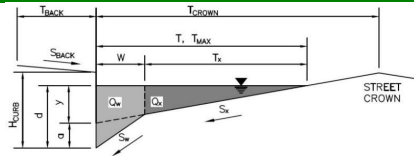
	MINOR	MAJOR	
d =	0.61	0.83	
Q <sub>a</sub> =	8.9	14.0	cfs
Q <sub>b</sub> =	0.0	0.0	cfs
C% =	100	100	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B39A

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	17.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	25.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	16.0	25.0	ft
$d_{MAX}$ =	5.4	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

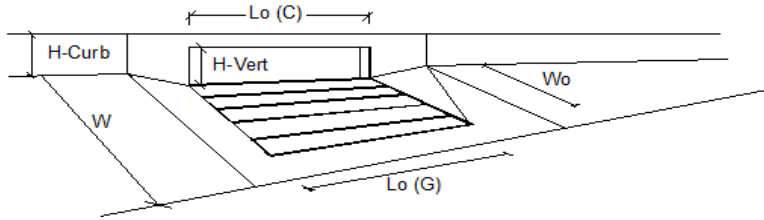
	Minor Storm	Major Storm	
$Q_{allow}$ =	16.3	59.1	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.31 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 1.37 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



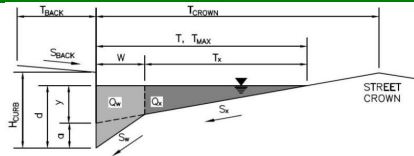
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$No$ =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$					
Total Inlet Interception Capacity		$Q$ =	0.3	1.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b$ =	0.0	0.0	cfs
Capture Percentage = $Q_i/Q_a$		$C\%$ =	100	97	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B39B

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	17.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	25.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_W$ =	0.083	ft/ft
$S_o$ =	0.040	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	16.0	25.0	ft
$d_{MAX}$ =	5.4	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

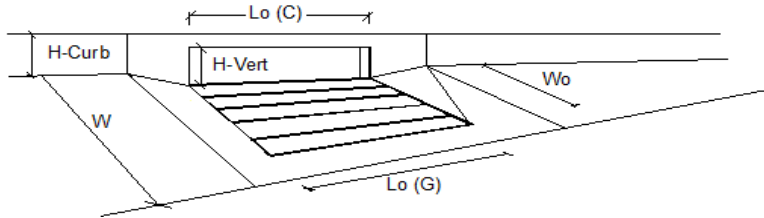
	Minor Storm	Major Storm	
$Q_{allow}$ =	16.3	59.1	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.48 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 1.69 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



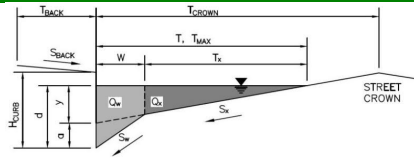
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$					
Total Inlet Interception Capacity		$Q$ =	0.5	1.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	0.1	cfs
Capture Percentage = $Q_i/Q_o$		$C\%$ =	100	92	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: B61

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$ =	5.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	18.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_w$ =	0.083	ft/ft
$S_o$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$ =	18.0	18.0	ft
$d_{MAX}$ =	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

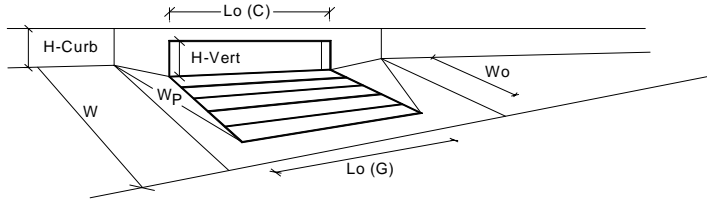
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow}$ =	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.8	7.7	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.23	0.48	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.85	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	4.4	15.2	cfs
		Q <sub>PEAK REQUIRED</sub> =	4.4	15.2	cfs

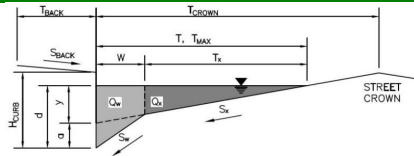


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: C1

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

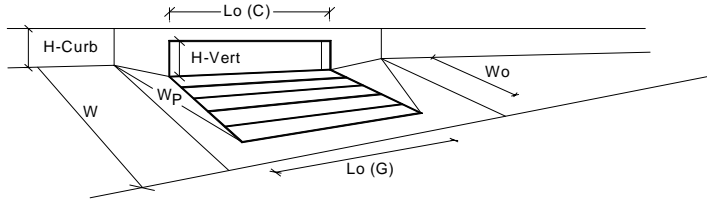
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



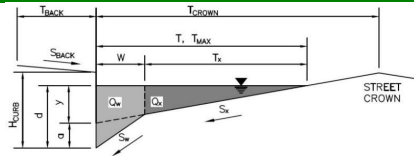
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.2	6.0	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.10	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.96	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.9	5.3	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.9	5.3	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: C2

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_0 = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

MINOR STORM Allowable Capacity is not applicable to Sump Condition

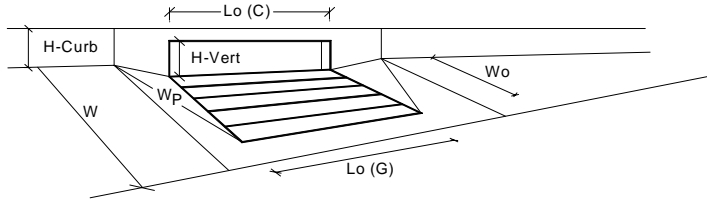
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

Warning 02

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



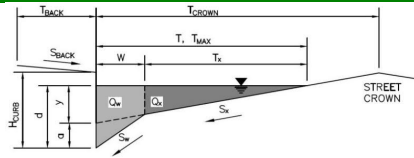
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.6	6.4	inches
<b>Grate Information</b>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.13	0.36	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>		MINOR		MAJOR	
		Q <sub>a</sub> =	1.3	6.1	cfs
<b>Inlet Capacity IS GOOD for Minor and Major Storms (&gt;Q Peak)</b>		Q <sub>PEAK REQUIRED</sub> =	1.3	6.1	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: C3

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_0 = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is not applicable to Sump Condition

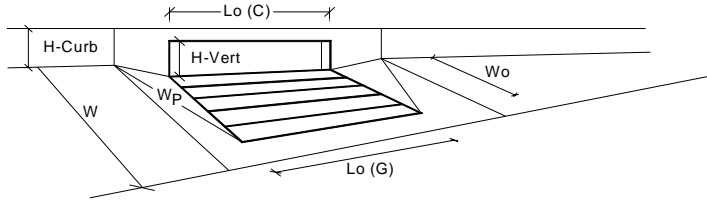
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

Warning 02

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



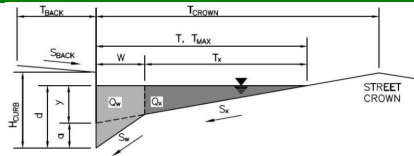
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.5	6.9	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.12	0.41	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.73	0.98	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
		MINOR		MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q <sub>a</sub> =	1.4	11.8	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>PEAK REQUIRED</sub> =	1.4	11.7	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: C4

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.020	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

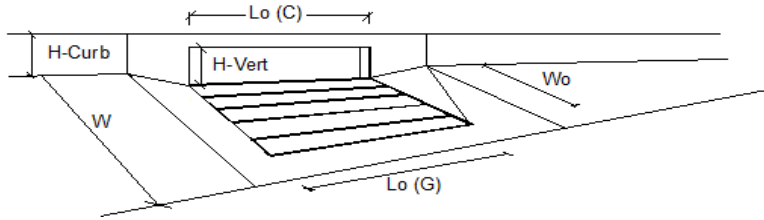
	Minor Storm	Major Storm	
$Q_{allow} =$	16.5	16.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.81 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 14.55 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		Type =	5.0	5.0 inches
Total Number of Units in the Inlet (Grate or Curb Opening)		a <sub>LOCAL</sub> =	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)		No =	10.00	10.00 ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		L <sub>o</sub> =	N/A	N/A ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		W <sub>o</sub> =	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>f</sub> (G) =	N/A	N/A
Street Hydraulics: OK - Q < Allowable Street Capacity		C <sub>f</sub> (C) =	0.10	0.10
Total Inlet Interception Capacity		MINOR		MAJOR
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q =	2.8	9.149 cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>a</sub>		Q <sub>b</sub> =	0.0	5.4 cfs
		C% =	100	63 %

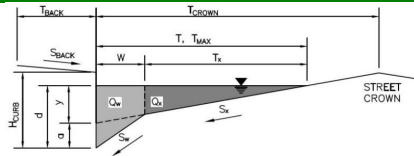


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: C5

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

☐ ☐

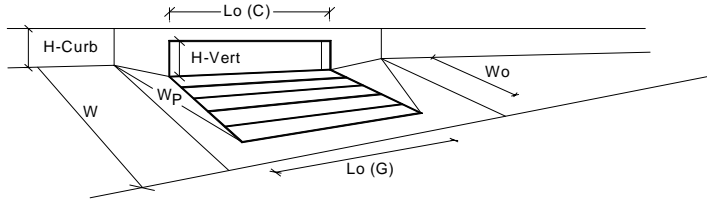
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

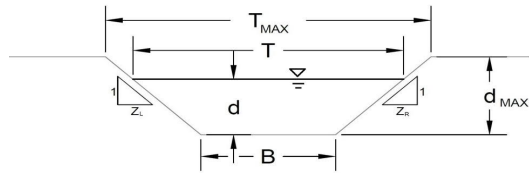
MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.7	6.2	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.14	0.35	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.76	0.95	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.9	9.1	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.9	9.0	cfs

## AREA INLET IN A SWALE

C6



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

## Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

Soil Type:	Max. Velocity ( $V_{MAX}$ )	Max Froude No. ( $F_{MAX}$ )
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

A, B, C, D, or E =

C
see details below
$S_0 = 0.0200$ ft/ft
$B = 0.00$ ft
$Z_1 = 4.00$ ft/ft
$Z_2 = 4.00$ ft/ft

Choose One:

- ☐ Non-Cohesive  
☒ Cohesive  
☐ Paved

Maximum Allowable Top Width of Channel for Minor &amp; Major Storm

Maximum Allowable Water Depth in Channel for Minor &amp; Major Storm

	Minor Storm	Major Storm
$T_{MAX} =$	8.00	11.50
$d_{MAX} =$	1.00	1.50

## Allowable Channel Capacity Based On Channel Geometry

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Top Width Criterion

	Minor Storm	Major Storm
$Q_{allow} =$	3.7	25.1
$d_{allow} =$	1.00	1.44

## Water Depth in Channel Based On Design Peak Flow

Design Peak Flow

Water Depth

	Minor Storm	Major Storm
$Q_o =$	0.1	4.1
$d =$	0.32	1.03

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

## AREA INLET IN A SWALE

C6

## Inlet Design Information (Input)

Type of Inlet

CDOT Type C

Inlet Type =

CDOT Type C

Angle of Inclined Grate (must be  $\leq 30$  degrees)

Width of Grate

Length of Grate

Open Area Ratio

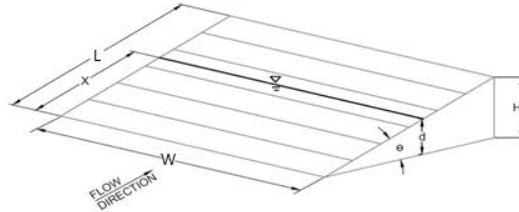
Height of Inclined Grate

Clogging Factor

Grate Discharge Coefficient

Orifice Coefficient

Weir Coefficient

 $\theta =$  0.00 degrees

W = 3.00 ft

L = 3.00 ft

 $A_{\text{RATIO}} =$  0.70 $H_b =$  0.00 ft $C_g =$  0.50 $C_o =$  0.96 $C_w =$  0.64 $C_w =$  2.05

Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)

Total Inlet Interception Capacity (assumes clogged condition)

Bypassed Flow

Capture Percentage =  $Q_a/Q_o$ 

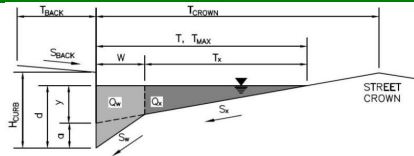
	MINOR	MAJOR	
d =	0.32	1.03	
$Q_a =$	3.4	16.4	cfs
$Q_b =$	0.0	0.0	cfs
C% =	100	100	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: D1

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 17.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

☐ ☐

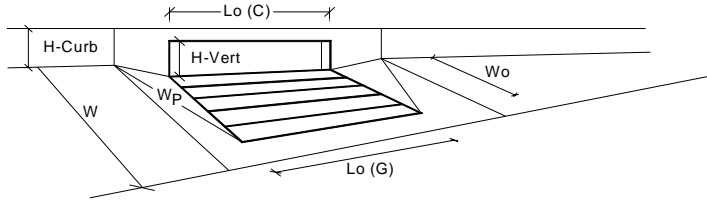
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



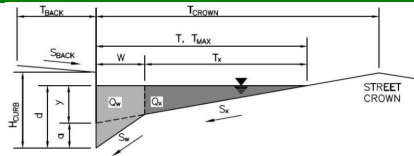
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local}$ =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		$N_o$ =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.1	7.1	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		$L_o$ (G) =	N/A	N/A	feet
Width of a Unit Grate		$W_o$ =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		$A_{ratio}$ =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_r$ (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w$ (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o$ (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		$L_o$ (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		$H_{vert}$ =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		$H_{throat}$ =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		$W_p$ =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_r$ (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w$ (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o$ (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		$d_{Grate}$ =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		$d_{Curb}$ =	0.17	0.43	ft
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb}$ =	0.80	0.99	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_a$ =	2.7	12.8	cfs
		$Q_{PEAK REQUIRED}$ =	2.7	12.8	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: D2

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_0 =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

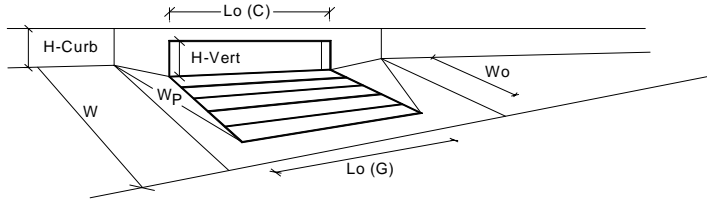
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local}$ =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		$N_o$ =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.1	7.2	inches
<u>Grate Information</u>			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		$L_o$ (G) =	N/A	N/A	feet
Width of a Unit Grate		$W_o$ =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		$A_{ratio}$ =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_f$ (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w$ (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o$ (G) =	N/A	N/A	
<u>Curb Opening Information</u>			MINOR	MAJOR	
Length of a Unit Curb Opening		$L_o$ (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		$H_{vert}$ =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		$H_{throat}$ =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		$W_p$ =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_f$ (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w$ (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o$ (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>			MINOR	MAJOR	
Depth for Grate Midwidth		$d_{Grate}$ =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		$d_{Curb}$ =	0.18	0.43	ft
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb}$ =	0.80	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_a$ =	2.8	12.9	cfs
		$Q_{PEAK REQUIRED}$ =	2.8	12.9	cfs

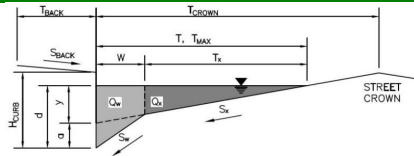


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: D3

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 19.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_0 = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	19.0	19.0	ft
$d_{MAX} =$	6.0	12.0	inches

MINOR STORM Allowable Capacity is not applicable to Sump Condition

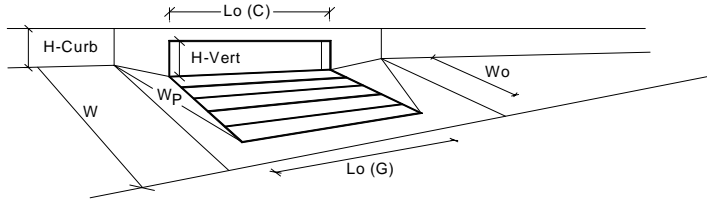
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

Warning 02

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



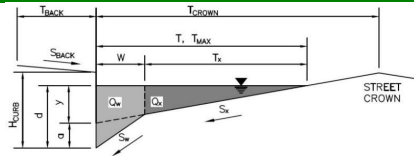
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.6	6.0	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.14	0.34	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.75	0.94	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.7	8.4	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.7	8.3	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: D4

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$  inches  
 $T_{CROWN} = 19.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.083$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	19.0	19.0	ft
$d_{MAX} =$	6.0	12.0	inches

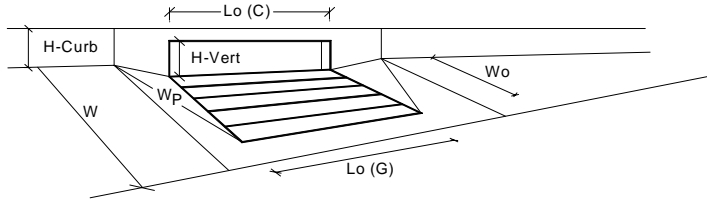
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.7	5.9	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d <sub>grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>curb</sub> =	0.14	0.32	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>curb</sub> =	0.76	0.93	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.9	7.8	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.9	7.8	cfs

COUNTY LINE ROAD  
ULTIMATE INLET CALCULATIONS

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<a href="#">CL6</a>	<a href="#">CL7</a>	<a href="#">CL3</a>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{Known}$ (cfs)	1.5	1.3	1.2
Major $Q_{Known}$ (cfs)	6.6	4.0	4.0

Bypass (Carry-Over) Flow from Upstream [Inlets must be organized from upstream \(left\) to downstream \(right\) in order for bypass flows to be linked.](#)

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.5	1.3	1.2
Major Total Design Peak Flow, $Q$ (cfs)	6.6	4.0	4.0
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	0.1	0.0	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	3.4	1.4	0.0

**INLET MANAGEMENT**

Worksheet Protected

INLET NAME	<b>CL4</b>	<b>CL5</b>	<b>UB12</b>
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

## USER-DEFINED INPUT

## User-Defined Design Flows

Minor $Q_{known}$ (cfs)	1.7	1.2	0.8
Major $Q_{known}$ (cfs)	10.7	4.7	3.4

## Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0	0.0

## Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

## Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

## Minor Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## Major Storm Rainfall Input

Design Storm Return Period, $T_r$ (years)			
One-Hour Precipitation, $P_1$ (inches)			

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.7	1.2	0.8
Major Total Design Peak Flow, $Q$ (cfs)	10.7	4.7	3.4
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	N/A	N/A

# INLET MANAGEMENT

Worksheet Protected

INLET NAME	<a href="#">UB13</a>	<a href="#">UB3A</a>
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	AREA
Hydraulic Condition	In Sump	Swale
Inlet Type	CDOT Type R Curb Opening	CDOT TYPE D (Parallel)

## USER-DEFINED INPUT

User-Defined Design Flows		
Minor $Q_{known}$ (cfs)	1.6	0.3
Major $Q_{known}$ (cfs)	10.7	3.4
Bypass (Carry-Over) Flow from Upstream		
Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0
Major Bypass Flow Received, $Q_b$ (cfs)	0.0	0.0
Watershed Characteristics		
Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		
Watershed Profile		
Overland Slope (ft/ft)		
Overland Length (ft)		
Channel Slope (ft/ft)		
Channel Length (ft)		
Minor Storm Rainfall Input		
Design Storm Return Period, $T_r$ (years)		
One-Hour Precipitation, $P_1$ (inches)		
Major Storm Rainfall Input		
Design Storm Return Period, $T_r$ (years)		
One-Hour Precipitation, $P_1$ (inches)		

## CALCULATED OUTPUT

Minor Total Design Peak Flow, $Q$ (cfs)	1.6	0.3
Major Total Design Peak Flow, $Q$ (cfs)	10.7	3.4
Minor Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	0.0
Major Flow Bypassed Downstream, $Q_b$ (cfs)	N/A	0.0

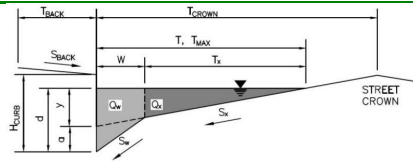


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Overland Ranch Filling 1

Inlet ID: CL6

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	24.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	26.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_o =$	0.083	ft/ft
$S_o =$	0.026	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	26.0	ft
$d_{MAX} =$	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

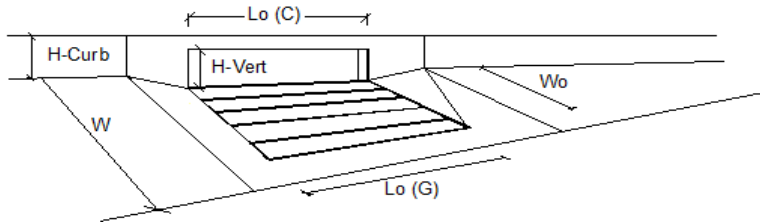
	Minor Storm	Major Storm	
$Q_{allow} =$	15.1	53.1	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.50 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.61 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



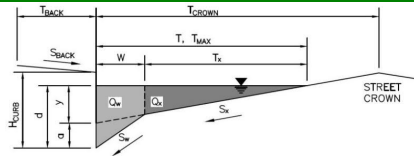
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$N_o$ =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity		MINOR		MAJOR	
Total Inlet Interception Capacity		$Q$ =	1.4	3.2	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.1	3.4	cfs
Capture Percentage = $Q_o/Q_a$		$C\%$ =	95	49	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Overland Ranch Filing 1

Inlet ID: CL7

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$	=	0.0	ft
$S_{BACK}$	=	0.020	ft/ft
$n_{BACK}$	=	0.016	

$H_{CURB}$	=	6.00	inches
$T_{CROWN}$	=	26.0	ft
$W$	=	2.00	ft
$S_x$	=	0.020	ft/ft
$S_w$	=	0.083	ft/ft
$S_o$	=	0.026	ft/ft
$n_{STREET}$	=	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$	= 16.0	= 26.0	ft
$d_{MAX}$	= 6.0	= 12.0	inches

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

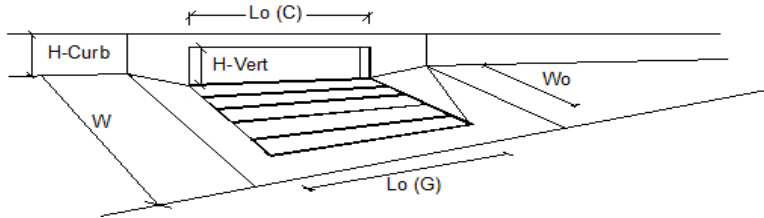
	Minor Storm	Major Storm	
$Q_{allow}$	= 15.1	= 51.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.25 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.99 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



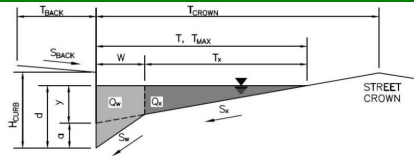
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_l$ (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_r$ (C) =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR		MAJOR
Total Inlet Interception Capacity		$Q$ =	1.2	2.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	1.4	cfs
Capture Percentage = $Q_i/Q_o$		C% =	99	64	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Overland Ranch Filing 1

Inlet ID: CL3

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	0.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	26.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.048	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	26.0	ft
$d_{MAX} =$	6.0	12.0	inches

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

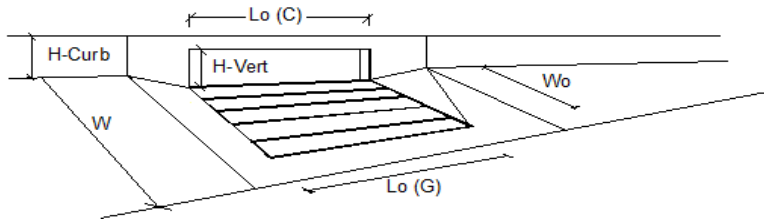
	Minor Storm	Major Storm	
$Q_{allow} =$	15.4	69.9	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.24 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.95 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



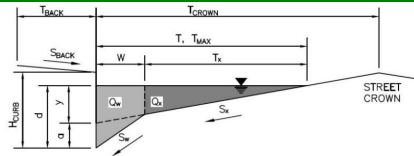
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_l (G)$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_r (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			MINOR		MAJOR
Total Inlet Interception Capacity		$Q$ =	1.2	3.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o$ =	0.0	0.0	cfs
Capture Percentage = $Q_i/Q_o$		$C\%$ =	100	99	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Overland Ranch Filing 1

Inlet ID: CL4

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	24.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	26.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	26.0	ft
$d_{MAX} =$	6.0	12.0	inches

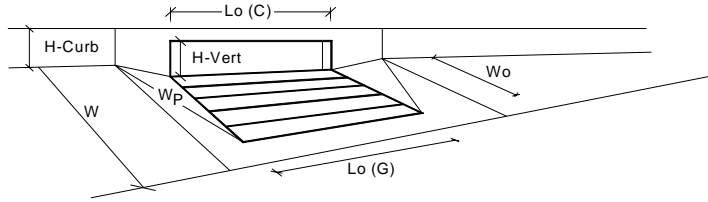
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.6	6.6	inches
<b>Grate Information</b>			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>			MINOR	MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>o</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			MINOR	MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.14	0.39	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.75	0.97	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.8	10.8	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.7	10.7	cfs

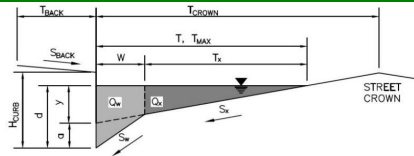


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Overland Ranch Filing 1

Inlet ID: CL5

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	0.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	26.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	16.0	26.0	ft
$d_{MAX} =$	6.0	12.0	inches

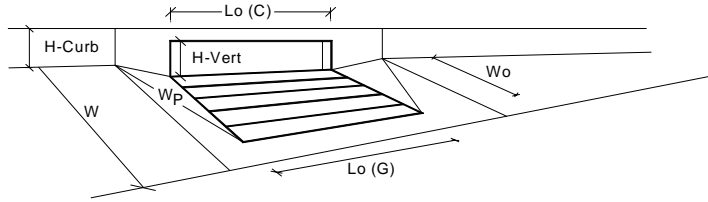
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



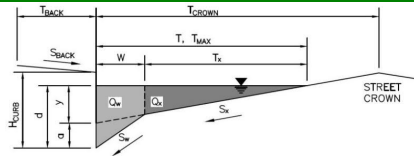
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.5	5.7	inches
<b>Grate Information</b>			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>			MINOR	MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>o</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			MINOR	MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.13	0.31	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.99	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.3	4.9	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.2	4.7	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Overland Ranch Filing 1

Inlet ID: UB12

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

MINOR STORM Allowable Capacity is not applicable to Sump Condition

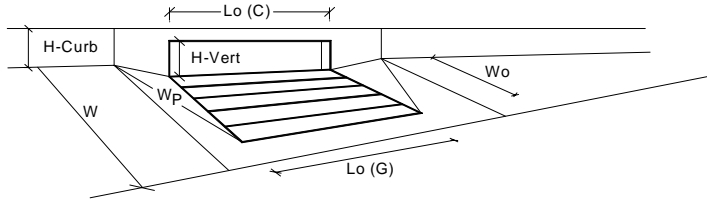
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

Warning 02

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



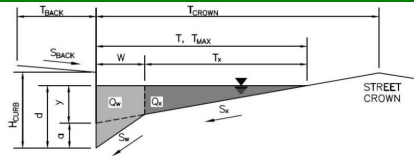
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.2	4.9	inches
<b>Grate Information</b>			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>			MINOR	MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>o</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			MINOR	MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.10	0.25	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.96	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	0.9	3.4	cfs
		Q <sub>PEAK REQUIRED</sub> =	0.8	3.4	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Overland Ranch Filing 1

Inlet ID: UB13

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	15.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.016	

$H_{CURB} =$	4.00	inches
$T_{CROWN} =$	17.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.016	

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.6	12.0	inches

MINOR STORM Allowable Capacity is not applicable to Sump Condition

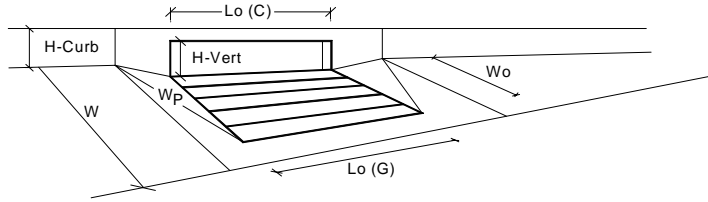
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

Warning 02

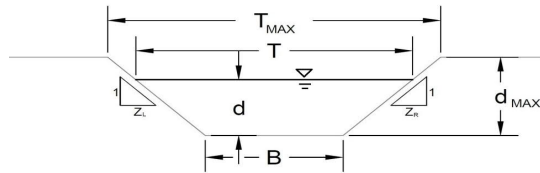
# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.8	8.6	inches
<b>Grate Information</b>			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>			MINOR	MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>r</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			MINOR	MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.15	0.55	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q <sub>a</sub> =	1.7	10.7	cfs
		Q <sub>PEAK REQUIRED</sub> =	1.6	10.7	cfs

## AREA INLET IN A SWALE

Overland Ranch Filing 1  
UB3A

This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

**Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)**

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

Soil Type:	Max. Velocity ( $V_{MAX}$ )	Max Froude No. ( $F_{MAX}$ )
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

A, B, C, D, or E =

n =	0.030
$S_0$ =	0.0500 ft/ft
B =	0.00 ft
Z1 =	10.00 ft/ft
Z2 =	4.50 ft/ft

Choose One:

- ☐ Non-Cohesive  
☒ Cohesive  
☐ Paved

Maximum Allowable Top Width of Channel for Minor & Major Storm  
 Maximum Allowable Water Depth in Channel for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX}$ =	14.00	18.00	ft
$d_{MAX}$ =	1.00	1.20	ft

**Allowable Channel Capacity Based On Channel Geometry**

MINOR STORM Allowable Capacity is based on Top Width Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow}$ =	45.9	81.9	cfs
$d_{allow}$ =	0.97	1.20	ft

**Water Depth in Channel Based On Design Peak Flow**

Design Peak Flow

Water Depth

$Q_o$ =	0.3	3.4	cfs
d =	0.15	0.36	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

## AREA INLET IN A SWALE

Overland Ranch Filing 1  
UB3A

## Inlet Design Information (Input)

Type of Inlet

CDOT TYPE D (Parallel)

Inlet Type =

CDOT TYPE D (Parallel)

Angle of Inclined Grate (must be  $\leq 30$  degrees)

Width of Grate

Length of Grate

Open Area Ratio

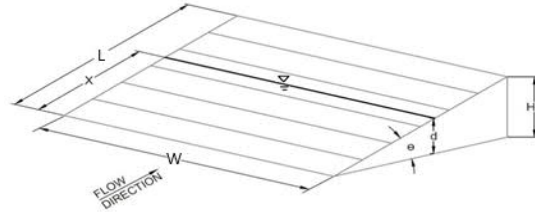
Height of Inclined Grate

Clogging Factor

Grate Discharge Coefficient

Orifice Coefficient

Weir Coefficient

 $\theta =$  0.00 degrees

W = 6.00 ft

L = 3.00 ft

 $A_{\text{RATIO}} =$  0.70 $H_B =$  0.00 ft $C_f =$  0.38 $C_d =$  0.76 $C_o =$  0.50 $C_w =$  1.62

Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)

Total Inlet Interception Capacity (assumes clogged condition)

Bypassed Flow

Capture Percentage =  $Q_a/Q_o$ 

MINOR

MAJOR

d = 0.15 0.36

 $Q_a =$  1.4 5.7 cfs $Q_b =$  0.0 0.0 cfs

C% = 100 100 %

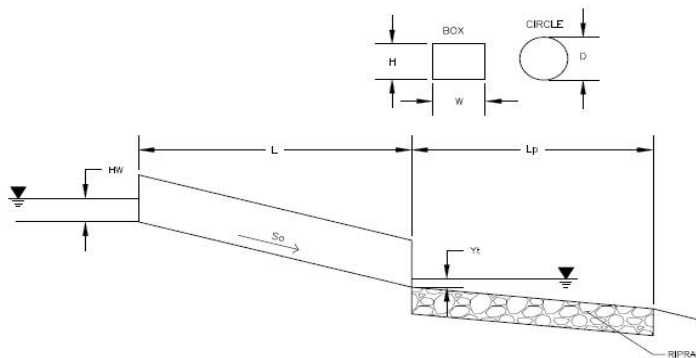


# DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: Trails at Overland Ranch

ID: Culvert A1



Soil Type:

Choose One:

☐ Sandy

☒ Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

## Design Information:

Design Discharge

Q = 4.91 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 18 inches

Inlet Edge Type (Choose from pull-down list)

Grooved Edge Projecting

OR:

Box Culvert:

Barrel Height (Rise) in Feet

H (Rise) =

Barrel Width (Span) in Feet

W (Span) =

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

# Barrels = 1

Inlet Elevation

Elev IN = 6096.26 ft

Outlet Elevation OR Slope

Elev OUT = 6095.15 ft

Culvert Length

L = 25.6 ft

Manning's Roughness

n = 0.013

Bend Loss Coefficient

k<sub>b</sub> = 0

Exit Loss Coefficient

k<sub>x</sub> = 1

Tailwater Surface Elevation

Y<sub>t</sub>, Elevation = 6096.35 ft

Max Allowable Channel Velocity

V = 7 ft/s

## Calculated Results:

Culvert Cross Sectional Area Available

A = 1.77 ft<sup>2</sup>

Culvert Normal Depth

Y<sub>n</sub> = 0.48 ft

Culvert Critical Depth

Y<sub>c</sub> = 0.85 ft

Froude Number

Fr = 2.98 Supercritical!

Entrance Loss Coefficient

k<sub>e</sub> = 0.20

Friction Loss Coefficient

k<sub>f</sub> = 0.46

Sum of All Loss Coefficients

k<sub>s</sub> = 1.66 ft

Headwater:

Inlet Control Headwater

HW<sub>i</sub> = 1.20 ft

Outlet Control Headwater

HW<sub>o</sub> = N/A

Design Headwater Elevation

HW = 6097.46 ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/D = 0.80

Outlet Protection:

Flow/(Diameter<sup>2.5</sup>)

Q/D<sup>2.5</sup> = 1.78 ft<sup>0.5</sup>/s

Tailwater Surface Height

Y<sub>t</sub> = 1.20 ft

Tailwater/Diameter

Y<sub>t</sub>/D = 0.80

Expansion Factor

1/(2\*tan(Θ)) = 6.70

Flow Area at Max Channel Velocity

A<sub>t</sub> = 0.70 ft<sup>2</sup>

Width of Equivalent Conduit for Multiple Barrels

W<sub>eq</sub> = - ft

Length of Riprap Protection

L<sub>p</sub> = 5 ft

Width of Riprap Protection at Downstream End

T = 3 ft

Adjusted Diameter for Supercritical Flow

Da = 0.99 ft

Minimum Theoretical Riprap Size

d<sub>50 min</sub> = 1 in

Nominal Riprap Size

d<sub>50 nominal</sub> = 6 in

MHFD Riprap Type

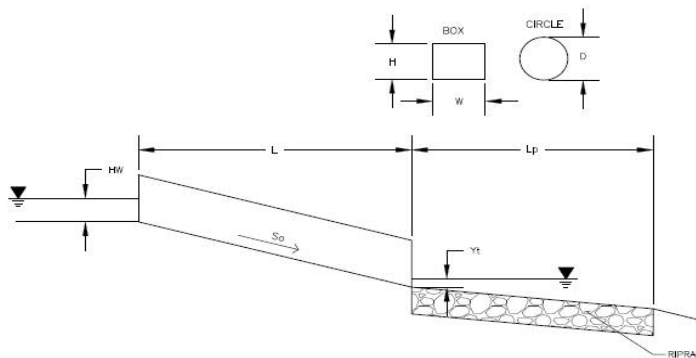
Type = VL

# DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: Trails at Overland Ranch

ID: Culvert B3C



Soil Type:

Choose One:

☒ Sandy

☐ Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

## Design Information:

Design Discharge

Q = 7.34 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 18 inches

Inlet Edge Type (Choose from pull-down list)

Grooved Edge Projecting

OR:

Box Culvert:

Barrel Height (Rise) in Feet

H (Rise) =

Barrel Width (Span) in Feet

W (Span) =

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

# Barrels = 1

Inlet Elevation

Elev IN = 6135.13 ft

Outlet Elevation OR Slope

Elev OUT = 6133.9 ft

Culvert Length

L = 49.25 ft

Manning's Roughness

n = 0.012

Bend Loss Coefficient

k<sub>b</sub> = 0

Exit Loss Coefficient

k<sub>x</sub> = 1

Tailwater Surface Elevation

Y<sub>t</sub>, Elevation =

Max Allowable Channel Velocity

V = 5 ft/s

## Calculated Results:

Culvert Cross Sectional Area Available

A = 1.77 ft<sup>2</sup>

Culvert Normal Depth

Y<sub>n</sub> = 0.67 ft

Culvert Critical Depth

Y<sub>c</sub> = 1.05 ft

Froude Number

Fr = 2.39 Supercritical!

Entrance Loss Coefficient

k<sub>e</sub> = 0.20

Friction Loss Coefficient

k<sub>f</sub> = 0.76

Sum of All Loss Coefficients

k<sub>s</sub> = 1.96 ft

Headwater:

Inlet Control Headwater

HW<sub>i</sub> = 1.57 ft

Outlet Control Headwater

HW<sub>o</sub> = N/A

Design Headwater Elevation

HW = 6136.70 ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/D = 1.04

Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:

Flow/(Diameter<sup>2.5</sup>)

Q/D<sup>2.5</sup> = 2.66 ft<sup>0.5</sup>/s

Tailwater Surface Height

Y<sub>t</sub> = 0.60 ft

Tailwater/Diameter

Y<sub>t</sub>/D = 0.40

Expansion Factor

1/(2\*tan(Θ)) = 4.84

Flow Area at Max Channel Velocity

A<sub>t</sub> = 1.47 ft<sup>2</sup>

Width of Equivalent Conduit for Multiple Barrels

W<sub>eq</sub> = - ft

Length of Riprap Protection

L<sub>p</sub> = 5 ft

Width of Riprap Protection at Downstream End

T = 3 ft

Adjusted Diameter for Supercritical Flow

Da = 1.08 ft

Minimum Theoretical Riprap Size

d<sub>50 min</sub> = 4 in

Nominal Riprap Size

d<sub>50 nominal</sub> = 6 in

MHFD Riprap Type

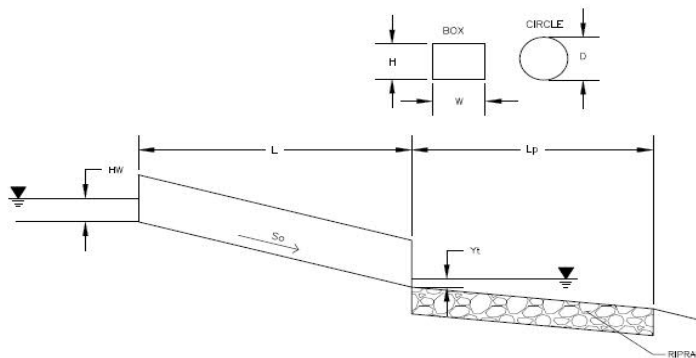
Type = VL

# DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: Trails at Overland Ranch

ID: Culvert B3D



Soil Type:

Choose One:

☒ Sandy

☐ Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

## Design Information:

Design Discharge

Q = 34.46 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 36 inches

Inlet Edge Type (Choose from pull-down list)

Grooved Edge Projecting

OR:

Box Culvert:

Barrel Height (Rise) in Feet

H (Rise) = OR ft

Barrel Width (Span) in Feet

W (Span) = ft

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

# Barrels = 1

Inlet Elevation

Elev IN = 6137.59 ft

Outlet Elevation OR Slope

Elev OUT = 6136.78 ft

Culvert Length

L = 40.25 ft

Manning's Roughness

n = 0.012

Bend Loss Coefficient

k<sub>b</sub> = 0

Exit Loss Coefficient

k<sub>x</sub> = 1

Tailwater Surface Elevation

Y<sub>t</sub>, Elevation = 6139.33 ft

Max Allowable Channel Velocity

V = 5 ft/s

## Calculated Results:

Culvert Cross Sectional Area Available

A = 7.07 ft<sup>2</sup>

Culvert Normal Depth

Y<sub>n</sub> = 1.20 ft

Culvert Critical Depth

Y<sub>c</sub> = 1.91 ft

Froude Number

Fr = 2.44 Supercritical!

Entrance Loss Coefficient

k<sub>e</sub> = 0.20

Friction Loss Coefficient

k<sub>f</sub> = 0.25

Sum of All Loss Coefficients

k<sub>s</sub> = 1.45 ft

Headwater:

Inlet Control Headwater

HW<sub>i</sub> = 2.77 ft

Outlet Control Headwater

HW<sub>o</sub> = 2.27 ft

Design Headwater Elevation

HW = 6140.36 ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/D = 0.92

Outlet Protection:

Flow/(Diameter<sup>2.5</sup>)

Q/D<sup>2.5</sup> = 2.21 ft<sup>0.5</sup>/s

Tailwater Surface Height

Y<sub>t</sub> = 2.55 ft

Tailwater/Diameter

Y<sub>t</sub>/D = 0.85

Expansion Factor

1/(2\*tan(Θ)) = 6.70

Flow Area at Max Channel Velocity

A<sub>t</sub> = 6.89 ft<sup>2</sup>

Width of Equivalent Conduit for Multiple Barrels

W<sub>eq</sub> = - ft

Length of Riprap Protection

L<sub>p</sub> = 9 ft

Width of Riprap Protection at Downstream End

T = 5 ft

Adjusted Diameter for Supercritical Flow

Da = 2.10 ft

Minimum Theoretical Riprap Size

d<sub>50 min</sub> = 2 in

Nominal Riprap Size

d<sub>50 nominal</sub> = 6 in

MHFD Riprap Type

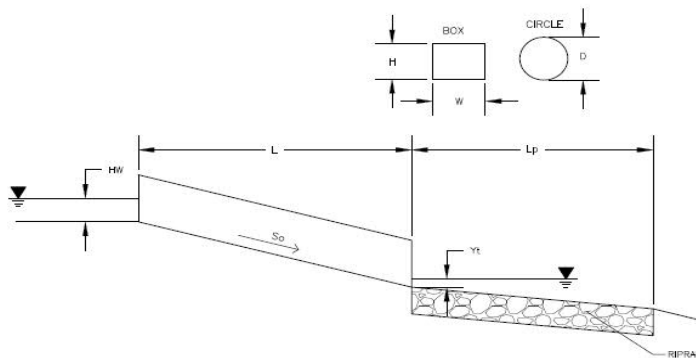
Type = VL

# DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: Trails at Overland Ranch

ID: Culvert B3E



Soil Type:

Choose One:

☒ Sandy

☐ Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

## Design Information:

Design Discharge

Q = 34.46 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 36 inches

Inlet Edge Type (Choose from pull-down list)

Grooved Edge Projecting

OR:

Box Culvert:

Barrel Height (Rise) in Feet

H (Rise) = OR ft

Barrel Width (Span) in Feet

W (Span) = ft

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

# Barrels = 1

Inlet Elevation

Elev IN = 6132 ft

Outlet Elevation OR Slope

Elev OUT = 6131.05 ft

Culvert Length

L = 47.7 ft

Manning's Roughness

n = 0.012

Bend Loss Coefficient

k<sub>b</sub> = 0

Exit Loss Coefficient

k<sub>x</sub> = 1

Tailwater Surface Elevation

Y<sub>t</sub> Elevation = 6134.07 ft

Max Allowable Channel Velocity

V = 5 ft/s

## Calculated Results:

Culvert Cross Sectional Area Available

A = 7.07 ft<sup>2</sup>

Culvert Normal Depth

Y<sub>n</sub> = 1.20 ft

Culvert Critical Depth

Y<sub>c</sub> = 1.91 ft

Froude Number

Fr = 2.43 Supercritical!

Entrance Loss Coefficient

k<sub>e</sub> = 0.20

Friction Loss Coefficient

k<sub>f</sub> = 0.29

Sum of All Loss Coefficients

k<sub>s</sub> = 1.49 ft

Headwater:

Inlet Control Headwater

HW<sub>i</sub> = 2.77 ft

Outlet Control Headwater

HW<sub>o</sub> = 2.62 ft

Design Headwater Elevation

HW = 6134.77 ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/D = 0.92

Outlet Protection:

Flow/(Diameter<sup>2.5</sup>)

Q/D<sup>2.5</sup> = 2.21 ft<sup>0.5</sup>/s

Tailwater Surface Height

Y<sub>t</sub> = 3.02 ft

Tailwater/Diameter

Y<sub>t</sub>/D = 1.01

Expansion Factor

1/(2\*tan(Θ)) = 6.70

Flow Area at Max Channel Velocity

A<sub>t</sub> = 6.89 ft<sup>2</sup>

Width of Equivalent Conduit for Multiple Barrels

W<sub>eq</sub> = - ft

Length of Riprap Protection

L<sub>p</sub> = 9 ft

Width of Riprap Protection at Downstream End

T = 5 ft

Adjusted Diameter for Supercritical Flow

Da = 2.10 ft

Minimum Theoretical Riprap Size

d<sub>50 min</sub> = 2 in

Nominal Riprap Size

d<sub>50 nominal</sub> = 6 in

MHFD Riprap Type

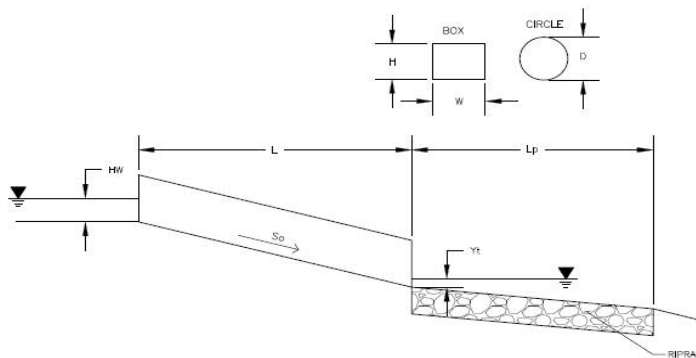
Type = VL

# DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: Trails at Overland Ranch

ID: Culvert OS2



Soil Type:

Choose One:

☒ Sandy

☐ Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

## Design Information:

Design Discharge

Q = 34.46 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 36 inches

Inlet Edge Type (Choose from pull-down list)

Grooved Edge Projecting

OR:

Box Culvert:

Barrel Height (Rise) in Feet

H (Rise) = OR ft

Barrel Width (Span) in Feet

W (Span) = ft

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

# Barrels = 1

Inlet Elevation

Elev IN = 6146.27 ft

Outlet Elevation OR Slope

Elev OUT = 6142.29 ft

Culvert Length

L = 86.93 ft

Manning's Roughness

n = 0.012

Bend Loss Coefficient

k<sub>b</sub> = 0

Exit Loss Coefficient

k<sub>x</sub> = 1

Tailwater Surface Elevation

Y<sub>t</sub>, Elevation = ft

Max Allowable Channel Velocity

V = 5 ft/s

## Calculated Results:

Culvert Cross Sectional Area Available

A = 7.07 ft<sup>2</sup>

Culvert Normal Depth

Y<sub>n</sub> = 0.96 ft

Culvert Critical Depth

Y<sub>c</sub> = 1.91 ft

Froude Number

Fr = 3.72 Supercritical!

Entrance Loss Coefficient

k<sub>e</sub> = 0.20

Friction Loss Coefficient

k<sub>f</sub> = 0.53

Sum of All Loss Coefficients

k<sub>s</sub> = 1.73 ft

Headwater:

Inlet Control Headwater

HW<sub>i</sub> = 2.73 ft

Outlet Control Headwater

HW<sub>o</sub> = N/A

Design Headwater Elevation

HW = 6149.00 ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/D = 0.91

Outlet Protection:

Flow/(Diameter<sup>2.5</sup>)

Q/D<sup>2.5</sup> = 2.21 ft<sup>0.5</sup>/s

Tailwater Surface Height

Y<sub>t</sub> = 1.20 ft

Tailwater/Diameter

Y<sub>t</sub>/D = 0.40

Expansion Factor

1/(2\*tan(Θ)) = 5.46

Flow Area at Max Channel Velocity

A<sub>t</sub> = 6.89 ft<sup>2</sup>

Width of Equivalent Conduit for Multiple Barrels

W<sub>eq</sub> = - ft

Length of Riprap Protection

L<sub>p</sub> = 15 ft

Width of Riprap Protection at Downstream End

T = 6 ft

Adjusted Diameter for Supercritical Flow

Da = 1.98 ft

Minimum Theoretical Riprap Size

d<sub>50</sub> min = 6 in

Nominal Riprap Size

d<sub>50</sub> nominal = 9 in

MHFD Riprap Type

Type = L

APPENDIX 4  
SUPPORTING DOCUMENTATION

## Master Drainage Report

### Trails at Overland Ranch

Aurora, Colorado

Project No. 1002-98

#### FACSIMILE

This electronic plan is a facsimile of the  
signed and sealed pdf set

*Xylina Warren-Laird*  
Xylina Warren-Laird, PE

Date: 7/22/2022

#### Submittal:

1<sup>st</sup>: September 10, 2021

2<sup>nd</sup>: December 17, 2021

3<sup>rd</sup>: April 15, 2022

4<sup>th</sup>: July 22, 2022

**Approved For One Year From This Date**

08/05/2022

DE GGS

*Haley B. Hansen*

City Engineer

07/26/2022

Date

*Vernon A. Adam*

Water Department

08/04/2022

Date

#### Prepared For:

Richmond American Homes  
4350 S. Monaco St.  
Denver, CO 80237  
(970) 977-3841  
Contact: Jerry Richmond  
Jerry.Richmond@mdch.com

#### Prepared By:

Innovative Land Consultants, Inc.  
12071 Tejon Street, Suite 470  
Westminster, CO 80234  
(303) 421-4224  
Contact: Xylina Warren-Laird  
xylina@innovativelandinc.com

has two large unregulated drainageways and multiple smaller ones. Although the site has multiple ridges and drainageways, the site drains to Coal Creek.

The project is a mix of single family residential, parks, open space, and a clubhouse amenity, along with associated infrastructure needed to serve the development. S. Monaghan Road, an arterial street, will be fully constructed with this development along with half of the full County Line Road arterial street section. This development is responsible for treating and detaining those adjacent offsite streets. The residential has a density of 3 dwelling units/acre, which, along with a standard local street section, generates a single family impervious of 53%. Note that the overall final project density is required to meet the 3 dwelling units/acre, if the density increases this master report will need to be amended. The right-of-way (ROW) impervious of the various street sections was analyzed to determine that an 80% impervious was the maximum impervious generated by a street section for a collector or arterial street; therefore 80% impervious was used for all non-local street ROW within the project. The below impervious values were used for the following conditions:

- 2% Imp – Type B Soils – Historic conditions and lawns
- 5% Imp – Type C Soils – Historic conditions, lawns, and open space
- 10% Imp – Parks and playgrounds
  - Playground impervious was used to allow flexibility between parks and playground areas in the development
- 53% Imp – Single family residential with Local Street ROW included
- 80% Imp – Collector/Arterial ROW
- 85% Imp – Planning Area 4 (PA-4) the Clubhouse
  - Corresponds to Business impervious in neighborhood areas
- 15% Imp – High Density Rural Residential
  - Impervious is from the governing FHAD of the area for the future development south of the project area
- 100% Imp – Streets and Ponds

Aurora has indicated that pond footprints should be considered 100% impervious for drainage calculations, therefore the pond footprints have been estimated to take this high impervious into consideration.

## II. Historic Drainage

### 1. Description of Property

#### a. Area in Acres, Soils, Ground Cover, Topography, Hydrologic Soil Groups

The site lies within the Coal Creek basin. Locally there are multiple ridges and drainageways through the project site, sending runoff from the site to the northwest, north, northeast, east, and southeast. There are three drainageways through the project site, all conveying runoff to the north and northeast. These correspond to Basins H34, H33, H37, and H39A and H39B. These drainageways do not connect onsite, but farther to the north they entry Mutchie Creek which outfalls to Coal Creek. Basin H29 at the western edge



flows north and west into S. Monaghan Road where it is picked up by the existing storm sewer system and conveyed to Mutchie Creek to the north. There are two basins in the southeast corner of the site, Basins H18B and H19, which flow to the southeast into Llama Draw, which flows to Coal Creek. The basins are shown on the Master Drainage Plan – Existing Conditions. The project is generally located at the most upstream end of the major basin that flows to Coal Creek.

There is a discrepancy in the soils classification for this project. The *Coal Creek (E. Yale Avenue to E. County Line Road) Flood Hazard Area Delineation* (henceforth referred to as the CC FHAD) classify nearly all of the onsite soils as Hydrologic Soil Groups C and D with only a small sliver of B soils at the southeastern corner of the project area. However, the NRCS map for the project area shows the site as mixed between Soils Groups B and C, with B as the predominate soil type. The NRCS soils map has been used for the soil types on the project site. Both sets of reference information can be found in Appendix C.

The project site has multiple ridges and drainageways. Slopes on the project site vary from 5% to 12% with steeper slopes in some of the drainageways near the north (downstream) side of the project site where there has been some erosion.

b. General Historic Drainage Patterns

As previously noted, runoff from the project site flows offsite to the northwest, north, northeast, east, and southeast, although predominately to the north through the three existing drainageways. 38% of the site flows to Drainageway 1 at DP2. 9% of the site drains to the middle, smaller drainageway at DP3. 41% of the site drains to Drainageway 2 at DP4. The three drainageways continue to flow to the north and east until joining with Mutchie Creek north of the project site. 4% of the project site drains to Monaghan Road to north. There are two basins at the southeast corner of the project, consisting of 8% of the site, that flow to the south and east, crossing E. County Line Road to the east of the project site and eventually to Llama Draw. All of the site ultimately outfalls to Coal Creek.

## 2. Overall Basin Description

a. Offsite Basins

There are two historic offsite basins that impact the project site. Basin HO33 is undeveloped land south of the project site, south of E. County Line Road. There are two low points for this basin, both with 18" CMP culverts which drain north across E. County Line Road into Basin H33 at Design Point 9 (DP9). The two points of discharge travel in separate draws until combining into the main western natural drainage channel, referred to as Drainageway 1.

The second offsite basin, Basin HO39 is located on the northeastern side of the property. It's a small undeveloped triangular basin in the Colorado State land. This basin concentrates into a small natural drainageway at the project site

boundary at DP10 within Basin H39B. This drainageway flows to the northwest and combines with the existing natural drainageway on the east half of the project, referred to as Drainageway 2, at DP4A north of the project site.

b. Major Drainageways

There are two main drainageways through the project; neither has an official name. The western drainageway has been named Drainageway 1 on the Master Drainage Plans. The eastern drainageway is Drainageway 2. The northern quarter of Drainageway 1 has enough contributing area that it is Mile High Flood District (MHFD) maintenance eligible. Drainageway 2 becomes MHFD maintenance eligible offsite north of the property line at DP4A.

Drainageway 1, because it is a MHFD maintenance eligible stream corridor, will be located within a separate tract and owned by the City of Aurora. The drainage corridor set aside for it is 115' wide with a reach length of 1,140'. Drainageway 2, which conveys a similar flow rate to Drainageway 1, has a drainage corridor set aside for it that is 115' wide with a reach length of 975'. Drainageway 2 shall be designed as an open channel per City of Aurora criteria.

Neither drainageway has a regulated or unregulated floodplain associated with it at this time.

The drainageways are natural channels with well-established vegetation. The southern half of the drainageways shows no signs of erosion. A site visit with both Mile High Flood District and Aurora Water determined that, in general, no channel improvements are necessary due to existing conditions in this area. There may be localized areas with minor erosion that will require some improvement, but that will be established in future detailed drainage reports.

As both drainageways progress to the north, the channels become more incised and there is clear evidence of erosion in the channel bed. Improvements to these areas are necessary to mitigate the erosion. These erosive areas within the drainageways are at the far downstream end of the project site. Proposed streets E. Mineral Avenue and E. Elmhurst Avenue, along with the culvert crossings, and the full spectrum inline detention ponds are located in the erosive areas. The proposed improvements will remove the eroded areas and the ponds will discharge into the natural drainageways at the north end of the project site.

c. Existing Irrigation Facilities

There are no known major irrigation facilities located on or adjacent to the project site.

d. Major Drainageway Planning Studies

The only current study for the project area is the *Coal Creek (E. Yale Avenue to E. County Line Road) Flood Hazard Area Delineation* (henceforth referred to as the CC FHAD), prepared by Matrix Design Group, and dated August 2014. Excerpts from the CC FHAD can be found in Appendix C. The CC FHAD

classified the entire project area as Residential (2 DU/ac) with an impervious of 45%. The proposed conditions of the project site have a higher residential density of 3 DU/ac which would have corresponded to a 50% impervious in the study.

The Trails at Overland Ranch project has a proposed total site impervious of 47%, just slightly higher than anticipated in the CC FHAD. This is primarily due to Aurora criteria using a higher impervious than MHDF criteria. For example, MHDF uses a 2% impervious for open space and Aurora uses 5%. Additionally, the proposed detention pond areas have been assumed to be 100% impervious in keeping with current Aurora standards for detention pond impervious. If these detention pond areas were converted to an open space impervious of 5%, the total project site impervious drops to 45%. Therefore, despite the minor increase in the impervious, the project is within conformance with the CC FHAD.

The CC FHAD shows that the individual basins that include the site have an impervious value lower than 45%. This is because, the CC FHAD basins include the offsite areas around the project site with lower impervious values, such as 40% impervious for the Colorado State Lane, and a 15% impervious for the future "high density rural residential" located immediately south of the project. The CC FHAD also does not include detention ponds in its modeling; it only includes regional ponds serving more than 130 acres. The proposed project detention ponds will reduce the proposed onsite runoff rate to the existing runoff rate or less.

The site is within flood zone "X" which are areas outside the FEMA regulated floodplain, according to the FEMA FIRM panels 08005C0508K and 08005C0509K, dated December 17, 2010. The FEMA FIRM maps may be found in Appendix C.

e. Existing Drainage Patterns Through Property

The majority of the site drains to the north to Mutchie Creek through the concentrated drainageways. The southeastern corner of the project drains to the southeast to Llama Draw. Both Mutchie Creek and Llama Draw drain toward the north to Coal Creek. The existing land is undeveloped.

f. Outfalls Downstream from Property

North and east of the project site is undeveloped Colorado State land. It may never be developed. The majority of the project outfalls through three existing drainageways through the Colorado State Land which extends approximately 4.5 miles north and 4 miles east of the project site. The proposed detention ponds will restrict the runoff to either the existing flow rate or the 1 cfs/ac allowable flowrate, whichever is smaller.

South of the project is existing undeveloped land with scattered existing individual residences. According to the CC FHAD, the land south of the project area is anticipated to be High Density Rural Residential (1DU/ 3-10 ac) with an impervious of 15%. Basin 18B-1, which flows to the southeast, discharges

provided in Appendix B. The below point rainfall values were used to generate the minor and major raingauges in the CUHP models.

2 Year  $P_1 = 0.99$  in

100 Year  $P_1 = 2.65$  in

The above point rainfall values were generated using figures RA1 – RA6 per City of Aurora criteria. This report is using these values as opposed to the NOAA 14 values, which are lower, to be more conservative and may result in oversized facilities. The flows may need to be corrected to the NOAA 14 peak rainfall values. The MHFD maintenance eligible channel flow rates may need to be calculated using NOAA 14 values.

b. Detention Volume Computation Method

Detention is provided by the proposed full spectrum detention ponds. The required volumes for the pond were calculated using the MHFD USDCM Vol. 3 equations for water quality and Excess Urban Runoff Volume (EURV). The SWMM model was used to determine the required detention pond volume for each pond. Allowable release rates of 0.85 cfs/acre (100-year) is based on the City of Aurora requirements per section 6.33 for detention ponds with Hydrologic Soil Group B watersheds. The historic release rate for each basin will be compared to the Aurora allowable release rate and the smaller of the two shall be used as the actual pond release rate. Refer to Appendix B for detention and water quality volume calculations

The ponds will be designed to comply with Colorado statute 37-92-602 (8):

- 97% of the 5-year storm event be drained within 72 hours, and
- 99% of all rainfall in events larger than the 5-year storm be released within 120 hours.

During the Site Plan development, the following items will be requirements for the detention pond.

- Aurora requires 1' of freeboard above the 100-yr water surface elevation to the emergency overflow weir crest
- The 100-yr detention volume is considered to be 100-yr + 1/2 EURV for full spectrum ponds, 100-yr + 1/2 WQCV for detention plus water quality ponds, and the 100-yr water surface elevation reached in the 100-yr event for EURV and/or WQ only ponds
- MHFD requires 1' of freeboard above the 100-yr water surface elevation over the emergency overflow to the top of the pond embankment
- The Preliminary Drainage must include a calculation of the 100-yr water surface elevation over the emergency overflow weir to determine freeboard requirements are met.

c. Design Frequencies

Runoff was calculated for the minor and major storm events, the 2-yr and 100-yr storms, respectively.

Basin names for the project conform to the basin names used in the CC FHAD. See the below table for detailed drainage proposed basin information.

Basin Runoff Calculations - Direct Runoff										
Basin ID	Design Point	Total Area (Ac.)	Imp (%)	Time Peak (min)		Runoff Coeff.			Peak Flow (cfs)	
				2-yr	100-yr	C <sub>2</sub>	C <sub>5</sub>	C <sub>100</sub>	Q <sub>2</sub>	Q <sub>100</sub>
Proposed										
18B-1	7	22.15	51%	32.0	37.0	0.42	0.47	0.60	12.00	59.00
19A	8	2.15	28%	30.0	35.0	0.28	0.31	0.40	1.00	8.00
29	1	8.74	68%	30.0	35.0	0.54	0.58	0.71	9.00	34.00
33A	5	34.80	51%	30.0	35.0	0.41	0.45	0.58	27.00	127.00
33B	5	38.96	44%	31.0	37.0	0.36	0.41	0.59	21.00	113.00
33C	12	26.85	41%	32.0	37.0	0.36	0.40	0.51	12.00	68.00
33D	11	23.45	46%	31.0	36.0	0.39	0.43	0.54	14.00	72.00
34	5A	26.98	50%	32.0	37.0	0.42	0.46	0.60	15.00	72.00
37	3	28.20	54%	32.0	37.0	0.43	0.47	0.61	17.00	76.00
39A-1	13	51.82	53%	31.0	36.0	0.42	0.47	0.62	37.00	171.00
39A-2	6	64.06	47%	30.0	35.0	0.38	0.43	0.57	49.00	246.00
39B-1	6A	30.36	39%	31.0	36.0	0.38	0.41	0.52	15.00	92.00
39B-2	4A	11.32	2%	35.0	41.0	0.15	0.16	0.20	0.00	19.00
39B-3	6A	5.25	29%	39.0	45.0	0.28	0.31	0.41	1.00	8.00
O33A	9	21.79	17%	32.0	39.0	0.32	0.36	0.61	4.00	49.00
O33B	9A	13.65	17%	31.0	36.0	0.32	0.37	0.61	3.00	34.00
Pond 302*	5A/2	186.48	41%		84.0	0.37	0.42	0.58	0.18	127.90
Pond 306	3A/3	28.20	54%		85.0	0.43	0.47	0.61	0.18	23.40
Pond 309	6A/4	151.49	47%		76.0	0.39	0.43	0.57	0.19	128.30
Pond 311	7A/7	22.15	51%		84.0	0.42	0.47	0.60	0.17	10.50
Pond 329	1A/1	8.74	68%		72.0	0.54	0.58	0.71	0.12	7.40

\*Pond 302 information includes offsite Basins O33A and O33B because they flow through the pond.

Basin 18B-1 is located at the southeastern corner of the project site. It includes a part of residential PA-9, PA-12, and PA-31, and open spaces PA-10 and PA-11, along with collector/arterial ROW. Detention Pond 311 is included in this area; the pond will outfall south to the north side of E. County Line Road to the existing roadside ditch at DP7.

Basin 19A is immediately north of Basin 18B-1 along the eastern site property line. It is comprised of a portion of residential PA-9 and open space PA-10. Runoff from this area sheet flows to the southeast to DP8. The area that drains in this direction has been significantly reduced and the proposed 100-yr peak flow rate is less than the historic flow rate from this basin. Additionally, the basin consists of the back halves of the residential lots draining through a green space prior to leaving the project site; a level of detail that is not shown in the planning area delineations. The greenspace provides water quality treatment as a grass buffer. Because this basin slopes away from the project

site, there are likely areas that cannot be treated in nearby Pond 311, but the pond is sized to treat the full basin and the pond allowable flow rate has been reduced to offset the free release from Basin 19A.

Basin 29 is located at the northwestern corner of the project site and includes a portion of residential PA-1 and PA-17, and adjacent collector/arterial ROW. Runoff from this basin is anticipated to sheet flow to the west and northwest where it will be treated and detained in a small detention pond located at the northwest corner of the project site, Pond 329. The pond outfalls to S. Monaghan Road where it will be collected by an existing storm sewer system and conveyed north at DP1.

Basin 33A is immediately north of Basin 33C. It is comprised of residential PA-1, PA-17 and PA-18, and open space PA-20 along with collector/arterial ROW. Runoff from this basin flows north to E. Mineral Avenue, then inward toward Drainageway 1 located within PA-20. Runoff will be collected via storm sewer and piped to the proposed 7'x7' RCB culvert needed to convey the runoff from Drainageway 1 to Detention Pond 302 north of E. Mineral Avenue. The basin outfalls to DP5A which represents the end of the culvert.

Basin 33B is immediately north of Basin 33D. It is comprised of residential PA-21, PA-22, and PA-24, neighborhood park PA-23, and open space PA-20 along with collector/arterial ROW. Runoff from this basin flows north to E. Mineral Avenue, then inward toward Drainageway 1 located within PA-20. Runoff will be collected via storm sewer and piped to the proposed 7'x7' RCB culvert needed to convey the runoff from Drainageway 1 to Detention Pond 302 north of E. Mineral Avenue. The basin outfalls to DP5A which represents the end of the culvert.

Basin 33C is immediately south of Basin 33A. It is comprised of residential PA-16, PA-18, and PA-21, park PA-19, and open space PA-20 along with collector/arterial ROW. The majority of this basin will be collected in storm sewer and piped to Drainageway 1 with only areas immediately adjacent to the drainageway sheet flowing directly to it. There are no anticipated improvements to the existing drainage channel other than what is needed to safely discharge piped flow. This basin outfalls to DP12 located within the natural drainage channel.

Basin 33D is located south of Basin 33B. It includes residential PA-14, PA-16, and PA-21, and open space PA-15 and PA-20 along with collector/arterial ROW. Runoff from this basin flows inward toward Drainageway 1 located within PA-20. The majority of this basin will be collected in storm sewer and piped to Drainageway 1 with only areas immediately adjacent to the drainageway sheet flowing directly to it. There are no anticipated improvements to the existing drainage channel other than what is needed to safely discharge piped flow. This basin outfalls to DP11 located within the natural drainage channel. There are no anticipated improvements to the existing drainage channel other than what is needed to safely discharge

pipled flow. Offsite Basins O33A and O33B are both pipled north under E. County Line Road to combine with the storm sewer system in Basin 33D and outfall into Drainageway 1.

Basin 34 is immediately north of Basins 33A and 33B. It includes residential PA-1 and PA-4, Administrative Activity Center (AAC) PA-3 and open space PA-2 along with collector ROW. The PA-3 AAC is split between a clubhouse amenity with a high impervious and a park/playground with that associated impervious. Runoff is conveyed inward toward Detention Pond 302 located within PA-2 via pipe and surface flow. The pond outfalls to the existing drainageway at the north property line at DP2.

Basin 37 is in the north central area of the site. Included within it is residential PA-4, PA-6, PA-25, and PA-26, and open space PA-5 along with collector ROW. Runoff from this basin flows inward toward PA-5 where Detention Pond 306 is located. Storm sewer will collect runoff from the various planning areas and convey the runoff to the pond. Pond 306 outfalls to the north to an existing drainageway at DP3.

Basin 39A-1 is located at the south-central area of the project site. It includes residential PA-12, PA-13, PA-14, PA-24, PA-25, PA-27, and PA-31, park PA-29, and open space PA-30 along with collector/arterial ROW. Runoff from this basin is conveyed via street and pipe to the open space PA-30 toward Drainageway 2. Only areas immediately adjacent to the drainageway will sheet flow to it. There are no anticipated improvements to the existing drainage channel other than what is needed to safely discharge piped flow. This basin outfalls to DP13 located within the natural drainage channel.

Basin 39A-2 is located immediately north of Basin 39A-1. The basin is comprised of residential PA-6 PA-9, PA-10, PA-26, and PA-31, , neighborhood park PA-30, and open space PA-30. Runoff flows in streets or is piped north to E. Elmhurst Avenue, then inward toward Drainageway 2 located within PA-30. Piped runoff will be conveyed to the proposed 7'x7' RCB culvert that conveys runoff from Drainageway 2 to Detention Pond 309 north of E. Elmhurst Avenue . The basin outfalls to DP6A at the end of the culvert.

Basin 39B-1 is north of Basin 39A-2 along the northern property line. It consists of residential PA-6 and PA-9 and open space PA-7. Runoff generally flows inward toward Detention Pond 309 located within PA-7 via pipe and surface flow. The pond outlets to the north to the existing drainageway at DP4.

Basin 39B-2 is in the northeast corner of the project site. It consists of open space PA-8. There is a local drainageway in PA-8 that conveys the runoff for this basin and adjacent offsite Basin HO39 to the northwest to the northern property line at DP4A. This drainageway combines with the outfall from Detention Pond 309 to flow to the north in the existing natural drainageway through the Colorado State land. Because of its location within the project site, this area is anticipated to be undisturbed/undeveloped by the proposed



development. The existing SWMM model shows a maximum velocity of 4.7 fps, which is considered non-erosive. Therefore, no improvements to the minor drainageway through this basin are anticipated. If this area is developed, Pond 309 will be oversized to detain for this area and water quality will be provided separately.

Basin 39B-3 is south of Basin 39B-2, adjacent to the eastern property line. It consists of residential PA-9 and open space PA-8. Runoff generally flows northwest toward Detention Pond 309 located within PA-7 via surface flow. The pond outlets to the north to the existing drainageway at DP4.

Pond information with the allowable release rates is shown in the table below. Additional pond information can be found in the Specific Details section below.

Detention Pond Table						
		Pond Name				
Desc.	Units	302***	306	309	311	329
Area	Acre	186.48	28.20	151.49	22.15	8.74
MEP Eligible**		Yes	No	Yes	No	No
Imperv.	%	41%	54%	47%	51%	68%
WQCV	Acre-Ft	3.66	0.58	2.99	0.46	0.08
EURV	Acre-Ft	8.73	1.49	7.48	1.21	0.23
100-Yr	Acre-Ft	19.48	2.83	15.74	2.78	1.07
100-Yr + 1/2 EURV	Acre-Ft	23.85	3.58	19.48	3.39	1.19
Hist. Release Rate	CFS	312.50	52.00	284.80	23.00	10.00
Aurora Release Rate	CFS	158.51	23.97	128.77	18.83	7.43
Allow. Release Rate	CFS	158.51	23.97	128.77	10.83*	7.43

\*Pond 311 Allowable Release Rate reduced to account for Basin 19A Free Release Rate

\*\*MEP - MHFD Maintenance Eligibility Program

\*\*\*Pond 302 contributing area & imperv. includes offsite Basins O33A & O33B

#### b. Conveyance of Offsite Drainage

There are three offsite drainage basins that impact the project area. Existing offsite Basin HO39 drains to DP10 located at the northeast edge of the property into an existing drainageway within Basin 39B-2. This entire area is anticipated to be undistributed and the existing drainageway has a non-erosive velocity based on the SWMM modeling. This existing runoff will continue undisturbed through the project site.

The remaining two proposed offsite Basins are south of E. County Line Road. Basins O33A and O33B are the developed basin from the existing Basin HO33.



This area is anticipated to be "High Density Rural Residential" with a 15% impervious according to the CC FHAD. Because there are two low points in this area, the historic basin was divided into two basins with separate storm systems. With development, the offsite areas will be required to provide onsite 100-yr detention to reduce the flows to either historic flow rates per Delbert County drainage criteria. Runoff from these basins is piped north through Basins 33E and 33F to Drainageway 1. Because this runoff will mix with the onsite untreated runoff, water quality treatment for these offsite basins will be included in Detention Pond 302. The offsite 100-yr flow will be routed undetained through Detention Pond 302.

- c. Coordination with Surrounding Developments  
There is no anticipated negative impact to the surrounding developments. The flows from the project site will either be at or less than the historic condition flow rates.
- d. Compliance with Other Existing Master Drainage Reports  
The only master type drainage report that is impacted by this project is the CC FHAD. As previously mentioned, the project site has a developed impervious of 47% while the CC FHAD assumed an impervious of 45%. However, this difference is solely due to the higher impervious values used in Aurora versus those used by MHFD. MHFD uses a 2% impervious for open space areas and Aurora uses 5%. Aurora also requires that detention ponds be evaluated at 100% impervious, while the MHFD study does not assume that condition. If the area set as the pond surface is converted to standard open space area at 5% impervious the total project site has a 45% impervious. The project is in compliance with the CC FHAD.
- e. Conveyance Considerations for Major Flows to a Major Drainage Way  
Discharges from conceptual onsite Ponds 302, 306, 309, 311, and 329 will detain to historic levels (or allowable release rates per the City of Aurora criteria, whichever is lower) and be conveyed to their historic discharge locations and eventually to Coal Creek.

Drainageway 1 and Drainageway 2, both existing natural drainageways, do not show signs of erosion in the existing conditions except at the downstream end of Drainageway 1. This is supported by the existing SWMM analysis which shows non-erosion channel velocities less than 5 fps everywhere other than the downstream end of Drainageway 1 where the channel velocity is over 9 fps. The downstream ends of the existing drainageways will be replaced with proposed inline detention ponds. This will remove the eroded areas and allow the site to discharge at historic or less conditions.

However, in the developed conditions, Drainageways 1 and 2, upstream of DP5 and DP6 respectively both have velocities in excess of 13 fps as shown in the proposed condition SWMM model (output is included in Appendix B). Based on this information, the existing drainageways will require improvement to prevent erosion from occurring due to the developed flow rates in these channels. Locations where channel improvement is necessary will be

determined with future drainage design, when the storm sewer discharge points into the drainageways have been determined.

- f. Discussion of Content of Tables, Charts, Figures, Plates or Drawings Presented  
The Basin Weighted Runoff Coefficient Calculations within Appendix A uses areas contained within a conceptual layout that is not approved by this report nor plan.

WQ and EURV calculations were done using MHFD criteria. That, along with Aurora criteria 100-yr detention volume calculations can be found in Appendix B for the conceptual layout and conceptual ponds. Subsequent drainage reports within the area developing will be required to provide site-specific calculations, as these are for conceptual use only.

Reference information within Appendix C includes the *Coal Creek (E. Yale Avenue to E. County Line Road) Flood Hazard Area Delineation* report excerpts which is the basis for the basin nomenclature. Excerpts from the *High Plains Country Club Filing No. 3 Final Drainage Report* are included to show that the existing runoff to S. Monaghan Road is in excess of the proposed flow rate from Pond 329, as required by Aurora criteria, and therefore the existing storm sewer is adequately sized.

## 2. Specific Details

- a. Drainage Problems Encountered and Associated Solutions

No drainage problems have been encountered with this project.

- b. Plan for Existing Drainageways or Creeks

Although the existing natural drainageways in the project site are well vegetated and show no signs of erosion, in the proposed conditions improvements will need to be made to the areas designated as Drainageway 1 and Drainageway 2.

The storm sewer outfall locations to the drainageways will impact the location of the proposed improvements. For Drainageway 1, a 115' W x 1,140' L channel area has been set aside for improvements along the existing channel flowline. The width is based on the MHFD stream management corridor width of the channel immediately downstream of DP5.

Drainageway 2 has less runoff than Drainageway 1 because of a smaller contributing area. To be conservative, the same improvement width has been set aside along the length of the existing drainageway flowline, for a 115' W x 975' L improvement area.

Drainageway 1, because it is a MHFD maintenance eligible stream corridor, will be located within a separate tract and owned by the City of Aurora, but designed to be MHFD compliant. Drainageway 2 shall be designed as a private open channel per City of Aurora criteria.

This areas for each drainage improvement corridor may decrease in size with a more detailed analysis of the channel conditions and proposed development. The final design of the conveyance will be detailed within the final drainage report prepared for the respective development planning areas.

c. Detention Pond Plan

Detention is required for all developments in the City of Aurora per current City of Aurora criteria. The allowable pond release rates are limited to 1 cfs per contributory acre or historic flow rates, whichever is lower.

There are four proposed detention ponds to treat for WQCV, EURV and 100-yr detention; refer to Appendix B for conceptual pond volumes.

- Pond 302 (DP 5A): Treats onsite Basins 33A through 33D and 34 directly. Offsite Basins O33A and O33B will flow through the detention pond. Water quality will be provided for those offsite basins, EURV and 100-yr detention will not be provided for the offsite basins. Runoff will be piped from the respective basins to Drainageway 1, located in PA-20. Pond 302 outfalls to an existing drainageway and leaves the site at DP2. From this design point, the runoff outlets north to Mutchie Creek and eventually Coal Creek.
- Pond 306 (DP 3A): Treats Basin 37 and will be located in PA-5. Pond 306 outfalls north to Mutchie Creek via existing drainageway and leaves the site at DP3.
- Pond 309 (DP 6A): Treats Basins 39A-1, 39A-2, 39B-1, and 39B-3 directly. The pond is located in PA-7. Runoff will be piped from the respective basins to Drainageway 2, located in PA-28. Pond 309 outfalls to an existing drainageway and leaves the site at DP4. From this design point, the runoff outlets north to Mutchie Creek and eventually Coal Creek.
- Pond 311 (DP 7A): Treats Basin 18B-1 directly. Onsite Basin 19A cannot be treated by the detention pond due to elevation constraints, but the pond has been oversized to account for this runoff. Any free release from Basin 19A will be removed from the allowable release rate of Pond 311. The pond is located in PA-10. Pond 311 outfalls to storm sewer at DP7 on the north side of E. County Line Road in the roadside ditch. From there, runoff flows east to Llama Draw and eventually Coal Creek.
- Pond 329 (DP 1A): Treats Basin 29 directly and will be located in PA-1 at the northwest corner of the site. Pond 329 outfalls north to Mutchie Creek via S. Monaghan Road and its existing storm sewer and leaves the site at DP1.

Ponds are shown in a conceptual location on the Master Drainage Plan and will be placed in subsequent drainage reports when the parcels develop. All ponds are sized as extended dry detention basins (EDB) as the largest water

quality volume requirement. Subsequent detailed design for the individual planning areas may determine an alternative water quality treatment option that is more suitable for their layout.

d. Water Quality BMP Plan

The ponds have been preliminarily sized according to the City of Aurora criteria and Urban Storm Drainage Criteria Manual, Volume 3; sizing information can be found in the appendices of this report using the empirical formula method from the City of Aurora criteria and the MHFD criteria. The outlet structure for water quality ponds will convey the minor storm runoff and up to the major storm runoff to an existing drainageway or roadside ditch. The outlet structure for the detention/water quality ponds will effectively be a three-stage release structure (water quality, EURV, and 100-year event). Pond release rates for detained land areas are determined by the soil types and have been set within this report as 0.85 cfs/acre for the 100-year per the City of Aurora criteria. Additional details of the detention/water quality pond facilities will be presented in subsequent drainage reports.

e. Drainage Facility Easement Requirements

Drainage facilities on-site may be accessed via conceptual street right-of-way and drainage easements that will be provided over detention ponds.

f. Maintenance Responsibilities and Maintenance Access

Maintenance of Drainageway 2 and the detention ponds will be provided by the HOA and/or District formed for such purposes by the parcel under development. Maintenance access to the detention ponds will be via future street right-of-way and maintenance paths per the City criteria. Drainageway 1, located in PA-20, is MHFD maintenance eligible and will be in a tract owned by the City of Aurora. Drainageway 2 is located within PA-28.

g. Drainageway Public Improvement Requirements and Funding Source

The proposed drainageway improvements are private and will be funded by the development.

h. Potential Impacts to Downstream Properties

All onsite development will be detained to historic levels or City-allowable release rates, whichever is less. The proposed site drainage patterns are in conformance with the existing topography and surrounding developments. There is no expected negative impact to the downstream developments or existing streets.

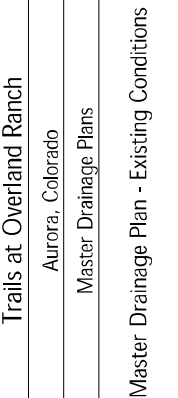
i. Drainageway Public Improvements Correlation to FDP

Drainageways 1 and 2 are shown on the newly proposed PIP for this development. A maximum anticipated improvement area has been set aside on for these improvements that may decrease with final design. Subsequent drainage reports will determine the necessary improvements.

j. CUHP/SWMM Modeling Input Criteria and Output Data

CUHP and SWMM were used to calculate runoff, route the runoff, model the detention ponds to determine the necessary volume, and to model the existing



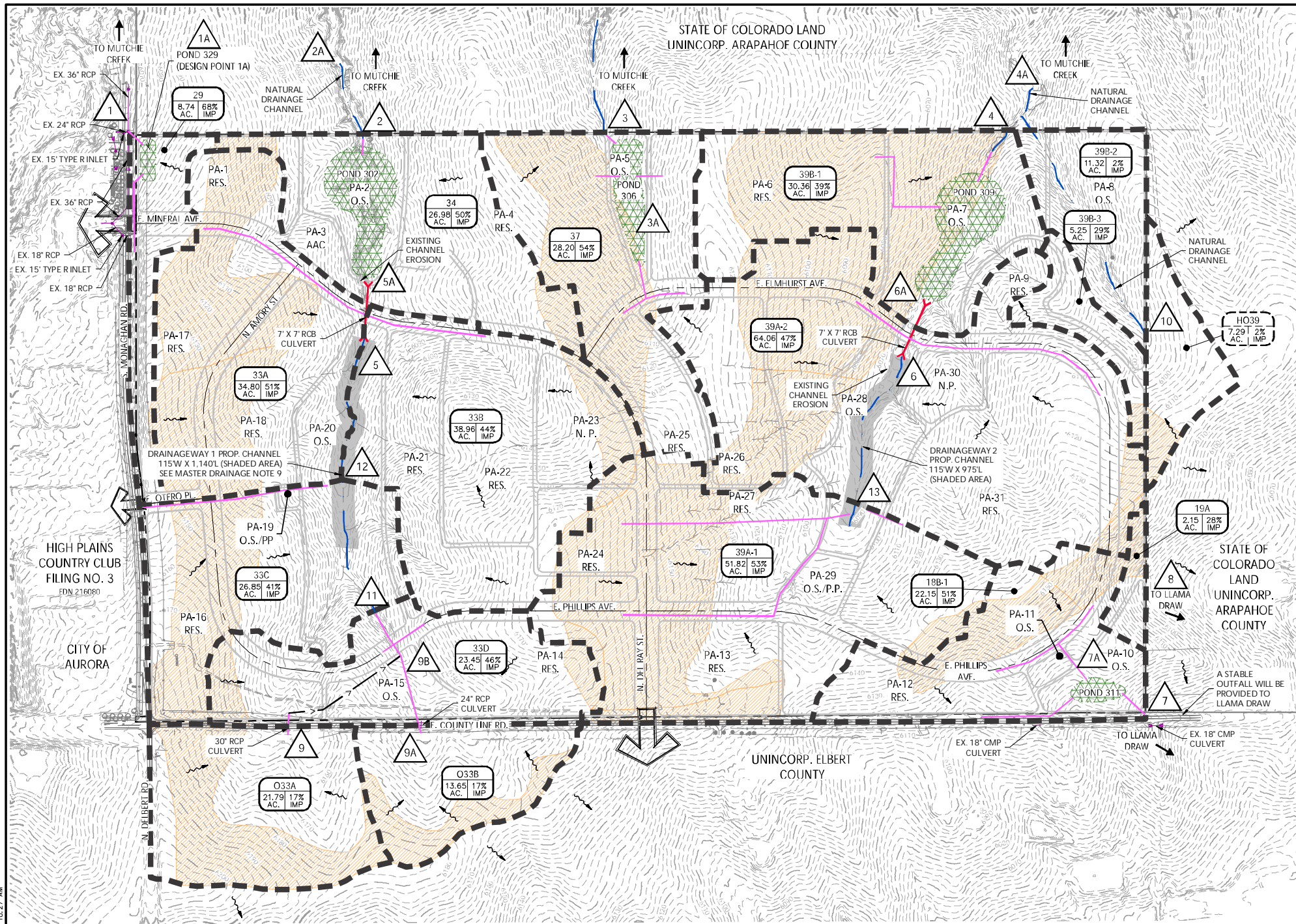


Location:

Plan Set:

Sheet Name:

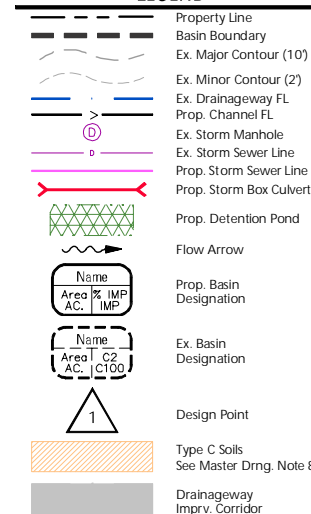




## MASTER DRAINAGE NOTES:

- CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
- STORM SEWER SYSTEMS, IN COMBINATION WITH THE STREETS, WILL BE SIZED FOR THE 100YR STORM EVENT.
- STORM SEWER SHALL BE PUBLIC UNLESS LABELED AS PRIVATE.
- THE STORM SEWER SHOWN MAY NOT BE IN ITS FINAL LOCATION. ADDITIONAL STORM SEWER MAY BE REQUIRED AND WILL BE REFINED WITH THE PRELIMINARY DRAINAGE REPORT.
- DETENTION PONDS SHALL BE PRIVATE. MEP ELIGIBLE PONDS SHALL BE DESIGNED AT MINIMUM TO MEET MHFD STANDARDS. PONDS SHOWN ARE CONCEPTUAL ONLY. ACTUAL SIZE, SHAPE, AND LOCATION MAY VARY.
- CULVERTS SHALL BE PROVIDED WITH AN EMERGENCY OVERFLOW PATH THAT DOES NOT ENCRUSH INTO ANY RESIDENTIAL LOTS.
- AT EACH CULVERT & DETENTION POND EMERGENCY SPILLWAY, THE ADJACENT FINISHED FLOOR ELEVATIONS WILL BE 1' ABOVE THE EMERGENCY WATER SURFACE ELEVATION OVER THE ROAD OR POND EMBANKMENT.
- SOIL TYPE IS MIXED, CONSISTING OF HYDROLOGIC TYPE B AND C SOILS. ANY AREA NOT SHOWN AS TYPE C SOIL IS TYPE B SOIL.
- DRAINAGEWAY 1 IS A MILE HIGH FLOOD DISTRICT MAINTENANCE ELIGIBLE STREAM CORRIDOR. IT WILL BE LOCATED WITHIN A SEPARATE TRACT AND OWNED BY THE CITY OF AURORA.
- DRAINAGEWAY 2 SHALL BE DESIGNED AS A PRIVATE OPEN CHANNEL PER CITY OF AURORA CRITERIA.

## LEGEND



Runoff Comparison Table						
Design Point	Existing			Proposed		
	Contrib. Basin	Q <sub>2</sub>	Q <sub>100</sub>	Contrib. Basin	Pre-Detention	Detention
1	H29	0.0	10.0	29	9.0	34.0
2	H33, H34, HO33	4.9	312.5	33A, 33B, 33C, 33D, 34, O33A, O33B	89.4	522.9
3	H37	1.0	52.0	37	17.0	76.0
4	H39A, H39B	2.8	269.3	39A-1, 39A-2, 39B-1, 39B-2, 39A-1, 39A-2, 39B-1, 39B-2, 39B-3, HO39	98.0	508.7
4A	H39A, H39B, HO39	2.9	284.8	33A, 33B, 33C, 33D, O33A, O33B	0.4	151.2
5	H33, HO33	3.9	225.4	O33A, O33B	74.9	451.1
6	H39A	2.0	121.0	39A-1, 39A-2	81.8	409.3
7	H18B	1.0	23.0	18B-1	12.0	59.0
8	H19	0.0	15.0	19A	1.0	8.0
9 (9B)	HO33	2.0	81.0	O33A, O33B	6.6	82.4
10	HO39	0.0	17.0	HO39	0.0	17.0

## Basin Runoff Calculations - Direct Runoff

Basin ID	Design Point	Total Area [Ac.]	Imp (%)	Time Peak (min)		Runoff Coeff.			Peak Flow (cfs)	
				2-yr	100-yr	C <sub>2</sub>	C <sub>5</sub>	C <sub>100</sub>	Q <sub>2</sub>	Q <sub>100</sub>
Proposed										
18B-1	7	22.15	51%	32.0	37.0	0.42	0.47	0.60	12.00	59.00
19A	8	2.15	28%	30.0	35.0	0.28	0.31	0.40	1.00	8.00
29	1	8.74	68%	30.0	35.0	0.54	0.58	0.71	9.00	34.00
33A	5	34.80	51%	30.0	35.0	0.41	0.45	0.58	27.00	127.00
33B	5	38.96	44%	31.0	37.0	0.36	0.41	0.59	21.00	113.00
33C	12	26.85	41%	32.0	37.0	0.36	0.40	0.51	12.00	68.00
33D	11	23.45	46%	31.0	36.0	0.39	0.43	0.54	14.00	72.00
34	5A	26.98	50%	32.0	37.0	0.42	0.46	0.60	15.00	72.00
37	3	28.20	54%	32.0	37.0	0.43	0.47	0.61	17.00	76.00
39A-1	13	51.82	53%	31.0	36.0	0.42	0.47	0.62	37.00	171.00
39A-2	6	64.06	47%	30.0	35.0	0.38	0.43	0.57	49.00	246.00
39B-1	6A	30.36	39%	31.0	36.0	0.38	0.41	0.52	15.00	92.00
39B-2	4A	11.32	2%	35.0	41.0	0.15	0.16	0.20	0.00	19.00
39B-3	6A	5.25	29%	39.0	45.0	0.28	0.31	0.41	1.00	8.00
O33A	9	21.79	17%	32.0	39.0	0.32	0.36	0.61	4.00	49.00
O33B	9A	13.65	17%	31.0	36.0	0.32	0.37	0.61	3.00	34.00

\*Note Pond 302 information includes offsite Basins O33A &amp; O33B

Outfall Runoff Comparison Table				
Design Point	Existing		Proposed (Detention)	
	Q <sub>2</sub>	Q <sub>100</sub>	Q <sub>2</sub>	Q <sub>100</sub>
1	0.0	10.0	N/A	7.4
2	4.9	312.5	N/A	127.9
3	1.0	52.0	N/A	23.4
4	2.8	269.3	N/A	128.3
7	1.0	23.0	N/A	10.5
8	0.0	15.0	1.0	8.0

## Detention Pond Table

		Pond Name			
Desc.	Units	302***	306	309	311
Area	Acre	186.48	28.20	151.49	22.15
MEP Eligible**		Yes	No	Yes	No
Imperv.	%	41%	54%	47%	51%
WQCV	Acre-Ft	3.66	0.58	2.99	0.46
EURV	Acre-Ft	8.73	1.49	7.48	1.21
100-yr	Acre-Ft	19.48	2.83	15.74	2.78
100-Yr +1/2 EURV	Acre-Ft	23.65	3.58	19.48	3.39
Hist. Release Rate	CFS	312.50	52.00	264.80	23.00
Aurora Release Rate	CFS	158.51	23.97	128.77	18.83
Allow. Release Rate	CFS	158.51	23.97	128.77	10.83*

\*\*Pond 311 Allowable Release Rate reduced to account for Basin 19A Free Release Rate

\*\*\*MEP - MHFD Maintenance Eligibility Program

\*\*\*Pond 302 contributing area &amp; Imperv. includes offsite Basins O33A &amp; O33B

## PROJECT BENCHMARK:

BM: 556529SE001  
RECOVERED 3" BRASS CAP LOCATED ON THE SOUTHEASTERLY CORNER OF CURB OPENING INLET ON THE EASTERLY SIDE OF SMOKY HILL ROAD AND BEING NEARLY ON A PROJECTED LINE WITH THE SOUTHEASTERLY BOUNDARY OF SERENITY RIDGE FILING NO. 3 AND THE NORTHWESTERLY BOUNDARY OF SERENITY RIDGE FILING NO. 1.

DATUM ELEV. = 6145.93' (NAVD 88)

FACSIMILE  
This electronic plan is a facsimile of the signed and sealed pdf set

*Xylina Warren-Laird* Date: 7/22/2022  
Xylina Warren-Laird, PE



Know what's below.  
Call before you dig.

Sheet:

2

Revision Type:

No. Rev. Date:

Trails at Overland Ranch  
Aurora, Colorado

Master Drainage Plans

Master Drainage Plan - Proposed Conditions

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Basin Runoff Calculations - Direct Runoff											
										Project No.:	1002-98
										22-Jul-22	
Basin ID	Design Point	Total Area (Ac.)	Imp (%)	Time Peak (min)		Runoff Coeff.			Peak Flow (cfs)		
				2-yr	100-yr	C <sub>2</sub>	C <sub>5</sub>	C <sub>100</sub>	Q <sub>2</sub>	Q <sub>100</sub>	
Proposed											
18B-1	7	22.15	51%	32.0	37.0	0.42	0.47	0.60	12.00	59.00	
19A	8	2.15	28%	30.0	35.0	0.28	0.31	0.40	1.00	8.00	
29	1	8.74	68%	30.0	35.0	0.54	0.58	0.71	9.00	34.00	
33A	5	34.80	51%	30.0	35.0	0.41	0.45	0.58	27.00	127.00	
33B	5	38.96	44%	31.0	37.0	0.36	0.41	0.59	21.00	113.00	
33C	12	26.85	41%	32.0	37.0	0.36	0.40	0.51	12.00	68.00	
33D	11	23.45	46%	31.0	36.0	0.39	0.43	0.54	14.00	72.00	
34	5A	26.98	50%	32.0	37.0	0.42	0.46	0.60	15.00	72.00	
37	3	28.20	54%	32.0	37.0	0.43	0.47	0.61	17.00	76.00	
39A-1	13	51.82	53%	31.0	36.0	0.42	0.47	0.62	37.00	171.00	
39A-2	6	64.06	47%	30.0	35.0	0.38	0.43	0.57	49.00	246.00	
39B-1	6A	30.36	39%	31.0	36.0	0.38	0.41	0.52	15.00	92.00	
39B-2	4A	11.32	2%	35.0	41.0	0.15	0.16	0.20	0.00	19.00	
39B-3	6A	5.25	29%	39.0	45.0	0.28	0.31	0.41	1.00	8.00	
O33A	9	21.79	17%	32.0	39.0	0.32	0.36	0.61	4.00	49.00	
O33B	9A	13.65	17%	31.0	36.0	0.32	0.37	0.61	3.00	34.00	
Pond 302*	5A/2	186.48	41%		84.0	0.37	0.42	0.58	0.18	127.90	
Pond 306	3A/3	28.20	54%		85.0	0.43	0.47	0.61	0.18	23.40	
Pond 309	6A/4	151.49	47%		76.0	0.39	0.43	0.57	0.19	128.30	
Pond 311	7A/7	22.15	51%		84.0	0.42	0.47	0.60	0.17	10.50	
Pond 329	1A/1	8.74	68%		72.0	0.54	0.58	0.71	0.12	7.40	
Existing											
H18B	7	23.07	7%	44.0	54.0	0.22	0.23	0.29	1.0	23.0	
H19	8	6.17	4%	31.0	36.0	0.20	0.22	0.28	0.0	15.0	
H29	1	12.76	2%	45.0	63.0	0.15	0.16	0.20	0.0	10.0	
H33	5	86.85	4%	38.0	43.0	0.18	0.19	0.24	3.0	149.0	
H34	2	57.26	3%	39.0	45.0	0.17	0.18	0.23	1.0	88.0	
H37	3	33.53	4%	39.0	44.0	0.20	0.22	0.28	1.0	52.0	
H39A	6	71.84	3%	38.0	43.0	0.19	0.20	0.26	2.0	121.0	
H39B	4	83.60	3%	36.0	42.0	0.19	0.20	0.26	2.0	156.0	
HO33	9	35.44	6%	32.0	37.0	0.21	0.23	0.28	2.0	81.0	
HO39	10	7.29	2%	31.0	36.0	0.16	0.18	0.22	0.0	17.0	
2 Year P <sub>1</sub> =									0.99		
5 Year P <sub>1</sub> =									1.39		
100 Year P <sub>1</sub> =									2.65		

\*Note Pond 302 information includes offsite Basins O33A & O33B

Proposed 100-yr Conditions

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f.)	Excess (Inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
18B-1		0.088	0.120	19.8	2.12	10.3	1.50	3.5	52	80,405	2.17	174,605	37.0	59	174,574	2.67
19A		0.103	0.029	10.1	0.53	5.2	0.37	0.9	10	7,805	1.87	14,632	35.0	8	14,486	3.63
29		0.081	0.089	10.9	1.04	5.6	0.73	1.7	38	31,726	2.37	75,229	35.0	34	75,142	3.95
33A		0.088	0.147	12.0	1.65	6.2	1.17	2.8	136	126,324	2.19	277,160	35.0	127	276,965	3.64
33B		0.092	0.143	16.5	2.11	8.6	1.49	3.5	111	141,425	2.05	290,388	37.0	113	290,319	2.90
33C		0.093	0.116	20.1	2.09	10.4	1.48	3.5	63	97,466	2.04	199,305	37.0	68	199,274	2.55
33D		0.091	0.117	15.2	1.66	7.9	1.17	2.8	72	85,124	2.08	177,340	36.0	72	177,278	3.07
34		0.089	0.130	19.5	2.24	10.1	1.58	3.7	65	97,937	2.14	209,175	37.0	72	209,145	2.67
37		0.087	0.137	19.8	2.39	10.3	1.69	4.0	67	102,366	2.22	227,311	37.0	76	227,319	2.71
39A-1		0.087	0.179	14.5	2.30	7.6	1.62	3.8	167	188,216	2.21	415,344	36.0	171	415,243	3.29
39A-2		0.090	0.185	10.4	1.78	5.4	1.26	3.0	290	232,465	2.11	491,592	35.0	246	491,240	3.85
39B-1		0.094	0.119	15.3	1.70	8.0	1.20	2.8	93	110,207	2.04	225,367	36.0	92	225,296	3.04
39B-2		0.157	0.076	27.3	1.90	14.2	1.34	3.2	19	41,092	1.50	61,807	41.0	19	61,799	1.70
39B-3		0.102	0.044	37.0	1.56	19.2	1.11	2.6	7	19,058	1.86	35,380	45.0	8	35,377	1.56
O33A		0.116	0.081	21.2	1.62	11.0	1.14	2.7	48	79,098	1.76	139,028	39.0	49	139,000	2.23
O33B		0.117	0.066	17.5	1.18	9.1	0.83	2.0	37	49,550	1.73	85,822	36.0	34	85,817	2.52
HO39		0.157	0.063	17.0	1.12	8.9	0.79	1.9	20	26,463	1.47	38,957	36.0	17	38,939	2.27



Proposed 100-yr Conditions

Summary of CUHP Input Parameters (Version 2.0.1)

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (Inches)	Imperv. (Inches)	Initial Rate (in./hr.)	Final Rate (in./hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con't Imperv. Fraction	Receiv. Perv. Fraction	
18B-1	7A	RAINGAGE	0.035	0.139	0.225	0.010	51.0	0.35	0.10	3.97	0.56	0.0018	0.00	0.86	0.23	49.96
19A	8	RAINGAGE	0.003	0.013	0.061	0.075	28.0	0.35	0.10	3.99	0.57	0.0018	0.00	0.56	0.16	26.53
29	1A	RAINGAGE	0.014	0.090	0.177	0.078	68.0	0.35	0.10	4.50	0.60	0.0018	0.00	0.92	0.29	67.12
33A	5	RAINGAGE	0.054	0.119	0.284	0.040	51.0	0.35	0.10	3.60	0.54	0.0018	0.00	0.86	0.23	50.02
33B	5	RAINGAGE	0.061	0.161	0.333	0.035	44.0	0.35	0.10	4.39	0.59	0.0018	0.00	0.82	0.21	42.83
33C	12	RAINGAGE	0.042	0.154	0.322	0.034	41.0	0.35	0.10	3.94	0.56	0.0018	0.00	0.81	0.20	39.89
33D	11	RAINGAGE	0.037	0.085	0.317	0.028	46.0	0.35	0.10	4.34	0.59	0.0018	0.00	0.83	0.22	44.85
34	5A	RAINGAGE	0.042	0.118	0.379	0.016	50.0	0.35	0.10	4.35	0.59	0.0018	0.00	0.85	0.23	48.89
37	3A	RAINGAGE	0.044	0.129	0.352	0.011	54.0	0.35	0.10	3.79	0.55	0.0018	0.00	0.87	0.25	53.03
39A-1	13	RAINGAGE	0.081	0.162	0.396	0.027	53.0	0.35	0.10	3.81	0.55	0.0018	0.00	0.87	0.24	52.01
39A-2	6	RAINGAGE	0.100	0.099	0.359	0.034	47.0	0.35	0.10	4.05	0.57	0.0018	0.00	0.84	0.22	45.91
39B-1	6A	RAINGAGE	0.047	0.107	0.239	0.026	39.0	0.35	0.10	3.60	0.54	0.0018	0.00	0.78	0.20	37.90
39B-2	4A	RAINGAGE	0.018	0.091	0.210	0.070	2.0	0.35	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.75
39B-3	6A	RAINGAGE	0.008	0.092	0.237	0.040	29.0	0.35	0.10	4.37	0.59	0.0018	0.00	0.58	0.17	27.45
O33A	9	RAINGAGE	0.034	0.095	0.189	0.040	17.0	0.35	0.10	3.77	0.55	0.0018	0.00	0.34	0.12	15.74
O33B	9A	RAINGAGE	0.021	0.051	0.152	0.040	17.0	0.35	0.10	4.04	0.57	0.0018	0.00	0.34	0.12	15.68
HO39	10	RAINGAGE	0.011	0.038	0.107	0.051	2.0	0.40	0.10	4.29	0.59	0.0018	0.00	0.00	0.02	1.75

## Existing 100-yr Conditions

## Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f.)	Excess (Inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
H33		0.150	0.183	27.7	4.19	14.4	2.96	7.0	147	315,266	1.52	479,916	43.0	149	479,890	1.72
H34		0.153	0.155	31.9	4.10	16.6	2.90	6.8	84	207,854	1.50	311,554	45.0	88	311,538	1.53
H37		0.150	0.119	32.2	3.25	16.7	2.29	5.4	49	121,714	1.56	189,804	44.0	52	189,798	1.55
H39A		0.153	0.171	28.4	4.04	14.8	2.85	6.7	119	260,779	1.53	398,276	43.0	121	398,249	1.69
H39B		0.153	0.184	24.6	3.77	12.8	2.66	6.3	159	303,468	1.53	463,724	42.0	156	463,718	1.87
H033		0.143	0.117	18.2	1.94	9.4	1.37	3.2	91	128,647	1.57	201,444	37.0	81	201,406	2.29
H039		0.157	0.063	17.0	1.12	8.9	0.79	1.9	20	26,463	1.47	38,957	36.0	17	38,939	2.27
H18B		0.140	0.095	58.3	4.54	30.3	3.21	7.6	19	83,744	1.58	131,967	54.0	23	131,967	1.01
H19		0.150	0.056	16.2	0.99	8.4	0.70	1.7	18	22,397	1.56	34,917	36.0	15	34,885	2.45
H29		0.157	0.080	75.7	4.97	39.3	3.52	8.3	8	46,319	1.46	67,400	63.0	10	67,399	0.77

## Existing 100-yr Conditions

## Summary of CUHP Input Parameters (Version 2.0.1)

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (Inches)	Imperv. (Inches)	Initial Rate (in./hr.)	Final Rate (in./hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con/ct Imperv. Fraction	Receiv. Perv. Fraction	
H33	5	RAINGAGE	0.136	0.204	0.503	0.041	4.0	0.40	0.10	4.12	0.57	0.0018	0.00	0.08	0.04	3.54
H34	2	RAINGAGE	0.089	0.175	0.525	0.040	3.0	0.40	0.10	4.16	0.58	0.0018	0.00	0.06	0.03	2.64
H37	3	RAINGAGE	0.052	0.165	0.404	0.055	4.0	0.40	0.10	3.69	0.55	0.0018	0.00	0.08	0.04	3.57
H39A	6	RAINGAGE	0.112	0.210	0.473	0.050	3.0	0.40	0.10	3.94	0.56	0.0018	0.00	0.06	0.03	2.66
H39B	4	RAINGAGE	0.131	0.170	0.479	0.046	3.0	0.40	0.10	3.92	0.56	0.0018	0.00	0.06	0.03	2.66
HO33	9	RAINGAGE	0.055	0.088	0.248	0.057	6.0	0.40	0.10	3.87	0.56	0.0018	0.00	0.12	0.06	5.35
HO39	10	RAINGAGE	0.011	0.038	0.107	0.051	2.0	0.40	0.10	4.29	0.59	0.0018	0.00	0.00	0.02	1.75
H18B	7	RAINGAGE	0.036	0.220	0.552	0.030	7.0	0.40	0.10	3.92	0.56	0.0018	0.00	0.14	0.07	6.26
H19	8	RAINGAGE	0.010	0.042	0.105	0.100	4.0	0.40	0.10	3.70	0.55	0.0018	0.00	0.08	0.04	3.57
H29	1	RAINGAGE	0.020	0.251	0.533	0.039	2.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.75

Proposed 2-yr Conditions

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results										Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f.)	Excess (Inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)	
18B-1		0.089	0.118	20.2	2.13	10.5	1.51	3.6	51	80,405	0.48	38,385	32.0	12	38,380	0.56	
19A		0.105	0.028	10.7	0.53	5.6	0.37	0.9	9	7,805	0.24	1,862	30.0	1	1,845	0.46	
29		0.082	0.088	11.0	1.04	5.7	0.74	1.7	37	31,726	0.65	20,604	30.0	9	20,579	1.07	
33A		0.089	0.145	12.2	1.66	6.4	1.18	2.8	133	126,324	0.48	60,758	30.0	27	60,717	0.77	
33B		0.093	0.140	17.0	2.13	8.8	1.51	3.5	107	141,425	0.40	56,948	31.0	21	56,933	0.54	
33C		0.094	0.113	20.7	2.10	10.8	1.49	3.5	61	97,466	0.38	36,683	32.0	12	36,674	0.44	
33D		0.092	0.114	15.6	1.67	8.1	1.18	2.8	70	85,124	0.42	36,036	31.0	14	36,021	0.59	
34		0.089	0.128	20.0	2.26	10.4	1.60	3.8	63	97,937	0.46	45,465	32.0	15	45,463	0.55	
37		0.087	0.136	20.2	2.40	10.5	1.70	4.0	65	102,366	0.51	52,198	32.0	17	52,196	0.59	
39A-1		0.088	0.177	14.8	2.31	7.7	1.63	3.9	164	188,216	0.50	93,999	31.0	37	93,978	0.72	
39A-2		0.091	0.182	10.6	1.79	5.5	1.26	3.0	282	232,465	0.44	101,298	30.0	49	101,250	0.76	
39B-1		0.095	0.116	15.8	1.71	8.2	1.21	2.9	90	110,207	0.36	39,569	31.0	15	39,549	0.51	
39B-2		0.158	0.077	27.3	1.91	14.2	1.35	3.2	19	41,092	0.01	516	35.0	0	516	0.02	
39B-3		0.104	0.042	39.7	1.59	20.7	1.12	2.7	6	19,058	0.24	4,656	39.0	1	4,656	0.19	
O33A		0.119	0.082	21.5	1.65	11.2	1.17	2.7	48	79,098	0.14	10,748	32.0	4	10,746	0.18	
O33B		0.119	0.066	17.7	1.20	9.2	0.85	2.0	36	49,550	0.13	6,604	31.0	3	6,604	0.21	
HO39		0.158	0.063	17.0	1.12	8.9	0.79	1.9	20	26,463	0.01	311	31.0	0	311	0.02	

Proposed 2-yr Conditions

Summary of CUHP Input Parameters (Version 2.0.1)

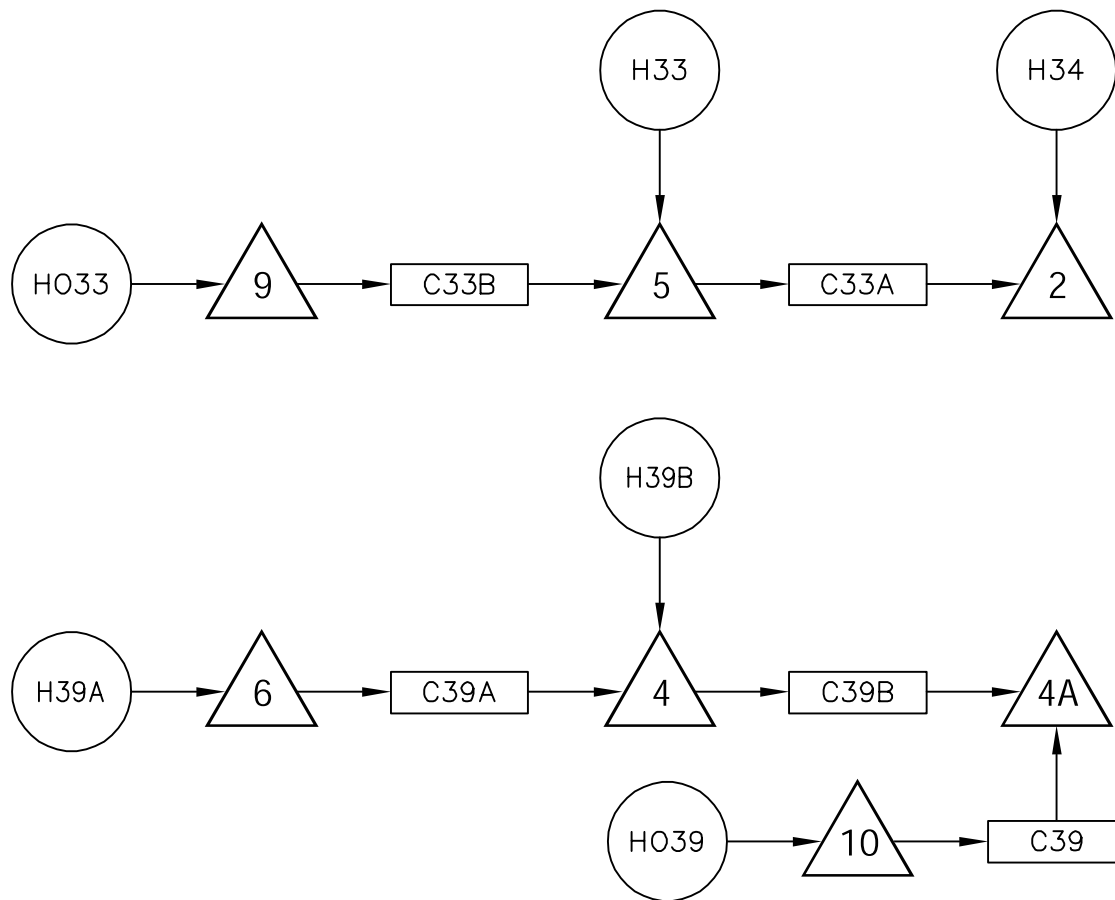
Catchment Name/ID	SWMM Node/ID	Raining Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
								Pervious (Inches)	Imperv. (Inches)	Initial Rate (in./hr.)	Final Rate (in./hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con/ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
18B-1	7A	RAINGAGE-2YR	0.035	0.139	0.225	0.010	51.0	0.35	0.10	3.97	0.56	0.0018	0.00	0.86	0.23	48.57
19A	8	RAINGAGE-2YR	0.003	0.013	0.061	0.075	28.0	0.35	0.10	3.99	0.57	0.0018	0.00	0.56	0.16	24.49
29	1A	RAINGAGE-2YR	0.014	0.090	0.177	0.078	68.0	0.35	0.10	4.50	0.60	0.0018	0.00	0.92	0.29	65.94
33A	5	RAINGAGE-2YR	0.054	0.119	0.284	0.040	51.0	0.35	0.10	3.60	0.54	0.0018	0.00	0.86	0.23	48.71
33B	5	RAINGAGE-2YR	0.061	0.161	0.333	0.035	44.0	0.35	0.10	4.39	0.59	0.0018	0.00	0.82	0.21	41.25
33C	12	RAINGAGE-2YR	0.042	0.154	0.322	0.034	41.0	0.35	0.10	3.94	0.56	0.0018	0.00	0.81	0.20	38.41
33D	11	RAINGAGE-2YR	0.037	0.085	0.317	0.028	46.0	0.35	0.10	4.34	0.59	0.0018	0.00	0.83	0.22	43.31
34	5A	RAINGAGE-2YR	0.042	0.118	0.379	0.016	50.0	0.35	0.10	4.35	0.59	0.0018	0.00	0.85	0.23	47.40
37	3A	RAINGAGE-2YR	0.044	0.129	0.352	0.011	54.0	0.35	0.10	3.79	0.55	0.0018	0.00	0.87	0.25	51.74
39A-1	13	RAINGAGE-2YR	0.081	0.162	0.396	0.027	53.0	0.35	0.10	3.81	0.55	0.0018	0.00	0.87	0.24	50.69
39A-2	6	RAINGAGE-2YR	0.100	0.099	0.359	0.034	47.0	0.35	0.10	4.05	0.57	0.0018	0.00	0.84	0.22	44.44
39B-1	6A	RAINGAGE-2YR	0.047	0.107	0.239	0.026	39.0	0.35	0.10	3.60	0.54	0.0018	0.00	0.78	0.20	36.41
39B-2	4A	RAINGAGE-2YR	0.018	0.091	0.210	0.070	2.0	0.35	0.10	4.50	0.60	0.0018	0.00	0.04	0.02	1.40
39B-3	6A	RAINGAGE-2YR	0.008	0.092	0.237	0.040	29.0	0.35	0.10	4.37	0.59	0.0018	0.00	0.58	0.17	25.31
O33A	9	RAINGAGE-2YR	0.034	0.095	0.189	0.040	17.0	0.35	0.10	3.77	0.55	0.0018	0.00	0.34	0.12	13.96
O33B	9A	RAINGAGE-2YR	0.021	0.051	0.152	0.040	17.0	0.35	0.10	4.04	0.57	0.0018	0.00	0.34	0.12	13.84
HO39	10	RAINGAGE-2YR	0.011	0.038	0.107	0.051	2.0	0.40	0.10	4.29	0.59	0.0018	0.00	0.00	0.02	1.40

## APPENDIX B

---

### Hydraulic Computations

## EXISTING SWMM DIAGRAMS



## Existing 2-yr Conditions - Input File

### [TITLE]

```
;; Project Title/Notes
Trails at Overland Ridge
Existing Conditions
2-yr
```

### [OPTIONS]

```
;; Option      Value
FLOW_UNITS     CFS
INFILTRATION   HORTON
FLOW_ROUTING   KINWAVE
LINK_OFFSETS   DEPTH
MIN_SLOPE      0
ALLOW_PONDING  NO
SKIP_STEADY_STATE NO
```

```
START_DATE     01/01/2005
START_TIME     00:00:00
REPORT_START_DATE 01/01/2005
REPORT_START_TIME 00:00:00
END_DATE       01/01/2005
END_TIME       06:00:00
SWEEP_START    01/01
SWEEP_END      12/31
DRY_DAYS       0
REPORT_STEP    00:15:00
WET_STEP       00:05:00
DRY_STEP       01:00:00
ROUTING_STEP   0:00:30
```

```
INERTIAL_DAMPING PARTIAL
NORMAL_FLOW_LIMITED BOTH
FORCE_MAIN_EQUATION H-W
VARIABLE_STEP    0.75
LENGTHENING_STEP 0
MIN_SURFAREA     12.557
MAX_TRIALS       8
```



## Existing 2-yr Conditions - Input File

HEAD\_TOLERANCE 0.005  
 SYS\_FLOW\_TOL 5  
 LAT\_FLOW\_TOL 5

### [FILES]

;; Interfacing Files

USE INFLOWS "D:\Temp Projects\1002-98\Drainage Rpt\Calcs\CUHP\Existing\Output\BF-SWMM-Ex-2.txt"

### [EVAPORATION]

;; Evap Data Parameters

;; -----

CONSTANT 0.0

DRY\_ONLY NO

### [JUNCTIONS]

;; Junction Invert Dmax Di nit Dsurch Aponded

;; -----

9 6144 0 0 0 0

5 6066 0 0 0 0

6 6064 0 0 0 0

4 6028 0 0 0 0

10 6087 0 0 0 0

### [OUTFALLS]

;; Outfall Invert Type Stage Data Gated

;; -----

4A 6026 FREE NO

2 6034 FREE NO

### [CONDUITS]

;; Conduit From Node To Node Length Roughness InOffset OutOffset InitFlow MaxFlow

;; -----

C33B 9 5 2075 0.05 0 0 0 0

C33A 5 2 1095 .05 13 0 0 0

# Existing 2-yr Conditions - Input File

C39A	6	4	1515	.05	0	0	0	0
C39B	4	4A	135	.05	0	0	0	0
C39	10	4A	1345	.05	0	0	0	0

## [XSECTIONS]

;; Link	Shape	Geom1	Geom2	Geom3	Geom4	Barrel s
;; -----	-----	-----	-----	-----	-----	-----
C33B	TRAPEZOIDAL	15	20	8	8	1
C33A	IRREGULAR	C33A	0	0	0	1
C39A	TRAPEZOIDAL	20	25	10	10	1
C39B	TRAPEZOIDAL	20	20	9	9	1
C39	IRREGULAR	C39B	0	0	0	1

## [TRANSECTS]

;; Transect Data in HEC-1 format

;									
NC .05	.05	.045							
X1 C33A	6	84	103	0.0	0.0	0.0	0.0	0.0	0.0
GR 6070	0	6062	59	6048	84	6045.7	92	6052	103
GR 6070	260								
;									
NC .05	.05	.04							
X1 C34	6	106	136	0.0	0.0	0.0	0.0	0.0	0.0
GR 6050	0	6038	68	6028	106	6027.5	114	6030	136
GR 6050	158								
;									
NC .05	.05	.04							
X1 C39B	5	64	154	0.0	0.0	0.0	0.0	0.0	0.0
GR 6080	0	6072	64	6063	100	6074	154	6080	208

## [LOSSES]

;; Link	Kin	Kout	Kavg	Flap Gate	SeepRate
;; -----	-----	-----	-----	-----	-----

# Existing 2-yr Conditions - Input File

```
[REPORT]
;; Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL
```

```
[TAGS]
```

```
[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None
```

```
[COORDINATES]
;; Node      X-Coord      Y-Coord
;; -----
9            -3173.633      3236.501
5            -2440.889      4183.432
6            2482.079       2437.276
4            2517.921       4354.839
10           3987.455       5985.663
4A           2428.315       6541.219
2            -2213.262      5448.029
```

```
[VERTICES]
;; Link      X-Coord      Y-Coord
;; -----
```

## Existing 2-yr Conditions

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.006)

Trails at Overland Ridge  
Existing Conditions  
2-yr

\*\*\*\*\*  
NOTE: The summary statistics displayed in this report are  
based on results found at every computational time step,  
not just on results from each reporting time step.  
\*\*\*\*\*

\*\*\*\*\*

### Analysis Options

\*\*\*\*\*

Flow Units ..... CFS

#### Process Models:

Rainfall/Runoff ..... NO

RDII ..... NO

Snowmelt ..... NO

Groundwater ..... NO

Flow Routing ..... YES

Ponding Allowed ..... NO

Water Quality ..... NO

Flow Routing Method ..... KINWAVE

Starting Date ..... JAN-01-2005 00:00:00

Ending Date ..... JAN-01-2005 06:00:00

Antecedent Dry Days ..... 0.0

Report Time Step ..... 00:15:00

Routing Time Step ..... 30.00 sec

\*\*\*\*\*

Flow Routing Continuity

\*\*\*\*\*

Volume

acre-feet

-----

Volume

10^6 gal

-----

# Existing 2-yr Conditions

Dry Weather Inflow .....	0.000	0.000
Wet Weather Inflow .....	0.000	0.000
Groundwater Inflow .....	0.000	0.000
RDII Inflow .....	0.000	0.000
External Inflow .....	0.643	0.209
External Outflow .....	0.664	0.216
Internal Outflow .....	0.000	0.000
Evaporation Loss .....	0.000	0.000
Seepage Loss .....	0.000	0.000
Initial Stored Volume ....	0.000	0.000
Final Stored Volume .....	0.000	0.000
Continuity Error (%) .....	-3.257	

\*\*\*\*\*

## Highest Flow Instability Indexes

\*\*\*\*\*

Link C39A2 (1)

\*\*\*\*\*

## Routing Time Step Summary

\*\*\*\*\*

Minimum Time Step	:	30.00 sec
Average Time Step	:	30.00 sec
Maximum Time Step	:	30.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00
Percent Not Converging	:	0.00

\*\*\*\*\*

## Node Depth Summary

\*\*\*\*\*

-----  
Average Maximum Maximum Time of Max

### Existing 2-yr Conditions

Node	Type	Depth Feet	Depth Feet	HGL Feet	Occurrence days hr:mi n
9	JUNCTION	0.01	0.10	6144.10	0 00:32
5	JUNCTION	13.21	13.66	6079.66	0 00:46
6	JUNCTION	0.02	0.08	6064.08	0 00:38
4	JUNCTION	0.03	0.14	6028.14	0 00:48
10	JUNCTION	0.03	0.13	6087.13	0 00:31
4A	OUTFALL	0.03	0.14	6026.14	0 00:50
2	OUTFALL	0.17	0.66	6034.66	0 00:51

\*\*\*\*\*

#### Node Inflow Summary

\*\*\*\*\*

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:mi n	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
9	JUNCTION	2.41	2.41	0 00:32	0.038	0.038	0.000
5	JUNCTION	2.84	3.88	0 00:46	0.0594	0.104	0.000
6	JUNCTION	1.76	1.76	0 00:38	0.0374	0.0374	0.000
4	JUNCTION	2.29	2.76	0 00:48	0.0436	0.0832	0.000
10	JUNCTION	0.17	0.17	0 00:31	0.00232	0.00232	0.000
4A	OUTFALL	0.00	2.87	0 00:50	0	0.0848	0.000
2	OUTFALL	1.24	4.87	0 00:49	0.0286	0.131	0.000

\*\*\*\*\*

#### Node Surcharge Summary

\*\*\*\*\*

No nodes were surcharged.

## Existing 2-yr Conditions

### \*\*\*\*\* Node Flooding Summary \*\*\*\*\*

No nodes were flooded.

### \*\*\*\*\* Outfall Loading Summary \*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
4A	42.72	1.23	2.87	0.085
2	55.34	1.47	4.87	0.131
System	49.03	2.70	7.73	0.216

### \*\*\*\*\* Link Flow Summary \*\*\*\*\*

Link	Type	Maximum  Flow  CFS	Time of Max Occurrence days hr:min	Maximum  Veloc  ft/sec	Max/ Full Flow	Max/ Full Depth
C33B	CONDUIT	1.64	0 00:55	1.17	0.00	0.00
C33A	CHANNEL	3.84	0 00:51	3.44	0.00	0.03
C39A1	CONDUIT	1.27	0 01:00	0.83	0.00	0.00
C39A2	CONDUIT	2.75	0 00:50	0.93	0.00	0.01
C39B	CHANNEL	0.11	0 00:48	2.67	0.00	0.01

## Existing 2-yr Conditions

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Thu Dec 16 17:51:45 2021  
Analysis ended on: Thu Dec 16 17:51:45 2021  
Total elapsed time: < 1 sec



# Existing 100-yr Conditions - Input File

## [TITLE]

```
;; Project Title/Notes
Trails at Overland Ridge
Existing Conditions
100-yr
```

## [OPTIONS]

```
;; Option      Value
FLOW_UNITS    CFS
INFILTRATION  HORTON
FLOW_ROUTING   KINWAVE
LINK_OFFSETS  DEPTH
MIN_SLOPE     0
ALLOW_PONDING NO
SKIP_STEADY_STATE NO
```

```
START_DATE    01/01/2005
START_TIME    00:00:00
REPORT_START_DATE 01/01/2005
REPORT_START_TIME 00:00:00
END_DATE      01/01/2005
END_TIME      06:00:00
SWEEP_START   01/01
SWEEP_END     12/31
DRY_DAYS      0
REPORT_STEP   00:15:00
WET_STEP      00:05:00
DRY_STEP      01:00:00
ROUTING_STEP  0:00:30
```

```
INERTIAL_DAMPING PARTIAL
NORMAL_FLOW_LIMITED BOTH
FORCE_MAIN_EQUATION H-W
VARIABLE_STEP    0.75
LENGTHENING_STEP 0
MIN_SURFAREA     12.557
MAX_TRIALS        8
```

# Existing 100-yr Conditions - Input File

HEAD\_TOLERANCE 0.005  
 SYS\_FLOW\_TOL 5  
 LAT\_FLOW\_TOL 5

## [FILES]

:: Interfacing Files  
 USE INFLOWS "D:\Temp Projects\1002-98\Drainage Rpt\Calcs\CUHP\Existing\Output\BF-SWMM-Ex-100.txt"

## [EVAPORATION]

:: Evap Data Parameters  
 -----  
 CONSTANT 0.0  
 DRY\_ONLY NO

## [JUNCTIONS]

:: Junction	Invert	Dmax	Di nit	Dsurch	Aponded
9	6144	0	0	0	0
5	6066	0	0	0	0
6	6064	0	0	0	0
4	6028	0	0	0	0
10	6087	0	0	0	0

## [OUTFALLS]

:: Outfall	Invert	Type	Stage Data	Gated
4A	6026	FREE		NO
2	6034	FREE		NO

## [CONDUITS]

:: Conduit	From Node	To Node	Length	Roughness	InOffset	OutOffset	InitFlow	MaxFlow
C33B	9	5	2075	0.05	0	0	0	0
C33A	5	2	1095	.05	13	0	0	0

## Existing 100-yr Conditions - Input File

C39A	6	4	1515	.05	0	0	0	0
C39B	4	4A	135	.05	0	0	0	0
C39	10	4A	1345	.05	0	0	0	0

## [XSECTIONS]

Link	Shape	Geom1	Geom2	Geom3	Geom4	Barrel s
C33B	TRAPEZOIDAL	15	20	8	8	1
C33A	IRREGULAR	C33A	0	0	0	1
C39A	TRAPEZOIDAL	20	25	10	10	1
C39B	TRAPEZOIDAL	20	20	9	9	1
C39	IRREGULAR	C39B	0	0	0	1

## [TRANSECTS]

;; Transect Data in HEC-1 format

NC .05	.05	.045							
X1 C33A	6	84	103	0.0	0.0	0.0	0.0	0.0	0.0
GR 6070	0	6062	59	6048	84	6045.7	92	6052	103
GR 6070	260								
NC .05	.05	.04							
X1 C34	6	106	136	0.0	0.0	0.0	0.0	0.0	0.0
GR 6050	0	6038	68	6028	106	6027.5	114	6030	136
GR 6050	158								
NC .05	.05	.04							
X1 C39B	5	64	154	0.0	0.0	0.0	0.0	0.0	0.0
GR 6080	0	6072	64	6063	100	6074	154	6080	208

## [LOSSES]

Link	Kin	Kout	Kavg	Flap Gate	SeepRate
------	-----	------	------	-----------	----------

# Existing 100-yr Conditions - Input File

```
[REPORT]
;; Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL
```

```
[TAGS]
```

```
[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None
```

```
[COORDINATES]
;; Node      X-Coord      Y-Coord
;; -----
9            -3173.633      3236.501
5            -2440.889      4183.432
6            2482.079       2437.276
4            2517.921       4354.839
10           3987.455       5985.663
4A           2428.315       6541.219
2            -2213.262      5448.029
```

```
[VERTICES]
;; Link      X-Coord      Y-Coord
;; -----
```

## Existing 100-yr Conditions

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.006)

Trails at Overland Ridge  
Existing Conditions  
100-yr

\*\*\*\*\*  
NOTE: The summary statistics displayed in this report are  
based on results found at every computational time step,  
not just on results from each reporting time step.  
\*\*\*\*\*

\*\*\*\*\*

### Analysis Options

\*\*\*\*\*

Flow Units ..... CFS

#### Process Models:

Rainfall/Runoff ..... NO

RDII ..... NO

Snowmelt ..... NO

Groundwater ..... NO

Flow Routing ..... YES

Ponding Allowed ..... NO

Water Quality ..... NO

Flow Routing Method ..... KINWAVE

Starting Date ..... JAN-01-2005 00:00:00

Ending Date ..... JAN-01-2005 06:00:00

Antecedent Dry Days ..... 0.0

Report Time Step ..... 00:15:00

Routing Time Step ..... 30.00 sec

\*\*\*\*\*

Flow Routing Continuity

\*\*\*\*\*

Volume

acre-feet

-----

Volume

10^6 gal

-----

# Existing 100-yr Conditions

Dry Weather Inflow .....	0.000	0.000
Wet Weather Inflow .....	0.000	0.000
Groundwater Inflow .....	0.000	0.000
RDII Inflow .....	0.000	0.000
External Inflow .....	43.473	14.166
External Outflow .....	43.691	14.237
Internal Outflow .....	0.000	0.000
Evaporation Loss .....	0.000	0.000
Seepage Loss .....	0.000	0.000
Initial Stored Volume ....	0.000	0.000
Final Stored Volume .....	0.000	0.000
Continuity Error (%) .....	-0.502	

\*\*\*\*\*

## Highest Flow Instability Indexes

\*\*\*\*\*

All links are stable.

\*\*\*\*\*

## Routing Time Step Summary

\*\*\*\*\*

Minimum Time Step	:	30.00 sec
Average Time Step	:	30.00 sec
Maximum Time Step	:	30.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00
Percent Not Converging	:	0.00

\*\*\*\*\*

## Node Depth Summary

\*\*\*\*\*

-----  
Average Maximum Maximum Time of Max

### Existing 100-yr Conditions

Node	Type	Depth Feet	Depth Feet	HGL Feet	Occurrence days hr:mi n
9	JUNCTION	0.12	0.75	6144.75	0 00:37
5	JUNCTION	13.77	16.10	6082.10	0 00:44
6	JUNCTION	0.19	0.94	6064.94	0 00:43
4	JUNCTION	0.38	1.79	6029.79	0 00:46
10	JUNCTION	0.16	0.89	6087.89	0 00:36
4A	OUTFALL	0.38	1.79	6027.79	0 00:47
2	OUTFALL	0.74	3.10	6037.10	0 00:46

\*\*\*\*\*

#### Node Inflow Summary

\*\*\*\*\*

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:mi n	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
9	JUNCTION	81.22	81.22	0 00:37	1.51	1.51	0.000
5	JUNCTION	149.00	225.37	0 00:44	3.59	5.13	0.000
6	JUNCTION	121.17	121.17	0 00:43	2.98	2.98	0.000
4	JUNCTION	155.98	269.32	0 00:46	3.47	6.48	0.000
10	JUNCTION	16.54	16.54	0 00:36	0.291	0.291	0.000
4A	OUTFALL	0.00	284.84	0 00:46	0	6.77	0.000
2	OUTFALL	87.55	312.49	0 00:46	2.33	7.46	0.000

\*\*\*\*\*

#### Node Surcharge Summary

\*\*\*\*\*

No nodes were surcharged.

## Existing 100-yr Conditions

\*\*\*\*\*  
Node Flooding Summary  
\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*  
Outfall Loading Summary  
\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
4A	64.22	65.19	284.84	6.773
2	64.63	71.37	312.49	7.463
System	64.42	136.56	597.14	14.236

\*\*\*\*\*  
Link Flow Summary  
\*\*\*\*\*

Link	Type	Maximum  Flow  CFS	Time of Max Occurrence days hr:min	Maximum  Veloc  ft/sec	Max/ Full Flow	Max/ Full Depth
C33B	CONDUIT	77.23	0 00:46	4.17	0.00	0.05
C33A	CHANNEL	225.11	0 00:46	9.16	0.00	0.13
C39A1	CONDUIT	119.07	0 00:49	3.77	0.00	0.05
C39A2	CONDUIT	269.30	0 00:47	4.16	0.00	0.09
C39B	CHANNEL	16.25	0 00:42	4.57	0.00	0.05



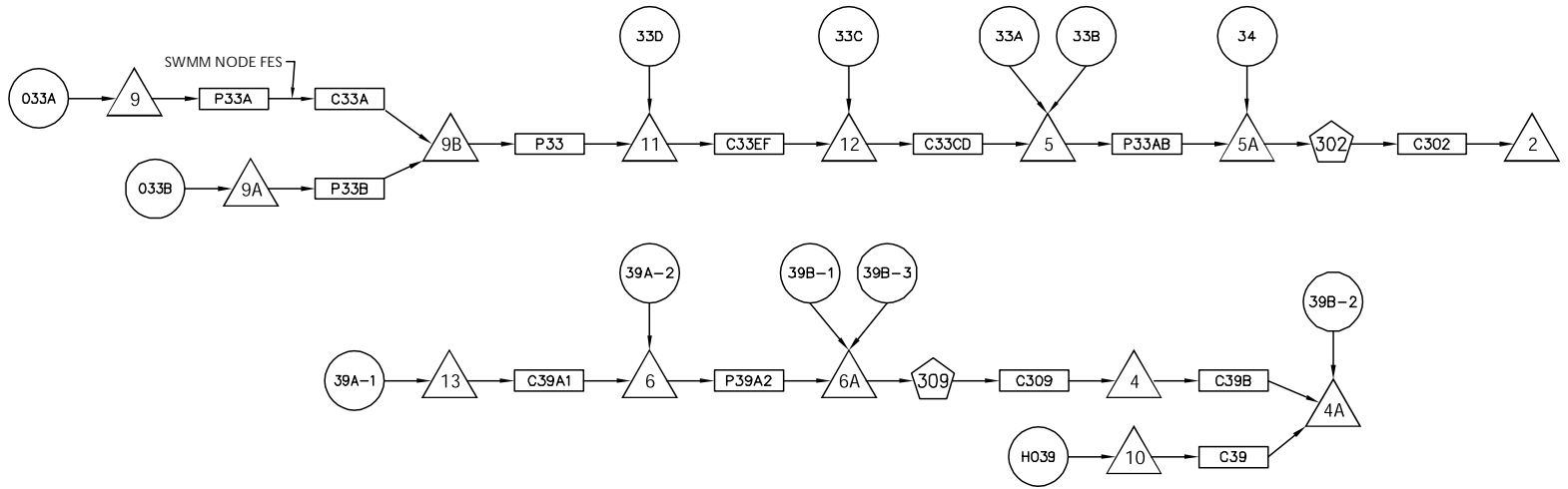
## Existing 100-yr Conditions

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

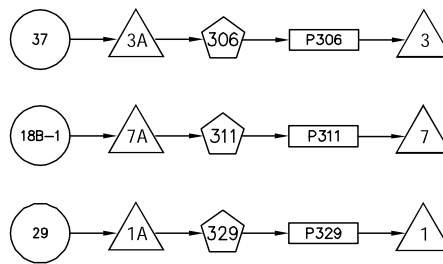
No conduits were surcharged.

Analysis begun on: Thu Dec 16 17:26:41 2021  
Analysis ended on: Thu Dec 16 17:26:41 2021  
Total elapsed time: < 1 sec

# PROPOSED SWMM DIAGRAMS



## PROPOSED SWMM DIAGRAMS



# Proposed 2-yr Conditions - Input File

## [TITLE]

```
;; Project Title/Notes
Trail at Overland Ranch
Proposed Conditions
2-yr
```

## [OPTIONS]

;; Option	Value
FLOW_UNITS	CFS
INFILTRATION	HORTON
FLOW_ROUTING	KINWAVE
LINK_OFFSETS	DEPTH
MIN_SLOPE	0
ALLOW_PONDING	NO
SKIP_STEADY_STATE	NO
START_DATE	01/01/2005
START_TIME	00:00:00
REPORT_START_DATE	01/01/2005
REPORT_START_TIME	00:00:00
END_DATE	01/01/2005
END_TIME	06:00:00
SWEEP_START	01/01
SWEEP_END	12/31
DRY_DAYS	0
REPORT_STEP	00:15:00
WET_STEP	00:05:00
DRY_STEP	01:00:00
ROUTING_STEP	0:00:30
INERTIAL_DAMPING	PARTIAL
NORMAL_FLOW_LIMITED	BOTH
FORCE_MAIN_EQUATION	H-W
VARIABLE_STEP	0.75
LENGTHENING_STEP	0
MIN_SURFAREA	12.557
MAX_TRIALS	8

# Proposed 2-yr Conditions - Input File

HEAD\_TOLERANCE 0.005  
 SYS\_FLOW\_TOL 5  
 LAT\_FLOW\_TOL 5

## [FILES]

:: Interfacing Files

USE INFLOWS "D:\Temp Projects\1002-98\Drainage Rpt\Calcs\CUHP\Proposed\Output\BF-SWMM-Pr-2.txt"

## [EVAPORATION]

:: Evap Data Parameters

-----  
 CONSTANT 0.0  
 DRY\_ONLY NO

## [JUNCTIONS]

:: Junction	Invert	Dmax	Di nit	Dsurch	Aponded
-----	-----	-----	-----	-----	-----
9	6142	0	0	0	0
11	6110	0	0	0	0
12	6087	0	0	0	0
13	6090	0	0	0	0
6	6060	0	0	14	0
9A	6142	0	0	0	0
5	6066	0	0	16	0
3A	6080	0	0	0	0
3060ut	6078	0	0	0	0
7A	6100	0	0	0	0
3110ut	6098	0	0	0	0
1A	6080	0	0	0	0
3290ut	6078	0	0	0	0
5A	6063	0	0	0	0
6A	6057	0	0	0	0
3020ut	6061	0	0	0	0
4	6046	0	0	0	0
10	6090	0	0	0	0
FES	6148	0	0	0	0
9B	6131	0	0	0	0

# Proposed 2-yr Conditions - Input File

## [OUTFALLS]

;; Outfall	Invert	Type	Stage Data	Gated
3	6076	FREE		NO
7	6093	FREE		NO
1	6076.6	FREE		NO
2	6059	FREE		NO
4A	6044	FREE		NO

## [STORAGE]

;; Storage Node	Invert	Dmax	Di ni t	Curve	Name/Params	Aponded	Fevap	SeepRate
306	6080	7	0	TABULAR	Pond306	0	0	0
311	6100	7	0	TABULAR	Pond311	0	0	0
329	6080	6	0	TABULAR	Pond329	0	0	0
302	6063	8	0	TABULAR	Pond302	0	0	0
309	6048	8	0	TABULAR	Pond309	0	0	0

## [CONDUITS]

;; Conduit	From Node	To Node	Length	Roughness	InOffset	OutOffset	Ini tFlow	MaxFlow
P33A	9	FES	200	.013	10	0	0	0
C33EF	11	12	735	.05	0	0	0	0
C33CD	12	5	760	.05	0	0	0	0
C39A1	13	6	950	.05	0	0	0	0
P39A2	6	6A	300	.016	0	0	0	0
P33AB	5	5A	300	.016	0	0	0	0
P33B	9A	9B	455	.013	5	0	0	0

Proposed 2-yr Conditions - Input File

3A-Dum	3A	306	400	0.01	0	0	0	0
P306	306Out	3	50	.016	1	0	0	0
7A-Dum	7A	311	400	0.01	0	0	0	0
11	311Out	7	170	.016	1	0	0	0
1A-Dum	1A	329	400	0.01	0	0	0	0
14	329Out	1	70	.016	1	0	0	0
5A-Dum	5A	302	400	0.01	0	0	0	0
C302	302Out	2	70	.016	0	0	0	0
6A-Dum	6A	309	400	0.01	0	0	0	0
C39B	4	4A	100	.016	0	0	0	0
C39	10	4A	1260	0.01	0	0	0	0
C33A	FES	9B	600	.035	0	5	0	0
P33	9B	11	265	.013	0	10	0	0

[ORIFICES]

;; Ori fice	From Node	To Node	Type	CrestHt	Qcoeff	Gated	CloseTime
306-Ori f	306	306Out	SIDE	0	0.65	NO	0
311-Ori f	311	311Out	SIDE	0	0.65	NO	0
329-Ori f	329	329Out	SIDE	0	0.65	NO	0
309-Ori f	309	4	SIDE	0	0.65	NO	0
302-Ori f	302	302Out	SIDE	0	0.65	NO	0

# Proposed 2-yr Conditions - Input File

## [XSECTIONS]

;; Link	Shape	Geom1	Geom2	Geom3	Geom4	Barrel s
P33A	CIRCULAR	2.5	0	0	0	1
C33EF	IRREGULAR	C33EF	0	0	0	1
C33CD	IRREGULAR	C33EF	0	0	0	1
C39A1	IRREGULAR	C39A1A	0	0	0	1
P39A2	RECT_OPEN	7	6	0	0	1
P33AB	RECT_OPEN	7	7	0	0	1
P33B	CIRCULAR	2	0	0	0	1
3A-Dum	DUMMY	0	0	0	0	1
P306	CIRCULAR	2.5	0	0	0	1
7A-Dum	DUMMY	0	0	0	0	1
11	CIRCULAR	3	0	0	0	1
1A-Dum	DUMMY	0	0	0	0	1
14	CIRCULAR	1.5	0	0	0	1
5A-Dum	DUMMY	0	0	0	0	1
C302	CIRCULAR	4	0	0	0	1
6A-Dum	DUMMY	0	0	0	0	1
C39B	IRREGULAR	C39A1A	0	0	0	1
C39	IRREGULAR	C39B	0	0	0	1
C33A	TRAPEZOIDAL	2	5	4	4	1
P33	CIRCULAR	3	0	0	0	1
306-Orif	CIRCULAR	.15	0	0	0	
311-Orif	CIRCULAR	.15	0	0	0	
329-Orif	CIRCULAR	.15	0	0	0	
309-Orif	CIRCULAR	.15	0	0	0	
302-Orif	CIRCULAR	.15	0	0	0	

## [TRANSECTS]

;; Transect Data in HEC-1 format

NC	.05	.05	.045						
X1 C33EF		6	84	103	0.0	0.0	0.0	0.0	0.0
GR 6070	0	6062	59	6048	84	6045.7	92	6052	103
GR 6070	260								

# Proposed 2-yr Conditions - Input File

```

NC .05      .05      .04
X1 C34      6        106      136      0.0      0.0      0.0      0.0      0.0
GR 6050     0        6038     68      6028     106      6027.5    114      6030     136
GR 6050     158
;
NC .05      .05      .04
X1 C39B     5        64      154      0.0      0.0      0.0      0.0      0.0
GR 6080     0        6072     64      6063     100      6074      154      6080     208
;
NC .05      .05      .045
X1 C39A1A   6        95      135      0.0      0.0      0.0      0.0      0.0
GR 6084     0        6078     65      6071     95       6070      115      6074     135
GR 6084     235

```

## [LOSSES]

```

;; Link      Kin      Kout      Kavg      Flap Gate  SeepRate
;; -----

```

## [CURVES]

```

;; Curve      Type      X-Value      Y-Value
;; -----
Pond306       Storage    0            0
Pond306       Storage    7            51500
;
Pond311       Storage    0            0
Pond311       Storage    7            45000
;
Pond329       Storage    0            0
Pond329       Storage    6            80000
;
Pond309       Storage    0            0
Pond309       Storage    8            200000
;
Pond302       Storage    0            0
Pond302       Storage    8            250000

```

## [REPORT]



# Proposed 2-yr Conditions - Input File

:: Reporting Options

INPUT NO

CONTROLS NO

SUBCATCHMENTS ALL

NODES ALL

LINKS ALL

[TAGS]

[MAP]

DIMENSIONS 0.000 0.000 10000.000 10000.000

Units None

[COORDINATES]

:: Node	X-Coord	Y-Coord
:: -----	-----	-----
9	-3897.849	2329.749
11	-2440.889	4183.432
12	-2213.262	5448.029
13	1693.548	3835.125
6	1980.287	5197.133
9A	-2051.971	2311.828
5	-1998.208	6917.563
3A	5188.172	6810.036
3060ut	8037.634	6845.878
7A	5188.172	5591.398
3110ut	8091.398	5573.477
1A	5152.330	4390.681
3290ut	8091.398	4390.681
5A	-1890.681	7939.068
6A	2159.498	6415.771
3020ut	-313.620	9372.760
4	3270.609	8405.018
10	4166.667	7813.620
FES	-3575.269	2885.305
9B	-2267.025	3333.333
3	9740.143	6845.878

# Proposed 2-yr Conditions - Input File

7	9686.380	5609.319
1	9632.616	4426.523
2	672.043	9032.258
4A	4704.301	8817.204
306	6729.391	6810.036
311	6657.706	5573.477
329	6675.627	4390.681
302	-1102.151	8476.703
309	2589.606	7634.409

[VERTICES]

```
;; Link      X-Coord      Y-Coord
;; -----
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.006)

Trail at Overland Ranch

Proposed Conditions

2-yr

WARNING 04: minimum elevation drop used for Conduit 3A-Dum

WARNING 04: minimum elevation drop used for Conduit 7A-Dum

WARNING 04: minimum elevation drop used for Conduit 1A-Dum

WARNING 04: minimum elevation drop used for Conduit 5A-Dum

\*\*\*\*\*

NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.

\*\*\*\*\*

\*\*\*\*\*

Analysis Options

\*\*\*\*\*

Flow Units ..... CFS

Process Models:

Rainfall/Runoff ..... NO

RDI ..... NO

Snowmelt ..... NO

Groundwater ..... NO

Flow Routing ..... YES

Ponding Allowed ..... NO

Water Quality ..... NO

Flow Routing Method ..... KINWAVE

Starting Date ..... JAN-01-2005 00:00:00

Ending Date ..... JAN-01-2005 06:00:00

Antecedent Dry Days ..... 0.0

Report Time Step ..... 00:15:00

Routing Time Step ..... 30.00 sec

## Proposed 2-yr Conditions

```

*****
Flow Routing Continuity      Volume      Volume
                             acre-feet    10^6 gal
*****      -----      -----
Dry Weather Inflow .....    0.000      0.000
Wet Weather Inflow .....    0.000      0.000
Groundwater Inflow .....    0.000      0.000
RDII Inflow .....           0.000      0.000
External Inflow .....       13.879      4.523
External Outflow .....       0.393      0.128
Internal Outflow .....       0.000      0.000
Evaporation Loss .....       0.000      0.000
Seepage Loss .....          0.000      0.000
Initial Stored Volume ....    0.000      0.000
Final Stored Volume .....    13.495      4.398
Continuity Error (%) .....   -0.065

```

```

*****
Highest Flow Instability Indexes
*****
Link C39A1 (1)
Link P39A2 (1)
Link P33AB (1)

```

```

*****
Routing Time Step Summary
*****
Minimum Time Step      :    30.00 sec
Average Time Step      :    30.00 sec
Maximum Time Step      :    30.00 sec
Percent in Steady State :     0.00
Average Iterations per Step :    1.02
Percent Not Converging  :     0.00

```

## Proposed 2-yr Conditions

\*\*\*\*\*  
Node Depth Summary  
\*\*\*\*\*

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:mi n
9	JUNCTION	10.09	10.44	6152.44	0 00:32
11	JUNCTION	10.10	10.45	6120.45	0 00:35
12	JUNCTION	0.41	1.61	6088.61	0 00:34
13	JUNCTION	0.20	0.91	6090.91	0 00:31
6	JUNCTION	0.25	1.48	6061.48	0 00:32
9A	JUNCTION	5.06	5.35	6147.35	0 00:31
5	JUNCTION	0.40	1.61	6067.61	0 00:37
3A	JUNCTION	0.00	0.00	6080.00	0 00:00
306Out	JUNCTION	1.08	1.09	6079.09	0 02:48
7A	JUNCTION	0.00	0.00	6100.00	0 00:00
311Out	JUNCTION	1.08	1.09	6099.09	0 02:45
1A	JUNCTION	0.00	0.00	6080.00	0 00:00
329Out	JUNCTION	1.09	1.09	6079.09	0 02:21
5A	JUNCTION	0.22	1.23	6064.23	0 00:34
6A	JUNCTION	0.23	1.48	6058.48	0 00:32
302Out	JUNCTION	0.09	0.09	6061.09	0 03:06
4	JUNCTION	0.09	0.10	6046.10	0 03:03
10	JUNCTION	0.03	0.14	6090.14	0 00:31
FES	JUNCTION	0.09	0.44	6148.44	0 00:32
9B	JUNCTION	5.05	5.28	6136.28	0 00:37
3	OUTFALL	0.08	0.09	6076.09	0 02:48
7	OUTFALL	0.08	0.09	6093.09	0 02:46
1	OUTFALL	0.09	0.09	6076.69	0 02:21
2	OUTFALL	0.09	0.09	6059.09	0 03:06
4A	OUTFALL	0.08	0.09	6044.09	0 03:05
306	STORAGE	3.24	3.71	6083.71	0 02:48
311	STORAGE	2.96	3.39	6103.39	0 02:45
329	STORAGE	1.52	1.72	6081.72	0 02:21

# Proposed 2-yr Conditions

302	STORAGE	3. 51	4. 01	6067. 01	0	03: 06
309	STORAGE	3. 85	4. 36	6052. 36	0	03: 03

\*\*\*\*\*  
Node Inflow Summary  
\*\*\*\*\*

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:mi n	Lateral Inflow Volume 10^6 gal	Total Inflow Vol ume 10^6 gal	Flow Balance Error Percent
9	JUNCTION	3. 98	3. 98	0 00: 32	0. 0804	0. 0804	0. 000
11	JUNCTION	13. 89	19. 85	0 00: 32	0. 269	0. 399	0. 000
12	JUNCTION	11. 86	31. 29	0 00: 34	0. 274	0. 673	-0. 000
13	JUNCTION	37. 19	37. 19	0 00: 31	0. 703	0. 703	0. 000
6	JUNCTION	48. 97	81. 79	0 00: 32	0. 757	1. 46	0. 000
9A	JUNCTION	2. 83	2. 83	0 00: 31	0. 0494	0. 0494	0. 000
5	JUNCTION	47. 70	74. 89	0 00: 33	0. 88	1. 55	0. 000
3A	JUNCTION	16. 77	16. 77	0 00: 32	0. 39	0. 39	0. 000
306Out	JUNCTION	0. 00	0. 18	0 02: 48	0	0. 0257	0. 000
7A	JUNCTION	12. 36	12. 36	0 00: 32	0. 287	0. 287	0. 000
311Out	JUNCTION	0. 00	0. 17	0 02: 45	0	0. 0245	0. 000
1A	JUNCTION	9. 33	9. 33	0 00: 30	0. 154	0. 154	0. 000
329Out	JUNCTION	0. 00	0. 12	0 02: 21	0	0. 0175	0. 000
5A	JUNCTION	14. 78	89. 43	0 00: 34	0. 34	1. 89	0. 000
6A	JUNCTION	16. 41	97. 96	0 00: 32	0. 331	1. 79	0. 000
302Out	JUNCTION	0. 00	0. 18	0 03: 06	0	0. 0268	0. 000
4	JUNCTION	0. 00	0. 19	0 03: 03	0	0. 0281	0. 000
10	JUNCTION	0. 17	0. 17	0 00: 31	0. 00232	0. 00232	0. 000
FES	JUNCTION	0. 00	3. 98	0 00: 32	0	0. 0803	0. 000
9B	JUNCTION	0. 00	6. 57	0 00: 35	0	0. 13	0. 000
3	OUTFALL	0. 00	0. 18	0 02: 48	0	0. 0257	0. 000
7	OUTFALL	0. 00	0. 17	0 02: 46	0	0. 0245	0. 000
1	OUTFALL	0. 00	0. 12	0 02: 21	0	0. 0174	0. 000

# Proposed 2-yr Conditions

2	OUTFALL	0.00	0.18	0	03:06	0	0.0267	0.000
4A	OUTFALL	0.19	0.43	0	00:44	0.00386	0.0336	0.000
306	STORAGE	0.00	16.77	0	00:32	0	0.39	-0.001
311	STORAGE	0.00	12.36	0	00:32	0	0.287	-0.001
329	STORAGE	0.00	9.33	0	00:30	0	0.154	-0.002
302	STORAGE	0.00	89.43	0	00:34	0	1.89	-0.000
309	STORAGE	0.00	97.96	0	00:32	0	1.79	-0.000

\*\*\*\*\*

## Node Surge Summary

\*\*\*\*\*

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
3A	JUNCTION	6.01	0.000	0.000
7A	JUNCTION	6.01	0.000	0.000
1A	JUNCTION	6.01	0.000	0.000
306	STORAGE	5.75	3.562	3.288
311	STORAGE	5.75	3.241	3.609
329	STORAGE	5.74	1.571	4.279
302	STORAGE	5.73	3.861	3.989
309	STORAGE	5.74	4.213	3.637

\*\*\*\*\*

## Node Flooding Summary

\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*

## Proposed 2-yr Conditions

### Storage Volume Summary

\*\*\*\*\*

Storage Unit	Average Volume 1000 ft <sup>3</sup>	Avg Pcnt Full	Evap Pcnt Loss	Infil Pcnt Loss	Maximum Volume 1000 ft <sup>3</sup>	Max Pcnt Full	Time of Max Occurrence days hr: min	Maximum Outflow CFS
306	41.991	23	0	0	50.692	28	0 02: 48	0.18
311	30.553	19	0	0	36.966	23	0 02: 44	0.17
329	16.620	7	0	0	19.748	8	0 02: 20	0.12
302	210.440	21	0	0	251.359	25	0 03: 05	0.18
309	201.200	25	0	0	237.949	30	0 03: 03	0.19

\*\*\*\*\*

### Outfall Loading Summary

\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10 <sup>6</sup> gal
3	96.26	0.17	0.18	0.026
7	95.98	0.16	0.17	0.024
1	96.26	0.11	0.12	0.017
2	95.98	0.17	0.18	0.027
4A	95.56	0.22	0.43	0.034
System	96.01	0.82	0.96	0.128

\*\*\*\*\*

### Link Flow Summary

\*\*\*\*\*



## Proposed 2-yr Conditions

Link	Type	Maximum  Flow  CFS	Time of Max Occurrence days hr:mi n	Maximum  Vel oc  ft/sec	Max/ Full Flow	Max/ Full Depth
P33A	CONDUIT	3.98	0 00: 32	6.77	0.07	0.18
C33EF	CHANNEL	19.68	0 00: 35	4.24	0.00	0.05
C33CD	CHANNEL	31.11	0 00: 37	4.54	0.00	0.07
C39A1	CHANNEL	36.17	0 00: 34	13.75	0.00	0.06
P39A2	CONDUIT	81.73	0 00: 32	9.23	0.13	0.21
P33AB	CONDUIT	74.87	0 00: 34	8.72	0.09	0.18
P33B	CONDUIT	2.81	0 00: 32	7.67	0.07	0.17
3A-Dum	DUMMY	16.77	0 00: 32			
P306	CONDUIT	0.18	0 02: 48	3.34	0.00	0.03
7A-Dum	DUMMY	12.36	0 00: 32			
11	CONDUIT	0.17	0 02: 46	2.66	0.00	0.03
1A-Dum	DUMMY	9.33	0 00: 30			
14	CONDUIT	0.12	0 02: 21	2.63	0.01	0.06
5A-Dum	DUMMY	89.43	0 00: 34			
C302	CONDUIT	0.18	0 03: 06	2.45	0.00	0.02
6A-Dum	DUMMY	97.96	0 00: 32			
C39B	CHANNEL	0.19	0 03: 05	1.75	0.00	0.01
C39	CHANNEL	0.11	0 00: 48	2.48	0.00	0.01
C33A	CONDUIT	3.90	0 00: 37	2.30	0.02	0.14
P33	CONDUIT	6.57	0 00: 35	9.95	0.05	0.15
306-Ori f	ORIFICE	0.18	0 02: 48			0.00
311-Ori f	ORIFICE	0.17	0 02: 45			0.00
329-Ori f	ORIFICE	0.12	0 02: 21			0.00
309-Ori f	ORIFICE	0.19	0 03: 03			0.00
302-Ori f	ORIFICE	0.18	0 03: 06			0.00

\*\*\*\*\*

### Conduit Surcharge Summary

\*\*\*\*\*

No conduits were surcharged.

## Proposed 2-yr Conditions

Analysis begun on: Sat Apr 16 18:06:06 2022  
Analysis ended on: Sat Apr 16 18:06:06 2022  
Total elapsed time: < 1 sec

# Proposed 100-yr Conditions - Input File

## [TITLE]

```
;; Project Title/Notes
Trail at Overland Ranch
Proposed Conditions
100-yr
```

## [OPTIONS]

```
;; Option      Value
FLOW_UNITS    CFS
INFILTRATION  HORTON
FLOW_ROUTING   KINWAVE
LINK_OFFSETS  DEPTH
MIN_SLOPE     0
ALLOW_PONDING NO
SKIP_STEADY_STATE NO
```

```
START_DATE    01/01/2005
START_TIME    00:00:00
REPORT_START_DATE 01/01/2005
REPORT_START_TIME 00:00:00
END_DATE      01/01/2005
END_TIME      06:00:00
SWEEP_START   01/01
SWEEP_END     12/31
DRY_DAYS      0
REPORT_STEP   00:15:00
WET_STEP      00:05:00
DRY_STEP      01:00:00
ROUTING_STEP  0:00:30
```

```
INERTIAL_DAMPING PARTIAL
NORMAL_FLOW_LIMITED BOTH
FORCE_MAIN_EQUATION H-W
VARIABLE_STEP    0.75
LENGTHENING_STEP 0
MIN_SURFAREA     12.557
MAX_TRIALS        8
```

# Proposed 100-yr Conditions - Input File

HEAD\_TOLERANCE 0.005  
 SYS\_FLOW\_TOL 5  
 LAT\_FLOW\_TOL 5

## [FILES]

;; Interfacing Files

USE INFLOWS "D:\Temp Projects\1002-98\Drainage Rpt\Calcs\CUHP\Proposed\Output\BF-SWMM-Pr-100.txt"

## [EVAPORATION]

;; Evap Data Parameters

;; -----

CONSTANT 0.0

DRY\_ONLY NO

## [JUNCTIONS]

;; Junction	Invert	Dmax	Di n i t	Dsurch	Aponded
;; -----	-----	-----	-----	-----	-----
9	6142	0	0	0	0
11	6110	0	0	0	0
12	6087	0	0	0	0
13	6090	0	0	0	0
6	6060	0	0	14	0
9A	6142	0	0	0	0
5	6066	0	0	16	0
3A	6080	0	0	0	0
3060ut	6078	0	0	0	0
7A	6100	0	0	0	0
3110ut	6098	0	0	0	0
1A	6080	0	0	0	0
3290ut	6078	0	0	0	0
5A	6063	0	0	0	0
6A	6057	0	0	0	0
3020ut	6061	0	0	0	0
4	6046	0	0	0	0
10	6090	0	0	0	0
FES	6148	0	0	0	0
9B	6131	0	0	0	0

Proposed 100-yr Conditions - Input File

[OUTFALLS]

;; Outfall	Invert	Type	Stage Data	Gated
3	6076	FREE		NO
7	6093	FREE		NO
1	6076.6	FREE		NO
2	6059	FREE		NO
4A	6044	FREE		NO

[STORAGE]

;; Storage Node	Invert	Dmax	Di ni t	Curve	Name/Params	Aponded	Fevap	SeepRate
306	6080	7	0	TABULAR	Pond306	0	0	0
311	6100	7	0	TABULAR	Pond311	0	0	0
329	6080	6	0	TABULAR	Pond329	0	0	0
302	6063	8	0	TABULAR	Pond302	0	0	0
309	6048	8	0	TABULAR	Pond309	0	0	0

[CONDUITS]

;; Conduit	From Node	To Node	Length	Roughness	InOffset	OutOffset	Ini tFlow	MaxFlow
P33A	9	FES	200	.013	10	0	0	0
C33EF	11	12	735	.05	0	0	0	0
C33CD	12	5	760	.05	0	0	0	0
C39A1	13	6	950	.05	0	0	0	0
P39A2	6	6A	300	.016	0	0	0	0
P33AB	5	5A	300	.016	0	0	0	0
P33B	9A	9B	455	.013	5	0	0	0

Proposed 100-yr Conditions - Input File

3A-Dum	3A	306	400	0.01	0	0	0	0
P306	306Out	3	50	.016	1	0	0	0
7A-Dum	7A	311	400	0.01	0	0	0	0
11	311Out	7	170	.016	1	0	0	0
1A-Dum	1A	329	400	0.01	0	0	0	0
14	329Out	1	70	.016	1	0	0	0
5A-Dum	5A	302	400	0.01	0	0	0	0
C302	302Out	2	70	.016	0	0	0	0
6A-Dum	6A	309	400	0.01	0	0	0	0
C39B	4	4A	100	.016	0	0	0	0
C39	10	4A	1260	0.01	0	0	0	0
C33A	FES	9B	600	.035	0	5	0	0
P33	9B	11	265	.013	0	10	0	0

[ORIFICES]

;; Ori fice	From Node	To Node	Type	CrestHt	Qcoeff	Gated	CloseTime
306-Ori f	306	306Out	SIDE	0	0.65	NO	0
311-Ori f	311	311Out	SIDE	0	0.65	NO	0
329-Ori f	329	329Out	SIDE	0	0.65	NO	0
309-Ori f	309	4	SIDE	0	0.65	NO	0
302-Ori f	302	302Out	SIDE	0	0.65	NO	0

# Proposed 100-yr Conditions - Input File

## [XSECTIONS]

;; Link	Shape	Geom1	Geom2	Geom3	Geom4	Barrel s
P33A	CIRCULAR	2.5	0	0	0	1
C33EF	IRREGULAR	C33EF	0	0	0	1
C33CD	IRREGULAR	C33EF	0	0	0	1
C39A1	IRREGULAR	C39A1A	0	0	0	1
P39A2	RECT_OPEN	7	6	0	0	1
P33AB	RECT_OPEN	7	7	0	0	1
P33B	CIRCULAR	2	0	0	0	1
3A-Dum	DUMMY	0	0	0	0	1
P306	CIRCULAR	2.5	0	0	0	1
7A-Dum	DUMMY	0	0	0	0	1
11	CIRCULAR	3	0	0	0	1
1A-Dum	DUMMY	0	0	0	0	1
14	CIRCULAR	1.5	0	0	0	1
5A-Dum	DUMMY	0	0	0	0	1
C302	CIRCULAR	4	0	0	0	1
6A-Dum	DUMMY	0	0	0	0	1
C39B	IRREGULAR	C39A1A	0	0	0	1
C39	IRREGULAR	C39B	0	0	0	1
C33A	TRAPEZOIDAL	2	5	4	4	1
P33	CIRCULAR	3	0	0	0	1
306-Ori f	CIRCULAR	1.6	0	0	0	
311-Ori f	CIRCULAR	1.04	0	0	0	
329-Ori f	CIRCULAR	1.12	0	0	0	
309-Ori f	CIRCULAR	3.64	0	0	0	
302-Ori f	CIRCULAR	3.64	0	0	0	

## [TRANSECTS]

;; Transect Data in HEC-1 format

NC	.05	.05	.045						
X1 C33EF		6	84	103	0.0	0.0	0.0	0.0	0.0
GR 6070	0	6062	59	6048	84	6045.7	92	6052	103
GR 6070	260								

# Proposed 100-yr Conditions - Input File

```

NC .05      .05      .04
X1 C34      6      106      136      0.0      0.0      0.0      0.0      0.0
GR 6050     0      6038     68      6028     106      6027.5    114      6030     136
GR 6050     158
;
NC .05      .05      .04
X1 C39B     5      64      154      0.0      0.0      0.0      0.0      0.0
GR 6080     0      6072     64      6063     100      6074      154      6080     208
;
NC .05      .05      .045
X1 C39A1A   6      95      135      0.0      0.0      0.0      0.0      0.0
GR 6084     0      6078     65      6071     95      6070      115      6074     135
GR 6084     235

```

## [LOSSES]

```

;; Link      Kin      Kout      Kavg      Flap Gate  SeepRate
;; -----

```

## [CURVES]

```

;; Curve      Type      X-Value      Y-Value
;; -----
Pond306       Storage    0             0
Pond306       Storage    7             51500
;
Pond311       Storage    0             0
Pond311       Storage    7             45000
;
Pond329       Storage    0             0
Pond329       Storage    6             80000
;
Pond309       Storage    0             0
Pond309       Storage    8             200000
;
Pond302       Storage    0             0
Pond302       Storage    8             250000

```

## [REPORT]



# Proposed 100-yr Conditions - Input File

:: Reporting Options

INPUT NO

CONTROLS NO

SUBCATCHMENTS ALL

NODES ALL

LINKS ALL

[TAGS]

[MAP]

DIMENSIONS 0.000 0.000 10000.000 10000.000

Units None

[COORDINATES]

:: Node	X-Coord	Y-Coord
:: -----	-----	-----
9	-3897.849	2329.749
11	-2440.889	4183.432
12	-2213.262	5448.029
13	1693.548	3835.125
6	1980.287	5197.133
9A	-2051.971	2311.828
5	-1998.208	6917.563
3A	5188.172	6810.036
3060ut	8037.634	6845.878
7A	5188.172	5591.398
3110ut	8091.398	5573.477
1A	5152.330	4390.681
3290ut	8091.398	4390.681
5A	-1890.681	7939.068
6A	2159.498	6415.771
3020ut	-313.620	9372.760
4	3270.609	8405.018
10	4166.667	7813.620
FES	-3575.269	2885.305
9B	-2267.025	3333.333
3	9740.143	6845.878

Proposed 100-yr Conditions - Input File

7	9686.380	5609.319
1	9632.616	4426.523
2	672.043	9032.258
4A	4704.301	8817.204
306	6729.391	6810.036
311	6657.706	5573.477
329	6675.627	4390.681
302	-1102.151	8476.703
309	2589.606	7634.409

[VERTICES]		
:: Link	X-Coord	Y-Coord
:: -----	-----	-----

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.006)

Trail at Overland Ranch

Proposed Conditions

100-yr

WARNING 04: minimum elevation drop used for Conduit 3A-Dum

WARNING 04: minimum elevation drop used for Conduit 7A-Dum

WARNING 04: minimum elevation drop used for Conduit 1A-Dum

WARNING 04: minimum elevation drop used for Conduit 5A-Dum

\*\*\*\*\*

NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.

\*\*\*\*\*

\*\*\*\*\*

Analysis Options

\*\*\*\*\*

Flow Units ..... CFS

Process Models:

Rainfall/Runoff ..... NO

RDI ..... NO

Snowmelt ..... NO

Groundwater ..... NO

Flow Routing ..... YES

Ponding Allowed ..... NO

Water Quality ..... NO

Flow Routing Method ..... KINWAVE

Starting Date ..... JAN-01-2005 00:00:00

Ending Date ..... JAN-01-2005 06:00:00

Antecedent Dry Days ..... 0.0

Report Time Step ..... 00:15:00

Routing Time Step ..... 30.00 sec

## Proposed 100-yr Conditions

```

*****
Flow Routing Continuity      Volume      Volume
                             acre-feet    10^6 gal
*****      -----      -----
Dry Weather Inflow .....    0.000      0.000
Wet Weather Inflow .....    0.000      0.000
Groundwater Inflow .....    0.000      0.000
RDII Inflow .....           0.000      0.000
External Inflow .....       71.685      23.360
External Outflow .....      71.545      23.314
Internal Outflow .....      0.000      0.000
Evaporation Loss .....      0.000      0.000
Seepage Loss .....          0.000      0.000
Initial Stored Volume ....    0.000      0.000
Final Stored Volume .....    0.134      0.044
Continuity Error (%) .....    0.009

```

### \*\*\*\*\* Highest Flow Instability Indexes \*\*\*\*\*

```

Link C302 (7)
Link P306 (2)
Link P33AB (1)
Link C39A1 (1)
Link 5A-Dum (1)

```

### \*\*\*\*\* Routing Time Step Summary \*\*\*\*\*

```

Minimum Time Step      :    30.00 sec
Average Time Step      :    30.00 sec
Maximum Time Step      :    30.00 sec
Percent in Steady State :     0.00
Average Iterations per Step :    1.31
Percent Not Converging  :     0.00

```

# Proposed 100-yr Conditions

\*\*\*\*\*  
Node Depth Summary  
\*\*\*\*\*

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:mi n
9	JUNCTION	10.32	11.75	6153.75	0 00:39
11	JUNCTION	10.31	11.69	6121.69	0 00:39
12	JUNCTION	0.76	3.32	6090.32	0 00:38
13	JUNCTION	0.34	1.61	6091.61	0 00:36
6	JUNCTION	0.65	4.86	6064.86	0 00:36
9A	JUNCTION	5.22	6.37	6148.37	0 00:36
5	JUNCTION	0.83	4.44	6070.44	0 00:38
3A	JUNCTION	0.00	0.00	6080.00	0 00:00
306Out	JUNCTION	1.48	1.92	6079.92	0 01:26
7A	JUNCTION	0.00	0.00	6100.00	0 00:00
3110ut	JUNCTION	1.55	1.65	6099.65	0 01:37
1A	JUNCTION	0.00	0.00	6080.00	0 00:00
3290ut	JUNCTION	1.41	1.72	6079.72	0 01:12
5A	JUNCTION	0.67	4.44	6067.44	0 00:38
6A	JUNCTION	0.63	4.86	6061.86	0 00:36
3020ut	JUNCTION	1.42	2.35	6063.35	0 01:25
4	JUNCTION	0.89	1.57	6047.57	0 01:16
10	JUNCTION	0.17	0.93	6090.93	0 00:36
FES	JUNCTION	0.32	1.75	6149.75	0 00:39
9B	JUNCTION	5.20	6.08	6137.08	0 00:41
3	OUTFALL	0.48	0.92	6076.92	0 01:26
7	OUTFALL	0.54	0.65	6093.65	0 01:37
1	OUTFALL	0.41	0.72	6077.32	0 01:13
2	OUTFALL	1.42	2.35	6061.35	0 01:25
4A	OUTFALL	0.89	1.57	6045.57	0 01:17
306	STORAGE	2.35	5.79	6085.79	0 01:26

# Proposed 100-yr Conditions

311	STORAGE	3. 98	6. 13	6106. 13	0	01: 37
329	STORAGE	1. 18	2. 64	6082. 64	0	01: 12
302	STORAGE	3. 60	7. 37	6070. 37	0	01: 25
309	STORAGE	3. 05	7. 41	6055. 41	0	01: 16

\*\*\*\*\*

## Node Inflow Summary

\*\*\*\*\*

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:mi n	Lateral Inflow Volume 10^6 gal	Total Inflow Vol ume 10^6 gal	Flow Bal ance Error Percent
9	JUNCTION	48. 68	48. 68	0 00: 39	1. 04	1. 04	0. 000
11	JUNCTION	72. 07	152. 87	0 00: 37	1. 33	3. 01	0. 000
12	JUNCTION	68. 43	220. 85	0 00: 38	1. 49	4. 5	0. 000
13	JUNCTION	170. 70	170. 70	0 00: 36	3. 11	3. 11	0. 000
6	JUNCTION	246. 43	409. 29	0 00: 36	3. 67	6. 78	0. 000
9A	JUNCTION	34. 35	34. 35	0 00: 36	0. 642	0. 642	0. 000
5	JUNCTION	239. 11	451. 12	0 00: 38	4. 24	8. 74	0. 000
3A	JUNCTION	76. 46	76. 46	0 00: 37	1. 7	1. 7	0. 000
306Out	JUNCTION	0. 00	23. 43	0 01: 26	0	1. 7	0. 000
7A	JUNCTION	59. 13	59. 13	0 00: 37	1. 31	1. 31	0. 000
3110Out	JUNCTION	0. 00	10. 50	0 01: 37	0	1. 27	0. 000
1A	JUNCTION	34. 49	34. 49	0 00: 35	0. 562	0. 562	0. 000
3290Out	JUNCTION	0. 00	7. 41	0 01: 12	0	0. 562	0. 000
5A	JUNCTION	71. 97	522. 88	0 00: 38	1. 56	10. 3	0. 000
6A	JUNCTION	99. 86	508. 72	0 00: 36	1. 95	8. 73	0. 000
3020Out	JUNCTION	0. 00	127. 86	0 01: 25	0	10. 3	0. 000
4	JUNCTION	0. 00	128. 29	0 01: 16	0	8. 73	0. 000
10	JUNCTION	16. 54	16. 54	0 00: 36	0. 291	0. 291	0. 000
FES	JUNCTION	0. 00	48. 68	0 00: 39	0	1. 04	0. 000
9B	JUNCTION	0. 00	82. 40	0 00: 39	0	1. 68	0. 000
3	OUTFALL	0. 00	23. 43	0 01: 26	0	1. 7	0. 000

# Proposed 100-yr Conditions

7	OUTFALL	0.00	10.50	0	01:37	0	1.26	0.000
1	OUTFALL	0.00	7.41	0	01:13	0	0.562	0.000
2	OUTFALL	0.00	127.86	0	01:25	0	10.3	0.000
4A	OUTFALL	19.26	151.19	0	00:59	0.462	9.49	0.000
306	STORAGE	0.00	76.46	0	00:37	0	1.7	0.016
311	STORAGE	0.00	59.13	0	00:37	0	1.31	0.011
329	STORAGE	0.00	34.49	0	00:35	0	0.562	0.066
302	STORAGE	0.00	522.88	0	00:38	0	10.3	0.026
309	STORAGE	0.00	508.72	0	00:36	0	8.73	0.023

\*\*\*\*\*

## Node Surcharge Summary

\*\*\*\*\*

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
3A	JUNCTION	6.01	0.000	0.000
7A	JUNCTION	6.01	0.000	0.000
1A	JUNCTION	6.01	0.000	0.000
306	STORAGE	3.12	4.189	1.211
311	STORAGE	5.60	5.095	0.865
329	STORAGE	2.92	1.518	3.362
302	STORAGE	2.91	3.729	0.631
309	STORAGE	2.47	3.766	0.594

\*\*\*\*\*

## Node Flooding Summary

\*\*\*\*\*

No nodes were flooded.

## Proposed 100-yr Conditions

### \*\*\*\*\* Storage Volume Summary \*\*\*\*\*

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Infil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
306	38.397	21	0	0	123.292	68	0 01:25	23.43
311	60.525	38	0	0	120.985	77	0 01:37	10.50
329	15.287	6	0	0	46.411	19	0 01:12	7.41
302	302.425	30	0	0	848.467	85	0 01:24	127.86
309	207.448	26	0	0	685.724	86	0 01:16	128.29

### \*\*\*\*\* Outfall Loading Summary \*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
3	73.93	14.21	23.43	1.700
7	97.09	8.05	10.50	1.265
1	90.43	3.84	7.41	0.562
2	97.23	65.47	127.86	10.298
4A	86.41	67.87	151.19	9.488
System	89.02	159.44	314.96	23.312

### \*\*\*\*\* Link Flow Summary



# Proposed 100-yr Conditions

\*\*\*\*\*

Link	Type	Maximum  Flow  CFS	Time of Max Occurrence days hr:mi n	Maximum  Vel oc  ft/sec	Max/ Full Flow	Max/ Full Depth
P33A	CONDUIT	48.68	0 00:39	13.23	0.84	0.70
C33EF	CHANNEL	152.59	0 00:39	7.40	0.00	0.12
C33CD	CHANNEL	220.55	0 00:40	15.13	0.00	0.14
C39A1	CHANNEL	169.47	0 00:38	13.78	0.01	0.11
P39A2	CONDUIT	409.09	0 00:36	14.03	0.64	0.69
P33AB	CONDUIT	451.02	0 00:38	14.53	0.56	0.63
P33B	CONDUIT	34.31	0 00:36	15.04	0.81	0.68
3A-Dum	DUMMY	76.46	0 00:37			
P306	CONDUIT	23.43	0 01:26	14.37	0.29	0.37
7A-Dum	DUMMY	59.13	0 00:37			
11	CONDUIT	10.50	0 01:37	9.29	0.10	0.22
1A-Dum	DUMMY	34.49	0 00:35			
14	CONDUIT	7.41	0 01:13	8.80	0.47	0.48
5A-Dum	DUMMY	522.88	0 00:38			
C302	CONDUIT	127.86	0 01:25	16.69	0.65	0.59
6A-Dum	DUMMY	508.72	0 00:36			
C39B	CHANNEL	128.29	0 01:17	4.53	0.01	0.11
C39	CHANNEL	16.24	0 00:42	4.22	0.00	0.05
C33A	CONDUIT	48.66	0 00:41	4.86	0.27	0.54
P33	CONDUIT	82.40	0 00:39	20.14	0.61	0.56
306-Ori f	ORIFICE	23.43	0 01:26			0.00
311-Ori f	ORIFICE	10.50	0 01:37			0.00
329-Ori f	ORIFICE	7.41	0 01:12			0.00
309-Ori f	ORIFICE	128.29	0 01:16			0.00
302-Ori f	ORIFICE	127.86	0 01:25			0.00

\*\*\*\*\*

Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Sat Apr 16 18:02:45 2022

Analysis ended on: Sat Apr 16 18:02:45 2022

Total elapsed time: < 1 sec

Runoff Comparison Table							
Design Point	Existing			Proposed			
	Contrib. Basin	Q <sub>2</sub>	Q <sub>100</sub>	Contrib. Basin	Pre-Detention		Detained
					Q <sub>2</sub>	Q <sub>100</sub>	Q <sub>100</sub>
1	H29	0.0	10.0	29	9.0	34.0	7.4
2	H33, H34, HO33	4.9	312.5	33A, 33B, 33C, 33D, 34, O33A, O33B	89.4	522.9	127.9
3	H37	1.0	52.0	37	17.0	76.0	23.4
4	H39A, H39B	2.8	269.3	39A-1, 39A-2, 39B-1, 39B-2, 39A-1, 39A-2, 39B-1, 39B-2	98.0	508.7	128.3
4A	H39A, H39B, HO39	2.9	284.8	2, 39B-3, HO39	0.4	151.2	N/A
5	H33, HO33	3.9	225.4	33A, 33B, 33C, 33D, O33A, O33B	74.9	451.1	N/A
6	H39A	2.0	121.0	39A-1, 39A-2	81.8	409.3	N/A
7	H18B	1.0	23.0	18B-1	12.0	59.0	10.5
8	H19	0.0	15.0	19A	1.0	8.0	N/A
9 (9B)	HO33	2.0	81.0	O33A, O33B	6.6	82.4	N/A
10	HO39	0.0	17.0	HO39	0.0	17.0	N/A



# Coal Creek (E. Yale Avenue to E. County Line Road)

## Flood Hazard Area Delineation

### August 2014

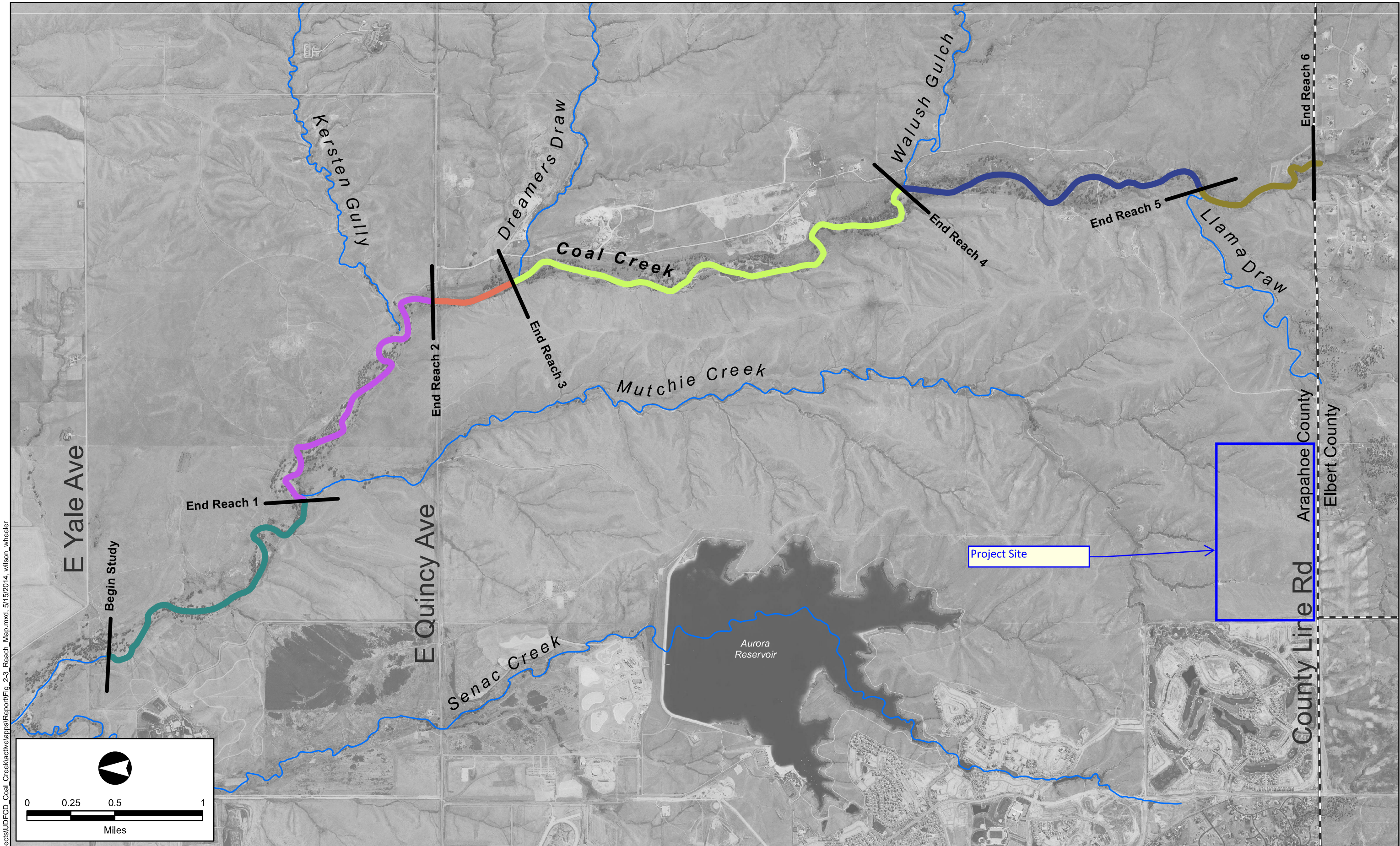


Urban Drainage & Flood Control District  
Arapahoe County

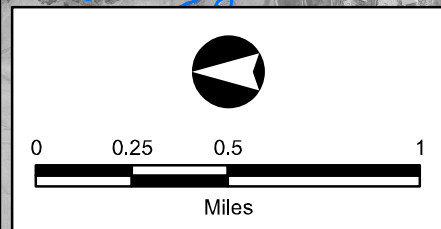


1601 Blake Street, Suite 200  
Denver, CO 80202





FILE: G:\gis\_projects\UDFCD\_Coal\_Creek\active\apps\Report\Fig\_2-3\_Reach\_Map.mxd, 5/15/2014, wilson\_wheeler



No.	DATE	DESCRIPTION	APPR.



designed by: \_\_\_\_\_  
drawn by: WW  
checked by: RK  
project no.: 11.155.019  
date: 4/7/2014



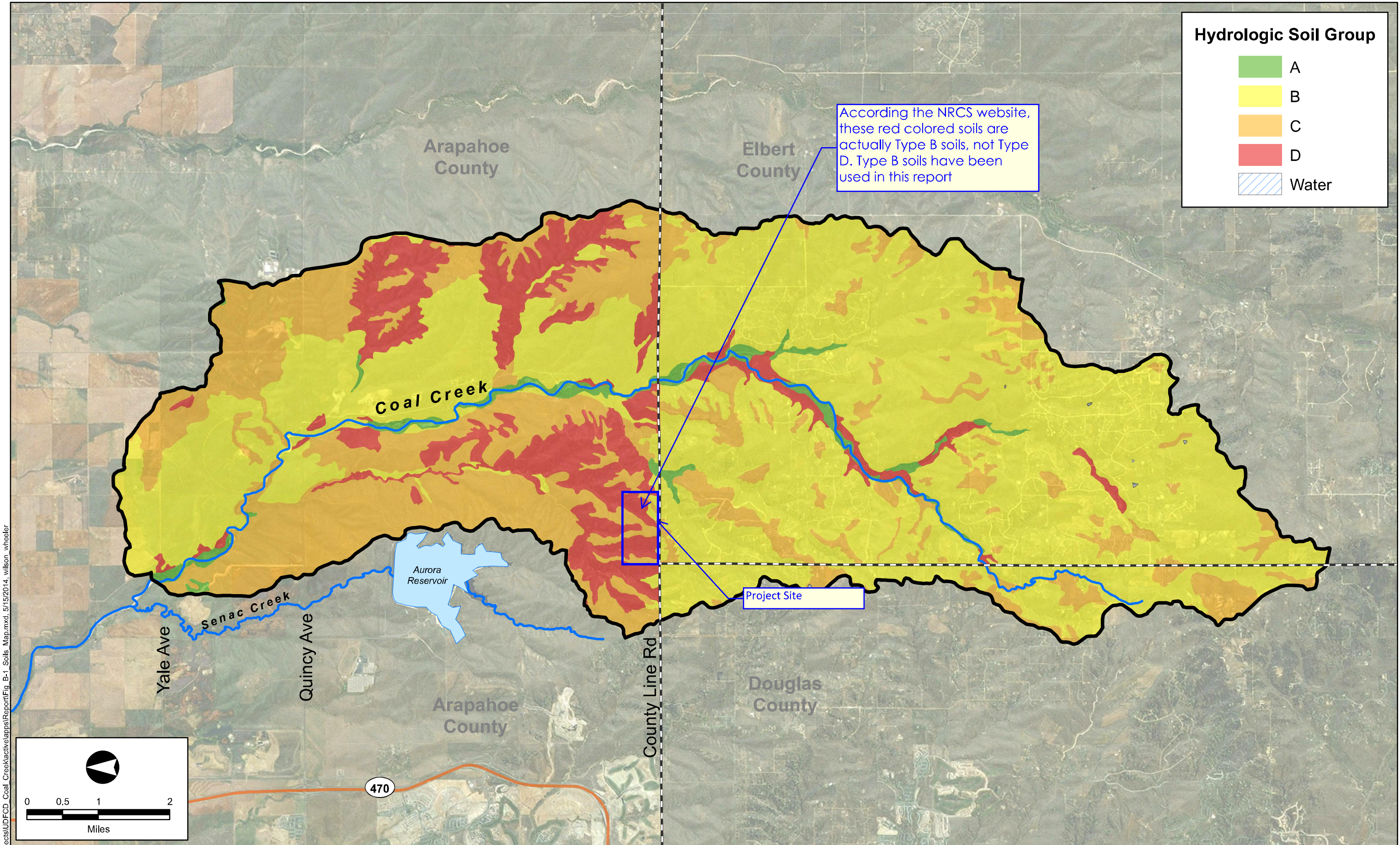
URBAN DRAINAGE AND FLOOD  
CONTROL DISTRICT AND  
ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION  
COAL CREEK (YALE TO COUNTY LINE RD)

REACH DEFINITION MAP

FIGURE  
2-3





FILE: G:\gis\_projects\UDFCD\_Coal\_Creek\active\apps\Report\Fig. B-1\_Soils\_Map.mxd, 5/15/2014, wilson\_wheeler

No.	DATE	DESCRIPTION	APPR.



designed by: \_\_\_\_\_  
 drawn by: WW  
 checked by: RK  
 project no.: 11.155.019  
 date: 4/7/2014



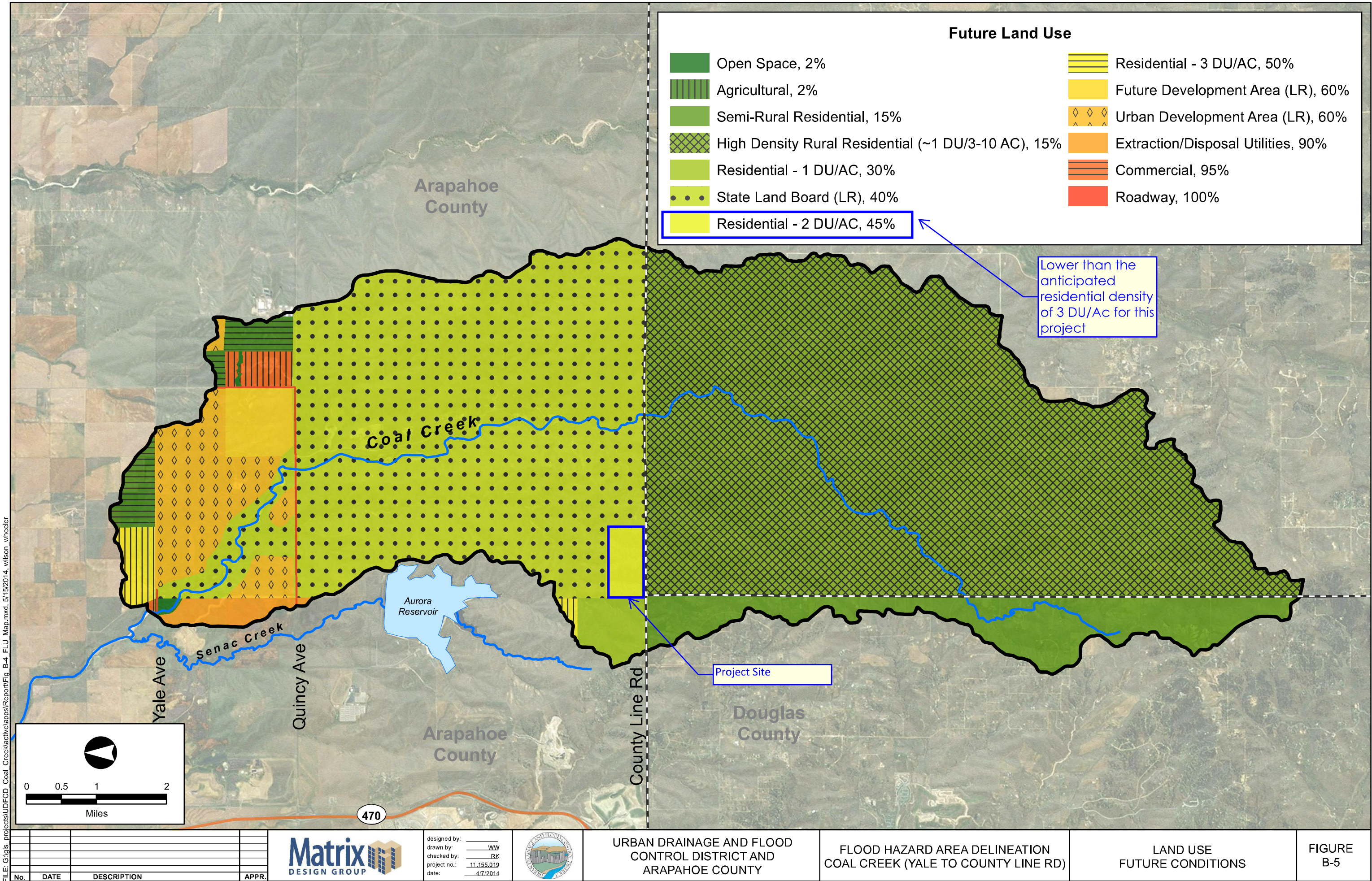
URBAN DRAINAGE AND FLOOD  
 CONTROL DISTRICT AND  
 ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION  
 COAL CREEK (YALE TO COUNTY LINE RD)

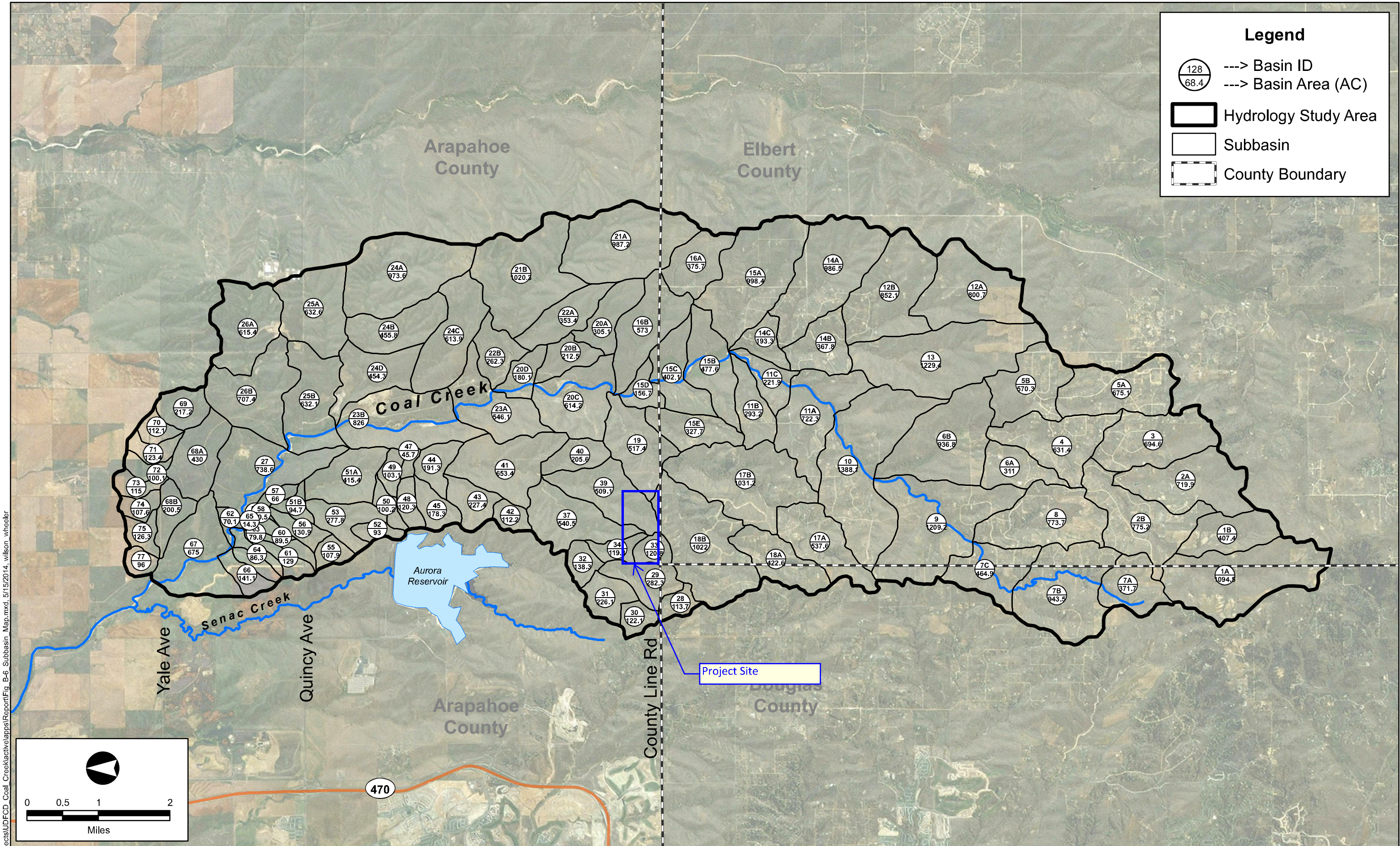
HYDROLOGIC SOIL GROUPS

FIGURE  
 B-1









FILE: G:\gis\_projects\UDFCD\_Coal\_Creek\active\apps\Report\Fig. B-6 Subbasin Map.mxd, 5/15/2014, wilson\_wheeler

No.	DATE	DESCRIPTION	APPR.



designed by: \_\_\_\_\_  
drawn by: WVV  
checked by: RK  
project no.: 11.155.019  
date: 4/7/2014



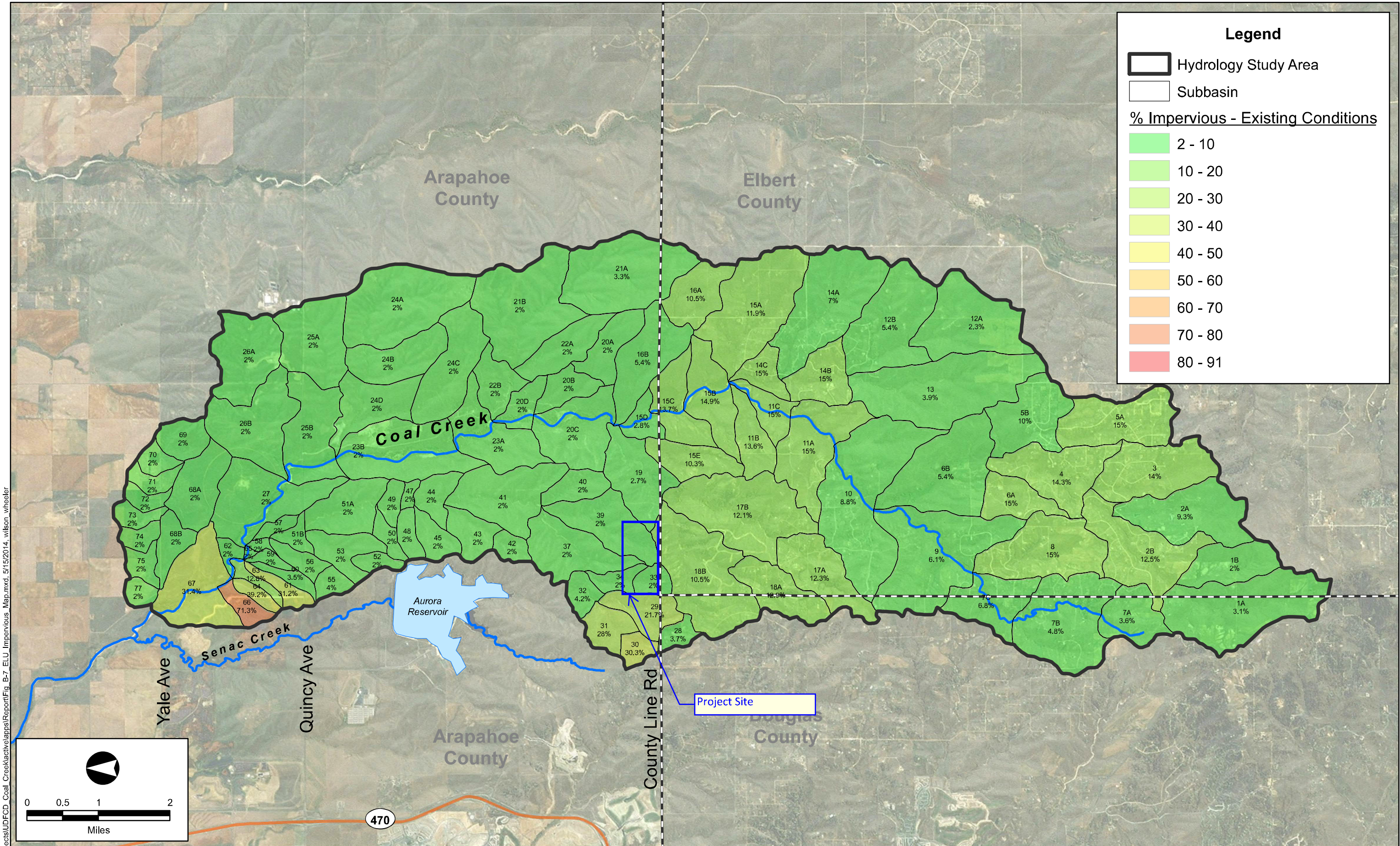
URBAN DRAINAGE AND FLOOD  
CONTROL DISTRICT AND  
ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION  
COAL CREEK (YALE TO COUNTY LINE RD)

SUBWATERSHED MAP

FIGURE  
B-6





FILE: G:\gis\_projects\UDFCD\_Coal\_Creek\active\apps\Report\Fig. B-7 ELU Impervious Map.mxd, 5/15/2014, wilson\_wheeler

No.	DATE	DESCRIPTION	APPR.



designed by: \_\_\_\_\_  
 drawn by: WW  
 checked by: RK  
 project no.: 11.155.019  
 date: 4/7/2014



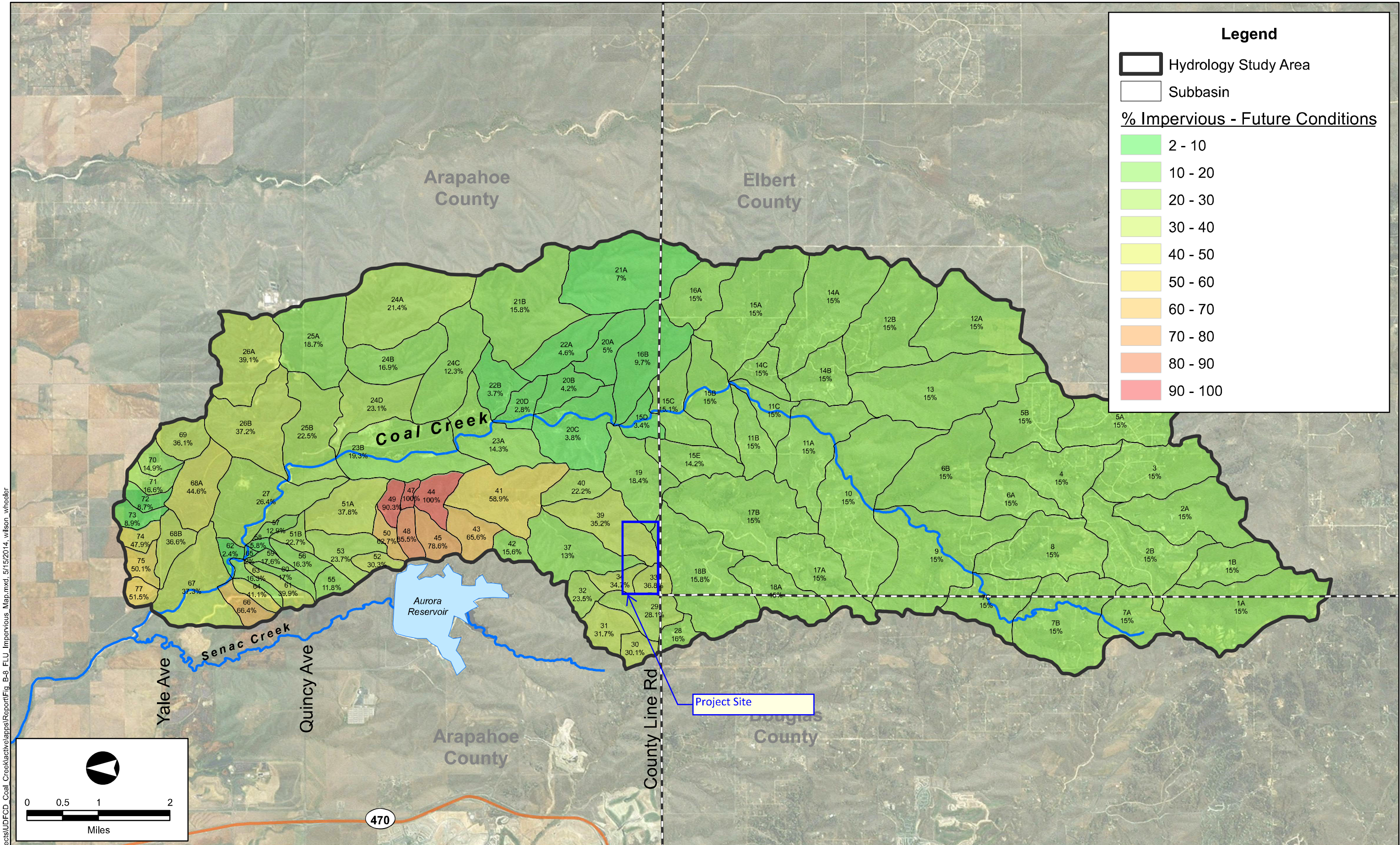
URBAN DRAINAGE AND FLOOD  
 CONTROL DISTRICT AND  
 ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION  
 COAL CREEK (YALE TO COUNTY LINE RD)

PERCENT IMPERVIOUS  
 EXISTING CONDITIONS

FIGURE  
 B-7





FILE: G:\gis\_projects\UDFCD\_Coal\_Creek\active\apps\Report\Fig. B-8\_FLU\_Impervious\_Map.mxd, 5/15/2014, wilson\_wheeler

No.	DATE	DESCRIPTION	APPR.



designed by: \_\_\_\_\_  
 drawn by: WW  
 checked by: RK  
 project no.: 11.155.019  
 date: 4/7/2014



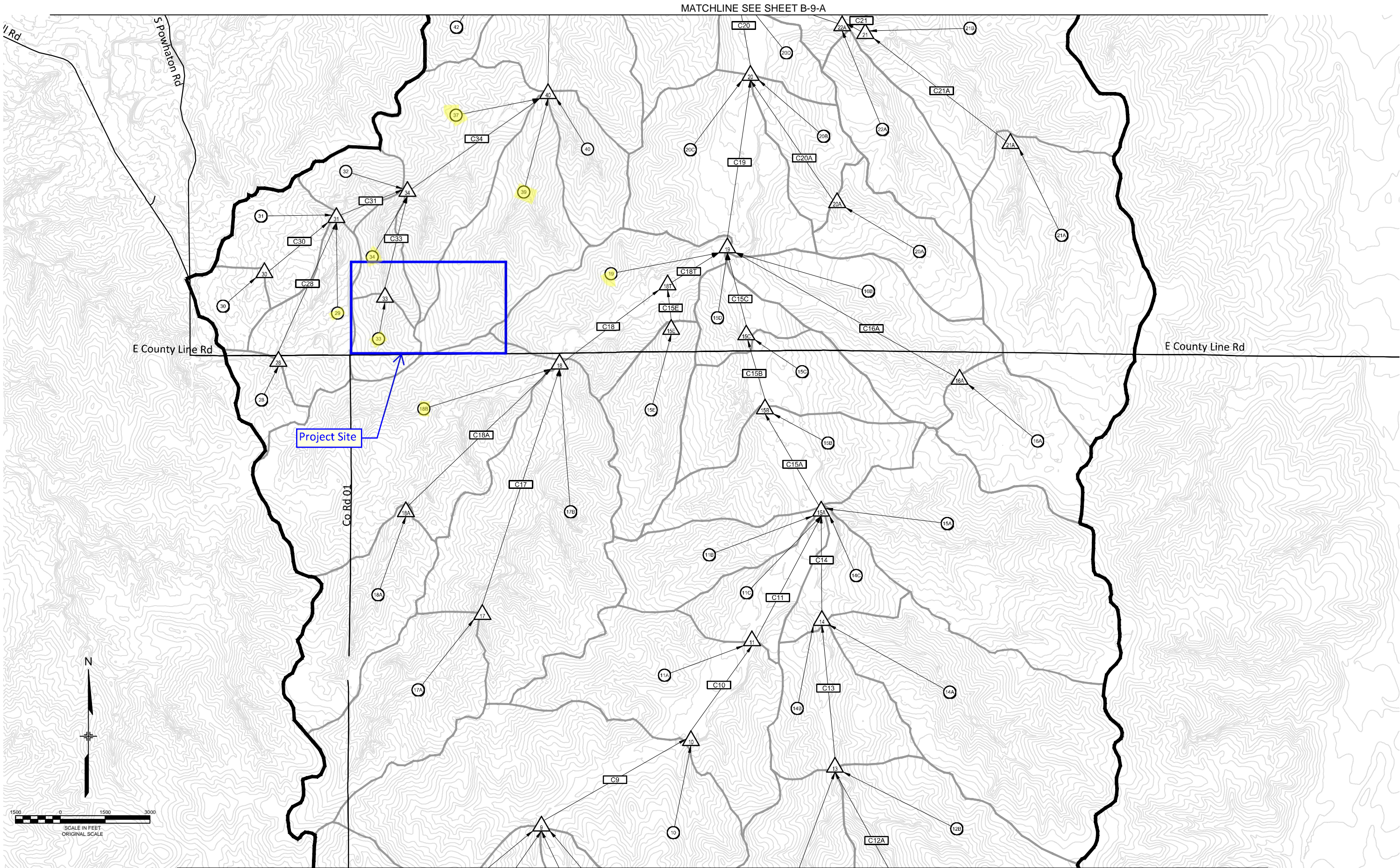
URBAN DRAINAGE AND FLOOD  
 CONTROL DISTRICT AND  
 ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION  
 COAL CREEK (YALE TO COUNTY LINE RD)

PERCENT IMPERVIOUS  
 FUTURE CONDITIONS

FIGURE  
 B-8





No.	DATE	DESCRIPTION	APPR.



Designed by: HTH  
Drawn by: HTH  
Checked by: RK  
Project no.: 11-155,019  
Date: 5/12/2014



URBAN DRAINAGE AND FLOOD CONTROL  
DISTRICT, ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION  
COAL CREEK (YALE TO COUNTY LINE RD)

BASIN DELINEATION AND  
CONVEYANCE ELEMENTS

FIGURE  
B-9-B



LEGEND:

- XXX

BASIN ID "out"
- XXX

DESIGN POINT "dp"
- XXX

CONVEYANCE ELEMENT "re"
- XXX

DETENTION ELEMENT

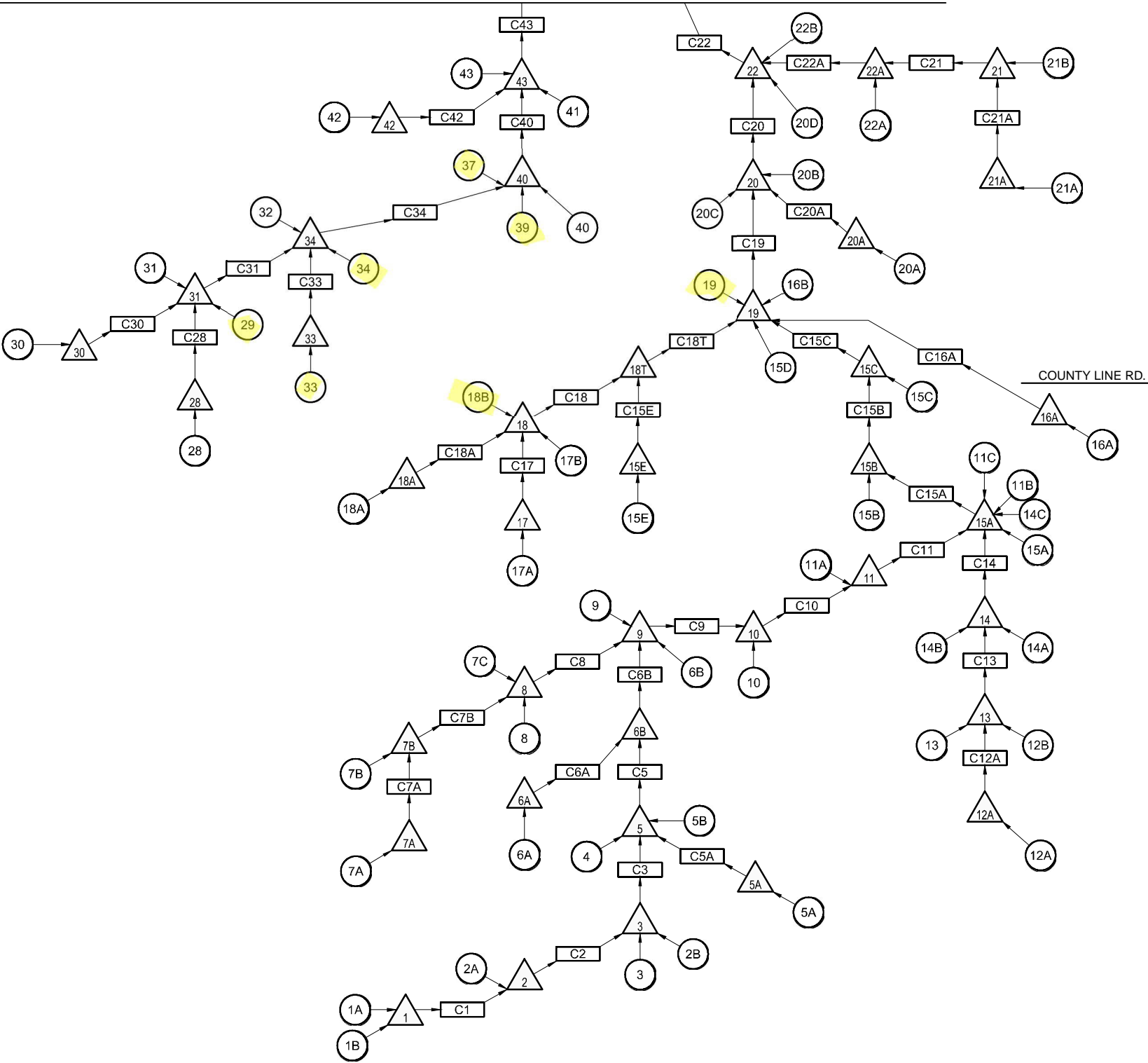
ARAPAHOE RD.

E SMOKY HILL RD.

E SMOKY HILL PKWY.

CO RD 194/COUNTY LINE RD

COUNTY LINE RD.



No.	DATE	DESCRIPTION	APPR.



Designed by: HTH  
Drawn by: HTH  
Checked by: RK  
Project no.: 11-155-019  
Date: 5/12/2014



URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION COAL CREEK (YALE TO COUNTY LINE RD)

EPA SWMM 5.0 ROUTING SCHEMATIC

FIGURE B-10-B

Table B-3 - CUHP 2005 Input Parameters

Catchment Name	Area	Area	Distance to Centroid	Length	Slope	Existing Percent Imperviousness	Future Percent Imperviousness	Exisitng Depression Storage on Pervious	Future Depression Storage on Pervious	Exisitng Depression Storage on Impervious	Future Depression Storage on Impervious	Initial Infiltration Rate	Horton's Decay Coefficient	Final Infiltration Rate
	acres	mi <sup>2</sup>	mi	mi	ft/ft	%	%	in	in	in	in	in/hr	1/seconds	in/hr
3	695	1.0853	0.9387	1.9597	0.0203	14	15	0.4	0.35	0.1	0.1	4.44	0.00180	0.60
4	631	0.9866	1.0782	2.2626	0.0159	14	15	0.4	0.35	0.1	0.1	4.47	0.00177	0.61
8	774	1.2089	1.0883	2.0585	0.0244	15	15	0.4	0.35	0.1	0.1	4.38	0.00180	0.59
9	1209	1.8893	1.4375	2.6741	0.0188	6	15	0.4	0.35	0.1	0.1	4.29	0.00175	0.60
10	1388	2.1689	0.9819	2.6139	0.0225	9	15	0.4	0.35	0.1	0.1	4.32	0.00176	0.60
13	1229	1.9210	1.4035	3.1932	0.0176	4	15	0.4	0.35	0.1	0.1	4.30	0.00180	0.59
19	517	0.8084	0.8833	1.8310	0.0217	3	38	0.4	0.35	0.1	0.1	3.48	0.00175	0.55
27	739	1.1541	0.8648	1.9189	0.0158	2	52	0.4	0.35	0.1	0.1	4.10	0.00180	0.57
28	114	0.1777	0.2422	0.6560	0.0375	4	16	0.4	0.35	0.1	0.1	4.39	0.00180	0.59
29	282	0.4411	0.7774	1.3217	0.0301	22	28	0.35	0.35	0.1	0.1	3.54	0.00180	0.54
30	122	0.1908	0.3030	0.5886	0.0322	30	30	0.35	0.35	0.1	0.1	3.00	0.00180	0.50
31	226	0.3533	0.4602	0.9485	0.0339	28	32	0.35	0.35	0.1	0.1	3.00	0.00180	0.50
32	138	0.2162	0.3737	0.8610	0.0330	4	42	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
33	121	0.1888	0.2881	0.6049	0.0407	2	37	0.4	0.35	0.1	0.1	3.35	0.00180	0.52
34	120	0.1872	0.4756	1.0236	0.0370	2	42	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
37	541	0.8446	0.7203	1.9572	0.0261	2	40	0.4	0.35	0.1	0.1	3.03	0.00180	0.50
39	509	0.7955	0.9772	1.9550	0.0262	2	41	0.4	0.35	0.1	0.1	3.04	0.00180	0.50
40	206	0.3212	0.6156	1.1606	0.0326	2	40	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
41	653	1.0210	0.9950	2.0323	0.0210	2	40	0.4	0.35	0.1	0.1	3.06	0.00180	0.50
42	112	0.1754	0.3015	0.6705	0.0430	2	40	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
43	227	0.3553	0.6073	1.0815	0.0280	2	40	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
44	191	0.2990	0.3538	1.0026	0.0208	2	40	0.4	0.35	0.1	0.1	3.05	0.00180	0.50
45	178	0.2786	0.5430	1.0254	0.0332	2	40	0.4	0.35	0.1	0.1	3.09	0.00180	0.51
47	46	0.0714	0.2702	0.5106	0.0334	2	40	0.4	0.35	0.1	0.1	3.18	0.00180	0.51
48	120	0.1880	0.3819	0.8408	0.0360	2	40	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
49	103	0.1611	0.2186	0.6484	0.0321	2	40	0.4	0.35	0.1	0.1	3.27	0.00180	0.52
50	100	0.1565	0.3990	0.8798	0.0323	2	40	0.4	0.35	0.1	0.1	3.01	0.00180	0.50
52	93	0.1454	0.3778	0.8007	0.0307	2	39	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
53	278	0.4341	0.5765	1.3116	0.0231	2	40	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
55	108	0.1687	0.2421	0.5817	0.0261	4	41	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
56	131	0.2045	0.6176	1.0461	0.0221	2	47	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
57	66	0.1032	0.3942	0.7389	0.0231	2	44	0.4	0.35	0.1	0.1	4.23	0.00180	0.58
58	30	0.0476	0.2052	0.4800	0.0260	2	40	0.4	0.35	0.1	0.1	3.31	0.00163	0.58
59	60	0.0944	0.2918	0.7444	0.0254	2	54	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
60	90	0.1399	0.5677	1.1275	0.0252	3	56	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
61	129	0.2015	0.6462	1.2126	0.0266	31	68	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
62	70	0.1096	0.2790	0.6320	0.0300	2	42	0.4	0.35	0.1	0.1	4.38	0.00170	0.63
63	80	0.1246	0.3793	0.8992	0.0337	13	55	0.4	0.35	0.1	0.1	3.06	0.00180	0.50
64	86	0.1348	0.3925	0.8206	0.0346	39	69	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
65	14	0.0223	0.0910	0.2393	0.0396	2	40	0.4	0.35	0.1	0.1	3.33	0.00178	0.53
66	141	0.2204	0.3796	0.9819	0.0312	71	79	0.4	0.35	0.1	0.1	3.02	0.00179	0.50
67	675	1.0546	0.8464	1.5693	0.0193	31	61	0.4	0.35	0.1	0.1	4.04	0.00159	0.64
69	217	0.3394	0.4907	0.9242	0.0246	2	59	0.4	0.35	0.1	0.1	3.07	0.00180	0.50
70	112	0.1752	0.2362	0.7225	0.0204	2	23	0.4	0.35	0.1	0.1	3.00	0.00180	0.50
71	123	0.1927	0.1922	0.7182	0.0295	2	24	0.4	0.35	0.1	0.1	3.63	0.00180	0.54
72	100	0.1563	0.1728	0.5918	0.0307	2	12	0.4	0.35	0.1	0.1	3.95	0.00180	0.56
73	115	0.1797	0.2014	0.6257	0.0260	2	10	0.4	0.35	0.1	0.1	4.32	0.00180	0.59

Table B-3 - CUHP 2005 Input Parameters

Catchment Name	Area	Area	Distance to Centroid	Length	Slope	Existing Percent Imperviousness	Future Percent Imperviousness	Exisitng Depression Storage on Pervious	Future Depression Storage on Pervious	Exisitng Depression Storage on Impervious	Future Depression Storage on Impervious	Initial Infiltration Rate	Horton's Decay Coefficient	Final Infiltration Rate
	acres	mi <sup>2</sup>	mi	mi	ft/ft	%	%	in	in	in	in	in/hr	1/seconds	in/hr
74	108	0.1681	0.3158	0.8051	0.0249	2	48	0.4	0.35	0.1	0.1	4.50	0.00180	0.60
75	126	0.1973	0.6302	1.0552	0.0162	2	50	0.4	0.35	0.1	0.1	4.48	0.00180	0.60
77	96	0.1500	0.3044	0.5750	0.0204	2	52	0.4	0.35	0.1	0.1	4.47	0.00180	0.60
11A	722	1.1286	0.7086	1.8515	0.0245	15	15	0.4	0.35	0.1	0.1	4.33	0.00170	0.62
11B	293	0.4581	0.6791	1.2900	0.0338	14	15	0.4	0.35	0.1	0.1	4.16	0.00179	0.58
11C	222	0.3466	0.8438	1.5005	0.0227	15	15	0.4	0.35	0.1	0.1	3.94	0.00165	0.61
12A	801	1.2512	0.8888	1.8603	0.0204	2	15	0.4	0.35	0.1	0.1	4.08	0.00180	0.57
12B	852	1.3314	1.0252	2.1073	0.0211	5	15	0.4	0.35	0.1	0.1	4.35	0.00180	0.59
14A	986	1.5414	1.3647	2.3975	0.0205	7	15	0.4	0.35	0.1	0.1	4.33	0.00179	0.59
14B	368	0.5747	0.6088	1.3559	0.0279	15	15	0.4	0.35	0.1	0.1	4.53	0.00168	0.64
14C	193	0.3021	0.6937	1.1198	0.0245	15	15	0.4	0.35	0.1	0.1	4.47	0.00163	0.66
15A	998	1.5601	1.1564	2.3761	0.0223	12	15	0.4	0.35	0.1	0.1	4.46	0.00180	0.60
15B	478	0.7463	0.4431	1.3418	0.0311	15	15	0.4	0.35	0.1	0.1	3.96	0.00169	0.60
15C	402	0.6283	0.3926	1.1697	0.0324	14	18	0.4	0.35	0.1	0.1	4.35	0.00165	0.64
15D	157	0.2448	0.3961	0.8643	0.0241	3	39	0.4	0.35	0.1	0.1	3.78	0.00170	0.58
15E	328	0.5121	0.6749	1.4683	0.0310	10	18	0.4	0.35	0.1	0.1	3.91	0.00180	0.56
16A	376	0.5871	0.6204	1.3541	0.0224	11	15	0.4	0.35	0.1	0.1	4.21	0.00180	0.58
16B	573	0.8953	1.1078	2.0336	0.0214	5	34	0.4	0.35	0.1	0.1	3.99	0.00180	0.57
17A	538	0.8400	0.7212	1.9241	0.0276	12	15	0.4	0.35	0.1	0.1	4.17	0.00180	0.58
17B	1031	1.6113	1.4497	2.6002	0.0202	12	15	0.4	0.35	0.1	0.1	4.13	0.00177	0.58
18A	423	0.6603	0.7600	1.6984	0.0256	13	15	0.4	0.35	0.1	0.1	4.05	0.00179	0.57
18B	1022	1.5969	1.3303	2.3851	0.0242	11	16	0.4	0.35	0.1	0.1	4.35	0.00177	0.60
1A	1094	1.7101	0.9520	2.4697	0.0222	3	15	0.4	0.35	0.1	0.1	3.94	0.00180	0.56
1B	407	0.6365	0.7487	1.5371	0.0271	2	15	0.4	0.35	0.1	0.1	4.26	0.00180	0.58
20A	305	0.4767	0.5404	1.2765	0.0267	2	40	0.4	0.35	0.1	0.1	4.05	0.00180	0.57
20B	212	0.3320	0.5675	1.1648	0.0244	2	40	0.4	0.35	0.1	0.1	4.51	0.00178	0.61
20C	614	0.9597	0.7529	1.6497	0.0218	2	40	0.4	0.35	0.1	0.1	3.73	0.00162	0.61
20D	180	0.2814	0.6335	1.1616	0.0245	2	40	0.4	0.35	0.1	0.1	4.26	0.00154	0.67
21A	987	1.5425	1.3179	2.5205	0.0158	3	36	0.4	0.35	0.1	0.1	3.17	0.00180	0.51
21B	1020	1.5942	1.2206	2.5331	0.0157	2	40	0.4	0.35	0.1	0.1	3.22	0.00180	0.51
22A	353	0.5523	0.8340	1.8097	0.0246	2	40	0.4	0.35	0.1	0.1	3.67	0.00180	0.54
22B	262	0.4099	0.6326	1.2697	0.0269	2	40	0.4	0.35	0.1	0.1	3.90	0.00180	0.56
23A	546	0.8533	0.6130	1.6856	0.0247	2	40	0.4	0.35	0.1	0.1	3.65	0.00172	0.57
23B	826	1.2906	0.9624	2.2202	0.0145	2	40	0.4	0.35	0.1	0.1	3.98	0.00168	0.61
24A	974	1.5212	0.9813	2.1416	0.0203	2	40	0.4	0.35	0.1	0.1	3.05	0.00180	0.50
24B	456	0.7122	0.5367	1.5821	0.0287	2	40	0.4	0.35	0.1	0.1	3.57	0.00180	0.54
24C	614	0.9593	0.8132	1.9125	0.0208	2	40	0.4	0.35	0.1	0.1	4.46	0.00180	0.60
24D	454	0.7098	0.8875	1.9429	0.0205	2	40	0.4	0.35	0.1	0.1	4.47	0.00176	0.61
25A	633	0.9884	0.7513	1.6204	0.0222	2	40	0.4	0.35	0.1	0.1	3.25	0.00180	0.52
25B	632	0.9877	0.7506	1.9718	0.0211	2	47	0.4	0.35	0.1	0.1	4.27	0.00180	0.58
26A	615	0.9616	1.0308	1.8232	0.0249	2	46	0.4	0.35	0.1	0.1	3.02	0.00179	0.51
26B	707	1.1053	0.8861	1.9958	0.0218	2	62	0.4	0.35	0.1	0.1	3.70	0.00180	0.55
2A	720	1.1248	0.9570	2.0542	0.0258	9	15	0.4	0.35	0.1	0.1	4.46	0.00180	0.60
2B	775	1.2113	1.2979	2.4662	0.0223	12	15	0.4	0.35	0.1	0.1	4.14	0.00180	0.58
51A	415	0.6491	0.6957	1.5173	0.0187	2	40	0.4	0.35	0.1	0.1	3.26	0.00180	0.52
51B	95	0.1479	0.4075	0.8263	0.0206	2	47	0.4	0.35	0.1	0.1	3.39	0.00180	0.53
5A	675	1.0549	0.8654	2.0114	0.0160	15	15	0.4	0.35	0.1	0.1	4.46	0.00180	0.60

Table B-4 Composite Infiltration Rates and Decay Coefficients Calculation

BASIN_ID	Area of Soil Types and Water Body Distribution						Area of Soil Types and Water Body Distribution					Area Weighted Composite Coefficients*		
	A	B	C	D	Water	Total	A	B	C	D	Water	Initial f <sub>i</sub>	Decay Coefficient a	Final f <sub>o</sub>
	(ACRES)	(ACRES)	(ACRES)	(ACRES)	(ACRES)	(ACRES)	(%)	(%)	(%)	(%)	(%)	(in/hr)	(1/second)	(in/hr)
3		671.2	21.5	0.0	1.9	695	0%	97%	3%	0%	0%	4.44	0.00180	0.60
4	17.9	596.7	3.3	13.5		631	3%	95%	1%	2%	0%	4.47	0.00177	0.61
8	0.1	711.4	62.1			774	0%	92%	8%	0%	0%	4.38	0.00180	0.59
9	55.1	964.3	169.8	19.9		1209	5%	80%	14%	2%	0%	4.29	0.00175	0.60
10	44.8	1159.5	97.9	85.8		1388	3%	84%	7%	6%	0%	4.32	0.00176	0.60
13		1066.6	162.9			1229	0%	87%	13%	0%	0%	4.30	0.00180	0.59
19	22.5	137.0	128.8	229.1		517	4%	26%	25%	44%	0%	3.48	0.00175	0.55
27	0.8	541.0	196.8			739	0%	73%	27%	0%	0%	4.10	0.00180	0.57
28		105.5	8.0	0.2		114	0%	93%	7%	0%	0%	4.39	0.00180	0.59
29		100.7	23.6	158.0		282	0%	36%	8%	56%	0%	3.54	0.00180	0.54
30		0.3	100.1	21.7		122	0%	0%	82%	18%	0%	3.00	0.00180	0.50
31			143.0	83.1		226	0%	0%	63%	37%	0%	3.00	0.00180	0.50
32			32.4	105.9		138	0%	0%	23%	77%	0%	3.00	0.00180	0.50
33		28.3	34.8	57.7		121	0%	23%	29%	48%	0%	3.35	0.00180	0.52
34			32.5	87.3		120	0%	0%	27%	73%	0%	3.00	0.00180	0.50
37		11.3	381.2	148.0		541	0%	2%	71%	27%	0%	3.03	0.00180	0.50
39		12.3	200.4	296.4		509	0%	2%	39%	58%	0%	3.04	0.00180	0.50
40		0.1	25.4	180.0		206	0%	0%	12%	88%	0%	3.00	0.00180	0.50
41		27.9	343.2	282.3		653	0%	4%	53%	43%	0%	3.06	0.00180	0.50
42			112.2			112	0%	0%	100%	0%	0%	3.00	0.00180	0.50
43			221.3	6.1		227	0%	0%	97%	3%	0%	3.00	0.00180	0.50
44		6.7	98.4	86.2		191	0%	4%	51%	45%	0%	3.05	0.00180	0.50
45		10.8	156.7	10.8		178	0%	6%	88%	6%	0%	3.09	0.00180	0.51
47		5.5	35.1	5.1		46	0%	12%	77%	11%	0%	3.18	0.00180	0.51
48			110.6	9.7		120	0%	0%	92%	8%	0%	3.00	0.00180	0.50
49		18.5	77.0	7.6		103	0%	18%	75%	7%	0%	3.27	0.00180	0.52
50		0.4	98.6	1.1		100	0%	0%	98%	1%	0%	3.01	0.00180	0.50
52			93.0			93	0%	0%	100%	0%	0%	3.00	0.00180	0.50
53			277.8			278	0%	0%	100%	0%	0%	3.00	0.00180	0.50
55			107.9			108	0%	0%	100%	0%	0%	3.00	0.00180	0.50
56			130.9			131	0%	0%	100%	0%	0%	3.00	0.00180	0.50
57		54.3	11.7			66	0%	82%	18%	0%	0%	4.23	0.00180	0.58
58	4.7		25.7			30	16%	0%	84%	0%	0%	3.31	0.00163	0.58
59			60.4			60	0%	0%	100%	0%	0%	3.00	0.00180	0.50
60			89.5			90	0%	0%	100%	0%	0%	3.00	0.00180	0.50
61			129.0			129	0%	0%	100%	0%	0%	3.00	0.00180	0.50
62	6.4	56.3	4.6	2.9		70	9%	80%	7%	4%	0%	4.38	0.00170	0.63
63		3.1	76.6			80	0%	4%	96%	0%	0%	3.06	0.00180	0.50
64			86.3			86	0%	0%	100%	0%	0%	3.00	0.00180	0.50

\* Composite coefficients were calculated using Table RO-7 in the USDCM and weighting the area of the soil distribution in the individual subwatershed.

Table B-4 Composite Infiltration Rates and Decay Coefficients Calculation

BASIN_ID	Area of Soil Types and Water Body Distribution						Area of Soil Types and Water Body Distribution					Area Weighted Composite Coefficients*		
	A	B	C	D	Water	Total	A	B	C	D	Water	Initial f <sub>i</sub>	Decay Coefficient a	Final f <sub>o</sub>
	(ACRES)	(ACRES)	(ACRES)	(ACRES)	(ACRES)	(ACRES)	(%)	(%)	(%)	(%)	(%)	(in/hr)	(1/second)	(in/hr)
65	0.2	2.8	11.2			14	1%	20%	79%	0%	0%	3.33	0.00178	0.53
66	1.3		139.7			141	1%	0%	99%	0%	0%	3.02	0.00179	0.50
67	131.2	293.2	208.6	41.9		675	19%	43%	31%	6%	0%	4.04	0.00159	0.64
69		9.6	187.0	20.6		217	0%	4%	86%	9%	0%	3.07	0.00180	0.50
70		0.1	112.1			112	0%	0%	100%	0%	0%	3.00	0.00180	0.50
71		51.7	71.7			123	0%	42%	58%	0%	0%	3.63	0.00180	0.54
72		63.4	36.7			100	0%	63%	37%	0%	0%	3.95	0.00180	0.56
73		101.0	14.0			115	0%	88%	12%	0%	0%	4.32	0.00180	0.59
74		107.6				108	0%	100%	0%	0%	0%	4.50	0.00180	0.60
75		124.7		1.6		126	0%	99%	0%	1%	0%	4.48	0.00180	0.60
77	0.0	94.3		1.7		96	0%	98%	0%	2%	0%	4.47	0.00180	0.60
11A	63.5	556.4	39.6	62.8		722	9%	77%	5%	9%	0%	4.33	0.00170	0.62
11B	2.5	223.3	42.7	24.8		293	1%	76%	15%	8%	0%	4.16	0.00179	0.58
11C	30.8	98.7		92.4		222	14%	45%	0%	42%	0%	3.94	0.00165	0.61
12A		578.8	221.9			801	0%	72%	28%	0%	0%	4.08	0.00180	0.57
12B	0.2	768.6	83.3			852	0%	90%	10%	0%	0%	4.35	0.00180	0.59
14A	10.2	863.1	113.2			986	1%	87%	11%	0%	0%	4.33	0.00179	0.59
14B	40.4	322.0	5.4			368	11%	88%	1%	0%	0%	4.53	0.00168	0.64
14C	30.4	148.7		14.2		193	16%	77%	0%	7%	0%	4.47	0.00163	0.66
15A	0.5	968.6	20.4	8.9		998	0%	97%	2%	1%	0%	4.46	0.00180	0.60
15B	47.2	244.2	117.4	68.8		478	10%	51%	25%	14%	0%	3.96	0.00169	0.60
15C	55.7	287.4	57.6	1.3		402	14%	71%	14%	0%	0%	4.35	0.00165	0.64
15D	13.8	63.5	8.2	71.1		157	9%	41%	5%	45%	0%	3.78	0.00170	0.58
15E		198.1	100.8	28.8		328	0%	60%	31%	9%	0%	3.91	0.00180	0.56
16A		304.0	71.7			376	0%	81%	19%	0%	0%	4.21	0.00180	0.58
16B	1.4	375.7	41.0	154.9		573	0%	66%	7%	27%	0%	3.99	0.00180	0.57
17A		421.1	116.5			538	0%	78%	22%	0%	0%	4.17	0.00180	0.58
17B	23.8	747.8	259.5			1031	2%	73%	25%	0%	0%	4.13	0.00177	0.58
18A		302.1	117.0		3.5	423	0%	71%	28%	0%	1%	4.05	0.00179	0.57
18B	23.4	885.5	108.6	4.5		1022	2%	87%	11%	0%	0%	4.35	0.00177	0.60
1A		686.6	407.9			1094	0%	63%	37%	0%	0%	3.94	0.00180	0.56
1B		341.8	65.5			407	0%	84%	16%	0%	0%	4.26	0.00180	0.58
20A		213.7	91.3			305	0%	70%	30%	0%	0%	4.05	0.00180	0.57
20B	3.0	209.5				212	1%	99%	0%	0%	0%	4.51	0.00178	0.61
20C	102.8	163.4	227.5	120.4		614	17%	27%	37%	20%	0%	3.73	0.00162	0.61
20D	42.6	94.5	43.0	0.0		180	24%	52%	24%	0%	0%	4.26	0.00154	0.67
21A		113.4	593.4	280.3		987	0%	11%	60%	28%	0%	3.17	0.00180	0.51
21B		151.3	249.6	619.4		1020	0%	15%	24%	61%	0%	3.22	0.00180	0.51
22A		158.6	104.2	90.7		353	0%	45%	29%	26%	0%	3.67	0.00180	0.54

\* Composite coefficients were calculated using Table RO-7 in the USDCM and weighting the area of the soil distribution in the individual subwatershed.



# High Plains (Blackstone) Country Club - Filing No. 3

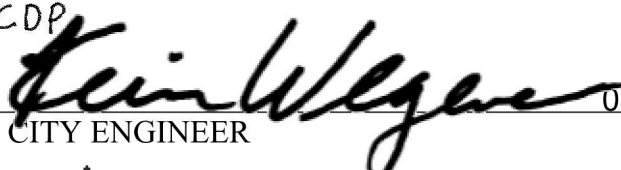



## FINAL DRAINAGE REPORT

March 30, 2016  
 Rev. November 25, 2016  
 Rev. January 30, 2017  
 Rev. February 17, 2017

Prepared For:  
**Lennar Colorado LLC**  
 9781 South Meridian Blvd. #120  
 Englewood, CO 80112  
 303-681-1185  
 Contact: Richard Holpp

Prepared By:  
**BOWMAN CONSULTING GROUP**  
 603 Park Point Drive, Suite 100  
 Golden, Colorado 80401  
 303-674-7355  
 303-674-3263 (Fax)  
 Contact: Cliff Dayton, P.E.

APPROVED ONE YEAR FROM THIS DATE	
03.07.17	
CDP A.T. 	03/06/2017
CITY ENGINEER	DATE
	03/06/2017
WATER DEPARTMENT	DATE

To accommodate the construction of Filing No. 3, arterial roads South Monaghan Road and East Smoky Hill Road will be connected at the northeast corner of the HPCC property. The westerly half of the southern end of South Monaghan Road was completed with the improvement completed 2006. It is anticipated that the future development to the east will be widened to add a bike lane and curb & gutter and storm facilities will be designed for the final layout. The full section of South Monaghan Road will be constructed from the Golf Maintenance building north to the intersection with East Smoky Hill Road. Existing storm sewer system Q will convey the majority of drainage in and along South Monaghan Road to Mutchie Creek while the northernmost portion will be conveyed through storm sewer system P to Pond D. The south half of East Smoky Hill Road will be constructed from South Country Club Parkway to South Monaghan Road. This runoff will also be conveyed through storm sewer system P to Pond D.

The following is a description of the storm sewer systems within Major Basin A that will convey runoff associated with the development of Filing 3:

#### **4.2.1 Storm Sewer System ‘P’**

Storm sewer system ‘P’ consists of approximately 140 lf of 36” RCP that was stubbed from Pond D north to East Smoky Hill Road during the golf course construction (Reference 6). A sump inlet will be located at the low point of the curve intersection of South Monaghan Road and East Smoky Hill Road and will connect to the existing 36” RCP stub to convey the 2-year and 100-year storm events from Basins 132 and 314A to Pond D.

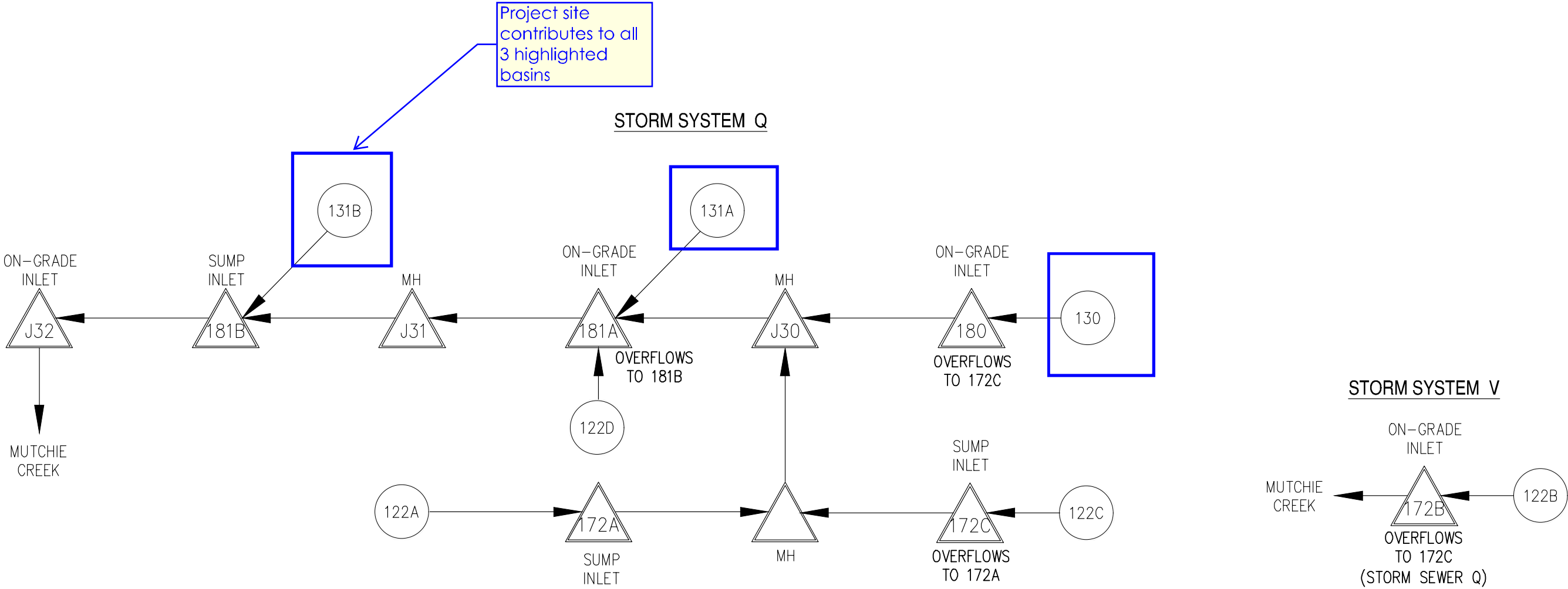
Basin 132 consists of the northern portion of S. Monaghan Road and unincorporated State property east of S. Monaghan Road. Runoff for the 2-year and 100-year events will be collected in the curb & gutter and conveyed to a sump inlet at DP 182, before then discharging into Pond D through a flared end section and rip-rap pad.

Basin 314A consists of the south half of E. Smoky Hill Road and adjacent southern right-of-way from S. Country Club Parkway to the intersection with S Monaghan Road. 2-year and 100-year runoff will be conveyed through curb & gutter to the sump inlet at DP 364A, which will connect to the existing 36” RCP stub and discharge into Pond D.

#### **4.2.2 Storm Sewer System ‘Q’**

Storm sewer system ‘Q’ was installed during the previous development of Filing 3. The system begins on East Mineral Place and continues east then north through South Monaghan Road and discharges into Mutchie Creek north of the existing Golf Maintenance building. Based on the proposed road grading the off-site basins have been revised from the approved City of Aurora # 206088 storm sewer plan.

During the 2-year storm event, this system will convey runoff from Basins 122A, 122C, 122D, 130, 131A and 131B to Mutchie Creek.





PROJECT: Blackstone Filing No. 3  
SUBJECT: Site Improvements - Impervious Cover Calculations

JOB #: 020067  
DATE: 2/17/17  
BY: PDB

	% Imp	C-2	C-5	C-100
Park	7	0.10	0.20	0.60
Offiste Undeveloped	5	0.25	0.27	0.35
School/Rec Center/Clubhouse	50	0.45	0.50	0.70
Street, Paved	100	0.87	0.88	0.93
Open Space 2-7% slope	5	0.18	0.19	0.22
Road ROW Open Space	5	0.25	0.27	0.35
Parcel I	50	0.40	0.45	0.60
Parcel Q	54	0.40	0.45	0.60
Fire Station	95	0.87	0.87	0.89

Subbasin	Total Area (acres)	Land Use Area per Sub-Basin									% Check	Composite Imperviousne ss	Runoff Coefficients		
		Park	Offiste Undevelop ed	School/Rec Center/Clu bhouse	Street, Paved	Open Space 2- 7% slope	Road ROW Open Space	Parcel I	Parcel Q	Fire Station			C-2	C-5	C-100
		Area (acres)	Area (acres)	Area (acres)	Area (acres)	Area (acres)	Area (acres)	Area (acres)	Area (acres)	Area (acres)					
101	28.80	0.00	27.92	0.00	0.53	0.00	0.35	0.00	0.00	0.00	100%	7%	0.26	0.28	0.36
112A	5.88	0.00	0.00	0.00	0.23	0.62	0.00	1.58	3.45	0.00	100%	50%	0.40	0.44	0.57
112B	2.57	0.00	0.00	0.00	0.23	0.00	0.00	2.15	0.19	0.00	100%	55%	0.44	0.49	0.63
114D	1.29	0.00	0.00	0.00	0.67	0.12	0.50	0.00	0.00	0.00	100%	54%	0.57	0.58	0.64
114E	1.37	0.00	0.06	0.00	0.85	0.00	0.46	0.00	0.00	0.00	100%	64%	0.63	0.65	0.71
115A	4.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.27	0.00	100%	54%	0.40	0.45	0.60
115B	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00	100%	54%	0.40	0.45	0.60
115C	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93	0.00	100%	54%	0.40	0.45	0.60
119A	0.05	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.04	0.00	100%	54%	0.43	0.47	0.60
119B	0.05	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.04	0.00	100%	54%	0.43	0.47	0.60
119C	2.72	0.00	0.00	0.00	0.00	0.22	0.00	0.00	2.50	0.00	100%	50%	0.38	0.43	0.57
120A	8.20	5.27	0.00	0.00	0.00	0.00	0.00	2.93	0.00	0.00	100%	22%	0.21	0.29	0.60
120B	1.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.38	0.00	100%	54%	0.40	0.45	0.60
121A	4.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.61	0.00	100%	54%	0.40	0.45	0.60
121B	0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.00	100%	54%	0.40	0.45	0.60
122A	2.76	0.00	0.00	0.00	0.03	0.00	0.00	0.00	2.73	0.00	100%	55%	0.41	0.45	0.60
122B	10.65	0.00	0.00	0.00	0.00	0.21	0.02	0.00	10.42	0.00	100%	53%	0.40	0.44	0.59
122C	6.62	0.00	0.23	0.00	0.06	0.25	0.07	0.00	4.39	1.62	100%	60%	0.50	0.54	0.65
122D	1.66	0.00	0.00	1.66	0.00	0.00	0.00	0.00	0.00	0.00	100%	50%	0.45	0.50	0.70
123A	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	100%	54%	0.40	0.45	0.60
123B	4.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.00	100%	54%	0.40	0.45	0.60
123C	1.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.89	0.00	100%	54%	0.40	0.45	0.60
123D	5.85	0.00	0.00	0.00	0.00	0.00	0.05	0.00	4.82	0.00	100%	45%	0.36	0.40	0.53
130	10.93	0.00	7.01	0.00	2.59	0.00	1.33	0.00	0.00	0.00	100%	28%	0.40	0.41	0.49
131A	4.04	0.00	3.28	0.00	0.42	0.00	0.34	0.00	0.00	0.00	100%	15%	0.31	0.33	0.41
131B	10.79	0.00	9.51	0.00	1.09	0.00	0.19	0.00	0.00	0.00	100%	15%	0.31	0.33	0.41
132	3.88	0.00	1.58	0.00	1.52	0.00	0.78	0.00	0.00	0.00	100%	42%	0.49	0.51	0.58
314A	3.64	0.00	0.00	0.00	2.18	0.00	1.46	0.00	0.00	0.00	100%	62%	0.62	0.64	0.70
Total	142.58	5.27	52.16	1.66	14.54	2.72	8.74	6.66	49.21	1.62	100%	35%	0.37	0.41	0.52

- 1. From Table 1 in the City of Aurora SDTCM
- 2. Ruoff Coefficients based on equation RO-6 and RO-7 in the UDFCD



PROJECT:  
SUBJECT:

Blackstone Filing No. 3  
Site Improvements - Time of Concentration - Modified Form SF-1

JOB #:  
DATE:

020067  
2/17/17

			INITIAL/OVERLAND TIME (Ti) [Max. 300']			TRAVEL TIME (Tt)				Tc CHECK (Urbanized Basins)			FINAL Tc	Remarks	RUNOFF SUMMARY	
Basin No.	Area (acres)	5Yr. co-eff.	Dist. (ft)	Slope (%)	Ti (min)	Dist. (ft)	Slope (%)	Vel. (fps)	Tt (min)	Tc	Length (ft)	Tc (min)	(min)		Q <sub>2</sub> (cfs)	Q <sub>100</sub> (cfs)
101	28.80	0.28	279	2.5	18.4	1113	5.2	3.42	5.4	23.8	1392	17.7	17.7		15.2	63.0
112A	5.88	0.44	70	6.4	5.4	1275	3.3	3.65	5.8	11.3	1345	17.5	11.3		5.9	23.0
112B	2.57	0.49	64	2.3	6.7	1248	3.4	3.67	5.7	12.4	1312	17.3	12.4		2.7	10.7
114D	1.29	0.58	78	1.1	8.2	843	2.8	3.32	4.2	12.4	921	15.1	12.4		1.8	5.5
114E	1.37	0.65	90	2.3	5.9	900	2.9	3.41	4.4	10.3	990	15.5	10.3		2.2	6.9
115A	4.27	0.45	231	7.1	9.4	613	3.3	3.65	2.8	12.2	844	14.7	12.2		4.1	17.0
115B	1.27	0.45	76	3.3	7.0	565	3.6	3.77	2.5	9.5	641	13.6	9.5		1.4	5.6
115C	0.93	0.45	88	2.6	8.2	298	0.9	1.91	2.6	10.8	386	12.1	10.8		0.9	3.9
119A	0.05	0.47	17	3.5	3.1	32	2.4	3.12	0.2	3.3	49	10.3	5.0	5 MIN MINIM	0.1	0.3
119B	0.05	0.47	17	3.3	3.2	32	0.8	1.77	0.3	3.5	49	10.3	5.0	5 MIN MINIM	0.1	0.3
119C	2.72	0.43	224	3.5	12.2	580	2.6	3.21	3.0	15.2	804	14.5	14.5		2.3	9.5
120A	8.20	0.29	300	4.4	15.7	1311	2.9	3.39	6.5	22.2	1611	19.0	19.0		3.4	26.5
120B	1.38	0.45	84	3.0	7.5	663	3.8	3.92	2.8	10.4	747	14.2	10.4		1.4	5.9
121A	4.61	0.45	84	3.2	7.4	800	4.4	4.20	3.2	10.6	884	14.9	10.6		4.7	19.5
121B	0.96	0.45	64	6.5	5.1	454	5.5	4.71	1.6	6.7	518	12.9	6.7		1.2	4.8
122A	2.76	0.45	93	2.2	8.9	1348	2.1	2.90	7.8	16.7	1441	18.0	16.7		2.4	9.5
122B	10.65	0.44	300	7.4	10.8	1112	3.4	3.71	5.0	15.8	1412	17.8	15.8		9.2	37.2
122C	6.62	0.54	300	6.1	9.8	896	1.8	2.67	5.6	15.4	1196	16.6	15.4		7.2	25.8
122D	1.66	0.50	120	9.8	5.6	493	1.9	2.75	3.0	8.6	613	13.4	8.6		2.1	8.9
123A	0.64	0.45	186	8.8	7.9	125	1.4	2.34	0.9	8.7	311	11.7	8.7		0.7	2.9
123B	4.68	0.45	70	1.6	8.6	1150	3.2	3.56	5.4	14.0	1220	16.8	14.0		4.3	17.6
123C	1.89	0.45	78	3.6	6.9	913	2.8	3.32	4.6	11.5	991	15.5	11.5		1.9	7.7
123D	5.85	0.40	171	4.0	10.5	1625	3.7	3.86	7.0	17.6	1796	20.0	17.6		4.3	17.4
130	10.93	0.41	92	1.6	10.5	2512	3.7	3.83	10.9	21.4	2604	24.5	21.4		8.0	27.1
131A	4.04	0.33	202	14.9	8.2	496	4.1	4.03	2.1	10.2	698	13.9	10.2		3.3	11.9
131B	10.79	0.33	300	7.1	12.7	840	3.8	3.92	3.6	16.3	1140	16.3	16.3		7.1	25.8
132	3.88	0.51	300	8.3	9.3	805	5.9	4.85	2.8	12.0	1105	16.1	12.0		4.6	15.1
314A	3.64	0.64	25	2.5	3.1	2575	4.2	4.08	10.5	13.6	2600	24.4	13.6		5.2	16.2
Total	142.58															

Higher than  
proposed runoff  
from basin 29







## STANDARD FORM SF-2 STORM DRAINAGE SYSTEM DESIGN (RATIONAL METHOD PROCEDURE)

**CALCULATED BY:**

**BAR**

**P1= 2.67 in**

**JOB NO:**

020067

DATE:

**2/16/17**

**PROJECT:**

Blackstone Filing No. 3

**CHECKED BY:**

**CJD**

### DESIGN STORM:

## 100 Year

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			Remarks
STREET/BASIN AREAS CONTRIBUTING TO DESIGN POINT	DESIGN POINT	AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	Tt (min)	
STORM SYSTEM 'P'																					
	182	132	3.88	0.58	12.0	2.25	6.70	15.1													
	364A	314A	3.64	0.70	13.6	2.55	6.34	16.2													
132, 314A	182/364A								13.6	4.80	6.34	30.4									Outfall to Mutchie Creek
STORM SYSTEM 'Q'																					
	180	130	10.93	0.49	21.4	5.36	5.07	27.1													Peak surface flow to DP180
	180								21.4	3.12	5.07	15.8			15.8	7.25%	18	82	15.9	0.1	Captured by on-grade inlet at DP 180
	180								21.4	2.23	5.07	11.3	2.85%	11.3				246	3.4	1.2	Carryover from DP 180 to DP 172C
	172B	122B	10.65	0.59	15.8	6.28	5.91	37.2													
	172B								15.8	3.28	5.91	19.4									Captured by on-grade inlet at DP 172B
	172B								15.8	3.01	5.91	17.8	2.93%	17.8				762	3.4	3.7	Carryover from DP 172B to DP 172C
	172C	122C	6.62	0.65	15.4	4.30	5.99	25.8													
122B, 122C, 130	172C								22.6	9.54	4.92	46.9			46.9	2.83%	36	177	14.6	0.2	Captured by sump inlet at DP 172C
	172A	122A	2.76	0.60	16.7	1.66	5.76	9.5							9.5	3.39%	36	184	10.3	0.3	Captured by sump inlet at DP 172A
122B, 122C, 130, 180, 172B, 122A	J30								22.8	14.32	4.89	70.1			70.1	2.47%	36	514	14.5	0.6	Peak to DP J30 in pipe, to DP J31
	181A	122D	1.66	0.70	8.6	1.16	7.65	8.9							8.9	9.16%	24	14	15.0	0.0	Captured by sump inlet
	181A	131A	4.04	0.41	10.2	1.66	7.17	11.9													
	181A								10.2	1.42	7.17	10.2			10.2	6.35%	24	27	13.7	0.0	Captured by on-grade inlet at DP 181A
	181A								10.2	0.23	7.17	1.7	1.55%	1.7				308	2.5	2.1	Carryover from DP 181A to DP 181B
122B, 122C, 130, 180, 172B, 122A, 122D, 131A	J31								23.4	16.91	4.83	81.6			81.6	1.08%	36	326	11.1	0.5	Peak to DP J31 in pipe, to DP J32
	181B	131B	10.79	0.41	16.3	4.42	5.82	25.8													
									16.3	4.66	5.82	27.1			27.1	1.08%	36	326	9.2	0.6	Captured by sump inlet at DP 181B
122B, 122C, 130, 172B, 122A, 122D, 131A, 181B	J32								23.9	21.56	4.77	102.9									Outfall to Mutchie Creek
STORM SYSTEM 'R'																					
	151	101	28.80	0.39	17.7	11.27	5.59	63.0							63.0	1.98%	42	500	14.3	0.58	Captured by FES at DP 151
	164D	114D	1.29	0.60	12.4	0.50	6.61	3.3													Peak surface flow at DP 164D
	164D								12.4	0.32	6.61	2.1			2.1	2.00%	18	35	6.6	0.09	Captured by on-grade inlet at DP 164D
	164D								12.4	0.18	6.61	1.2	0.70%	1.2				40	1.7	0.4	Carryover from DP 164D to DP 169B
	169B	119B	0.05	0.60	5.0	0.03	9.06	0.3													
114D, 119B	169B								12.5	0.21	6.59	1.4									Peak surface flow at DP 169B
	169B								12.5	0.02	6.59	0.1			0.1	2.00%	18	26	2.4	0.18	Captured by sump inlet at DP 169B
	169B								12.5	0.20	6.59	1.3	0.70%	1.3				122	1.7	1.2	Carryover from DP 169B to DP 169C
119A	169A	119A	0.05	0.60	5.0	0.03	9.06	0.3							0.3	2.00%	18	26	3.3	0.13	Captured by on-grade inlet at DP 169A
101, 114D, 119B, 119A	J34								18.3	11.64	5.50	64.0			64.0	7.36%	42	1077	23.2	0.77	Peak to DP J34 in pipe, to DP J35
	169C	119C	2.72	0.57	14.5	1.55	6.16	9.5													
	169C								13.7	1.75	6.32	11.1									Peak surface flow at DP 169C
	169C								14.5	0.74	6.16	4.6			4.6	7.36%	42	1001	11.1	1.50	Captured by inlets at DP 169C
101, 114D,1 19B, 119A, 119C	169C								14.5	0.81	6.16	5.0									Carryover from DP 169C to DP 162A
	171A	121A	4.61	0.60	10.6	2.77	7.06	19.5													Peak surface flow at 171A
	171A								10.6	1.98	7.06	14.0			14.0	2.00%	18	13	7.8	0.03	Captured by inlets at DP 171A





**PROJECT:** Blackstone Filing No. 3  
**SUBJECT:** Site Improvements - Street Flow - 2 Year

**JOB #:** 020067  
**DATE:** 2/17/17  
**BY:** JHL

Design Point	Minimum Slope (%)	Street Type	Curb and Gutter Type	Allowable Half		Flow Depth (in)
				Half Street Flow (cfs)	Street Capacity (cfs)	
162A	1.0%	Local Type I	Mountable	5.6	9.2	5.6
162B	1.0%	Local Type I	Mountable	2.7	9.2	5.6
165A	1.0%	Local Type I	Mountable	7.0	9.2	5.6
165B	1.0%	Local Type I	Mountable	7.8	9.2	5.6
165C	1.0%	Local Type I	Mountable	0.9	9.2	5.6
169A	1.0%	Local Type I	Mountable	0.1	9.2	5.6
169B	1.0%	Local Type I	Mountable	0.1	9.2	5.6
169C	1.0%	Local Type I	Mountable	2.3	9.2	5.6
170A	5.0%	Local Type II	Mountable	3.4	7.5	5.1
170B	4.0%	Local Type II	Mountable	1.9	9.2	5.1
171A	2.0%	Local Type II	Mountable	4.7	9.7	5.1
171B	2.0%	Local Type II	Mountable	2.8	9.7	5.1
172A	1.0%	Local Type I	Mountable	2.4	9.2	5.6
172B	5.0%	Local Type I	Mountable	9.2	10.1	5.6
172C	1.0%	Local Type I	Mountable	7.2	9.2	5.6
173A	2.5%	Local Type II	Mountable	0.7	9.5	5.1
173B	1.0%	Local Type I	Mountable	4.3	9.2	5.6
173C	1.0%	Local Type I	Mountable	1.9	9.2	5.6
173D	1.0%	Local Type I	Mountable	7.4	9.2	5.6
181A	0.5%	Collector	Vertical	3.3	8.1	6
181B	0.5%	Collector	Vertical	7.1	8.1	6
182	1.0%	Collector	Vertical	5.2	11.5	6





**PROJECT:** Blackstone Filing No. 3  
**SUBJECT:** Site Improvements - Street Capacities - 100 Year

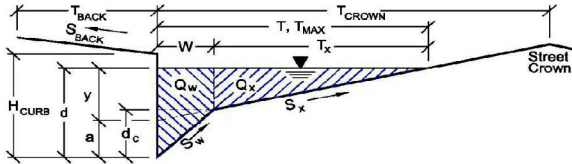
**JOB #:** 020067  
**DATE:** 2/17/17  
**BY:** JHL

Design Point	Minimum Slope (%)	Street Type	Curb and Gutter Type	Full Street Flow (cfs)	Allowable Full Street Capacity (cfs)	Flow Depth (ft)
162A	1.0%	Local Type I	Mountable	40.0 #	212.0	<1.0
162B	1.0%	Local Type I	Mountable	40.0 #	212.0	<1.0
165A	1.0%	Local Type I	Mountable	52.0 #	212.0	<1.0
165B	1.0%	Local Type I	Mountable	52.0 #	212.0	<1.0
165C	1.0%	Local Type I	Mountable	52.0 #	212.0	<1.0
169A	1.0%	Local Type I	Mountable	0.3	212.0	<1.0
169B	1.0%	Local Type I	Mountable	1.4	212.0	<1.0
169C	1.0%	Local Type I	Mountable	11.1	212.0	<1.0
170A	5.0%	Local Type II	Mountable	26.8	178.0	<1.0
170B	4.0%	Local Type II	Mountable	14.1	191.0	<1.0
171A	2.0%	Local Type II	Mountable	19.5	237.0	<1.0
171B	2.0%	Local Type II	Mountable	9.6	237.0	<1.0
172A	1.0%	Local Type I	Mountable	47.9 #	212.0	<1.0
172B	5.0%	Local Type I	Mountable	37.2	190.0	<1.0
172C	1.0%	Local Type I	Mountable	47.9 #	212.0	<1.0
173A	2.5%	Local Type II	Mountable	3.9	221.0	<1.0
173B	1.0%	Local Type I	Mountable	17.6	212.0	<1.0
173C	1.0%	Local Type I	Mountable	7.7	212.0	<1.0
173D	1.0%	Local Type I	Mountable	30.6	212.0	<1.0
181A	0.5%	Collector	Vertical	11.9	143.0	<1.0
181B	0.5%	Collector	Vertical	27.1	143.0	<1.0
182	1.0%	Collector	Vertical	30.4	202.0	<1.0

# When two design points are located adjacently in a sump, on opposite sides of a local street, the sum of the flows to the sump was used for the full street flow.

<b>ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor &amp; Major Storm)</b>	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
<b>Project:</b>	High Plains Country Club Filing No. 3
<b>Inlet ID:</b>	182/364A

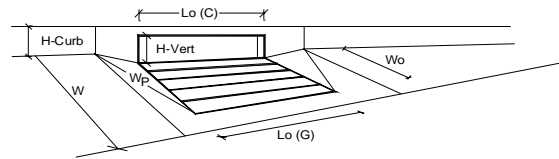


Gutter Geometry (Enter data in the blue cells)							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 14.0$ ft						
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft						
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$						
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches						
Distance from Curb Face to Street Crown	$T_{CROWN} = 42.0$ ft						
Gutter Width	$W = 2.00$ ft						
Street Transverse Slope	$S_x = 0.020$ ft/ft						
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft						
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.000$ ft/ft						
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$						
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; text-align: center;">Minor Storm</th> <th style="width: 50%; text-align: center;">Major Storm</th> </tr> <tr> <td style="border: 1px solid black; text-align: center;"><math>T_{MAX} = 42.0</math></td> <td style="border: 1px solid black; text-align: center;"><math>T_{MAX} = 42.0</math></td> </tr> <tr> <td style="border: 1px solid black; text-align: center;"><math>d_{MAX} = 6.0</math></td> <td style="border: 1px solid black; text-align: center;"><math>d_{MAX} = 12.0</math></td> </tr> </table>	Minor Storm	Major Storm	$T_{MAX} = 42.0$	$T_{MAX} = 42.0$	$d_{MAX} = 6.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm						
$T_{MAX} = 42.0$	$T_{MAX} = 42.0$						
$d_{MAX} = 6.0$	$d_{MAX} = 12.0$						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm							
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input checked="" type="checkbox"/> check = yes						
<b>MINOR STORM Allowable Capacity is based on Depth Criterion</b> <b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>							
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; text-align: center;">Minor Storm</th> <th style="width: 50%; text-align: center;">Major Storm</th> </tr> <tr> <td style="border: 1px solid black; text-align: center;"><math>Q_{allow} = \text{SUMP}</math></td> <td style="border: 1px solid black; text-align: center;"><math>Q_{allow} = \text{SUMP}</math></td> </tr> </table>	Minor Storm	Major Storm	$Q_{allow} = \text{SUMP}$	$Q_{allow} = \text{SUMP}$		
Minor Storm	Major Storm						
$Q_{allow} = \text{SUMP}$	$Q_{allow} = \text{SUMP}$						
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'							

### INLET IN A SUMP OR SAG LOCATION

Project = High Plains Country Club Filing No. 3  
 Inlet ID = 182/364A



#### Design Information (Input)

Type of Inlet  
 Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')  
 Number of Unit Inlets (Grate or Curb Opening)  
 Water Depth at Flowline (outside of local depression)

#### Grate Information

Length of a Unit Grate  
 Width of a Unit Grate  
 Area Opening Ratio for a Grate (typical values 0.15-0.90)  
 Clogging Factor for a Single Grate (typical value 0.50 - 0.70)  
 Grate Weir Coefficient (typical value 2.15 - 3.60)  
 Grate Orifice Coefficient (typical value 0.60 - 0.80)

#### Curb Opening Information

Length of a Unit Curb Opening  
 Height of Vertical Curb Opening in Inches  
 Height of Curb Orifice Throat in Inches  
 Angle of Throat (see USDCM Figure ST-5)  
 Side Width for Depression Pan (typically the gutter width of 2 feet)  
 Clogging Factor for a Single Curb Opening (typical value 0.10)  
 Curb Opening Weir Coefficient (typical value 2.3-3.7)  
 Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

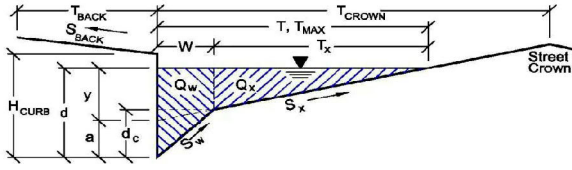
**Total Inlet Interception Capacity (assumes clogged condition)**

**Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)**

	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
$a_{local}$ =	3.00	3.00	inches
No =	1	1	
Ponding Depth =	6.0	11.6	inches
	<input checked="" type="checkbox"/> Override Depths		
	MINOR	MAJOR	
$L_G (G)$ =	N/A	N/A	feet
$W_G$ =	N/A	N/A	feet
$A_{ratio}$ =	N/A	N/A	
$C_G (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_G (C)$ =	30.00	30.00	feet
$H_{vert}$ =	6.00	6.00	inches
$H_{throat}$ =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
$W_p$ =	2.00	2.00	feet
$C_r (C)$ =	0.20	0.20	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
$Q_a$ =	17.6	74.1	cfs
$Q_{PEAK REQUIRED}$ =	9.6	30.4	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	High Plains Country Club Filing No. 3
Inlet ID:	DP 180

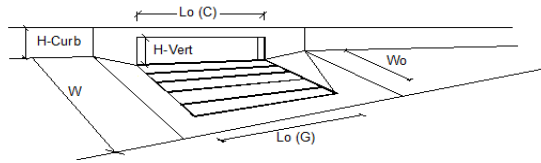


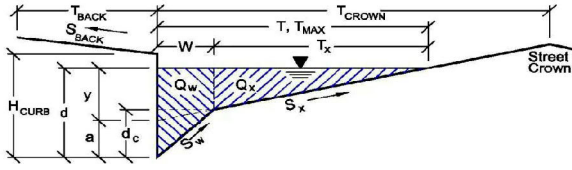
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 14.0$ ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$				
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 29.0$ ft				
Gutter Width	$W = 2.00$ ft				
Street Transverse Slope	$S_x = 0.020$ ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.040$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Minor Storm</th> <th style="width: 50%;">Major Storm</th> </tr> </thead> <tbody> <tr> <td><math>T_{MAX} = 18.5</math></td> <td><math>T_{MAX} = 23.0</math></td> </tr> </tbody> </table>	Minor Storm	Major Storm	$T_{MAX} = 18.5$	$T_{MAX} = 23.0$
Minor Storm	Major Storm				
$T_{MAX} = 18.5$	$T_{MAX} = 23.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Minor Storm</th> <th style="width: 50%;">Major Storm</th> </tr> </thead> <tbody> <tr> <td><math>d_{MAX} = 6.0</math></td> <td><math>d_{MAX} = 12.0</math></td> </tr> </tbody> </table>	Minor Storm	Major Storm	$d_{MAX} = 6.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 6.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input type="checkbox"/> check = yes				
<b>MINOR STORM Allowable Capacity is based on Depth Criterion</b>					
<b>MAJOR STORM Allowable Capacity is based on Spread Criterion</b>					
	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Minor Storm</th> <th style="width: 50%;">Major Storm</th> </tr> </thead> <tbody> <tr> <td><math>Q_{allow} = 16.3</math></td> <td><math>Q_{allow} = 47.0</math></td> </tr> </tbody> </table>	Minor Storm	Major Storm	$Q_{allow} = 16.3$	$Q_{allow} = 47.0$
Minor Storm	Major Storm				
$Q_{allow} = 16.3$	$Q_{allow} = 47.0$				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak' Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

# INLET ON A CONTINUOUS GRADE

Project: High Plains Country Club Filing No. 3  
 Inlet ID: DP 180

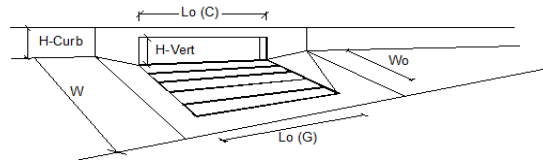


Design Information (Input)		MINOR	MAJOR
Type of Inlet	Type =	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL}$ =	3.0	3.0 inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_u$ =	15.00	15.00 ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_u$ =	N/A	N/A ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{-G}$ =	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{-C}$ =	0.20	0.20
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR
Total Inlet Interception Capacity	Q =	7.77	15.83 cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_o$ =	0.2	11.3 cfs
Capture Percentage = $Q_u/Q_o$ =	C% =	97	58 %

<b>ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor &amp; Major Storm)</b>							
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)							
<b>Project:</b>	High Plains Country Club Filing No. 3						
<b>Inlet ID:</b>	181A						
							
<b>Gutter Geometry (Enter data in the blue cells)</b>							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 14.0$ ft						
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft						
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$						
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches						
Distance from Curb Face to Street Crown	$T_{CROWN} = 31.0$ ft						
Gutter Width	$W = 2.00$ ft						
Street Transverse Slope	$S_x = 0.020$ ft/ft						
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft						
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.035$ ft/ft						
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$						
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; text-align: center;">Minor Storm</th> <th style="width: 50%; text-align: center;">Major Storm</th> </tr> <tr> <td style="border: 1px solid black; text-align: center;"><math>T_{MAX} = 18.5</math></td> <td style="border: 1px solid black; text-align: center;"><math>T_{MAX} = 23.0</math></td> </tr> <tr> <td style="border: 1px solid black; text-align: center;"><math>d_{MAX} = 6.0</math></td> <td style="border: 1px solid black; text-align: center;"><math>d_{MAX} = 12.0</math></td> </tr> </table>	Minor Storm	Major Storm	$T_{MAX} = 18.5$	$T_{MAX} = 23.0$	$d_{MAX} = 6.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm						
$T_{MAX} = 18.5$	$T_{MAX} = 23.0$						
$d_{MAX} = 6.0$	$d_{MAX} = 12.0$						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm							
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input type="checkbox"/> check = yes						
<b>MINOR STORM Allowable Capacity is based on Depth Criterion</b>							
<b>MAJOR STORM Allowable Capacity is based on Spread Criterion</b>							
	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; text-align: center;">Minor Storm</th> <th style="width: 50%; text-align: center;">Major Storm</th> </tr> <tr> <td style="border: 1px solid black; text-align: center;"><math>Q_{allow} = 17.0</math></td> <td style="border: 1px solid black; text-align: center;"><math>Q_{allow} = 43.9</math></td> </tr> </table>	Minor Storm	Major Storm	$Q_{allow} = 17.0$	$Q_{allow} = 43.9$		
Minor Storm	Major Storm						
$Q_{allow} = 17.0$	$Q_{allow} = 43.9$						
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'							
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'							

# INLET ON A CONTINUOUS GRADE

Project: High Plains Country Club Filing No. 3  
 Inlet ID: 181A



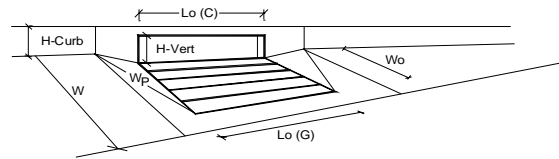
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL}$ =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_u$ =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_u$ =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_G$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_C$ =	0.20	0.20	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	Q =	3.30	10.20	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_o$ =	0.0	1.7	cfs
Capture Percentage = $Q_i/Q_o$ =	C% =	100	86	%

<b>ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor &amp; Major Storm)</b>							
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)							
<b>Project:</b>	High Plains Country Club Filing No. 3						
<b>Inlet ID:</b>	181B						
<b>Gutter Geometry (Enter data in the blue cells)</b>							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 14.0$ ft						
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft						
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$						
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches						
Distance from Curb Face to Street Crown	$T_{CROWN} = 31.0$ ft						
Gutter Width	$W = 2.00$ ft						
Street Transverse Slope	$S_x = 0.020$ ft/ft						
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft						
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.000$ ft/ft						
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$						
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; text-align: center;">Minor Storm</th> <th style="width: 50%; text-align: center;">Major Storm</th> </tr> <tr> <td style="border: 1px solid black; text-align: center;"><math>T_{MAX} = 18.5</math></td> <td style="border: 1px solid black; text-align: center;"><math>T_{MAX} = 23.0</math></td> </tr> <tr> <td style="border: 1px solid black; text-align: center;"><math>d_{MAX} = 6.0</math></td> <td style="border: 1px solid black; text-align: center;"><math>d_{MAX} = 12.0</math></td> </tr> </table>	Minor Storm	Major Storm	$T_{MAX} = 18.5$	$T_{MAX} = 23.0$	$d_{MAX} = 6.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm						
$T_{MAX} = 18.5$	$T_{MAX} = 23.0$						
$d_{MAX} = 6.0$	$d_{MAX} = 12.0$						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm							
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input type="checkbox"/> check = yes						
<b>MINOR STORM Allowable Capacity is based on Depth Criterion</b>							
<b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>							
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} =$ <span style="border: 1px solid black; padding: 2px;">SUMP</span> cfs						
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	<span style="border: 1px solid black; padding: 2px;">SUMP</span> cfs						



### INLET IN A SUMP OR SAG LOCATION

Project = High Plains Country Club Filing No. 3  
 Inlet ID = 181B



#### Design Information (Input)

Type of Inlet  
 Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')  
 Number of Unit Inlets (Grate or Curb Opening)  
 Water Depth at Flowline (outside of local depression)

#### Grate Information

Length of a Unit Grate  
 Width of a Unit Grate  
 Area Opening Ratio for a Grate (typical values 0.15-0.90)  
 Clogging Factor for a Single Grate (typical value 0.50 - 0.70)  
 Grate Weir Coefficient (typical value 2.15 - 3.60)  
 Grate Orifice Coefficient (typical value 0.60 - 0.80)

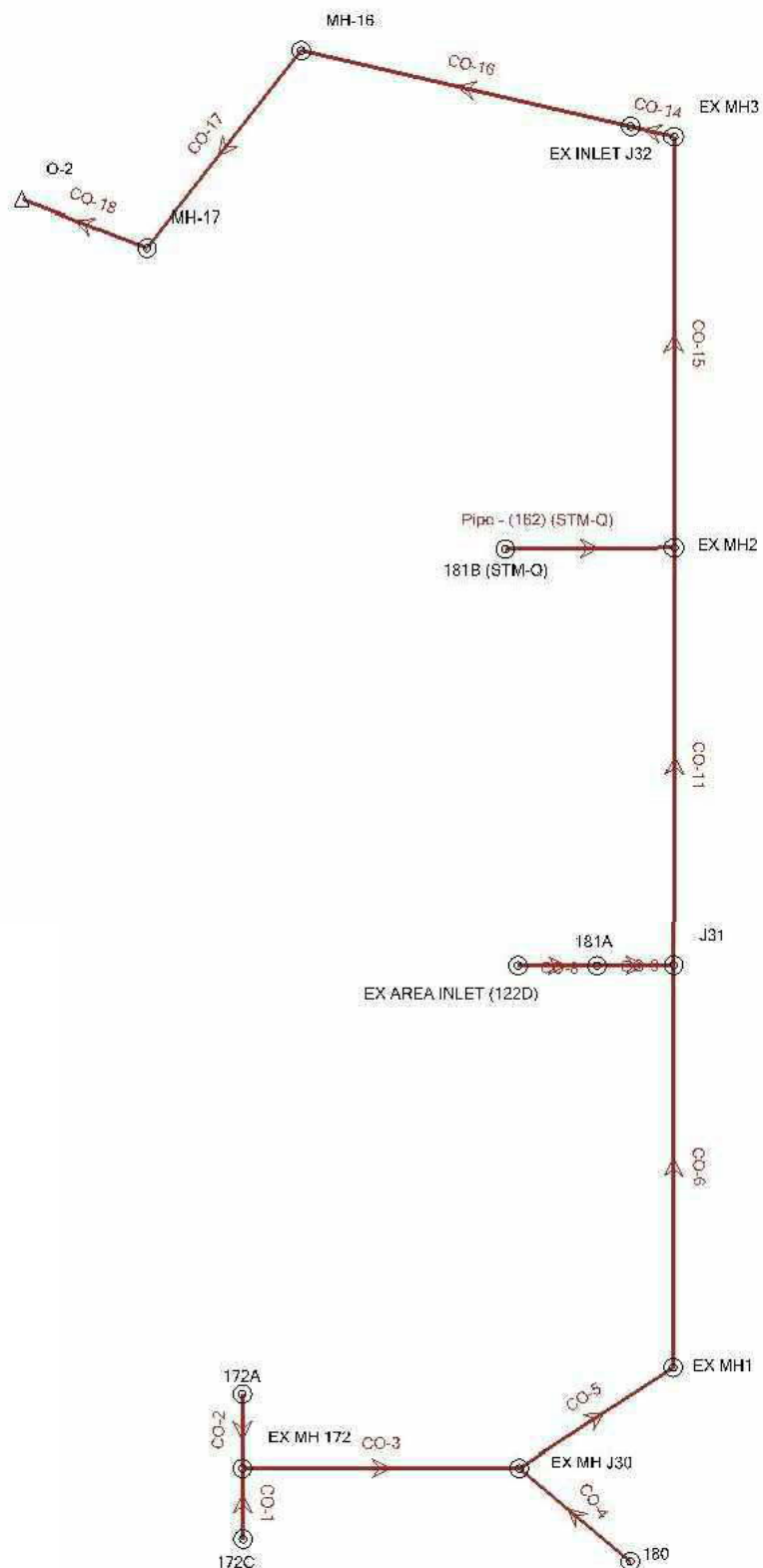
#### Curb Opening Information

Length of a Unit Curb Opening  
 Height of Vertical Curb Opening in Inches  
 Height of Curb Orifice Throat in Inches  
 Angle of Throat (see USDCM Figure ST-5)  
 Side Width for Depression Pan (typically the gutter width of 2 feet)  
 Clogging Factor for a Single Curb Opening (typical value 0.10)  
 Curb Opening Weir Coefficient (typical value 2.3-3.7)  
 Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

**Total Inlet Interception Capacity (assumes clogged condition)**

**Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)**

	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
$a_{local}$ =	3.00	3.00	inches
No =	2	2	
Ponding Depth =	6.0	7.8	inches
	<input checked="" type="checkbox"/> Override Depths		
	MINOR	MAJOR	
$L_G (G)$ =	N/A	N/A	feet
$W_G$ =	N/A	N/A	feet
$A_{ratio}$ =	N/A	N/A	
$C_G (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_G (C)$ =	15.00	15.00	feet
$H_{vert}$ =	6.00	6.00	inches
$H_{throat}$ =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
$W_p$ =	2.00	2.00	feet
$C_r (C)$ =	0.20	0.20	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
$Q_a$ =	19.0	38.1	cfs
$Q_{PEAK REQUIRED}$ =	7.1	27.1	cfs



**Bowman**  
CONSULTING

603 Park Point Drive, Suite 100  
Golden, CO 80401

Phone: (303) 674-7355  
Fax: (303) 674-3263  
www.bowmanconsulting.com

STORM SCHEMATIC - SYSTEM Q

HPCC FILING 3 (BLACKSTONE)  
AURORA, CO

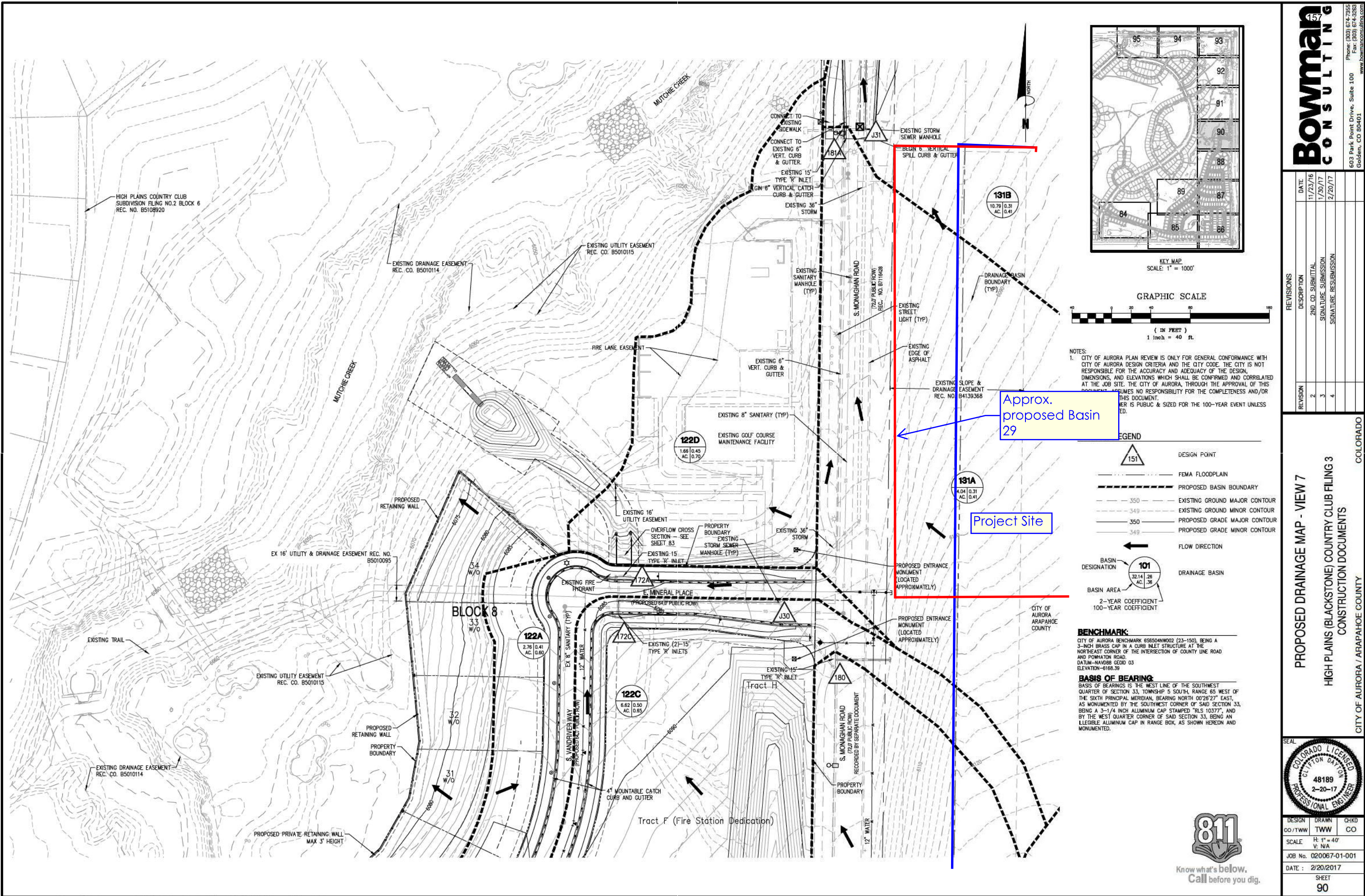
2-yr Scenario - Storm System Q																
ID	Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Slope (Calculated) (%)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Depth (Normal) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
35	Pipe - (162) (STM-Q)	181B (STM-Q)	EX MH2	6054.4	6053.83	28.7	0.02	2	24	0.013	7.1	8.17	31.88	0.64	6055.35	6054.52
50	CO-1	172C	EX MH 172	6079.24	6079	13.8	0.017	1.7	30	0.013	7.2	7.66	54.17	0.62	6080.13	6079.7
51	CO-2	172A	EX MH 172	6080.45	6079	21.4	0.068	6.8	18	0.013	2.4	9.52	27.33	0.3	6081.04	6079.88
52	CO-3	EX MH 172	EX MH J30	6078.9	6074.2	162.8	0.029	2.9	36	0.013	9.6	9.76	113.32	0.59	6079.88	6074.79
53	CO-4	180	EX MH J30	6081.84	6075.9	82	0.072	7.2	18	0.013	7.8	13.67	28.27	0.54	6082.92	6076.44
55	CO-5	EX MH J30	EX MH1	6073.4	6070.66	115.2	0.024	2.4	36	0.013	15.6	10.5	102.88	0.79	6074.66	6071.45
59	CO-6	EX MH1	J31	6070.26	6060.73	398	0.024	2.4	36	0.013	15.6	10.53	103.2	0.79	6071.52	6061.52
61	CO-8	AREA INLET (122)	181A	6062.9	6062.45	32.3	0.014	1.4	24	0.013	2.1	5.07	26.72	0.38	6063.4	6063.27
62	CO-9	181A	J31	6062.45	6060.73	27.1	0.063	6.3	24	0.013	5.4	11.42	56.99	0.42	6063.27	6061.92
66	CO-11	J31	EX MH2	6060.53	6052.83	317	0.024	2.4	36	0.013	18.7	11.14	103.95	0.86	6061.92	6054.37
72	CO-14	EX MH3	EX INLET J32	6045.85	6045.5	22.4	0.016	1.6	36	0.013	25.8	10.4	83.37	1.15	6047.49	6046.81
73	CO-15	EX MH2	EX MH3	6052.73	6045.95	303.2	0.022	2.2	36	0.013	25.8	11.84	99.73	1.04	6054.37	6046.99
78	CO-16	EX INLET J32	MH-16	6045.5	6032.59	203.4	0.063	6.3	36	0.013	23.8	16.82	168.03	0.76	6047.07	6033.35
79	CO-17	MH-16	MH-17	6032.49	6030.61	90.4	0.021	2.1	36	0.013	23.8	11.28	96.16	1.02	6034.06	6031.66
80	CO-18	MH-17	O-2	6030.34	6029.68	30.3	0.022	2.2	36	0.013	23.8	11.46	98.38	1	6031.91	6030.83

100-yr Scenario - Storm System Q																
ID	Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Slope (Calculated) (%)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Depth (Normal) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
35	Pipe - (162) (STM-Q)	181B (STM-Q)	EX MH2	6054.4	6053.83	28.7	0.02	2	24	0.013	27.1	8.63	31.88	1.42	6057.53	6057.12
50	CO-1	172C	EX MH 172	6079.24	6079	13.8	0.017	1.7	30	0.013	46.9	12.42	54.17	1.8	6081.5	6081.33
51	CO-2	172A	EX MH 172	6080.45	6079	21.4	0.068	6.8	18	0.013	9.5	14.07	27.33	0.61	6081.64	6081.33
52	CO-3	EX MH 172	EX MH J30	6078.9	6074.2	162.8	0.029	2.9	36	0.013	56.4	16.01	113.32	1.5	6081.33	6075.74
53	CO-4	180	EX MH J30	6081.84	6075.9	82	0.072	7.2	18	0.013	15.8	16.44	28.27	0.8	6083.26	6076.73
55	CO-5	EX MH J30	EX MH1	6073.4	6070.66	115.2	0.024	2.4	36	0.013	70.1	15.66	102.88	1.82	6076.06	6072.58
59	CO-6	EX MH1	J31	6070.26	6060.73	398	0.024	2.4	36	0.013	70.1	15.69	103.2	1.81	6072.92	6062.54
61	CO-8	AREA INLET (122	181A	6062.9	6062.45	32.3	0.014	1.4	24	0.013	8.9	7.65	26.72	0.79	6063.96	6064.02
62	CO-9	181A	J31	6062.45	6060.73	27.1	0.063	6.3	24	0.013	19.1	16.34	56.99	0.8	6064.02	6063.31
66	CO-11	J31	EX MH2	6060.53	6052.83	317	0.024	2.4	36	0.013	81.6	16.28	103.95	2	6063.31	6057.12
72	CO-14	EX MH3	EX INLET J32	6045.85	6045.5	22.4	0.016	1.6	36	0.013	108.7	15.38	83.37	(N/A)	6049.06	6048.42
73	CO-15	EX MH2	EX MH3	6052.73	6045.95	303.2	0.022	2.2	36	0.013	108.7	15.38	99.73	(N/A)	6057.12	6049.06
78	CO-16	EX INLET J32	MH-16	6045.5	6032.59	203.4	0.063	6.3	36	0.013	102.9	24.96	168.03	1.7	6048.41	6034.35
79	CO-17	MH-16	MH-17	6032.49	6030.61	90.4	0.021	2.1	36	0.013	102.9	15.24	96.16	2.73	6035.22	6033.34
80	CO-18	MH-17	O-2	6030.34	6029.68	30.3	0.022	2.2	36	0.013	102.9	15.78	98.38	2.61	6033.25	6032.47













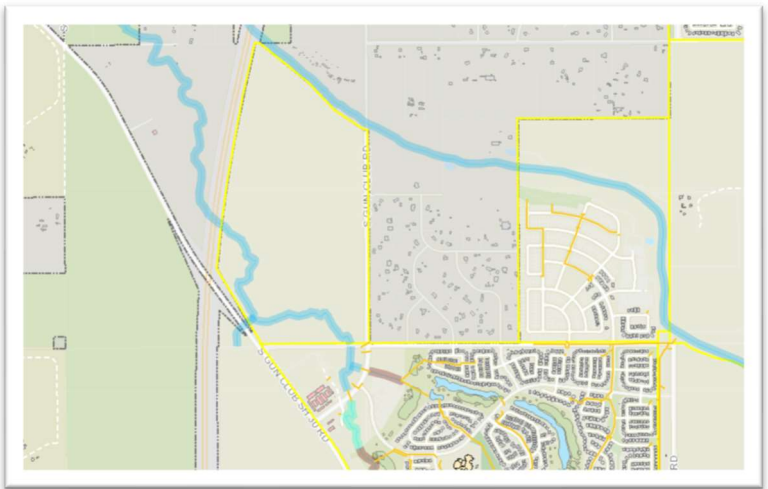
December 23, 2022

RE: Stormwater Conveyance - Notification of Adjacent Property Owners

Property Owners and Developers:

The intent of this letter is to provide information to property owners who will receive stormwater flow from an adjacent developing property. The letter explains what a stormwater drainage system is, why coordination between adjacent properties is necessary, and the authority by which the City must allow the conveyance of stormwater from one property to another. This letter represents an initial step to provide coordination between owners and is accompanied by specific information about the project that will tie the stormwater systems together and may require minor construction on your property.

A stormwater drainage system collects rainwater from rooftops, pavement, and other ground surfaces and conveys it through properly designed channels, detention ponds and subsurface pipes to protect the people and properties within our community from flooding. Historic stormwater drainage, or the stormwater that flowed over the ground surface before any land was developed, follows natural ground contours which cross both property and jurisdictional boundaries. When a property is developed, the City requires the historic drainage patterns be maintained because the downstream infrastructure is designed to accommodate those flows whereas if the stormwater were diverted elsewhere, there would be negative downstream impacts.



The Aurora Water Department provides stormwater and storm drainage services to annexed parcels within the City of Aurora and has established guidelines for the review, approval, permitting and enforcement of stormwater conveyance to ensure adequate drainage and control of stormwater as an integral and important part of any development. To maintain a

functioning system across the variety of land parcels across the City, the City's Municipal Code provides authority to require this conveyance as demonstrated by the two following sections:

*Per Section 138-365 (a), "Every subdivider shall provide, without cost to the City, an easement of not less than 16 feet in width up to such maximum width as is necessary to accommodate drainage from a 100-year storm or for the purpose of constructing and maintaining drainage facilities for the transmission, through the subdivider's property, of all stormwater generated upstream from the subdivision. Notwithstanding this requirement, any natural drainageway having an identifiable bed and banks which traverses any subdivider's property shall not be encroached upon or altered so as to render the drainageway less suitable to accept and transport stormwater which has historically flowed through such drainageway."*

*Furthermore, per Section 138-365(c), "It shall be the responsibility of the subdivider, at his or her sole expense, to construct or provide for the construction of all minor facilities required within his or her subdivision for the acceptance and conveyance of all stormwater generated outside of his or her subdivision, as though such water was in fact generated from land in its fully developed state. It shall further be the duty of the subdivider, at this or her sole expense, to construct or provide for the construction of all minor facilities required for the acceptance and conveyance of all stormwater generated from within his or her subdivision, as though such subdivision was in fact fully developed, or as may be otherwise be approved by the directors of water and public works department."*

Responsible stormwater management must be exercised by the subdivider in accordance with established rules and regulations of the City of Aurora when such permits have been reviewed and approved by the Aurora Water and Public Works Departments. This includes the responsibility of the subdivider to notify and coordinate with downstream property owners when conducting permitted activities. Per Section 138-442, *"it shall be unlawful for any person to begin construction upon or cause any excavation or grading of any site within the city without first having procured a stormwater quality permit when such permit is required by the rules and regulations promulgated pursuant to this article in accordance with federal and state stormwater control regulations."* Accordingly, it is in the best interest of subdividers to work collaboratively when activities encroach onto adjacent parcels located within or outside the City of Aurora.

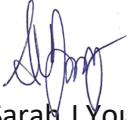
The intent of this letter is stormwater infrastructure interconnectedness only and in no way obligates downstream property owners to detain water for upstream property owners unless otherwise identified in an approved, and current, Master Drainage Report or Master Drainage Plan.

City approval of plans, reports and permits shall not be deemed as approval to commence offsite construction. Appropriate property access must be granted by the property owner at the time of construction.



If you have any questions or concerns, please reach out the Aurora Water at [aurorawaterdrainage@auroragov.org](mailto:aurorawaterdrainage@auroragov.org).

Sincerely,

A handwritten signature in blue ink, appearing to read 'SJ Young', with a stylized flourish at the end.

Sarah J Young, P.E.  
Aurora Water Department  
Aurora Water Deputy Director – Planning and Engineering

## SECTION 600

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## SECTION 600 STORM DRAINAGE FACILITIES

### 601.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County.

All enclosed Storm Water Collection Systems, Catch Basins, Curbs, Gutters and Detention/Retention Structures shall be owned and maintained by the governing Metro District or Homeowners Association. All Open Roadside Drainage Channels and Culverts will be maintained by Elbert County.

### 610.00 STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA

All proposed construction plans and submittals shall be accompanied by a storm drainage analysis. Appropriate drainage system design shall be submitted for approval by the DPW Director Or designee for each phase of construction. Approval of the analysis and design is subject to the following conditions:

- A. Construction of the system shall commence within 365 days of the date of the approval.
- B. No construction has been completed on any adjacent property that may have affected the drainage pattern within the basin.

New submittals may be required by the DPW Director or designee.

The proposed construction shall not damage upstream or downstream properties. The planning and design of the drainage system shall not transfer the problem from one location to another.

Except where specified in these CONSTRUCTION STANDARDS & SPECIFICATIONS, the procedure, criteria, and standards set forth in the latest revision of the Urban Drainage Flood Control District Storm Drainage Criteria Manual—hereby referred to as the UDFCD Manual—shall be instituted for the analysis of any drainage system. Current engineering practices and drainage methodology, as well as common sense, shall be involved with the analysis of any drainage system.

The runoff analysis for a particular area shall be based on the natural, undisturbed land for that area. Any contributing runoff from upstream areas shall be based on the existing land use and topographic characteristics of those areas.

Where a master drainage plan for a given area of Elbert County is available, proposed drainage systems shall conform to that plan. Consideration shall be given as to how the proposed master plan drainage systems shall tie into the existing upstream and downstream drainage system.

In areas where a master plan is not available, major drainageways and easements shall be located to provide continuity with existing drainage conditions. These drainageways and easements shall be shown on all drainage plans.

**A CONSTRUCTION STORMWATER DISCHARGE (CDPS) PERMIT SHALL BE OBTAINED FROM THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT FOR DISTURBANCE OF ANY SITE LARGER THAN ONE ACRE.**

**FOR CAPITAL IMPROVEMENT PROJECTS, THE CONTRACTOR IS REQUIRED TO OBTAIN A CDPS PERMIT.**

Permanent stormwater quality facilities shall be designed and constructed in accordance with the UDFCD Manual (Volume 3).

The Federal Emergency Management Agency (FEMA) floodplain boundaries are available from the DPW Director Or designee and shall be shown on all preliminary and final drainage plans.

All ponding facilities shall be of the detention type. Retention facilities shall only be allowed with the written approval of the DPW Director or designee

Construction that shall impair surface or subsurface drainage shall not be approved. Elbert County reserves the right to issue and enforce more stringent criteria shall adverse conditions exist. Designs that vary from the criteria shall require written approval of a variance by the DPW Director Or designee prior to final approval of the plans.

Natural topographic features shall be the basis of location for easements and future runoff calculations. Where defined, existing drainage patterns and slopes shall be used. The drainage facilities shall be able to handle the design flows with no erosion damage to the system.

Streets shall not be used as primary floodways for major storm runoff. The amount of runoff in the streets shall not exceed the limits established in Section 613.04 Street Flow Capacities of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

For inlet and manhole details, refer to the CDOT *M&S Standards*.

Stormwater detention facilities or natural drainageways are to be used whenever feasible. Any alteration to natural drainage patterns shall not be approved unless a thorough

investigation and analysis shows no hazard or liability. The DPW Director Or designee shall have final authority over any system design.

**ALL DRAINAGE FACILITIES SHALL BE IN AN EASEMENT OR PUBLIC R.O.W.**

All drainage improvements shall be as natural in appearance as possible to be aesthetically pleasing. Maintenance access shall be provided for all drainage and flood control facilities.

Irrigation ditches shall not be used as the outfall of any drainage basin.

**611.00 Design Methods**

**611.01 Minor and Major Design Storms**

Every urban area has two separate and distinct drainage systems whether or not they are actually planned for and designed. One is the initial system, which corresponds to the minor (or ordinary) storm recurring at regular intervals. The other is the major system, which corresponds to the major (or extraordinary storm), which is unlikely to occur more often than once in one hundred (100) or more years ("100-year storm"). Since the effects and routing of stormwaters for the major storm may not be the same as for the minor storm, all storm drainage plans submitted for approval shall be submitted in detail in two separate phases: one indicating the effects of the minor storm and the other showing the effects of the major storm.

- A. Minor storm provisions: The objectives of the minor storm planning are to minimize inconvenience, to protect against recurring minor damage, to reduce rising maintenance costs, to create an orderly drainage system and to provide a sociological benefit to the urban resident. The minor storm drainage system may include curb and gutter, storm sewer, swales, and other open drainageways and detention facilities.
- B. Major storm provisions: The major storm shall be considered the 100-year storm. The objectives of the major storm planning are to eliminate substantial property damage or loss of life and shall be as directed and approved by the DPW Director or designee. Major drainage systems may include storm sewers, open drainageways and detention facilities. The correlation between the minor and major storm system shall be analyzed to ensure a well-coordinated drainage system.

**611.02 Storm Return Periods**

The minor and major storm design return periods shall not be less than those shown below:

### DESIGN STORM RETURN PERIODS

Land Use or Zoning	Design Storm Return Period	
	Minor Storm	Major Storm
Residential	2-year	100-year
Business	5-year	100-year
Public Building Areas	5-year	100-year
Parks, Greenbelts, etc.	2-year	100-year
Open Channels and Drainageways	-	100-year
Detention Facilities	10-year <sup>1</sup>	100-year

<sup>1</sup>A two (2) year storm return period shall be used if the detention facility does not have a water quality outlet.

#### 611.03 Rainfall Intensities

The rainfall intensities to be used in the computation of runoff shall be obtained from the Time-Intensity-Frequency Curves shown in the Detail Drawings.

#### 611.04 Runoff Computations, Rational Method

The Rational Method shall be utilized for sizing storm sewers and for determining runoff magnitude for all watersheds

The procedures for the Rational Method, as explained in the latest edition of the UDFCD Manual (Volume 1), shall be followed in the preparation of drainage reports and storm drainage facility designs in Elbert County.

#### 611.05 Runoff Coefficients

Rational method runoff coefficients: The runoff coefficient (C) to be used in conjunction with the Rational Method shall not be less than those listed below:

**RUNOFF COEFFICIENTS (C) FOR RATIONAL METHOD**

Land Use or Surface Characteristics	Percent Impervious	Frequency			
		2	5	10	100
Business					
Commercial Areas	95	.79	.81	.83	.88
Neighborhood Areas	85	.66	.68	.69	.75
Residential					
Single-Family	*	*	*	*	*
Multi-Unit (detached)	60	.37	.41	.46	.63
Multi-Unit (attached)	75	.51	.54	.58	.66
1/2 Acre Lot or Larger	*	*	*	*	*
Apartments	80	.57	.59	.63	.70
Industrial					
Light Areas	80	.57	.59	.63	.70
Heavy Areas	90	.71	.73	.75	.81
Parks, Cemeteries	5	.08	.18	.28	.52
Playgrounds	10	.11	.21	.30	.53
Schools	50	.34	.40	.46	.60
Railroad Yard Areas	15	.14	.24	.32	.54
Undeveloped Areas					
Historic Flow Analysis	2	(See "Lawns")			
Greenbelts, Agricultural	2				
Offsite Flow Analysis					
(when land use not defined)	45	.31	.37	.44	.59
Streets					
Paved	100	.89	.90	.92	.96
Gravel	40	.28	.35	.42	.58
Drives and Walks	90	.71	.73	.75	.81
Roofs	90	.71	.73	.75	.81
Lawns, Sandy Soil	0	.00	.01	.05	.20
Lawns, Clay Soil	0	.04	.15	.25	.50

\*Refer to the graphs in the Runoff Chapter of the UDFCD Manual.

**612.00 Detention****612.01 General**

Onsite detention is required for all new development, expansion and redevelopment. The required minimum detention volume and maximum release rates at these volumes for the 2-year, 5-year and 100-year storms shall be determined in accordance with the procedure and data set forth in these criteria. If the pond does not include a water quality outlet, which controls about the one and one-half (1½) year storm, the pond shall be designed to release the two (2) year historic rate.



Exemptions from the detention requirement may be granted if it can be demonstrated that the developed area does not adversely affect the downstream major drainageways (assuming the entire drainage area is fully developed) and that the water quality is maintained.

Offsite flows cannot be passed through the detention pond. Offsite areas shall be included in the drainage area contributing to the pond. In certain cases, offsite flow can be routed around the detention pond.

Parking lots that serve as detention storage ponds shall not have a storage depth of more than one (1) foot. Parking lots that serve as detention storage ponds shall place notification signs that the area ponds during a rainfall event. The signs shall be permanent and high quality and shall meet Elbert County's specifications for traffic signs.

#### 612.02           Equation Method

The equation method found in the Storage section of the UDFCD Manual may be used to design detention ponds for drainage areas smaller than ninety (90) acres; however, if the calculated allowable release is greater than the historic runoff, a different method shall be used to determine the storage requirements.

#### 612.03           Sequential Detention

The sequential detention method shall be used for ponds that drain into each other. Use the Sequential Detention Form at the end of Section 600 of these CONSTRUCTION STANDARDS & SPECIFICATIONS to size sequential detention ponds.

### **613.00       Design Standards**

#### 613.01           Open Channels

Except as modified herein, open channels shall be designed for the 100-year storm and shall conform to the UDFCD Manual. In addition, the channel design shall also be analyzed with respect to minor storm runoff. Whenever practical, the channel shall have slow flow characteristics, be wide and shallow, and be natural in its appearance and functioning.

Channels shall be designed so that critical depth and super-critical flows are avoided. Channel capacities shall be computed from Manning's Formula for uniform flow, except at crossings and transitions where the design shall account for backwater effects.

The channel cross-section may be any type suitable to the location; however, the limitations for design for the major storm and minor storm design flows shall include:

- A. Capacity: The channel and overbank areas shall have adequate capacity for the 100-year storm runoff.
- B. Side slopes: Side slopes shall be as flat as practical. Side slopes of 4:1 (run:rise) shall be considered a normal minimum. Under special conditions, slopes of 3:1 may be utilized with written approval of the DPW Director or designee. The practical slope for mowing equipment is 4:1 or less.
- C. Depth: The maximum design depth of flow for the major storm shall be limited to five (5) feet of depth in the channel cross section outside of the low-flow or trickle channel. Any design variation exceeding the maximum depth of flow shall be submitted in writing for approval by the DPW Director or designee. Critical depths and velocities shall be investigated and reported for both the major and minor storm runoffs.
- D. Freeboard: Except where localized overflow in certain areas is desirable for additional ponding benefits or other reasons, the minimum allowable freeboard shall be one (1) foot.
- E. Bottom width: The bottom width shall be designed to satisfy the hydraulic capacity of the cross-section recognizing the limitations on velocity, depth and Froude number.
- F. Slope of channel: Grass-lined channel slopes are dictated by velocity and Froude number requirements. Grass-lined channels normally shall have slopes of 0.2% to 0.6%. Where the natural topography is steeper than desirable, drops may be utilized.
- G. Curvature: The centerline curvature shall have a radius of not less than twice the design flow top width, but not less than one hundred (100) feet.
- H. Trickle channels: Concrete trickle channels to carry low flows may be required for all new urban grassed channels. The capacity of a trickle channel shall be approximately two (2) percent of the major design flow. The shape of concrete trickle channels shall be parabolic. Where two (2) percent of the major design flow exceeds ninety (90) cfs, a low flow channel shall be required. Low flow channels shall be in accordance with the UDFCD Manual (Volume 2). **All concrete trickle channels shall have a minimum slope of one (1) percent.**
- I. Design velocity: The maximum velocity for the major storm design runoff shall not exceed seven (7) feet per second for grass-lined channels, except in sandy soil where the maximum velocity shall not exceed five (5) feet per second. The Froude number (turbulence factor) shall be less than 0.8 for grass-lined channels. Grass-lined channels having a Froude number greater than 0.8

- shall not be permitted. Minimum velocities for all channels shall not be less than two (2) feet per second for the minor storm runoff.
- J. Erosion: All channels shall be designed with the proper and adequate erosion control features.
  - K. Grass lining: The grass lining for channels shall be in accordance with the UDFCD Manual (Volume 2).
  - L. Water surface profile: A water surface profile for the major storm runoff shall be computed for all channels and clearly shown on the construction plans submitted for approval. Computations of the water surface profile shall utilize standard backwater methods such as HEC-2 and shall take into consideration all losses due to velocity changes, drops, bridge and culvert openings, and other obstructions. A Computations Report shall be submitted along with the construction plans. The energy gradient line shall be shown on the construction plans.
  - M. Roughness coefficient (n): The value of the roughness coefficient (n) to be used in Manning's Formula shall not be less than those listed below:

#### MINIMUM VALUES OF ROUGHNESS COEFFICIENT (n)

Type of Channel and Description Closed Conduits:			Minimum
Concrete Pipe:			
		Culverts with bends, connections & debris	0.013
		Storm sewer	0.013
		Subdrain with open joints	0.016
PVC Pipe			0.011
Concrete Surfaces (bottom & sides):			
		Smooth finish	0.015
		Unfinished	0.017
Concrete Bottom (with sides of):			
		Mortared stone	0.020
		Dry rubble or riprap	0.030
Gravel Bottom (with sides of):			
		Formed concrete	0.020
		Dry rubble or riprap	0.040
Excavated or Dredged Channels and Ditches:			
	Earthen, Straight & Uniform, no brush or debris:		
		Grassed, less than 6" high with:	
		Depth of flow < 2.0 feet	0.035
		Depth of flow > 2.0 feet	0.030
		Grassed, approx. 12" high with:	
		Depth of flow < 2.0 feet	0.060
		Depth of flow > 2.0 feet	0.035
		Grassed, approx. 24" high with:	

		Depth of flow < 2.0 feet	0.070
		Depth of flow > 2.0 feet	0.035
		Earth bottom with riprap on sides	0.040
Rock or Shale Cuts:			
		Smooth and uniform	0.035
		Jagged and irregular	0.040
		Curb and Gutter (concrete)	0.016

#### 613.02 Storm Sewers and Storm Inlets

Except as subsequently modified, the design of storm sewers and inlets shall conform to the criteria set forth in the UDFCD Manual. Storm sewers and inlets shall be of sufficient capacity to adequately carry the expected runoff from the initial design storm. Computer programs such as UDFCD's UDSewer and UDIInlet are encouraged in the design of the storm sewer system.

**THE STORM DRAINAGE SYSTEM DESIGN FORM IN THE BACK OF SECTION 600 OF THESE CONSTRUCTION STANDARDS & SPECIFICATIONS SHALL BE USED IN THE DESIGN OF STORM SEWERS AND INLETS.** The completed form shall be included in the drainage report.

The storm sewer system shall be installed at all locations where the allowable street capacity is exceeded or wherever ponding of water is likely to occur.

The invert elevation of storm sewer outfalls into channels shall be at least one (1) foot above the channel invert.

The minimum allowable pipe size for storm sewer systems shall be as follows:

#### MINIMUM ALLOWABLE PIPE SIZE

Type of conduit	Min. Inside Pipe Dia.
Main Trunk Sewer	21"
Individual laterals/Driveway Culverts	18"

Pipe diameters of less than eighteen (18) inches may be allowed; however, a variance request shall be submitted to the or designee in writing, and approval shall be obtained from the DPW Director Or designee prior to final design.

Arch pipes may be allowed where design conditions dictate, provided that the minimum cross-sectional areas are not less than those specified above. All storm sewer conduits shall have sufficient structural strength to withstand an H-20 design load.

Manholes shall be a minimum of sixty (60) inches for lines eighteen (18) inches to twenty-one (21) inches diameter, and seventy-two (72) inches for lines twenty-four (24) inches to thirty (30) inches diameter. For storm pipe larger than thirty (30) inches diameter, the DPW Director Or designee shall approve the manhole design size. Where two or more pipes enter a manhole, the or designee shall approve the manhole design size.

The maximum allowable distance between manholes or other suitable appurtenances for cleanouts shall not exceed those listed below:

#### MAXIMUM ALLOWABLE MANHOLE SPACING

Inside Diameter	Maximum Allowable Distance Between Manholes and Cleanouts
18" - 36"	400 feet
36" - 60"	500 feet
60" & Larger	750 feet

The velocity for the minor flows in conduits shall not be less than two (2) feet per second.

Storm inlets shall be utilized at all points where ponding or sump conditions exist. Inlets shall be curb opening inlets, type "R", or grated inlets with curb openings. All inlets shall be similar and equal to those in the Detail Drawings or as approved by the DPW Director or designee.

Grated inlets shall be recommended for bicycle traffic. Grated Inlets shall be Neenah Foundry model number R-3157A or R-3233 or an approved equivalent.

The theoretical capacity and spacing of storm inlets shall be analyzed using the criteria—including reduction factors—set forth in the UDFCD Manual.

The size of outlet pipes from stormwater inlets shall be based on the theoretical capacity of the inlet. All pipe outlets shall be protected in accordance with the Detail Drawings.

#### 613.03 Culverts

Culvert capacities shall be at least equal to the capacities of culverts designed in accordance with the procedures outlined in Federal Highway Administration Hydraulic Design Series Number 5, "Hydraulic Design of Highway Culverts". The DPW Director Or designee shall approve the shape, location and type of construction of culverts.

Culverts shall be sized to have sufficient capacity to pass all of the runoff from the major storm if twenty (20) percent of the pipe is plugged.

The following design criteria shall be utilized for all culvert design:

- A. The culvert, including inlet and outlet structures, shall properly convey water and debris at all stages of flow.
  - B. Culvert inlets shall be designed to minimize entrance and friction losses. Inlets shall be provided with either flared end sections or head walls with wing walls. Projecting ends are not acceptable. Large structures shall be designed to resist hydrostatic uplift forces.
  - C. Culvert outlets shall be designed to avoid sedimentation, undermining of culvert, or erosion of downstream channels. Outlets shall be provided with either flared end sections or headwalls, with wingwalls and riprap. Projecting ends are not acceptable. Additional outlet control, in the form of riprap, channel shaping, etc., may be required.
  - D. Culvert slopes shall be selected to eliminate excessive velocities and scour. Generally, the minimum slope of culverts shall be limited to one-half (½) percent.
  - E. Headwater ponding above culvert inlets shall not be acceptable if such ponding appears likely to cause property or roadway damage, culvert clogging, saturation of fills, detrimental upstream deposits of debris, or inundation of existing or future utilities and structures.
  - F. Tailwater height at the outlet shall be subject to approval by the DPW Director or designee.
  - G. Culverts shall be analyzed to determine whether discharge is controlled by inlet or outlet conditions for both the minor storm discharge and the major storm discharge. Computations for selected culvert sizes shall be submitted to the DPW Director Or designee for approval. Computer programs such as the FHWA HY8 may be used to design culverts.
  - H. Minimum Allowable Size: The required size of a culvert shall be based on adequate hydraulic design analysis.
    - 1. Circular culverts under roadways/driveways shall have a minimum diameter of twenty-four (24) inches.
    - 2. Oval culvert dimensions shall be forty-three (42) inches by twenty-seven (27) inches or larger.
    - 3. Box culverts shall have a minimum height of four (4) feet.
- Smaller culvert sizes may be approved by the DPW Director or designee.
- I. An overflow path shall be provided in case the culvert becomes plugged.
  - J. Where physical conditions dictate, multiple culvert installations may be approved by the DPW Director or designee.

- K. The structural design of culverts shall conform to the methods and criteria recommended by the manufacturer of a specific type of culvert for the specified embankment conditions.

#### 613.04 Street Flow Capacities

Except as modified herein, the criteria set forth in the UDFCD Manual shall be used to analyze and to determine the adequacy of streets as a function of the drainage system. Both the minor storm runoff and major storm runoff shall be considered, and calculations showing such runoff at critical sections shall be submitted. The following criteria shall apply in the determination of allowable street flow capacities:

- A. Street, curb and gutter, sidewalks, cross pans and curb cuts shall conform to all applicable Sections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
- B. Street encroachment for the minor design storm shall not exceed the limitations set forth below:

#### ALLOWABLE STREET ENCROACHMENT AND DEPTH OF FLOW FOR MINOR STORM RUNOFF

Street Classification	Maximum Encroachment
Local	If curb present, no curb overtopping. Flow may spread to crown of street.
Connector	If curb present, no curb overtopping. Flow spread shall leave the equivalent of one 10-foot driving lane clear of water.
Arterials	If curb present, no curb overtopping. Flow spread shall leave the equivalent of two 10-foot driving lanes clear of water – one lane in each direction. No more than two lanes in each direction shall be flooded.

Where no curb exists, street encroachment shall not extend past the public R.O.W.

A storm sewer system shall be installed at all points where the maximum allowable street encroachment occurs.

- C. The allowable depth of flow and inundated area for the major design storm shall not exceed the following limitations:

**ALLOWABLE DEPTH OF FLOW AND INUNDATED AREA FOR  
MAJOR STORM RUNOFF**

Street Classification	Allowable Depth and Inundated Areas
Local & Connector	Lowest entry to residential dwellings and public, commercial, and industrial buildings shall not be less than twelve (12) inches above the 100-year water surface elevation. The depth of water over the gutter flowline shall not exceed twelve (12) inches.
Arterial	Lowest entry to residential dwellings and public, commercial, and industrial buildings shall be not less than twelve (12) inches above the 100-year water surface elevation. The depth of water at the street crown shall not exceed six (6) inches to allow operation of emergency vehicles. Depth of water over gutter flow line shall not exceed twelve (12) inches.

- D. Cross-street flow occurs when runoff flowing in a gutter flow across the street to the opposite gutter or inlet. Allowable cross-street flow is summarized in the following table:

**ALLOWABLE CROSS-STREET FLOW**

Street Classification	Initial Storm Flow	Major Storm Flow
Local	Six (6) inches depth in crossspan	Twelve (12) inches of depth above gutter flow line
Collector	Six (6) inches of depth in crossspan	Twelve (12) inches of depth above gutter flow line
Arterial	None	No cross-street flow. Maximum depth of upstream gutter of twelve (12) inches.



**620.00 GENERAL PROVISIONS****621.00 General**

All storm drainage construction in the Elbert County R.O.W./Dedicated Easements shall comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS. These standards shall include new storm drainage construction and repairs and maintenance of existing facilities within Elbert County.

**622.00 Approved Plans**

All storm drainage construction shall be in accordance with engineered construction plans prepared under the direction of a Colorado Registered Professional Engineer. Storm drainage plans shall include an Area Grading Plan and an Erosion Control plan as defined in Section 161.09 Area Grading Plan Details and Section 161.10 Erosion Control Plan Details of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Where work is to be performed over, under or in an irrigation ditch, written approval of the ditch owner is required prior to written approval by the DPW Director or designee.

**623.00 Permits Required**

A PPIP or Grading Permit issued by Elbert County shall be required and shall not be issued until the DPW Director Or designee has approved the storm sewer plans. A NPDES permit shall be obtained for any disturbance of one acre or more. Refer to Section 150.00 PERMITS AND INSPECTIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements.

**624.00 Traffic Control**

Traffic control shall comply with Section 141.12 Traffic Control, Barricades and Warning Signs of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

**630.00 EROSION CONTROL****631.00 General**

Erosion and sedimentation are natural processes, the intensity of which is increased by land disturbing activities that reduce or destroy the aesthetic and practical values of neighboring properties, streams and lakes. The purpose of these erosion control criteria is to reduce intensified erosion—caused by either wind or water—to an acceptable level without placing undue burdens on the landowner, builder or community.

**632.00 Requirements**

Erosion control measures shall be designed in conformance with the UDFCD Manual (Volume 3). All land-disturbing activities within Elbert County shall comply with the Colorado Department of Public Health and Environment Regulations.

**633.00 Submittal**

A discussion that summarizes erosion control methods shall be submitted as part of the preliminary and final drainage reports, as required in Section 162.00 Engineering Reports of these CONSTRUCTION STANDARDS & SPECIFICATIONS. A detailed erosion control plan shall accompany the Area Grading Plan and approved Drainage Plan, as required in Section 161.10 Erosion Control Plan Details of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The erosion control plan shall be approved by Elbert County prior to receiving a PPIP or Grading Permit.

**634.00 Erosion Control Measures**

A CONSTRUCTION STORMWATER DISCHARGE PERMIT (NPDES PERMIT) SHALL BE OBTAINED FROM THE COLORADO DEPARTMENT OF HEALTH AND ENVIRONMENT FOR SITE DISTURBANCE LARGER THAN ONE ACRE.

Detailed erosion control measures shall be provided to protect the following:

- A. Inlets and culverts
- B. Drainageways
- C. Streams or other water bodies immediately adjacent to land disturbed by construction activity
- D. Cut and fill areas
- E. Properties and improved streets adjacent to construction activity
- F. Others as required by the Road & Bridge Superintendent / Elbert County Engineer

Temporary erosion control measures such as sediment traps, straw bales or silt fence shall be properly placed in accordance with the Colorado Department of Public Health and Environment approved Stormwater Management Plan (SWMP) (CDPS Permit) prior to any earthmoving on the site. Erosion control measures shall be kept in good repair and fully functional until erosion potential from the site no longer exists.

Permanent erosion control (sod, seed, mulching, etc.) shall be in place prior to the request for a Certificate of Occupancy or Letter of Final Acceptance.

**635.00 Erosion Control Structures**

Refer to the Detail Drawings for erosion control installation. When applicable, details of additional erosion control measures may be obtained from the UDFCD Manual (Volume 3).

## **640.00 STORM DRAINAGE CONSTRUCTION**

### **641.00 Site Work and Earthwork**

#### **641.01 General**

Site work and earthwork shall be performed in accordance with Section 300.00 SOILS AND EARTHWORK of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

#### **641.02 Trenching, Backfilling and Compacting**

Trenching, backfilling and compacting shall be performed in accordance with Section 350.00 TRENCHING, BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

### **642.00 Materials**

#### **642.01 Pipe**

Reinforced Concrete Pipe (RCP) shall be manufactured to comply with ASTM C76. All applicable portions of Section 706 Concrete and Clay Pipe of the CDOT *Standard Specifications for Road and Bridge Construction* shall apply.

Polyvinyl Chloride Pipe (PVC) shall be manufactured to comply with ASTM F794/F949 (ribbed) or ASTM D3034, SDR-35 (smooth). All joints shall be factory prepared compression type (elastomeric gasket joint), providing a watertight seal.

Non-Reinforced Concrete Pipe (NRCP) shall be manufactured to comply with ASTM C14. NRCP shall be specified under the criteria of Section M-603-2 of the CDOT *M&S Standards* for all sizes thirty-six (36) inches diameter and smaller.

Polymer Coated Steel Pipe (PCSP) shall be manufactured to comply with AASHTO Section 36. All applicable portions of Section 707 Metal Pipe of the CDOT *Standard Specifications for Road and Bridge Construction* shall apply. The corrugation of the pipe shall be ¾" x ¾" x 7 ½" spiral rib. Polymer coating, grade 250/250, shall be applied prior to corrugating in conformance with AASHTO 26.3.7.

Corrugated aluminum pipe (CAP) shall be manufactured to comply with all applicable portions of Section 707 Metal Pipe of the CDOT *Standard Specifications for Road and Bridge Construction*. The pipe sizes shall be as shown on the project plans. The corrugation profile of the pipe shall be ¾" x ¾" x 7 ½" spiral rib. At all locations where corrugated aluminum pipe is proposed to be installed, a corrosion resistance level test shall be performed and a test report detailing any corrosion protection requirements shall be submitted to the DPW Director Or designee for approval.

Corrugated polyethylene pipe (CPP) or High-Density Polyethylene Pipe (HDPEP) shall be manufactured to comply with ASTM D3350, with the minimum cell classification of 315412C. Requirements for test methods, dimensions and markings shall comply with AASHTO Designation M-294. The minimum pipe stiffness shall be 46 psi to comply with ASTM D2412 at five (5) percent deflection.

Corrugated steel pipe (CSP) shall be manufactured to comply with all applicable portions of Section 707 Metal Pipe of the CDOT *Standard Specifications for Road and Bridge Construction*. The pipe sizes shall be as shown on the project plans. These conduits and coupling bands shall conform to the requirements of AASHTO M 36M (M 36).

Other storm sewer pipe materials may be approved at the discretion of the DPW Director or designee Pipe class designation or gauge shall be as shown on the approved plans or as designated by the DPW Director Or designee for each individual project. Pipe material shall be selected based on strength and soil conditions.

All pipe shall be inspected by the Elbert County Inspector/Representative in order to allow for rejection of pipe that fails to conform to the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Defects shall be marked so as not to disfigure the rejected pipe. Rejected pipe shall be removed from the job site within twenty-four (24) hours.

#### 642.02 Pipe Joints

All pipe joints shall be watertight. RCP and NRCP joints shall comply with ASTM C443. CPP joints shall comply with ASTM D3212. PCSP and CAP joints shall comply with AASHTO Section 26.4.2.4.f. Cement mortar joints shall be constructed with mortar mixture composed of one (1) part Portland cement to three (3) parts sand and enough water to produce a workable mix. Mortar that has started to set shall be discarded and a new batch prepared.

#### 642.03 Manholes, Inlets and Sidewalk Chases

Manhole bases, vaults and inlets may be constructed of cast-in-place or pre-cast concrete. Manhole materials, including access ring and cover sets for all inlet types, shall comply with all applicable portions of Section 532.03 Manholes of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Inlets, except as modified above, shall be constructed in accordance with the Detail Drawings and all CDOT *M&S Standards*.

#### 642.04 Manhole Base Slabs & Base Beams

Refer to Section 532.04 Manhole Base Slabs and Base Beams of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

#### 642.05 Concrete

Concrete shall conform to Section 800.00 CONCRETE MIX DESIGN AND CONSTRUCTION of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Type II cement shall be used except where sulfate resistant cement is required. Concrete encasement of pipe shall conform to the details shown on the approved plans.

#### 642.06 Cast and Ductile Iron Fittings

Refer to Section 532.06 Cast and Ductile Iron Fittings of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Lids shall be furnished with the words “STORM SEWER” cast on top.

#### 642.07 Bedding Material

All applicable portions of Section 353.00 Bedding for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS shall apply.

#### 642.08 Riprap and Filter Cloth

Riprap and filter cloth shall be installed at locations shown on the approved plans, or in locations designated by the DPW Director or designee.

Rock used for riprap shall be hard, durable, angular in shape, and be free from cracks, overburden, shale and organic matter. Neither breadth nor thickness of a single stone shall be less than one-third ( $\frac{1}{3}$ ) its length, and rounded stone shall not be approved. The rock shall sustain the abrasion test (Los Angeles machine - ASTM C0535-69) and shall sustain a loss of not more than ten (10) percent after twelve (12) cycles of freezing and thawing (AASHTO test 103 for ledge rock procedure A). The rock shall have a minimum specific gravity of 2.50. Classification and gradation for riprap are shown below.

The riprap designation and total thickness of riprap shall be as specified on the approved plans. The maximum stone size shall not be larger than the thickness of the riprap.

### CLASSIFICATION AND GRADATION OF RIPRAP

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (Inches)	d(50) * (Inches)
Type VL	70-100	12	
	50-70	9	
	35-50	6	6**
	2-10	2	
Type L	70-100	15	
	50-70	12	
	35-50	9	9**
	2-10	3	
Type M	70-100	21	
	50-70	18	
	35-50	12	12
	2-10	4	
Type H	70-100	30	
	50-70	24	
	35-50	18	18
	2-10	6	
Type VH	70-100	42	
	50-70	33	
	35-50	24	24
	2-10	9	

\*d (50) = Mean particle size

\*\* To minimize vandalism, mix Types VL and L riprap with thirty (30) percent (by volume) topsoil and bury it with a minimum of six (6) inches of topsoil, vibration compacted and revegetated.

Filter cloth shall be manufactured especially for the stability of erosion control construction and made from polyethylene, polypropylene or polyester yarns in accordance with the following:

Filter cloth shall be manufactured especially for the stability of erosion control construction and shall meet the requirements of CDOT Class B drainage geotextile as specified in Section 712 of the CDOT *CONSTRUCTION STANDARDS & SPECIFICATIONS for Road and Bridge Construction*.

Filter material which is to be placed on top of the filter cloth (at specified thickness) prior to placement of the riprap shall meet the bedding requirements in of the UDFCD Manual (Volume 1).

When requested by the DPW Director or designee the Contractor shall furnish copies of test reports from a certified testing laboratory for the following:

- A. Gradation and soundness of riprap
- B. Gradation of filter material
- C. Strength and characteristic tests for filter cloth
- D. Compaction tests of the prepared subgrade

#### **643.00 Installation**

Refer to Section 533.01 General of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

##### 643.01 Alignment and Grade

Refer to Section 533.02 Alignment and Grade of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

##### 643.02 Protection of Existing Underground Utilities

Refer to Section 533.03 Protection of Existing Underground Utilities of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

##### 643.03 Wet Trench

Refer to Section 352.00 Trench Excavation for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

##### 643.04 (Left Blank Intentionally)

##### 643.05 Storm Sewer Pipe Installation

Refer to Section 533.04 Sewer Pipe Installation of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

##### 643.06 Connections to Existing Manholes

Refer to Section 533.06 Connections to Existing Manholes of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

##### 643.07 Construction of Manholes, Inlets and Sidewalk Chases

Manholes and inlets shall be constructed in accordance with applicable portions of Section 533.07 Construction of Manholes and Clean-outs of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

**643.08 Construction of Open Channels and Special Structures**

All work shall conform to details in the approved plans and supplemental specifications. Construction shall comply with Section 533.02 Alignment and Grade of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

When approved, sidewalk chases shall be constructed in accordance with the Detail Drawings.

**643.09 Riprap and Filter Cloth**

Excavation for riprap shall conform to Section 300.00 SOILS AND EARTHWORK of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Filter cloth shall be placed according to the manufacturer's specifications. Holes, rips or other damage to the filter cloth shall be repaired at the Contractor's expense, in accordance with the manufacturer's recommendations.

Stabilization material, as described in Section 340.01 Definitions of these CONSTRUCTION STANDARDS & SPECIFICATIONS, shall be placed on top of the filter cloth (where filter cloth is used) to the required thickness. The material shall be placed using equipment that shall not rip, tear or otherwise damage the filter cloth. Any damaged areas shall be promptly repaired at the Contractor's expense. The material shall be leveled to a finished surface that is within one (1) inch of the specified thickness.

Riprap shall be placed to conform to the details shown on the approved plans. The larger size stones shall be placed first and roughly arranged in close contact. The toe trench and foundation course shall be closed first. The spaces between the larger stones shall then be filled with smaller stone of suitable size, and placed as to leave the surface evenly stepped, conforming to the contour required. The finished surface shall be even and tight and shall not vary from the planned surface grade by more than three (3) inches per foot of depth. The material may be machine placed with sufficient handwork to conform to these CONSTRUCTION STANDARDS & SPECIFICATIONS.

All riprap shall be grouted. The stones shall be laid with care to prevent earth and sand from filling the joints. Joints shall be filled with grout and the surfaces swept with a stiff broom. The work shall be protected and kept moist during hot weather for at least three (3) days after grouting or coated with a clear membrane curing compound. Grout shall consist of one (1) part cement and three (3) parts aggregate, by volume. The Portland Cement shall be Type II and aggregate shall be two (2) parts sand and one (1) part gravel passing a three-eighths ( $\frac{3}{8}$ ) inch square mesh screen. Grout shall be mixed with enough water to permit gravity flow of grout into the interstices with limited spading and brooming. A six (6)



inch by six (6) inch concrete mow strip is required around the edges of riprap structures.

When concreting is permitted during cold weather, the temperature of the mix shall not be less than sixty (60) degrees Fahrenheit at the time of placing. Filter cloth, stabilization material, or riprap shall not be placed on frozen ground. Concrete grout shall not be placed when there is frost in the subgrade.

#### 643.10 Testing

##### 643.10.01 Pipe – Water Tightness

All pipe shall be tested for water tightness in accordance with manufacturer's requirements.

- A. Reinforced concrete pipe (RCP) shall be tested in accordance with ASTM C443.
- B. High density polyethylene pipe (HDPE) shall be tested in accordance with ASTM D3212.
- C. Polyvinyl chloride pipe (PVC) shall be tested in accordance with ASTM D3212.
- D. Spiral-ribbed aluminized steel pipe (CMP, ASP) does not require watertight joints.

##### 643.10.02 Pipe – Deflection

All flexible pipe shall be tested for deflection in accordance with Section 534.03 Deflection Testing Pipe of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

##### 643.10.03 Manholes

All manholes shall be tested in accordance with Section 534.02 Vacuum Testing Manholes of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

##### 643.10.04 Infiltration and Exfiltration

If deemed necessary by the DPW Director or designee, the storm sewer system shall be tested in accordance with Section 534.04 Infiltration and Exfiltration Testing of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

#### 644.00 Inspections

Refer to Section 154.00 Inspections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Adequate inspections assure compliance to Elbert County requirements and are the basis for Elbert County's recommendation that said improvements be accepted for maintenance and for release of performance guarantees. It is the responsibility of the Contractor to contact the DPW Director Or designee a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required inspections shall include:

- A. Stockpiled Materials – Verify that materials meet CONSTRUCTION STANDARDS & SPECIFICATIONS and approved submittals, including but not limited to: bedding material, pipe, fittings, valves, valve boxes, and fire hydrants. Verify that pipe meets roundness specifications and that bells and spigots are not cracked or chipped.
- B. Excavation – Verify proper trench depths, shoring, spoil pile location, dewatering, and location and protection of existing utilities.
- C. Installation – Verify proper bedding depth, alignment and grade, clean pipe and lubricants. Verify “slicing in” of bedding at haunches and that all lifting holes in RCP are plugged.
- D. Backfill and Compaction – Verify proper methods of backfill and compaction, depths of lifts, moisture control, backfill material free of large rock and organic or frozen material, and proper compaction effort and passing tests.
- E. Testing – Verify that testing methods comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS. Verify that Elbert County has witnesses all low-pressure air tests, joint testing, vacuum testing of manholes and any other testing requirements.
- F. Construction Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. General items include:
  - 1. All temporary structures, debris, mud and waste materials shall be removed from public property.
  - 2. All relative testing certifications and documentation shall be submitted to Elbert County, including all compaction tests. Copies of originals are acceptable.
  - 3. All storm sewer manholes and inlets are at construction grade, clean, and grouted, ladders straight, inlet protection installed, and storm sewer lines jetted. Verify that storm sewer drainage swales have erosion and sediment control measures installed in accordance with the approved plans.

Prior to requesting a Construction Acceptance inspection, the Contractor shall clean storm sewer mains and shall have the lines inspected with TV video equipment. A copy of the videotape and written report shall be submitted to Elbert County for review. Video shall also include an audio description of pipe and manhole deficiencies, and camera location during the inspection. Any sections that contain debris or obstructions shall be cleaned and re-videotaped. Video shall be continuous from manhole to manhole, and all notations shall correspond to the approved construction plans. If, after visual inspection of the storm sewer lines the DPW Director Or designee suspects that there is a problem, alignment, infiltration, exfiltration and/or deflection tests may be required at the Contractor's expense.

G. Final Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1. Verify that all temporary structures, debris, mud, and waste materials are removed from public property.
2. Verify that all storm sewer manholes and inlets are clean.

## **650.00 TRENCHING, BACKFILLING AND COMPACTING**

Refer to Section 350.00 TRENCHING BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

## **660.00 RESTORATION AND CLEANUP**

Refer to Section 370.00 RESTORATION AND CLEANUP of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

## **670.00 GRADING AND EXCAVATION**

Refer to Section 330.00 SITE PREPARATION of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

## TIME OF CONCENTRATION

SUBDIVISION: \_\_\_\_\_

CALCULATED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

SUB-BASIN DATA			INITIAL / OVERLAND TIME ( $t_i$ )			TRAVEL TIME ( $t_t$ )				$t_c$ CHECK (URBANIZED BASINS)		FINAL $t_c$	REMARKS
DESIGN (1)	$C_s$ (2)	AREA $A_c$ (3)	LENGTH Ft (4)	SLOPE % (5)	$t_i$ Min (6)	LENGTH Ft (7)	SLOPE % (8)	VEL. FPS (9)	$t_t$ Min (10)	TOTAL LENGTH Ft (11)	$t_c = (L/180) + 10$ Min (12)	Min (13)	

## STORM DRAINAGE SYSTEM DESIGN (RATIONAL METHOD PROCEDURE)

CALCULATED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

CHECKED BY: \_\_\_\_\_

JOB NO: \_\_\_\_\_

PROJECT: \_\_\_\_\_

DESIGN STORM: \_\_\_\_\_

STREET		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			AREA DESIGN	AREA (AC)	RUNOFF COEFF	C * A (AC)	t <sub>c</sub> (MIN)	I IN/HR	Q (CFS)	t <sub>c</sub> (MIN)	I (IN/HR)	Σ(C * A) (AC)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t <sub>t</sub> (MIN)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1																						
2																						
3																						
4																						
5																						
6																						
7																						

## SEQUENTIAL DETENTION CALCULATION

SUBDIVISION \_\_\_\_\_

CALCULATED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

	FACILITY NUMBER	BASIN AREA (A) Ac	$Q_i$ CFS	IMP %	K Ft	$Q_i/A$ CFS/Ac		$\Sigma Q$ CFS	Z Ac	$S_m$ Ac-Ft	$Q_m$ CFS
	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)	(10)
10 - YEAR											
100 - YEAR											

- (1) Facility Number: Designated number of the detention facility being analyzed.
- (2) Basin Area: Area of basin (sub-basin) tributary to the detention facility not including any area tributary to an upstream detention facility
- (3)  $Q_i$ : Peak inflow in cfs from the area described in Column 2
- (4) Imp %: Percent imperviousness of the area described in Column 2
- (5) K:  $K_{100} = (1.78I - 0.002I^2 - 3.56)/1000$ ;  $K_{10} = (0.95I - 1.9)/1000$
- (6)  $Q_i/A$ : Peak inflow ( $Q_i$ ) in column 3 divided by the area (A) in Column 2
- (7)  $\Sigma Q$ : Peak inflow into detention facility computed by summation of the peak inflow in Column 3 and the maximum release rate in Column 10
- (8) Z: Equivalent inflow area computed by dividing Column 7 by Column 6 ( $\Sigma Q/Q_i/A$ )
- (9) Minimum  $S_m$ : Minimum allowed storage volume for the respective detention facility  $V=KA$ , where K is from Column 5 and A = Z from Column 8
- (10) Maximum  $Q_m$ : Maximum allowed release rate for the respective detention facility  $Q_{10} = 0.24Z$ ,  $Q_{100} = 1.00Z$ , where Z is from Column 8



## COLORADO

Division of Water Resources

Department of Natural Resources

[www.water.state.co.us](http://www.water.state.co.us) P 303.866.3581

### NON-JURISDICTIONAL WATER IMPOUNDMENT STRUCTURE<sup>1</sup>

This notice is required per Section 37-87-125, C.R.S. (1998) and must be submitted to the Division Engineer's Office a minimum of 45 days prior to construction.

#### OWNER INFORMATION

Name: Jen Colorado 19, LLC Telephone/E-Mail: (720) 937-8692 / jerry@integritylandventures.com

Address: 680 5th Avenue, Fl 25 New York NY 10019  
Street / P.O. Box/ Rural Route City State Zip Code

Responsible Person: Jerry Richmond (Authorized Rep.) Telephone/E-Mail: (720) 937-8692 / jerry@integritylandventures.com

Address: 7200 S. Alton Way, Suite C400 Centennial CO 80111  
Street / P.O. Box/ Rural Route City State Zip Code

Contractor: Kurtis Williams (Engineer) Telephone/E-Mail: (303) 740-9393 / kwilliams@jrengineering.com

#### STRUCTURE INFORMATION

Name of Dam: Pond 302 Water Division: 1 Water District: 2

Location: (Provide Section, Township, Range, and GPS Point taken at crest of dam above streamline/outlet)

- Section: 34, Township: 5 South, Range: 65 West, 6th P.M.

- Northing 529500.4 meters, Easting 4380534.0 meters (Datum should be UTM, NAD 83)

#### Dam Dimensions:

- Vertical Height<sup>2</sup>: 9.35 ft., Length: 679 ft., Crest Width: 334 ft., Slopes: U/S: 4 (H:1V), D/S 4 (H:1V)

#### Reservoir:

- Surface Area<sup>1</sup>: 5.56 acres, Capacity<sup>1</sup>: 15.74 acre-feet, Drainage Area\*: 179.17 acres

\*(If drainage area is unknown leave blank and a spillway size will be assigned):

#### Emergency Spillway: (See Table 1, Spillway Sizing Guidelines)

- Bottom Width: 100 ft., Side Slopes: 10 H:1V, Freeboard<sup>3</sup>: 1.0 ft

Outlet Conduit Type: Reinforced Concrete Pipe, Size: 48 inches, Location: North side of pond.

Stream Name or Water Source<sup>4</sup>: N/A Proposed Water Use: Storm Drainage

Water Court Case or WDID : \_\_\_\_\_  
(Water District Identification Number)

Signature of Owner

Date

#### Office Use Only

#### DIVISION ENGINEER'S REQUIREMENTS:

Dam I.D. \_\_\_\_\_

Signature of Division Engineer

Date

<sup>1</sup> A "Non-Jurisdictional Structure" is a dam creating a reservoir with a capacity of 100 acre-feet or less and a surface area of 20 acres or less and a vertical height (footnote 2) of 10 feet or less. Non-jurisdictional size dams are regulated and subject to the authority of the State Engineer consistent with sections 37-87-102 and 37-87-105 C.R.S.

<sup>2</sup> "Vertical Height" is measured from the elevation of the lowest point of the natural surface of the ground or the invert of the outlet conduit (whichever is lower) where that point occurs along the longitudinal centerline of the dam up to the crest of the emergency spillway of the dam.

<sup>3</sup> "Freeboard" is the vertical distance from the bottom of spillway to the crest of the dam. Minimum Freeboard is 3 feet.

<sup>4</sup> If construction in reservoir intercepts groundwater, a well permit is required. (Well permit applications can be found at [www.water.state.co.us](http://www.water.state.co.us))









INTERSECTION OF TRICKLE CHANNEL 2 AND 3

STA: 10+00.00  
EL: 6040.32

PR. FOREBAY 03  
SEE DETAIL ON SHEET 109

100-YR WSEL: 6048.64

EURV WSEL: 6045.44

WQCV WSEL: 6043.53

0.50%

EXISTING GRADE

PROPOSED 2' TRICKLE CHANNEL  
SEE DETAIL ON SHEET 106

PR. 24" RCP STORM

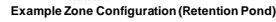
STA: 11+09.12  
INV: 6041.10

10+00 11+00 11+25

CITY OF AURORA BENCHMARK COA ID 556529SC001 BEING MONUMENTED BY A 3" BRASS CAP ON THE SELY CORNER OF A CURB OPENING INLET STRUCTURE BEING ON THE EASTERLY SIDE OF SMOKY HILL ROAD AND BEING NEARLY ON A PROJECTED LINE WITH THE SELY BOUNDARY OF SERENITY RIDGE SUBD. FILING NO. 3 & THE NWLY BDY OF SERENITY RIDGE FILING NO. 1, HAVING AN ELEVATION OF 6145.93' NAVD(88).



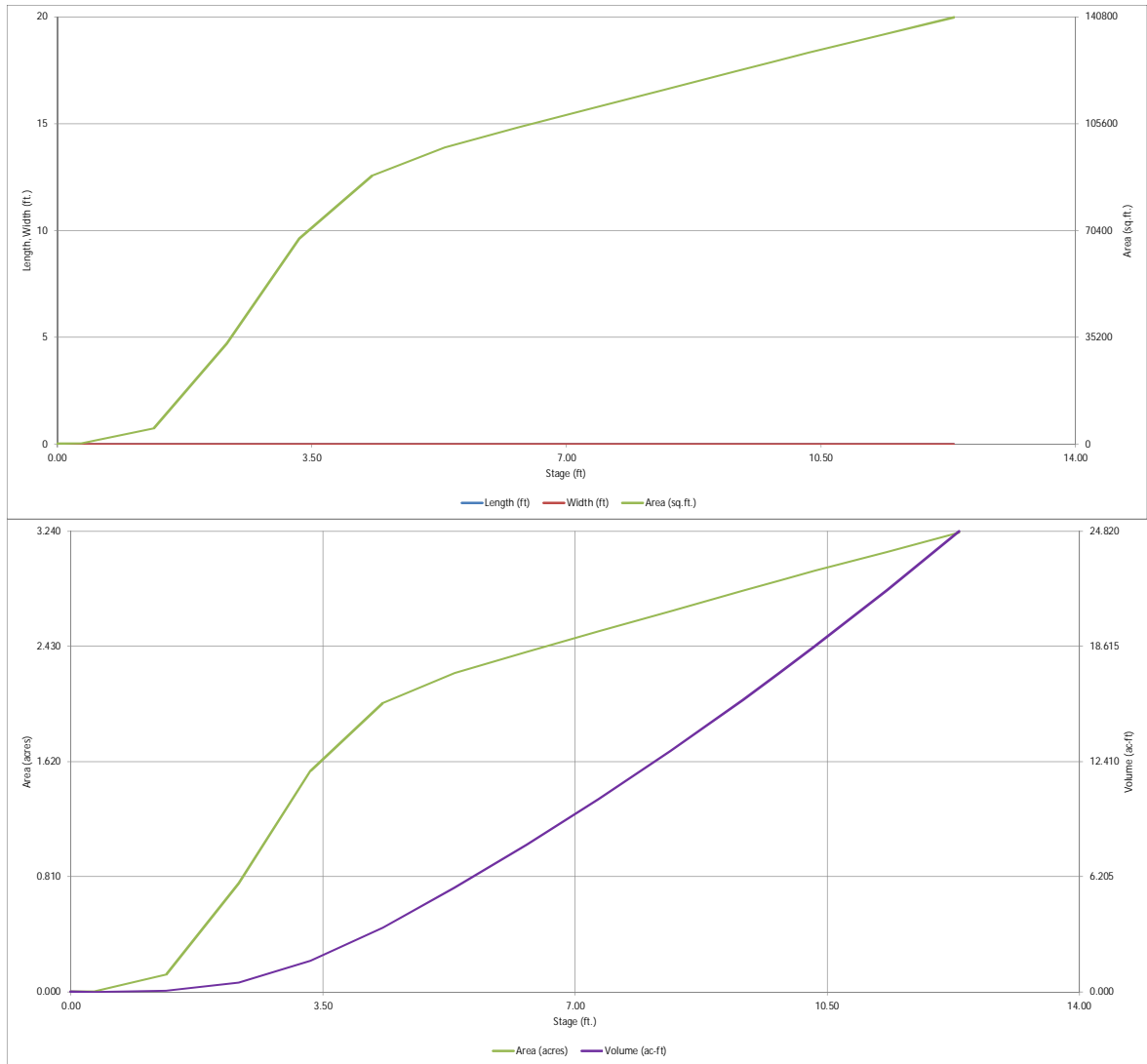
## MHFD-Detention, Version 4.05 (January 2022)

Basin ID: Pond 302

	acre-feet
	acre-feet
0.83	inches
	inches
1.37	inches
	inches
	inches
2.38	inches
	inches

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

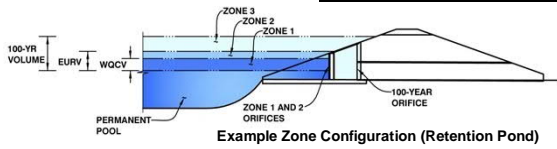
MHFD-Detention, Version 4.05 (January 2022)



# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: Trails at Overland Ranch  
Basin ID: Pond 302



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WOCV)	3.86	2.543	Orifice Plate
Zone 2 (EURV)	5.77	4.054	Rectangular Orifice
Zone 3 (100-year)	8.22	6.074	Weir&Pipe (Restrict)
Total (all zones)		12.671	

User Input: Orifice at Underdrain Outlet (typically used to drain WOCV in a Filtration BMP)

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WOCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (use rectangular openings)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.29	2.57					
Orifice Area (sq. inches)	7.08	7.08	7.08					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Height =  inches  
Vertical Orifice Width =  inches

Calculated Parameters for Vertical Orifice  
Zone 2 Rectangular:  Not Selected  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Gate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Gate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Gate Type =  inches  
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Zone 3 Weir:  Not Selected  
Height of Gate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Gate Open Area / 100-yr Orifice Area =    
Overflow Gate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Gate Open Area w/ Debris =  ft<sup>2</sup>

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Zone 3 Restrictor:  Not Selected  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

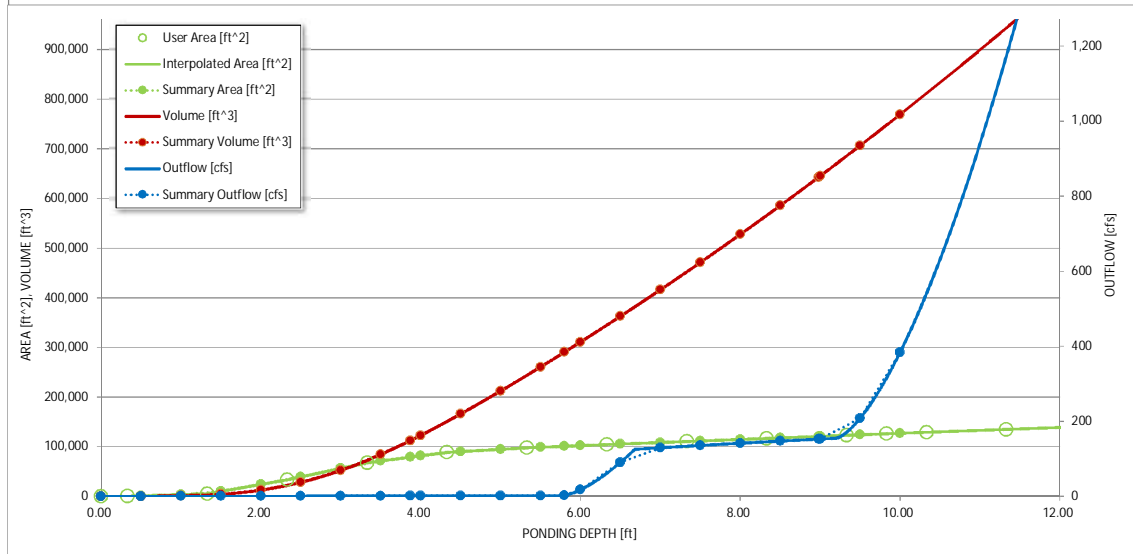
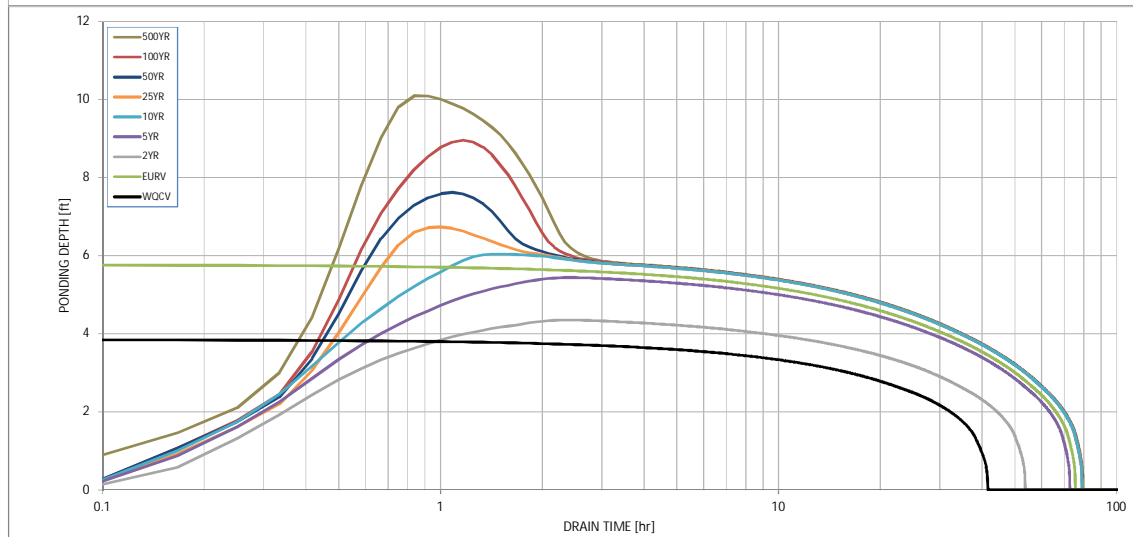
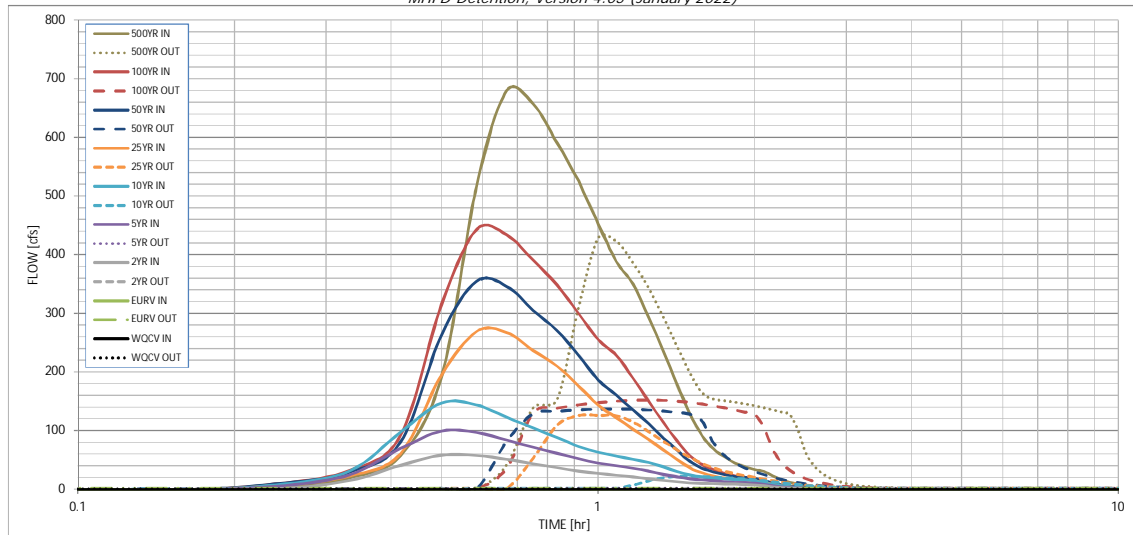
## Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.83	1.14	1.37	1.76	2.08	2.38	3.30
One-Hour Rainfall Depth (in) =	N/A	N/A	0.83	1.14	1.37	1.76	2.08	2.38	3.30
CUHP Runoff Volume (acre-ft) =	2.543	6.597	3.723	6.124	8.746	15.241	19.889	25.173	39.335
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.723	6.124	8.746	15.241	19.889	25.173	39.335
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.1	14.2	48.3	147.4	210.3	277.4	454.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.08	0.27	0.82	1.17	1.55	2.53
Peak Inflow Q (cfs) =	N/A	N/A	58.3	99.3	147.4	269.0	354.6	442.8	679.6
Peak Outflow Q (cfs) =	1.1	1.7	1.3	1.6	22.1	126.1	137.1	152.3	428.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.5	0.9	0.7	0.5	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	0.3	1.7	1.8	2.1	2.2
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	49	66	70	66	63	61	54
Time to Drain 99% of Inflow Volume (hours) =	40	72	52	69	75	73	72	71	68
Maximum Ponding Depth (ft) =	3.86	5.77	4.35	5.44	6.04	6.74	7.62	8.97	10.10
Area at Maximum Ponding Depth (acres) =	1.81	2.31	2.04	2.26	2.35	2.45	2.58	2.77	2.93
Maximum Volume Stored (acre-ft) =	2.556	6.598	3.499	5.844	7.227	8.908	11.121	14.701	17.950

# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: \_\_\_\_\_

## Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.36
	0:15:00	0.00	0.00	1.86	6.44	9.17	7.45	10.74	10.92	19.77
	0:20:00	0.00	0.00	15.09	24.93	31.41	23.00	29.51	32.31	57.13
	0:25:00	0.00	0.00	40.78	69.60	97.37	60.65	80.13	91.44	192.14
	0:30:00	0.00	0.00	58.30	99.32	147.41	195.58	263.99	315.60	515.64
	0:35:00	0.00	0.00	57.61	96.99	144.07	269.01	354.62	442.81	679.63
	0:40:00	0.00	0.00	51.21	83.81	122.90	267.55	346.32	434.09	657.28
	0:45:00	0.00	0.00	43.68	71.59	104.54	236.84	305.25	390.79	590.91
	0:50:00	0.00	0.00	36.73	61.61	88.09	210.12	271.01	348.35	525.71
	0:55:00	0.00	0.00	31.08	51.98	73.34	176.53	228.26	299.98	452.59
	1:00:00	0.00	0.00	26.97	44.83	63.31	143.54	186.53	255.24	388.90
	1:05:00	0.00	0.00	24.18	40.02	56.80	122.49	160.98	228.43	349.63
	1:10:00	0.00	0.00	21.13	36.03	51.18	102.87	135.44	189.83	293.35
	1:15:00	0.00	0.00	18.09	31.12	45.68	84.95	111.57	150.47	236.01
	1:20:00	0.00	0.00	15.31	25.70	38.60	67.35	88.07	114.67	179.79
	1:25:00	0.00	0.00	12.84	21.02	30.30	51.55	66.96	83.21	129.89
	1:30:00	0.00	0.00	11.04	17.98	24.40	36.92	47.76	57.34	91.71
	1:35:00	0.00	0.00	10.08	16.36	21.17	27.97	36.38	42.18	68.85
	1:40:00	0.00	0.00	9.65	14.64	19.10	22.65	29.48	33.32	54.88
	1:45:00	0.00	0.00	9.42	13.14	17.62	19.33	25.04	27.11	45.03
	1:50:00	0.00	0.00	9.27	12.06	16.61	17.08	22.00	22.90	38.36
	1:55:00	0.00	0.00	8.35	11.27	15.59	15.72	20.08	19.94	33.57
	2:00:00	0.00	0.00	7.33	10.42	14.12	14.76	18.74	17.90	30.24
	2:05:00	0.00	0.00	5.78	8.21	10.97	11.58	14.62	13.65	23.07
	2:10:00	0.00	0.00	4.30	5.99	7.91	8.32	10.47	9.79	16.38
	2:15:00	0.00	0.00	3.20	4.40	5.71	6.01	7.52	7.08	11.77
	2:20:00	0.00	0.00	2.35	3.21	4.14	4.36	5.45	5.20	8.62
	2:25:00	0.00	0.00	1.71	2.27	2.96	3.09	3.84	3.70	6.11
	2:30:00	0.00	0.00	1.22	1.58	2.08	2.16	2.68	2.58	4.25
	2:35:00	0.00	0.00	0.85	1.10	1.46	1.54	1.91	1.83	3.00
	2:40:00	0.00	0.00	0.56	0.74	0.97	1.03	1.27	1.21	1.97
	2:45:00	0.00	0.00	0.33	0.46	0.57	0.62	0.76	0.72	1.15
	2:50:00	0.00	0.00	0.17	0.24	0.28	0.31	0.38	0.35	0.55
	2:55:00	0.00	0.00	0.07	0.10	0.10	0.11	0.12	0.11	0.17
	3:00:00	0.00	0.00	0.02	0.02	0.01	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

### Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]



## COLORADO

Division of Water Resources

Department of Natural Resources

[www.water.state.co.us](http://www.water.state.co.us) P 303.866.3581

### NON-JURISDICTIONAL WATER IMPOUNDMENT STRUCTURE<sup>1</sup>

This notice is required per Section 37-87-125, C.R.S. (1998) and must be submitted to the Division Engineer's Office a minimum of 45 days prior to construction.

#### OWNER INFORMATION

Name: Jen Colorado 19, LLC Telephone/E-Mail: (720) 937-8692 / jerry@integritylandventures.com

Address: 680 5th Avenue, Fl 25 New York NY 10019  
Street / P.O. Box/ Rural Route City State Zip Code

Responsible Person: Jerry Richmond (Authorized Rep.) Telephone/E-Mail: (720) 937-8692 / jerry@integritylandventures.com

Address: 7200 S. Alton Way, Suite C400 Centennial CO 80111  
Street / P.O. Box/ Rural Route City State Zip Code

Contractor: Kurtis Williams (Engineer) Telephone/E-Mail: (303) 740-9393 / kwilliams@jrengineering.com

#### STRUCTURE INFORMATION

Name of Dam: Pond 306 Water Division: 1 Water District: 2

Location: (Provide Section, Township, Range, and GPS Point taken at crest of dam above streamline/outlet)

- Section: 34, Township: 5 South, Range: 65 West, 6th P.M.

- Northing 529897.7 meters, Easting 4380489.9 meters (Datum should be UTM, NAD 83)

#### Dam Dimensions:

- Vertical Height<sup>2</sup>: 9.35 ft., Length: 473 ft., Crest Width: 179 ft., Slopes: U/S: 4 (H:1V), D/S 4 (H:1V)

#### Reservoir:

- Surface Area<sup>1</sup>: 1.69 acres, Capacity<sup>1</sup>: 3.71 acre-feet, Drainage Area\*: 28.53 acres

\*(If drainage area is unknown leave blank and a spillway size will be assigned):

#### Emergency Spillway: (See Table 1, Spillway Sizing Guidelines)

- Bottom Width: 50 ft., Side Slopes: 10 H:1V, Freeboard<sup>3</sup>: 1.0 ft

Outlet Conduit Type: Reinforced Concrete Pipe, Size: 18 inches, Location: North side of pond.

Stream Name or Water Source<sup>4</sup>: N/A Proposed Water Use: Storm Drainage

Water Court Case or WDID : \_\_\_\_\_  
(Water District Identification Number)

Jerry B Richmond 12/7/23  
Signature of Owner Date

#### Office Use Only

#### DIVISION ENGINEER'S REQUIREMENTS:

Dam I.D. \_\_\_\_\_

Signature of Division Engineer \_\_\_\_\_

Date \_\_\_\_\_

<sup>1</sup> A "Non-Jurisdictional Structure" is a dam creating a reservoir with a capacity of 100 acre-feet or less and a surface area of 20 acres or less and a vertical height (footnote 2) of 10 feet or less. Non-jurisdictional size dams are regulated and subject to the authority of the State Engineer consistent with sections 37-87-102 and 37-87-105 C.R.S.

<sup>2</sup> "Vertical Height" is measured from the elevation of the lowest point of the natural surface of the ground or the invert of the outlet conduit (whichever is lower) where that point occurs along the longitudinal centerline of the dam up to the crest of the emergency spillway of the dam.

<sup>3</sup> "Freeboard" is the vertical distance from the bottom of spillway to the crest of the dam. Minimum Freeboard is 3 feet.

<sup>4</sup> If construction in reservoir intercepts groundwater, a well permit is required. (Well permit applications can be found at [www.water.state.co.us](http://www.water.state.co.us))





SCALE: 1"=700'

CURVE TABLE			
CURVE	DELTA	RADIUS	LENGTH
C11	141°31'17"	25.00'	61.75'

Stage - Storage Description	Stage [ft]	Area [ft <sup>2</sup> ]	Area [acres]	Volume [ft <sup>3</sup> ]	Volume [ac-ft]	Total Outflow [cfs]
	0.50	562	0.013	114	0.003	0.04
	1.00	1,626	0.037	661	0.015	0.05
	1.50	3,120	0.072	1,777	0.041	0.10
	2.00	5,447	0.125	3,919	0.090	0.12
	2.50	8,905	0.204	7,320	0.168	0.16
	3.00	14,558	0.334	13,186	0.303	0.21
	3.50	19,810	0.455	21,844	0.501	0.24
WQCV	3.58	20,525	0.471	23,458	0.539	0.24
	4.00	24,282	0.557	32,867	0.755	0.34
	4.50	27,954	0.642	46,058	1.057	0.41
	5.00	30,071	0.690	60,565	1.390	0.47
EURV	5.39	31,697	0.728	72,614	1.667	0.50
	5.50	32,114	0.737	76,123	1.748	0.75
	6.00	34,011	0.781	92,655	2.127	5.26
	6.50	35,905	0.824	110,134	2.528	15.22
	7.00	37,794	0.868	128,559	2.951	17.35
100-YR	7.36	39,156	0.899	142,410	3.269	17.76
	7.50	39,692	0.911	147,929	3.396	17.91
	8.00	41,608	0.955	168,254	3.863	29.09
	8.50	43,532	0.999	189,538	4.351	104.78
	8.83	44,812	1.029	204,114	4.686	178.93



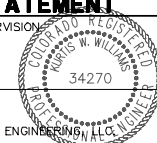
1. DETENTION POND 306 IS PRIVATE AND WILL BE OWNED AND MAINTAINED BY THE HOA.
2. FOR ALL SPOTS ELEVATION TABLES SEE SHEET 115.

CITY OF AURORA BENCHMARK COA ID 5S6529SC001 BEING MONUMENTED BY A 3" BRASS CAP ON THE SELY CORNER OF A CURB OPENING INLET STRUCTURE BEING ON THE EASTERLY SIDE OF SMOKY HILL ROAD AND BEING NEARLY ON A PROJECTED LINE WITH THE SELY BOUNDARY OF SERENITY RIDGE SUBD. FILING NO. 3 & THE NWLY BDY OF SERENITY RIDGE FILING NO. 1, HAVING AN ELEVATION OF 6145.93' NAVD(88).



Know what's **below**.  
Call before you dig.

PREPARED UNDER MY SUPERVISION



KURTIS W. WILLIAMS, P.E.  
COLORADO NO. 34270  
FOR AND ON BEHALF OF JR ENGINEERING, LLC

PREPARED FOR  
INTEGRITY LAND VENTURES  
7200 S. ALTON WAY, C400  
CENTENNIAL, CO 80112  
CONTACT: JERRY RICHMOND  
303-267-6255



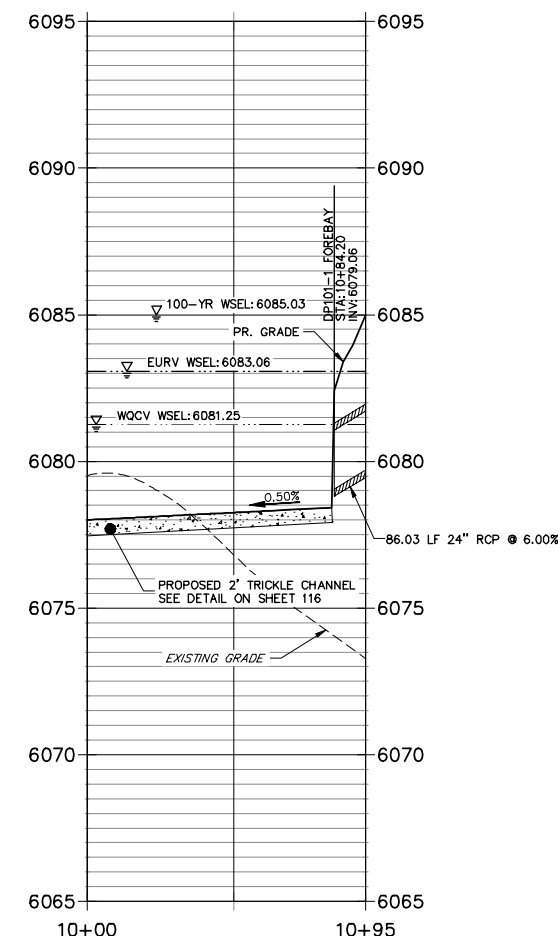
Centennial 303-740-9393 • Colorado Springs 719-593-2593  
Fort Collins 970-491-9888 • [www.jengineering.com](http://www.jengineering.com)

SHEET 112 OF 200		TRAILS AT OVERLAND RANCH			H-SCALE	1"= 30'	No.	REVISION	BY	DATE
JOB NO. 16118.00		POND PLANS	V-SCALE	N/A						
					DATE	11/15/23				
			DESIGNED BY		AAM					
			DRAWN BY		CJS					
		CHECKED BY								

**KEY MAP**

SCALE: 1"=700'

PREPARED FOR  
**INTEGRITY LAND VENTURES**  
7200 S. ALTON WAY, C400  
CENTENNIAL, CO 80112  
CONTACT: JERRY RICHMOND  
303-267-6255



	H-SCALE	I = 50	NO.	REVISION	B.T.	DATE
	V-SCALE	1"= 3'				
	DATE	11/15/23				
	DESIGNED BY	AAM				
	DRAWN BY	CJS				
	CHECKED BY					

DATE	11/15/23			
DESIGNED BY	AAM			
DRAWN BY	CJS			
CHECKED BY				

TRAILS AT OVERLAND RANCH

POND PLANS

SHEET 113 OF 200

JOB NO. 16118.00

### ENGINEER'S STATEMENT

PREPARED UNDER MY SUPERVISION

KURTIS W. WILLIAMS, P.E.  
COLORADO NO. 34270  
FOR AND ON BEHALF OF

KURTIS W. WILLIAMS, P.E.  
COLORADO NO. 34270  
FOR AND ON BEHALF OF JR ENGINEERING, LLC



Know what's **below**.  
**Call** before you dig.

### BENCHMARK:

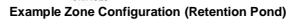
CITY OF AURORA BENCHMARK COA ID 5S6529SC001 BEING MONUMENTED BY A 3" BRASS CAP ON THE SELY CORNER OF A CURB OPENING INLET STRUCTURE BEING ON THE EASTERLY SIDE OF SMOKY HILL ROAD AND BEING NEARLY ON A PROJECTED LINE WITH THE SELY BOUNDARY OF SERENITY RIDGE SUBD. FILING NO. 3 & THE NWLY BDY OF SERENITY RIDGE FILING NO. 1, HAVING AN ELEVATION OF 6145.93' NAVD(88).

30 15 0 30 60

HORIZONTAL  
ORIGINAL SCALE: 1" = 30'

VERTICAL  
ORIGINAL SCALE: 1" = 3'

*MHFD-Detention, Version 4.05 (January 2022)*

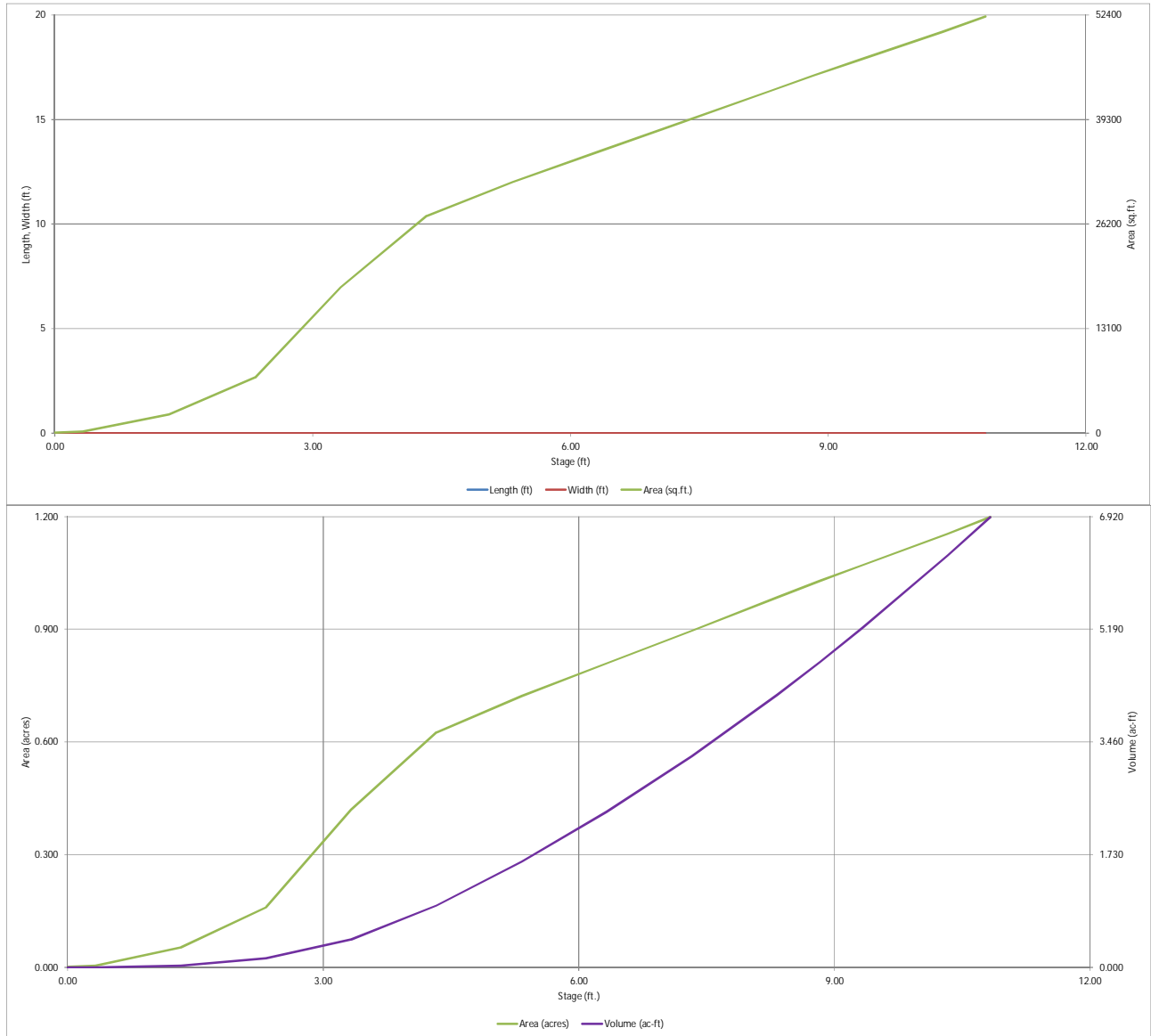
Basin ID: Pond 306

Initial Surcharge Area ( $A_{S1}$ )	=	user	ft <sup>2</sup>
Surcharge Volume Length ( $L_{S1}$ )	=	user	ft
Surcharge Volume Width ( $W_{S1}$ )	=	user	ft
Depth of Basin Floor ( $H_{B100R}$ )	=	user	ft
Length of Basin Floor ( $L_{F100R}$ )	=	user	ft
Width of Basin Floor ( $W_{F100R}$ )	=	user	ft
Area of Basin Floor ( $A_{F100R}$ )	=	user	ft <sup>2</sup>
Volume of Basin Floor ( $V_{F100R}$ )	=	user	ft <sup>3</sup>
Depth of Main Basin ( $H_{MA1N}$ )	=	user	ft
Length of Main Basin ( $L_{MA1N}$ )	=	user	ft
Width of Main Basin ( $W_{MA1N}$ )	=	user	ft
Area of Main Basin ( $A_{MA1N}$ )	=	user	ft <sup>2</sup>
Volume of Main Basin ( $V_{MA1N}$ )	=	user	ft <sup>3</sup>
Calculated Total Basin Volume ( $V_{B100}$ )	=	user	acre-feet

[illegible]

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

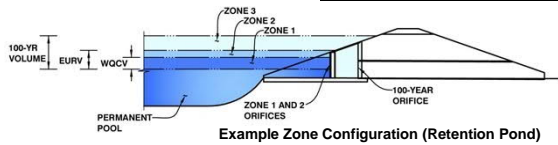


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: Trails at Overland Ranch

Basin ID: Pond 306



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WOCV)	3.58	0.536	Orifice Plate
Zone 2 (EURV)	5.39	1.128	Circular Orifice
Zone 3 (100-year)	6.74	1.059	Weir&Pipe (Restrict)
Total (all zones)		2.723	

User Input: Orifice at Underdrain Outlet (typically used to drain WOCV in a Filtration BMP)

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WOCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-7/16 inches)

Calculated Parameters for Plate  
WO Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.19	2.39					
Orifice Area (sq. inches)	1.61	1.61	1.61					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Zone 2 Circular   
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Zone 3 Weir   
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Zone 3 Restrictor   
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

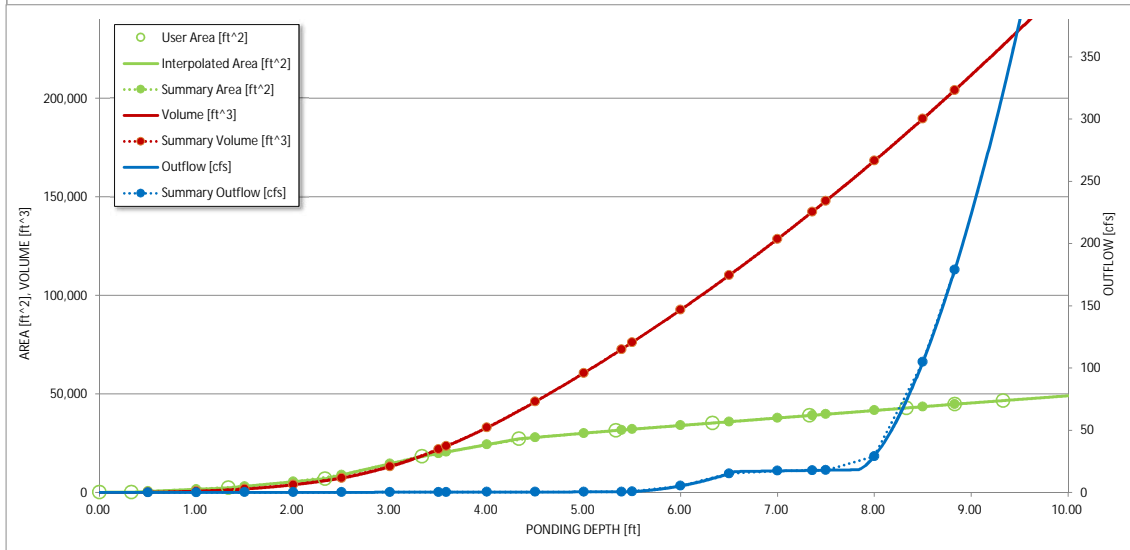
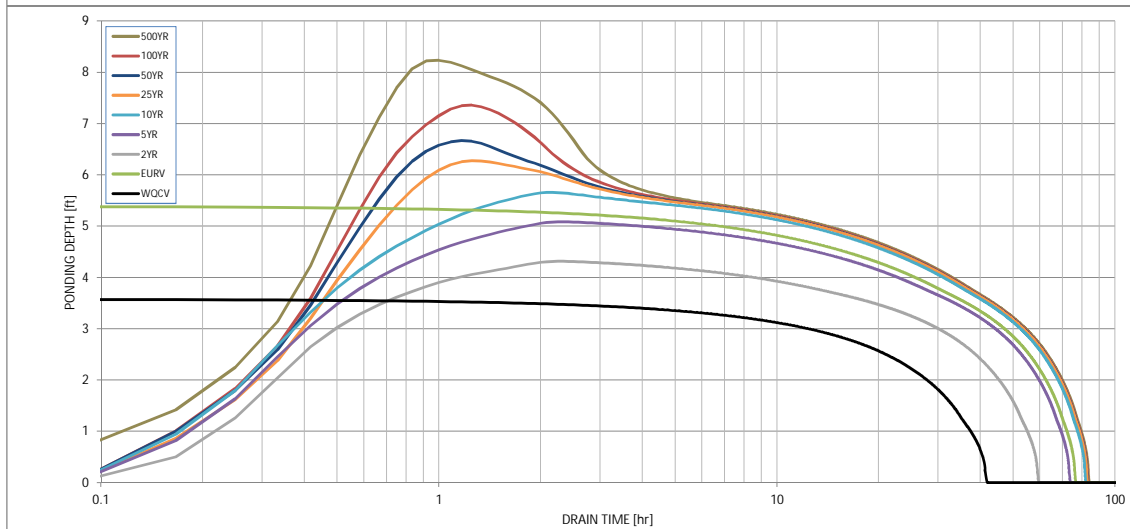
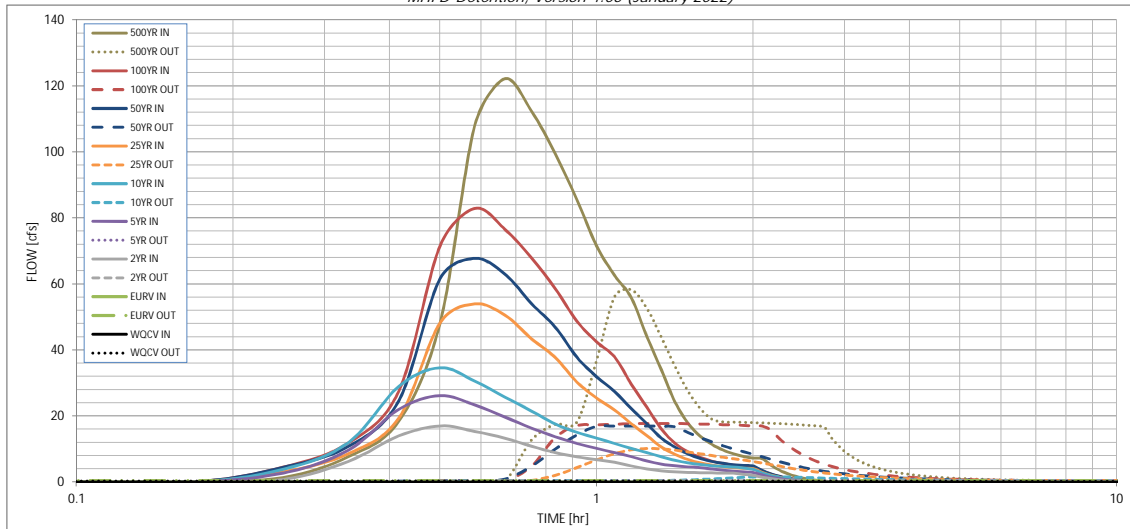
## Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WOCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period	N/A	N/A	0.83	1.14	1.37	1.76	2.08	2.38	3.30
One-Hour Rainfall Depth (in)	N/A	N/A	0.998	1.522	1.997	3.012	3.770	4.573	6.849
CUHP Runoff Volume (acre-ft)	N/A	N/A	0.998	1.522	1.997	3.012	3.770	4.573	6.849
Inflow Hydrograph Volume (acre-ft)	N/A	N/A	0.3	2.3	6.8	20.1	28.4	37.6	61.3
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	0.01	0.08	0.24	0.71	0.99	1.32	2.15
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A	17.0	26.2	34.6	54.0	67.8	82.9	122.2
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.4	0.5	1.6	10.2	17.0	17.76	58.3
Peak Inflow Q (cfs)	N/A	N/A	0.2	0.2	0.2	0.5	0.6	0.5	0.9
Peak Outflow Q (cfs)	N/A	N/A	0.2	0.2	0.2	0.5	0.6	0.5	0.9
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Structure Controlling Flow	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps)	N/A	N/A	N/A	N/A	0.1	0.8	1.4	1.5	1.6
Max Velocity through Grate 2 (fps)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours)	37	67	52	65	71	69	67	65	61
Time to Drain 99% of Inflow Volume (hours)	40	72	56	69	77	76	75	74	72
Maximum Ponding Depth (ft)	3.58	5.39	4.31	5.08	5.66	6.28	6.67	7.36	8.23
Area at Maximum Ponding Depth (acres)	0.47	0.73	0.62	0.70	0.75	0.80	0.84	0.90	0.98
Maximum Volume Stored (acre-ft)	0.539	1.667	0.937	1.446	1.859	2.341	2.670	3.269	4.085

# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			



# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: \_\_\_\_\_

## Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39
	0:15:00	0.00	0.00	0.81	2.74	3.88	3.12	4.48	4.52	7.69
	0:20:00	0.00	0.00	6.26	9.67	11.95	8.58	10.79	11.87	18.42
	0:25:00	0.00	0.00	13.98	22.01	28.98	19.34	24.61	27.53	48.06
	0:30:00	0.00	0.00	17.00	26.18	34.61	48.18	61.54	71.46	108.00
	0:35:00	0.00	0.00	15.34	23.35	30.59	53.98	67.76	82.91	122.21
	0:40:00	0.00	0.00	13.30	19.68	25.72	50.56	62.98	76.60	112.39
	0:45:00	0.00	0.00	10.84	16.34	21.51	43.41	54.06	67.91	99.43
	0:50:00	0.00	0.00	8.92	13.73	17.58	37.71	46.90	58.60	85.60
	0:55:00	0.00	0.00	7.66	11.69	15.07	30.32	37.82	48.76	71.62
	1:00:00	0.00	0.00	6.78	10.22	13.32	25.46	31.92	42.52	62.61
	1:05:00	0.00	0.00	5.99	8.90	11.69	21.82	27.44	37.91	55.86
	1:10:00	0.00	0.00	4.89	7.69	10.18	17.68	22.24	29.68	44.07
	1:15:00	0.00	0.00	3.97	6.37	8.92	14.06	17.67	22.65	33.98
	1:20:00	0.00	0.00	3.38	5.42	7.67	10.59	13.27	16.02	24.16
	1:25:00	0.00	0.00	3.07	4.90	6.56	8.41	10.56	11.72	17.81
	1:30:00	0.00	0.00	2.91	4.60	5.81	6.80	8.47	9.09	13.87
	1:35:00	0.00	0.00	2.83	4.40	5.30	5.79	7.15	7.48	11.42
	1:40:00	0.00	0.00	2.77	3.93	4.94	5.11	6.24	6.36	9.70
	1:45:00	0.00	0.00	2.72	3.57	4.70	4.69	5.67	5.62	8.56
	1:50:00	0.00	0.00	2.69	3.31	4.52	4.39	5.27	5.09	7.75
	1:55:00	0.00	0.00	2.32	3.12	4.27	4.20	5.01	4.77	7.25
	2:00:00	0.00	0.00	2.03	2.89	3.84	4.09	4.85	4.65	7.05
	2:05:00	0.00	0.00	1.48	2.10	2.75	2.96	3.50	3.37	5.09
	2:10:00	0.00	0.00	1.04	1.47	1.92	2.07	2.44	2.37	3.57
	2:15:00	0.00	0.00	0.72	1.02	1.34	1.44	1.70	1.66	2.51
	2:20:00	0.00	0.00	0.50	0.68	0.92	0.99	1.16	1.14	1.71
	2:25:00	0.00	0.00	0.33	0.45	0.61	0.66	0.77	0.75	1.13
	2:30:00	0.00	0.00	0.21	0.30	0.40	0.45	0.52	0.51	0.76
	2:35:00	0.00	0.00	0.12	0.19	0.24	0.27	0.32	0.31	0.47
	2:40:00	0.00	0.00	0.06	0.10	0.12	0.15	0.17	0.16	0.24
	2:45:00	0.00	0.00	0.02	0.04	0.04	0.06	0.06	0.06	0.09
	2:50:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

### Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all

[illegible]



Austin McMullan

---

From: McCormick - DNR, Brian <brian.c.mccormick@state.co.us>  
Sent: Monday, December 11, 2023 3:51 PM  
To: Austin McMullan  
Cc: Jeremy Franz - DNR; Kurtis Williams; Daniel Clark  
Subject: Fwd: Trails at Overland Ranch Dam Jurisdiction Clarification  
Attachments: Pond 302 NOI Application.pdf; Pond 306 NOI Application.pdf

Austin,

Thanks for reaching out to Colorado Dam Safety with this question. I am the regional engineer for this area in Aurora. I have reviewed the NOIs and concur that the two proposed structures are non-jurisdictional size as designed. Non-jurisdictional size dams are still subject to state regulation - regulation and oversight are streamlined however compared to jurisdictional size dams.

Are you ready for these NOIs to be processed? If so, please let me know and I'll work with our PA in Division 1 to get DAMIDs assigned.

Thanks and don't hesitate to reach out with any dam safety questions in the future.

Brian McCormick, PE  
Dam Safety Engineer



719.248.3876  
4255 Sinton Road, Colorado Springs, CO 80907  
[brian.c.mccormick@state.co.us](mailto:brian.c.mccormick@state.co.us)  
<https://dwr.colorado.gov/services/dam-safety>

----- Forwarded message -----

From: **Jeremy Franz** <[jeremy.franz@state.co.us](mailto:jeremy.franz@state.co.us)>  
Date: Mon, Dec 11, 2023 at 10:27 AM  
Subject: Fwd: Trails at Overland Ranch Dam Jurisdiction Clarification  
To: Brian McCormick - DNR <[brian.c.mccormick@state.co.us](mailto:brian.c.mccormick@state.co.us)>

Hi Brian,

A couple of NJ storm detention ponds for you...

Let me know if you need any assistance.

Jeremy

----- Forwarded message -----

From: **Austin McMullan** <[amcmullan@jrengineering.com](mailto:amcmullan@jrengineering.com)>

Date: Fri, Dec 8, 2023 at 2:27 PM

Subject: Trails at Overland Ranch Dam Jurisdiction Clarification

To: [Jeremy.Franz@state.co.us](mailto:Jeremy.Franz@state.co.us) <[Jeremy.Franz@state.co.us](mailto:Jeremy.Franz@state.co.us)>

Cc: Daniel Clark <[dclark@jrengineering.com](mailto:dclark@jrengineering.com)>, Kurtis Williams <[kwilliams@jrengineering.com](mailto:kwilliams@jrengineering.com)>

Hello Jeremy,

I am currently working on a project in Aurora that contains two ponds that have depths just over 9 feet, and was informed that you have helped clarify Colorado's DWR Dam Jurisdiction criteria in the past. We believe we are meeting the criteria for a Non-Jurisdictional Dam, but the Drainage Supervisor with the City of Aurora wanted a determination obtained from the SEO prior to approving our Preliminary Drainage Report. If you could please help us verify our exemption from being classified as a jurisdictional dam, I would greatly appreciate it. I have attached the applications and exhibits for both ponds in question. Please let me know if you need anything else for this.

Thank you,

Austin McMullan | Project Lead | JR Engineering, LLC  
7200 S. Alton Way, Suite C400 | Centennial, CO 80112  
Office: (303) 740-9393 | Direct: (303) 267-6174 | Fax: (303) 721-9019  
[amcmullan@jrengineering.com](mailto:amcmullan@jrengineering.com)

--

**Jeremy J. Franz, P.E.**

Design Review Engineer

Dam Safety Branch



**COLORADO**  
**Division of Water Resources**  
Department of Natural Resources

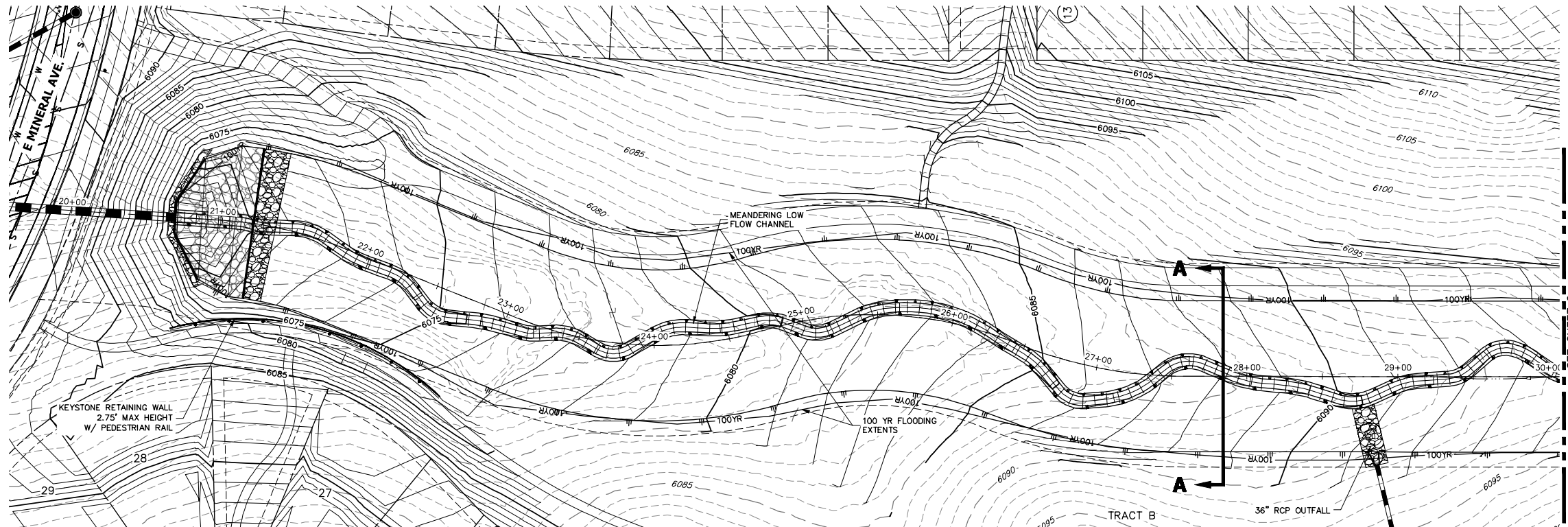
P 970.231.6990

PO Box 1201, Berthoud, CO 80513

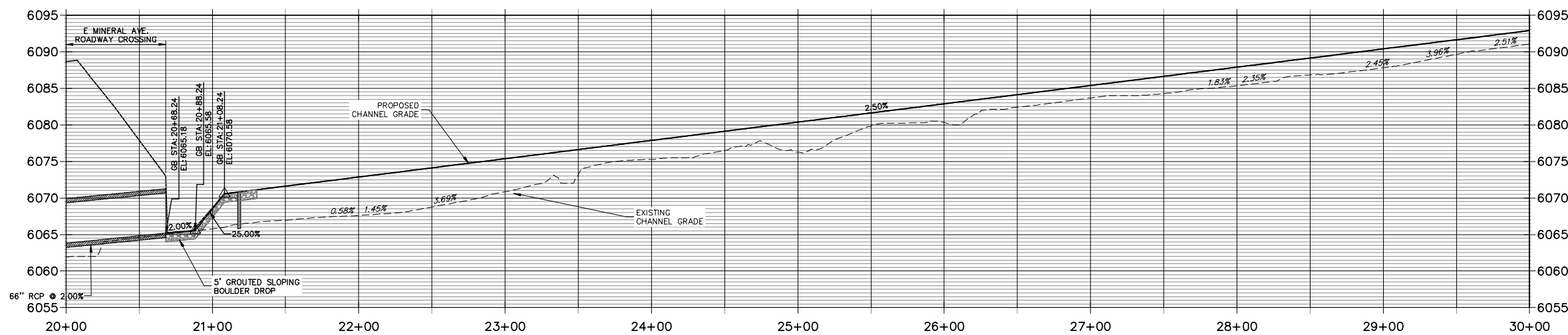
[jeremy.franz@state.co.us](mailto:jeremy.franz@state.co.us) / <https://dwr.colorado.gov/services/dam-safety>



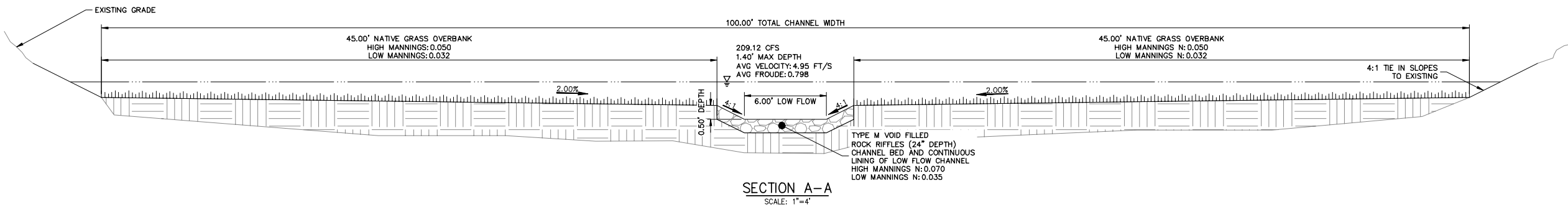
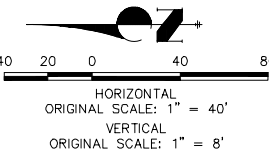
TRAILS AT OVERLAND RANCH  
CHANNEL PLAN & PROFILE



DP20 PROFILE (1)  
STA 20+00.00 TO 30+00.00

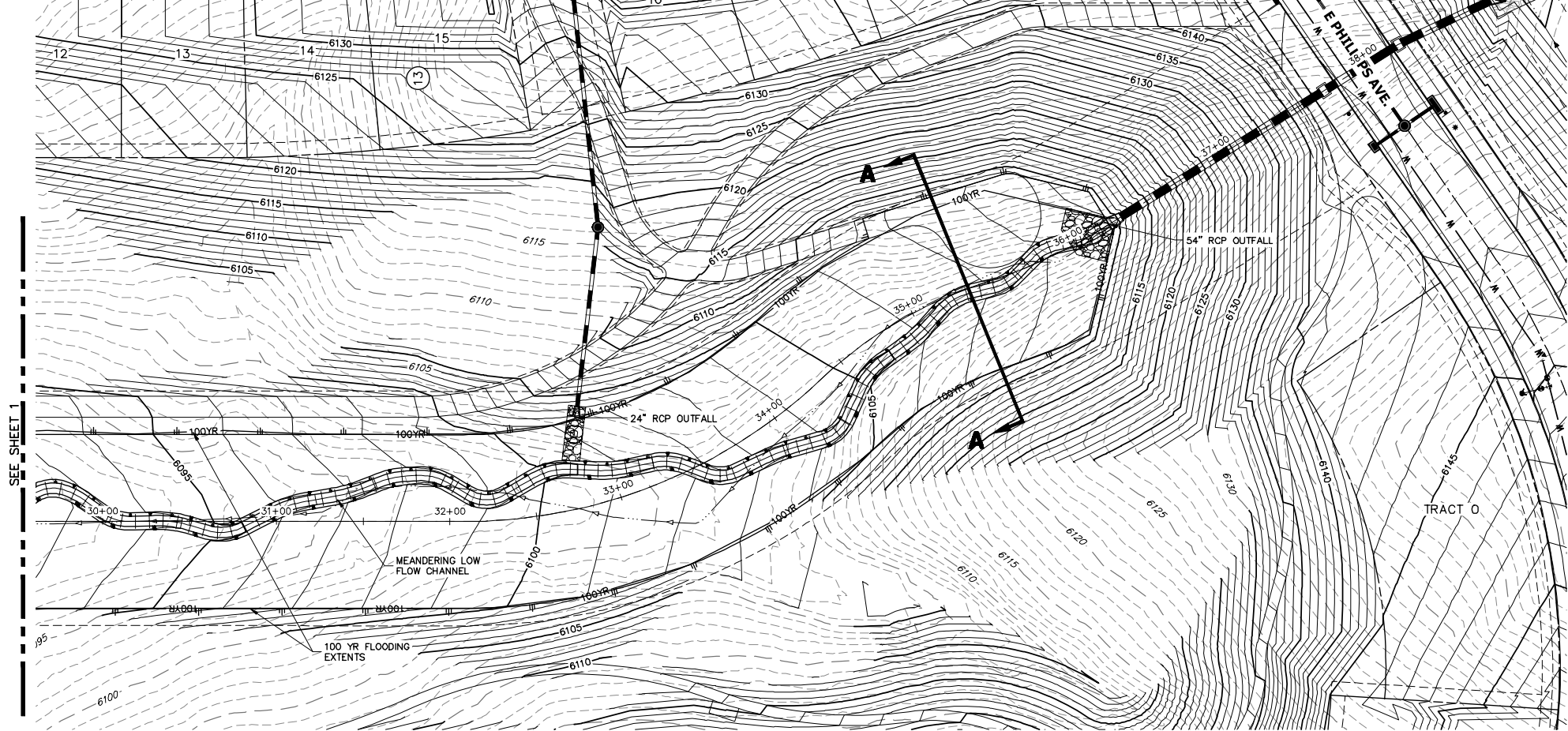


- NOTES**
1. DETAILS OF RIPRAP SIZING AND OTHER ELEMENTS OF EROSION PROTECTION INCLUDING THE SOIL RIPRAP AND REVEGETATION WHERE APPROPRIATE WILL BE EVALUATED WITH THE CD'S/FDR.
  2. LOCALIZED EROSION PROTECTION FOR ERODED CHANNEL BANKS OUTSIDE OF THE MAIN CHANNEL WILL BE EVALUATED AND PROVIDED WITH CD'S/FDR.
  3. STORM SEWER DROPS AND SLOPES WILL BE DESIGNED AND EVALUATED WITH CD'S/FDR.
  4. ENERGY DISSIPATER WILL BE DESIGNED AS WARRANTED AT TIME OF CIVIL CONSTRUCTION DRAWINGS.
  5. HEADWALLS, WINGWALLS, SAFETY GRATE, EROSION PROTECTION AND ENERGY DISSIPATION TO BE EVALUATED WITH THE CD'S/FDR.
  6. DROP MANHOLES WITH GREATER THAN A 30" DROP REQUIRE A VARIANCE AND DESIGN MEASURE TO ADDRESS STRUCTURAL STABILITY, POTENTIAL FOR INCREASED EROSION AND POSSIBLE PROVISION OF AIR VENTS. THIS SHALL BE EVALUATED AT TIME OF CIVIL PLANS ALONG WITH ALTERNATIVE APPROACHES.

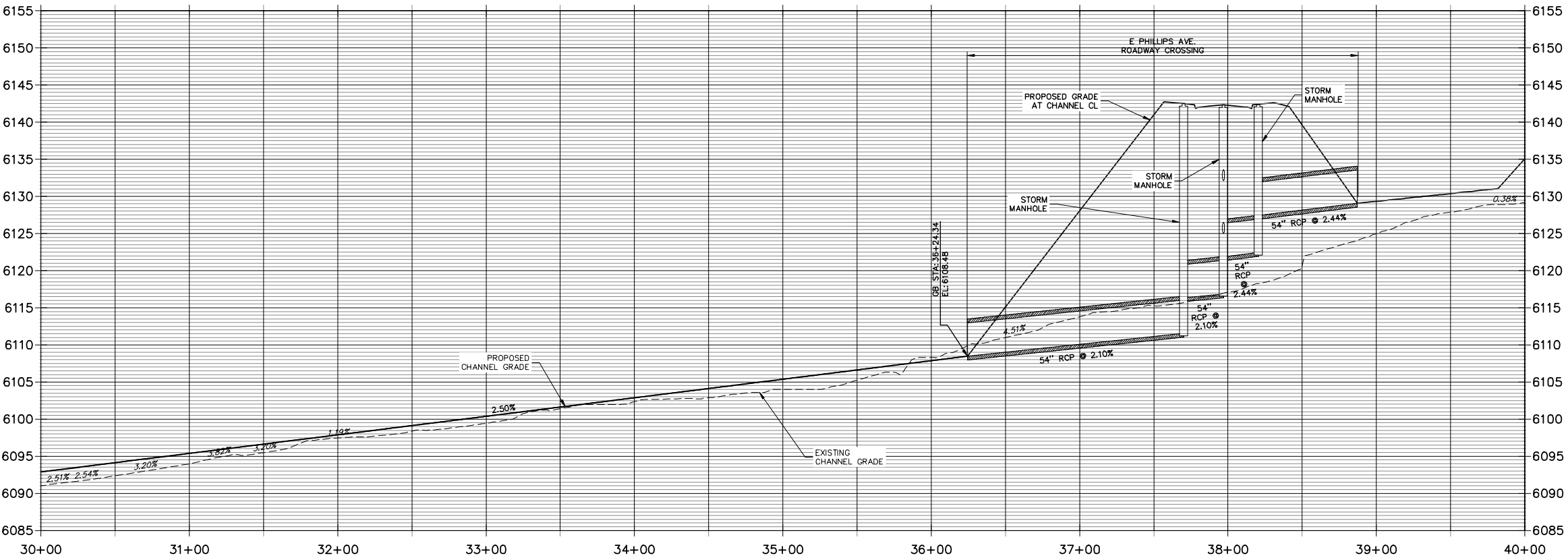


CHANNEL PLAN & PROFILE  
TRAILS AT OVERLAND RANCH  
JOB NO. 16118.10  
02/02/24  
SHEET 1 OF 2

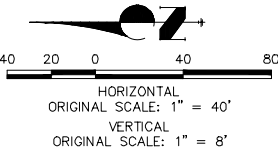
TRAILS AT OVERLAND RANCH  
CHANNEL PLAN & PROFILE



DP20 PROFILE  
STA 30+00.00 TO 40+00.00



- NOTES**
1. DETAILS OF RIPRAP SIZING AND OTHER ELEMENTS OF EROSION PROTECTION INCLUDING THE SOIL RIPRAP AND REVEGETATION WHERE APPROPRIATE WILL BE EVALUATED WITH THE CD'S/FDR.
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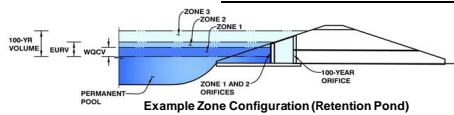
CHANNEL PLAN & PROFILE  
TRAILS AT OVERLAND RANCH  
JOB NO. 16118.10  
02/02/24  
SHEET 2 OF 2



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Fort Collins 970-491-9888 • www.jrengineering.com

*MHFD-Detention, Version 4.06 (July 2022)*

Basin ID: Pond A



### Example Zone Configuration (Retention Pond)

Selected BMP Type	=	EDB	
Watershed Area	=	31.68	acres
Watershed Length	=	1.676	ft
Watershed Length to Centroid	=	480	ft
Watershed Slope	=	0.005	ft/ft
Watershed Imperviousness	=	41.00%	percent
Percentage Hydrologic Soil Group A	=	0.0%	percent
Percentage Hydrologic Soil Group B	=	66.3%	percent
Percentage Hydrologic Soil Groups C/D	=	33.7%	percent
Target WQSW Drain Time	=	40.0	hours
Location for 1-hr Rainfall Depths	=	User Input	

### Optional User Overrides

Water Quality Capture Volume (WQC) =	0.482	acre-feet
Excess Urban Runoff Volume (EUCV) =	1.314	acre-feet
2-yr Runoff Volume ( $P1 = 1 \text{ in.}$ ) =	0.996	acre-feet
5-yr Runoff Volume ( $P1 = 1.42 \text{ in.}$ ) =	1.864	acre-feet
10-yr Runoff Volume ( $P1 = 1.68 \text{ in.}$ ) =	2.488	acre-feet
25-yr Runoff Volume ( $P1 = 1.69 \text{ in.}$ ) =	2.687	acre-feet
50-yr Runoff Volume ( $P1 = 2.35 \text{ in.}$ ) =	4.407	acre-feet
100-yr Runoff Volume ( $P1 = 2.71 \text{ in.}$ ) =	5.500	acre-feet
500-yr Runoff Volume ( $P1 = 3.14 \text{ in.}$ ) =	6.686	acre-feet
Approximate 2-yr Detention Volume =	0.862	acre-feet
Approximate 5-yr Detention Volume =	1.407	acre-feet
Approximate 10-yr Detention Volume =	1.835	acre-feet
Approximate 25-yr Detention Volume =	1.791	acre-feet
Approximate 50-yr Detention Volume =	2.316	acre-feet
Approximate 100-yr Detention Volume =	2.747	acre-feet

	acre-feet
	acre-feet
1.00	inches
1.42	inches
1.68	inches
	inches
2.35	inches
2.71	inches
	inches

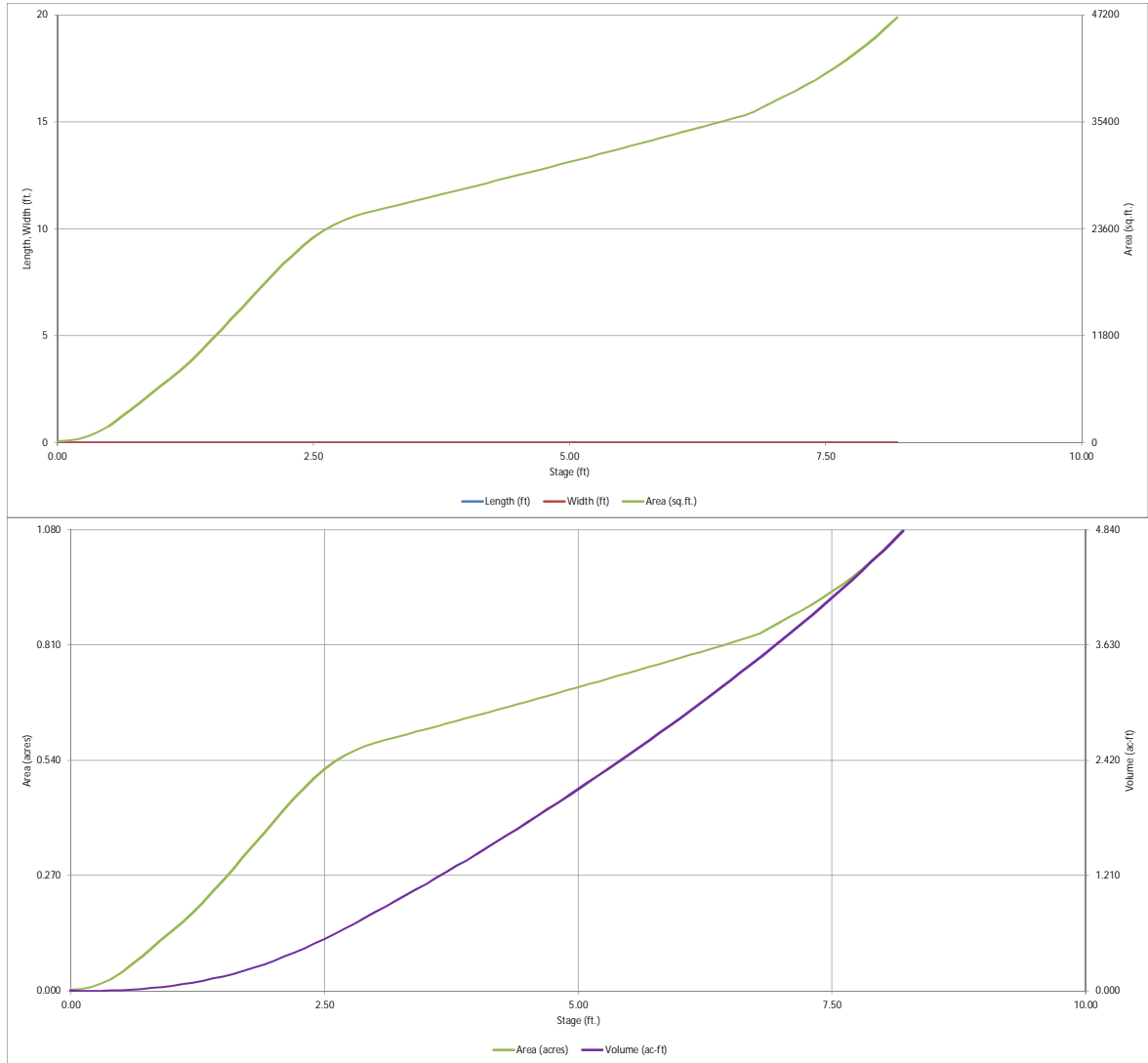
Zone 1 Volume (WOCV) =	0.482	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.832	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.434	acre-feet
Total Detention Basin Volume =	2.747	acre-feet
Initial Surcharge Volume (ISV) =	user	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth ( $H_{\text{total}}$ ) =	user	ft
Depth of Trickle Channel ( $H_{TC}$ ) =	user	ft
Slope of Trickle Channel ( $S_{TC}$ ) =	user	ft/ft
Slopes of Main Basin Sides ( $S_{\text{main}}$ ) =	user	H:V
Basin Length-to-Width Ratio ( $R_{L/W}$ ) =	user	

Initial Surcharge Area ( $A_{S1}$ )	=	user	ft <sup>2</sup>
Surcharge Volume Length ( $L_{S1}$ )	=	user	ft
Surcharge Volume Width ( $W_{S1}$ )	=	user	ft
Depth of Basin Floor ( $H_{1(LC0R)}$ )	=	user	ft
Length of Basin Floor ( $L_{1(LC0R)}$ )	=	user	ft
Width of Basin Floor ( $W_{1(LC0R)}$ )	=	user	ft
Area of Basin Floor ( $A_{1(LC0R)}$ )	=	user	ft <sup>2</sup>
Volume of Basin Floor ( $V_{1(LC0R)}$ )	=	user	ft <sup>3</sup>
Depth of Main Basin ( $H_{4(MAN)}$ )	=	user	ft
Length of Main Basin ( $L_{4(MAN)}$ )	=	user	ft
Width of Main Basin ( $W_{4(MAN)}$ )	=	user	ft
Area of Main Basin ( $A_{4(MAN)}$ )	=	user	ft <sup>2</sup>
Volume of Main Basin ( $V_{4(MAN)}$ )	=	user	ft <sup>3</sup>
Calculated Total Basin Volume ( $V_{4(TOT)}$ )	=	user	acre-feet

Depth Increment =	0.10	ft										
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)			
Top of Micropool	--	0.00	--	--	--	99	0.002					
6,144.70	--	0.10	--	--	--	198	0.005	15	0.000			
6,144.80	--	0.20	--	--	--	395	0.009	44	0.001			
6,144.90	--	0.30	--	--	--	742	0.017	101	0.002			
6,145.00	--	0.40	--	--	--	1,223	0.028	200	0.005			
6,145.10	--	0.50	--	--	--	1,844	0.042	353	0.008			
6,145.20	--	0.60	--	--	--	2,637	0.061	577	0.013			
6,145.30	--	0.70	--	--	--	3,501	0.080	884	0.020			
6,145.40	--	0.80	--	--	--	4,379	0.101	1,278	0.029			
6,145.50	--	0.90	--	--	--	5,258	0.121	1,760	0.040			
6,145.60	--	1.00	--	--	--	6,139	0.141	2,330	0.053			
6,145.70	--	1.10	--	--	--	7,031	0.161	2,988	0.069			
6,145.80	--	1.20	--	--	--	7,975	0.183	3,738	0.086			
6,145.90	--	1.30	--	--	--	8,995	0.207	4,587	0.105			
6,146.00	--	1.40	--	--	--	10,097	0.232	5,541	0.127			
6,146.10	--	1.50	--	--	--	11,262	0.259	6,609	0.152			
6,146.20	--	1.60	--	--	--	12,434	0.285	7,794	0.179			
6,146.30	--	1.70	--	--	--	13,682	0.314	9,100	0.209			
6,146.40	--	1.80	--	--	--	14,871	0.341	10,528	0.242			
6,146.50	--	1.90	--	--	--	16,068	0.369	12,074	0.277			
6,146.60	--	2.00	--	--	--	17,290	0.397	13,742	0.315			
6,146.70	--	2.10	--	--	--	18,500	0.425	15,532	0.357			
6,146.80	--	2.20	--	--	--	19,648	0.451	17,439	0.400			
6,146.90	--	2.30	--	--	--	20,712	0.475	19,457	0.447			
6,147.00	--	2.40	--	--	--	21,722	0.499	21,579	0.495			
6,147.10	--	2.50	--	--	--	22,619	0.519	23,796	0.546			
6,147.20	--	2.60	--	--	--	23,395	0.537	26,097	0.599			
6,147.30	--	2.70	--	--	--	24,040	0.552	28,469	0.654			
6,147.40	--	2.80	--	--	--	24,560	0.564	30,899	0.709			
6,147.50	--	2.90	--	--	--	24,965	0.573	33,375	0.766			
6,147.60	--	3.00	--	--	--	25,296	0.581	35,888	0.824			
6,147.70	--	3.10	--	--	--	25,593	0.588	38,432	0.882			
6,147.80	--	3.20	--	--	--	25,868	0.594	41,005	0.941			
6,147.90	--	3.30	--	--	--	26,144	0.600	43,606	1.001			
6,148.00	--	3.40	--	--	--	26,421	0.607	46,234	1.061			
6,148.10	--	3.50	--	--	--	26,699	0.613	48,890	1.122			
6,148.20	--	3.60	--	--	--	26,977	0.619	51,574	1.184			
6,148.30	--	3.70	--	--	--	27,257	0.626	54,286	1.246			
6,148.40	--	3.80	--	--	--	27,538	0.632	57,025	1.309			
6,148.50	--	3.90	--	--	--	27,819	0.639	59,793	1.373			
6,148.60	--	4.00	--	--	--	28,102	0.645	62,589	1.437			
6,148.70	--	4.10	--	--	--	28,385	0.652	65,414	1.502			
6,148.80	--	4.20	--	--	--	28,669	0.658	68,266	1.567			
6,148.90	--	4.30	--	--	--	28,955	0.665	71,148	1.633			
6,149.00	--	4.40	--	--	--	29,241	0.671	74,057	1.700			
6,149.10	--	4.50	--	--	--	29,528	0.678	76,996	1.768			
6,149.20	--	4.60	--	--	--	29,816	0.684	79,963	1.836			
6,149.30	--	4.70	--	--	--	30,106	0.691	82,959	1.904			
6,149.40	--	4.80	--	--	--	30,396	0.698	85,984	1.974			
6,149.50	--	4.90	--	--	--	30,687	0.704	89,038	2.044			
6,149.60	--	5.00	--	--	--	30,979	0.711	92,122	2.115			
6,149.70	--	5.10	--	--	--	31,273	0.718	95,234	2.186			
6,149.80	--	5.20	--	--	--	31,567	0.725	98,376	2.258			
6,149.90	--	5.30	--	--	--	31,862	0.731	101,548	2.331			
6,150.00	--	5.40	--	--	--	32,158	0.738	104,749	2.405			
6,150.10	--	5.50	--	--	--	32,456	0.745	107,979	2.479			
6,150.20	--	5.60	--	--	--	32,754	0.752	111,240	2.554			
6,150.30	--	5.70	--	--	--	33,054	0.759	114,530	2.629			
6,150.40	--	5.80	--	--	--	33,354	0.766	117,851	2.705			
6,150.50	--	5.90	--	--	--	33,656	0.773	121,201	2.782			
6,150.60	--	6.00	--	--	--	33,959	0.780	124,582	2.860			
6,150.70	--	6.10	--	--	--	34,262	0.787	127,993	2.938			
6,150.80	--	6.20	--	--	--	34,567	0.794	131,434	3.017			
6,150.90	--	6.30	--	--	--	34,873	0.801	134,906	3.097			
6,151.00	--	6.40	--	--	--	35,180	0.808	138,409	3.177			
6,151.10	--	6.50	--	--	--	35,489	0.815	141,943	3.259			
6,151.20	--	6.60	--	--	--	35,798	0.822	145,507	3.340			
6,151.30	--	6.70	--	--	--	36,109	0.829	149,102	3.423			
6,151.40	--	6.80	--	--	--	36,535	0.839	152,734	3.506			
6,151.50	--	6.90	--	--	--	37,109	0.852	156,417	3.591			
6,151.60	--	7.00	--	--	--	37,673	0.865	160,156	3.677			
6,151.70	--	7.10	--	--	--	38,232	0.878	163,951	3.764			
6,151.80	--	7.20	--	--	--	38,807	0.891	167,803	3.852			
6,151.90	--	7.30	--	--	--	39,397	0.904	171,713	3.942			
6,152.00	--	7.40	--	--	--	40,025	0.919	175,684	4.033			
6,152.10	--	7.50	--	--	--	40,701	0.924	179,720	4.126			
6,152.20	--	7.60	--	--	--	41,428	0.951	183,827	4.220			
6,152.30	--	7.70	--	--	--	42,206	0.969	188,009	4.316			
6,152.40	--	7.80	--	--	--	43,037	0.988	192,271	4.414			
6,152.50	--	7.90	--	--	--	43,924	1.008	196,619	4.514			
6,152.60	--	8.00	--	--	--	44,868	1.030	201,058	4.616			
6,152.70	--	8.10	--	--	--	45,874	1.053	205,595	4.720			
6,152.80	--	8.20	--	--	--	46,943	1.078	210,236	4.826			
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# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Defention, Version 4.06 (July 2022)



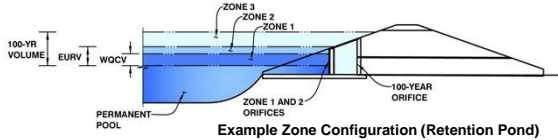


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Elora Filing No. 1

Basin ID: Pond A



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WOCV)	2.38	0.482	Orifice Plate
Zone 2 (EURV)	3.81	0.832	Orifice Plate
Zone 3 (100-year)	5.86	1.434	Weir&Pipe (Restrict)
Total (all zones)		2.747	

User Input: Orifice at Underdrain Outlet (typically used to drain WOCV in a Filtration BMP)

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WOCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-13/16 inches)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.15	1.27	2.54					
Orifice Area (sq. inches)	2.57	2.57	2.57					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice =   ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =   ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =   inches

Calculated Parameters for Vertical Orifice  
Vertical Orifice Area =   ft<sup>2</sup>  
Vertical Orifice Centroid =   feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Overflow Weir Front Edge Height, H<sub>o</sub> =   ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =   feet  
Overflow Weir Grate Slope =   H:V  
Horiz. Length of Weir Sides =   feet  
Overflow Grate Type =    
Debris Clogging % =   %

Calculated Parameters for Overflow Weir  
Height of Grate Upper Edge, H<sub>u</sub> =   feet  
Overflow Weir Slope Length =   feet  
Grate Open Area / 100-yr Orifice Area =    
Overflow Grate Open Area w/o Debris =   ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =   ft<sup>2</sup>

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Depth to Invert of Outlet Pipe =   ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =   inches  
Restrictor Plate Height Above Pipe Invert =   inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Outlet Orifice Area =   ft<sup>2</sup>  
Outlet Orifice Centroid =   feet  
Half-Central Angle of Restrictor Plate on Pipe =   radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

## Routed Hydrograph Results

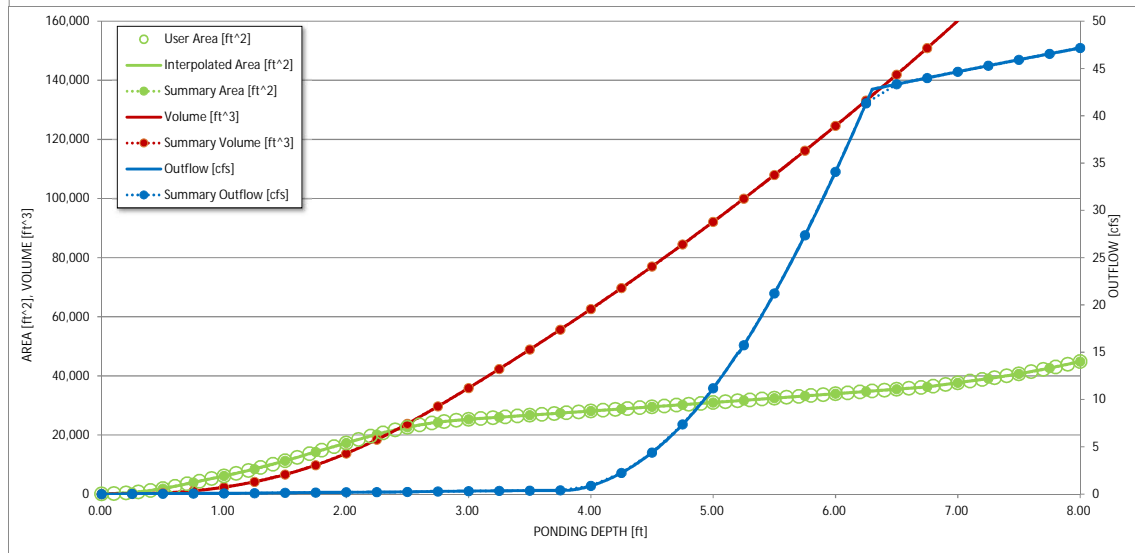
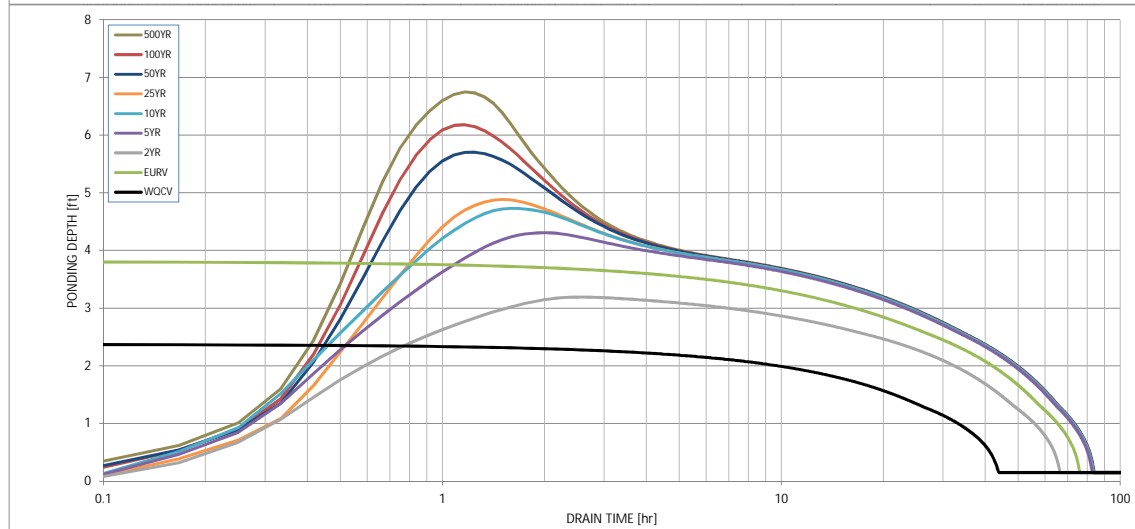
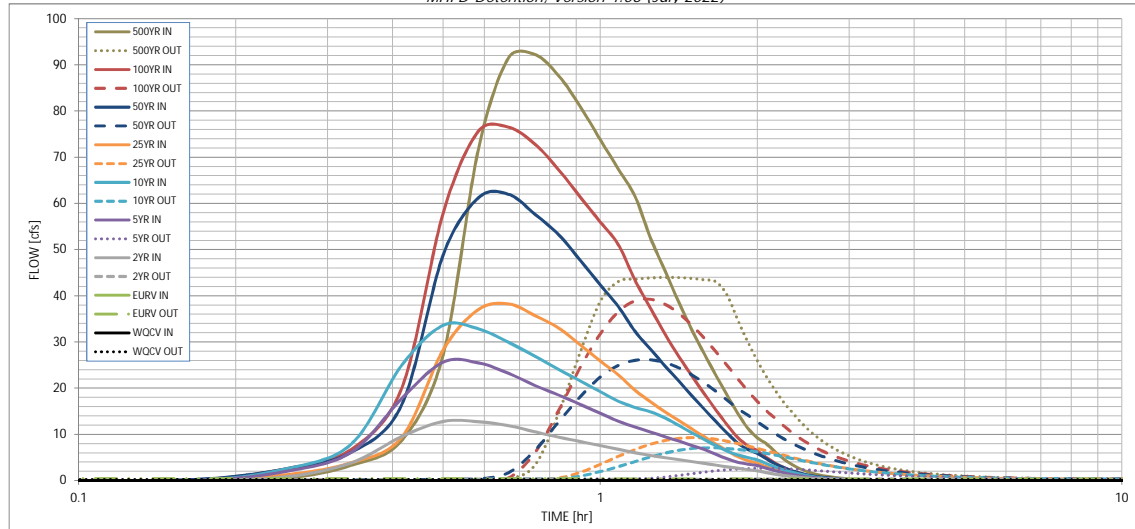
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WOCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.00	1.42	1.68	1.69	2.35	2.71	3.14
One-Hour Rainfall Depth (in) =	N/A	N/A	0.996	1.864	2.488	2.687	4.407	5.500	6.686
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.996	1.864	2.488	2.687	4.407	5.500	6.686
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.4	8.1	13.2	17.7	33.9	44.6	55.7
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	0.26	0.42	0.56	1.07	1.41	1.76
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	12.8	25.7	33.6	38.3	62.0	76.5	92.2
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.3	2.7	7.1	9.3	26.1	39.2	44.0
Peak Inflow Q (cfs) =	N/A	N/A	N/A	0.3	0.5	0.5	0.8	0.9	0.8
Peak Outflow Q (cfs) =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.3	0.4	1.1	1.7	1.9
Structure Controlling Flow =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-3.7
Max Velocity through Gate 1 (fps) =	40	68	60	72	70	69	63	60	58
Max Velocity through Gate 2 (fps) =	42	72	64	78	78	77	75	73	71
Time to Drain 97% of Inflow Volume (hours) =	2.38	3.81	3.19	4.31	4.73	4.88	5.70	6.18	6.75
Time to Drain 99% of Inflow Volume (hours) =	0.49	0.63	0.59	0.66	0.69	0.70	0.76	0.79	0.83
Maximum Ponding Depth (ft) =	0.485	1.315	0.935	1.633	1.925	2.030	2.629	2.994	3.456
Area at Maximum Ponding Depth (acres) =									
Maximum Volume Stored (acre-ft) =									



# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: \_\_\_\_\_

## Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.16	0.50
	0:15:00	0.00	0.00	0.83	2.00	2.57	1.27	2.54	2.60	3.33
	0:20:00	0.00	0.00	3.86	6.18	7.95	3.88	6.16	6.81	8.76
	0:25:00	0.00	0.00	9.58	17.84	25.04	9.44	16.53	20.13	27.33
	0:30:00	0.00	0.00	12.81	25.66	33.63	28.33	48.92	58.00	71.53
	0:35:00	0.00	0.00	12.75	25.49	32.85	36.98	61.19	75.56	91.50
	0:40:00	0.00	0.00	11.89	23.23	29.95	38.26	61.99	76.51	92.21
	0:45:00	0.00	0.00	10.54	20.58	26.90	35.69	57.63	72.81	87.57
	0:50:00	0.00	0.00	9.39	18.49	24.04	33.00	53.17	67.21	80.86
	0:55:00	0.00	0.00	8.44	16.47	21.55	29.31	47.60	61.29	73.79
	1:00:00	0.00	0.00	7.56	14.56	19.26	25.90	42.37	56.00	67.41
	1:05:00	0.00	0.00	6.79	12.83	17.18	22.88	37.65	51.05	61.44
	1:10:00	0.00	0.00	6.02	11.57	15.79	19.53	32.27	43.31	52.37
	1:15:00	0.00	0.00	5.43	10.52	14.87	17.02	28.39	37.17	45.21
	1:20:00	0.00	0.00	4.96	9.48	13.53	14.81	24.70	31.59	38.45
	1:25:00	0.00	0.00	4.53	8.52	11.89	12.93	21.47	26.74	32.52
	1:30:00	0.00	0.00	4.13	7.61	10.34	11.13	18.33	22.58	27.43
	1:35:00	0.00	0.00	3.73	6.74	8.90	9.47	15.43	18.78	22.78
	1:40:00	0.00	0.00	3.33	5.69	7.57	7.92	12.76	15.28	18.51
	1:45:00	0.00	0.00	2.97	4.72	6.40	6.48	10.29	12.08	14.61
	1:50:00	0.00	0.00	2.70	3.99	5.57	5.21	8.16	9.38	11.39
	1:55:00	0.00	0.00	2.38	3.56	5.00	4.30	6.76	7.58	9.28
	2:00:00	0.00	0.00	2.12	3.26	4.49	3.77	5.92	6.47	7.96
	2:05:00	0.00	0.00	1.73	2.66	3.66	2.99	4.68	5.01	6.18
	2:10:00	0.00	0.00	1.39	2.11	2.91	2.31	3.60	3.76	4.65
	2:15:00	0.00	0.00	1.11	1.67	2.30	1.79	2.78	2.81	3.48
	2:20:00	0.00	0.00	0.88	1.32	1.80	1.39	2.13	2.07	2.57
	2:25:00	0.00	0.00	0.70	1.03	1.39	1.07	1.63	1.53	1.90
	2:30:00	0.00	0.00	0.55	0.80	1.06	0.82	1.23	1.16	1.43
	2:35:00	0.00	0.00	0.43	0.61	0.80	0.63	0.93	0.88	1.08
	2:40:00	0.00	0.00	0.33	0.46	0.60	0.48	0.70	0.67	0.83
	2:45:00	0.00	0.00	0.25	0.35	0.46	0.37	0.54	0.52	0.64
	2:50:00	0.00	0.00	0.19	0.26	0.35	0.28	0.41	0.40	0.49
	2:55:00	0.00	0.00	0.14	0.18	0.25	0.20	0.30	0.29	0.35
	3:00:00	0.00	0.00	0.09	0.12	0.17	0.14	0.20	0.20	0.24
	3:05:00	0.00	0.00	0.05	0.08	0.10	0.09	0.13	0.12	0.15
	3:10:00	0.00	0.00	0.03	0.04	0.05	0.05	0.07	0.06	0.08
	3:15:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.03	0.03
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.06 (July 2022)*

### Summary Stage-Area-Volume-Discharge Relationships

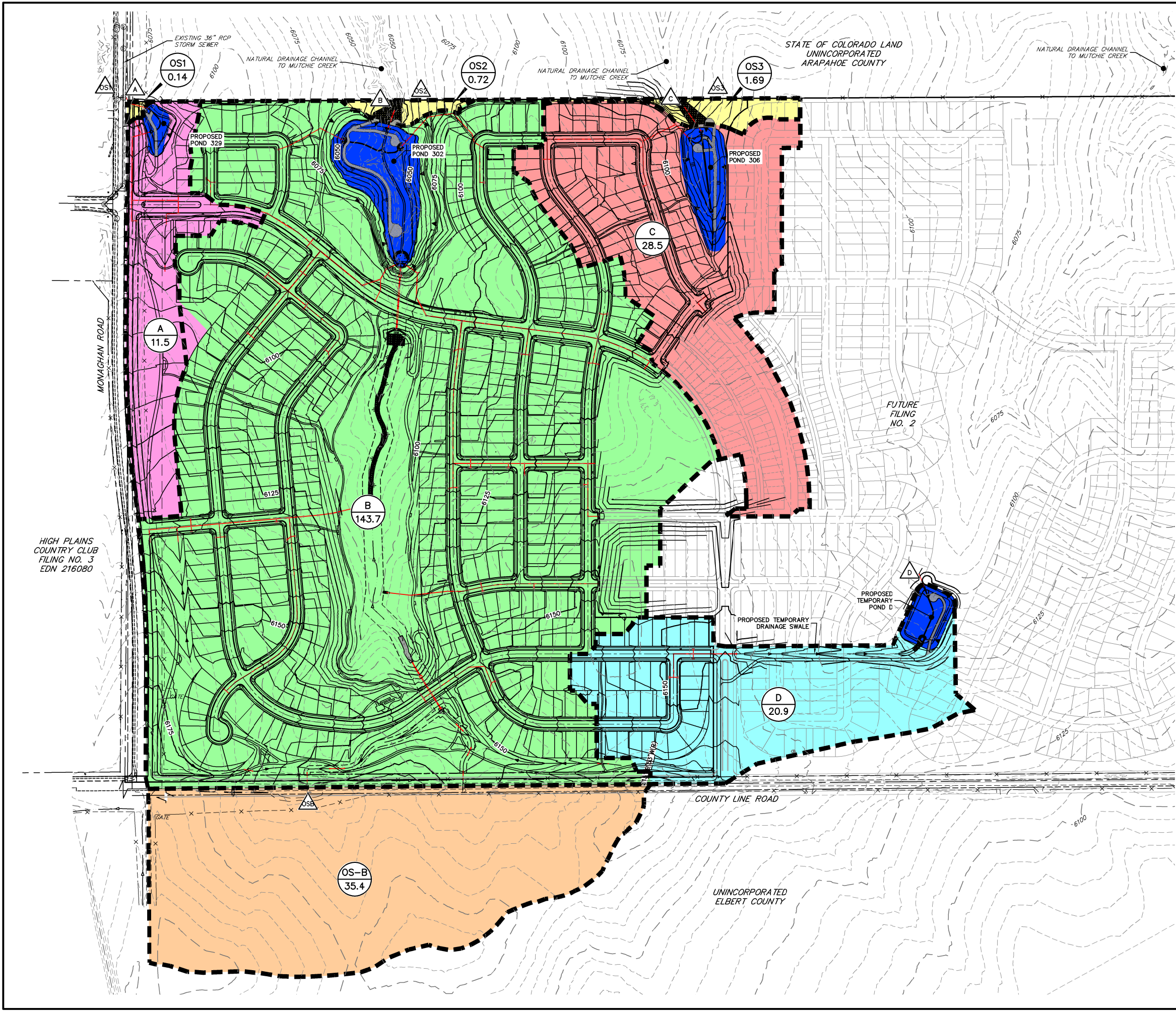
The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]

APPENDIX 5  
DRAINAGE PLAN & EXHIBITS





POND ID	AREA SERVICED (AC)	IMPERVIOUS %
POND 329	11.49	39.4%
POND 302	179.17	36.5%
POND 306	28.53	56.7%
POND D	20.91	29.1%
TOTAL	240.1	

LEGEND:

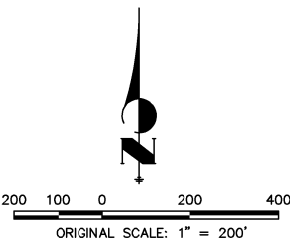
- PROPOSED STORM SEWER
- 6100 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 6100 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- BASIN TRIBUTARY TO POND A
- BASIN TRIBUTARY TO POND B
- BASIN TRIBUTARY TO POND C
- BASIN TRIBUTARY TO POND D
- OFFSITE BASIN TRIBUTARY TO POND B
- OFFSITE BASIN
- PROPOSED POND

A  
B

A = BASIN DESIGNATION  
B = AREA IN ACRES

1

DESIGN OUTLET



OVERALL DRAINAGE PLAN  
TRAILS AT OVERLAND RANCH  
JOB NO. 16118.00  
10/27/22  
SHEET 1 OF 1



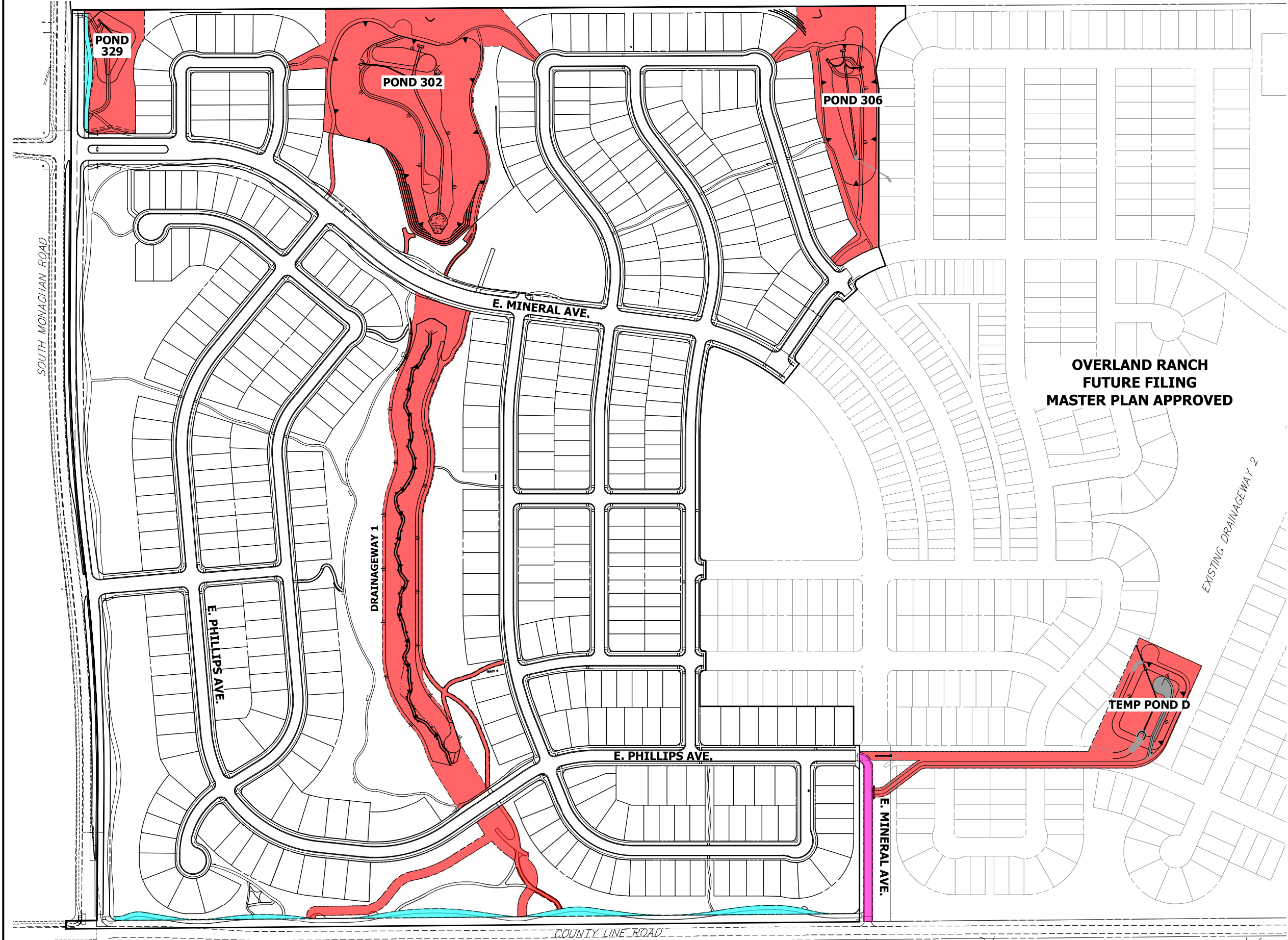
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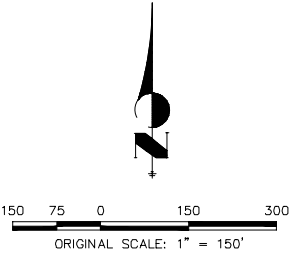


OVERLAND RANCH FILING 1  
DRAINAGE EASEMENT EXHIBIT



OVERLAND RANCH  
FUTURE FILING  
MASTER PLAN APPROVED

- LEGEND**
- DRAINAGE & ACCESS EASEMENT
  - PUBLIC ACCESS EASEMENT
  - FIRE & ACCESS EASEMENT

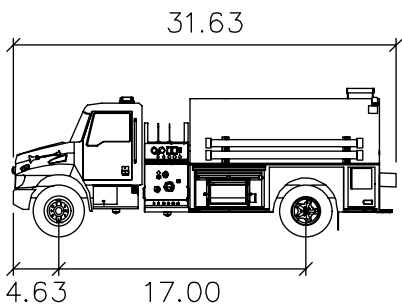
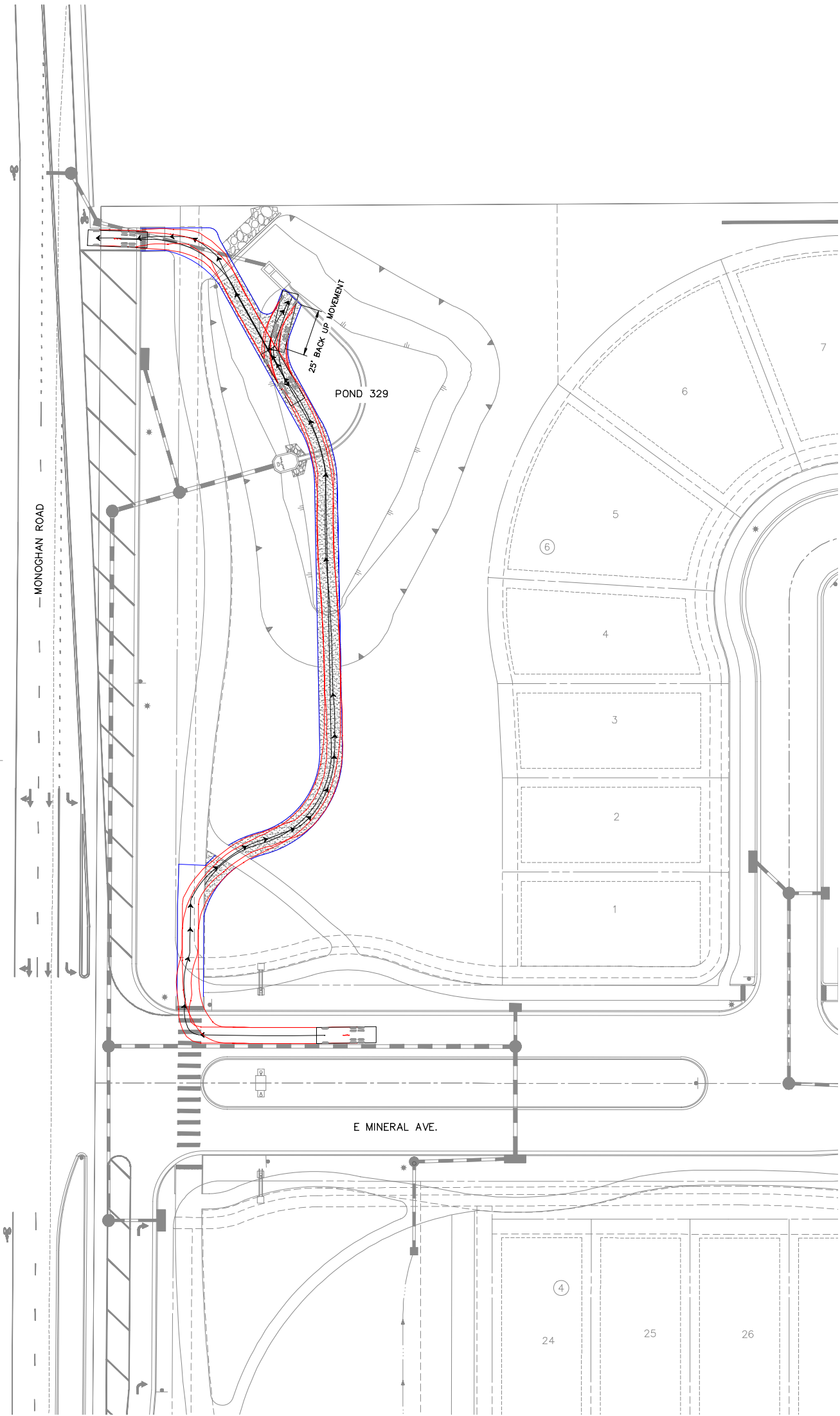


DRAINAGE EASEMENT EXHIBIT  
OVERLAND RANCH FILING 1  
JOB NO. 16118.00  
5/2/24  
SHEET 1 OF 1



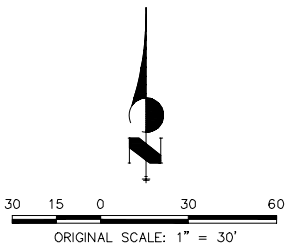
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OVERLAND RANCH FILING NO. 1  
VAC TRUCK MOVEMENT EXHIBIT



Aurora Vac Truck

	feet
Width	: 8.50
Track	: 8.50
Lock to Lock Time	: 6.0
Steering Angle	: 53.6

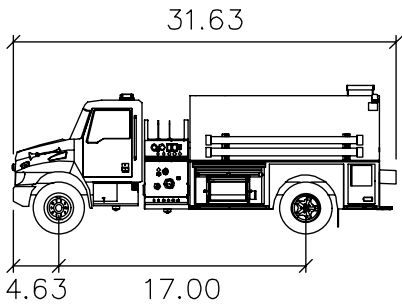
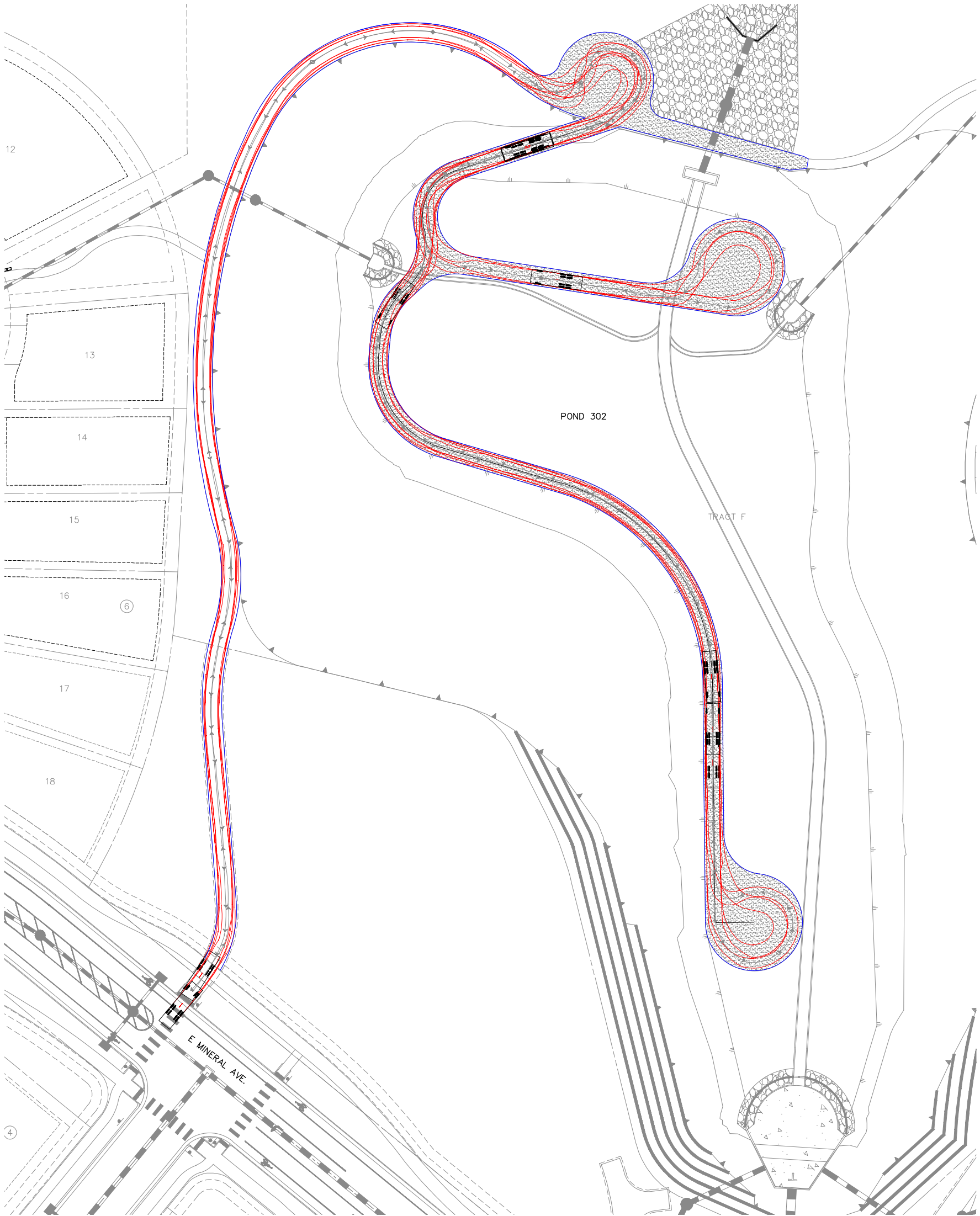


VAC TRUCK MOVEMENT EXHIBIT  
OVERLAND RANCH FIL. 1  
JOB NO. 16118.10  
04/16/2024  
SHEET 1 OF 7



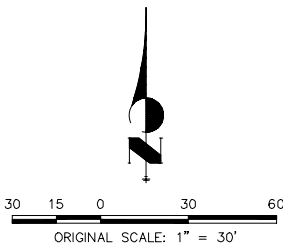
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OVERLAND RANCH FILING NO. 1  
VAC TRUCK MOVEMENT EXHIBIT



Aurora Vac Truck

	feet
Width	: 8.50
Track	: 8.50
Lock to Lock Time	: 6.0
Steering Angle	: 53.6



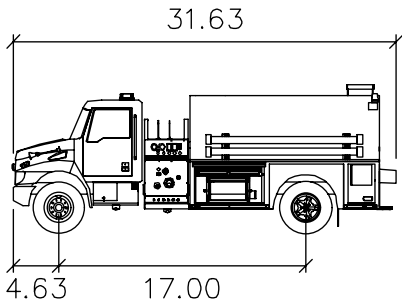
VAC TRUCK MOVEMENT EXHIBIT  
OVERLAND RANCH FIL. 1  
JOB NO. 16118.10  
04/16/2024  
SHEET 2 OF 7



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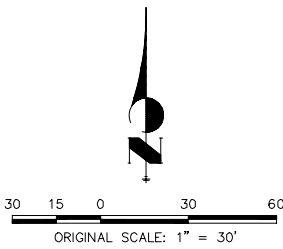


OVERLAND RANCH FILING NO. 1  
VAC TRUCK MOVEMENT EXHIBIT



Aurora Vac Truck

	feet
Width	: 8.50
Track	: 8.50
Lock to Lock Time	: 6.0
Steering Angle	: 53.6

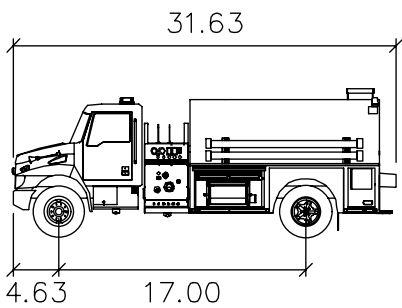
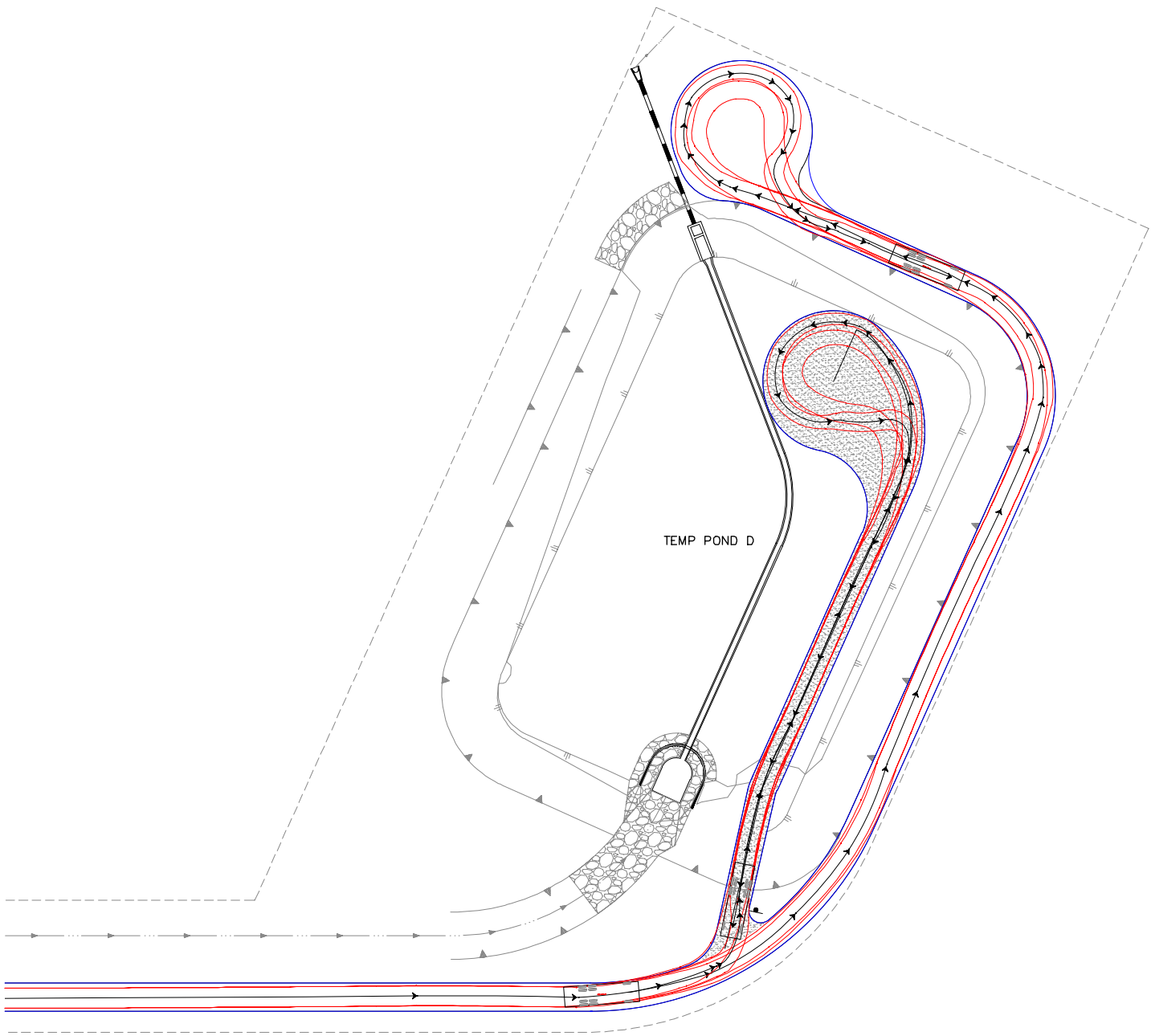


VAC TRUCK MOVEMENT EXHIBIT  
OVERLAND RANCH FIL. 1  
JOB NO. 16118.10  
04/16/2024  
SHEET 3 OF 7



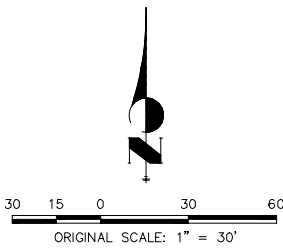
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OVERLAND RANCH FILING NO. 1  
VAC TRUCK MOVEMENT EXHIBIT



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	feet
Width	: 8.50
Track	: 8.50
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Steering Angle	: 53.6

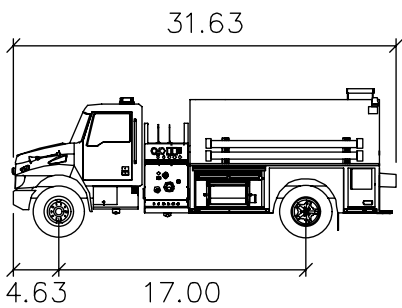


VAC TRUCK MOVEMENT EXHIBIT  
OVERLAND RANCH FIL. 1  
JOB NO. 16118.10  
04/16/2024  
SHEET 4 OF 7



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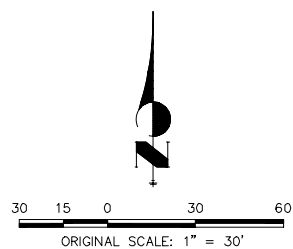
OVERLAND RANCH FILING NO. 1  
VAC TRUCK MOVEMENT EXHIBIT



Aurora Vac Truck

feet

Width	: 8.50
Track	: 8.50
Lock to Lock Time	: 6.0
Steering Angle	: 53.6

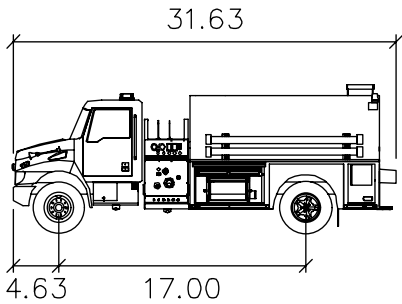
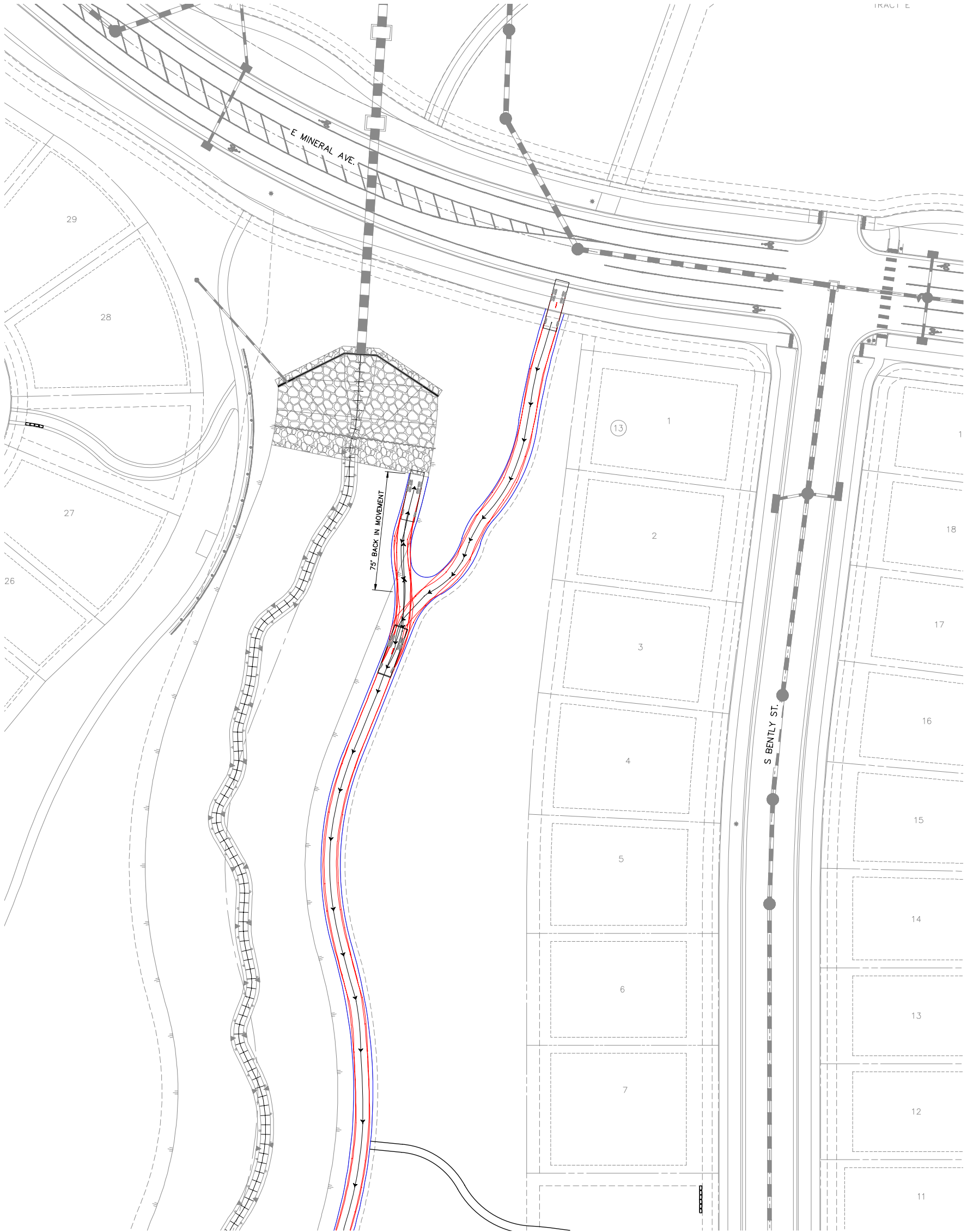


VAC TRUCK MOVEMENT EXHIBIT  
OVERLAND RANCH FIL. 1  
JOB NO. 16118.10  
04/16/2024  
SHEET 5 OF 7



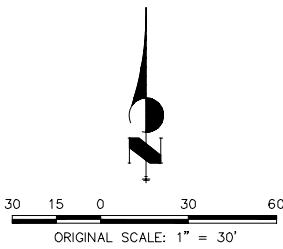
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OVERLAND RANCH FILING NO. 1  
VAC TRUCK MOVEMENT EXHIBIT



Aurora Vac Truck

	feet
Width	: 8.50
Track	: 8.50
Lock to Lock Time	: 6.0
Steering Angle	: 53.6



VAC TRUCK MOVEMENT EXHIBIT  
OVERLAND RANCH FIL. 1  
JOB NO. 16118.10  
04/16/2024  
SHEET 6 OF 7

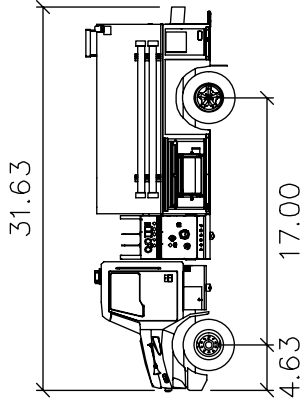


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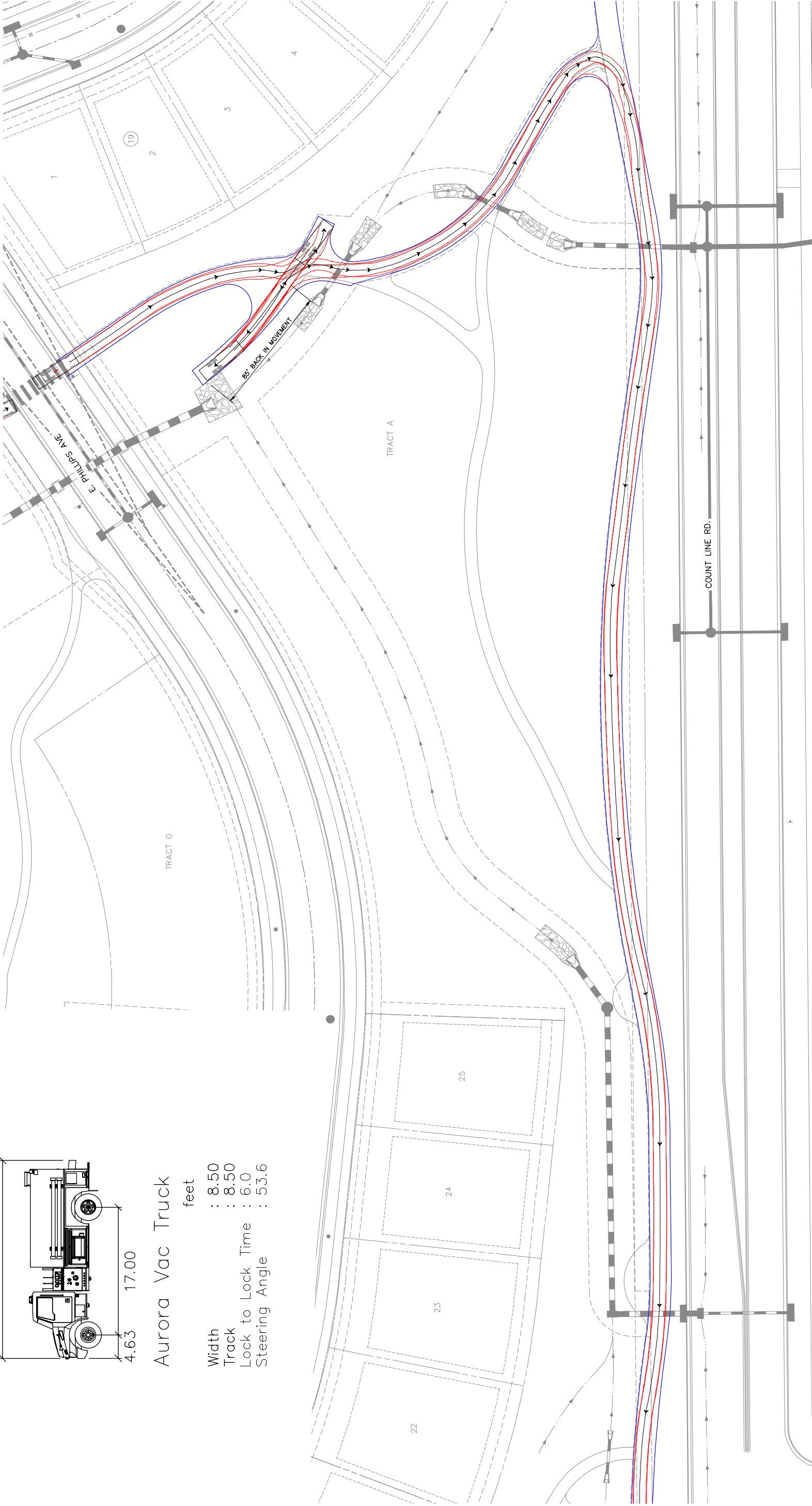
# OVERLAND RANCH FILING NO. 1

## VAC TRUCK MOVEMENT EXHIBIT



Aurora Vac Truck

	feet
Width	: 8.50
Track	: 8.50
Lock to Lock Time	: 6.0
Steering Angle	: 53.6



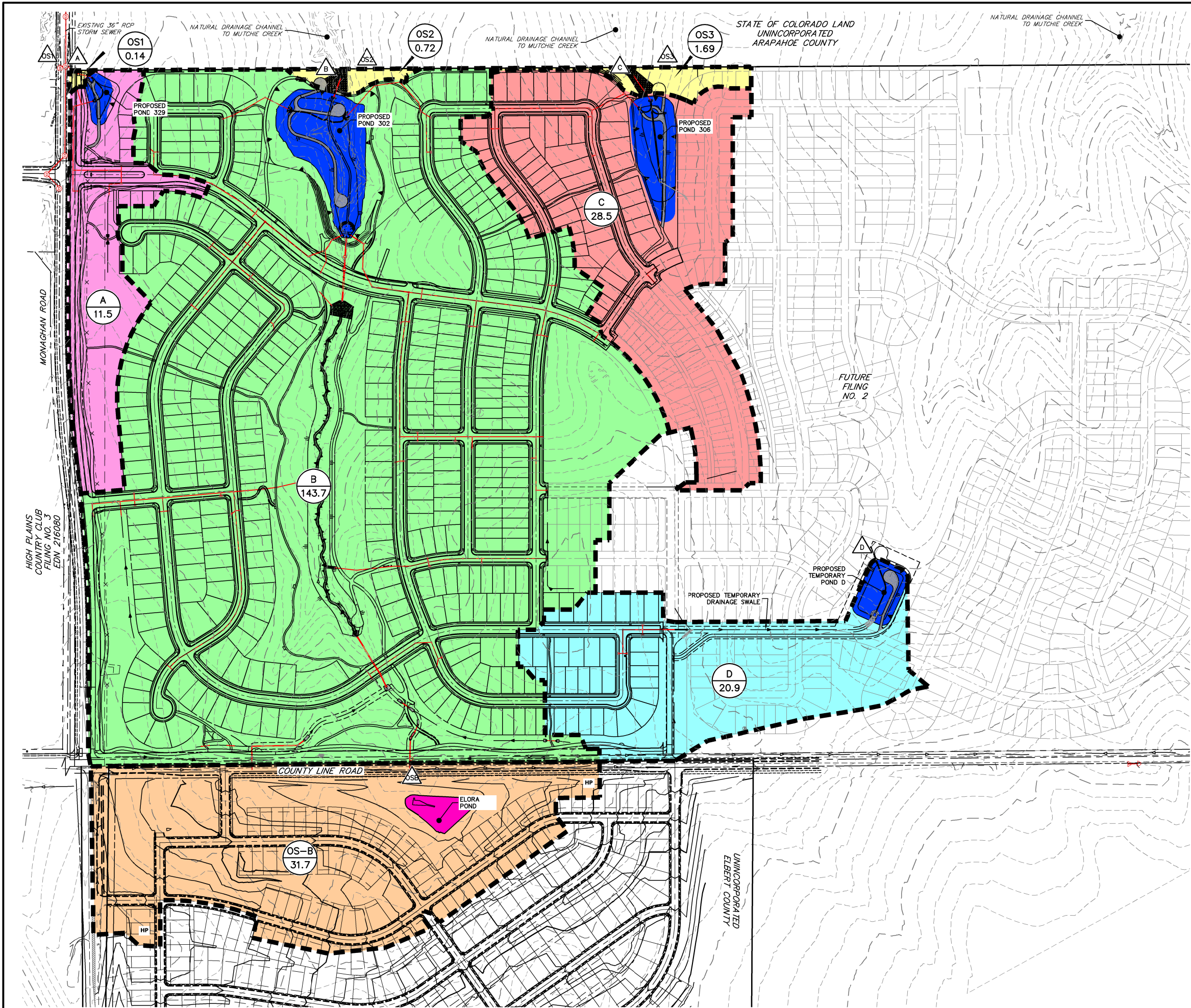
VAC TRUCK MOVEMENT EXHIBIT  
OVERLAND RANCH FIL. 1  
JOB NO. 16118.10  
04/16/24  
SHEET 7 OF 7



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OVERALL DRAINAGE PLAN  
W/ ELORA



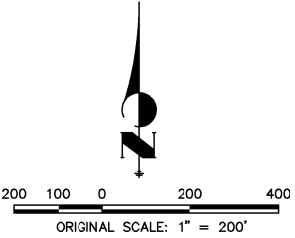


POND ID	AREA SERVICED (AC)	IMPERVIOUS %
POND 329	11.49	39.4%
POND 302	179.17	36.5%
POND 306	28.53	56.7%
ELORA POND	31.68	41.0%
POND D	20.91	29.1%
TOTAL	271.78	

**LEGEND:**

- PROPOSED STORM SEWER
- 6100 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 6100 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- BASIN TRIBUTARY TO POND 311
- BASIN TRIBUTARY TO POND 302
- BASIN TRIBUTARY TO POND 306
- BASIN TRIBUTARY TO POND 309
- OFFSITE BASIN TRIBUTARY TO POND 309
- OFFSITE BASIN
- DETENTION POND
- DETENTION POND BY OTHERS

- A = BASIN DESIGNATION
- B = AREA IN ACRES
- 1 DESIGN OUTLET



OVERALL DRAINAGE PLAN  
TRAILS AT OVERLAND RANCH  
JOB NO. 16118.00  
10/27/22  
SHEET 1 OF 1



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