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Eastonville Road – Londonderry Dr. to Rex Rd.
Segment 2 Improvements
Stationing 47+00.00 – 79+31.62

Final Drainage Report

August 2024

HR Green Project No: 201662.08

Prepared For:

D.R. Horton

Contact: Riley Hillen, P.E.

9555 S. Kingston Ct.

Englewood, CO 80112

Prepared By:

HR Green Development, LLC

Contact: Colleen Monahan, P.E., LEED AP

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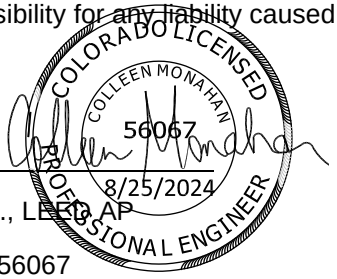
EDARP Filing No:

CDR2321

Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.



Colleen Monahan, P.E., LEED AP — Date

State of Colorado No. 56067

For and on behalf of HR Green Development, LLC

Owner/Developer's Statement:

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

By: _____ _____

Authorized Signature — Date

Address: D.R. Horton
9555 S. Kingston Court
Englewood, CO

El Paso County Statement

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development code, as amended.

_____

Joshua Palmer, P.E. — Date

County Engineer/ECM Administrator

Conditions:

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Appendices

I. General Purpose, Location and Description

a. Purpose

The purpose of this Final Drainage Report (FDR) for Eastonville Road Segment 2 Improvements is to describe the onsite and offsite drainage patterns, size drainage infrastructure to safely capture and convey developed runoff to water quality and detention facilities, and to safely route detained stormwater to adequate outfalls. This drainage report will detail the improvements of Eastonville Road from Londonderry Dr. to Rex Road for Segment 2. Stations 47+00.00 to 79+32.00 contain the Segment 2 Improvements for the Eastonville Road from Londonderry Drive to Rex Road for the portion of the project north of Grandview Filing No. 1. The project is all one project, however, the plan set has been broken into two segments to align with the Grandview Reserve Filings. A separate FDR describes Segment 1 of the project.

b. Location

Eastonville Road from Londonderry Dr. to Rex Road, referred to as 'the site' herein, is an existing 26' wide treated gravel road in El Paso County, Colorado. Per field inspection the existing pavement is not full depth, and therefore described as 'temporary' for the purpose of this report. The site lies in the existing 60' wide El Paso County Right-of-Way within Sections 21 and 28, Township 12 South, Range 64 West of the 6th Principal Meridian, in El Paso County, State of Colorado.

The site is bound by undeveloped land to the east and west that has historically been used as ranching lands. Falcon Regional Park, which contains ballparks and parking, and Falcon High School also border the site to the west. All lands to the east and west of the site are unplatted. A vicinity map is presented in Appendix A.

c. Description of Property

The site is approximately 0.69 miles (2.17 acres) of existing treated gravel roadway north of Londonderry Dr. and south of Rex Road. Per field inspection the existing pavement is not full depth, and therefore described as 'temporary' for the purpose of this report. The existing treated gravel width for the length of the project is 26' wide. There are 4' wide gravel shoulders and native landscaped swales are located on both sides of the roadway. Offsite stormwater is bypassed under the road through a series of existing culverts. See Appendix A for an existing conditions photo.

The existing roadway has slopes ranging from 0.3% up to about 4%. The general topography of the surrounding area is typical of high desert, short prairie grass with gently rolling hillside with slopes ranging from 2% to 4%. The project site drains generally from the west to the east and is tributary to Black Squirrel Creek.

Per a NRCS soil survey, the site is made up of Type A Columbine gravelly sandy loam, Type A Blakeland loamy sand and Type B Stapleton sandy loam. The NRCS soil survey is presented in Appendix A.

Gieck Ranch Tributary #1 (Channel A) is the only drainageway that traverses the site in the west to east direction through an existing culvert under Eastonville Road. The channel is a mapped wetland and a wetland permit will be required for a part of this Eastonville Road improvement project. Channel A is not within a FEMA floodplain.

Gieck Ranch Tributary #2 is located on the north end of the project site and will not be impacted by this project. There are no known irrigation facilities in the area.

Existing utilities include an underground gas line that runs under Eastonville road through the Grandview reserve property south of the segment 2 improvements, an existing raw water line that follows the west side of Eastonville north of Falcon Regional Park, and an existing aboveground electrical line along the western side of Eastonville Road. An existing drainage map with these facilities is presented in Appendix F.

d. Floodplain Statement

Based on FEMA Firm map 08041C0552G December 7, 2018, the site is not located in any FEMA designated floodplain. See FEMA Firm Map in Appendix A. There is a Zone A floodplain north of the site and a Zone AE south of the site, both of which will not be altered with the associated Eastonville Road improvements.

II. Drainage Design Criteria

a. Drainage Criteria

Hydrologic data and calculations were performed using Drainage Criteria Manual Volume 1 of El Paso County (EPCDCM), with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual (CCSDCM), May 2014 revised January 2021.

Onsite drainage improvements are designed for the 5-year storm (minor event) and 100-year storm (major event) using rainfall values from the NOAA Atlas 14 Point Precipitation Frequency Data Server. Runoff was calculated per CCSDCM Section 6.3.0 - Rational Method. Private, full spectrum pond design was completed using the latest version of Mile High Flood District's (MHFD) UD-Detention per CCSDCM Section 13.3.2.1 – Private, full spectrum Detention. The detention pond allowable release rate will be limited to less than historic rates.

Rainfall Depths per NOAA Atlas 14		
Return Period (yr)	5	100
1-hr Rainfall Depth (in)	1.21	2.49

Inlet sizing was performed per the methods described in EPCDCM Section III Chapter 7 – Street Drainage and Storm Water Inlets. Storm sewer sizing was performed per the methods described in EPCDCM Section III Chapter 8 – Storm Drains and Appurtenances.

III. Drainage Basins and Subbasins

a. Major Basin Description

The site is located within the Gieck Ranch Drainage Basin. The site's drainage characteristics were previously studied in the following reports:

1. "Gieck Ranch Drainage Basin Planning Study" prepared by Drexel, Barrel & Co, February 2010.
2. "Master Development Drainage Plan Meridian Ranch" prepared by Tech Contractors, July 2021.
3. "Final Drainage Report for The Sanctuary Filing 1 at Meridian Ranch" by Tech Contractors, August 2022.

Gieck Ranch Drainage Basin is a 22.05 square mile watershed located in El Paso County, Colorado. Gieck Ranch Drainage Basin is tributary to Black Squirrel Creek which drains to the Arkansas River. The majority of the basin is undeveloped and is rolling range land typical of Colorado's semi-arid climates. It should be noted that the Gieck Ranch DBPS has not been approved at the time of this report.

The Meridian Ranch MDDP and The Final Drainage Report for The Sanctuary Filing 1 at Meridian Ranch indicate that the Eastonville Road culvert crossing at the Gieck Ranch Tributary #1, within the project boundary, does not provide enough capacity for the historic flow rates. This culvert will be upgraded as part of this project.

Within the Gieck Ranch Drainage Basin, ranching has historically been the predominant land use, with rolling topography between 2%-4% slopes. Recently urbanization is occurring within the drainage basin, most notably for this project are Meridian Ranch and Latigo Trails Developments. Both are single family residential neighborhoods located upstream to the west and northwest of the Eastonville Segment 2 Improvements project site.

b. Existing Subbasin Description

Eastonville Road Segment 2 (the site) accepts flows from areas to the west and northwest of the site, including portions of Meridian Ranch and Latigo Trails Development. The flows and design points used in the following descriptions are taken from the approved Meridian Ranch MDDP and The Final Drainage Report for The Sanctuary Filing 1 at Meridian Ranch provides the detailed analysis of the pond releases and flows as they outfall from those developments upstream of this Eastonville Road site. For the purpose of this report, full buildout of the Meridian Ranch development was assumed; hence the developed peak flow rates from the "future buildout conditions" for the entirety of Meridian Ranch were used to evaluate the existing conditions below.

Basin EX1 (The Sanctuary Filing 1 FG-38) is 85.16 acres of undeveloped area and treated gravel area to the crown of Eastonville Road roadway. Stormwater from this basin combines with flows from Latigo Trails South Pond (The Sanctuary Filing 1 G-17) is conveyed overland to DP1 for a total area of 321.5 acres (The Sanctuary Filing 1 G18). Flows at DP1 (Q_5 = 28.3 cfs Q_{100} = 365.2 cfs) are conveyed across Eastonville Road in an existing 24" CMP culvert and discharges to Gieck Ranch Tributary #2 (Channel B). This basin is located upstream of the Eastonville project and is presented here to show where flows go that are upstream of the project site. The Eastonville project will have no impact on this basin.

Basin EX2 (The Sanctuary Filing 1 FG36) is 18.88 acres undeveloped area, parking lot, and treated gravel to the crown of Eastonville Road roadway. Stormwater from this basin is conveyed overland to DP2 (The Sanctuary Filing 1 FG36). Flows at DP2 (Q_5 = 1.7 cfs Q_{100} = 18.8 cfs) are conveyed southerly across Rex Road in an existing 24" RCP culvert and discharges to Basin EX3.

Basin EX3 is 51.06 acres of undeveloped area and the Falcon Regional Park ball fields and treated gravel to the crown of Eastonville Road roadway. Stormwater from this basin combines with flows from The Sanctuary Filing 1 Design Point G15 via an existing roadside swale where it then combines with DP2 flows. Flows travel to DP3 for a total area of 131.3 acres (The Sanctuary Filing 1 Design Point G16) where they are conveyed across Eastonville Road in an existing 24" CMP culvert (Q_5 = 6.1 cfs Q_{100} = 112.1 cfs).

Basin EX4 is 62.87 acres of undeveloped area and treated gravel to the crown of Eastonville Road roadway. Stormwater from this basin combines with flows from The Sanctuary Filing 1 Design Point G12 (Meridian Ranch Pond G) to Gieck Ranch Tributary #1 and an existing roadside swale to DP 4 for a total area of 832.7 acres (The Sanctuary Filing 1 Design Point G06) (Q_5 = 22.4 cfs Q_{100} = 491 cfs). Flows at DP4 are conveyed across Eastonville Road in an existing 18" CMP culvert and discharges to Gieck Ranch Tributary #1 (Channel A).

Basin EX5 is 12.19 acres of undeveloped area and a future church property on the east side of the Eastonville Roadway. Stormwater from this basin sheet flows east directly to the Gieck Ranch Tributary #1 at DP13.1 (Q_5 = 2.7 cfs Q_{100} = 18.0 cfs).

Basin EX6 is 0.61 acres of undeveloped area on the future church property on the east side of the Eastonville Roadway. Stormwater from this basin flows south via an existing drainage channel south to DP O3.1 (Q_5 = 0.1 cfs Q_{100} = 0.9 cfs). Ultimately draining east to the Gieck Ranch Tributary #1.

Basin EX7 is 1.90 acres of undeveloped area on the east side of the Eastonville Roadway. Stormwater from this basin flows south via an existing drainage channel south to DP O3 (Q_5 = 0.4 cfs Q_{100} = 2.5 cfs). Ultimately draining east to the Gieck Ranch Tributary #1 combined with flows from DP G16 from the Sanctuary Filing 1.

Basin EX8 is 2.86 acres of undeveloped area on the east side of the Eastonville Roadway. Stormwater from this basin flows south via an existing drainage channel south to DP O3 (Q_5 = 0.6 cfs Q_{100} = 4.0 cfs). Ultimately draining east to the Gieck Ranch Tributary #1 combined with flows from DP G06 from the Sanctuary Filing 1.

c. Proposed Subbasin Description

Description of Proposed Project

The proposed project includes improvements to Eastonville Road from Londonderry Drive to Rex Road. As described above, the current condition of the existing roadway in this area consists of 26’ wide treated gravel roadway with 4’ wide sand shoulders and weedy swales located on both sides of the roadway. Offsite stormwater is bypassed under the road through a series of existing culverts.

The proposed improvements from Rex Road south to the southern property line of the proposed Grandview Reserve Filing 1 include removal of the 26’ wide treated gravel and replacing the road with a Modified Urban Minor Arterial Roadway Cross-Section consisting of 48’ pavement and Type A EPC curb (53’ back of curb to back of curb). This includes Basins EA1-EA11.

Refer to the Eastonville Road Segment 1 improvements FDR for subbasin information and calculations south of subbasins EA10 & EA11.

Eastonville Road Basins

Basin EA1 is 0.22 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater (Q_5 = 0.7 cfs Q_{100} = 1.3 cfs) is conveyed in curb and gutter to DP2. Flows at DP2 are captured in a 5’ Type R sump inlet (Public) and piped to Pond C, a private full spectrum sand filter basin. Basin EA1 will be detained by the Pond C Sand Filter.

Basin EA2 is 0.25 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater (Q_5 = 0.8 cfs Q_{100} = 1.5 cfs) is conveyed in curb and gutter to DP3. Flows at DP3 are captured in a 5’ Type R sump inlet (Public) and piped to Pond C. Basin EA2 will be detained by the Pond C Sand Filter.

Basin EA3 is 0.20 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater (Q_5 = 0.7 cfs Q_{100} = 1.4 cfs) is conveyed in curb and gutter to DP5. Flows at DP5 are captured in a 10’ Type R sump inlet (Public) and piped to DP9. Basin EA3 will not be detained per the Meridian Ranch MDDP as this basin has been over-detained within Meridian Ranch.

Basin EA4 is 0.17 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater (Q_5 = 0.5 cfs Q_{100} = 1.1 cfs) is conveyed in curb and gutter to DP6. Flows at DP6 are captured in

a 5' Type R sump inlet (Public) and piped to DP9. Basin EA4 will not be detained per the Meridian Ranch MDDP as this basin has been over-detained within Meridian Ranch.

Basin EA5 is 0.16 acres of undeveloped area and includes the Pond C Sand Filter. Stormwater (Q_5 = 0.1 cfs Q_{100} = 0.4 cfs) is flows directly into the Pond C Sand Filter.

Basin EA6 is 0.70 acres of undeveloped area that will be future roadway (Rex Road) once the Grandview Filing 1 development is constructed. Stormwater (Q_5 = 3.1 cfs Q_{100} = 5.5 cfs) is conveyed in a swale to DP10: Temporary Sediment Basin #1 (TSB #1). TSB #1 has been sized for the paved area of the roundabout and the future paved area of Rex Road within Basin EA6. The swale will be removed with the construction of Rex Road curb and gutter. Basin EA6 will be detained in TSB #1.

Basin EA7 is 0.65 acres of undeveloped area that will be future roadway (Rex Road) once the Grandview Filing 1 development is constructed. Stormwater (Q_5 = 2.5 cfs Q_{100} = 4.7 cfs is conveyed in a swale to DP10: Temporary Sediment Basin #1 (TSB #1). TSB #1 has been sized for the paved area of the roundabout and the future paved area of Rex Road within Basin EA7. The swale will be removed with the construction of Rex Road curb and gutter. Basin EA7 will be detained in TSB #1.

Basin EA8 is 2.08 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater (Q_5 = 5.0 cfs Q_{100} = 9.0 cfs) is conveyed in curb and gutter to DP14. Flows at DP14 are captured in a 10' Type R sump inlet (Public) and piped to Pond B. Basin EA8 will be detained Pond B Full Spectrum Detention Basin.

Basin EA9 is 2.99 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater (Q_5 = 4.6 cfs Q_{100} = 9.5 cfs) is conveyed in curb and gutter to DP15. Flows at DP15 are captured in a 10' Type R sump inlet (Public) and piped to Pond B. Basin EA9 will be detained Pond B Full Spectrum Detention Basin.

Basin EA10 is 0.12 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater (Q_5 = 0.6 cfs Q_{100} = 1.1cfs) is conveyed in curb and gutter to DP16.1 Flows from DP16.1 drain south and captured in a 10' Type R sump inlet (Public) and piped to Pond B. This inlet design is in the Eastonville Road Segment 1 FDR. Basin EA10 will be detained Pond B Full Spectrum Detention Basin which is detailed in the Eastonville Road Segment 1 FDR.

Basin EA11 is 0.19 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater (Q_5 = 0.5 cfs Q_{100} = 1.0 cfs) is conveyed in curb and gutter to DP17.1. Flows from DP17.1 drain south and captured in a 10' Type R sump inlet (Public) and piped to Pond B. This inlet design is in the Eastonville Road Segment 1 FDR. Basin EA10 will be detained Pond B Full Spectrum Detention Basin which is detailed in the Eastonville Road Segment 1 FDR.

Basin EA12 is 0.34 acres of landscaping east of the Eastonville Roadway. Stormwater (Q_5 = 0.1 cfs Q_{100} = 1.0 cfs) is conveyed south to DP O4. Flows at DP O4 combine with DP G06 per the Sanctuary Filing 1 Report. This design point then drains east offisite in the Geick Ranch Tributary #1.

Basin EA13 is 0.45 acres of Eastonville Roadway at the Dawlish Dr roundabout. Stormwater (Q_5 = 1.4 cfs Q_{100} = 2.8 cfs) is conveyed east to DP O4.1. Flows to DP O4.1 will be detained and treated as a part of the Grandview Reserve development. This design point then drains southeast offisite in the Geick Ranch Tributary #1.

Basin EA14 is 1.48 acres of landscaping and concrete/gravel trail on the east side of Eastonville Rd. Stormwater (Q_5 = 1.2 cfs Q_{100} = 3.8 cfs) is conveyed southeast to DP O4.2. Flows to DP O4.2 will be detained

and treated as a part of the Grandview Reserve development. This design point then drains southeast offisite in the Geick Ranch Tributary #1.

Basin EA15 is 0.76 acres of landscaping and concrete/gravel trail on the east side of Eastonville Rd. Stormwater (Q_5 = 0.7 cfs Q_{100} = 2.1 cfs) is conveyed southeast to DP O3. Flows to DP O3 combine with flows from the Sanctuary Filing 1 FDR design point G16. Flows to DP O3 will be detained and treated as a part of the Grandview Reserve development. This design point then drains southeast offisite in the Geick Ranch Tributary #1.

Basin EA16 is 1.18 acres of landscaping on the east side of Eastonville Rd and south of the church property. Stormwater (Q_5 = 0.3 cfs Q_{100} = 2.5 cfs) is conveyed southeast to DP 13.1. Flows to DP 13.1 will be detained and treated as a part of the Grandview Reserve development. This design point then drains southeast offisite in the Geick Ranch Tributary #2.

Basin EA17 is 0.30 acres of landscaping on the east side of Eastonville Rd and south of the church property. Stormwater (Q_5 = 0.1 cfs Q_{100} = 0.7 cfs) is conveyed southeast to DP 10.1. This design point drains southeast offisite in the Geick Ranch Tributary #2.

Offsite Basins

Basin OS1 (EX1) is 85.16 acres of undeveloped area. Stormwater from this basin combines with flows from Latigo Trails South Pond (The Sanctuary Filing 1 G-17) is conveyed overland to DP1 (The Sanctuary Filing 1 G18). Flows at DP1 (Q_5 = 28.3 cfs Q_{100} = 365.2 cfs) are conveyed across Eastonville Road in an existing 24" CMP culvert and discharges to Gieck Ranch Tributary #2 (Channel B). This basin is located upstream of the Eastonville project and is presented here to show where flows go that are upstream of the project site. The Eastonville project will have no impact on this basin.

Basin OS2 is 15.03 acres of undeveloped land and parking area north of Rex Road and contains a portion of Rex Road (Q_5 = 4.2 cfs Q_{100} = 21.6 cfs). Stormwater is conveyed to DP7 and is captured in a proposed 24" RCP culvert and piped south across Rex Road. No development associated with Eastonville Road will occur in Basin OS2.

Basin OS3 is 1.00 acre of undeveloped land (Q_5 = 0.2 cfs Q_{100} = 1.2 cfs) along the western edge of Eastonville Road. Stormwater is conveyed to DP8 and is captured in a proposed 18" RCP culvert and piped south across Rex Road. No development associated with Eastonville Road will occur in Basin OS3.

Basin OS4 is 9.60 acres of undeveloped land (Q_5 = 4.8 cfs Q_{100} = 21.6 cfs) along the western edge of Eastonville Road. Stormwater is conveyed to DP11 in a roadside swale where it combines with Meridian Ranch DP G15 flows (Q_5 = 8 cfs Q_{100} = 54.0 cfs) before being captured in a proposed 24" RCP culvert and piped to DP11.1. The combined flows as it reaches DP11 is Q_5 = 7.5 cfs Q_{100} = 44 cfs.

Basin OS5 is 40.26 acres of undeveloped land and Falcon Regional Park along the western edge of Eastonville Road. Stormwater is conveyed to DP3 where per the Sanctuary Filing 1 FDR the total flow is 112.2.1 cfs to a proposed 48" RCP culvert and piped to Channel B.

Basin OS6 is 60.83 acres of undeveloped land along the western edge of Eastonville Road. Basin OS6 flows are adapted directly from the approved The Sanctuary Filing 1 FDR. Stormwater is conveyed to DP16 in a roadside swale where it combines with Meridian Ranch DP G12 flows before being conveyed across

Eastonville Road in dual 10' x 3.5' RCBC to Channel A. The combined flows at DP16 (EX4) are Q_5 = 22.4 cfs Q_{100} = 491 cfs.

Basin OS7 is future outflow of 11.29 acres of a future stormwater detention pond outflow developed land that will be detained to meet existing conditions (Q_5 = 3.9 cfs Q_{100} = 24.6 cfs) in the southeast corner of Eastonville Road and Rex Road. From there, stormwater is piped to Channel B.

IV. Drainage Facility Design

a. General Concept

The proposed improvements from Rex Road south to the southern property line of the proposed Grandview Reserve Filing 1 include removal of the 26' wide treated gravel and replacing the road with a Modified Urban Minor Arterial Roadway Cross-Section consisting of 48' pavement and Type A EPC curb (53' back of curb to back of curb). Inlets will be placed at low points and roundabout entrances. Stormwater from this roadway will be piped to either a full spectrum detention pond, sand filter or temporary sediment basin. All ponds and water quality features will discharge at less than historic rates.

b. Water Quality & Detention

Pond C (Sand Filter)

Water quality and stormwater detention for Basins EA1, 2, & 5 is provided in Sand Filter Basin C. SFB C is a public, full spectrum sand filter basin within the Grandview Reserve property to be developed in the future. In Pond C, a total of 0.63 from the proposed project acres at 54% composite imperviousness will be detained. The minimum required acreage of treatment is 0.63 acres. The WQCV is 0.009 ac-ft, the EURV is 0.037 ac-ft, and the 100-year detention volume is 0.062 ac-ft. The WQCV, EURV and 100-year storms are released in 12, 41 and 44 hours, respectively. A 10' access and maintenance road is provided to the bottom of the pond to facilitate maintenance of the pond facilities. A 12' emergency overflow spillway is provided that conveys the developed, peak 100-yr flow rate with 1.0' of freeboard south. SFB C outfalls towards the future Channel B improvements at historic runoff rates. Runoff from Pond C will follow historic drainage patterns and not exceed historic flow rates.

Extended Detention Basin B (Full Spectrum EDB)

Water quality and detention for Basins EA6 – EA8 per the segment 1 FDR and EA9-10 per the segment 2 FDR is provided in Extended Detention Basin B; a public county owned, full spectrum extended detention basin within Filing No. 1 of Grandview Reserve within a proposed drainage easement. A total of 9.02 acres of disturbed area from the proposed project at 67% composite imperviousness will be treated and detained by EDB B for the ultimately developed Eastonville Road Improvements. Ultimate conditions include fully built sections of Eastonville Road from Londonderry Road to Rex Road and is anticipated for Spring 2025. Ultimate condition pond sizing calculations have also been provided in the Appendix of this report. The ultimate conditions WQCV is 0.197 ac-ft, the EURV is 0.756 ac-ft, and the 100-year detention volume is 1.119 ac-ft. The WQCV, EURV and 100-year storms are released in 40, 70 and 73 hours, respectively. A forebay is located at the outfall into the pond and a 40" trickle channel conveys flow towards the outlet structure. A 15' access and maintenance road is provided to the bottom of the pond to facilitate maintenance of the pond facilities. A 15.5' emergency overflow spillway is provided that conveys the developed, peak 100-yr flow rate with 1.0' of freeboard towards Gieck Ranch Tributary #1. EDB B outfalls towards DP8 at historic runoff rates. Runoff from DP8 will follow historic drainage patterns and not exceed historic flow rates.

c. Inspection and Maintenance

After completion of construction and upon the Board of County Commissioners acceptance, it is anticipated that all drainage facilities within the public Right-of-Way are to be owned and maintained by El Paso County.

All public detention ponds are to be owned and maintained by El Paso County, once established, unless an agreement is reached stating otherwise. Maintenance access for all full spectrum detention facilities will be provided from public Right-of-Way. Maintenance access for the drainageways will be provided through the proposed tracts.

V. Wetlands Mitigation

There is an existing wetland in Gieck Ranch Tributary #1 (Channel A). The wetland is contained entirely within the channel and is classified as jurisdictional. A Nationwide Wetland Permit will be applied for due to the disturbed area at the Dawlish Roundabout. Wetlands maintenance will be the responsibility of the DISTRICT.

VI. Four Step Method to Minimize Adverse Impacts of Urbanization

Step 1 – Reducing Runoff Volumes: Low impact development (LID) practices are utilized to reduce runoff at the source. In general, stormwater discharges are routed across pervious areas prior to capture in storm sewer. This practice promotes infiltration and reduces peak runoff rates. The Impervious Reduction Factor (IRF) method was used and is presented in Appendix D.

Step 2 – Treat and slowly release the WQCV: This step utilizes full spectrum water quality and detention to capture the WQCV and slowly release runoff from the site. Onsite full spectrum detention pond provides water quality treatment for the site. The WQCV is released over a period of at least 12 hours for SFBs and 40 hours for EDBs while the EURV is released over a period of 40-44 hours for SFBs and 68 - 72 hours for EDBs as recommended by the MHFD.

Step 3 – Stabilize stream channels: This step establishes practices to stabilize drainageways and provide scour protection at stormwater outfalls. Erosion protection is provided at all concentrated stormwater discharge points in the form of riprap pads.

Step 4 – Consider the need for source controls: No industrial or commercial uses are proposed within this development and therefore no source controls are proposed.

VII. Drainage and Bridge Fees

Gieck Ranch drainage basin has not been established as a fee basin within El Paso County. Therefore, no drainage basin fees are due at time of platting.

VIII. Opinion of Probable Cost

An engineer's opinion of probable cost has been provided below for public and private drainage infrastructure improvements. This includes cost estimates for the public full spectrum sand filter basin C. All required stormwater infrastructure will be installed per El Paso County Requirements.

Public Infrastructure Cost Estimate				
Line Item	**Quantity**	**Unit Price**		**Cost**
18" Reinforced Concrete Pipe	290	$76	LF	$22,040
24" Reinforced Concrete Pipe	904	$114	LF	$103,056
48" Reinforced Concrete Pipe	1678	$187	LF	$313,786
18" CDOT FES	1	$500	EA	$500
24" CDOT FES	3	$684	EA	$2,052
48" CDOT FES	2	$912	EA	$1,824
6' DIA Storm Manhole	12	$7,734	EA	$92,808
CDOT Type D Inlet	1	$6,931	EA	$6,931
10' CDOT Type R Inlet	6	$6,703	EA	$40,218
Rip Rap, d50 size from 6"-24"	2	$97	Tons	$194
3' x 10' Concrete Box Culvert w/ Wingwalls	110	$400	Tons	$44,000
10% Contingency				$62,741
TOTAL:				**$690,150**

Public SFB C Cost Estimate				
Line Item	**Quantity**	**Unit Price**		**Cost**
Rip Rap, d50 size from 6"-24" (Inflow)	1.5	$97	Tons	$146
Sand Filter Media	44	$100	/CY	$4,400
4" Perforated PVC Underdrain	10	$10	/LF	$100
12" ABC Maintenance Access	19	$40	/CY	$760
Outlet Structure w/ Orifice Plate	1	$5,000	EA	$5,000
Rip Rap, d50 size from 6"-24" (Spillway)	19.5	$97	Tons	$1,892
18" RCP Outlet Pipe	180	$60	/LF	$10,800
18" RCP FES	1	$350	EA	$350
10% Contingency				$2,345
TOTAL:				**$25,792**

IX. Hydraulic Grade Line Analysis

Hydraulic grade line analysis and final pipe sizes have been sized and calculations are provided in Appendix C. All proposed storm sewer will be designed in accordance with El Paso County Drainage Criteria Manuals.

X. Summary

Eastonville Road lies within the Gieck Ranch Drainage Basin. Water quality and detention for the site is provided in full spectrum water quality and detention ponds, sand filters and temporary sediment basins. There is one major drainageway that traverses the site: Gieck Ranch Tributary 1. The water quality and

detention features ponds will be maintained by the Grandview Reserve Metropolitan District No. 2 (DISTRICT). All drainage facilities were sized per the El Paso County Drainage Criteria Manuals.

The development of this project will not adversely affect downstream properties.

XI. Drawings

Please refer to the appendices for vicinity and drainage basin maps.

XII. References

1. City of Colorado Springs – Drainage Criteria Manual, May 2014, Revised January 2021.
2. Drainage Criteria Manual of El Paso, Colorado, October 2018.
3. Urban Storm Drainage Criteria Manual, Urban Drainage Flood Control District, January 2018.
4. “Gieck Ranch Drainage Basin Planning Study” prepared by Drexel, Barrel & Co, February 2010.
5. “Master Development Drainage Plan Meridian Ranch” prepared by Tech Contractors, July 2021.
6. “The Sanctuary Filing 1 at Meridian Ranch” prepared by Tech Contactors, August 2022.

APPENDIX A – VICINITY MAP, PHOTOS, SOIL MAP, FEMA MAP

MERIDIAN RANCH

FALCON REGIONAL PARK

REX ROAD

GIECK RANCH TRIBUTARY 2

REX RD

DAWLISH DRIVE

EASTONVILLE ROAD

EASTONVILLE ROAD

MODIFIED CROSS-SECTION WITH 48' PAVEMENT AND TYPE A EPC CURB (53' BACK OF CURB TO BACK OF CURB)

PROP. ROW
100.00'
PROP. ROW
EX. ROW
60.00'
EX. ROW

GIECK RANCH TRIBUTARY 1

DAWLISH DRIVE

GRANDVIEW RESERVE METROPOLITAN DISTRICT NO. 2

PROP. ROW
PROP. ROW

EASTONVILLE ROAD

GRANDVIEW RESERVE FILING 1

EX. ROW
60.00'
EX. ROW

BRIXHAM DR

KATE MEADOW LN

GIECK RANCH TRIBUTARY 1

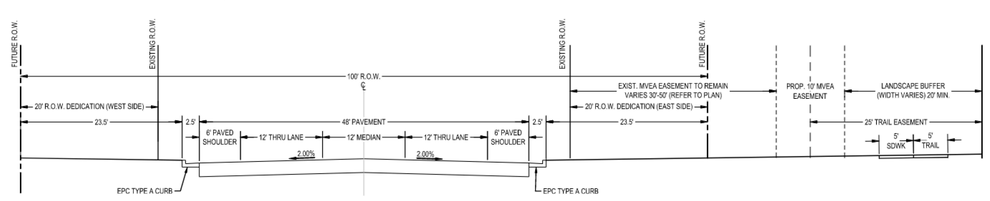
FLOODPLAIN FROM WATER RESOURCES REPORT (TYP.)

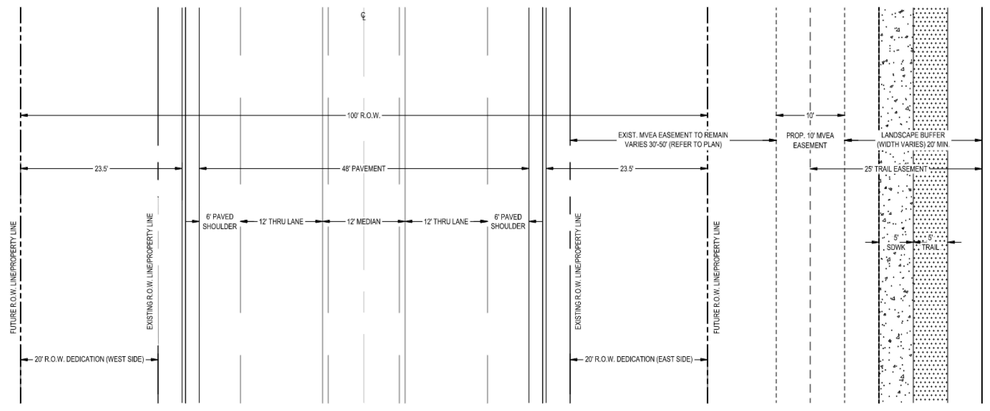
FALCON HIGH SCHOOL

LONDONDERRY DR

LONDONDERRY DRIVE

EASTONVILLE ROAD





EASTONVILLE RD ULTIMATE CROSS SECTION
(MINOR ARTERIAL)
SCALE: N.T.S.
*TRAIL AND SIDEWALK TO MEANDER WITHIN TRAIL EASEMENT

VICINITY MAP

N.T.S.

NORTH
0 150
75

DRAWN BY: CPM JOB DATE: 8/29/2023
APPROVED: JOB NUMBER: 201662.08
CAD DATE: 8/29/2023
CAD FILE: J:\2020\201662.08\CAD\Dwgs\Exhibits\-Overall-Exhibit

BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HR GREEN - COLORADO SPRINGS
7222 COMMERCE CENTER DR. SUITE 220
COLORADO SPRINGS CO 80919
PHONE: 719.622.6222
FAX: 844.273.1057

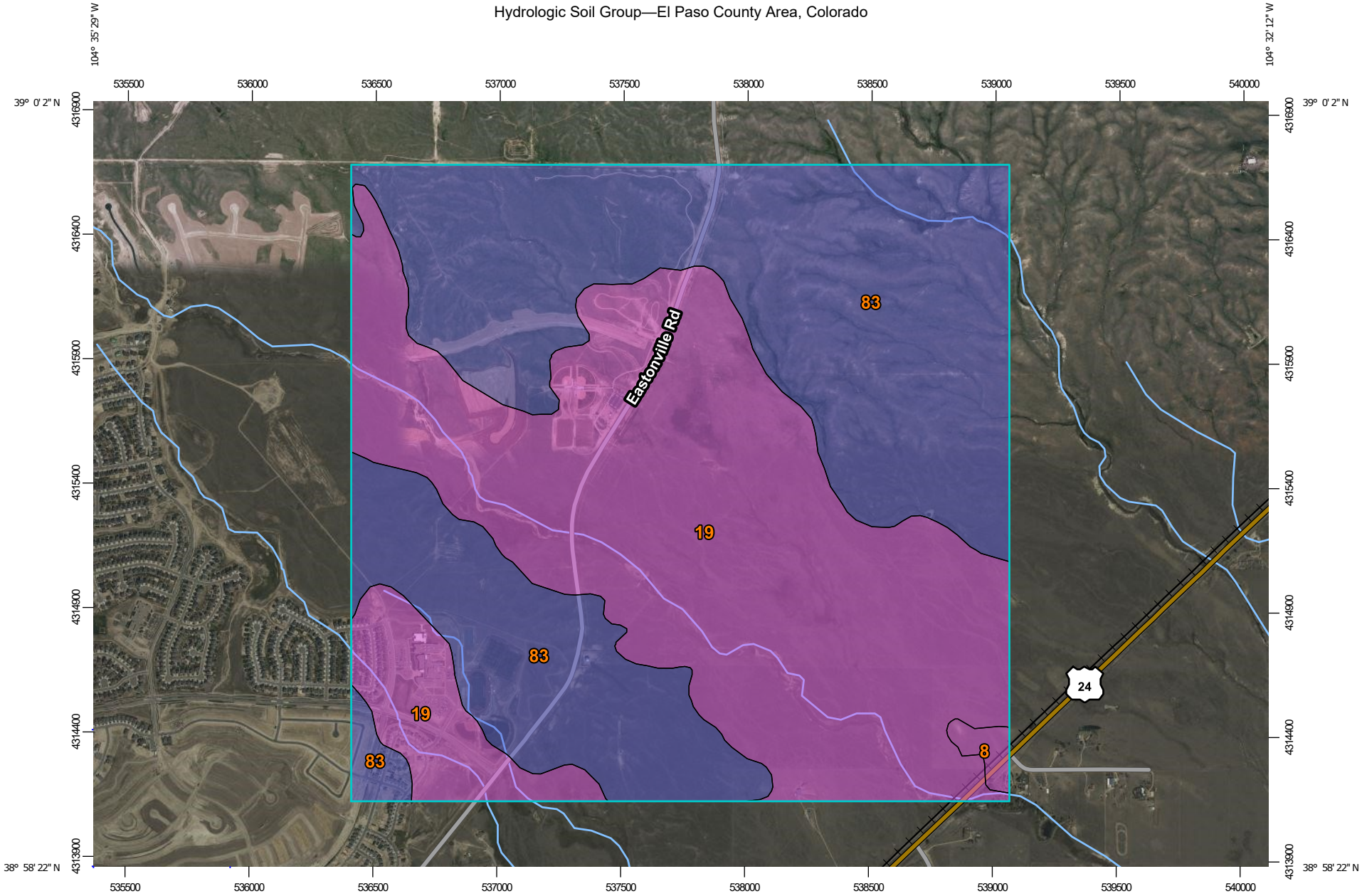
EASTONVILLE ROAD
DR HORTON
EL PASO COUNTY, CO

OVERALL EASTONVILLE PLAN

SHEET 1

1

Photo - at Londonderry and Eastonville looking north


104° 35' 29" W
104° 32' 12" W
39° 0' 2" N
38° 58' 22" N
535500
536000
536500
537000
537500
538000
538500
539000
539500
540000
4316900
4316400
4315900
4315400
4314900
4314400
4313900
Eastonville Rd
83
19
83
19
83
8
24
Map Scale: 1:21,700 if printed on A landscape (11" x 8.5") sheet.
N
0 300 600 1200 1800 Meters
0 1000 2000 4000 6000 Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

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 1:24,000.

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: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Sep 11, 2018—Jun 12, 2021

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
8	Blakeland loamy sand, 1 to 9 percent slopes	A	10.4	0.6%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	839.5	49.8%
83	Stapleton sandy loam, 3 to 8 percent slopes	B	835.7	49.6%
Totals for Area of Interest			**1,685.6**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

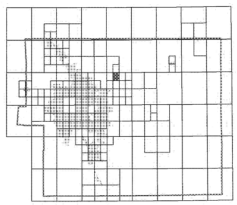
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

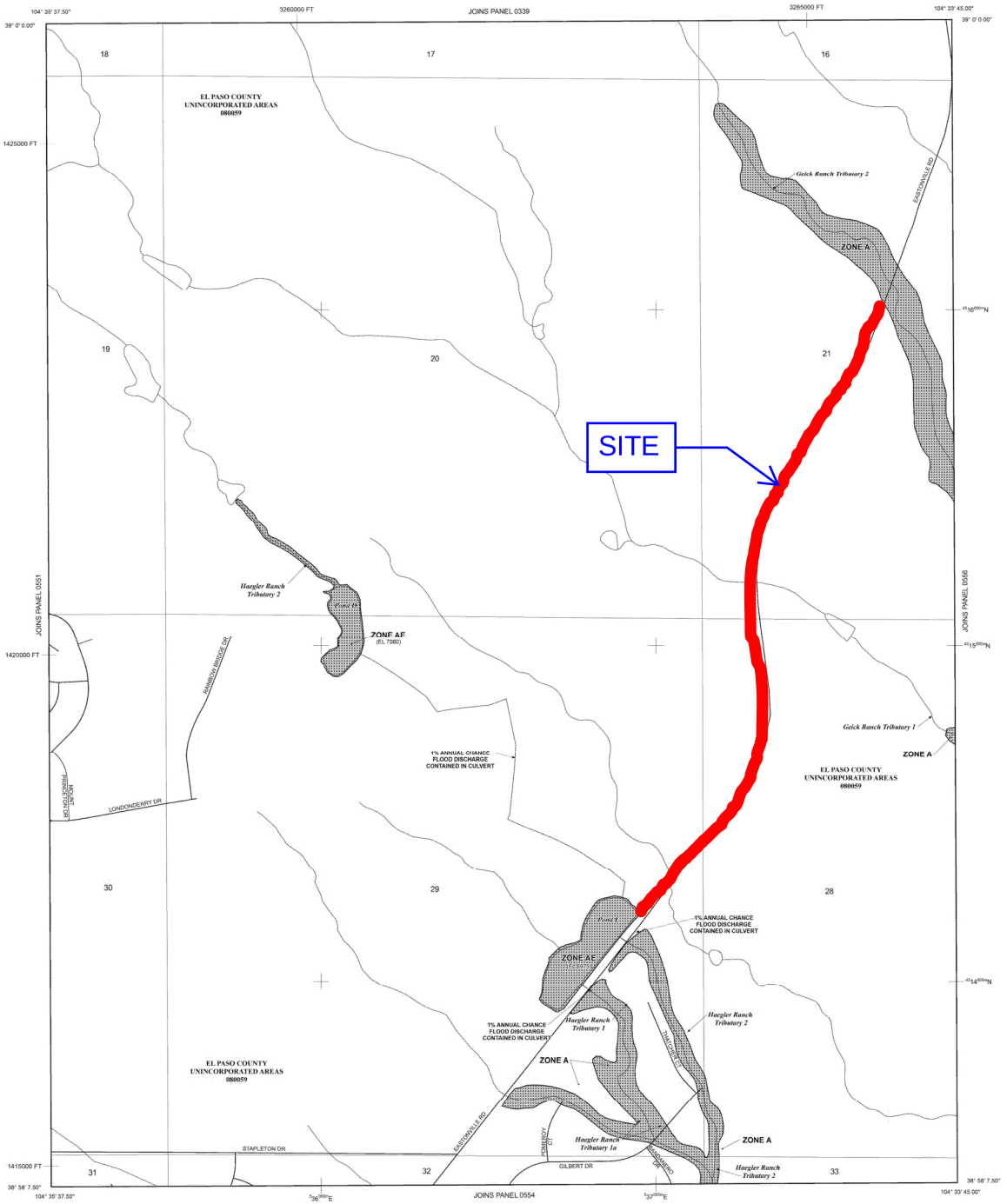
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 64 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary
Floodway boundary
Zone D Boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A — Cross section line
23 — 23 — Transect line
97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4175000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in 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.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0552G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 552 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0552	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0552G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

NOAA Atlas 14, Volume 8, Version 2
Location name: Elbert, Colorado, USA*
Latitude: 38.9796°, Longitude: -104.5696°
Elevation: 6996 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, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.239** (0.189-0.303)	**0.291** (0.231-0.370)	**0.381** (0.301-0.486)	**0.461** (0.361-0.589)	**0.576** (0.440-0.768)	**0.671** (0.499-0.904)	**0.770** (0.554-1.06)	**0.875** (0.604-1.24)	**1.02** (0.678-1.48)	**1.14** (0.733-1.67)
10-min	**0.350** (0.277-0.444)	**0.426** (0.338-0.542)	**0.558** (0.441-0.711)	**0.674** (0.529-0.863)	**0.844** (0.644-1.12)	**0.982** (0.731-1.32)	**1.13** (0.811-1.56)	**1.28** (0.884-1.81)	**1.49** (0.992-2.17)	**1.66** (1.07-2.44)
15-min	**0.426** (0.338-0.541)	**0.520** (0.412-0.660)	**0.681** (0.537-0.867)	**0.823** (0.645-1.05)	**1.03** (0.785-1.37)	**1.20** (0.891-1.62)	**1.37** (0.988-1.90)	**1.56** (1.08-2.21)	**1.82** (1.21-2.65)	**2.03** (1.31-2.98)
30-min	**0.608** (0.482-0.771)	**0.740** (0.586-0.940)	**0.968** (0.764-1.23)	**1.17** (0.916-1.49)	**1.46** (1.11-1.94)	**1.70** (1.26-2.28)	**1.94** (1.40-2.68)	**2.20** (1.52-3.12)	**2.57** (1.71-3.73)	**2.86** (1.84-4.19)
60-min	**0.775** (0.615-0.984)	**0.933** (0.739-1.18)	**1.21** (0.956-1.54)	**1.46** (1.15-1.87)	**1.84** (1.41-2.47)	**2.16** (1.61-2.92)	**2.49** (1.80-3.45)	**2.85** (1.97-4.05)	**3.37** (2.24-4.90)	**3.78** (2.44-5.54)
2-hr	**0.943** (0.754-1.19)	**1.12** (0.898-1.42)	**1.46** (1.16-1.84)	**1.76** (1.39-2.23)	**2.22** (1.72-2.97)	**2.62** (1.97-3.52)	**3.04** (2.21-4.19)	**3.50** (2.45-4.95)	**4.16** (2.80-6.03)	**4.70** (3.06-6.85)
3-hr	**1.03** (0.829-1.29)	**1.22** (0.978-1.53)	**1.57** (1.25-1.97)	**1.90** (1.51-2.40)	**2.41** (1.88-3.22)	**2.86** (2.17-3.84)	**3.34** (2.45-4.60)	**3.88** (2.73-5.48)	**4.66** (3.15-6.74)	**5.29** (3.46-7.69)
6-hr	**1.20** (0.968-1.48)	**1.40** (1.13-1.74)	**1.78** (1.44-2.22)	**2.16** (1.73-2.70)	**2.76** (2.18-3.66)	**3.28** (2.52-4.39)	**3.86** (2.86-5.29)	**4.51** (3.20-6.34)	**5.46** (3.73-7.86)	**6.24** (4.12-9.01)
12-hr	**1.38** (1.13-1.70)	**1.61** (1.31-1.98)	**2.05** (1.66-2.53)	**2.48** (2.00-3.07)	**3.15** (2.51-4.15)	**3.74** (2.89-4.96)	**4.39** (3.28-5.96)	**5.12** (3.66-7.13)	**6.17** (4.25-8.82)	**7.04** (4.69-10.1)
24-hr	**1.60** (1.31-1.95)	**1.87** (1.54-2.28)	**2.38** (1.94-2.91)	**2.85** (2.32-3.51)	**3.60** (2.88-4.67)	**4.24** (3.29-5.56)	**4.94** (3.71-6.63)	**5.71** (4.12-7.87)	**6.82** (4.73-9.66)	**7.73** (5.20-11.0)
2-day	**1.85** (1.54-2.24)	**2.18** (1.80-2.63)	**2.76** (2.28-3.34)	**3.29** (2.70-4.01)	**4.11** (3.30-5.27)	**4.80** (3.76-6.22)	**5.54** (4.19-7.36)	**6.35** (4.62-8.68)	**7.50** (5.25-10.5)	**8.44** (5.73-11.9)
3-day	**2.03** (1.69-2.44)	**2.39** (1.98-2.87)	**3.02** (2.50-3.64)	**3.60** (2.97-4.36)	**4.47** (3.60-5.69)	**5.20** (4.08-6.70)	**5.98** (4.55-7.90)	**6.83** (4.99-9.28)	**8.03** (5.65-11.2)	**9.00** (6.15-12.7)
4-day	**2.18** (1.82-2.61)	**2.56** (2.13-3.06)	**3.22** (2.68-3.87)	**3.82** (3.16-4.62)	**4.73** (3.83-6.00)	**5.49** (4.33-7.04)	**6.30** (4.81-8.30)	**7.18** (5.26-9.72)	**8.43** (5.94-11.7)	**9.43** (6.46-13.3)
7-day	**2.58** (2.17-3.07)	**2.98** (2.50-3.54)	**3.68** (3.08-4.39)	**4.32** (3.60-5.18)	**5.29** (4.30-6.65)	**6.09** (4.84-7.76)	**6.96** (5.34-9.09)	**7.89** (5.82-10.6)	**9.21** (6.55-12.8)	**10.3** (7.10-14.4)
10-day	**2.93** (2.48-3.47)	**3.36** (2.84-3.98)	**4.13** (3.47-4.90)	**4.81** (4.02-5.74)	**5.83** (4.76-7.28)	**6.68** (5.32-8.45)	**7.58** (5.85-9.86)	**8.55** (6.34-11.4)	**9.92** (7.08-13.7)	**11.0** (7.65-15.4)
20-day	**3.91** (3.33-4.58)	**4.51** (3.84-5.29)	**5.52** (4.68-6.50)	**6.39** (5.39-7.55)	**7.63** (6.25-9.37)	**8.62** (6.90-10.8)	**9.64** (7.47-12.4)	**10.7** (7.98-14.1)	**12.2** (8.74-16.6)	**13.3** (9.31-18.4)
30-day	**4.70** (4.02-5.47)	**5.44** (4.65-6.34)	**6.65** (5.66-7.78)	**7.66** (6.49-9.00)	**9.06** (7.44-11.0)	**10.1** (8.15-12.5)	**11.2** (8.74-14.3)	**12.3** (9.24-16.2)	**13.8** (9.98-18.7)	**15.0** (10.5-20.6)
45-day	**5.67** (4.88-6.57)	**6.55** (5.63-7.60)	**7.97** (6.82-9.27)	**9.12** (7.77-10.7)	**10.7** (8.79-12.9)	**11.9** (9.56-14.5)	**13.0** (10.2-16.4)	**14.2** (10.6-18.4)	**15.6** (11.3-21.0)	**16.7** (11.9-23.0)
60-day	**6.48** (5.60-7.48)	**7.46** (6.43-8.62)	**9.01** (7.74-10.4)	**10.3** (8.77-11.9)	**11.9** (9.82-14.3)	**13.1** (10.6-16.0)	**14.3** (11.2-18.0)	**15.5** (11.7-20.0)	**16.9** (12.3-22.6)	**18.0** (12.8-24.6)

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

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

Please refer to NOAA Atlas 14 document for more information.

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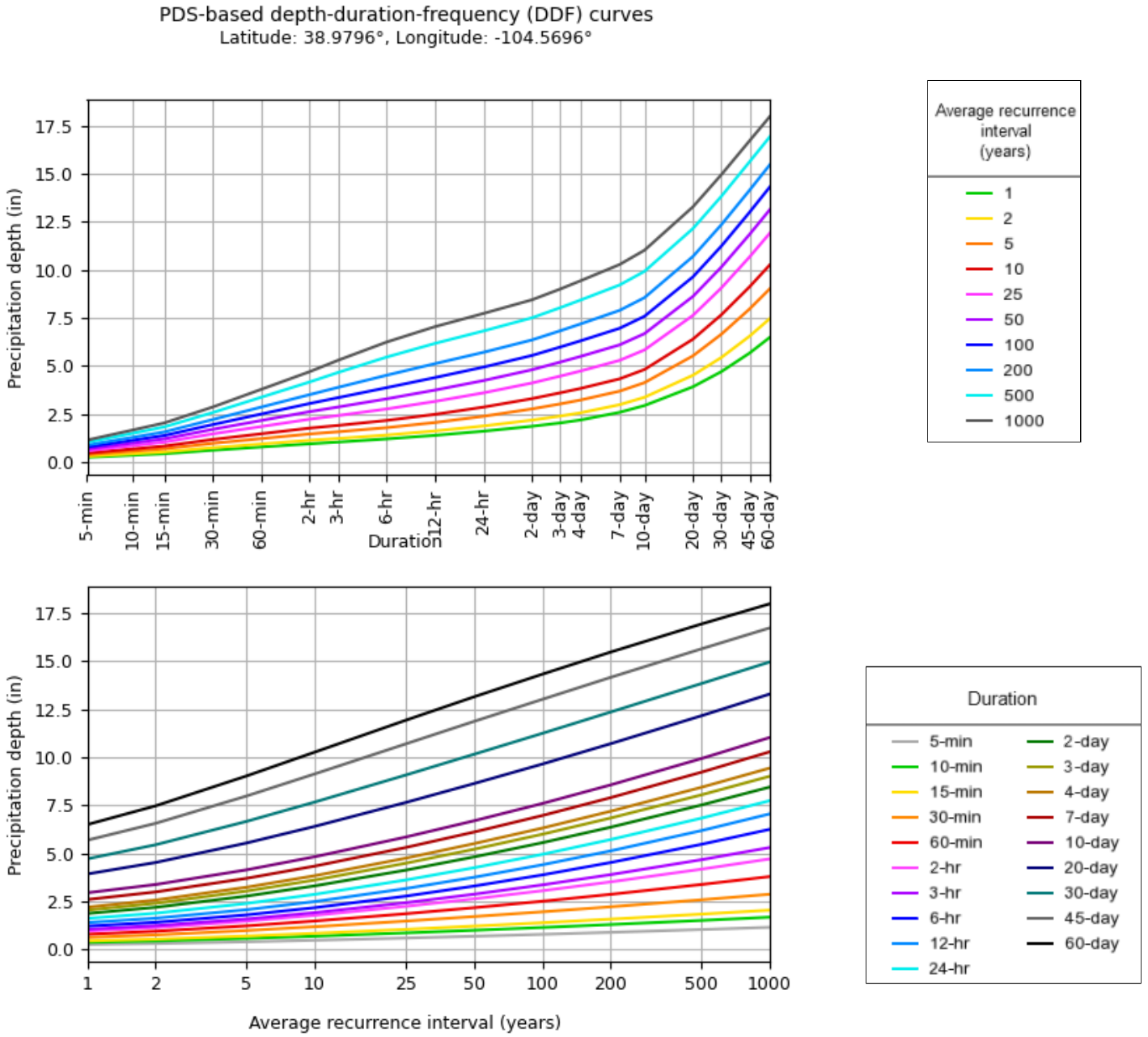
PF graphical



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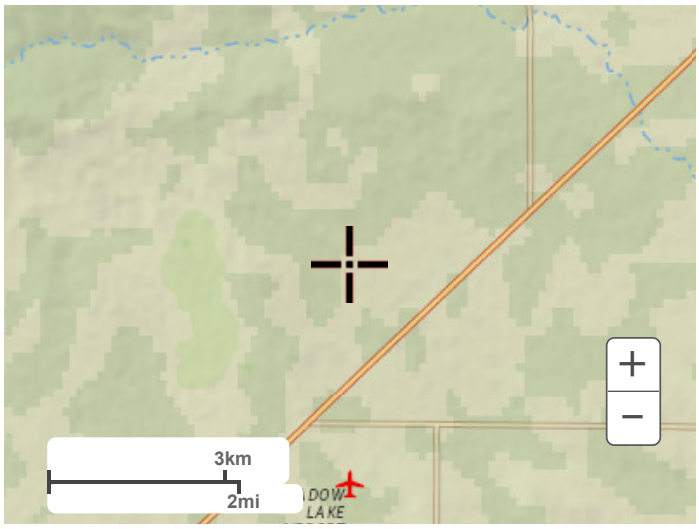
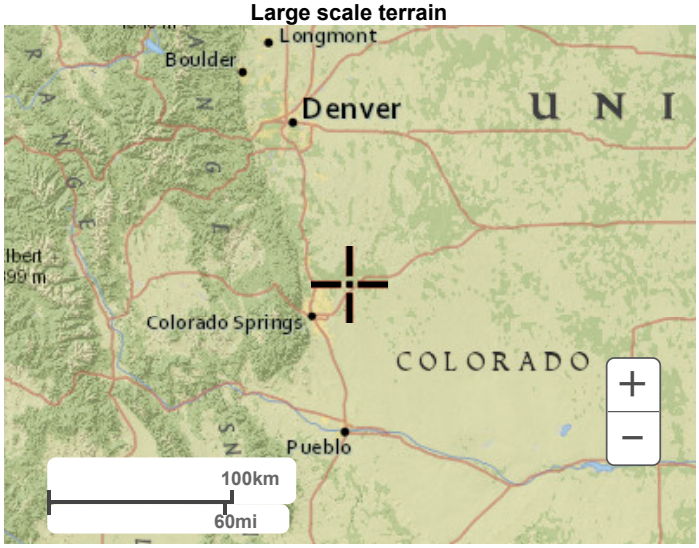
Maps & aerials

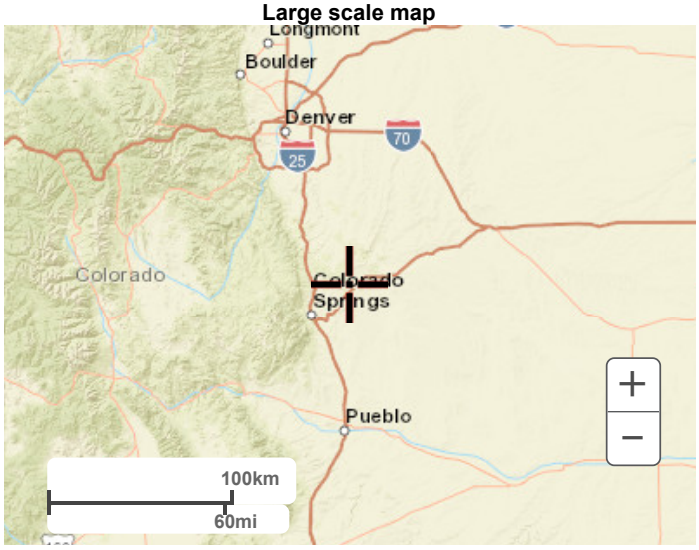
Small scale terrain



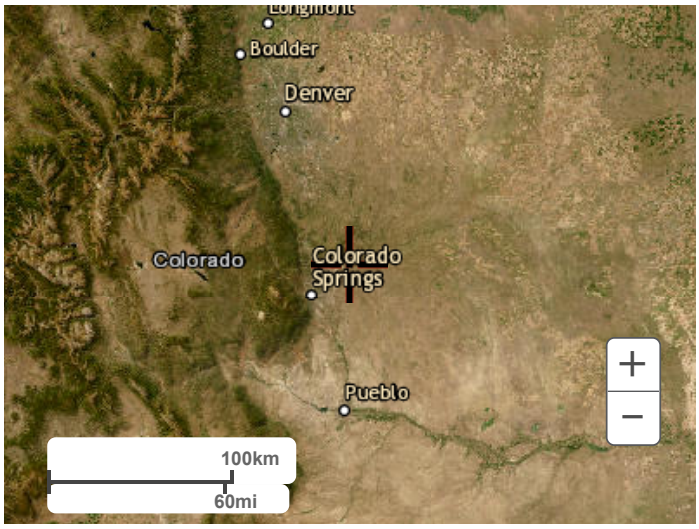
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX B – HYDROLOGIC CALCULATIONS

EASTONVILLE ROAD	**Calc'd by:**	**SPC**
EXISTING CONDITIONS	**Checked by:**	**CM**
EL PASO COUNTY, CO	**Date:**	**8/28/2024**

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
G18*	321.53	-	28.3	365.2
FG36*	18.88	-	1.7	18.8
G16*	131.26	-	6.1	112.1
G06*	832.70	-	22.4	491.0
EX5	12.19	2	2.7	18.0
EX6	0.61	2	0.1	0.9
EX7	1.90	2	0.4	2.5
EX8	2.86	2	0.6	4.0

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	G18*	28.3	365.2
2	FG36*	1.7	18.8
3	G16*	6.1	112.1
4	G06*	22.4	491.0
O3	EX7	6.5	114.6
O3.1	EX7	0.1	0.9
O4	EX7	23.0	495.0
13.1	EX7	2.7	18.0

*** AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR**

HRGreen	**EASTONVILLE ROAD**								**Calc'd by:**	**SPC**									
	EXISTING CONDITIONS								**Checked by:**	**CM**									
	EL PASO COUNTY, CO								**Date:**	**8/28/2024**									

COMPOSITE 'C' FACTORS

BASIN	UNDEVELOPED	WALKS & DRIVES	SINGLE FAMILY	TOTAL	SOIL TYPE	UNDEVELOPED			WALKS & DRIVES			SINGLE FAMILY			COMPOSITE IMPERVIOUSNESS & C		
	ACRES					%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}
EX1 - EX4*																	
EX5	12.19	0.00	0.00	12.19	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	2	0.09	0.36
EX6	0.61	0.00	0.00	0.61	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	2	0.09	0.36
EX7	1.90	0.00	0.00	1.90	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	2	0.09	0.36
EX8	2.86	0.00	0.00	2.86	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	2	0.09	0.36

* FLOWS TO DESIGN POINTS 1-4 WERE TAKEN FROM "THE SANCTUARY FILING 1 FDR" SO C WAS NOT CALCULATED FOR CONTRIBUTING AREAS EX1 - EX4

HRGreen	**EASTONVILLE ROAD**	**Calc'd by:**	**SPC**
	EXISTING CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**8/28/2024**

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)
EX1-EX4*											
EX5	0.09	12.19	300	2.8	22.8	10	835	3.0	1.7	8.0	30.8
EX6	0.09	0.61	180	1.3	22.8	10	411	1.6	1.3	5.4	28.2
EX7	0.09	1.90	116	1.5	17.4	10	1137	1.0	1.0	19.0	36.4
EX8	0.09	2.86	60	1.4	12.8	10	1302	1.1	1.0	20.7	33.5

* FLOWS TO THESE DESIGN POINTS WERE TAKEN FROM "THE SANCTUARY FILING 1 FDR" SO TC WAS NOT CALCULATED FOR CONTRIBUTING AREAS EX1 - EX4

FORMULAS:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{0.5}$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

HRGreen

EASTONVILLE ROAD
EXISTING CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	8/28/2024

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
	1	G18*	321.53									28.3											DP 1 CAPTURED IN GIECK RANCH TRIB #2 (CHANNEL B)
	2	FG36*	18.88									1.7											DP 2 CAPTURED IN 24" RCP CULVERT, PIPED TO BASIN EX3
	* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR 3	G16*	131.26									6.1											BASIN EX2, DP2 & DPG15 (SANCTUARY FDR Q5=3 CFS) CAPTURED IN 24" CMP CULVERT, PIPED ACROSS EASTONVILLE ROAD
	4	G06*	832.70									22.4											BASIN EX4 & DPG12 (SANCTUARY FDR Q5 = 21 CFS) CAPTURED IN 18" CMP CULVERT, PIPED ACROSS EASTONVILLE ROAD TO GIECK RANCH TRIB #1 (CHANNEL A)
																							* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR
	O3	EX7	1.90	0.09	36.4	0.17	2.19	0.4				6.5											* TOTAL FLOW INCLUDES Q TAKEN FROM DP3 FROM THE SANCTUARY FILING 1 FDR
	O3.1	EX6	0.61	0.09	28.2	0.05	2.58	0.1				0.1											
	O4	EX8	2.86	0.09	33.5	0.26	2.32	0.6				23.0											* TOTAL FLOW INCLUDES Q TAKEN FROM DP4 FROM THE SANCTUARY FILING 1 FDR
	13.1	EX5	12.19	0.09	30.8	1.10	2.44	2.7				2.7											

HRGreen

EASTONVILLE ROAD
EXISTING CONDITIONS
DESIGN STORM: 100-YEAR

Calc'd by:	SCP
Checked by:	CM
Date:	8/28/2024

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
	1	G18*	321.53									365.2											DP 1 CAPTURED IN GIECK RANCH TRIB #2 (CHANNEL B)
	2	FG36*	18.88									18.8											DP 2 CAPTURED IN 24" RCP CULVERT, PIPED TO BASIN EX3
	* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR 3	G16*	131.26									112.1											BASIN EX2, DP2 & DPG15 (SANCTUARY FDR Q5=3 CFS) CAPTURED IN 24" CMP CULVERT, PIPED ACROSS EASTONVILLE ROAD
	4	G06*	832.70									491.0											BASIN EX4 & DPG12 (SANCTUARY FDR Q5 = 21 CFS) CAPTURED IN 18" CMP CULVERT, PIPED ACROSS EASTONVILLE ROAD TO GIECK RANCH TRIB #1 (CHANNEL A)
																							* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR
	O3	EX7	1.90	0.36	36.4	0.68	3.68	2.5				114.6											* TOTAL FLOW INCLUDES Q TAKEN FROM DP3 FROM THE SANCTUARY FILING 1 FDR
	O3.1	EX6	0.61	0.36	28.2	0.22	4.32	0.9				0.9											
	O4	EX8	2.86	0.36	33.5	1.03	3.89	4.0				495.0											* TOTAL FLOW INCLUDES Q TAKEN FROM DP4 FROM THE SANCTUARY FILING 1 FDR
	13.1	EX5	12.19	0.36	30.8	4.39	4.10	18.0				18.0											

EASTONVILLE ROAD SEG 2	**Calc'd by:**	**SPC**
PROPOSED CONDITIONS	**Checked by:**	**CM**
EL PASO COUNTY, CO	**Date:**	**8/28/2024**

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
EA1	0.22	73	0.8	1.5
EA2	0.25	72	0.9	1.7
EA3	0.20	70	0.7	1.3
EA4	0.17	65	0.5	1.1
EA5	0.16	0	0.1	0.4
EA6	0.25	76	0.8	1.4
EA7	0.20	50	0.4	1.0
EA8	2.08	99	5.2	8.8
EA9	3.14	60	5.0	10.6
EA10	0.16	75	0.6	1.1
EA11	0.15	67	0.5	1.0
EA12	0.34	0	0.1	1.0
EA13	0.45	73	1.4	2.8
EA14	1.48	21	1.2	3.8
EA15	0.76	24	0.7	2.1
EA16	1.18	0	0.3	2.5
EA17	0.30	0	0.1	0.7
*G18	321.53	-	28.3	365.2
*FG36	18.88	-	1.7	18.8
OS3	1.00	2	0.3	2.2
OS4	9.60	9	4.8	21.6
*G16	131.26	-	6.1	112.1
*G06	832.70	-	22.4	491.0
OS7	11.29	3	3.9	24.6

* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	G18	28.3	365.2
2	FG36	1.7	18.8
2.1	EA1	0.8	1.5
3	G16	6.1	112.1
3.1	EA2, DP2.1	1.6	3.2
4	G06	22.4	491.0
4.1	EA5, DP3.1	1.7	3.4
5	EA3	0.7	1.3
6	DP5, EA4	1.2	2.4
6.1	DP6, DP8	2.9	22.4
7	OS3	0.3	2.2
8	DP2, DP7	2.0	21.0
9	DP6.1	2.9	22.4
10	EA6, EA7	1.2	2.3
11	OS4, DP9	7.5	44.0
12	OS7	3.9	24.6
13	DP11.1, DP12	10.0	180.6
14	EA8	5.2	8.8
15	EA9	5.0	10.6
15.1	DP14, DP15	10.2	19.3
16.1	EA10	0.6	1.1
17.1	EA11	0.5	1.0
O3	EA15	0.7	2.1
O3.1	-	0.0	0.0
O4	EA12, DP4	22.5	492.0
O4.1	EA13	1.4	2.8
O4.2	EA14	1.2	3.8
10.1	EA17	0.1	0.7
11.1	DP3, DP11	13.6	156.1
13.1	EA16, DP13	0.3	183.1

EASTONVILLE ROAD SEG 2
PROPOSED CONDITIONS
EL PASO COUNTY, CO

Calc'd by: SPC
Checked by: CM
Date: 11/27/2023

SOIL TYPE: HSG A&B

COMPOSITE 'C' FACTORS

BASIN	LAND USE TYPE															TOTAL	COMPOSITE IMPERVIOUSNESS & C FACTOR		
	Paved			Historic Flow Analysis-- Greenbelts, Agriculture			Lawns			Gravel			Drive and Walks						
	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}				
	100	0.90	0.96	2	0.09	0.36	0	0.08	0.35	80	0.59	0.70	100	0.90	0.96				
	ACRES			ACRES			ACRES			ACRES			ACRES			ACRES	%I	C_5	C_{100}
EA1	0.16						0.06									0.22	73	0.68	0.79
EA2	0.18						0.07									0.25	72	0.67	0.79
EA3	0.14						0.06									0.20	70	0.65	0.78
EA4	0.11						0.06									0.17	65	0.61	0.74
EA5	0.00						0.16									0.16	0	0.08	0.35
EA6	0.19						0.06									0.25	76	0.71	0.82
EA7	0.10						0.10									0.20	50	0.49	0.65
EA8	2.06						0.02									2.08	99	0.89	0.95
EA9	1.88						1.26									3.14	60	0.57	0.72
EA10	0.12						0.04									0.16	75	0.70	0.81
EA11	0.10						0.05									0.15	67	0.63	0.76
EA12							0.34									0.34	0	0.08	0.35
EA13	0.33						0.12									0.45	73	0.68	0.80
EA14							1.16			0.07			0.25			1.48	21	0.24	0.47
EA15							0.57			0.04			0.15			0.76	24	0.27	0.49
EA16							1.18									1.18	0	0.08	0.35
EA17							0.30									0.30	0	0.08	0.35
G18																321.53			
FG36																18.88			
OS3				1.00												1.00	2	0.09	0.36
OS4	0.70			8.90												9.60	9	0.15	0.40
OS5				40.26												40.26	2	0.09	0.36
G16																131.26			
G06																832.70			
OS7				11.16						0.03			0.10			11.29	3	0.10	0.37
SFB C	0.34			0.00			0.29									0.63	54		

COMPOSITE 'C' FACTORS

	LAND USE TYPE															TOTAL	COMPOSITE IMPERVIOUSNESS & C FACTOR		
	Paved			Historic Flow Analysis-- Greenbelts, Agriculture			Lawns			Gravel			Drive and Walks						
	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}				
	100	0.90	0.96	2	0.09	0.36	0	0.08	0.35	80	0.59	0.70	100	0.90	0.96				
BASIN	ACRES			ACRES			ACRES			ACRES			ACRES			ACRES	%I	C_5	C_{100}
EDB B	5.92			0.00			2.99			0.09			0.01			9.02	67		

HRGreen	**EASTONVILLE ROAD SEG 2**	**Calc'd by:**	**SPC**
	PROPOSED CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**8/28/2024**

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)
EA1	0.68	0.22	34	2.0	3.6	20	137	1.4	2.4	1.0	5.0
EA2	0.67	0.25	34	2.0	3.6	20	60	1.4	2.4	0.4	5.0
EA3	0.65	0.20	34	2.0	3.8	20	126	1.4	2.4	0.9	5.0
EA4	0.61	0.17	34	2.0	4.2	20	126	3.8	3.9	0.5	5.0
EA5	0.08	0.16	20	2.0	6.6	20	20	33.0	11.5	0.0	6.7
EA6	0.71	0.25	26	2.0	2.9	20	630	1.7	2.6	4.0	7.0
EA7	0.49	0.20	24	2.0	4.4	20	630	1.7	2.6	4.0	8.4
EA8	0.89	2.08	26	2.0	1.5	20	2500	0.7	1.7	24.9	26.4
EA9	0.57	3.14	26	2.0	3.9	20	2500	0.7	1.7	24.9	28.8
EA10	0.70	0.16	26	2.0	3.0	20	157	0.6	1.5	1.7	5.0
EA11	0.63	0.15	26	2.0	3.5	20	157	0.6	1.5	1.7	5.2
EA12	0.08	0.34	30	25.0	3.5	10	0	0.0	0.0	0.0	5.0
EA13	0.68	0.45	76	2.0	5.3	10	115	2.0	1.4	1.4	6.7
EA14	0.24	1.48	50	10.0	5.2	10	1300	1.1	1.0	20.7	25.8
EA15	0.27	0.76	50	10.0	5.0	10	1137	1.0	1.0	19.0	24.0
EA16	0.08	1.18	300	3.0	22.5	10	500	3.0	1.7	4.8	27.3
EA17	0.08	0.30	89	5.0	10.3	10	0	0.0	0.0	0.0	10.3
G18											
FG36											
OS3	0.09	1.00	220	2.1	21.4	10	345	2.3	1.5	3.8	25.2
OS4	0.15	9.60	153	3.1	14.8	10	1124	2.5	1.6	11.8	26.6
OS5	0.09	40.26	300	2.7	23.0	10	1400	2.7	1.6	14.2	37.2
G16											
G06											
OS7	0.10	11.29	200	11.6	11.5	10	675	3.4	1.8	6.1	17.6

FORMULAS:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{0.5}$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5

HRGreen	**EASTONVILLE ROAD SEG 2**	**Calc'd by:**	**SPC**
	PROPOSED CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**8/28/2024**

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)

Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

HRGreen

EASTONVILLE ROAD SEG 2

PROPOSED CONDITIONS

DESIGN STORM: 5-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	8/28/2024

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min)	
	1	G18	321.53					28.3				**28.3**											
	2	FG36	18.88					1.7				**1.7**											
	2.1	EA1	0.22	0.68	5.0	0.15	5.17	0.8	5.0	0.15	5.17	**0.8**				0.8	0.15	1.0	1.5	56	5.9	0.16	BASIN EA1 CAPTURED IN 5' TYPE R INLET @ DP2, PIPE TO DP3.1
	3	G16						6.1				**6.1**											
	3.1	EA2	0.25	0.67	5.0	0.17	5.17	0.9	5.0	0.32	5.17	**1.6**				1.6	0.32	5.1	1.5	34	13.4	0.04	BASIN EA2 CAPTURED IN 5' TYPE R INLET@ DP3, PIPE TO DP3.1
	4	G06						22.4				**22.4**											
	4.1	EA5	0.16	0.08	6.7	0.01	4.74	0.1	6.7	0.33	5.17	**1.7**											COMBINED DP2.1 & DP3.1 @ DP3.1, PIPE TO DP4 (POND A)
	5	EA3	0.20	0.65	5.0	0.13	5.17	0.7	5.0	0.13	5.17	**0.7**				0.7	0.13	0.5	1.3	48	3.7	0.21	BASIN EA3 CAPTURED IN 5' TYPE R INLET @ DP5, PIPE TO DP6.1
	6	EA4	0.17	0.61	5.0	0.10	5.17	0.5	5.2	0.23	5.11	**1.2**				1.2	0.23	2.4	1.3	43	8.1	0.09	BASIN EA4 CAPTURED IN 5' TYPE R INLET @ DP6, PIPE TO DP6.1
	6.1								13.2	0.32	3.71	**2.9**				2.9	0.32	1.0	2.0	61	7.2	0.14	DP6 & DP8 FLOW @ DP6.1, PIPE TO DP9
	7	OS3	1.00	0.09	13.1	0.09	3.72	0.3	13.1	0.09	3.72	**0.3**				0.3	0.09	0.8	2.0	43	6.4	0.11	BASIN OS3 CAPTURED IN 15" FES, PIPE TO DP8
	8	OS3	1.00	0.09	13.1	0.09	3.72	0.3	13.1	0.09	3.72	**2.0**				2.0	0.09	1.5	1.3	38	6.4	0.10	DP2 & DP7 FLOW @ DP8, PIPE TO DP9
	9								13.2	0.32	3.71	**2.9**	2.9	0.32	2.1					615	2.9	3.56	DP6.1 @ DP9, DISCHARGE TO ROADSIDE SWALE TO DP11
	10	EA6	0.25	0.71	7.0	0.18	4.67	0.8	8.4	0.28	4.39	**1.2**											BASIN EA6 & EA7 @ DP10 (TEMPORARY SEDIMENT BASIN #1)
		EA7	0.20	0.49	8.4	0.10	4.39	0.4															
	11	OS4	9.60	0.15	17.1	1.43	3.32	4.8	17.1	1.76	3.32	**7.5**				7.5	1.76	2.0	2.0	85	10.2	0.14	BASIN OS4, DP9.1 CAPTURED & MERIDIAN RANCH DPG15 (3 CFS) IN TYPE D INLET AT DP11
	12	OS7	11.29	0.10	14.9	1.12	3.53	3.9	14.9	1.12	3.53	**3.9**				3.9	1.12	1.0	1.5	28	5.9	0.08	BASIN OS7 CAPTURED @ DP12 IN TYPE C INLET, PIPE TO DP13
	13								14.9	1.12	3.53	**10.0**											COMBINED DP3 & DP12, PIPE TO CHANNEL B
	14	EA8	2.08	0.89	24.0	1.86	2.81	5.2	24.0	1.86	2.81	**5.2**				5.2	1.86	7.0	1.5	8	15.7	0.01	BASIN EA8 CAPTURED IN 10' TYPE R SUMP @ DP14, PIPE TO DP15.1
	15	EA9	3.14	0.57	24.0	1.79	2.81	5.0	24.0	1.79	2.81	**5.0**				5.0	1.79	1.8	1.5	54	7.9	0.11	BASIN EA8 CAPTURED IN 10' TYPE R SUMP @ DP15, PIPE TO DP15.1
	15.1								24.1	3.65	2.81	**10.2**											COMBINED DP14 & DP15, PIPE TO DP18 OF THE EASTONVILLE ROAD SEGMENT 1 FDR
	16.1	EA10	0.16	0.70	5.0	0.11	5.17	0.6	5.0	0.11	5.17	**0.6**											BASIN EA10 CONVEYED VIA CURB & GUTTER TO 10' TYPE R INLET. INLET DESIGN IS PROVIDED IN THE EASTONVILLE ROAD SEGMENT 1 FDR
	17.1	EA11	0.15	0.63	5.2	0.09	5.11	0.5	5.2	0.09	5.11	**0.5**											BASIN EA11 CONVEYED VIA CURB & GUTTER TO 10' TYPE R INLET. INLET DESIGN IS PROVIDED IN THE EASTONVILLE ROAD SEGMENT 1 FDR
	O3	EA15	0.76	0.27	16.6	0.21	3.37	0.7	16.6	0.21	3.37	**0.7**											
	O3.1	NA						0.0				**0.0**											
	O4	EA12	0.34	0.08	5.0	0.03	5.17	0.1				**22.5**											
	O4.1	EA13	0.45	0.68	6.7	0.30	4.73	1.4	6.7	0.30	4.73	**1.4**											

HRGreen

EASTONVILLE ROAD SEG 2
PROPOSED CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	8/28/2024

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min)	
	O4.2	EA14	1.48	0.24	17.5	0.36	3.29	1.2	17.5	0.36	3.29	**1.2**											
	10.1	EA17	0.30	0.08	10.3	0.02	4.08	0.1	10.3	0.02	4.08	**0.1**											
	11.1											**13.6**											
	13.1	EA16	1.18	0.08	14.4	0.09	3.58	0.3	14.4	0.09	3.58	**0.3**											

EASTONVILLE ROAD SEG 2

PROPOSED CONDITIONS

DESIGN STORM: 100-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	8/28/2024

HRGreen

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min	
	1	G18						365.2				**365.2**											
	2	FG36						18.8				**18.8**											
	2.1	EA1	0.22	0.79	5.0	0.17	8.68	1.5	5.0	0.17	8.68	**1.5**				1.5	0.17	1.0	1.5	56	5.9	0.16	BASIN EA1 CAPTURED IN 5' TYPE R INLET @ DP2, PIPE TO DP3.1
	3	G16						112.1				**112.1**				112.1	0.00	5.1	1.5	34	13.4	0.04	
	3.1	EA2	0.25	0.79	5.0	0.20	8.68	1.7	5.0	0.37	8.66	**3.2**											BASIN EA2 CAPTURED IN 5' TYPE R INLET@ DP3, PIPE TO DP3.1
	4	G06						491.0				**491.0**				491.0	0.00	0.5	1.3	48	3.7	0.21	
	4.1	EA5	0.16	0.35	6.7	0.06	7.95	0.4	6.7	0.43	7.95	**3.4**				3.4	0.43	2.4	1.3	43	8.1	0.09	COMBINED DP2.1 & DP3.1 @ DP3.1, PIPE TO DP4 (POND A)
	5	EA3	0.20	0.78	5.0	0.16	8.68	1.3	5.0	0.16	8.68	**1.3**				1.3	0.16	1.0	2.0	61	7.2	0.14	BASIN EA3 CAPTURED IN 5' TYPE R INLET @ DP5, PIPE TO DP6.1
	6	EA4	0.17	0.74	5.0	0.13	8.68	1.1	5.1	0.28	8.61	**2.4**				2.4	0.28	0.8	2.0	43	6.4	0.11	BASIN EA4 CAPTURED IN 5' TYPE R INLET @ DP6, PIPE TO DP6.1
	6.1								16.7	0.64	5.64	**22.4**				22.4	0.64	1.5	1.3	38	6.4	0.10	DP6 & DP8 FLOW @ DP6.1, PIPE TO DP9
	7	OS3	1.00	0.36	13.1	0.36	6.24	2.2	13.1	0.36	6.24	**2.2**				2.2	0.36	1.0	2.0	56	7.2	0.13	BASIN OS3 CAPTURED IN 15" FES, PIPE TO DP8
	8	OS3	1.00	0.36	13.1	0.36	6.24	2.2	13.1	0.36	6.24	**21.0**	21.0	0.36	2.1					615	2.9	3.56	DP2 & DP7 FLOW @ DP8, PIPE TO DP9
	9								16.8	0.64	5.63	**22.4**											DP6.1 @ DP9, DISCHARGE TO ROADSIDE SWALE TO DP11
	10	EA6	0.25	0.71	7.0	0.18	7.85	1.4	8.4	0.31	7.37	**2.3**											BASIN EA6 & EA7 @ DP10 (TEMPORARY SEDIMENT BASIN #1)
		EA7	0.20	0.65	8.4	0.13	7.37	1.0					0.0	0.00	0.5					530	1.4	6.25	
	11	OS4	9.60	0.40	17.1	3.88	5.58	21.6	17.1	4.52	5.58	**44.0**				44.0	4.52	1.0	4.0	1500	11.4	2.19	BASIN OS4, DP9.1 CAPTURED & MERIDIAN RANCH DPG15 (3 CFS) IN 30" FES @ DP11, SWALE TO DP3
	12	OS7	11.29	0.37	14.9	4.14	5.93	24.6	14.9	4.14	5.93	**24.6**				24.6	4.14	1.0	1.5	28	5.9	0.08	BASIN OS7 CAPTURED @ DP12 IN TYPE C INLET, PIPE TO DP13
	13								14.9	4.14	5.92	**180.6**											COMBINED DP3 & DP12, PIPE TO CHANNEL B
	14	EA8	2.08	0.89	24.0	1.86	4.72	8.8	24.0	1.86	4.72	**8.8**				8.8	1.86	7.0	1.5	8	15.7	0.01	BASIN EA8 CAPTURED IN 10' TYPE R SUMP @ DP14, PIPE TO DP15.1
	15	EA9	3.14	0.72	24.0	2.25	4.72	10.6	24.0	2.25	4.72	**10.6**				10.6	2.25	1.8	1.5	54	7.9	0.11	BASIN EA8 CAPTURED IN 10' TYPE R SUMP @ DP15, PIPE TO DP15.1
	15.1								24.1	4.10	4.71	**19.3**											COMBINED DP14 & DP15, PIPE TO DP18 OF THE EASTONVILLE ROAD SEGMENT 1 FDR
	16.1	EA10	0.16	0.81	5.0	0.13	8.68	1.1	5.0	0.13	8.68	**1.1**											BASIN EA10 CONVEYED VIA CURB & GUTTER TO 10' TYPE R INLET. INLET DESIGN IS PROVIDED IN THE EASTONVILLE ROAD SEGMENT 1 FDR
	17.1	EA11	0.15	0.76	5.2	0.11	8.58	1.0	5.2	0.11	8.58	**1.0**											BASIN EA11 CONVEYED VIA CURB & GUTTER TO 10' TYPE R INLET. INLET DESIGN IS PROVIDED IN THE EASTONVILLE ROAD SEGMENT 1 FDR
	O3	EA15	0.76	0.49	16.6	0.37	5.66	2.1	16.6	0.37	5.66	**2.1**											TOTAL FLOW OFFSITE AT DP O3
	O3.1	NA										**0.0**											
	O4	EA12	0.34	0.35	5.0	0.12	8.68	1.0				**492.0**											TOTAL FLOW OFFSITE AT DP4
	O4.1	EA13	0.45	0.80	6.7	0.36	7.95	2.8	6.7	0.36	7.95	**2.8**											TOTAL FLOW OFFSITE AT DP4.1
	O4.2	EA14	1.48	0.47	17.5	0.69	5.52	3.8	17.5	0.69	5.52	**3.8**											TOTAL FLOW OFFSITE AT DP4.2
	10.1	EA17	0.30	0.35	10.3	0.11	6.85	0.7	10.3	0.11	6.85	**0.7**											TOTAL FLOW OFFSITE AT DP10.1

HRGreen	EASTONVILLE ROAD SEG 2	Calc'd by:	SPC
	PROPOSED CONDITIONS	Checked by:	CM
	DESIGN STORM: 100-YEAR	Date:	8/28/2024

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min	
	11.1											**156.1**											TOTAL FLOW TO DP 11.1
	13.1	EA16	1.18	0.35	14.4	0.41	6.01	2.5	14.4	0.41	6.01	**183.1**											TOTAL FLOW OFFSITE AT DP 13.1

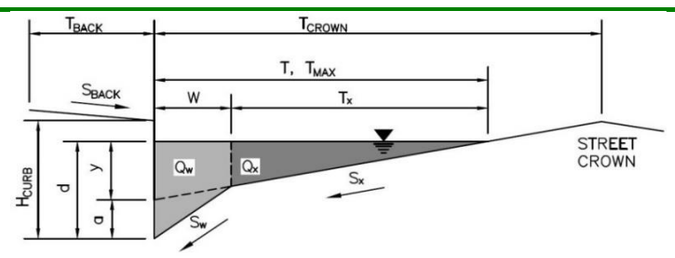
APPENDIX C – HYDRAULIC CALCULATIONS

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Eastonville Road

Inlet ID: DP2.1



Gutter Geometry:

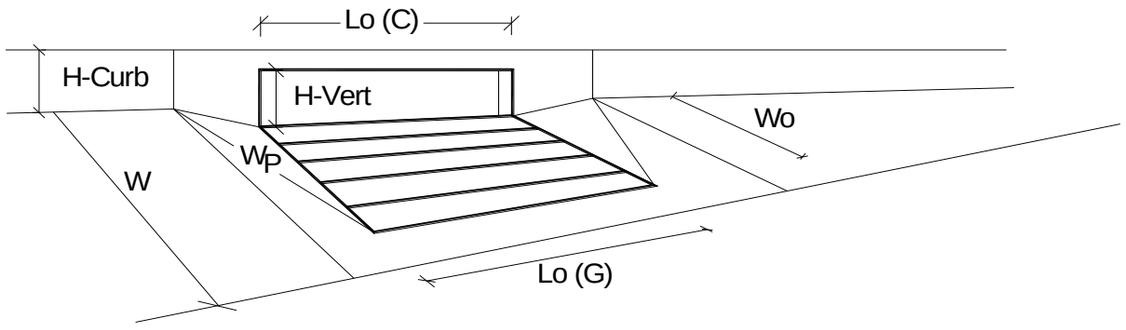
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	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	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.9	8.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



CDOT Type R Curb Opening

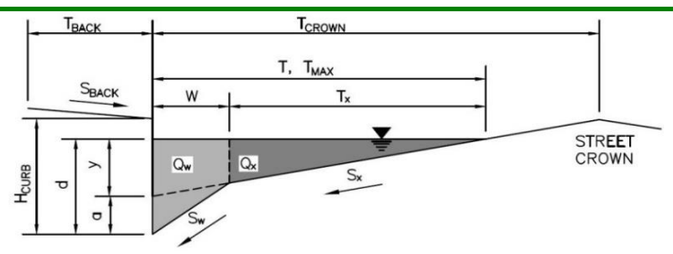
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.9	7.3	Override Depths
Grate Information		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
Area Opening 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	
Curb Opening Information		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 (see USDCM Figure ST-5)	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	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.32	0.44	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.75	0.93	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.1**	**8.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.8	1.5	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Eastonville Road**

Inlet ID: **DP3.1**



Gutter Geometry:

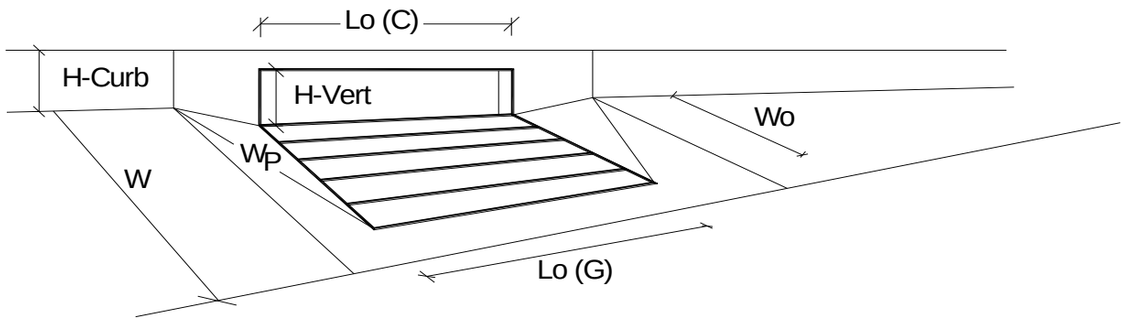
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	11.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	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	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.9	8.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



CDOT Type R Curb Opening

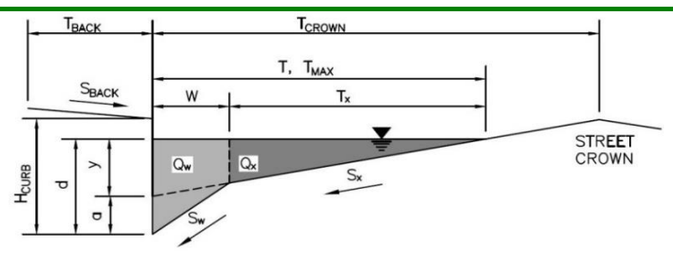
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.9	7.3	☐ Override Depths
Grate Information		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
Area Opening 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	
Curb Opening Information		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 (see USDCM Figure ST-5)	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	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.32	0.44	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.75	0.93	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.1**	**8.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.9	1.7	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Eastonville Road**

Inlet ID: **DP5**



Gutter Geometry:

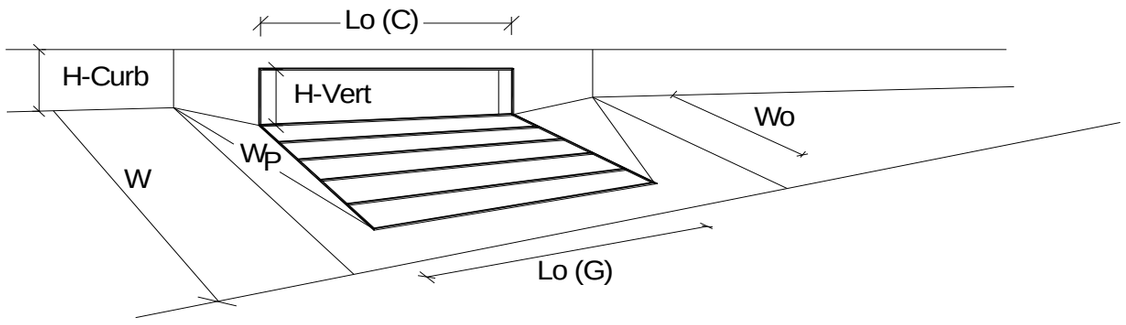
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	11.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	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	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.9	8.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



CDOT Type R Curb Opening

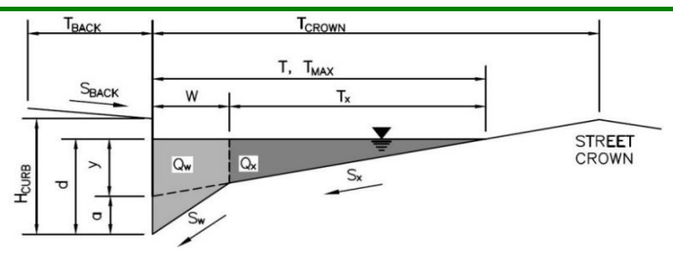
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.9	7.3	☐ Override Depths
Grate Information		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
Area Opening 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	
Curb Opening Information		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 (see USDCM Figure ST-5)	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	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.32	0.44	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.75	0.93	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.1**	**8.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.7	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: **Eastonville Road**

Inlet ID: **DP6**



Gutter Geometry:

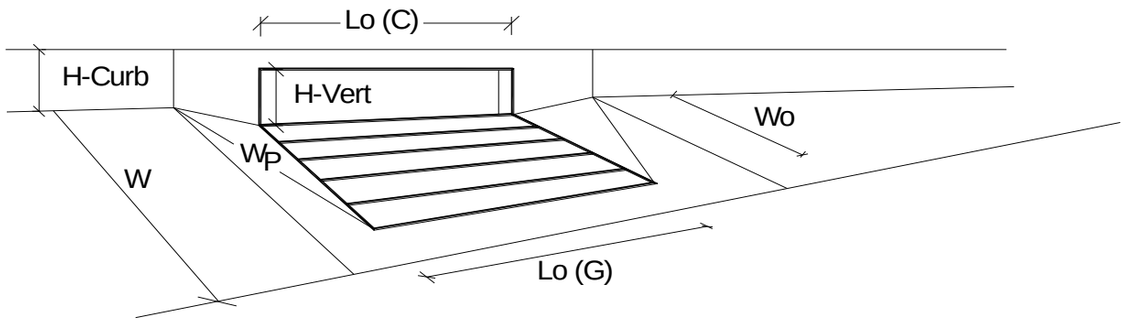
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	11.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	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	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	3.5	3.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



CDOT Type R Curb Opening

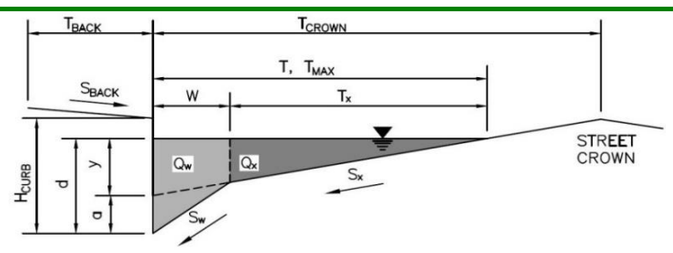
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	3.5	3.5	☐ Override Depths
Grate Information		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
Area Opening 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	
Curb Opening Information		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 (see USDCM Figure ST-5)	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	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.13	0.13	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.45	0.45	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.99	0.99	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.2**	**1.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.5	1.1	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Eastonville Road**

Inlet ID: **DP14**



Gutter Geometry:

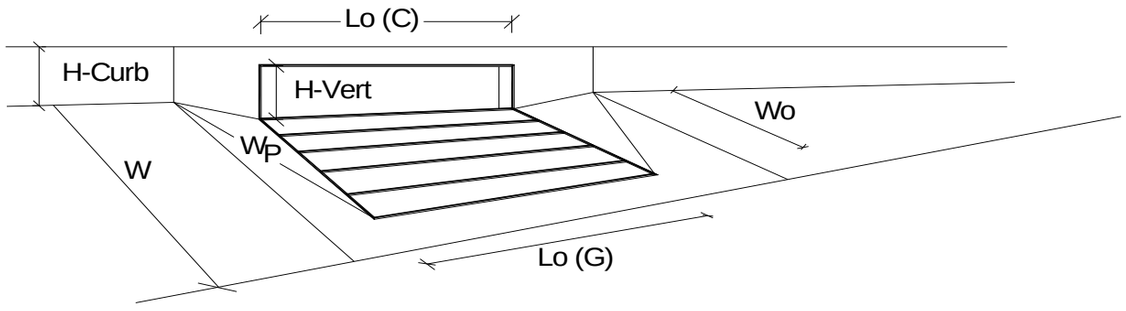
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	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	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.9	8.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



CDOT Type R Curb Opening

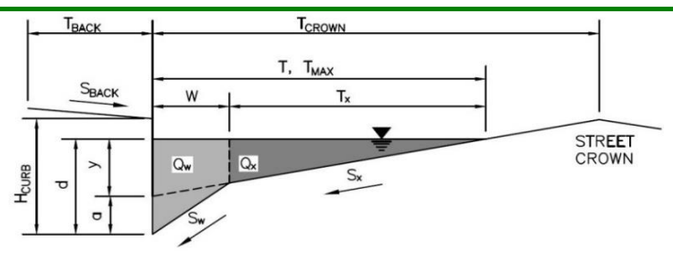
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.9	7.8	☐ Override Depths
Grate Information		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
Area Opening 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	
Curb Opening Information		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 (see USDCM Figure ST-5)	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	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.32	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.73	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.9**	**18.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.2	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: **Eastonville Road**

Inlet ID: **DP15**



Gutter Geometry:

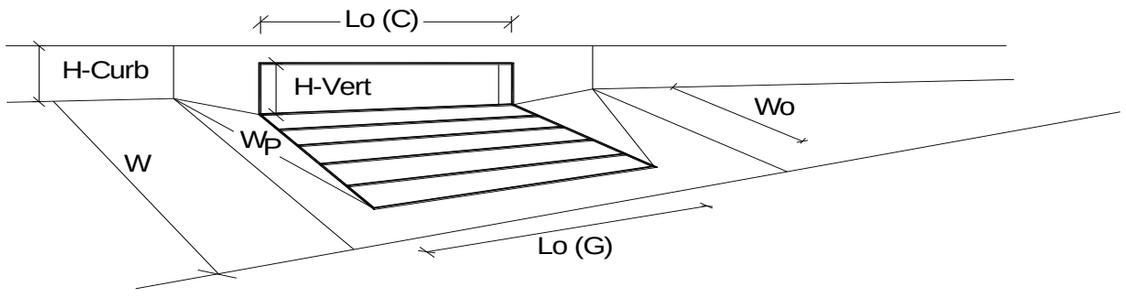
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	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	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.9	8.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



CDOT Type R Curb Opening

Design Information (Input)		MINOR	MAJOR	
Type of Inlet	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)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.9	7.8	☐ Override Depths
Grate Information		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
Area Opening 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	
Curb Opening Information		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 (see USDCM Figure ST-5)	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	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.32	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.73	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.9**	**18.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.0	10.6	cfs

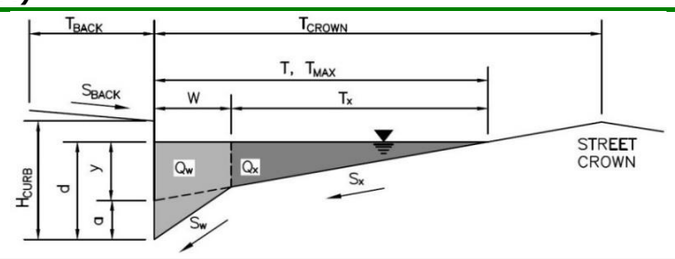
MHFD-Inlet, Version 5.01 (April 2021)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Eastonville Road**

Inlet ID: **Street Capacity (DP14)**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.0	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} =	0.015	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.9	8.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.3**	**30.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

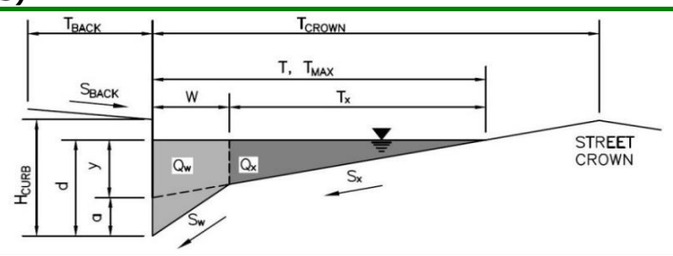
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Eastonville Road**

Inlet ID: **Street Capacity (DP15)**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	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} =	0.015	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.9	8.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.3**	**30.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

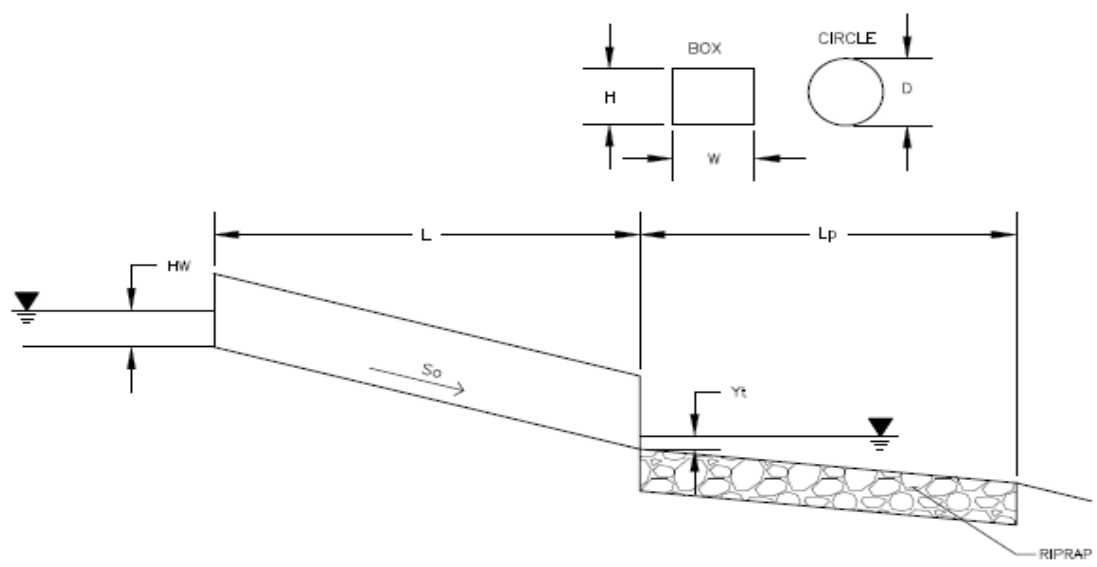
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project:

ID:



Soil Type:

Choose One:

○ Sandy

◉ Non-Sandy

Supercritical Flow! Using Adjusted Rise to calculate protection type.

Design Information:

Design Discharge	Q =	491	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =		inches
Inlet Edge Type (Choose from pull-down list)			
OR:			
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	H (Rise) =	3	ft
Barrel Width (Span) in Feet	W (Span) =	10	ft
Inlet Edge Type (Choose from pull-down list)		1:1 Bevel w/ 45 deg. Flared Wingwall	
Number of Barrels	# Barrels =	2	
Inlet Elevation	Elev IN =	100	ft
Outlet Elevation **OR** Slope	So =	0.015	ft/ft
Culvert Length	L =	116.5	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	7	ft/s

Calculated Results:

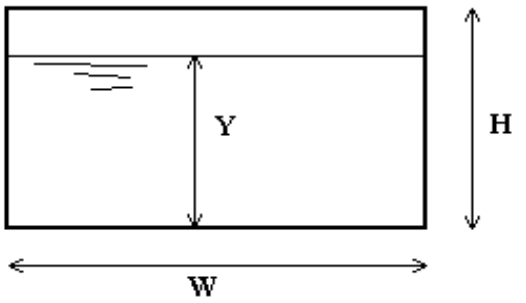
Culvert Cross Sectional Area Available	A =	30.00	ft^2
Culvert Normal Depth	Y_n =	1.48	ft
Culvert Critical Depth	Y_c =	2.65	ft
Froude Number	Fr =	2.41	**Supercritical!**
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.40	
Sum of All Loss Coefficients	k_s =	1.90	ft
Headwater:			
Inlet Control Headwater	HW_I =	4.57	ft
Outlet Control Headwater	HW_O =	3.06	ft
Design Headwater Elevation	**HW =**	**104.57**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/H=**	**1.52**	**HW/H > 1.5!**
Outlet Protection:			
Flow/(Span * Rise^1.5)	Q/WH^1.5 =	4.72	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	1.20	ft
Tailwater/Rise	Yt/H =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	1.85	
Flow Area at Max Channel Velocity	A_t =	70.14	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	20.00	ft
Length of Riprap Protection	**L_p =**	**30**	**ft**
Width of Riprap Protection at Downstream End	**T =**	**37**	**ft**
Adjusted Rise for Supercritical Flow	Ha =	2.24	ft
Minimum Theoretical Riprap Size	d_{50} min=	5	in
Nominal Riprap Size	d_{50} nominal=	6	in
MHFD Riprap Type	**Type =**	**VL**	

BOX CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Eastonville Road Segment 2

Box ID: Geick Ranch Tributary 1 Box Culvert



Design Information (Input)			
Box conduit invert slope	So =	0.0150	ft/ft
Box Manning's n-value	n =	0.0120	
Box Width	W =	10.00	ft
Box Height	H =	3.00	ft
Design discharge	Q =	491.00	cfs

Full-flow capacity (Calculated)			
Full-flow area	Af =	30.00	sq ft
Full-flow wetted perimeter	Pf =	26.00	ft
Full-flow capacity	Qf =	501.88	cfs

Calculations of Normal Flow Condition			
Normal flow depth (<H)	Yn =	2.36	ft
Flow area	An =	23.58	sq ft
Wetted perimeter	Pn =	14.72	ft
Flow velocity	Vn =	20.82	fps
Discharge	Qn =	491.02	cfs
Percent of Full Flow	Flow =	97.8%	of full flow
Normal Depth Froude Number	Fr_n =	2.39	supercritical

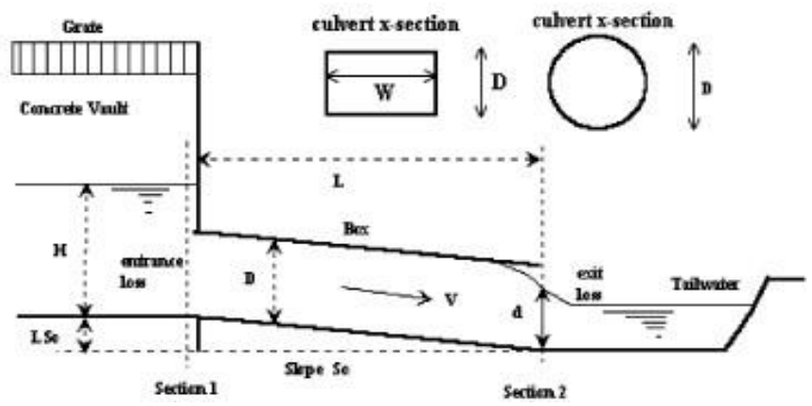
Calculation of Critical Flow Condition			
Critical flow depth	Yc =	3.00	ft
Critical flow area	Ac =	30.00	sq ft
Critical flow velocity	Vc =	16.37	fps
Critical Depth Froude Number	Fr_c =	1.67	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: EASTONVILLE ROAD

ID: DP8



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches — D = [ ] inches

Inlet Edge Type (Choose from pull-down list)

OR:

Box Culvert: Barrel Height (Rise) in Feet — H (Rise) = 3.00 ft

Barrel Width (Span) in Feet — W (Span) = 10.00 ft

Inlet Edge Type (Choose from pull-down list) — 1:1 Bevel w/ 45 deg. Flared Wingwall

Number of Barrels	# Barrels =	2
Inlet Elevation at Culvert Invert	Elev IN =	100 ft
Outlet Elevation **OR** Slope	So =	0.015 ft/ft
Culvert Length	L =	116.5 ft
Manning's Roughness	n =	0.012
Bend Loss Coefficient	K_b =	0
Exit Loss Coefficient	K_x =	1

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.50
Friction Loss Coefficient	K_f =	0.40
Sum of All Loss Coefficients	K_s =	1.90
Minimum Energy Condition Coefficient	KE_{low} =	0.0044
Orifice Inlet Condition Coefficient	C_d =	0.65

Calculations of Culvert Capacity (output):

Backwater calculations required to obtain Outlet Control Flowrate when HWo < 0.75 * Culvert Rise

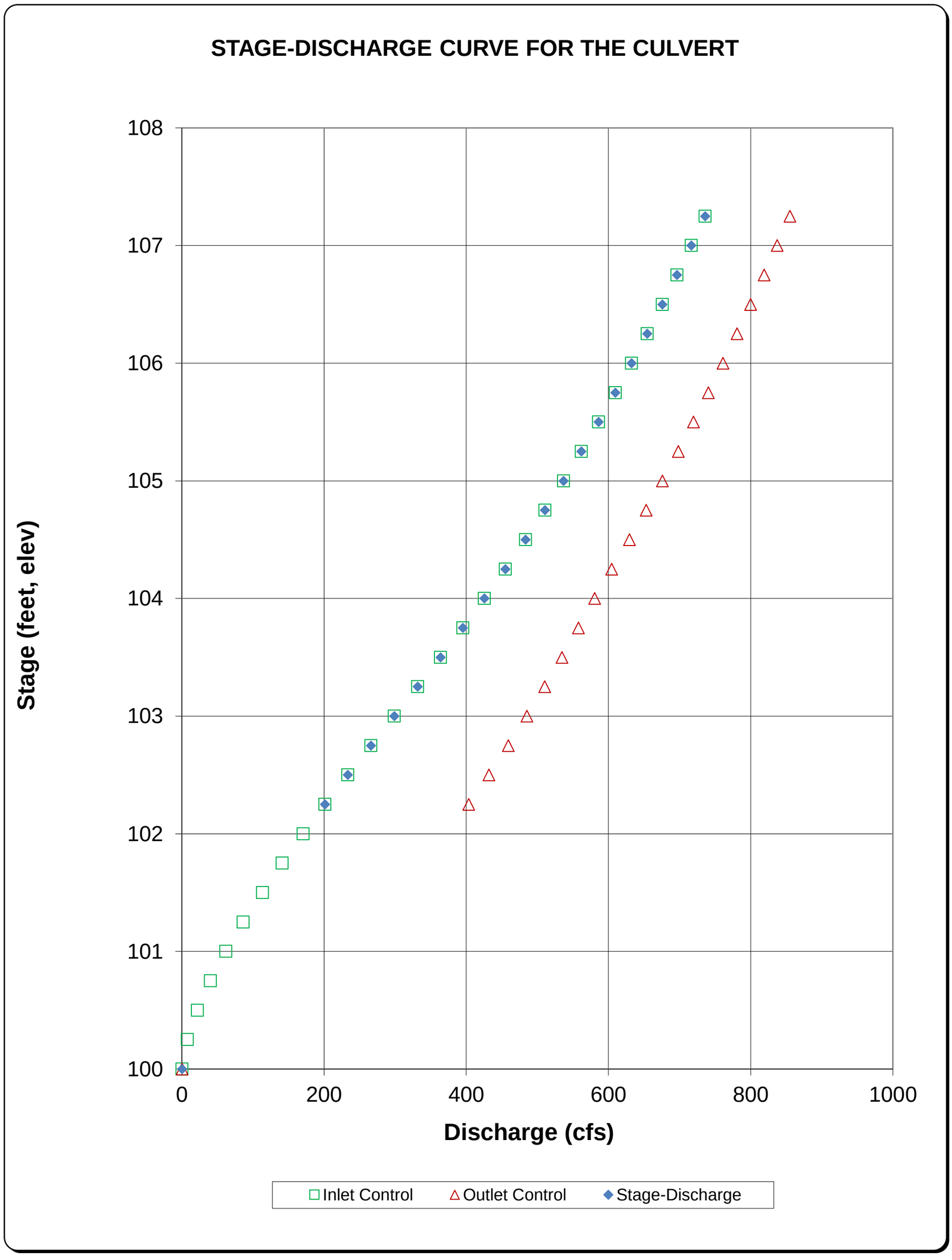
Headwater Surface Elevation (ft)	Tailwater Surface Elevation (ft)	Inlet Control Equation Used	Inlet Control Flowrate (cfs)	Outlet Control Flowrate (cfs)	Controlling Culvert Flowrate (cfs)	Flow Control Used
100.00		No Flow (WS < inlet)	0.00	0.00	**0.00**	N/A
100.25		Min. Energy. Eqn.	7.74	#N/A	#N/A	#N/A
100.50		Min. Energy. Eqn.	21.82	#N/A	#N/A	#N/A
100.75		Min. Energy. Eqn.	40.04	#N/A	#N/A	#N/A
101.00		Min. Energy. Eqn.	61.66	#N/A	#N/A	#N/A
101.25		Min. Energy. Eqn.	86.22	#N/A	#N/A	#N/A
101.50		Min. Energy. Eqn.	113.26	#N/A	#N/A	#N/A
101.75		Regression Eqn.	141.06	#N/A	#N/A	#N/A
102.00		Regression Eqn.	170.46	#N/A	#N/A	#N/A
102.25		Regression Eqn.	201.26	403.16	**201.26**	INLET
102.50		Regression Eqn.	233.22	431.72	**233.22**	INLET
102.75		Regression Eqn.	265.78	458.99	**265.78**	INLET
103.00		Regression Eqn.	298.68	485.11	**298.68**	INLET
103.25		Regression Eqn.	331.42	510.21	**331.42**	INLET
103.50		Regression Eqn.	363.62	534.39	**363.62**	INLET
103.75		Regression Eqn.	395.04	557.76	**395.04**	INLET
104.00		Regression Eqn.	425.50	580.38	**425.50**	INLET
104.25		Regression Eqn.	454.90	604.46	**454.90**	INLET
104.50		Regression Eqn.	483.22	629.17	**483.22**	INLET
104.75		Regression Eqn.	510.44	652.94	**510.44**	INLET
105.00		Regression Eqn.	536.62	675.87	**536.62**	INLET
105.25		Regression Eqn.	561.84	698.05	**561.84**	INLET
105.50		Regression Eqn.	586.16	719.54	**586.16**	INLET
105.75		Regression Eqn.	609.62	740.41	**609.62**	INLET
106.00		Regression Eqn.	632.28	760.72	**632.28**	INLET
106.25		Regression Eqn.	654.22	780.49	**654.22**	INLET
106.50		Regression Eqn.	675.50	799.77	**675.50**	INLET
106.75		Regression Eqn.	696.22	818.60	**696.22**	INLET
107.00		Regression Eqn.	716.24	837.01	**716.24**	INLET
107.25		Regression Eqn.	735.82	855.02	**735.82**	INLET
				Processing Time:	**00.20 Seconds**	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

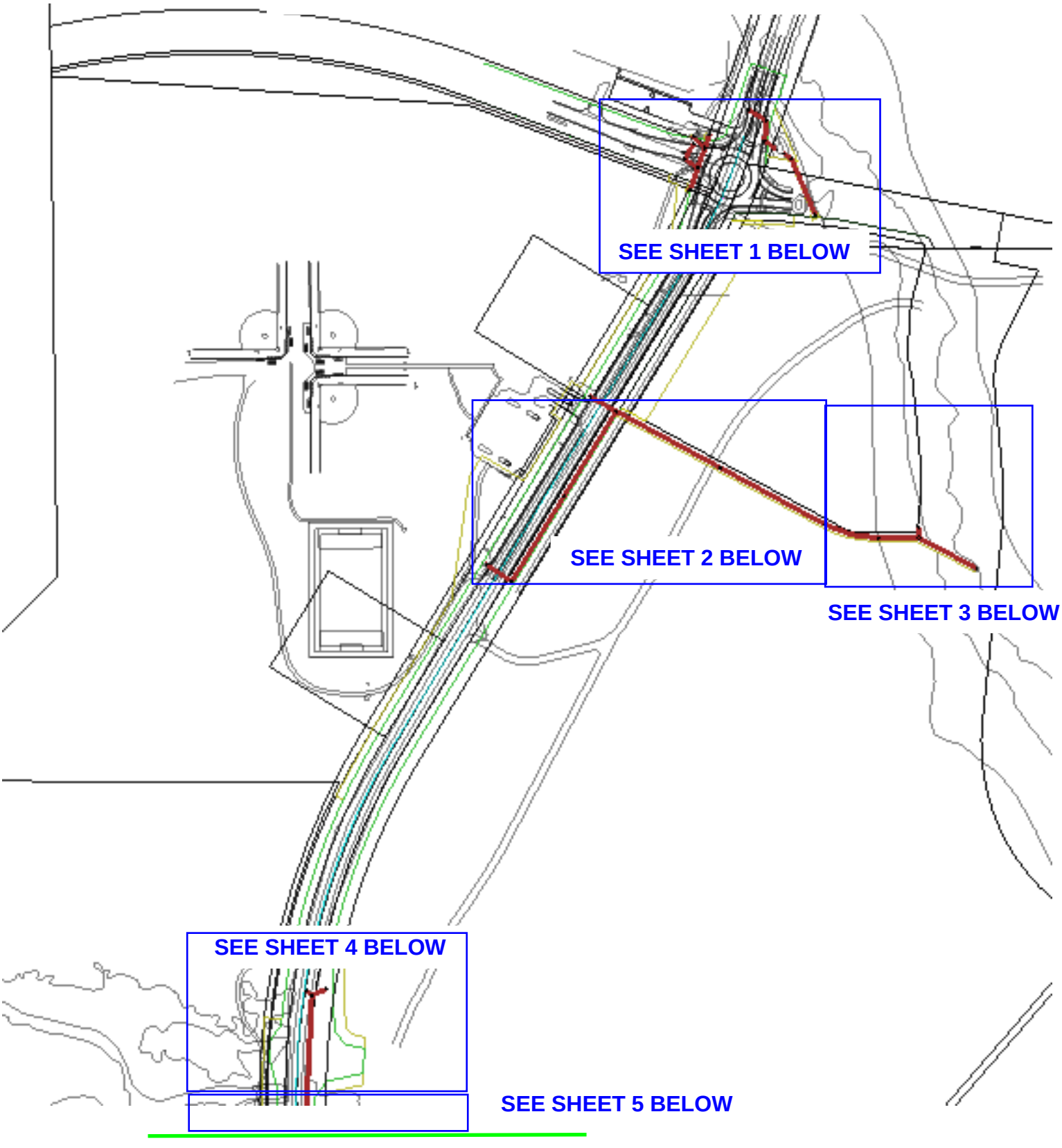
MHFD-Culvert, Version 4.00 (May 2020)

Project: **EASTONVILLE ROAD**

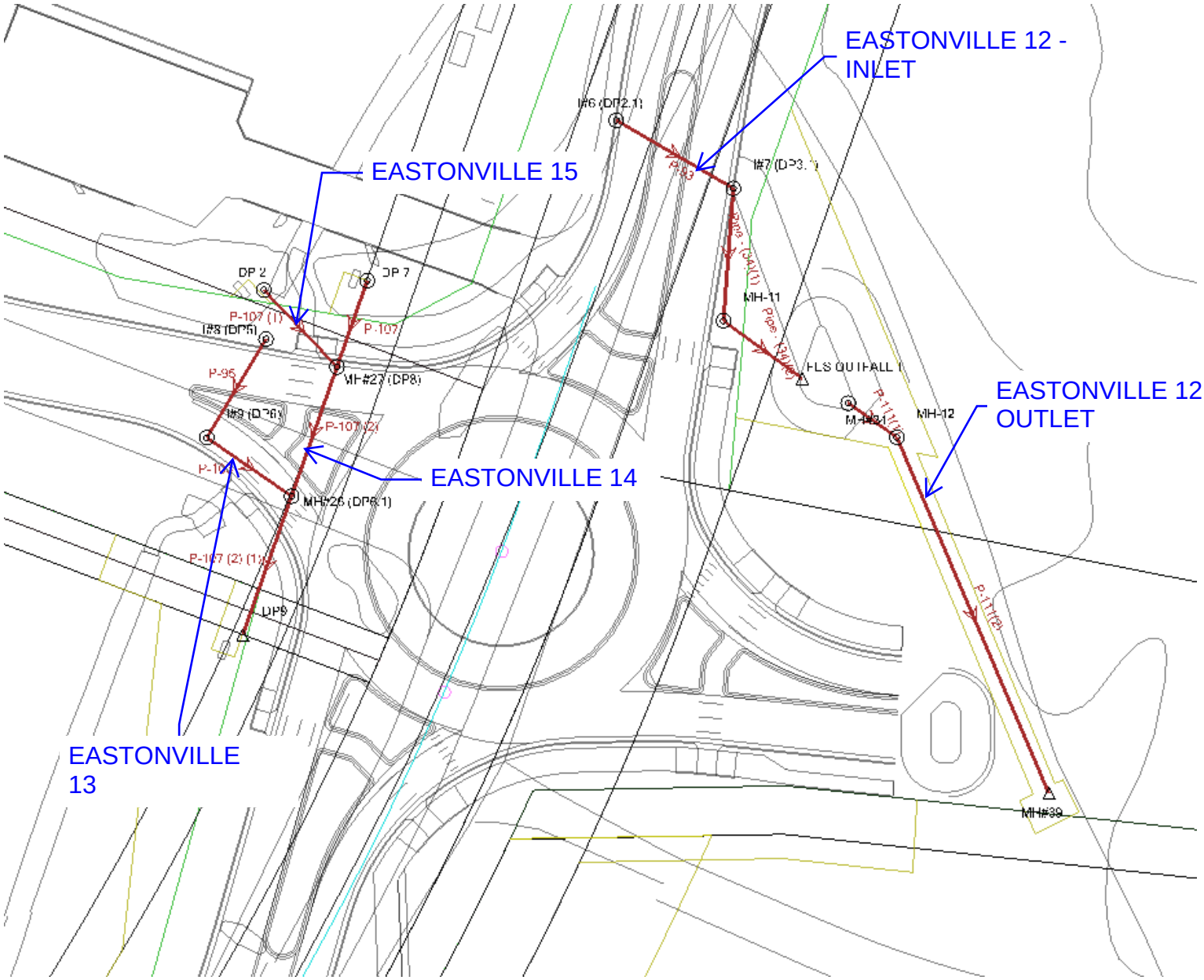
ID: **DP8**



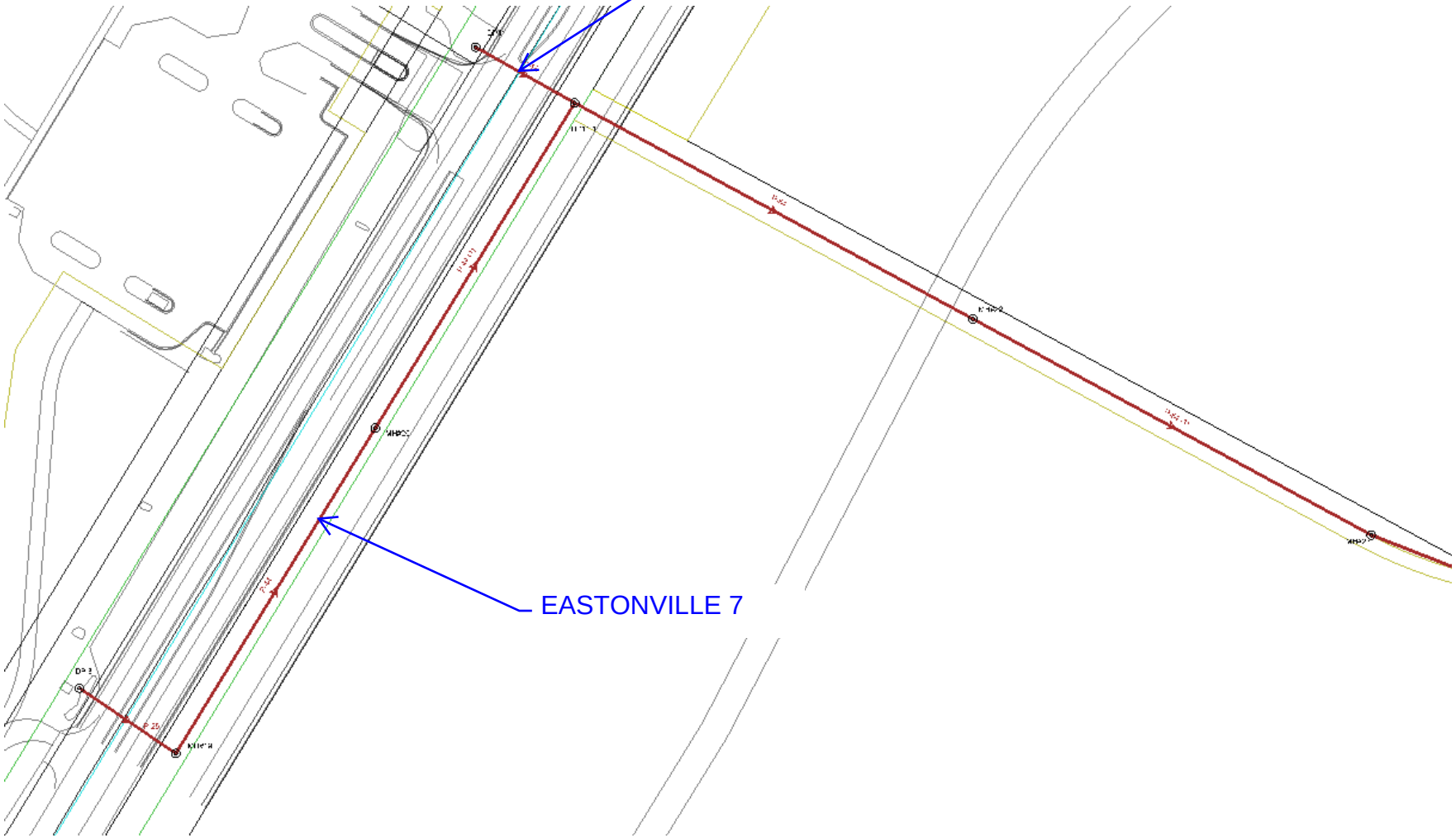
STORMCAD NETWORK LAYOUT: SEGMENT 2



MATCHLINE REFER TO SEGMENT 2 FDR


EASTONVILLE 12 - INLET
EASTONVILLE 15
EASTONVILLE 12 - OUTLET
EASTONVILLE 14
EASTONVILLE 13
DP 2
DP 7
MH-11
MH-12
MH#39

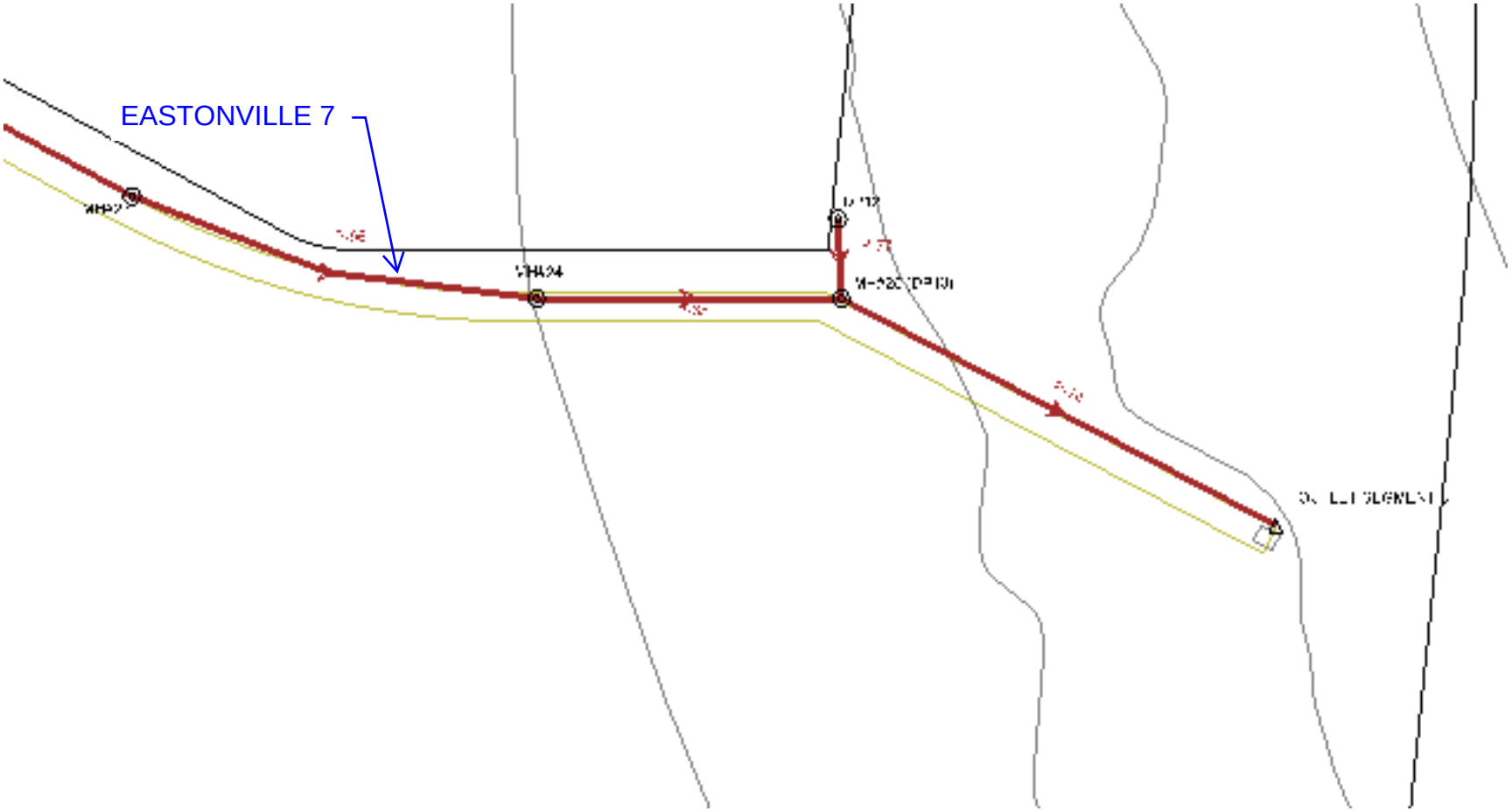
SHEET 1



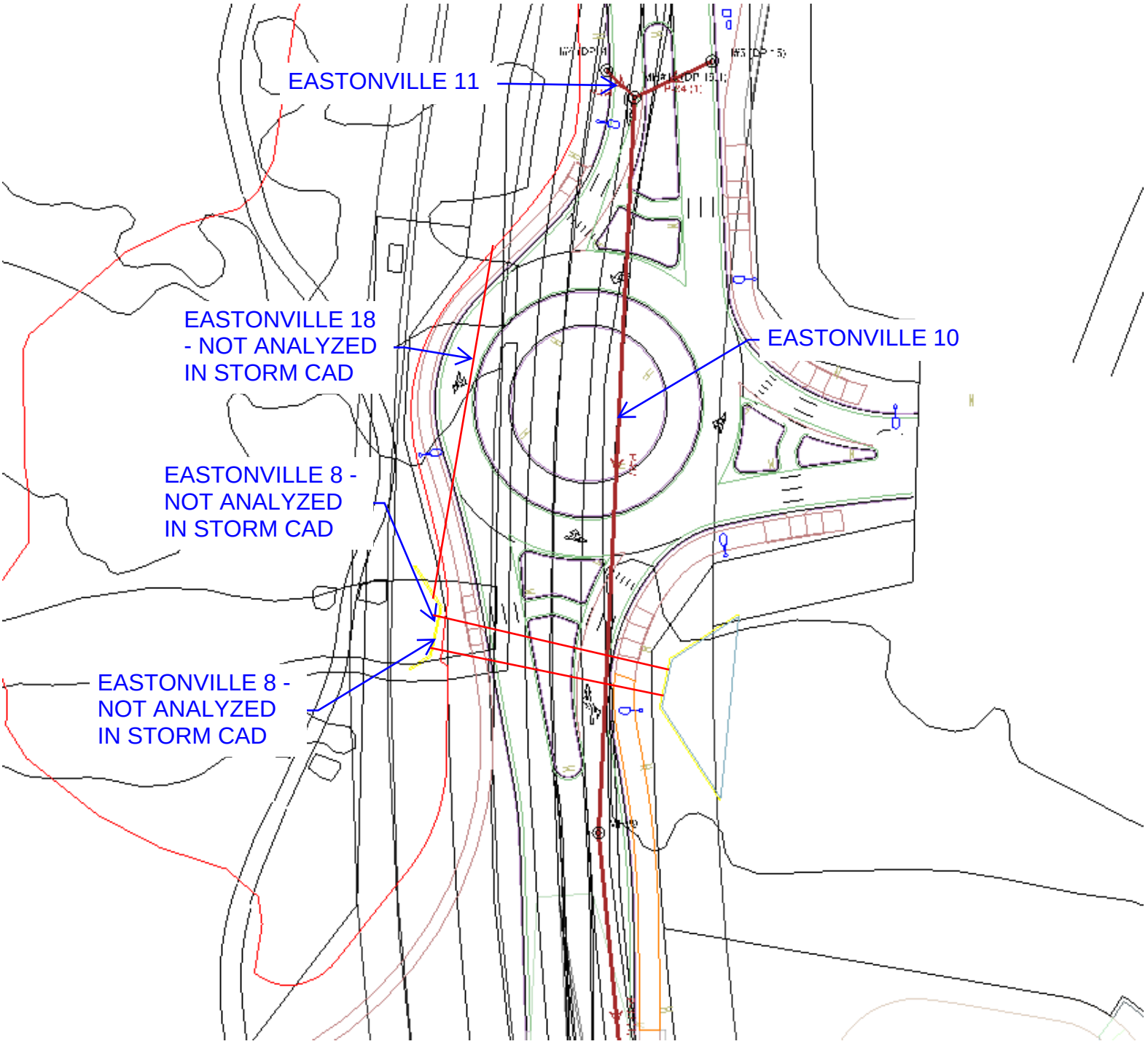
MATCHLINE SEE SHEET 3

SHEET 2

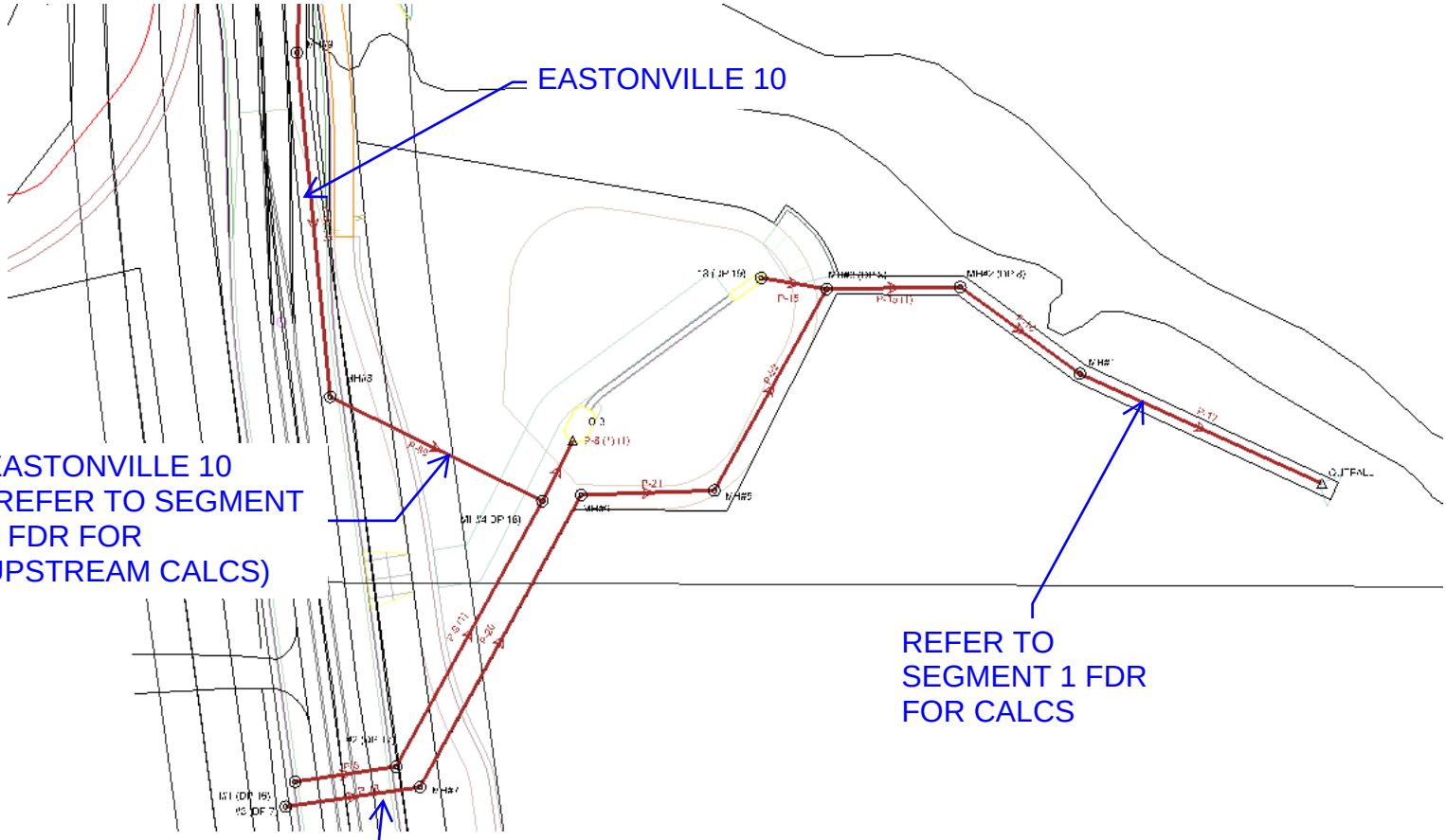
MATCHLINE SEE SHEET 2



SHEET 3


EASTONVILLE 11
EASTONVILLE 18
- NOT ANALYZED
IN STORM CAD
EASTONVILLE 10
EASTONVILLE 8 -
NOT ANALYZED
IN STORM CAD
EASTONVILLE 8 -
NOT ANALYZED
IN STORM CAD

SHEET 4


EASTONVILLE 10
EASTONVILLE 10
(REFER TO SEGMENT
1 FDR FOR
UPSTREAM CALCS)
REFER TO
SEGMENT 1 FDR
FOR CALCS
REFER TO
SEGMENT 1 FDR
FOR CALCS

SHEET 5

100 YEAR TAILWATER CONDITION: PIPE SUMMARY TABLE

	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
131: P-107 (2)	MH#26 (DP6.1)	7,020.50	DP9	7,019.00	60.7	0.025	24.0	0.013	22.40	11.97	35.57	63.0	7,022.19	7,020.22
132: P-103	I#9 (DP6)	7,023.00	MH#26 (DP6.1)	7,022.00	42.7	0.023	18.0	0.013	2.40	6.54	16.08	14.9	7,023.89	7,023.91
133: P-107 (2)	MH#27 (DP8)	7,021.00	MH#26 (DP6.1)	7,020.50	56.6	0.009	24.0	0.013	21.00	6.68	21.26	98.8	7,024.40	7,023.91
134: P-107	DP 7	7,023.01	MH#27 (DP8)	7,021.75	37.8	0.033	15.0	0.013	2.20	1.79	11.81	18.6	7,025.07	7,025.03
135: P-107 (1)	MH#27 (DP8)	7,021.00	DP 2	7,021.26	43.9	-0.006	24.0	0.013	18.80	5.98	17.41	108.0	7,025.33	7,025.03
136: P-95	I#8 (DP5)	7,024.00	I#9 (DP6)	7,023.00	47.5	0.021	18.0	0.013	1.30	5.26	15.24	8.5	7,024.43	7,023.94
137: P-93	I#6 (DP2.1)	7,022.34	I#7 (DP3.1)	7,021.78	55.9	0.010	18.0	0.013	1.50	4.22	10.51	14.3	7,022.80	7,022.73
140: P-44 (1)	MH#20	7,001.18	DP11.1	6,998.52	266.5	0.010	48.0	0.013	112.10	8.92	143.63	78.0	7,005.57	7,003.94
141: P-64	DP11.1	6,998.52	MH#22	6,995.26	316.5	0.010	48.0	0.013	112.10	12.80	145.88	76.8	7,001.72	6,997.89
142: P-44	MH#19	7,003.94	MH#20	7,001.28	266.5	0.010	48.0	0.013	112.10	12.64	143.63	78.0	7,007.14	7,005.63
143: P-26	DP 3	7,005.01	MH#19	7,004.04	81.5	0.012	48.0	0.013	112.10	8.92	156.73	71.5	7,009.86	7,009.36
144: P-64 (1)	MH#22	6,995.15	MH#23	6,988.82	316.6	0.020	48.0	0.013	112.10	16.57	203.15	55.2	6,998.35	6,995.32
145: P-87	MH#10 (DP 1...	6,993.41	MH#9	6,989.86	350.8	0.010	24.0	0.013	17.20	7.96	22.76	75.6	6,994.91	6,991.16
146: P-87 (1)	MH#9	6,989.76	MH#8	6,986.86	193.5	0.015	24.0	0.013	17.20	9.29	27.70	62.1	6,991.26	6,989.59
147: P-84	I#4 (DP14)	6,994.25	MH#10 (DP 1...	6,993.91	15.1	0.023	18.0	0.013	8.80	9.17	15.77	55.8	6,995.40	6,995.28
148: P-84 (1)	I#5 (DP 15)	6,994.74	MH#10 (DP 1...	6,993.91	39.7	0.021	18.0	0.013	10.40	9.25	15.18	68.5	6,995.98	6,995.28
149: P-66	MH#23	6,988.82	MH#24	6,988.00	149.0	0.006	48.0	0.013	112.10	8.92	106.64	105.1	6,995.26	6,994.35
150: P-68	MH#24	6,988.00	MH#25 (DP13)	6,987.50	107.8	0.005	48.0	0.013	112.10	8.92	97.84	114.6	6,994.29	6,993.63
151: P-77	DP12	6,990.32	MH#25 (DP13)	6,989.50	28.1	0.029	24.0	0.013	24.60	7.83	38.62	63.7	6,993.96	6,993.63
152: P-74	MH#25 (DP13)	6,987.50	OUTLET SEG...	6,986.67	173.3	0.005	48.0	0.013	136.60	10.87	99.34	137.5	6,991.98	6,990.15
225: P-42	DP11	7,001.22	DP11.1	6,999.51	85.7	0.020	24.0	0.013	44.00	14.01	31.96	137.7	7,007.19	7,003.94
227: Pipe - (34	I#7 (DP3.1)	7,021.78	MH-11	7,021.41	41.5	0.009	18.0	0.013	3.20	5.00	9.92	32.3	7,022.72	7,022.73
228: Pipe - (34	MH-11	7,021.21	FES OUTFALL 1	7,021.00	42.5	0.005	18.0	0.013	3.20	1.81	7.38	43.3	7,022.73	7,022.69
230: P-111(1)	MH#34	7,018.67	MH-12	7,018.57	20.4	0.005	18.0	0.013	0.80	2.73	7.35	10.9	7,019.00	7,018.90
231: P-111(2)	MH-12	7,018.37	MH#39	7,016.77	158.3	0.010	18.0	0.013	0.80	3.52	10.56	7.6	7,018.70	7,017.05

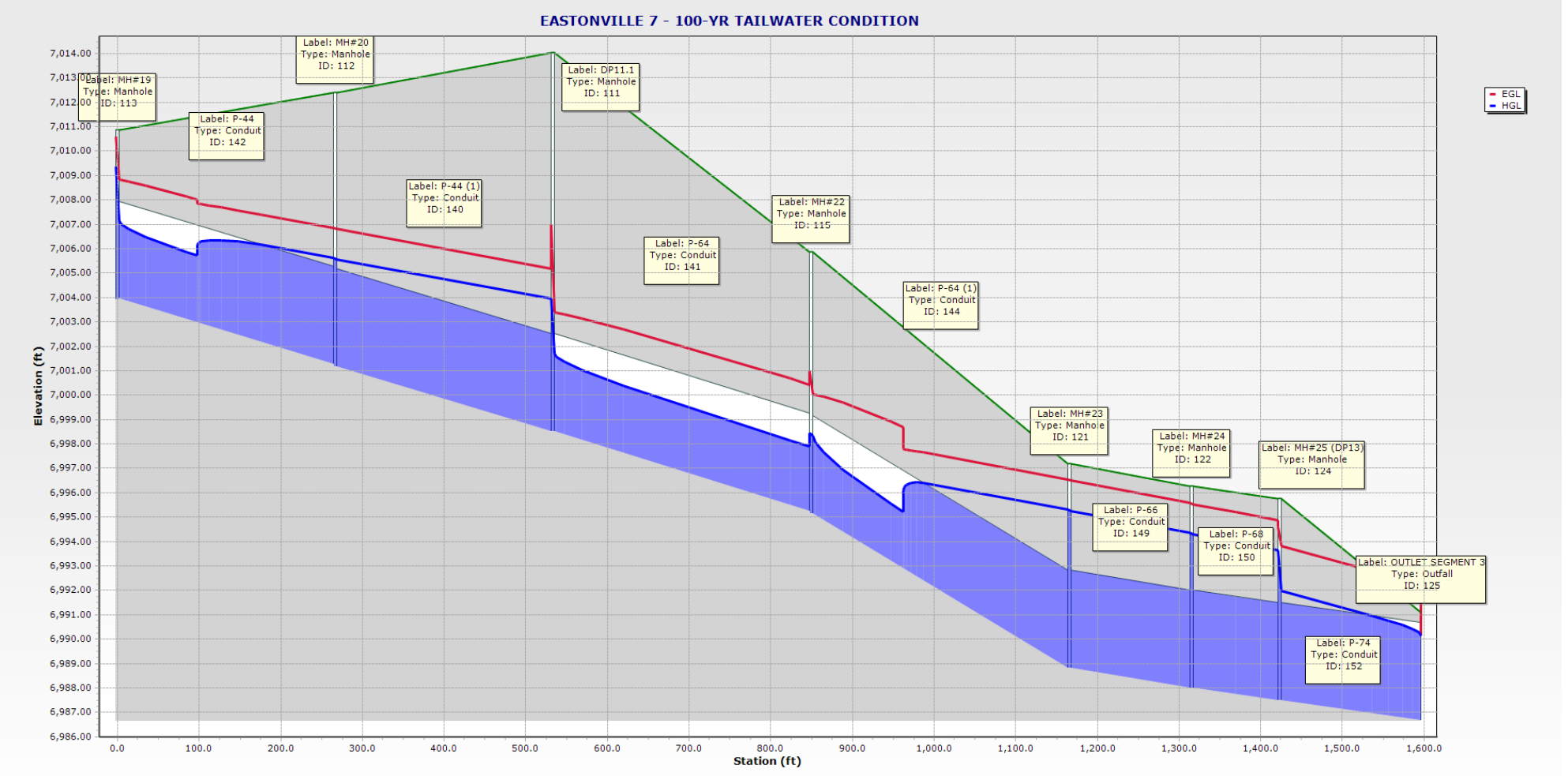
NOTE: EASTONVILLE 12 - INLET & EASTONVILLE 10 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 1 PIPES & STRUCTURES NOT INCLUDED IN TABLE, REFER TO SEGMENT 1 FDR.

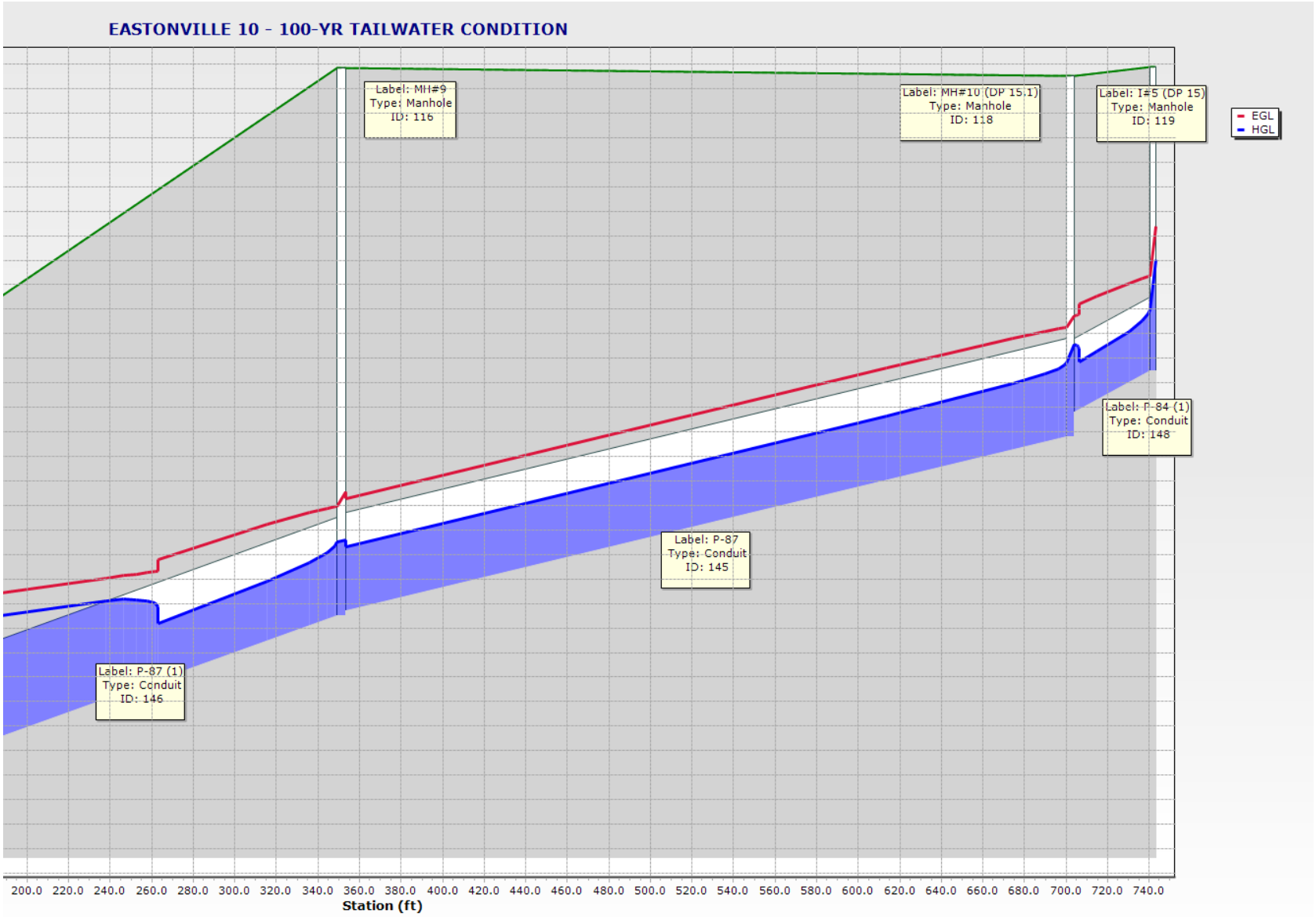
100 YEAR TAILWATER CONDITION: STRUCTURE SUMMARY TABLE

	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)	Notes
98: MH#26 (D	7,027.15	7,027.15	7,022.00	22.40	7,022.19	Standard	7,023.91	STORM MH
99: MH#27 (D	7,027.09	7,027.09	7,021.75	21.00	7,024.40	Standard	7,025.03	STORM MH
100: I#9 (DP6)	7,027.04	7,027.04	7,023.00	2.40	7,023.89	Standard	7,023.94	CDOT Type-R
101: I#8 (DP5)	7,026.63	7,026.63	(N/A)	1.30	7,024.43	Standard	7,024.66	CDOT Type-R
102: I#7 (DP3.	7,026.51	7,026.51	7,021.78	3.20	7,022.72	Standard	7,022.73	CDOT Type-R
103: I#6 (DP2.	7,026.38	7,026.38	(N/A)	1.50	7,022.80	Standard	7,023.05	CDOT Type-R
106: MH#34	7,025.00	7,025.00	(N/A)	0.80	7,019.00	Standard	7,019.06	CDOT Type-C
111: DP11.1	7,014.03	7,014.03	6,998.52	112.10	7,001.72	Standard	7,003.94	STORM MH
112: MH#20	7,012.41	7,012.41	7,001.28	112.10	7,005.57	Standard	7,005.63	STORM MH
113: MH#19	7,010.85	7,010.85	7,004.04	112.10	7,007.14	Standard	7,009.36	STORM MH
115: MH#22	7,005.85	7,005.85	6,995.26	112.10	6,998.35	Standard	6,998.44	STORM MH
116: MH#9	7,000.92	7,000.92	6,989.86	17.20	6,991.26	Standard	6,991.29	STORM MH
117: I#4 (DP1	7,000.75	7,000.75	(N/A)	8.80	6,995.40	Standard	6,996.25	CDOT Type-R
118: MH#10 (	7,000.75	7,000.75	6,993.91	17.20	6,994.91	Standard	6,995.28	STORM MH
119: I#5 (DP 1	7,000.94	7,000.94	(N/A)	10.40	6,995.98	Standard	6,997.01	CDOT Type-R
121: MH#23	6,997.20	6,997.20	6,988.82	112.10	6,995.26	Standard	6,995.32	STORM MH
122: MH#24	6,996.25	6,996.25	6,988.00	112.10	6,994.29	Standard	6,994.35	STORM MH
123: DP12	6,996.40	6,996.40	(N/A)	24.60	6,993.96	Standard	6,995.39	CDOT Type-C
124: MH#25 (	6,995.75	6,995.75	6,987.50	136.60	6,991.98	Standard	6,993.63	STORM MH
192: DP 7	7,024.45	7,024.45	(N/A)	2.20	7,024.45	Standard	7,024.52	CDOT FES
193: DP 2	7,024.26	7,024.26	(N/A)	18.80	7,024.26	Standard	7,025.10	CDOT FES
194: DP 3	7,009.43	7,009.43	(N/A)	112.10	7,009.43	Standard	7,011.29	CDOT FES
224: DP11	7,010.95	7,010.95	(N/A)	44.00	7,007.19	Absolute	7,007.19	CDOT TYPE D INLET
226: MH-11	7,026.84	7,026.84	7,021.41	3.20	7,022.73	Absolute	7,022.73	
229: MH-12	7,024.52	7,024.52	7,018.57	0.80	7,018.70	Absolute	7,018.70	

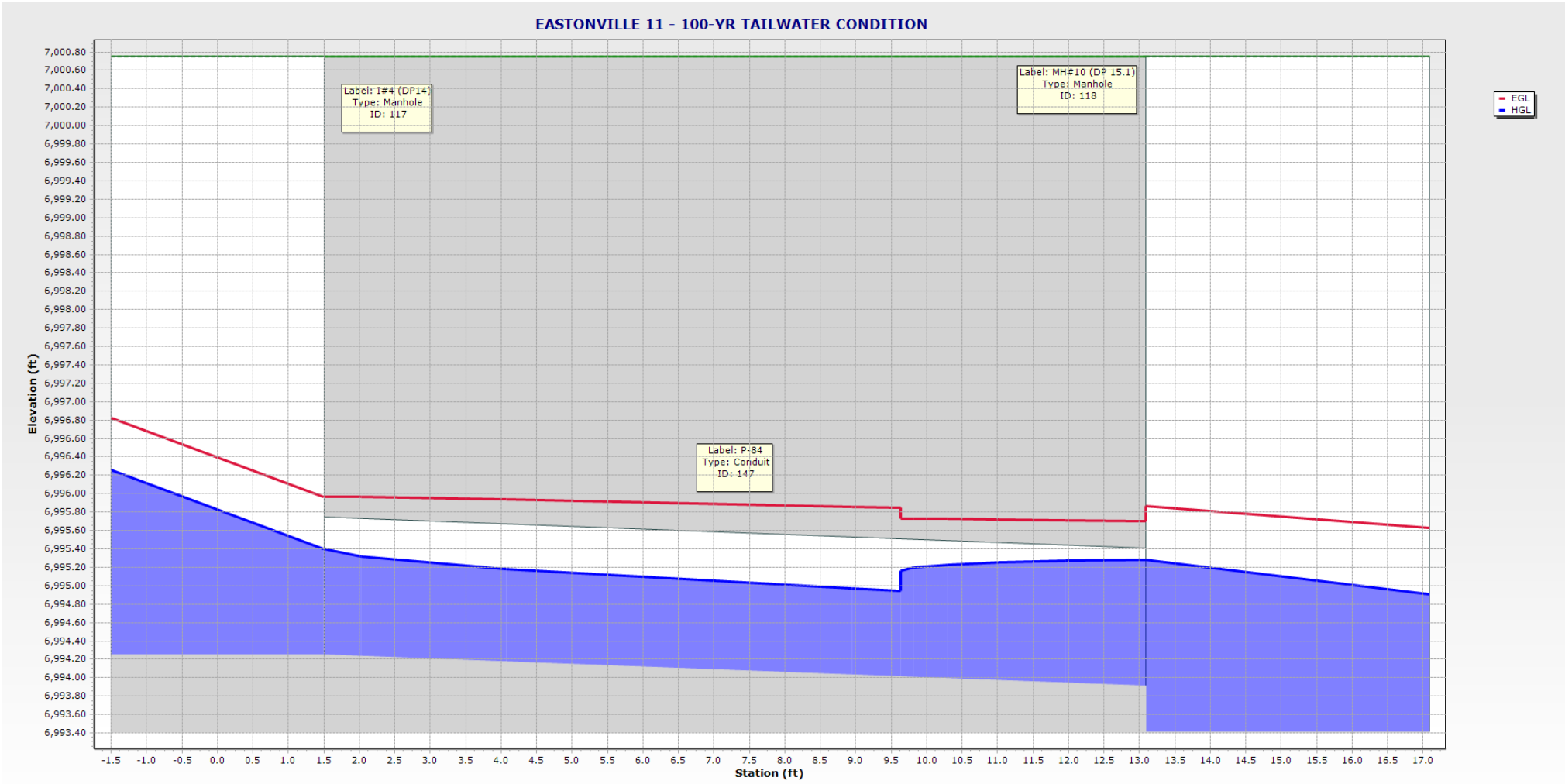
	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
107: DP9	7,022.74	7,019.00	Free Outfall		7,020.22	22.40	CDOT FES
108: FES OUTF	7,022.50	7,021.00	User Defined Tailwater	7,022.69	7,022.69	3.20	CDOT FES
110: MH#39	7,018.27	7,016.77	Free Outfall		7,017.05	0.80	CDOT FES
125: OUTLET S	6,991.09	6,986.67	Free Outfall		6,990.15	136.60	CDOT FES

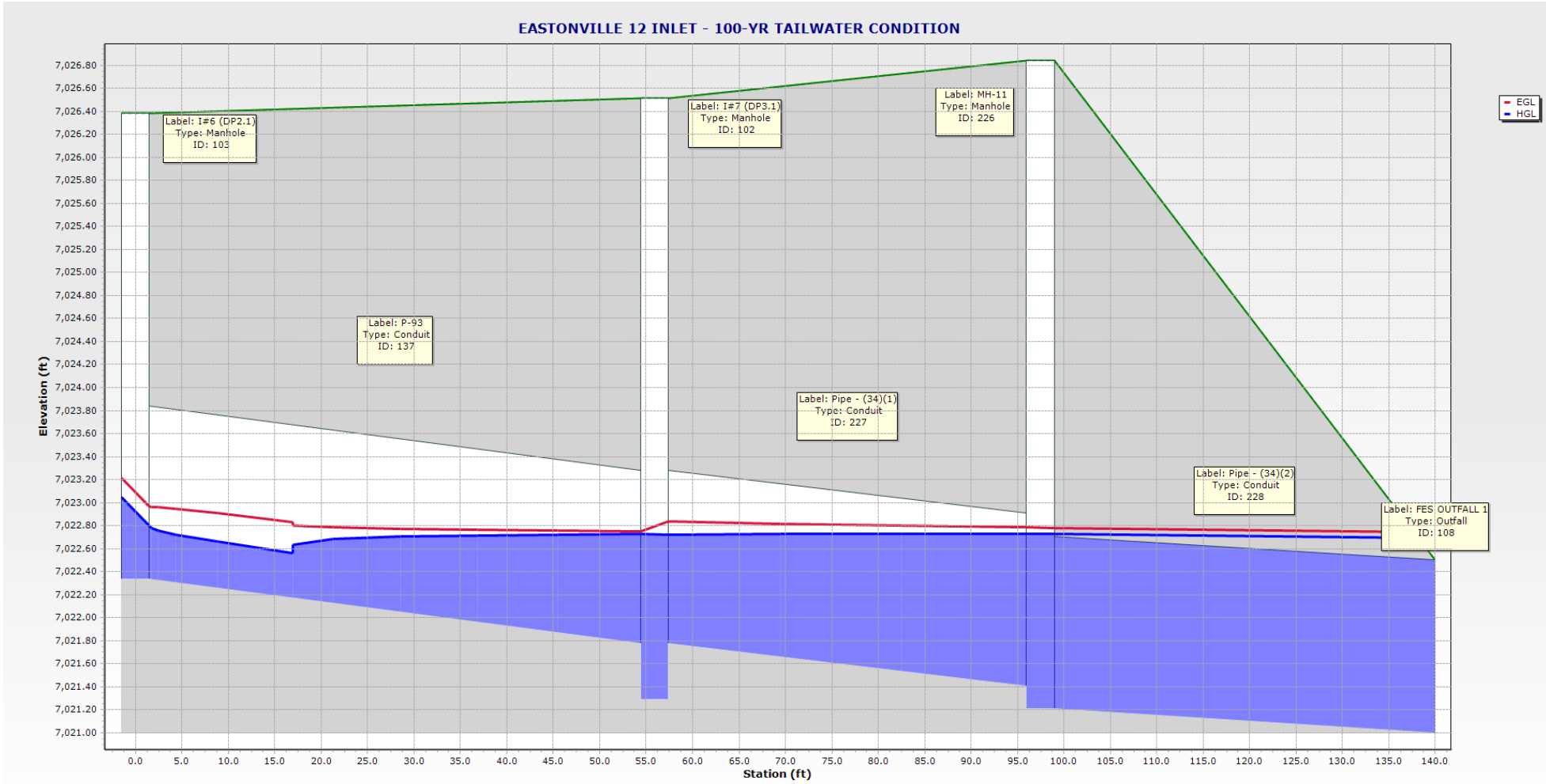
NOTE: EASTONVILLE 12 - INLET & EASTONVILLE 10 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 1 PIPES & STRUCTURES NOT INCLUDED IN TABLE, REFER TO SEGMENT 1 FDR.


EASTONVILLE 7 - 100-YR TAILWATER CONDITION
Elevation (ft)
Station (ft)
EGL
HGL
Label: MH#19
Type: Manhole
ID: 113
Label: P-44
Type: Conduit
ID: 142
Label: MH#20
Type: Manhole
ID: 112
Label: P-44 (1)
Type: Conduit
ID: 140
Label: DP11.1
Type: Manhole
ID: 111
Label: P-64
Type: Conduit
ID: 141
Label: MH#22
Type: Manhole
ID: 115
Label: P-64 (1)
Type: Conduit
ID: 144
Label: MH#23
Type: Manhole
ID: 121
Label: MH#24
Type: Manhole
ID: 122
Label: MH#25 (DP13)
Type: Manhole
ID: 124
Label: P-66
Type: Conduit
ID: 149
Label: P-68
Type: Conduit
ID: 150
Label: OUTLET SEGMENT 3
Type: Outfall
ID: 125
Label: P-74
Type: Conduit
ID: 152

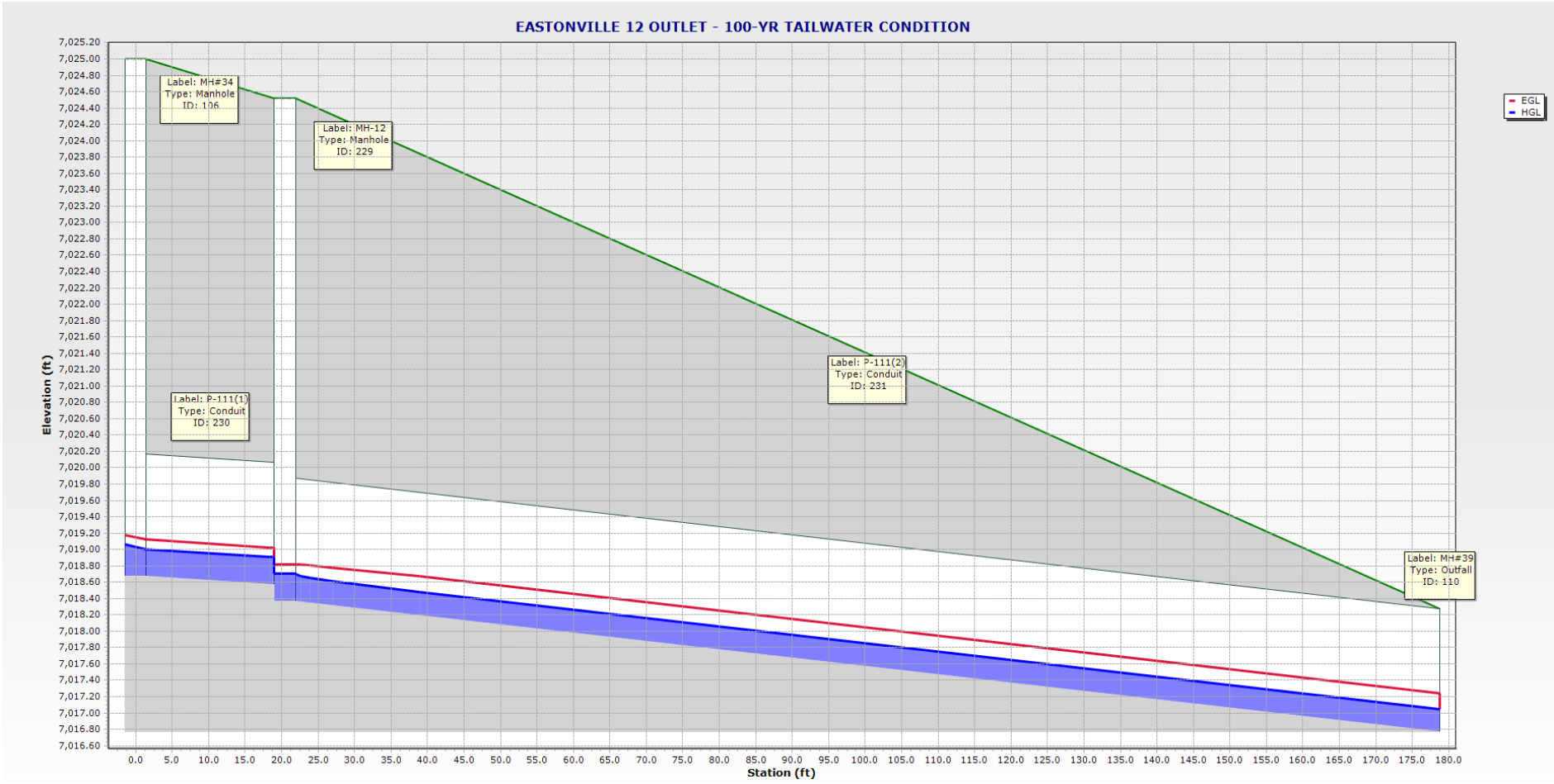


NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

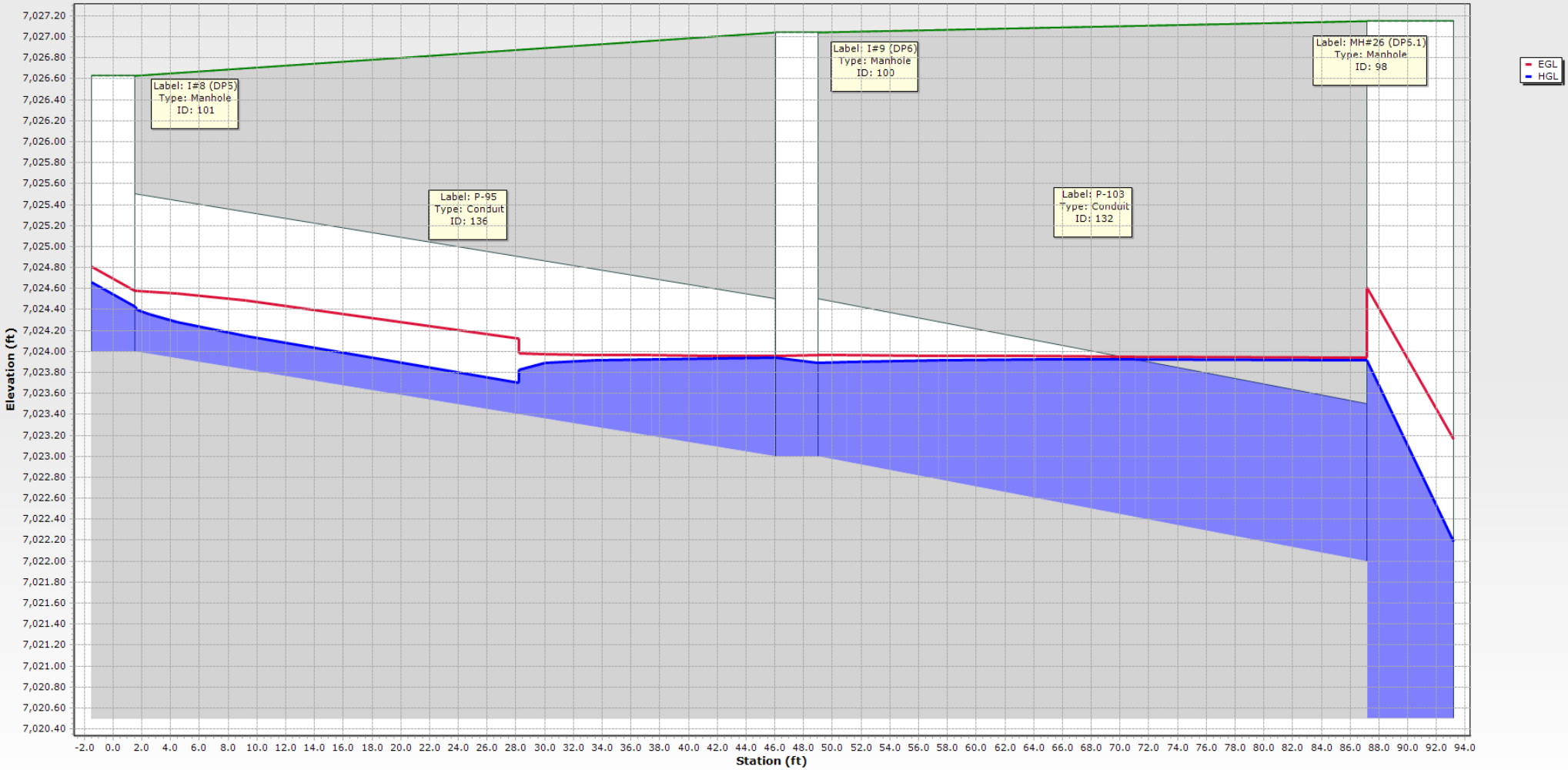

EASTONVILLE 11 - 100-YR TAILWATER CONDITION
Label: I#4 (DP14)
Type: Manhole
ID: 117
Label: MH#10 (DP 15.1)
Type: Manhole
ID: 118
Label: P-84
Type: Conduit
ID: 147
EGL
HGL
Elevation (ft)
Station (ft)

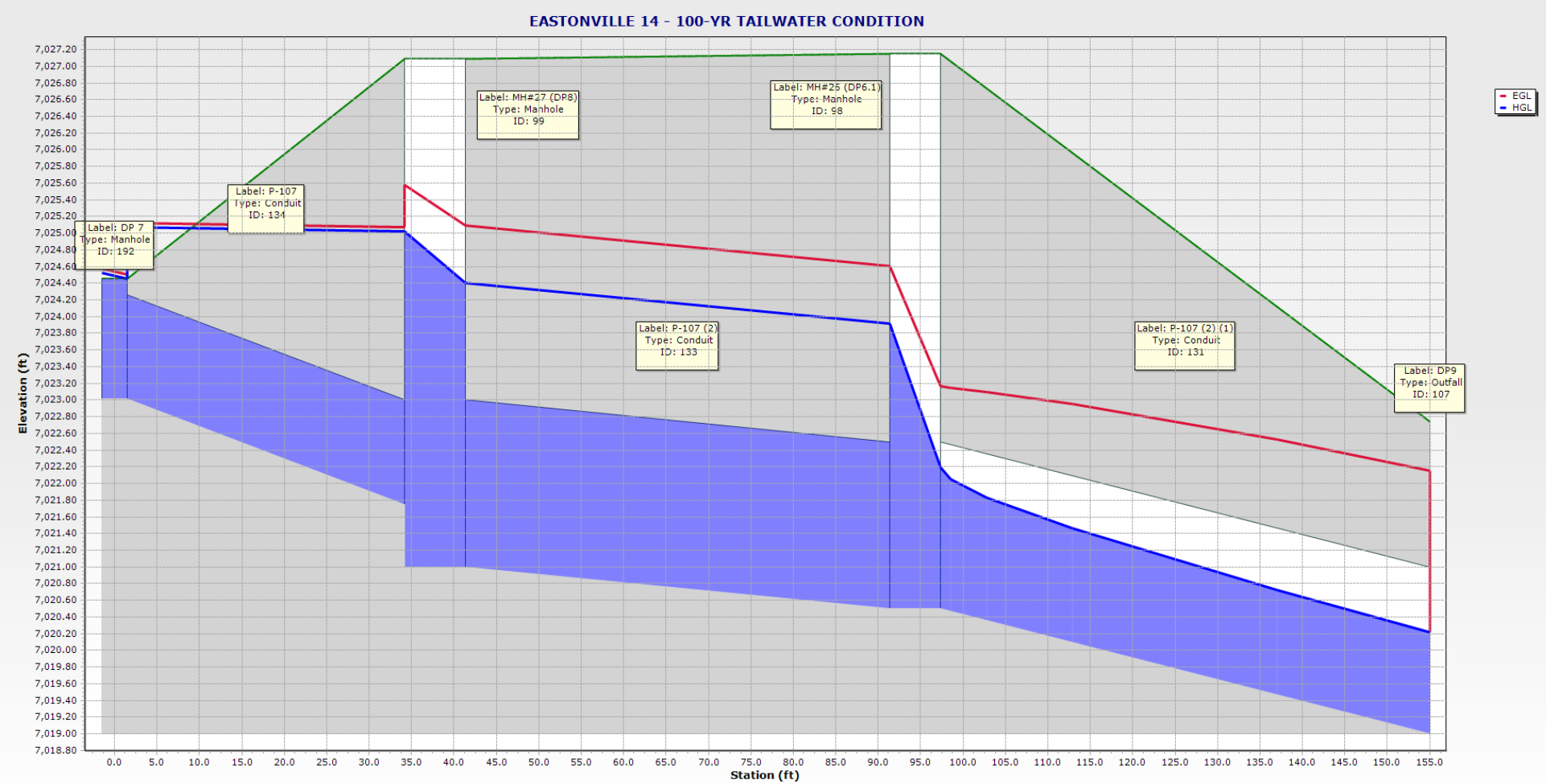


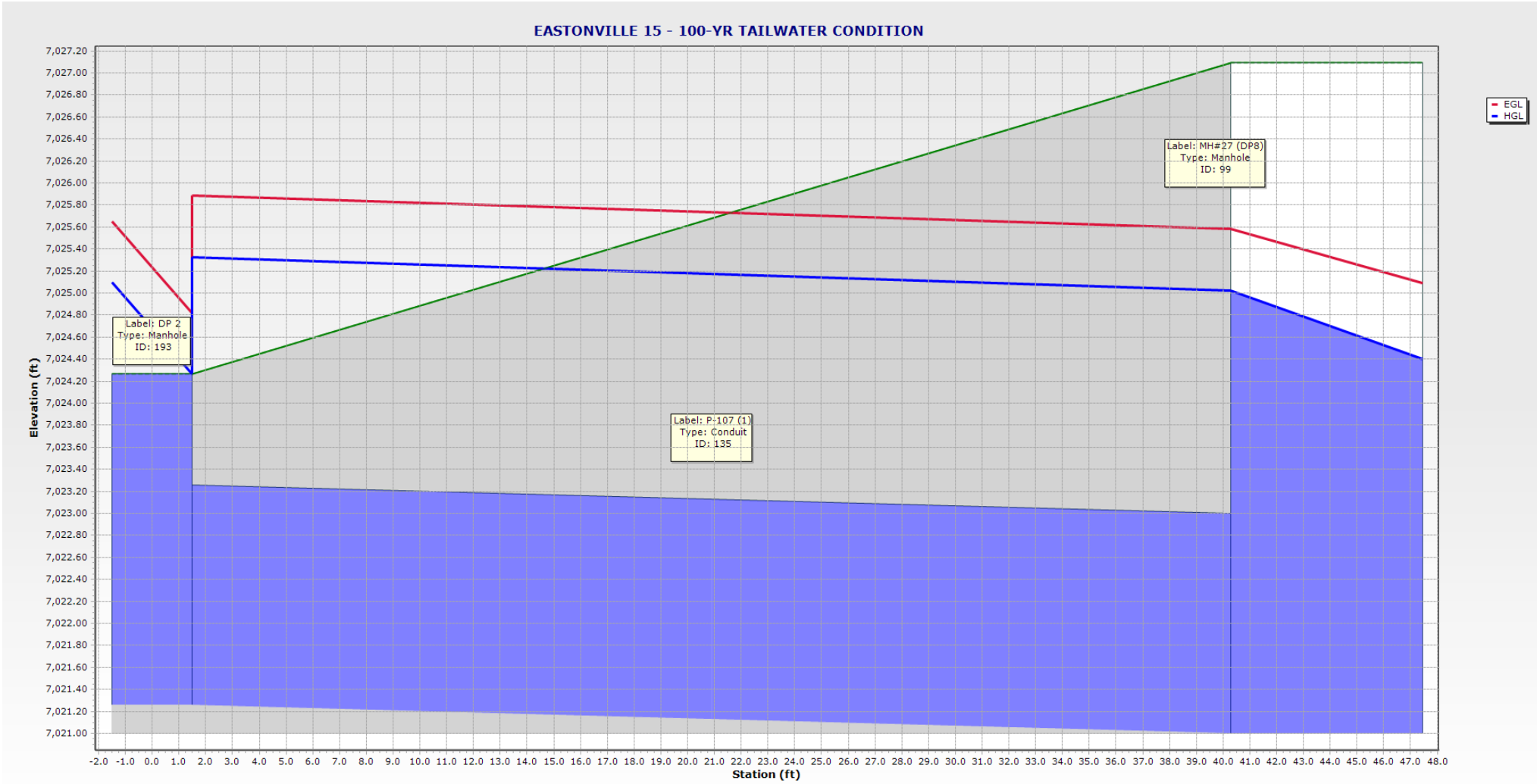
NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

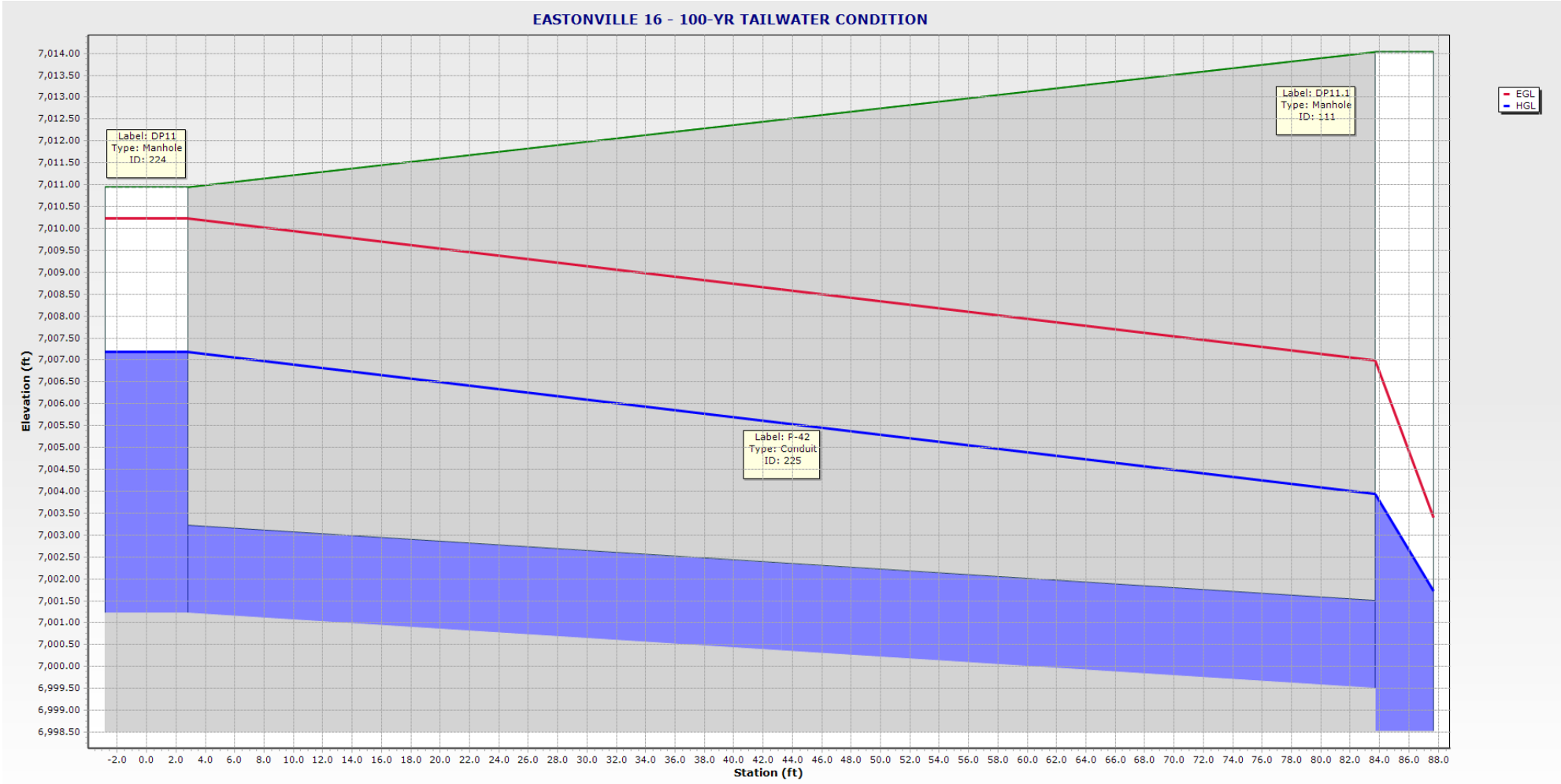

EASTONVILLE 12 OUTLET - 100-YR TAILWATER CONDITION
Label: MH#34
Type: Manhole
ID: 106
Label: MH-12
Type: Manhole
ID: 229
Label: P-111(1)
Type: Conduit
ID: 230
Label: P-111(2)
Type: Conduit
ID: 231
Label: MH#39
Type: Outfall
ID: 110
EGL
HGL
Elevation (ft)
Station (ft)

EASTONVILLE 13 - 100-YR TAILWATER CONDITION




EASTONVILLE 14 - 100-YR TAILWATER CONDITION
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP 7
Type: Manhole
ID: 192
Label: P-107
Type: Conduit
ID: 134
Label: MH#27 (DP8)
Type: Manhole
ID: 99
Label: MH#25 (DP6.1)
Type: Manhole
ID: 98
Label: P-107 (2)
Type: Conduit
ID: 133
Label: P-107 (2) (1)
Type: Conduit
ID: 131
Label: DP9
Type: Outfall
ID: 107


EASTONVILLE 15 - 100-YR TAILWATER CONDITION
EGL
HGL
Label: MH#27 (DP8)
Type: Manhole
ID: 99
Label: DP 2
Type: Manhole
ID: 193
Label: P:107 (1)
Type: Conduit
ID: 135
Elevation (ft)
Station (ft)
7,027.20
7,027.00
7,026.80
7,026.60
7,026.40
7,026.20
7,026.00
7,025.80
7,025.60
7,025.40
7,025.20
7,025.00
7,024.80
7,024.60
7,024.40
7,024.20
7,024.00
7,023.80
7,023.60
7,023.40
7,023.20
7,023.00
7,022.80
7,022.60
7,022.40
7,022.20
7,022.00
7,021.80
7,021.60
7,021.40
7,021.20
7,021.00
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0 40.0 41.0 42.0 43.0 44.0 45.0 46.0 47.0 48.0


EASTONVILLE 16 - 100-YR TAILWATER CONDITION
Label: DP11
Type: Manhole
ID: 224
Label: DP11.1
Type: Manhole
ID: 111
Label: F-42
Type: Conduit
ID: 225
EGL
HGL
Elevation (ft)
Station (ft)
7,014.00
7,013.50
7,013.00
7,012.50
7,012.00
7,011.50
7,011.00
7,010.50
7,010.00
7,009.50
7,009.00
7,008.50
7,008.00
7,007.50
7,007.00
7,006.50
7,006.00
7,005.50
7,005.00
7,004.50
7,004.00
7,003.50
7,003.00
7,002.50
7,002.00
7,001.50
7,001.00
7,000.50
7,000.00
6,999.50
6,999.00
6,998.50
-2.0 0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0 42.0 44.0 46.0 48.0 50.0 52.0 54.0 56.0 58.0 60.0 62.0 64.0 66.0 68.0 70.0 72.0 74.0 76.0 78.0 80.0 82.0 84.0 86.0 88.0

5 YEAR TAILWATER CONDITION: PIPE SUMMARY TABLE

	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
131: P-107 (2)	MH#26 (DP6.1)	7,020.50	DP9	7,019.00	60.7	0.025	24.0	0.013	2.90	6.82	35.57	8.2	7,021.09	7,019.39
132: P-103	I#9 (DP6)	7,023.00	MH#26 (DP6.1)	7,022.00	42.7	0.023	18.0	0.013	1.20	5.34	16.08	7.5	7,023.41	7,022.28
133: P-107 (2)	MH#27 (DP8)	7,021.00	MH#26 (DP6.1)	7,020.50	56.6	0.009	24.0	0.013	2.00	4.25	21.26	9.4	7,021.49	7,021.47
134: P-107	DP 7	7,023.01	MH#27 (DP8)	7,021.75	37.8	0.033	15.0	0.013	0.30	4.09	11.81	2.5	7,023.22	7,021.89
135: P-107 (1)	MH#27 (DP8)	7,021.00	DP 2	7,021.26	43.9	-0.006	24.0	0.013	1.70	3.52	17.41	9.8	7,021.71	7,021.65
136: P-95	I#8 (DP5)	7,024.00	I#9 (DP6)	7,023.00	47.5	0.021	18.0	0.013	0.70	4.38	15.24	4.6	7,024.31	7,023.50
137: P-93	I#6 (DP2.1)	7,022.34	I#7 (DP3.1)	7,021.78	55.9	0.010	18.0	0.013	0.80	3.51	10.51	7.6	7,022.67	7,022.26
140: P-44 (1)	MH#20	7,001.18	DP11.1	6,998.52	266.5	0.010	48.0	0.013	6.10	5.68	143.63	4.2	7,001.90	6,999.57
141: P-64	DP11.1	6,998.52	MH#22	6,995.26	316.5	0.010	48.0	0.013	6.10	5.74	145.88	4.2	6,999.24	6,995.82
142: P-44	MH#19	7,003.94	MH#20	7,001.28	266.5	0.010	48.0	0.013	6.10	5.68	143.63	4.2	7,004.66	7,001.84
143: P-26	DP 3	7,005.01	MH#19	7,004.04	81.5	0.012	48.0	0.013	6.10	6.03	156.73	3.9	7,005.73	7,004.99
144: P-64 (1)	MH#22	6,995.15	MH#23	6,988.82	316.6	0.020	48.0	0.013	6.10	7.23	203.15	3.0	6,995.87	6,989.55
145: P-87	MH#10 (DP 1...	6,993.41	MH#9	6,989.86	350.8	0.010	24.0	0.013	10.20	7.04	22.76	44.8	6,994.55	6,990.80
146: P-87 (1)	MH#9	6,989.76	MH#8	6,986.86	193.5	0.015	24.0	0.013	10.20	8.15	27.70	36.8	6,990.90	6,988.20
147: P-84	I#4 (DP14)	6,994.25	MH#10 (DP 1...	6,993.91	15.1	0.023	18.0	0.013	5.20	8.00	15.77	33.0	6,995.13	6,994.80
148: P-84 (1)	I#5 (DP 15)	6,994.74	MH#10 (DP 1...	6,993.91	39.7	0.021	18.0	0.013	5.00	7.70	15.18	32.9	6,995.60	6,994.80
149: P-66	MH#23	6,988.82	MH#24	6,988.00	149.0	0.006	48.0	0.013	6.10	4.60	106.64	5.7	6,989.54	6,988.73
150: P-68	MH#24	6,988.00	MH#25 (DP13)	6,987.50	107.8	0.005	48.0	0.013	6.10	4.33	97.84	6.2	6,988.72	6,988.71
151: P-77	DP12	6,990.32	MH#25 (DP13)	6,989.50	28.1	0.029	24.0	0.013	3.90	7.89	38.62	10.1	6,991.01	6,989.95
152: P-74	MH#25 (DP13)	6,987.50	OUTLET SEG...	6,986.67	173.3	0.005	48.0	0.013	10.00	5.07	99.34	10.1	6,988.42	6,988.30
225: P-42	DP11	7,001.22	DP11.1	6,999.51	85.7	0.020	24.0	0.013	7.50	8.31	31.96	23.5	7,002.19	7,000.17
227: Pipe - (34	I#7 (DP3.1)	7,021.78	MH-11	7,021.41	41.5	0.009	18.0	0.013	1.60	4.12	9.92	16.1	7,022.25	7,022.16
228: Pipe - (34	MH-11	7,021.21	FES OUTFALL 1	7,021.00	42.5	0.005	18.0	0.013	1.60	3.34	7.38	21.7	7,022.16	7,022.16
230: P-111(1)	MH#34	7,018.67	MH-12	7,018.57	20.4	0.005	18.0	0.013	0.10	1.46	7.35	1.4	7,018.79	7,018.70
231: P-111(2)	MH-12	7,018.37	MH#39	7,016.77	158.3	0.010	18.0	0.013	0.80	3.52	10.56	7.6	7,018.70	7,017.05

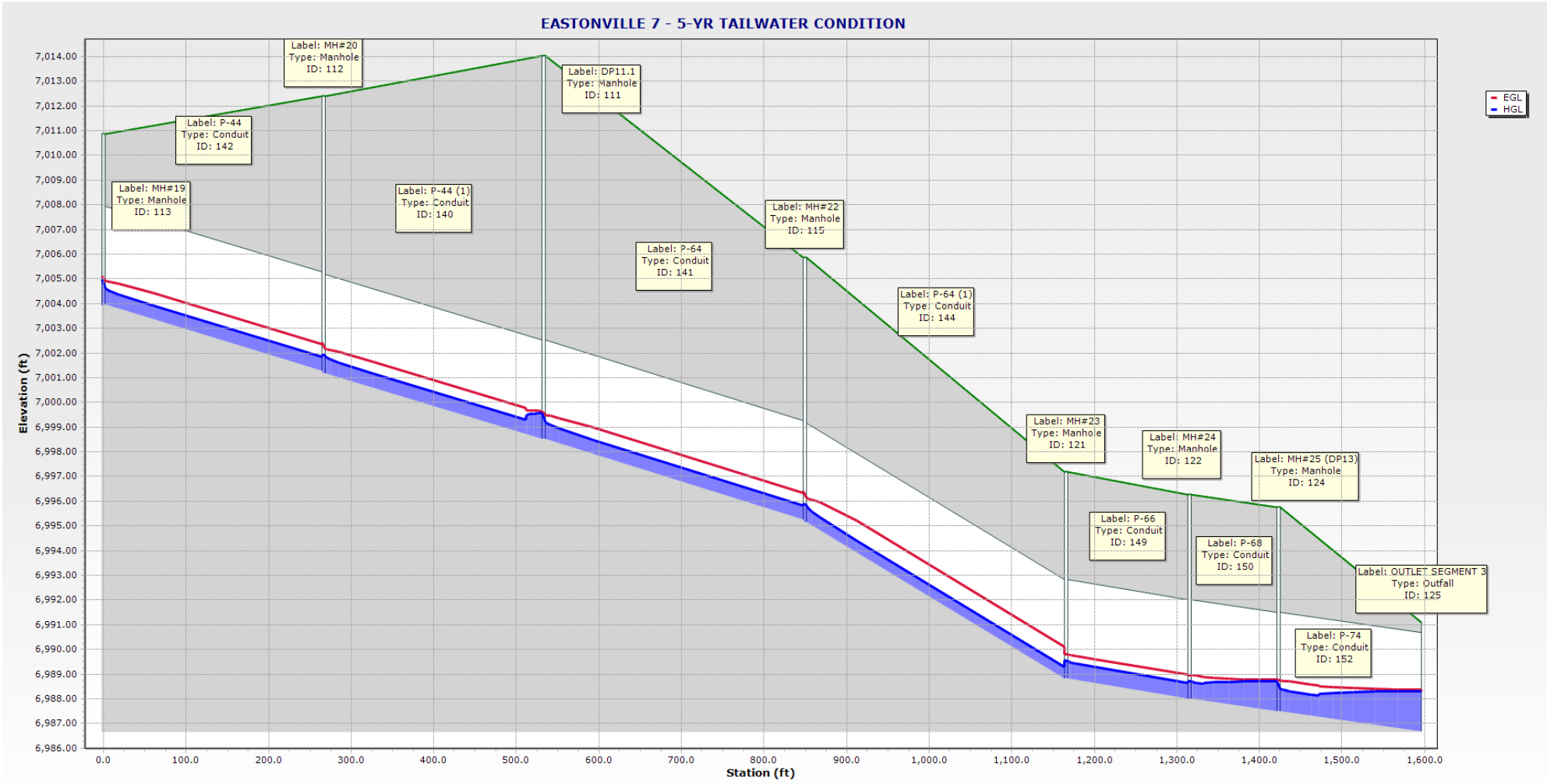
NOTE: EASTONVILLE 12 - INLET, EASTONVILLE 10, & EASTONVILLE 11 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 1 PIPES & STRUCTURES INCLUDED IN TABLE, REFER TO FDR FOR COMPLETE ANALYSIS.

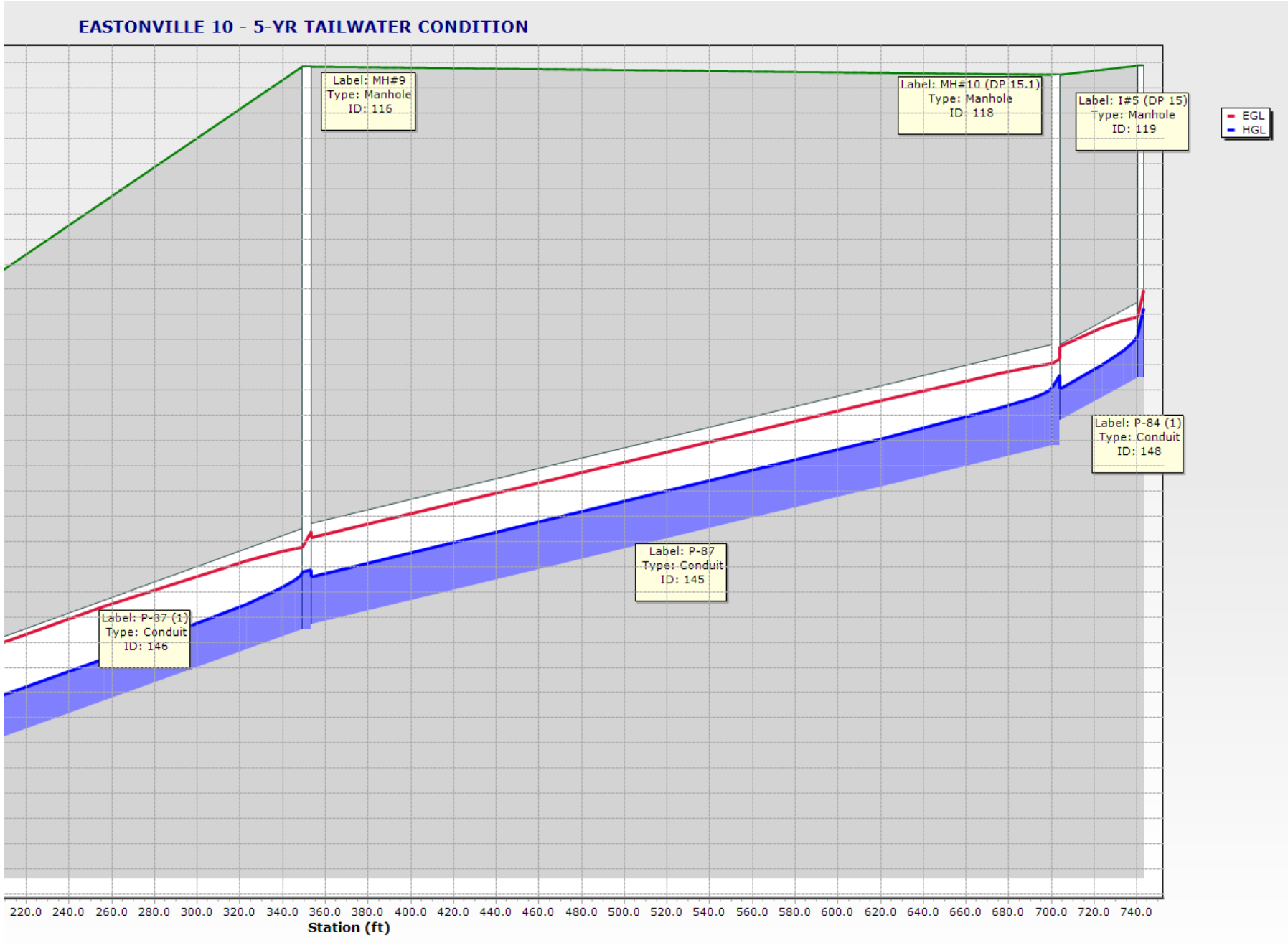
5 YEAR TAILWATER CONDITION: STRUCTURE SUMMARY TABLE

	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)	Notes
98: MH#26 (D	7,027.15	7,027.15	7,022.00	2.90	7,021.09	Standard	7,021.47	STORM MH
99: MH#27 (D	7,027.09	7,027.09	7,021.75	2.00	7,021.49	Standard	7,021.65	STORM MH
100: I#9 (DP6)	7,027.04	7,027.04	7,023.00	1.20	7,023.41	Standard	7,023.50	CDOT Type-R
101: I#8 (DP5)	7,026.63	7,026.63	(N/A)	0.70	7,024.31	Standard	7,024.47	CDOT Type-R
102: I#7 (DP3.	7,026.51	7,026.51	7,021.78	1.60	7,022.25	Standard	7,022.26	CDOT Type-R
103: I#6 (DP2.	7,026.38	7,026.38	(N/A)	0.80	7,022.67	Standard	7,022.85	CDOT Type-R
106: MH#34	7,025.00	7,025.00	(N/A)	0.10	7,018.79	Standard	7,018.81	CDOT Type-C
111: DP11.1	7,014.03	7,014.03	6,998.52	6.10	6,999.24	Standard	6,999.57	STORM MH
112: MH#20	7,012.41	7,012.41	7,001.28	6.10	7,001.90	Standard	7,001.91	STORM MH
113: MH#19	7,010.85	7,010.85	7,004.04	6.10	7,004.66	Standard	7,004.99	STORM MH
115: MH#22	7,005.85	7,005.85	6,995.26	6.10	6,995.87	Standard	6,995.88	STORM MH
116: MH#9	7,000.92	7,000.92	6,989.86	10.20	6,990.90	Standard	6,990.93	STORM MH
117: I#4 (DP1	7,000.75	7,000.75	(N/A)	5.20	6,995.13	Standard	6,995.67	CDOT Type-R
118: MH#10 (	7,000.75	7,000.75	6,993.91	10.20	6,994.55	Standard	6,994.80	STORM MH
119: I#5 (DP 1	7,000.94	7,000.94	(N/A)	5.00	6,995.60	Standard	6,996.13	CDOT Type-R
121: MH#23	6,997.20	6,997.20	6,988.82	6.10	6,989.54	Standard	6,989.55	STORM MH
122: MH#24	6,996.25	6,996.25	6,988.00	6.10	6,988.72	Standard	6,988.73	STORM MH
123: DP12	6,996.40	6,996.40	(N/A)	3.90	6,991.01	Standard	6,991.39	CDOT Type-C
124: MH#25 (	6,995.75	6,995.75	6,987.50	10.00	6,988.42	Standard	6,988.71	STORM MH
192: DP 7	7,024.45	7,024.45	(N/A)	0.30	7,023.22	Standard	7,023.33	CDOT FES
193: DP 2	7,024.26	7,024.26	(N/A)	1.70	7,021.71	Standard	7,021.95	CDOT FES
194: DP 3	7,009.43	7,009.43	(N/A)	6.10	7,005.73	Standard	7,006.10	CDOT FES
224: DP11	7,010.95	7,010.95	(N/A)	7.50	7,002.19	Absolute	7,002.19	CDOT TYPE D INLET
226: MH-11	7,026.84	7,026.84	7,021.41	1.60	7,022.16	Absolute	7,022.16	
229: MH-12	7,024.52	7,024.52	7,018.57	0.80	7,018.70	Absolute	7,018.70	

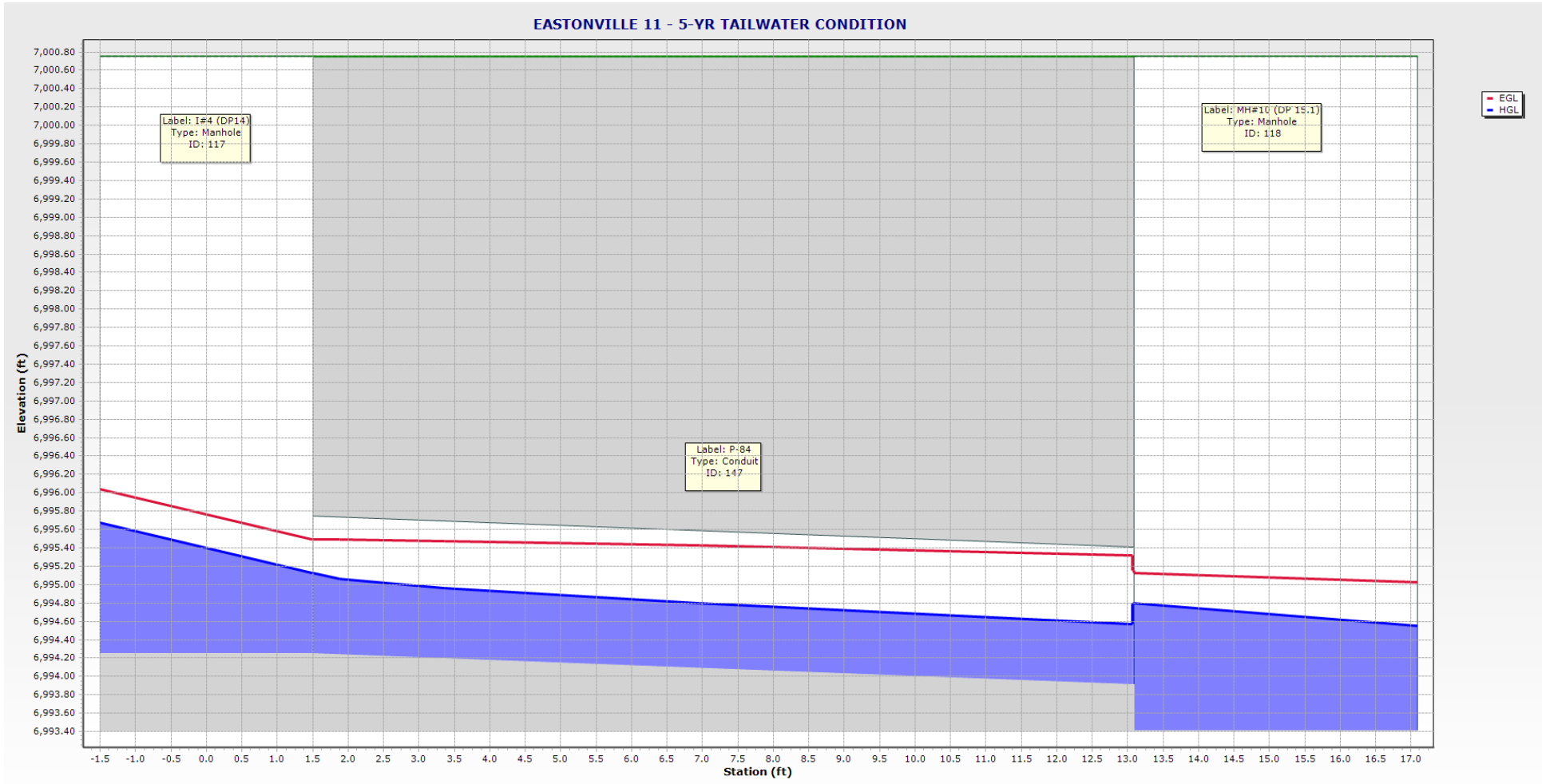
	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
107: DP9	7,022.74	7,019.00	Free Outfall		7,019.39	2.90	CDOT FES
108: FES OUTF	7,022.50	7,021.00	User Defined Tailwater	7,022.16	7,022.16	1.60	CDOT FES
110: MH#39	7,018.27	7,016.77	Free Outfall		7,017.05	0.80	CDOT FES
125: OUTLET S	6,991.09	6,986.67	User Defined Tailwater	6,988.30	6,988.30	10.00	CDOT FES

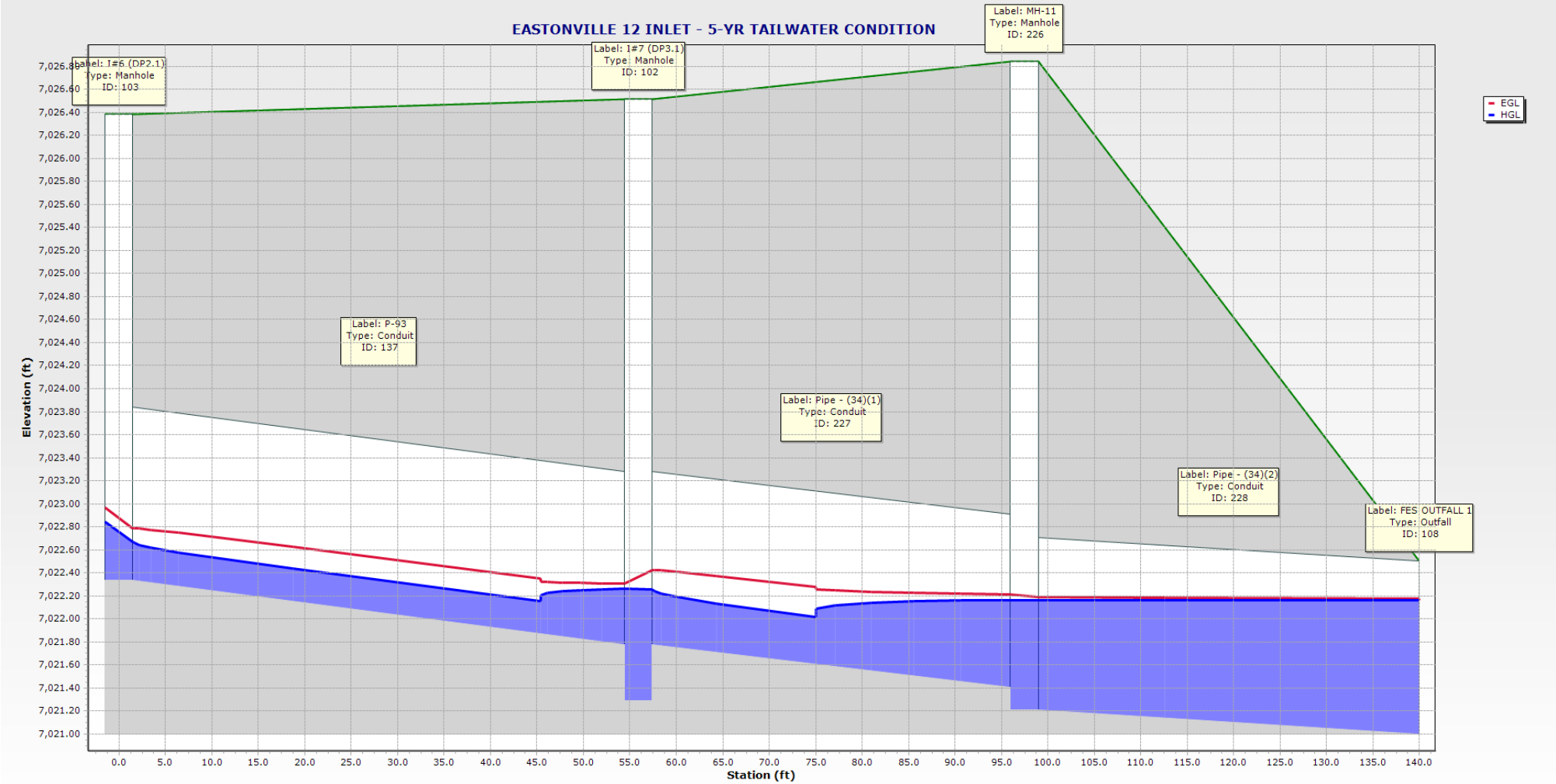
NOTE: EASTONVILLE 12 - INLET & EASTONVILLE 10 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 1 PIPES & STRUCTURES NOT INCLUDED IN TABLE, REFER TO SEGMENT 1 FDR.


EASTONVILLE 7 - 5-YR TAILWATER CONDITION
Label: MH#20
Type: Manhole
ID: 112
Label: DP11.1
Type: Manhole
ID: 111
Label: P-44
Type: Conduit
ID: 142
Label: MH#19
Type: Manhole
ID: 113
Label: P-44 (1)
Type: Conduit
ID: 140
Label: MH#22
Type: Manhole
ID: 115
Label: P-64
Type: Conduit
ID: 141
Label: P-64 (1)
Type: Conduit
ID: 144
Label: MH#23
Type: Manhole
ID: 121
Label: MH#24
Type: Manhole
ID: 122
Label: MH#25 (DP13)
Type: Manhole
ID: 124
Label: P-66
Type: Conduit
ID: 149
Label: P-68
Type: Conduit
ID: 150
Label: OUTLET SEGMENT 3
Type: Outfall
ID: 125
Label: P-74
Type: Conduit
ID: 152
EGL
HGL
Elevation (ft)
7,014.00
7,013.00
7,012.00
7,011.00
7,010.00
7,009.00
7,008.00
7,007.00
7,006.00
7,005.00
7,004.00
7,003.00
7,002.00
7,001.00
7,000.00
6,999.00
6,998.00
6,997.00
6,996.00
6,995.00
6,994.00
6,993.00
6,992.00
6,991.00
6,990.00
6,989.00
6,988.00
6,987.00
6,986.00
0.0
100.0
200.0
300.0
400.0
500.0
600.0
700.0
800.0
900.0
1,000.0
1,100.0
1,200.0
1,300.0
1,400.0
1,500.0
1,600.0
Station (ft)

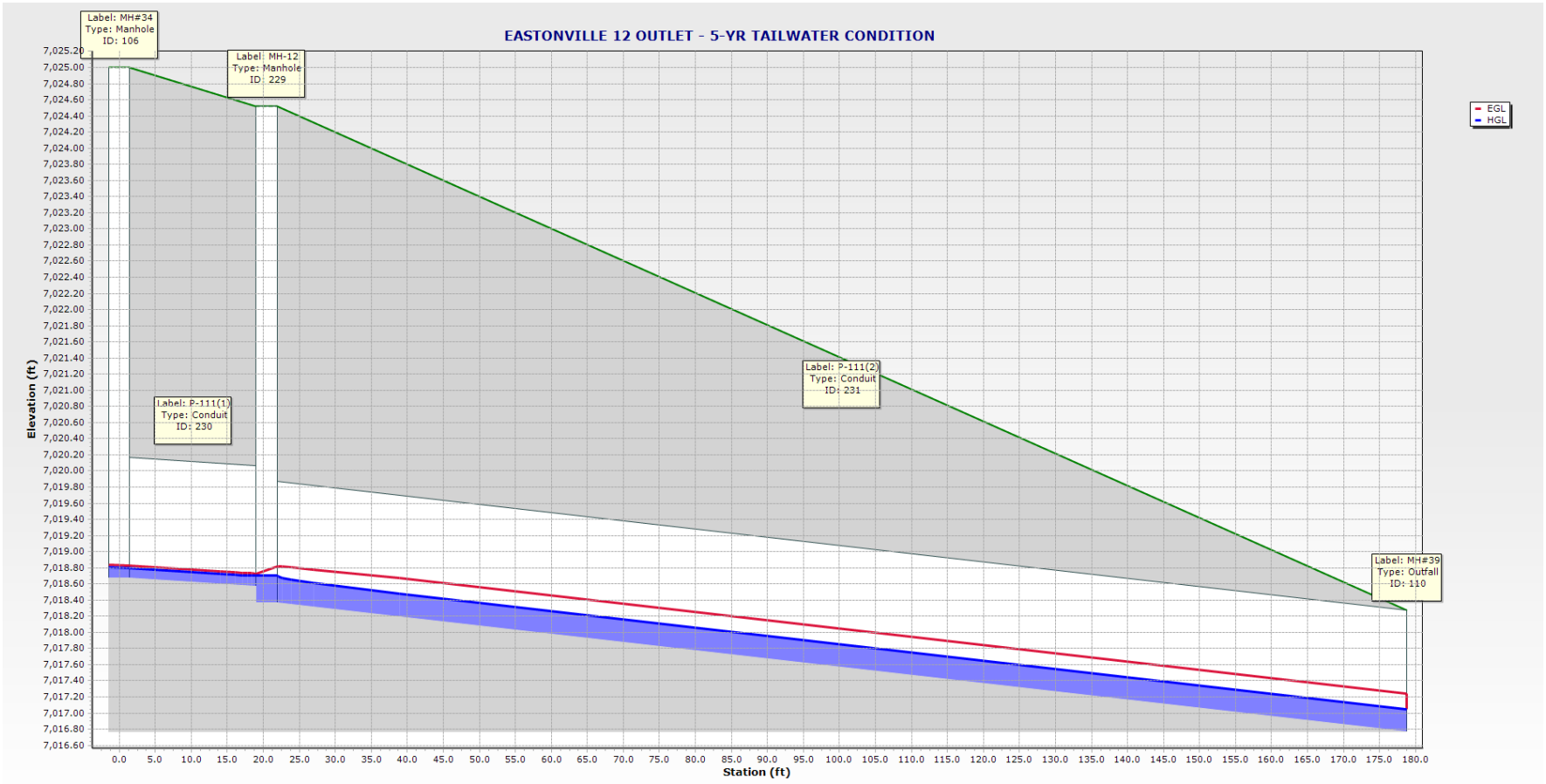


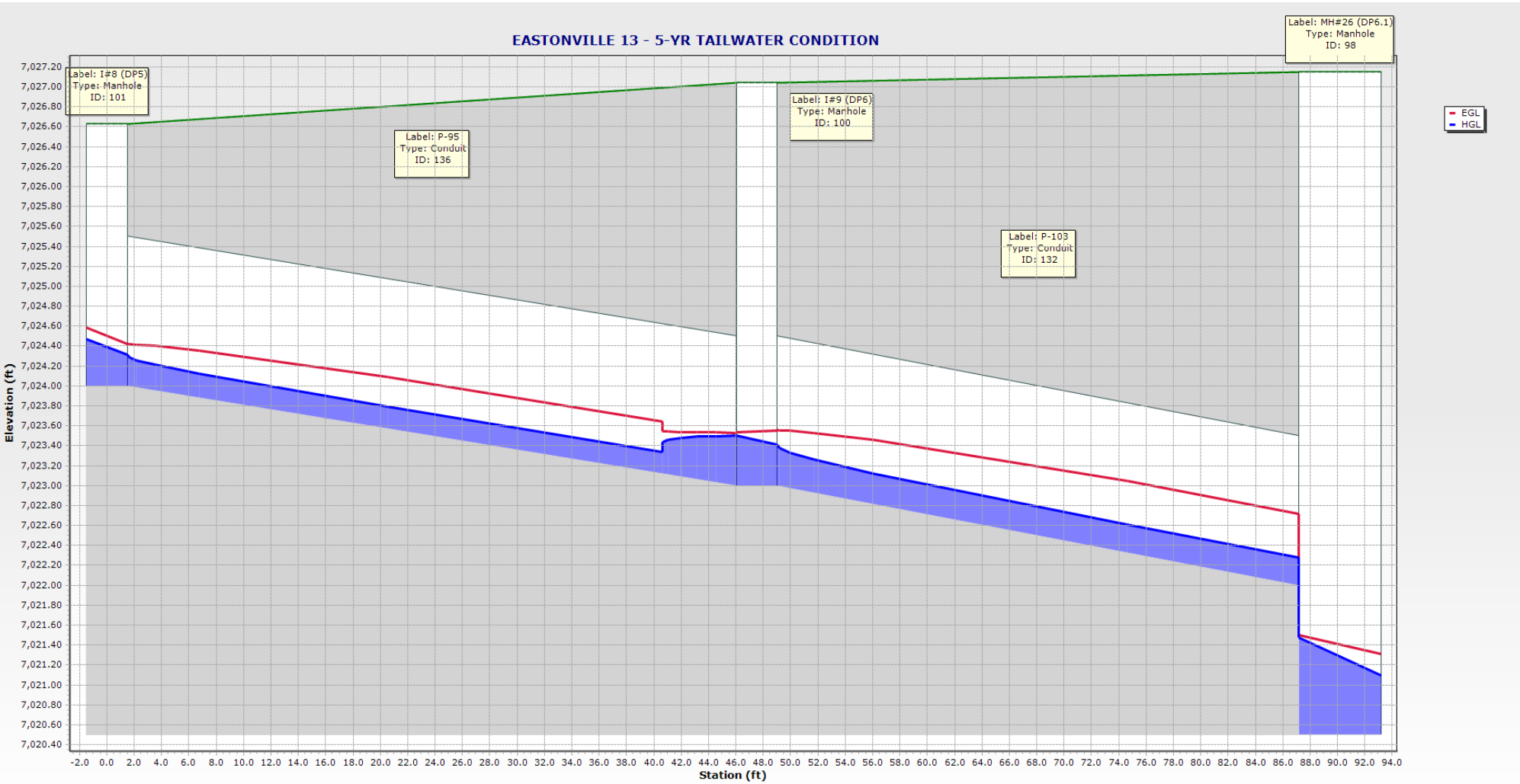
NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

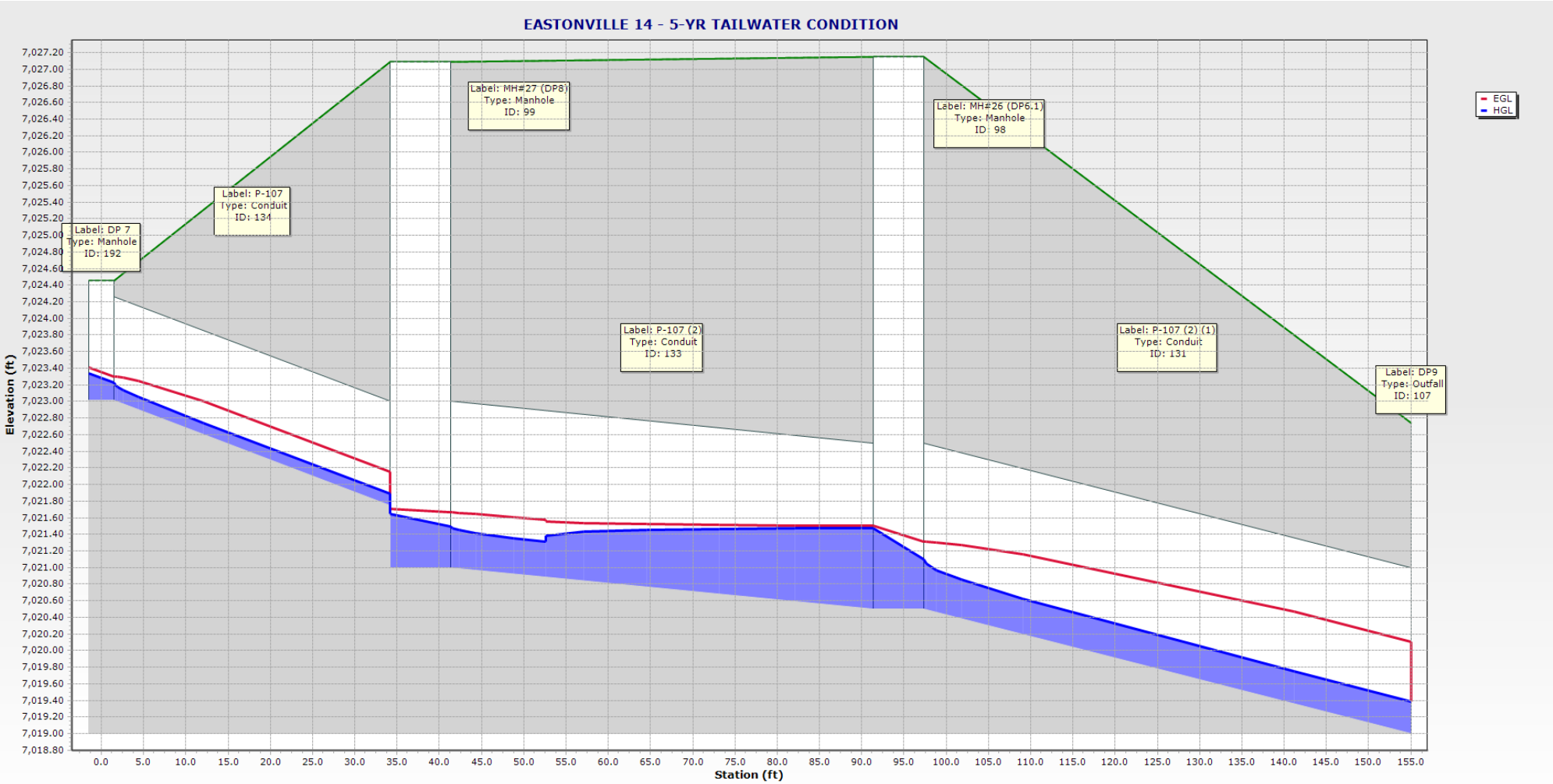

EASTONVILLE 11 - 5-YR TAILWATER CONDITION
Label: I#4 (DP14)
Type: Manhole
ID: 117
Label: MH#10 (DP 15.1)
Type: Manhole
ID: 118
Label: P-84
Type: Conduit
ID: 147
EGL
HGL
Elevation (ft)
Station (ft)

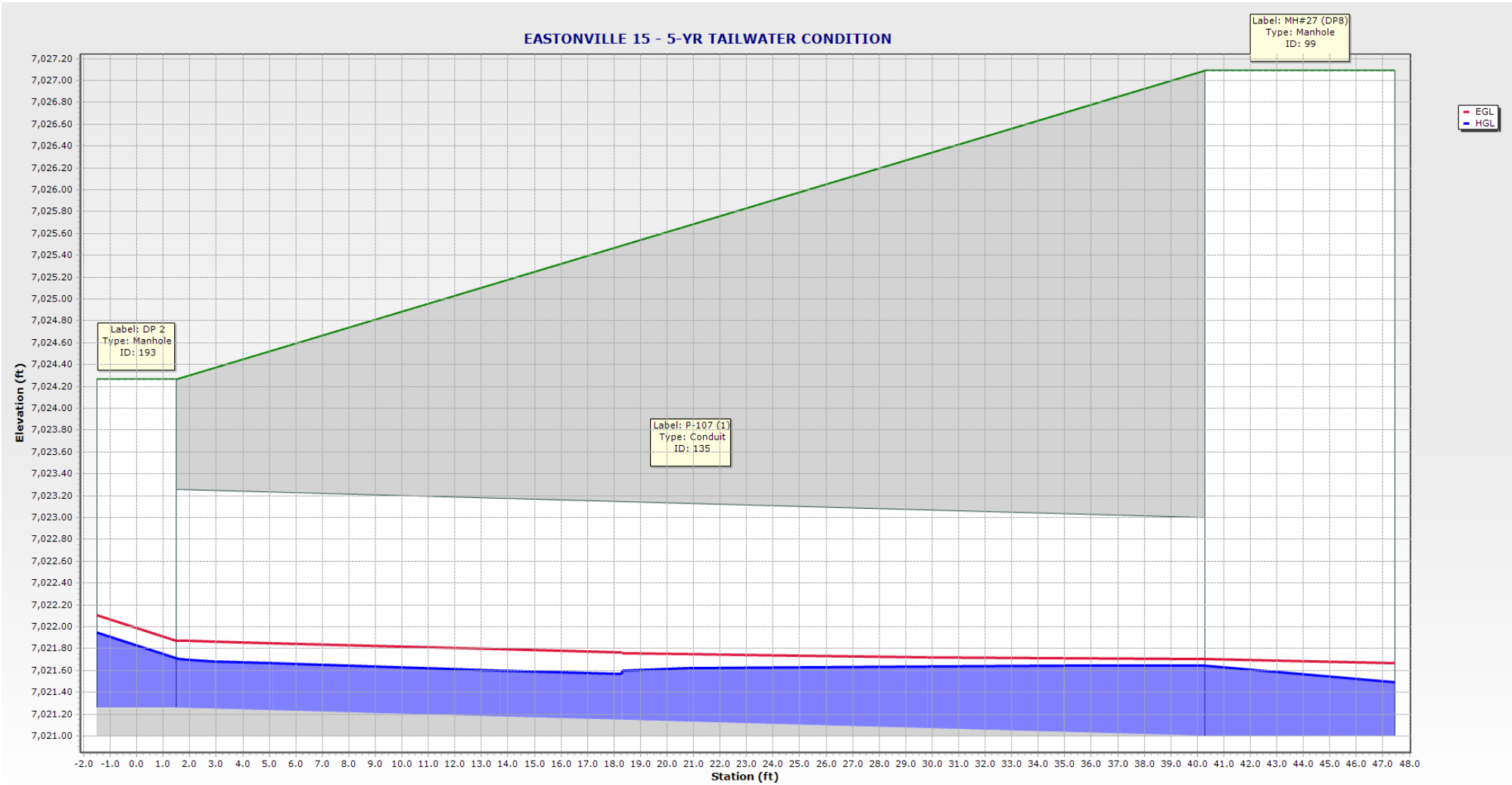


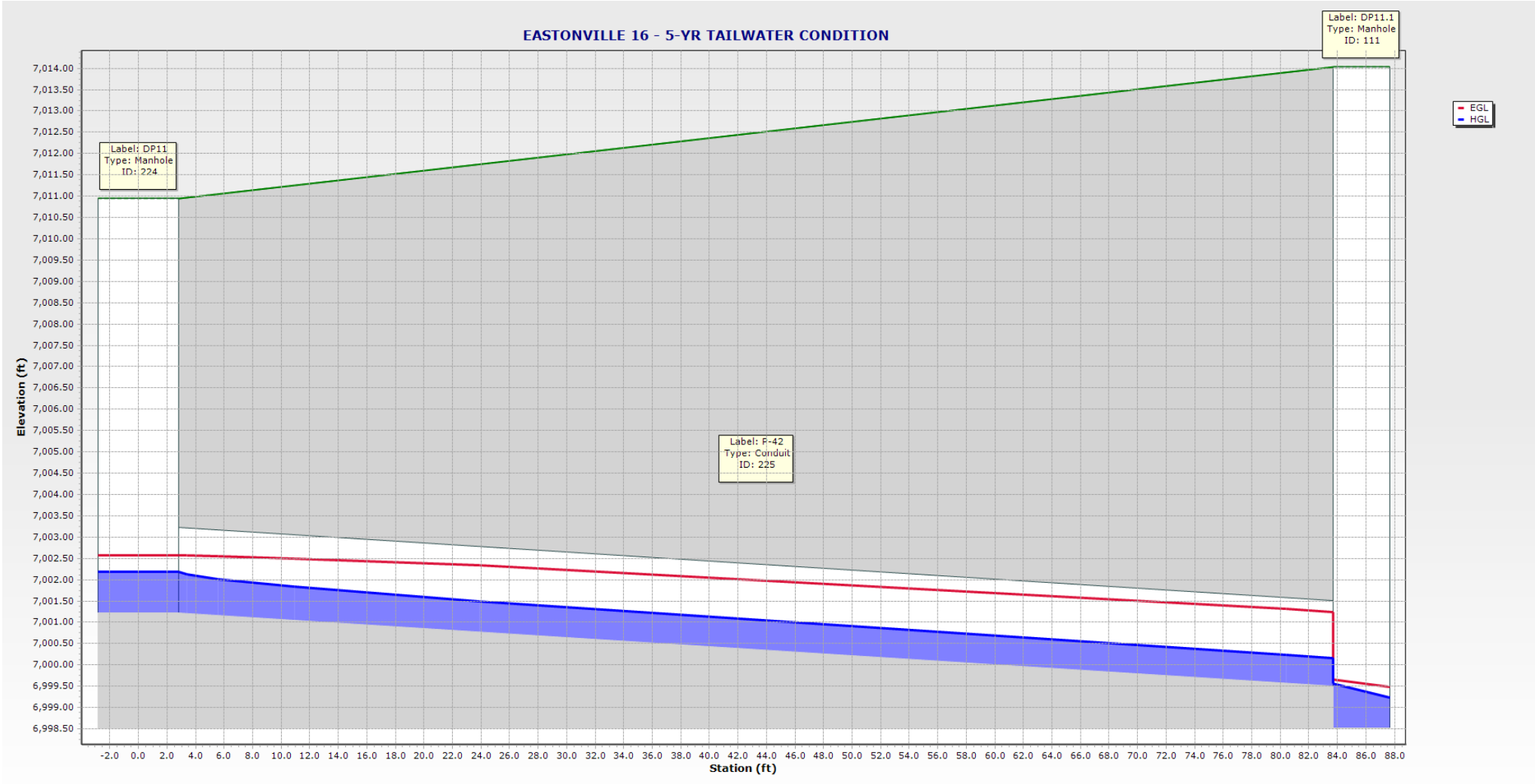
NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS


EASTONVILLE 12 OUTLET - 5-YR TAILWATER CONDITION
Label: MH#34
Type: Manhole
ID: 106
Label: MH-12
Type: Manhole
ID: 229
Label: P-111(1)
Type: Conduit
ID: 230
Label: P-111(2)
Type: Conduit
ID: 231
Label: MH#39
Type: Outfall
ID: 110
EGL
HGL
Elevation (ft)
Station (ft)


EASTONVILLE 13 - 5-YR TAILWATER CONDITION
Label: I#8 (DP5)
Type: Manhole
ID: 101
Label: P-95
Type: Conduit
ID: 136
Label: I#9 (DP6)
Type: Manhole
ID: 100
Label: P-103
Type: Conduit
ID: 132
Label: MH#26 (DP6.1)
Type: Manhole
ID: 98
EGL
HGL
Elevation (ft)
7,027.20
7,027.00
7,026.80
7,026.60
7,026.40
7,026.20
7,026.00
7,025.80
7,025.60
7,025.40
7,025.20
7,025.00
7,024.80
7,024.60
7,024.40
7,024.20
7,024.00
7,023.80
7,023.60
7,023.40
7,023.20
7,023.00
7,022.80
7,022.60
7,022.40
7,022.20
7,022.00
7,021.80
7,021.60
7,021.40
7,021.20
7,021.00
7,020.80
7,020.60
7,020.40
-2.0 0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0 42.0 44.0 46.0 48.0 50.0 52.0 54.0 56.0 58.0 60.0 62.0 64.0 66.0 68.0 70.0 72.0 74.0 76.0 78.0 80.0 82.0 84.0 86.0 88.0 90.0 92.0 94.0
Station (ft)


EASTONVILLE 14 - 5-YR TAILWATER CONDITION
Label: DP 7
Type: Manhole
ID: 192
Label: P-107
Type: Conduit
ID: 134
Label: MH#27 (DP8)
Type: Manhole
ID: 99
Label: P-107 (2)
Type: Conduit
ID: 133
Label: MH#26 (DP6.1)
Type: Manhole
ID: 98
Label: P-107 (2) (1)
Type: Conduit
ID: 131
Label: DP9
Type: Outfall
ID: 107
EGL
HGL
Elevation (ft)
Station (ft)


EASTONVILLE 15 - 5-YR TAILWATER CONDITION
Label: MH#27 (DP8)
Type: Manhole
ID: 99
Label: DP 2
Type: Manhole
ID: 193
Label: P-107 (1)
Type: Conduit
ID: 135
EGL
HGL
Elevation (ft)
Station (ft)
7,027.20
7,027.00
7,026.80
7,026.60
7,026.40
7,026.20
7,026.00
7,025.80
7,025.60
7,025.40
7,025.20
7,025.00
7,024.80
7,024.60
7,024.40
7,024.20
7,024.00
7,023.80
7,023.60
7,023.40
7,023.20
7,023.00
7,022.80
7,022.60
7,022.40
7,022.20
7,022.00
7,021.80
7,021.60
7,021.40
7,021.20
7,021.00
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0 40.0 41.0 42.0 43.0 44.0 45.0 46.0 47.0 48.0


EASTONVILLE 16 - 5-YR TAILWATER CONDITION
Label: DP11.1
Type: Manhole
ID: 111
Label: DP11
Type: Manhole
ID: 224
Label: P-42
Type: Conduit
ID: 225
EGL
HGL
Elevation (ft)
7,014.00
7,013.50
7,013.00
7,012.50
7,012.00
7,011.50
7,011.00
7,010.50
7,010.00
7,009.50
7,009.00
7,008.50
7,008.00
7,007.50
7,007.00
7,006.50
7,006.00
7,005.50
7,005.00
7,004.50
7,004.00
7,003.50
7,003.00
7,002.50
7,002.00
7,001.50
7,001.00
7,000.50
7,000.00
6,999.50
6,999.00
6,998.50
-2.0 0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0 42.0 44.0 46.0 48.0 50.0 52.0 54.0 56.0 58.0 60.0 62.0 64.0 66.0 68.0 70.0 72.0 74.0 76.0 78.0 80.0 82.0 84.0 86.0 88.0
Station (ft)

100 YEAR FREE OUTFALL CONDITION: PIPE SUMMARY TABLE

	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
131: P-107 (2)	MH#26 (DP6.1)	7,020.50	DP9	7,019.00	60.7	0.025	24.0	0.013	22.40	11.97	35.57	63.0	7,022.19	7,020.22
132: P-103	I#9 (DP6)	7,023.00	MH#26 (DP6.1)	7,022.00	42.7	0.023	18.0	0.013	2.40	6.54	16.08	14.9	7,023.89	7,023.91
133: P-107 (2)	MH#27 (DP8)	7,021.00	MH#26 (DP6.1)	7,020.50	56.6	0.009	24.0	0.013	21.00	6.68	21.26	98.8	7,024.40	7,023.91
134: P-107	DP 7	7,023.01	MH#27 (DP8)	7,021.75	37.8	0.033	15.0	0.013	2.20	1.79	11.81	18.6	7,025.07	7,025.03
135: P-107 (1)	MH#27 (DP8)	7,021.00	DP 2	7,021.26	43.9	-0.006	24.0	0.013	18.80	5.98	17.41	108.0	7,025.33	7,025.03
136: P-95	I#8 (DP5)	7,024.00	I#9 (DP6)	7,023.00	47.5	0.021	18.0	0.013	1.30	5.26	15.24	8.5	7,024.43	7,023.94
137: P-93	I#6 (DP2.1)	7,022.34	I#7 (DP3.1)	7,021.78	55.9	0.010	18.0	0.013	1.50	4.22	10.51	14.3	7,022.80	7,022.47
140: P-44 (1)	MH#20	7,001.18	DP11.1	6,998.52	266.5	0.010	48.0	0.013	112.10	8.92	143.63	78.0	7,005.57	7,003.94
141: P-64	DP11.1	6,998.52	MH#22	6,995.26	316.5	0.010	48.0	0.013	112.10	12.80	145.88	76.8	7,001.72	6,997.89
142: P-44	MH#19	7,003.94	MH#20	7,001.28	266.5	0.010	48.0	0.013	112.10	12.64	143.63	78.0	7,007.14	7,005.63
143: P-26	DP 3	7,005.01	MH#19	7,004.04	81.5	0.012	48.0	0.013	112.10	8.92	156.73	71.5	7,009.86	7,009.36
144: P-64 (1)	MH#22	6,995.15	MH#23	6,988.82	316.6	0.020	48.0	0.013	112.10	16.57	203.15	55.2	6,998.35	6,995.32
145: P-87	MH#10 (DP 1...	6,993.41	MH#9	6,989.86	350.8	0.010	24.0	0.013	17.20	7.96	22.76	75.6	6,994.91	6,991.16
146: P-87 (1)	MH#9	6,989.76	MH#8	6,986.86	193.5	0.015	24.0	0.013	17.20	9.29	27.70	62.1	6,991.26	6,988.76
147: P-84	I#4 (DP14)	6,994.25	MH#10 (DP 1...	6,993.91	15.1	0.023	18.0	0.013	8.80	9.17	15.77	55.8	6,995.40	6,995.28
148: P-84 (1)	I#5 (DP 15)	6,994.74	MH#10 (DP 1...	6,993.91	39.7	0.021	18.0	0.013	10.40	9.25	15.18	68.5	6,995.98	6,995.28
149: P-66	MH#23	6,988.82	MH#24	6,988.00	149.0	0.006	48.0	0.013	112.10	8.92	106.64	105.1	6,995.26	6,994.35
150: P-68	MH#24	6,988.00	MH#25 (DP13)	6,987.50	107.8	0.005	48.0	0.013	112.10	8.92	97.84	114.6	6,994.29	6,993.63
151: P-77	DP12	6,990.32	MH#25 (DP13)	6,989.50	28.1	0.029	24.0	0.013	24.60	7.83	38.62	63.7	6,993.96	6,993.63
152: P-74	MH#25 (DP13)	6,987.50	OUTLET SEG...	6,986.67	173.3	0.005	48.0	0.013	136.60	10.87	99.34	137.5	6,991.98	6,990.15
225: P-42	DP11	7,001.22	DP11.1	6,999.51	85.7	0.020	24.0	0.013	44.00	14.01	31.96	137.7	7,007.19	7,003.94
227: Pipe - (34	I#7 (DP3.1)	7,021.78	MH-11	7,021.41	41.5	0.009	18.0	0.013	3.20	5.00	9.92	32.3	7,022.46	7,022.00
228: Pipe - (34	MH-11	7,021.21	FES OUTFALL 1	7,021.00	42.5	0.005	18.0	0.013	3.20	4.03	7.38	43.3	7,021.90	7,021.68
230: P-111(1)	MH#34	7,018.67	MH-12	7,018.57	20.4	0.005	18.0	0.013	0.80	2.73	7.35	10.9	7,019.00	7,018.90
231: P-111(2)	MH-12	7,018.37	MH#39	7,016.77	158.3	0.010	18.0	0.013	0.80	3.52	10.56	7.6	7,018.70	7,017.05

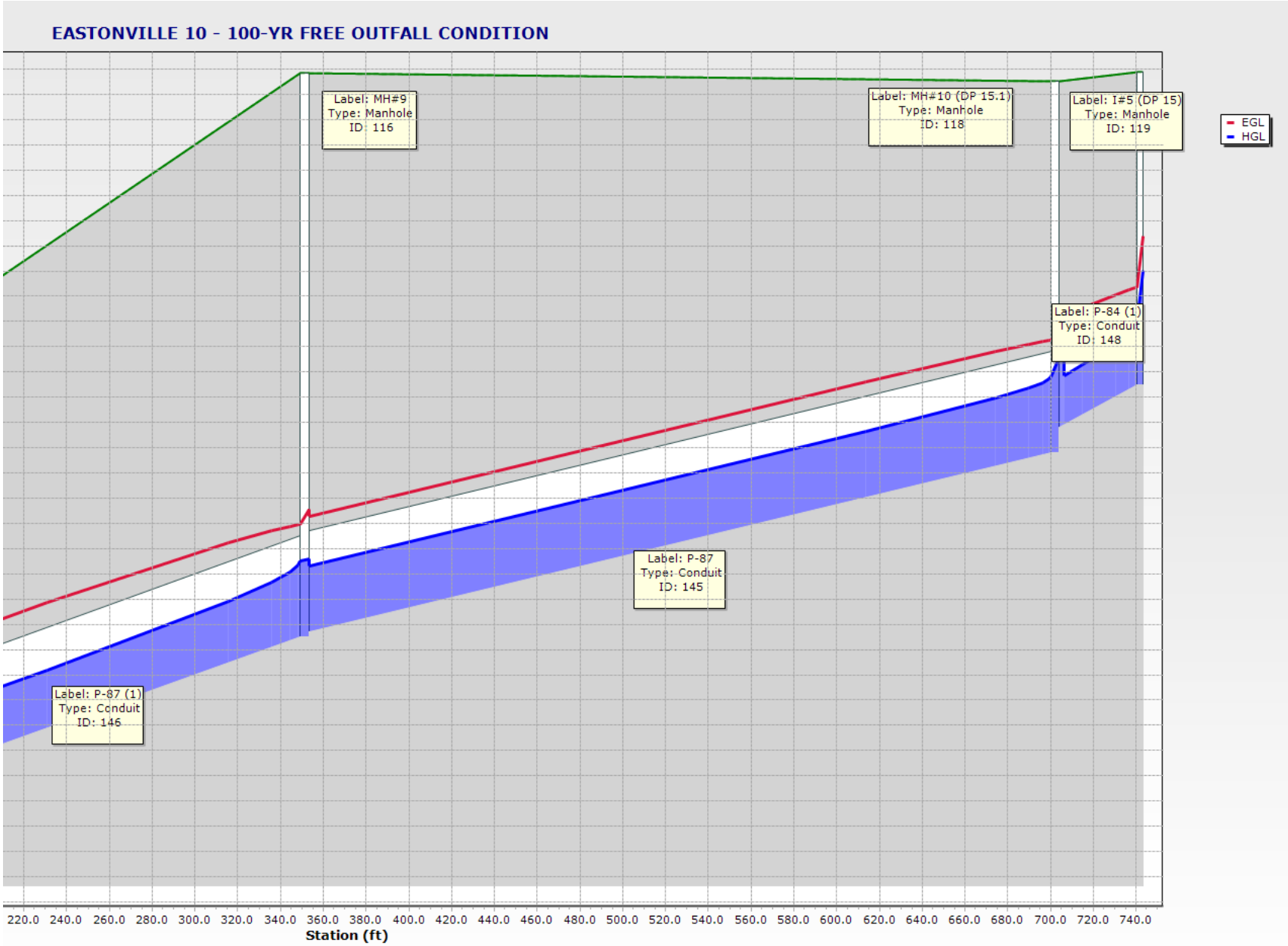
NOTE: SEE PROFILES BELOW FOR PIPES STUDIED WITH THIS ANALYSIS

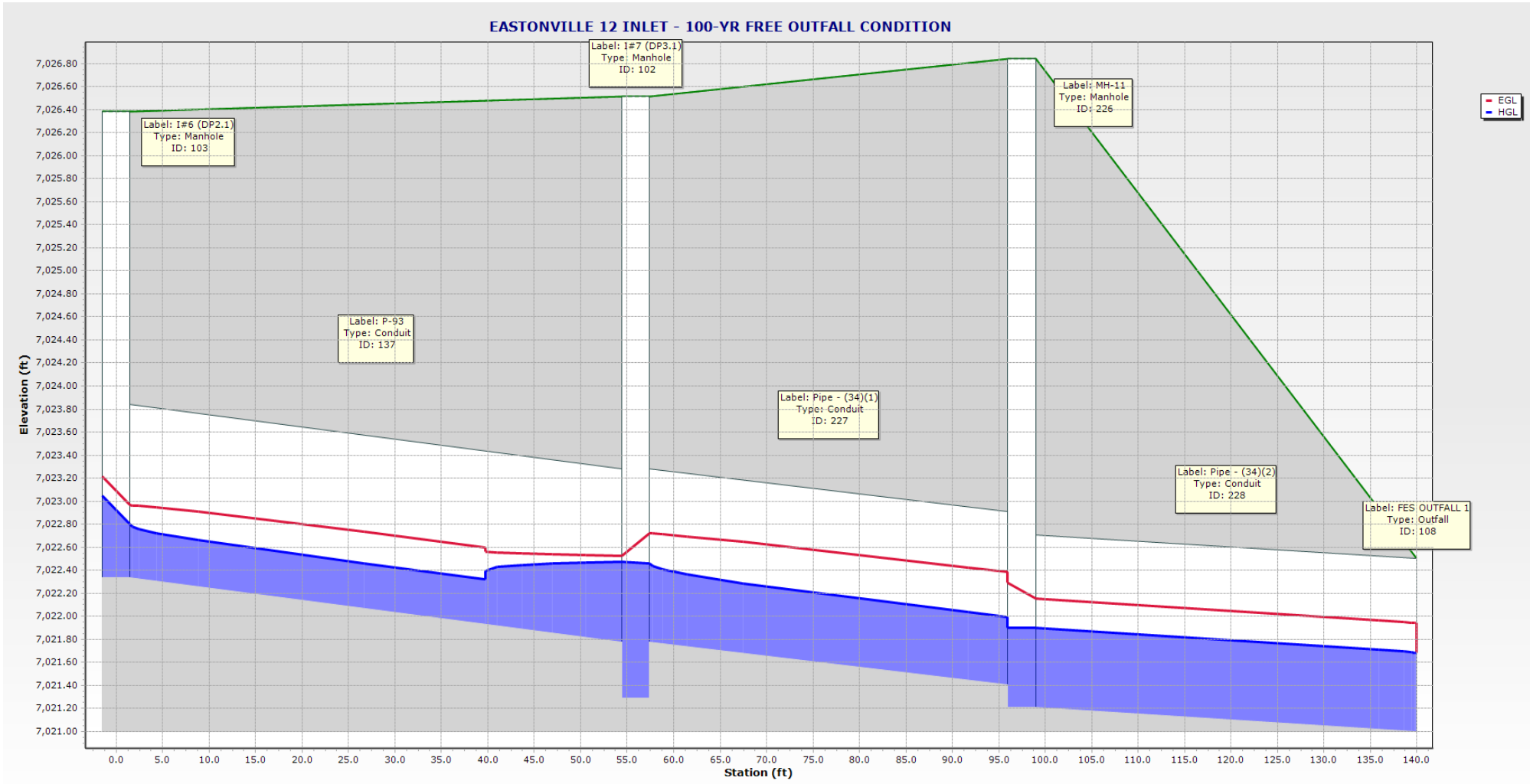
100 YEAR FREE OUTFALL CONDITION: STRUCTURE SUMMARY TABLE

	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)	Notes
98: MH#26 (D	7,027.15	7,027.15	7,022.00	22.40	7,022.19	Standard	7,023.91	STORM MH
99: MH#27 (D	7,027.09	7,027.09	7,021.75	21.00	7,024.40	Standard	7,025.03	STORM MH
100: I#9 (DP6)	7,027.04	7,027.04	7,023.00	2.40	7,023.89	Standard	7,023.94	CDOT Type-R
101: I#8 (DP5)	7,026.63	7,026.63	(N/A)	1.30	7,024.43	Standard	7,024.66	CDOT Type-R
102: I#7 (DP3.	7,026.51	7,026.51	7,021.78	3.20	7,022.46	Standard	7,022.47	CDOT Type-R
103: I#6 (DP2.	7,026.38	7,026.38	(N/A)	1.50	7,022.80	Standard	7,023.05	CDOT Type-R
106: MH#34	7,025.00	7,025.00	(N/A)	0.80	7,019.00	Standard	7,019.06	CDOT Type-C
111: DP11.1	7,014.03	7,014.03	6,998.52	112.10	7,001.72	Standard	7,003.94	STORM MH
112: MH#20	7,012.41	7,012.41	7,001.28	112.10	7,005.57	Standard	7,005.63	STORM MH
113: MH#19	7,010.85	7,010.85	7,004.04	112.10	7,007.14	Standard	7,009.36	STORM MH
115: MH#22	7,005.85	7,005.85	6,995.26	112.10	6,998.35	Standard	6,998.44	STORM MH
116: MH#9	7,000.92	7,000.92	6,989.86	17.20	6,991.26	Standard	6,991.29	STORM MH
117: I#4 (DP1	7,000.75	7,000.75	(N/A)	8.80	6,995.40	Standard	6,996.25	CDOT Type-R
118: MH#10 (	7,000.75	7,000.75	6,993.91	17.20	6,994.91	Standard	6,995.28	STORM MH
119: I#5 (DP 1	7,000.94	7,000.94	(N/A)	10.40	6,995.98	Standard	6,997.01	CDOT Type-R
121: MH#23	6,997.20	6,997.20	6,988.82	112.10	6,995.26	Standard	6,995.32	STORM MH
122: MH#24	6,996.25	6,996.25	6,988.00	112.10	6,994.29	Standard	6,994.35	STORM MH
123: DP12	6,996.40	6,996.40	(N/A)	24.60	6,993.96	Standard	6,995.39	CDOT Type-C
124: MH#25 (	6,995.75	6,995.75	6,987.50	136.60	6,991.98	Standard	6,993.63	STORM MH
192: DP 7	7,024.45	7,024.45	(N/A)	2.20	7,024.45	Standard	7,024.52	CDOT FES
193: DP 2	7,024.26	7,024.26	(N/A)	18.80	7,024.26	Standard	7,025.10	CDOT FES
194: DP 3	7,009.43	7,009.43	(N/A)	112.10	7,009.43	Standard	7,011.29	CDOT FES
224: DP11	7,010.95	7,010.95	(N/A)	44.00	7,007.19	Absolute	7,007.19	CDOT TYPE D INLET
226: MH-11	7,026.84	7,026.84	7,021.41	3.20	7,021.90	Absolute	7,021.90	
229: MH-12	7,024.52	7,024.52	7,018.57	0.80	7,018.70	Absolute	7,018.70	

	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
107: DP9	7,022.74	7,019.00	Free Outfall		7,020.22	22.40	CDOT FES
108: FES OUTF	7,022.50	7,021.00	Free Outfall		7,021.68	3.20	CDOT FES
110: MH#39	7,018.27	7,016.77	Free Outfall		7,017.05	0.80	CDOT FES
125: OUTLET S	6,991.09	6,986.67	Free Outfall		6,990.15	136.60	CDOT FES

NOTE: SEE PROFILES BELOW FOR PIPES STUDIED WITH THIS ANALYSIS


EASTONVILLE 10 - 100-YR FREE OUTFALL CONDITION
Label: MH#9
Type: Manhole
ID: 116
Label: MH#10 (DP 15.1)
Type: Manhole
ID: 118
Label: I#5 (DP 15)
Type: Manhole
ID: 119
EGL
HGL
Label: P-84 (1)
Type: Conduit
ID: 148
Label: P-87
Type: Conduit
ID: 145
Label: P-87 (1)
Type: Conduit
ID: 146
220.0 240.0 260.0 280.0 300.0 320.0 340.0 360.0 380.0 400.0 420.0 440.0 460.0 480.0 500.0 520.0 540.0 560.0 580.0 600.0 620.0 640.0 660.0 680.0 700.0 720.0 740.0
Station (ft)


EASTONVILLE 12 INLET - 100-YR FREE OUTFALL CONDITION
Label: I#7 (DP3.1)
Type: Manhole
ID: 102
Label: MH-11
Type: Manhole
ID: 226
Label: I#6 (DP2.1)
Type: Manhole
ID: 103
Label: P-93
Type: Conduit
ID: 137
Label: Pipe - (34)(1)
Type: Conduit
ID: 227
Label: Pipe - (34)(2)
Type: Conduit
ID: 228
Label: FES OUTFALL 1
Type: Outfall
ID: 108
EGL
HGL
Elevation (ft)
7,026.80
7,026.60
7,026.40
7,026.20
7,026.00
7,025.80
7,025.60
7,025.40
7,025.20
7,025.00
7,024.80
7,024.60
7,024.40
7,024.20
7,024.00
7,023.80
7,023.60
7,023.40
7,023.20
7,023.00
7,022.80
7,022.60
7,022.40
7,022.20
7,022.00
7,021.80
7,021.60
7,021.40
7,021.20
7,021.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
105.0
110.0
115.0
120.0
125.0
130.0
135.0
140.0
Station (ft)

5 YEAR FREE OUTFALL CONDITION: PIPE SUMMARY TABLE

	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
131: P-107 (2)	MH#26 (DP6.1)	7,020.50	DP9	7,019.00	60.7	0.025	24.0	0.013	2.90	6.82	35.57	8.2	7,021.09	7,019.39
132: P-103	I#9 (DP6)	7,023.00	MH#26 (DP6.1)	7,022.00	42.7	0.023	18.0	0.013	1.20	5.34	16.08	7.5	7,023.41	7,022.28
133: P-107 (2)	MH#27 (DP8)	7,021.00	MH#26 (DP6.1)	7,020.50	56.6	0.009	24.0	0.013	2.00	4.25	21.26	9.4	7,021.49	7,021.47
134: P-107	DP 7	7,023.01	MH#27 (DP8)	7,021.75	37.8	0.033	15.0	0.013	0.30	4.09	11.81	2.5	7,023.22	7,021.89
135: P-107 (1)	MH#27 (DP8)	7,021.00	DP 2	7,021.26	43.9	-0.006	24.0	0.013	1.70	3.52	17.41	9.8	7,021.71	7,021.65
136: P-95	I#8 (DP5)	7,024.00	I#9 (DP6)	7,023.00	47.5	0.021	18.0	0.013	0.70	4.38	15.24	4.6	7,024.31	7,023.50
137: P-93	I#6 (DP2.1)	7,022.34	I#7 (DP3.1)	7,021.78	55.9	0.010	18.0	0.013	0.80	3.51	10.51	7.6	7,022.67	7,022.26
140: P-44 (1)	MH#20	7,001.18	DP11.1	6,998.52	266.5	0.010	48.0	0.013	6.10	5.68	143.63	4.2	7,001.90	6,999.57
141: P-64	DP11.1	6,998.52	MH#22	6,995.26	316.5	0.010	48.0	0.013	6.10	5.74	145.88	4.2	6,999.24	6,995.82
142: P-44	MH#19	7,003.94	MH#20	7,001.28	266.5	0.010	48.0	0.013	6.10	5.68	143.63	4.2	7,004.66	7,001.84
143: P-26	DP 3	7,005.01	MH#19	7,004.04	81.5	0.012	48.0	0.013	6.10	6.03	156.73	3.9	7,005.73	7,004.99
144: P-64 (1)	MH#22	6,995.15	MH#23	6,988.82	316.6	0.020	48.0	0.013	6.10	7.23	203.15	3.0	6,995.87	6,989.55
145: P-87	MH#10 (DP 1...	6,993.41	MH#9	6,989.86	350.8	0.010	24.0	0.013	10.20	7.04	22.76	44.8	6,994.55	6,990.80
146: P-87 (1)	MH#9	6,989.76	MH#8	6,986.86	193.5	0.015	24.0	0.013	10.20	8.15	27.70	36.8	6,990.90	6,988.20
147: P-84	I#4 (DP14)	6,994.25	MH#10 (DP 1...	6,993.91	15.1	0.023	18.0	0.013	5.20	8.00	15.77	33.0	6,995.13	6,994.80
148: P-84 (1)	I#5 (DP 15)	6,994.74	MH#10 (DP 1...	6,993.91	39.7	0.021	18.0	0.013	5.00	7.70	15.18	32.9	6,995.60	6,994.80
149: P-66	MH#23	6,988.82	MH#24	6,988.00	149.0	0.006	48.0	0.013	6.10	4.60	106.64	5.7	6,989.54	6,988.73
150: P-68	MH#24	6,988.00	MH#25 (DP13)	6,987.50	107.8	0.005	48.0	0.013	6.10	4.33	97.84	6.2	6,988.72	6,988.71
151: P-77	DP12	6,990.32	MH#25 (DP13)	6,989.50	28.1	0.029	24.0	0.013	3.90	7.89	38.62	10.1	6,991.01	6,989.95
152: P-74	MH#25 (DP13)	6,987.50	OUTLET SEG...	6,986.67	173.3	0.005	48.0	0.013	10.00	5.07	99.34	10.1	6,988.42	6,988.30
225: P-42	DP11	7,001.22	DP11.1	6,999.51	85.7	0.020	24.0	0.013	7.50	8.31	31.96	23.5	7,002.19	7,000.17
227: Pipe - (34	I#7 (DP3.1)	7,021.78	MH-11	7,021.41	41.5	0.009	18.0	0.013	1.60	4.12	9.92	16.1	7,022.25	7,021.82
228: Pipe - (34	MH-11	7,021.21	FES OUTFALL 1	7,021.00	42.5	0.005	18.0	0.013	1.60	3.34	7.38	21.7	7,021.69	7,021.47
230: P-111(1)	MH#34	7,018.67	MH-12	7,018.57	20.4	0.005	18.0	0.013	0.10	1.46	7.35	1.4	7,018.79	7,018.70
231: P-111(2)	MH-12	7,018.37	MH#39	7,016.77	158.3	0.010	18.0	0.013	0.80	3.52	10.56	7.6	7,018.70	7,017.05

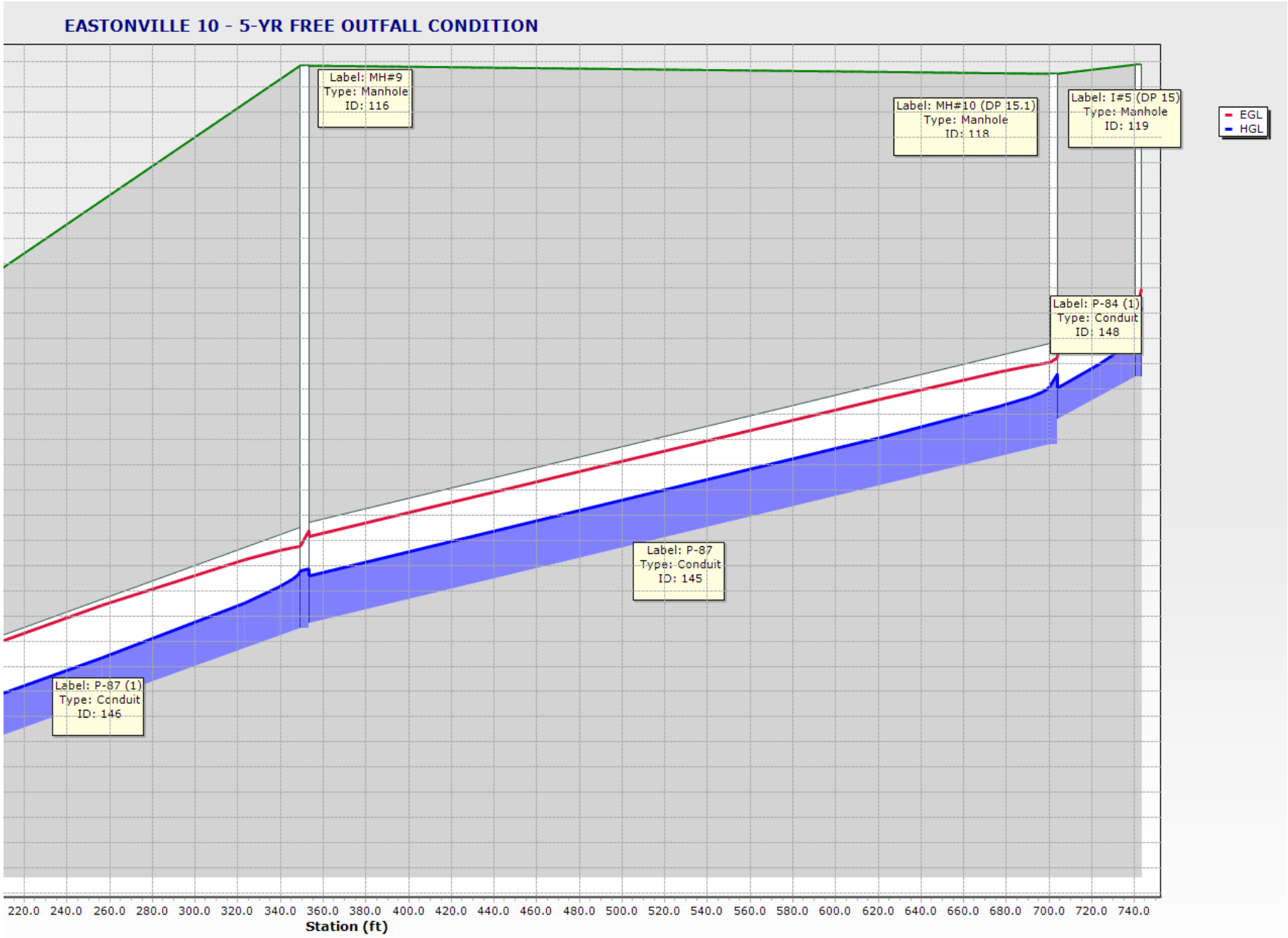
NOTE: SEE PROFILES BELOW FOR PIPES STUDIED WITH THIS ANALYSIS

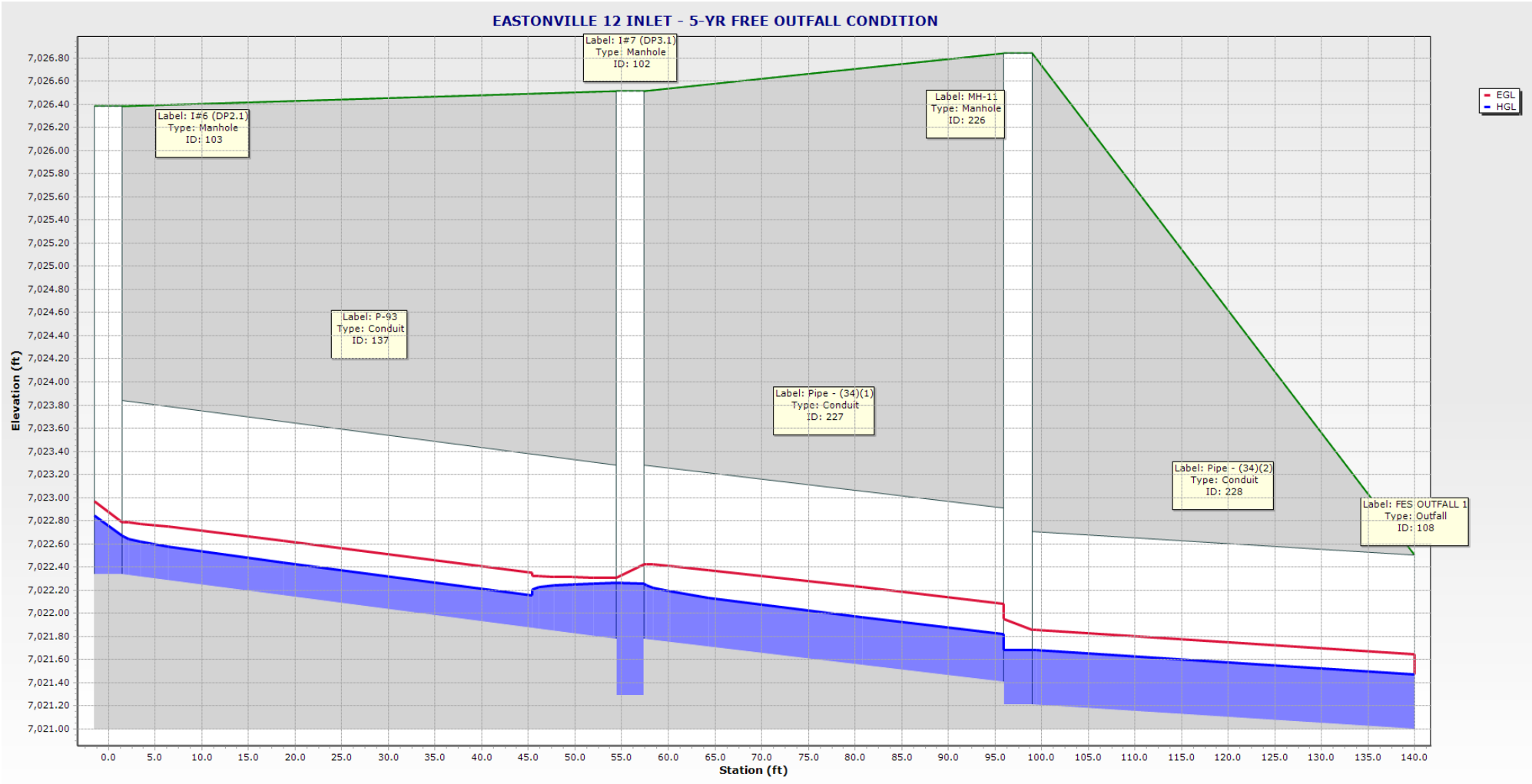
5 YEAR FREE OUTFALL CONDITION: STRUCTURE SUMMARY TABLE

	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)	Notes
98: MH#26 (D	7,027.15	7,027.15	7,022.00	2.90	7,021.09	Standard	7,021.47	STORM MH
99: MH#27 (D	7,027.09	7,027.09	7,021.75	2.00	7,021.49	Standard	7,021.65	STORM MH
100: I#9 (DP6)	7,027.04	7,027.04	7,023.00	1.20	7,023.41	Standard	7,023.50	CDOT Type-R
101: I#8 (DP5)	7,026.63	7,026.63	(N/A)	0.70	7,024.31	Standard	7,024.47	CDOT Type-R
102: I#7 (DP3.	7,026.51	7,026.51	7,021.78	1.60	7,022.25	Standard	7,022.26	CDOT Type-R
103: I#6 (DP2.	7,026.38	7,026.38	(N/A)	0.80	7,022.67	Standard	7,022.85	CDOT Type-R
106: MH#34	7,025.00	7,025.00	(N/A)	0.10	7,018.79	Standard	7,018.81	CDOT Type-C
111: DP11.1	7,014.03	7,014.03	6,998.52	6.10	6,999.24	Standard	6,999.57	STORM MH
112: MH#20	7,012.41	7,012.41	7,001.28	6.10	7,001.90	Standard	7,001.91	STORM MH
113: MH#19	7,010.85	7,010.85	7,004.04	6.10	7,004.66	Standard	7,004.99	STORM MH
115: MH#22	7,005.85	7,005.85	6,995.26	6.10	6,995.87	Standard	6,995.88	STORM MH
116: MH#9	7,000.92	7,000.92	6,989.86	10.20	6,990.90	Standard	6,990.93	STORM MH
117: I#4 (DP1	7,000.75	7,000.75	(N/A)	5.20	6,995.13	Standard	6,995.67	CDOT Type-R
118: MH#10 (	7,000.75	7,000.75	6,993.91	10.20	6,994.55	Standard	6,994.80	STORM MH
119: I#5 (DP 1	7,000.94	7,000.94	(N/A)	5.00	6,995.60	Standard	6,996.13	CDOT Type-R
121: MH#23	6,997.20	6,997.20	6,988.82	6.10	6,989.54	Standard	6,989.55	STORM MH
122: MH#24	6,996.25	6,996.25	6,988.00	6.10	6,988.72	Standard	6,988.73	STORM MH
123: DP12	6,996.40	6,996.40	(N/A)	3.90	6,991.01	Standard	6,991.39	CDOT Type-C
124: MH#25 (	6,995.75	6,995.75	6,987.50	10.00	6,988.42	Standard	6,988.71	STORM MH
192: DP 7	7,024.45	7,024.45	(N/A)	0.30	7,023.22	Standard	7,023.33	CDOT FES
193: DP 2	7,024.26	7,024.26	(N/A)	1.70	7,021.71	Standard	7,021.95	CDOT FES
194: DP 3	7,009.43	7,009.43	(N/A)	6.10	7,005.73	Standard	7,006.10	CDOT FES
224: DP11	7,010.95	7,010.95	(N/A)	7.50	7,002.19	Absolute	7,002.19	CDOT TYPE D INLET
226: MH-11	7,026.84	7,026.84	7,021.41	1.60	7,021.69	Absolute	7,021.69	
229: MH-12	7,024.52	7,024.52	7,018.57	0.80	7,018.70	Absolute	7,018.70	

	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
107: DP9	7,022.74	7,019.00	Free Outfall		7,019.39	2.90	CDOT FES
108: FES OUTF	7,022.50	7,021.00	Free Outfall		7,021.47	1.60	CDOT FES
110: MH#39	7,018.27	7,016.77	Free Outfall		7,017.05	0.80	CDOT FES
125: OUTLET S	6,991.09	6,986.67	User Defined Tailwater	6,988.30	6,988.30	10.00	CDOT FES

NOTE: SEE PROFILES BELOW FOR PIPES STUDIED WITH THIS ANALYSIS


EASTONVILLE 10 - 5-YR FREE OUTFALL CONDITION
Label: MH#9
Type: Manhole
ID: 116
Label: MH#10 (DP 15.1)
Type: Manhole
ID: 118
Label: I#5 (DP 15)
Type: Manhole
ID: 119
EGL
HGL
Label: P-84 (1)
Type: Conduit
ID: 148
Label: P-87
Type: Conduit
ID: 145
Label: P-87 (1)
Type: Conduit
ID: 146
220.0 240.0 260.0 280.0 300.0 320.0 340.0 360.0 380.0 400.0 420.0 440.0 460.0 480.0 500.0 520.0 540.0 560.0 580.0 600.0 620.0 640.0 660.0 680.0 700.0 720.0 740.0
Station (ft)


EASTONVILLE 12 INLET - 5-YR FREE OUTFALL CONDITION
Label: I#7 (DP3.1)
Type: Manhole
ID: 102
Label: I#6 (DP2.1)
Type: Manhole
ID: 103
Label: MH-11
Type: Manhole
ID: 226
Label: P-93
Type: Conduit
ID: 137
Label: Pipe - (34)(1)
Type: Conduit
ID: 227
Label: Pipe - (34)(2)
Type: Conduit
ID: 228
Label: FES OUTFALL 1
Type: Outfall
ID: 108
EGL
HGL
Elevation (ft)
7,026.80
7,026.60
7,026.40
7,026.20
7,026.00
7,025.80
7,025.60
7,025.40
7,025.20
7,025.00
7,024.80
7,024.60
7,024.40
7,024.20
7,024.00
7,023.80
7,023.60
7,023.40
7,023.20
7,023.00
7,022.80
7,022.60
7,022.40
7,022.20
7,022.00
7,021.80
7,021.60
7,021.40
7,021.20
7,021.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
105.0
110.0
115.0
120.0
125.0
130.0
135.0
140.0
Station (ft)

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 28 2024

DP3 SWALE

Trapezoidal

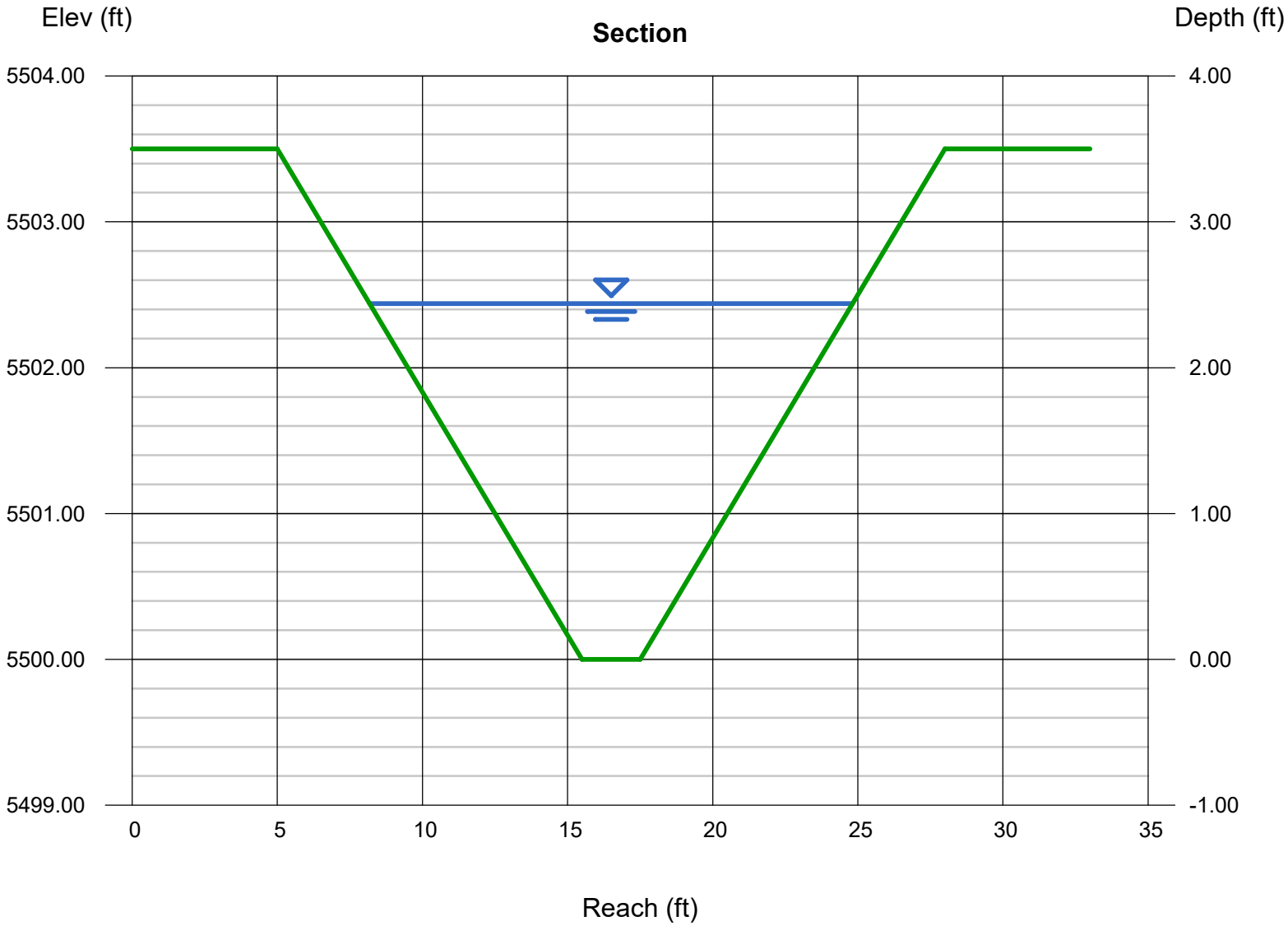
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.50
Invert Elev (ft)	= 5500.00
Slope (%)	= 0.70
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 112.00

Highlighted

Depth (ft)	= 2.44
Q (cfs)	= 112.00
Area (sqft)	= 22.74
Velocity (ft/s)	= 4.93
Wetted Perim (ft)	= 17.43
Crit Depth, Yc (ft)	= 2.14
Top Width (ft)	= 16.64
EGL (ft)	= 2.82



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 28 2024

DP4 SWALE

Trapezoidal

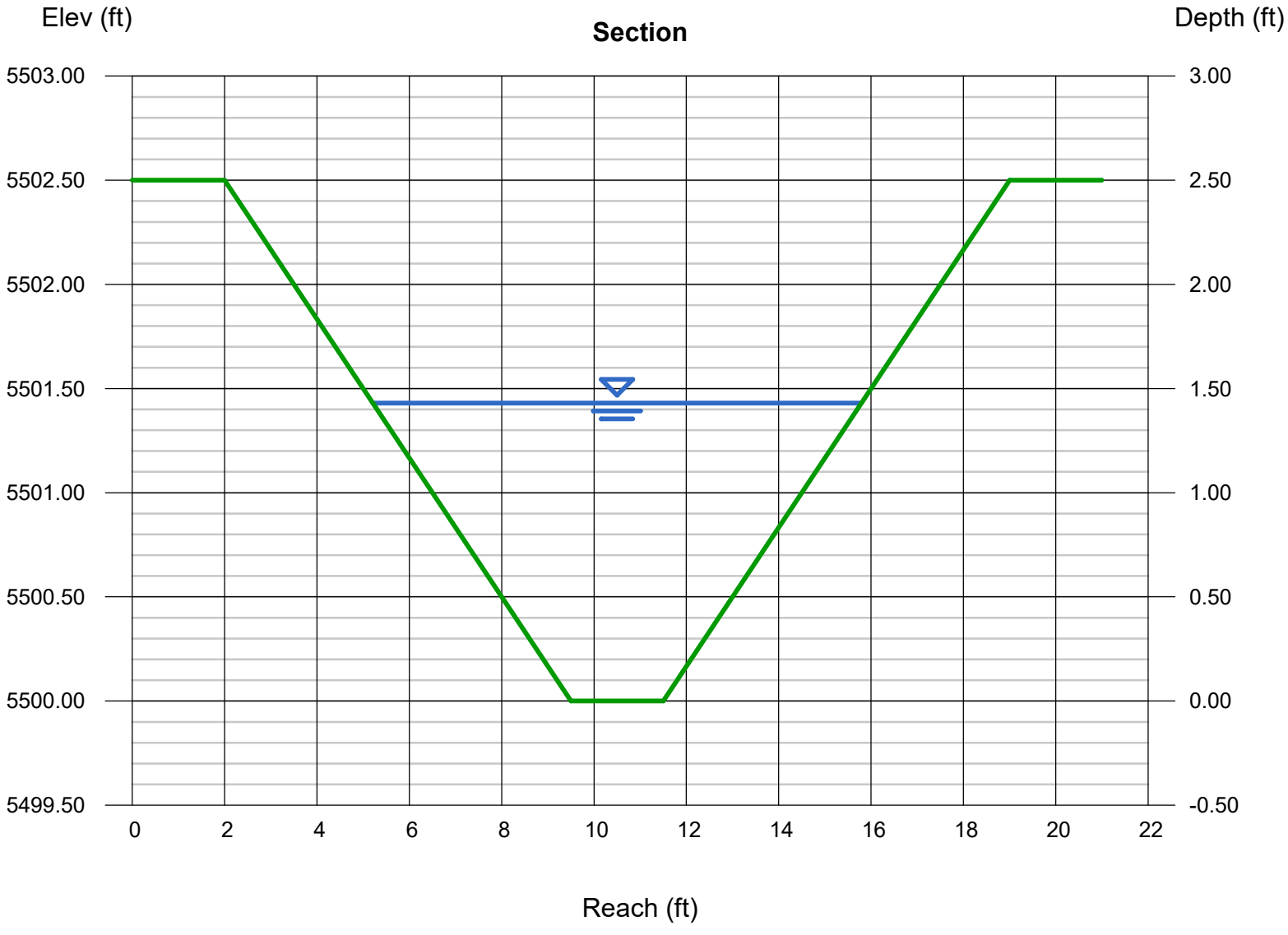
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 5500.00
Slope (%)	= 1.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 38.60

Highlighted

Depth (ft)	= 1.43
Q (cfs)	= 38.60
Area (sqft)	= 8.99
Velocity (ft/s)	= 4.29
Wetted Perim (ft)	= 11.04
Crit Depth, Yc (ft)	= 1.31
Top Width (ft)	= 10.58
EGL (ft)	= 1.72



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 28 2024

DP9 SWALE

Trapezoidal

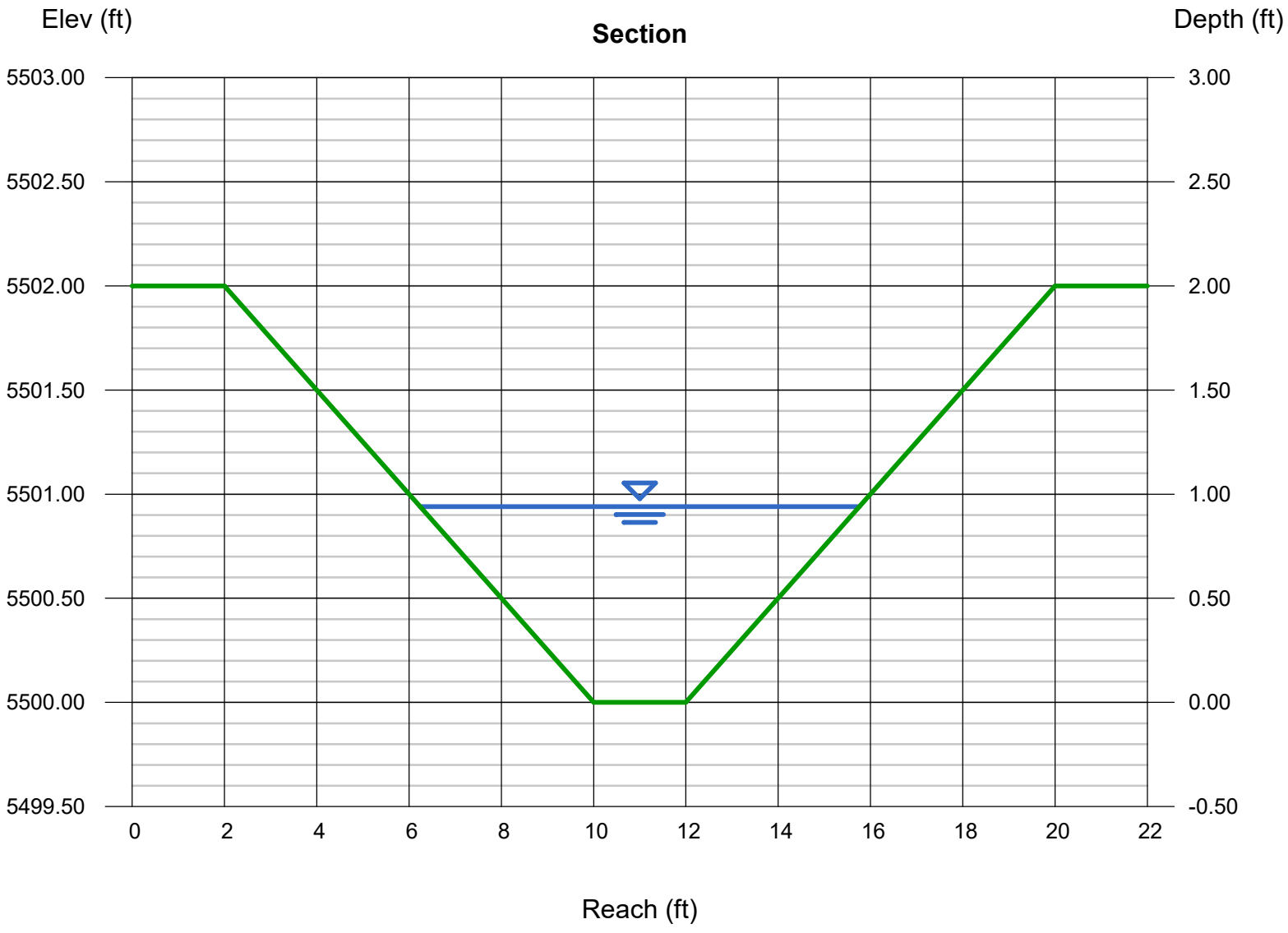
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 5500.00
Slope (%)	= 1.60
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 22.40

Highlighted

Depth (ft)	= 0.94
Q (cfs)	= 22.40
Area (sqft)	= 5.41
Velocity (ft/s)	= 4.14
Wetted Perim (ft)	= 9.75
Crit Depth, Yc (ft)	= 0.93
Top Width (ft)	= 9.52
EGL (ft)	= 1.21



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 28 2024

DP11 SWALE

Trapezoidal

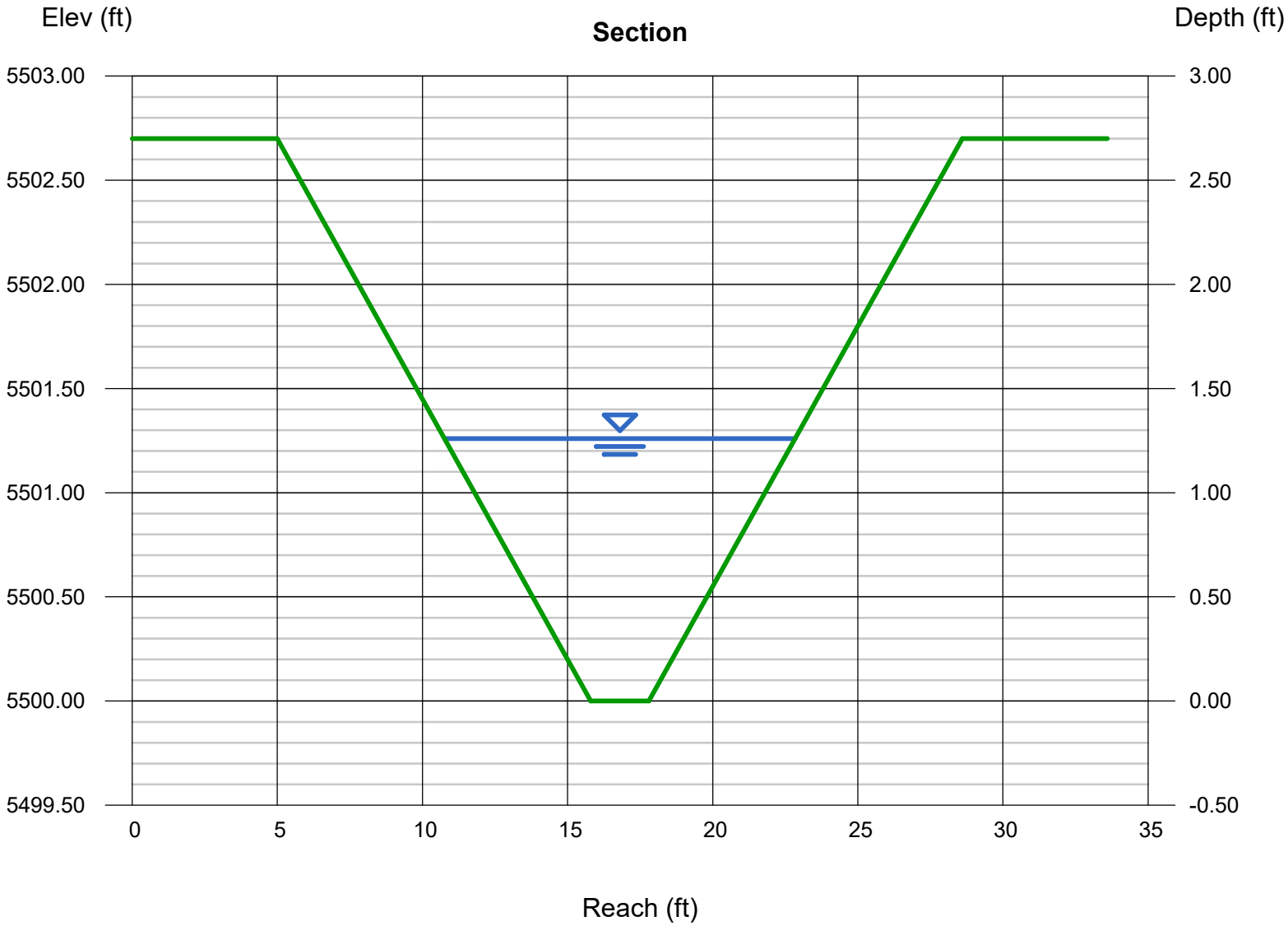
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.70
Invert Elev (ft)	= 5500.00
Slope (%)	= 1.60
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 44.00

Highlighted

Depth (ft)	= 1.26
Q (cfs)	= 44.00
Area (sqft)	= 8.87
Velocity (ft/s)	= 4.96
Wetted Perim (ft)	= 12.39
Crit Depth, Yc (ft)	= 1.28
Top Width (ft)	= 12.08
EGL (ft)	= 1.64



HRGreen	EASTONVILLE RD SEG 2	Calc'd by:	SPC
	201662.08	Checked by:	CM
	DP4.1 (SFB C INLET)	Date:	8/28/2024

Input Parameters		
Flow (Q)	3.4	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	6.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	1.23	
D_{50} =	1.53	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	4.50	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right)$$ Equation 9-11

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V}$$ Equation 9-12

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft^2)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	EASTONVILLE RD SEG 2	Calc'd by:	SPC
	201662.08	Checked by:	CM
	DP9 (24" RCP CULVERT OUTLET)	Date:	8/28/2024

Input Parameters		
Flow (Q)	22.4	cfs
Tailwater depth (Y_t)	0.80	ft
Conduit Diameter (D_c)	24	in
Expansion Factor (per Fig. 9-35)	3.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	3.96	
D_{50} =	6.56	in
UDFCD Riprap Type =	Type L	
Design D_{50} =	9	in
Minimum Mantle Thickness =	18	in
Minimum Length of Apron =	12.60	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right)$$ Equation 9-11

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V}$$ Equation 9-12

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft^2)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	EASTONVILLE RD SEG 2	Calc'd by:	SPC
	201662.08	Checked by:	CM
	DP10 (SFB C OUTLET)	Date:	8/28/2024

Input Parameters		
Flow (Q)	2.3	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	6.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	0.83	
D_{50} =	1.04	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	4.50	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right)$$ Equation 9-11

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V}$$ Equation 9-12

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft^2)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	EASTONVILLE RD SEG 1	Calc'd by:	SPC
	201662.08	Checked by:	CM
	DP13.1	Date:	8/28/2024

Input Parameters		
Flow (Q)	183.1	cfs
Tailwater depth (Y_t)	1.60	ft
Conduit Diameter (D_c)	48	in
Expansion Factor (per Fig. 9-35)	2	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	5.72	
D_{50} =	18.97	in
UDFCD Riprap Type =	Type VH	
Design D_{50} =	24	in
Minimum Mantle Thickness =	48	in
Minimum Length of Apron =	37.78	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right)$$ Equation 9-11

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V}$$ Equation 9-12

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft^2)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

SFB-C

Riprap Sizing - Spillway				
q (cfs/ft)	S (ft/ft)	C_f	n	D_{50} min. (in)
0.16	0.02	3	0.025	0.76

Type VL Riprap (D_{50} = 6") will be utilized for the spillway protection

$$D_{50} = 5.23\ S^{0.43}\ (1.35 C_f\ q)^{0.56}$$ Equation 13-9

Where:

D_{50} = median rock size (in)
S = longitudinal slope (ft/ft)
C_f = concentration factor (1.0 to 3.0)
q = unit discharge (cfs/ft)

When:

η (porosity) = 0.0 (i.e., for buried soil riprap)

APPENDIX D – WATER QUALITY & DETENTION

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018)

Designer: SPC
Company: HR Green
Date: August 28, 2024
Project: Eastonville Road - Segment 2 Improvements
Location: El Paso County, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter)	I_a =	54.0 %
B) Tributary Area's Imperviousness Ratio (i = I_a/100)	i =	0.540
C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time WQCV= 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i)	WQCV =	0.17 watershed inches
D) Contributing Watershed Area (including sand filter area)	Area =	27,443 sq ft
E) Water Quality Capture Volume (WQCV) Design Volume V_{WQCV} = WQCV / 12 * Area	V_{WQCV} =	398 cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 =	in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ =	cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ =	cu ft

2. Basin Geometry

A) WQCV Depth	D_{WQCV} =	1.0 ft
B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.	Z =	4.00 ft / ft
C) Minimum Filter Area (Flat Surface Area)	A_{Min} =	185 sq ft
D) Actual Filter Area	A_{Actual} =	200 sq ft
E) Volume Provided	V_T =	4288 cu ft

3. Filter Material

Choose One
- (●) 18" CDOT Class B or C Filter Material
- ( ) Other (Explain):

4. Underdrain System

A) Are underdrains provided?

Choose One
- (●) YES
- ( ) NO

B) Underdrain system orifice diameter for 12 hour drain time

i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y =	2.0 ft
ii) Volume to Drain in 12 Hours	Vol_{12} =	398 cu ft
iii) Orifice Diameter, 3/8" Minimum	D_O =	7/16 in

Design Procedure Form: Sand Filter (SF)

Designer: SPC
Company: HR Green
Date: August 28, 2024
Project: Eastonville Road - Segment 2 Improvements
Location: El Paso County, CO

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One ○ YES ◉ NO
6. Inlet / Outlet Works A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet	Engery dissapation at inlet points provided via riprap, and means of conveying flows in excess of the WQCV through the outlet is via the modified type 'C' inlet outlet structure grate, and a restricted outlet pipe.

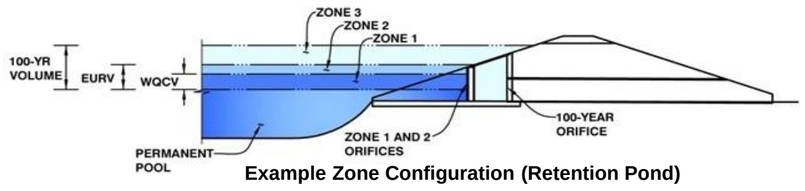
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road**

Basin ID: **POND C**



Example Zone Configuration (Retention Pond)

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
7021 **Media Surface**	--	0.00	--	--	--	461	0.011		
7022	--	1.00	--	--	--	973	0.022	717	0.016
7023	--	2.00	--	--	--	1,509	0.035	1,958	0.045
7024	--	3.00	--	--	--	2,165	0.050	3,795	0.087
7024.5	--	3.50	--	--	--	2,960	0.068	5,076	0.117

Watershed Information

Selected BMP Type =	**SF**	
Watershed Area =	0.63	acres
Watershed Length =	171	ft
Watershed Length to Centroid =	85	ft
Watershed Slope =	0.018	ft/ft
Watershed Imperviousness =	54.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

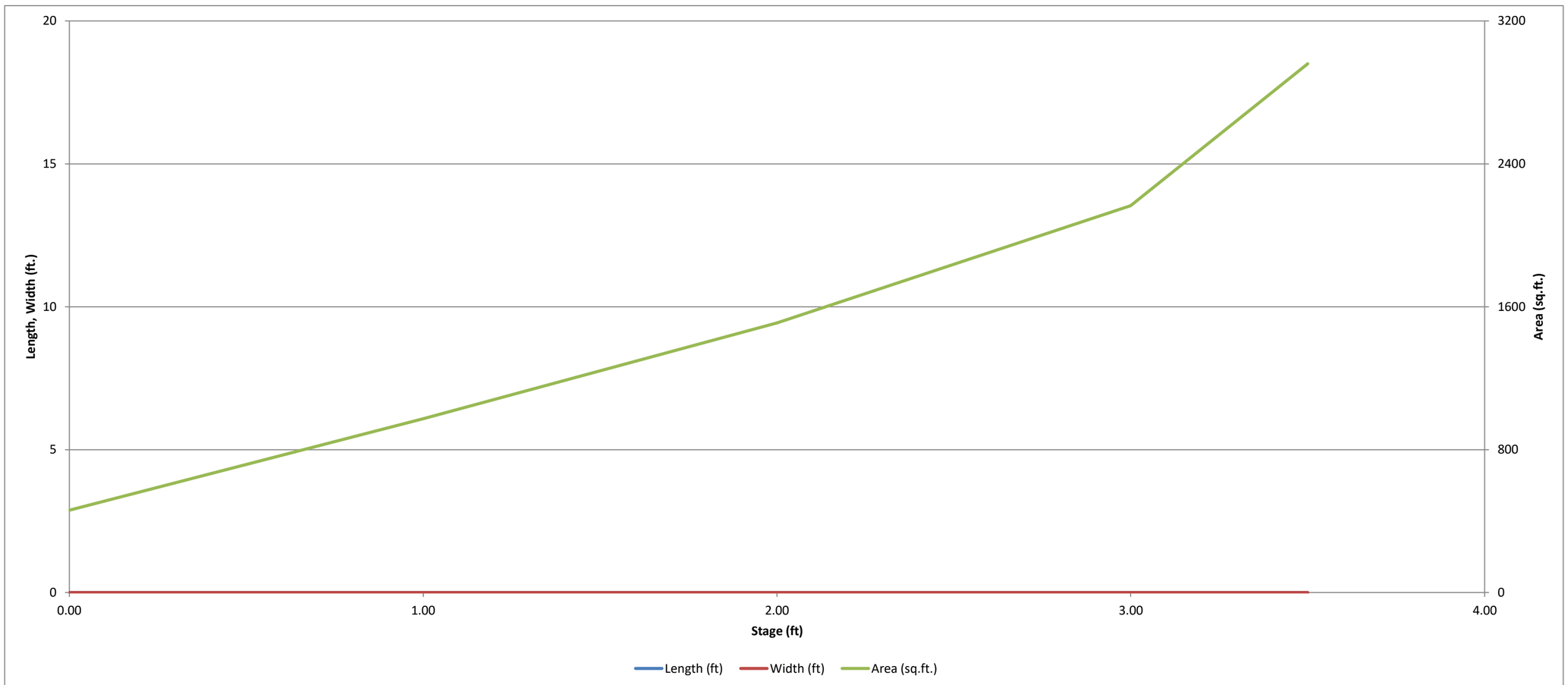
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.009	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.037	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.93 in.) =	0.023	acre-feet	0.93	inches
5-yr Runoff Volume (P1 = 1.21 in.) =	0.032	acre-feet	1.21	inches
10-yr Runoff Volume (P1 = 1.46 in.) =	0.043	acre-feet	1.46	inches
25-yr Runoff Volume (P1 = 1.84 in.) =	0.063	acre-feet	1.84	inches
50-yr Runoff Volume (P1 = 2.16 in.) =	0.079	acre-feet	2.16	inches
100-yr Runoff Volume (P1 = 2.49 in.) =	0.097	acre-feet	2.49	inches
500-yr Runoff Volume (P1 = 3.37 in.) =	0.142	acre-feet	3.37	inches
Approximate 2-yr Detention Volume =	0.022	acre-feet		
Approximate 5-yr Detention Volume =	0.031	acre-feet		
Approximate 10-yr Detention Volume =	0.041	acre-feet		
Approximate 25-yr Detention Volume =	0.050	acre-feet		
Approximate 50-yr Detention Volume =	0.054	acre-feet		
Approximate 100-yr Detention Volume =	0.062	acre-feet		

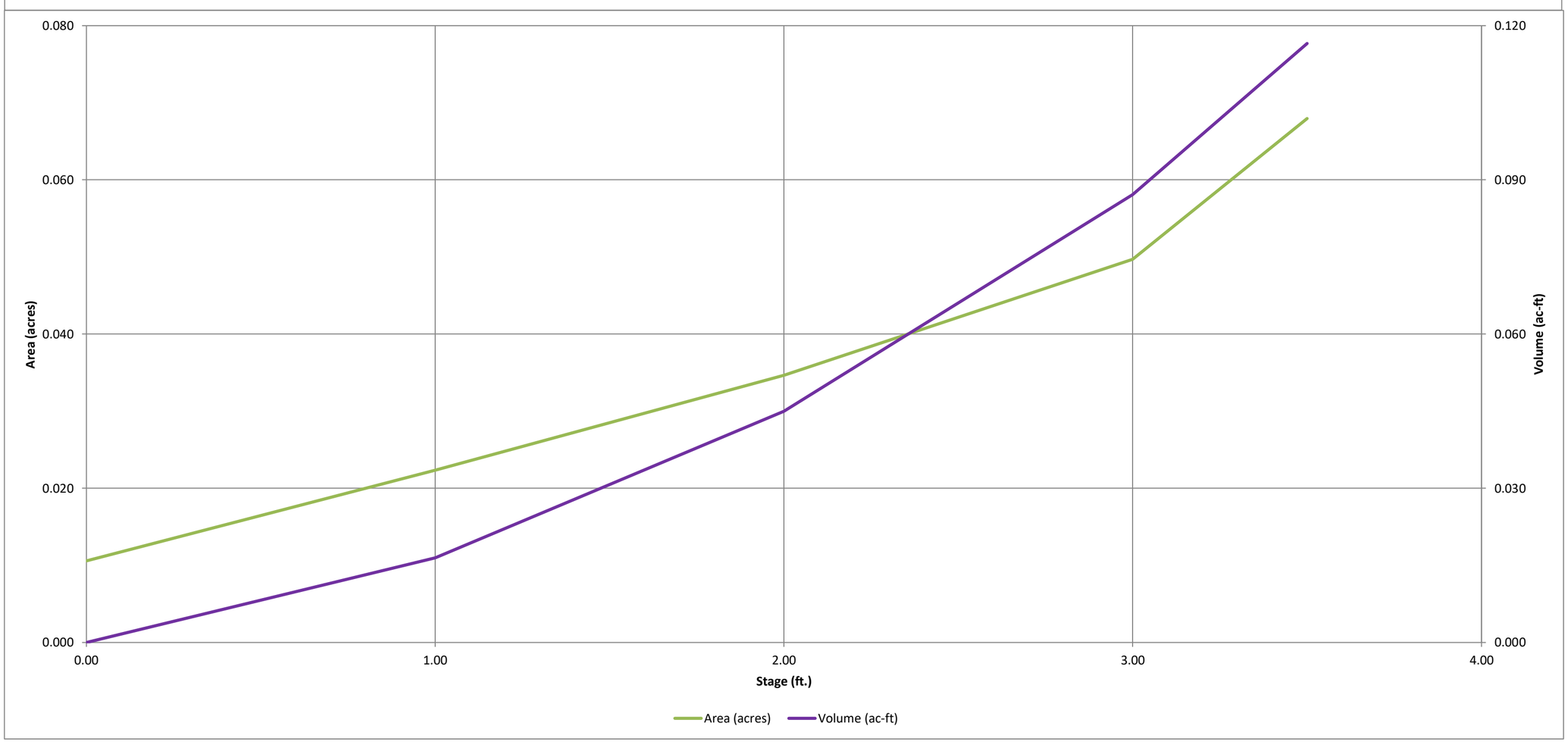
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.009	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.027	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.025	acre-feet
Total Detention Basin Volume =	0.062	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft³
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft²
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft²
Volume of Basin Floor (V_{FLOOR}) =	user	ft³
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	ft²
Volume of Main Basin (V_{MAIN}) =	user	ft³
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



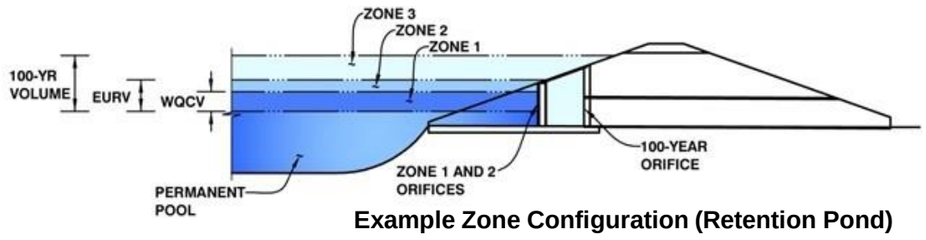


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road**

Basin ID: **POND C**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.64	0.009	Filtration Media
Zone 2 (EURV)	1.75	0.027	Filtration Media
Zone 3 (100-year)	2.44	0.025	Weir&Pipe (Restrict)
Total (all zones)		0.062	

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

Underdrain Orifice Invert Depth =	1.98	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	0.48	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Centroid =	0.02	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 =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (optional)	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.85	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	1.85	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	72.80	N/A	
Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.13	N/A	ft^2

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 =	2.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	12.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	2.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.09	N/A	ft^2
Outlet Orifice Centroid =	0.10	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.84	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	2.86	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	12.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.14	feet
Stage at Top of Freeboard =	4.00	feet
Basin Area at Top of Freeboard =	0.07	acres
Basin Volume at Top of Freeboard =	0.12	acre-ft

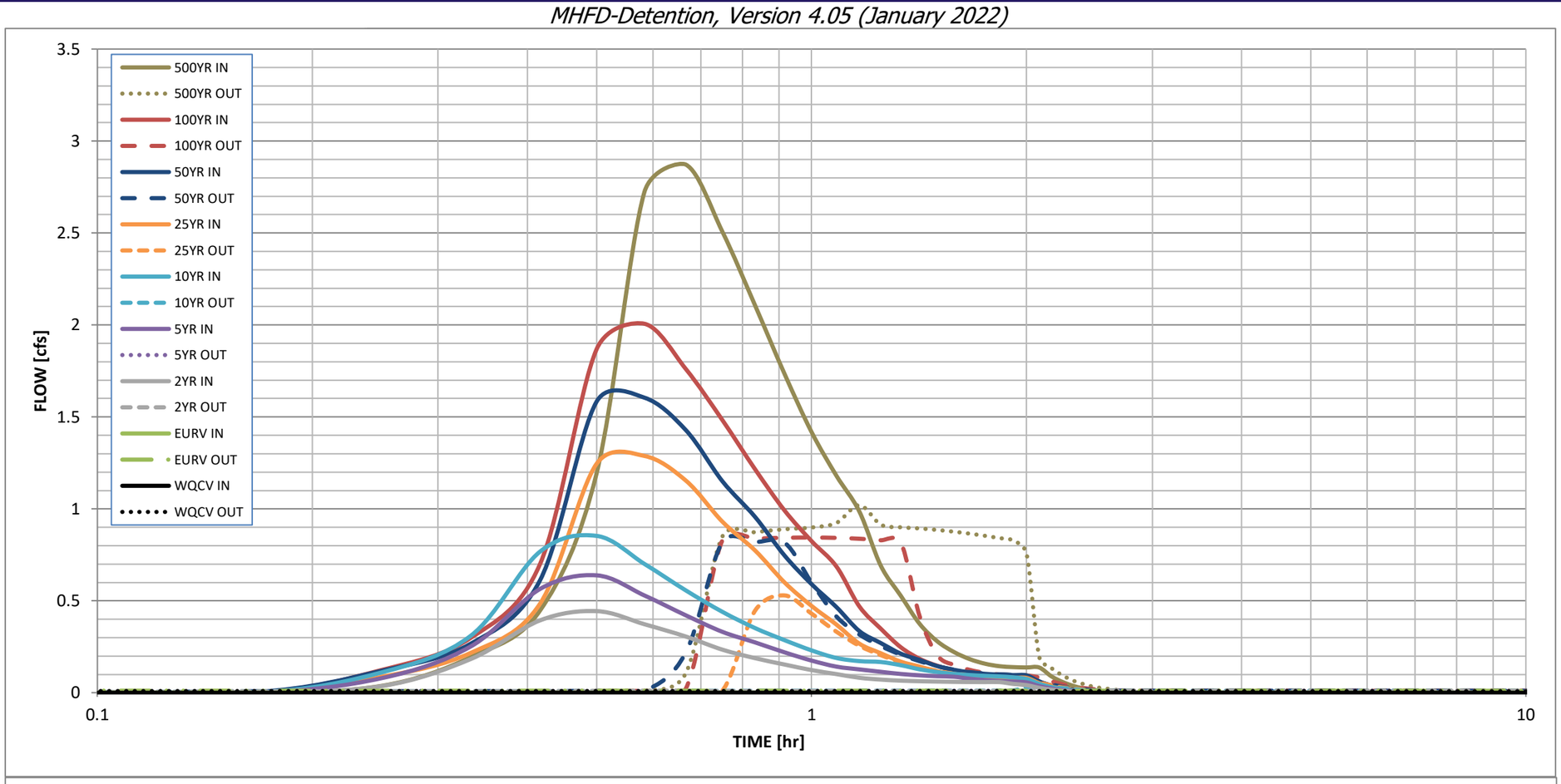
Routed Hydrograph Results

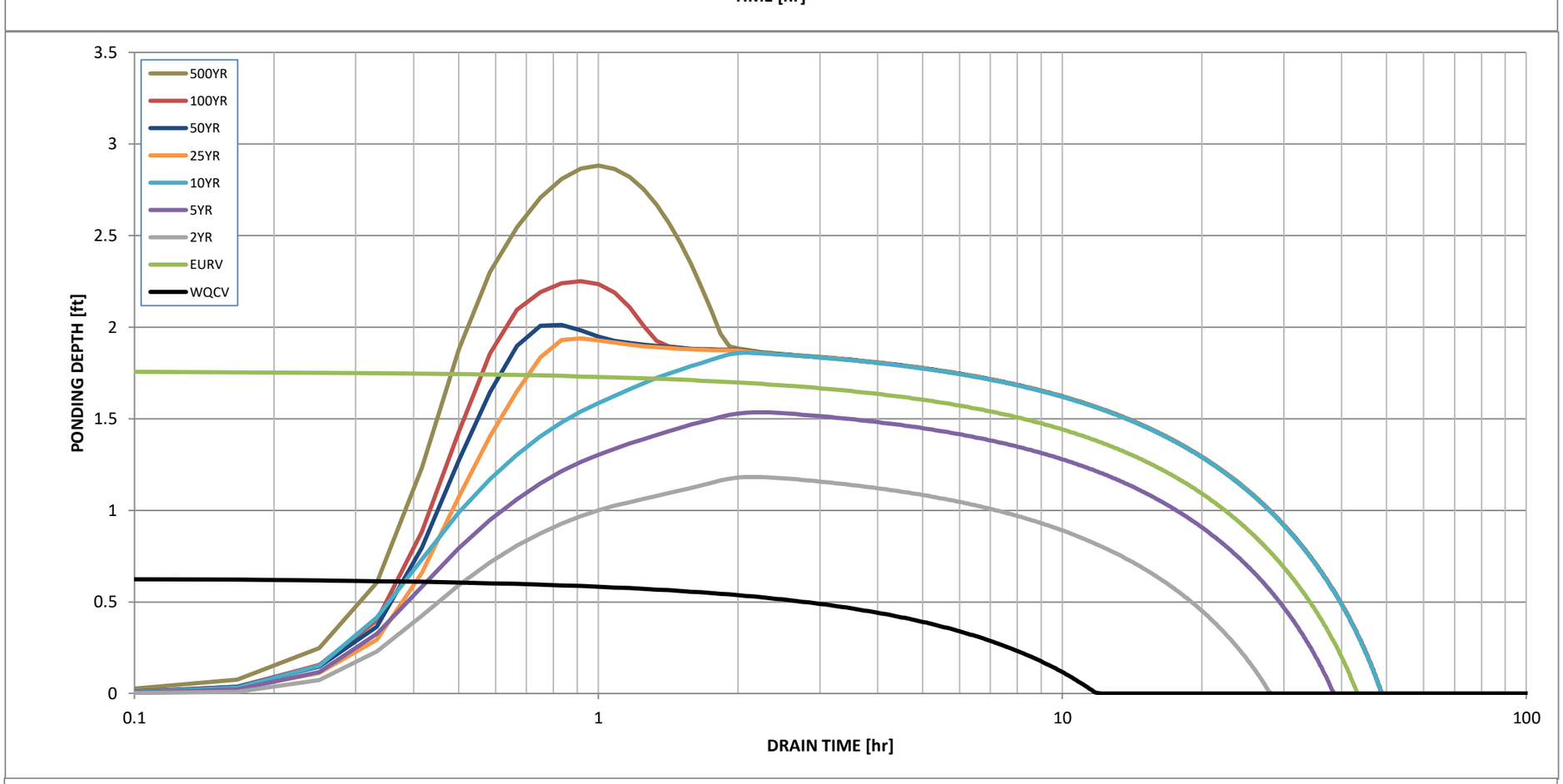
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

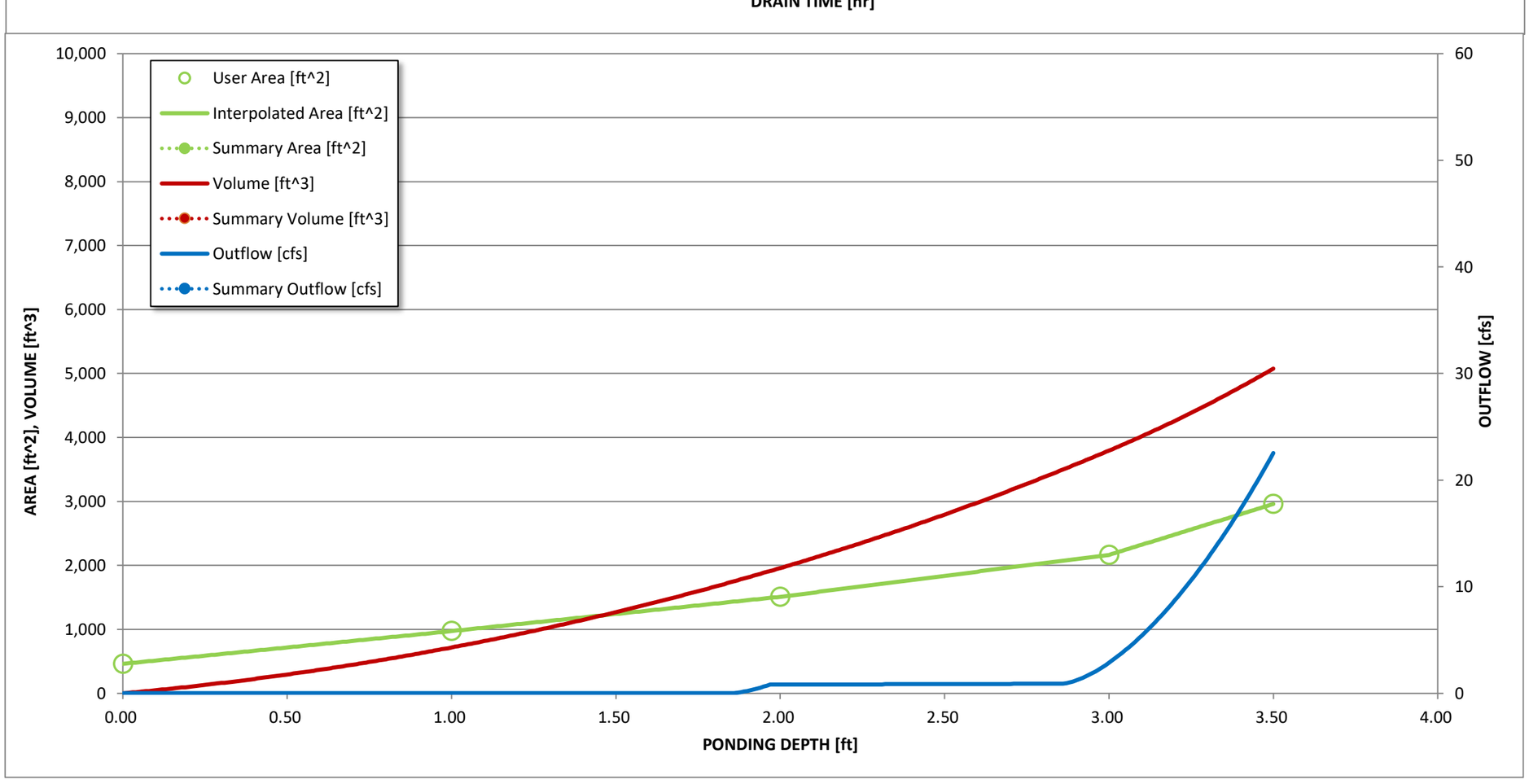
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.93	1.21	1.46	1.84	2.16	2.49	3.37
CUHP Runoff Volume (acre-ft) =	0.009	0.037	0.023	0.032	0.043	0.063	0.079	0.097	0.142
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.023	0.032	0.043	0.063	0.079	0.097	0.142
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.2	0.5	0.8	1.0	1.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.12	0.32	0.87	1.20	1.59	2.49
Peak Inflow Q (cfs) =	N/A	N/A	0.4	0.6	0.9	1.3	1.6	2.0	2.9
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.5	0.8	0.8	1.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.2	1.0	1.1	0.8	0.6
Structure Controlling Flow =	Filtration Media	Filtration Media	Filtration Media	Filtration Media	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	0.0	0.1	0.1	0.1	0.1
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) =	12	42	27	37	47	46	46	45	43
Time to Drain 99% of Inflow Volume (hours) =	**12**	43	28	38	48	48	48	47	47
Maximum Ponding Depth (ft) =	0.64	1.77	1.18	1.54	1.86	1.94	2.01	2.25	2.88
Area at Maximum Ponding Depth (acres) =	0.02	0.03	0.02	0.03	0.03	0.03	0.03	0.04	0.05
Maximum Volume Stored (acre-ft) =	0.009	0.037	0.021	0.030	0.040	0.043	0.045	0.054	0.081

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	0.04
	0:15:00	0.00	0.00	0.04	0.08	0.11	0.09	0.12	0.12	0.19
	0:20:00	0.00	0.00	0.18	0.25	0.31	0.22	0.27	0.30	0.45
	0:25:00	0.00	0.00	0.39	0.56	0.77	0.48	0.61	0.70	1.19
	0:30:00	0.00	0.00	0.44	0.64	0.85	1.25	1.58	1.87	2.72
	0:35:00	0.00	0.00	0.37	0.53	0.70	1.29	1.60	2.01	2.87
	0:40:00	0.00	0.00	0.31	0.42	0.56	1.15	1.43	1.76	2.51
	0:45:00	0.00	0.00	0.23	0.33	0.44	0.93	1.15	1.48	2.11
	0:50:00	0.00	0.00	0.19	0.27	0.35	0.77	0.96	1.22	1.73
	0:55:00	0.00	0.00	0.15	0.22	0.29	0.60	0.75	0.99	1.42
	1:00:00	0.00	0.00	0.12	0.18	0.23	0.47	0.59	0.83	1.18
	1:05:00	0.00	0.00	0.10	0.14	0.19	0.37	0.47	0.69	0.99
	1:10:00	0.00	0.00	0.08	0.13	0.17	0.27	0.34	0.47	0.69
	1:15:00	0.00	0.00	0.07	0.11	0.17	0.22	0.27	0.35	0.53
	1:20:00	0.00	0.00	0.07	0.10	0.15	0.17	0.21	0.25	0.38
	1:25:00	0.00	0.00	0.06	0.10	0.13	0.14	0.18	0.19	0.28
	1:30:00	0.00	0.00	0.06	0.09	0.11	0.12	0.15	0.15	0.22
	1:35:00	0.00	0.00	0.06	0.09	0.10	0.10	0.12	0.12	0.18
	1:40:00	0.00	0.00	0.06	0.08	0.10	0.09	0.11	0.11	0.16
	1:45:00	0.00	0.00	0.06	0.07	0.09	0.09	0.10	0.10	0.14
	1:50:00	0.00	0.00	0.06	0.06	0.09	0.08	0.10	0.09	0.14
	1:55:00	0.00	0.00	0.05	0.06	0.08	0.08	0.10	0.09	0.14
	2:00:00	0.00	0.00	0.04	0.06	0.08	0.08	0.10	0.09	0.14
	2:05:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.09
	2:10:00	0.00	0.00	0.02	0.02	0.03	0.03	0.04	0.04	0.06
	2:15:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.02	0.04
	2:20:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
	2:25:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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.

Stage - Storage Description	Stage [ft]	Area [ft ^{2}]	Area [acres]	Volume [ft ^{3}]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: SPC
Company: HR Green
Date: August 23, 2024
Project: Eastonville Road - Segment 1 Improvements EDB B ULTIMATE CONDITIONS
Location: EL PASO COUNTY, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 67.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.670

C) Contributing Watershed Area — Area = 9.020 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.42 in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- ○ Water Quality Capture Volume (WQCV)
- ◉ Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)
V_{DESIGN} = ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$
$V_{DESIGN\ OTHER}$ = 0.192 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)
$V_{DESIGN\ USER}$ = ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = 100 %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = 0 %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = 0 %

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
$EURV_{DESIGN}$ = 0.756 ac-f t

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)
$EURV_{DESIGN\ USER}$ = ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)
L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)
Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)
V_{FMIN} = 0.006 ac-ft

B) Actual Forebay Volume
V_F = 0.006 ac-ft

C) Forebay Depth (D_F = 18 inch maximum)
D_F = 15.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge
Q_{100} = 26.00 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)
Q_F = 0.52 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ◉ Wall with Rect. Notch
- ○ Wall with V-Notch Weir

Flow too small for berm w/ pipe

F) Discharge Pipe Size (minimum 8-inches)
Calculated D_P = in

G) Rectangular Notch Width
Calculated W_N = 4.3 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer: SPC
Company: HR Green
Date: August 23, 2024
Project: Eastonville Road - Segment 1 Improvements EDB B ULTIMATE CONDITIONS
Location: EL PASO COUNTY, CO

6. Trickle Channel

A) Type of Trickle Channel — Choose One: (●) Concrete ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 10 sq ft

C) Outlet Type — Choose One: (●) Orifice Plate ( ) Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 1.00 inches

E) Total Outlet Area — A_{ot} = 5.50 square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 25 cu ft

C) Initial Surcharge Provided Above Micropool — V_s = 3.3 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 193 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *S.S. Well Screen with 60% Open Area*

Other (Y/N): N

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio =

D) Total Water Quality Screen Area (based on screen type) — A_{total} = 321 sq. in.

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= 5.05 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR}= 88.6 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer: SPC
Company: HR Green
Date: August 23, 2024
Project: Eastonville Road - Segment 1 Improvements EDB B ULTIMATE CONDITIONS
Location: EL PASO COUNTY, CO

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = 4.00 ft / ft

11. Vegetation

Choose One
- ○ Irrigated
- ◉ Not Irrigated

12. Access

A) Describe Sediment Removal Procedures

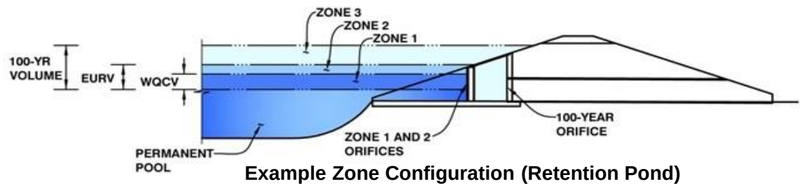
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road**

Basin ID: **POND B: Ultimate Conditions (INCLUDES SEGMENT 2 FLOW) [BASINS EA6 - EA10]**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	9.02	acres
Watershed Length =	1,750	ft
Watershed Length to Centroid =	500	ft
Watershed Slope =	0.009	ft/ft
Watershed Imperviousness =	67.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.197	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.756	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.556	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.728	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.866	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.043	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.217	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.427	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	2.302	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.493	acre-feet		
Approximate 5-yr Detention Volume =	0.644	acre-feet		
Approximate 10-yr Detention Volume =	0.775	acre-feet		
Approximate 25-yr Detention Volume =	0.930	acre-feet		
Approximate 50-yr Detention Volume =	1.024	acre-feet		
Approximate 100-yr Detention Volume =	1.119	acre-feet		

Define Zones and Basin Geometry

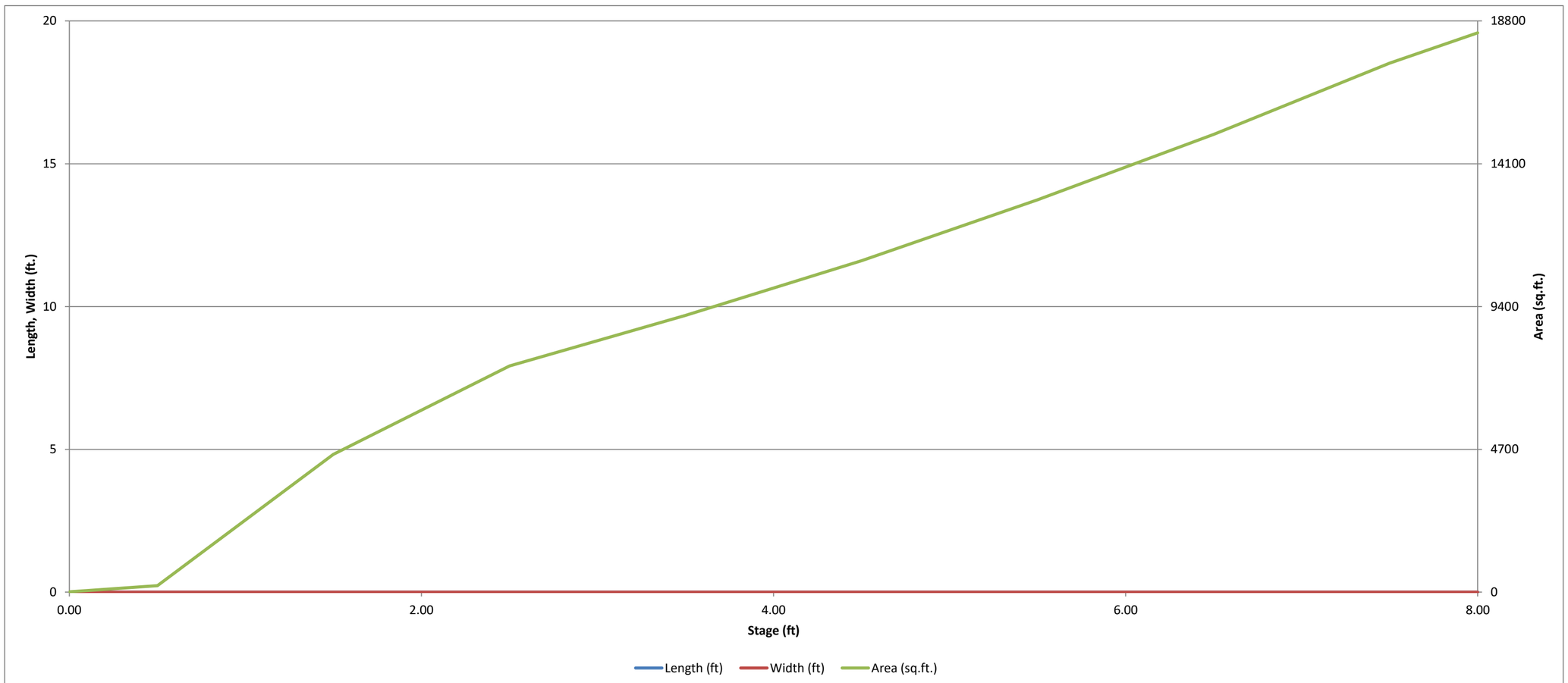
Zone 1 Volume (WQCV) =	0.197	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.559	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.363	acre-feet
Total Detention Basin Volume =	1.119	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{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_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
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^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

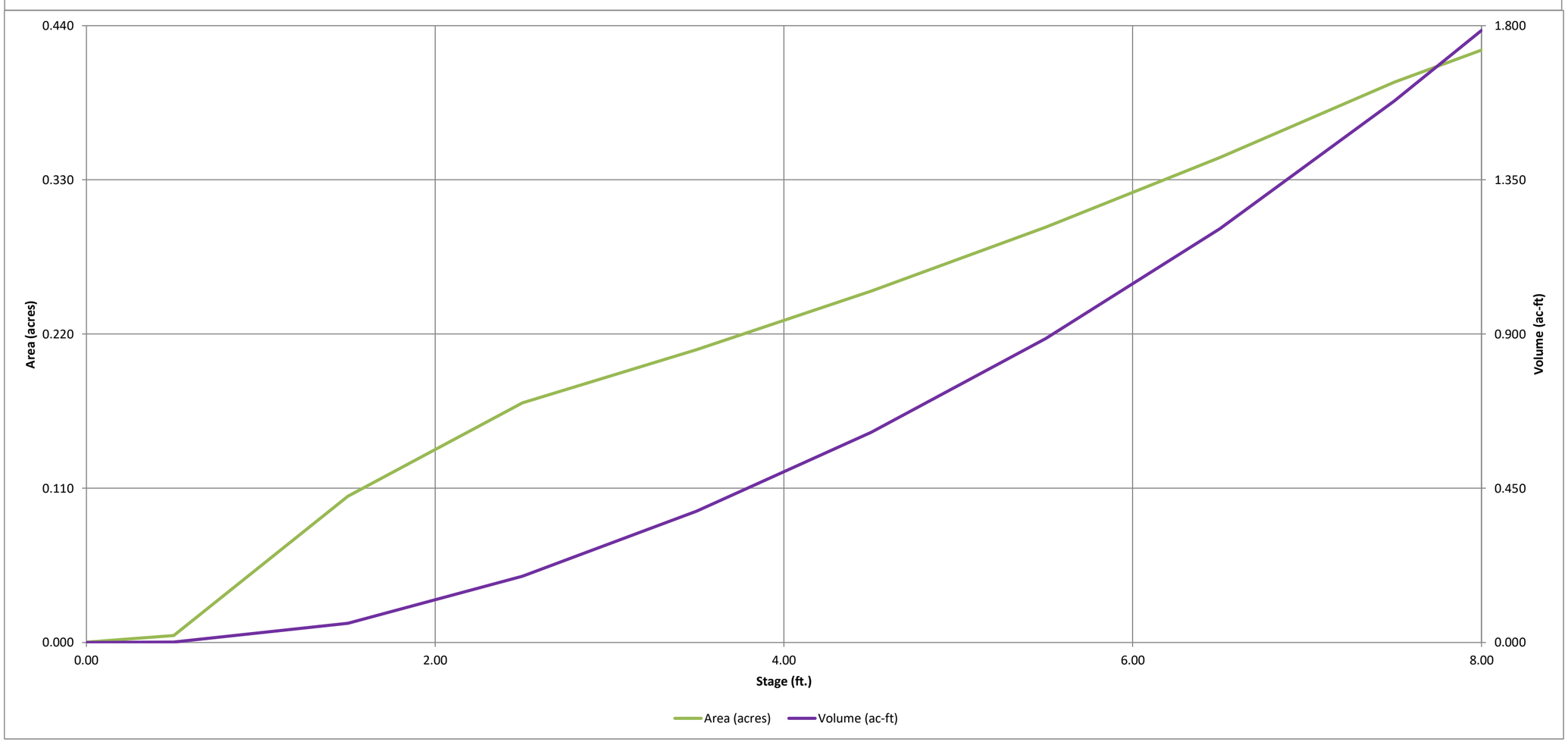
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
6983.5 **Top of Micropool**	--	0.00	--	--	--	10	0.000		
6984	--	0.50	--	--	--	211	0.005	55	0.001
6985	--	1.50	--	--	--	4,539	0.104	2,430	0.056
6986	--	2.50	--	--	--	7,443	0.171	8,421	0.193
6987	--	3.50	--	--	--	9,104	0.209	16,695	0.383
6988	--	4.50	--	--	--	10,914	0.251	26,704	0.613
6989	--	5.50	--	--	--	12,910	0.296	38,616	0.886
6990	--	6.50	--	--	--	15,069	0.346	52,605	1.208
6991	--	7.50	--	--	--	17,408	0.400	68,844	1.580
6991.5	--	8.00	--	--	--	18,407	0.423	77,797	1.786

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



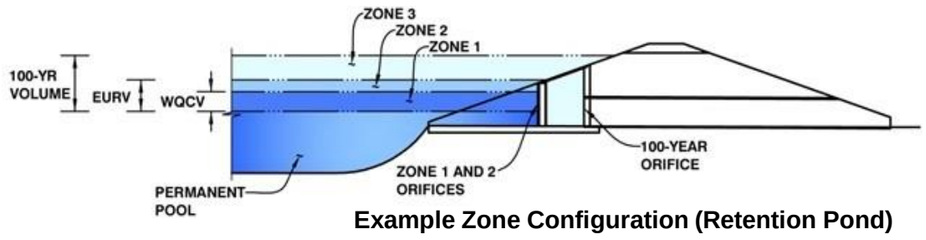


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road**

Basin ID: **POND B: Ultimate Conditions (INCLUDES SEGMENT 2 FLOW) [BASINS EA6 - EA10]**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.53	0.197	Orifice Plate
Zone 2 (EURV)	5.05	0.559	Circular Orifice
Zone 3 (100-year)	6.25	0.363	Weir&Pipe (Restrict)
Total (all zones)		1.119	

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^2
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 =	2.53	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	0.79	sq. inches (diameter = 1 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	5.451E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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	0.87	1.73					
Orifice Area (sq. inches)	0.79	0.79	0.79					

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.55	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.18	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	1.75	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.02	N/A	ft^2
Vertical Orifice Centroid =	0.07	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.20	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	25.92	N/A	
Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.13	N/A	ft^2

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 =	0.25	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 =	3.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.24	N/A	ft^2
Outlet Orifice Centroid =	0.17	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.91	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	15.50	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.50	feet
Stage at Top of Freeboard =	8.00	feet
Basin Area at Top of Freeboard =	0.42	acres
Basin Volume at Top of Freeboard =	1.79	acre-ft

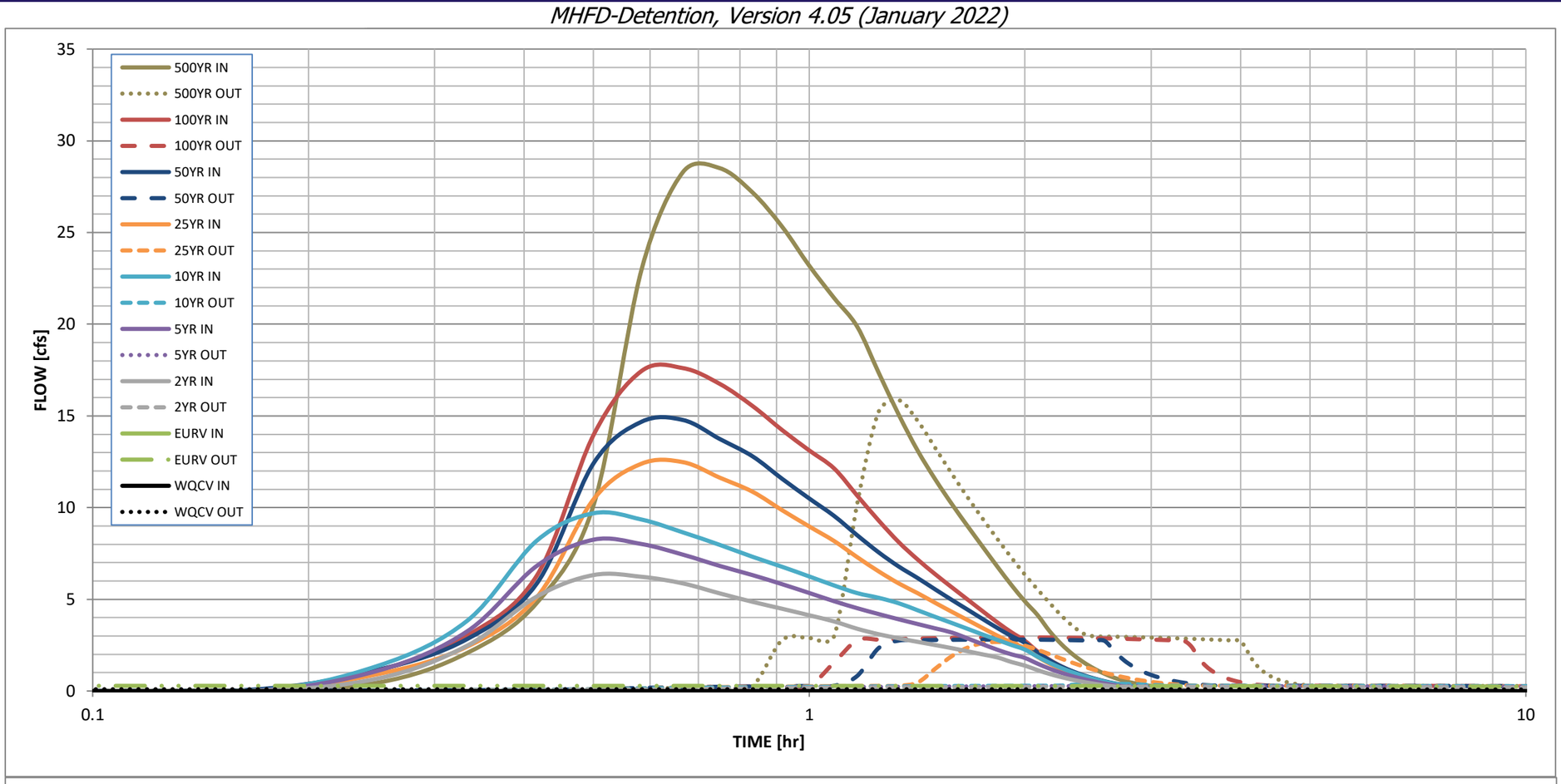
Routed Hydrograph Results

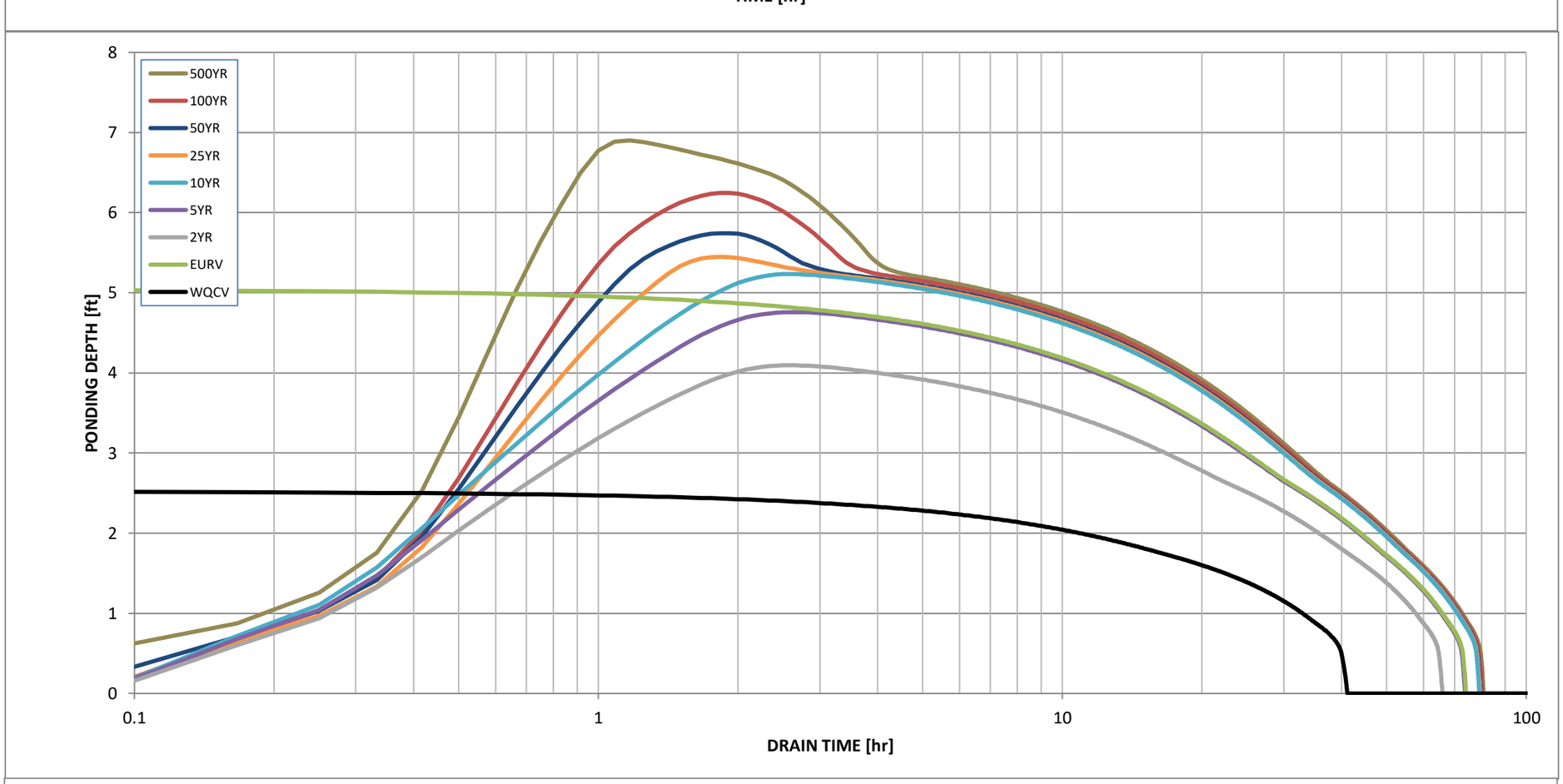
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

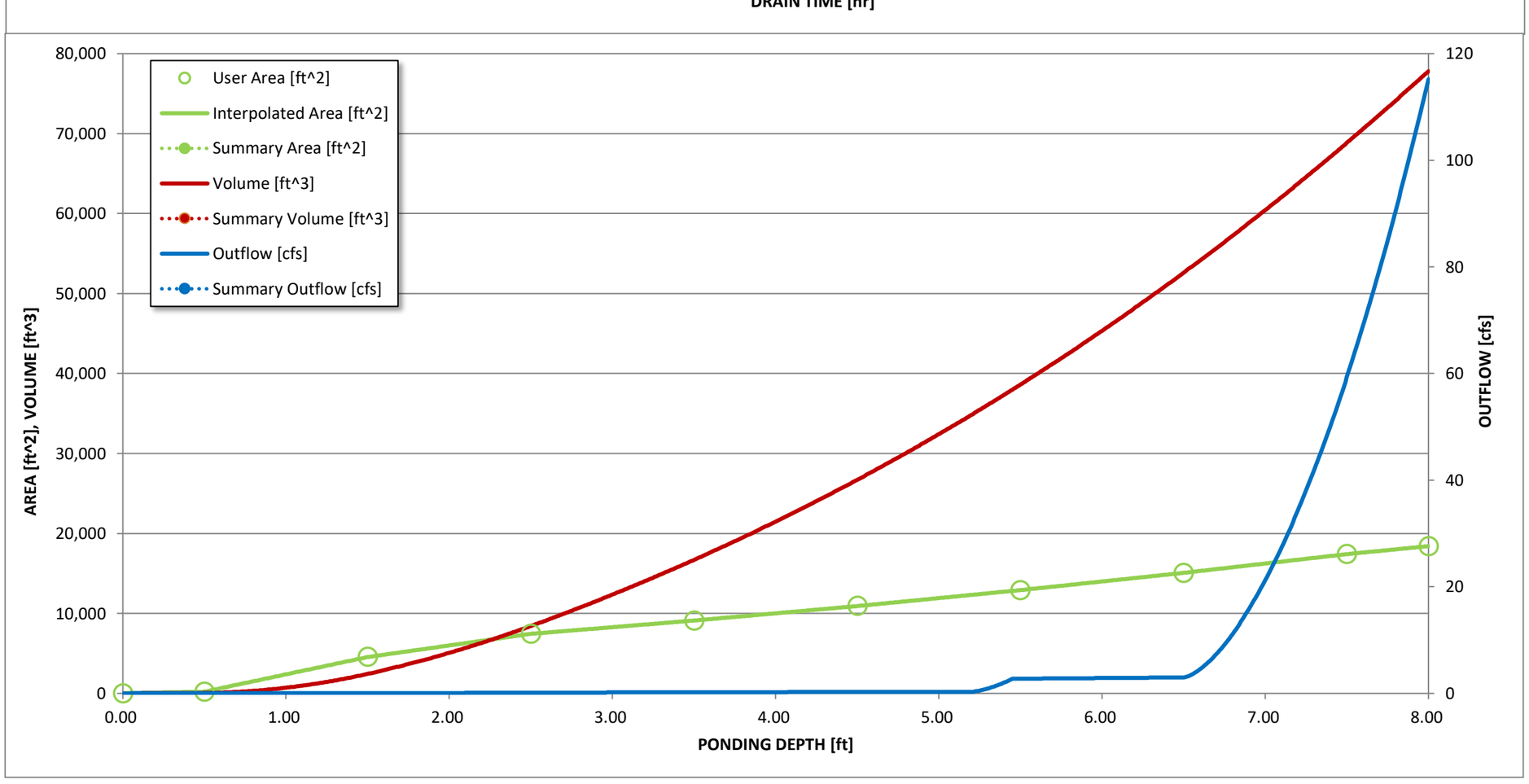
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.197	0.756	0.556	0.728	0.866	1.043	1.217	1.427	2.302
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.556	0.728	0.866	1.043	1.217	1.427	2.302
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.1	1.0	2.0	3.3	8.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.01	0.11	0.22	0.36	0.97
Peak Inflow Q (cfs) =	N/A	N/A	6.3	8.3	9.7	12.5	14.8	17.6	28.5
Peak Outflow Q (cfs) =	0.1	0.3	0.2	0.3	0.4	2.7	2.8	2.9	15.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.6	3.9	2.7	1.4	0.9	1.8
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.4	0.4	0.4
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	64	58	64	68	67	66	65	59
Time to Drain 99% of Inflow Volume (hours) =	**40**	70	62	69	74	74	73	73	71
Maximum Ponding Depth (ft) =	2.53	5.05	4.09	4.76	5.23	5.45	5.74	6.25	6.90
Area at Maximum Ponding Depth (acres) =	0.17	0.28	0.23	0.26	0.28	0.29	0.31	0.33	0.37
Maximum Volume Stored (acre-ft) =	0.198	0.758	0.514	0.677	0.808	0.869	0.959	1.119	1.350

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	0.08	0.01	0.46
	0:15:00	0.00	0.00	0.68	1.11	1.37	0.92	1.16	1.13	2.08
	0:20:00	0.00	0.00	2.48	3.26	3.84	2.43	2.84	3.03	4.80
	0:25:00	0.00	0.00	5.15	6.82	8.20	5.12	5.86	6.29	10.12
	0:30:00	0.00	0.00	6.32	8.25	9.69	10.45	12.41	13.96	22.97
	0:35:00	0.00	0.00	6.23	8.02	9.35	12.39	14.68	17.45	28.30
	0:40:00	0.00	0.00	5.87	7.44	8.65	12.48	14.78	17.61	28.51
	0:45:00	0.00	0.00	5.33	6.82	7.97	11.64	13.74	16.75	27.19
	0:50:00	0.00	0.00	4.87	6.32	7.32	10.87	12.80	15.54	25.32
	0:55:00	0.00	0.00	4.49	5.83	6.77	9.86	11.57	14.23	23.19
	1:00:00	0.00	0.00	4.13	5.35	6.25	8.98	10.50	13.12	21.43
	1:05:00	0.00	0.00	3.79	4.90	5.76	8.18	9.55	12.14	19.87
	1:10:00	0.00	0.00	3.40	4.52	5.34	7.30	8.50	10.66	17.36
	1:15:00	0.00	0.00	3.10	4.20	5.08	6.53	7.56	9.30	15.07
	1:20:00	0.00	0.00	2.88	3.91	4.79	5.87	6.79	8.12	13.12
	1:25:00	0.00	0.00	2.68	3.65	4.40	5.34	6.16	7.17	11.53
	1:30:00	0.00	0.00	2.51	3.42	4.04	4.80	5.54	6.36	10.17
	1:35:00	0.00	0.00	2.33	3.18	3.70	4.31	4.96	5.64	8.95
	1:40:00	0.00	0.00	2.16	2.86	3.38	3.85	4.42	4.97	7.82
	1:45:00	0.00	0.00	1.99	2.54	3.07	3.42	3.91	4.32	6.75
	1:50:00	0.00	0.00	1.83	2.24	2.78	3.01	3.43	3.73	5.77
	1:55:00	0.00	0.00	1.58	2.00	2.51	2.64	2.99	3.20	4.89
	2:00:00	0.00	0.00	1.39	1.81	2.26	2.33	2.63	2.74	4.14
	2:05:00	0.00	0.00	1.14	1.49	1.87	1.86	2.10	2.16	3.25
	2:10:00	0.00	0.00	0.93	1.22	1.53	1.49	1.67	1.70	2.55
	2:15:00	0.00	0.00	0.76	0.99	1.25	1.19	1.34	1.34	2.00
	2:20:00	0.00	0.00	0.61	0.80	1.02	0.95	1.07	1.05	1.56
	2:25:00	0.00	0.00	0.50	0.65	0.82	0.76	0.86	0.83	1.22
	2:30:00	0.00	0.00	0.40	0.52	0.66	0.61	0.68	0.65	0.94
	2:35:00	0.00	0.00	0.32	0.41	0.52	0.48	0.54	0.50	0.72
	2:40:00	0.00	0.00	0.25	0.32	0.40	0.37	0.42	0.39	0.56
	2:45:00	0.00	0.00	0.20	0.25	0.32	0.29	0.32	0.30	0.44
	2:50:00	0.00	0.00	0.16	0.20	0.25	0.23	0.26	0.24	0.35
	2:55:00	0.00	0.00	0.12	0.15	0.19	0.18	0.20	0.19	0.27
	3:00:00	0.00	0.00	0.09	0.11	0.14	0.14	0.15	0.14	0.21
	3:05:00	0.00	0.00	0.06	0.08	0.10	0.10	0.11	0.10	0.15
	3:10:00	0.00	0.00	0.04	0.05	0.07	0.07	0.07	0.07	0.10
	3:15:00	0.00	0.00	0.02	0.03	0.04	0.04	0.05	0.04	0.06
	3:20:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	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

APPENDIX E – REFERENCE MATERIAL

Final Drainage Report

for

The Sanctuary Filing 1

at

Meridian Ranch

EL PASO COUNTY, COLORADO

August 2022

Prepared For:

GTL DEVELOPMENT, INC.
P.O. Box 80036
San Diego, CA 92138

Prepared By:
Tech Contractors
11910 Tourmaline Dr., Ste 130
Falcon, CO 80831
719.495.7444

PCD Project No. SF22-020

Future Drainage - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics for the future conditions using the SCS calculation method. Please refer to Figure 6 - Meridian Ranch SCS Calculations – Future Basins Map

Table 5: Future Drainage Basins-SCS

FUTURE SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.7	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9
G2-G3	0.2820	163	108	27	10	1.9
FG03	0.0203	24	17	5.9	3.0	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	12	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	12	7.9	1.8	0.5	0.07
OS07ab-POND F	0.0170	12	7.6	1.7	0.5	0.07
POND F IN	0.4620	293	200	54	23	5.1
POND F	0.4620	178	121	16	8.0	2.1
POND F-G7	0.4620	177	120	16	8.0	2.1
OS07c	0.0296	19	12	2.7	0.9	0.12
OS07c-G4	0.0296	19	12	2.6	0.9	0.12
FG21a	0.0095	5.9	4.0	1.0	0.4	0.06
G4	0.0391	25	16	3.6	1.2	0.2
G4-G7	0.0391	24	16	3.5	1.2	0.2
FG21b	0.0150	21	16	6.5	3.9	1.7
G7	0.5161	194	131	18	8.9	2.3
G7-G8	0.5161	194	131	18	8.9	2.3
FG22	0.1354	121	88	32	17	5.4
OS08a	0.0251	16	11	2.3	0.7	0.10
OS08-G8	0.0251	16	10	2.3	0.7	0.10
FG23a	0.0216	21	15	5.2	2.7	0.8
OS07d	0.0034	2.5	1.6	0.4	0.11	0.01
OS07d-G8	0.0034	2.4	1.6	0.3	0.11	0.01
G8	0.7016	279	178	46	24	7.7
G8-G10	0.7016	278	177	45	24	7.6
FG24b	0.0589	76	57	24	15	6.5
FG24a	0.0348	24	16	4.5	2.0	0.4
OS08b	0.0165	9.5	6.3	1.4	0.5	0.07
OS08b-G9a	0.0165	9.4	6.0	1.4	0.5	0.07
OS09a	0.0093	5.3	3.5	0.8	0.3	0.04
OS09a-G9a	0.0093	5.2	3.4	0.7	0.3	0.04
G9a	0.1195	97	71	28	16	6.7

FUTURE SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G9a-G9b	0.1195	96	70	27	16	6.6
FG24c	0.0291	40	30	13	8.4	4.0
FG24d	0.0262	39	30	14	8.7	4.4
G9b	0.1748	170	127	53	32	14
REX RD WQCV	0.1748	158	125	51	31	14
G9b-G10	0.1748	158	123	50	31	13
FG23b	0.0236	17	11	2.7	0.9	0.13
G10	0.9000	390	263	90	46	15
G10-G11	0.9000	389	254	85	44	15
FG23c	0.0109	11	7.6	2.2	1.0	0.2
G11	0.9109	393	258	86	44	15
FG25	0.1084	111	84	36	22	9.9
FG28	0.0184	15	10	3.0	1.2	0.2
POND G IN-WEST	1.0377	503	350	122	63	22
FG27	0.0679	98	79	42	30	18
FG26	0.0570	65	50	24	16	8.2
G13	0.0570	65	50	24	16	8.2
G13-POND G	0.0570	64	50	24	16	8.1
POND G IN-EAST	0.1249	160	127	64	44	25
POND G	1.1626	450	293	52	21	5.3
G12	1.1626	450	293	52	21	5.3
G12-G06	1.1626	449	293	52	21	5.3
FG29	0.0983	60	39	8.9	2.9	0.4
FG32	0.0402	51	40	20	14	7.5
FG32-G06	0.0402	50	40	19	13	7.4
G06	1.3011	491	317	57	22	7.5

Rational Calculations

The Rational Hydrologic Calculation Method was used to estimate the total runoff from the 5-year and the 100-year design storm and thus establish the storm drainage system design. Using the rational calculation methodology outlined in the Hydrology Section (Ch 6) of the COSDCM coupled with the El Paso County EPCDCM an effective storm drainage design for the Sanctuary Filing 1 has been designed. The storm drainage facilities have been designed such that the minor storm will be captured by the inlets and conveyed by the storm drain pipes such that the street flow does not overtop the curbs. The storm drainage facility has been designed such that the major storm will be captured by the inlets and conveyed by the storm drain pipes such that the street flow does not exceed the right-of-way widths for residential streets and the hydraulic grade line will be less than one foot below the surface.

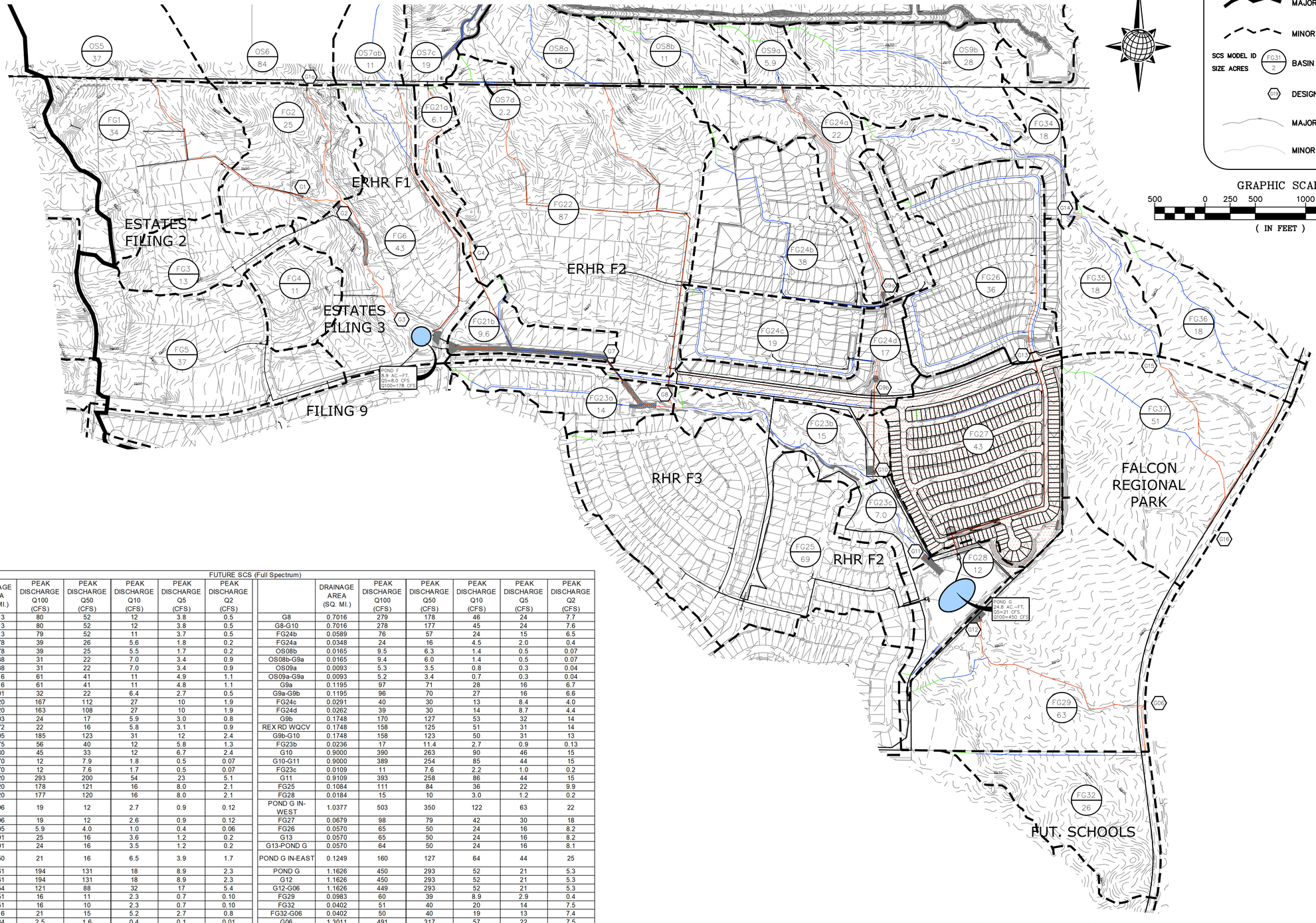
The site is located within the Gieck Ranch Drainage Basin. The storm drain runoff will be collected by a series of inlets and storm drain pipe then conveyed through the project and discharge directly into the existing Pond G that is properly sized to safely convey the storm water flows away from the project without damaging adjacent property.

Rational Narrative

The following is a detailed narrative of the storm drainage system located in the Sanctuary Filing 1. These storm drainage systems meet the requirements of as found in the El Paso

*NOTE: PRELIMINARY STORAGE VOLUMES AND OUTFLOW QUANTITIES HAVE BEEN PROVIDED FOR EACH OF THE FUTURE DETENTION FACILITIES LOCATED WITHIN THE DEVELOPMENT. THE ACTUAL STORAGE VOLUMES AND DISCHARGE RATES WILL BE DETERMINED UPON A COMPLETE ANALYSIS FOR EACH DETENTION FACILITY PRIOR TO CONSTRUCTION. THE VALUES GIVEN FOR DISCHARGE AND VOLUME ARE ESTIMATES FOR PLANNING PURPOSES ONLY.

THE SANCTUARY FILING 1



LEGEND

- MAJOR BASIN BOUNDARY
- MINOR BASIN BOUNDARY
- SCS MODEL ID / SIZE ACRES — FG31 / 2 — BASIN IDENTIFICATION
- DESIGN POINT
- MAJOR CONTOUR INTERVAL
- MINOR CONTOUR INTERVAL

GRAPHIC SCALE

500 0 250 500 1000 2000

(IN FEET)

FUTURE SCS (Full Spectrum)

	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.7	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9
G2-G3	0.2820	163	108	27	10	1.9
FG03	0.0203	24	17	5.9	3.0	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	12	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	12	7.9	1.8	0.5	0.07
OS07ab-POND F	0.0170	12	7.6	1.7	0.5	0.07
POND F IN	0.4620	293	200	54	23	5.1
POND F	0.4620	178	121	16	8.0	2.1
POND F-G7	0.4620	177	120	16	8.0	2.1
OS07c	0.0296	19	12	2.7	0.9	0.12
OS07c-G4	0.0296	19	12	2.6	0.9	0.12
FG21a	0.0095	5.9	4.0	1.0	0.4	0.06
G4	0.0391	25	16	3.6	1.2	0.2
G4-G7	0.0391	24	16	3.5	1.2	0.2
FG21b	0.0150	21	16	6.5	3.9	1.7
G7	0.5161	194	131	18	8.9	2.3
G7-G8	0.5161	194	131	18	8.9	2.3
FG22	0.1354	121	88	32	17	5.4
OS08a	0.0251	16	11	2.3	0.7	0.10
OS08-G8	0.0251	16	10	2.3	0.7	0.10
FG23a	0.0216	21	15	5.2	2.7	0.8
OS07d	0.0034	2.5	1.6	0.4	0.1	0.01
OS07d-G8	0.0034	2.4	1.6	0.3	0.1	0.01

	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G8	0.7016	279	178	46	24	7.7
G8-G10	0.7016	278	177	45	24	7.6
FG24b	0.0589	76	57	24	15	6.5
FG24a	0.0348	24	16	4.5	2.0	0.4
OS08b	0.0165	9.5	6.3	1.4	0.5	0.07
OS08b-G9a	0.0165	9.4	6.0	1.4	0.5	0.07
OS09a	0.0093	5.3	3.5	0.8	0.3	0.04
OS09a-G9a	0.0093	5.2	3.4	0.7	0.3	0.04
G9a	0.1195	97	71	28	16	6.7
G9a-G9b	0.1195	96	70	27	16	6.6
FG24c	0.0291	40	30	13	8.4	4.0
FG24d	0.0262	39	30	14	8.7	4.4
G9b	0.1748	170	127	53	32	14
REX RD WQCV	0.1748	158	125	51	31	14
G9b-G10	0.1748	158	123	50	31	13
FG23b	0.0236	17	11.4	2.7	0.9	0.13
G10	0.9000	390	263	90	46	15
G10-G11	0.9000	389	254	85	44	15
FG23c	0.0109	11	7.6	2.2	1.0	0.2
G11	0.9109	393	258	86	44	15
FG25	0.1084	111	84	36	22	9.9
FG28	0.0184	15	10	3.0	1.2	0.2
POND G IN-WEST	1.0377	503	350	122	63	22
FG27	0.0679	98	79	42	30	18
FG26	0.0570	65	50	24	16	8.2
G13	0.0570	65	50	24	16	8.2
G13-POND G	0.0570	64	50	24	16	8.1
POND G IN-EAST	0.1249	160	127	64	44	25
POND G	1.1626	450	293	52	21	5.3
G12	1.1626	450	293	52	21	5.3
G12-G06	1.1626	449	293	52	21	5.3
FG29	0.0983	60	39	8.9	2.9	0.4
FG32	0.0402	51	40	20	14	7.5
FG32-G06	0.0402	50	40	19	13	7.4
G06	1.3011	491	317	57	22	7.5

FUTURE CONDITIONS - SCS MAP

FIGURE 6

No.	Revisions	Date	Init.	Appr.	Date
-					
-					
-					

TECH CONTRACTORS
11910 TOURMALINE DR #130
FALCON, CO 80831
TELEPHONE: 719.495.7444

MERIDIAN RANCH

FUTURE CONDITIONS - SCS MAP
THE SANCTUARY FILING 1
FDR - FDR

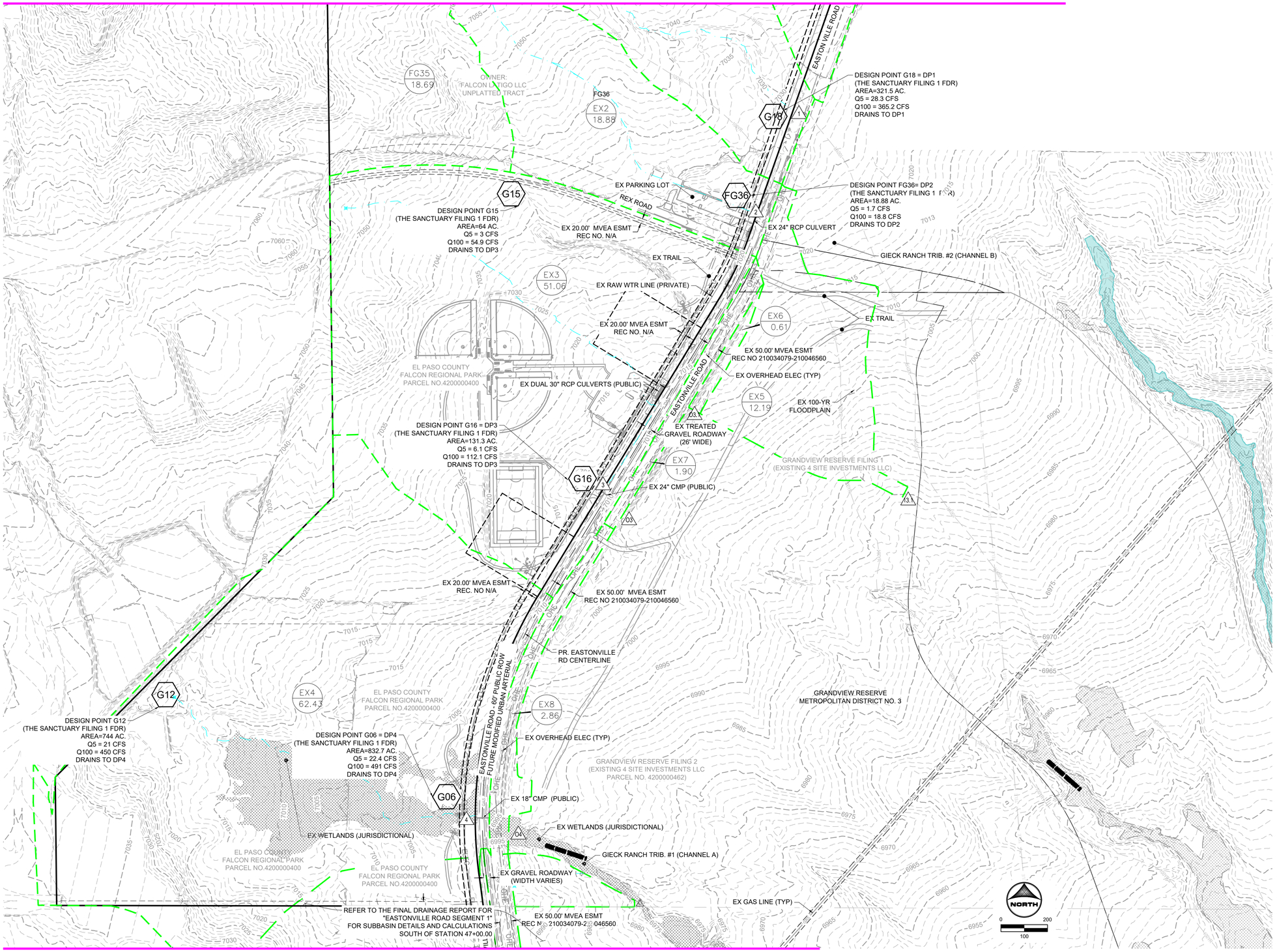
Drawn by TAK | Checked by . | Date JUNE 2022

Scale AS SHOWN

- of -

APPENDIX F – DRAINAGE MAPS

SEE SHEET 2



REFER TO EASTONVILLE ROAD SEGMENT 1 FDR

LEGEND:

- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- EX STORM SEWER
- EX DRAINAGE SWALE
- EX PROPERTY LINE
- EXISTING FLOW DIRECTION
- PROPOSED DRAINAGE BASIN
- DESIGN POINT
- PROPOSED BASIN LABEL (NAME / AREA)
- DESIGN POINT PER THE SANCTUARY FILING 1 FDR (GXX)

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
G18*	321.53	-	28.3	365.2
FG36*	18.88	-	1.7	18.8
G16*	131.26	-	6.1	112.1
G06*	832.70	-	22.4	491.0
EX5	12.19	2	2.7	18.0
EX6	0.61	2	0.1	0.9
EX7	1.90	2	0.4	2.5
EX8	2.86	2	0.6	4.0

* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	G18*	28.3	365.2
2	FG36*	1.7	18.8
3	G16*	6.1	112.1
4	G06*	22.4	491.0
O3	EX7	6.5	114.6
O3.1	EX7	0.1	0.9
O4	EX7	23.0	495.0
13.1	EX7	2.7	18.0

* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

DRAWN BY: SPC | JOB DATE: 8/28/2024 | APPROVED: CM | JOB NUMBER: 201662.08 | CAD DATE: 8/28/2024 | CAD FILE: J:\2020\201662\CAD\Dwgs\C\Eastonville_Road_662.08\Drainage\201662.08_FDR_map_ex_Sep2

BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen
HR GREEN - COLORADO SPRINGS
1975 RESEARCH PKWY SUITE 230
COLORADO SPRINGS CO 80920
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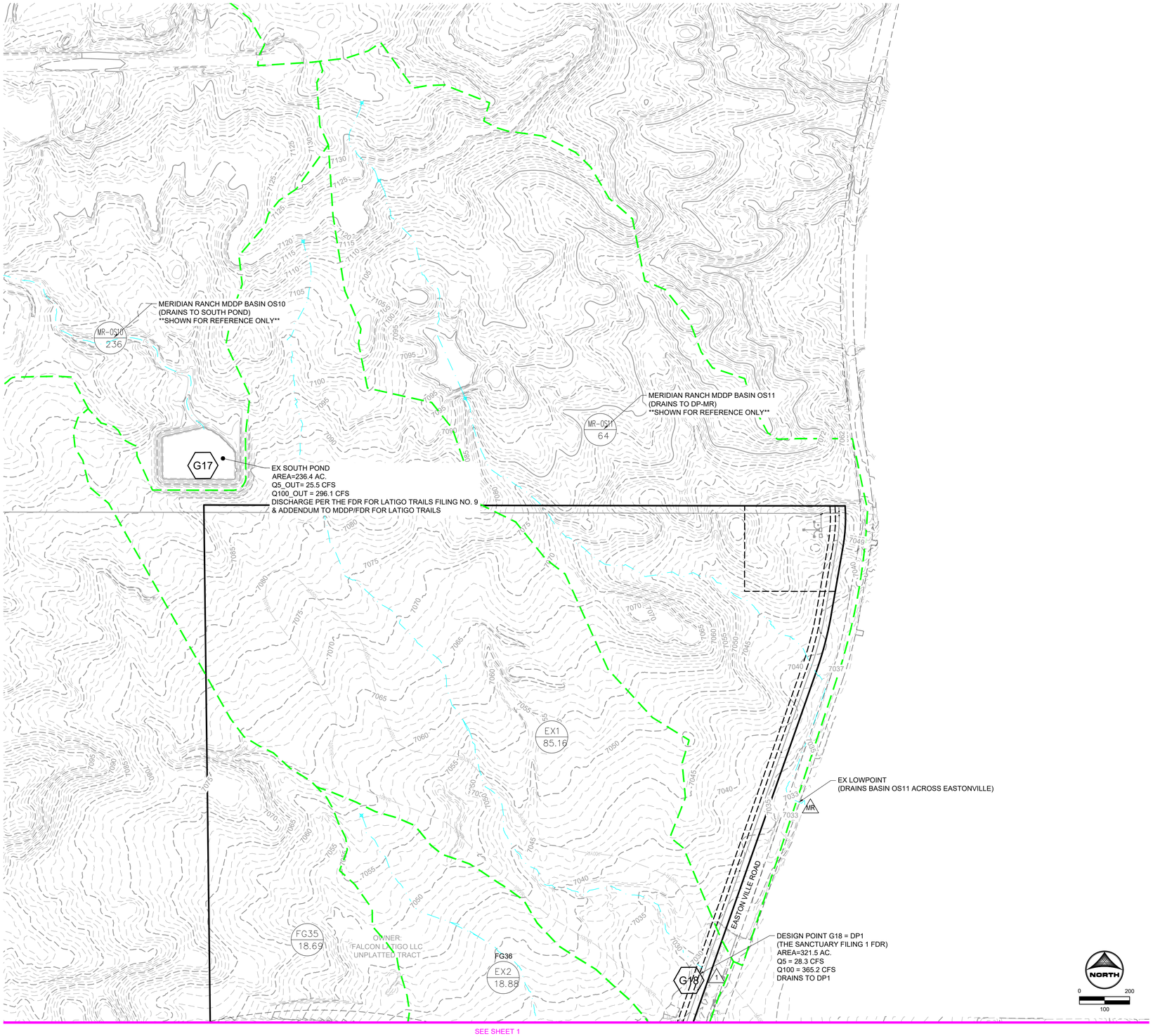
EASTONVILLE ROAD
D.R. HORTON
EL PASO COUNTY, CO

D·R·HORTON America's Builder

EXISTING CONDITIONS - DRAINAGE MAP

SHEET DRN 1



SEE SHEET 1

LEGEND:

- EXISTING MAJOR CONTOUR — — — 5250 — — —
- EXISTING MINOR CONTOUR
- EX STORM SEWER
- EX DRAINAGE SWALE
- EX PROPERTY LINE
- EXISTING FLOW DIRECTION
- PROPOSED DRAINAGE BASIN
- DESIGN POINT
- PROPOSED BASIN LABEL (NAME / AREA)
- DESIGN POINT PER THE SANCTUARY FILING 1 FDR (GXX)

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
G18*	321.53	-	28.3	365.2
FG36*	18.88	-	1.7	18.8
G16*	131.26	-	6.1	112.1
G06*	832.70	-	22.4	491.0
EX5	12.19	2	2.7	18.0
EX6	0.61	2	0.1	0.9
EX7	1.90	2	0.4	2.5
EX8	2.86	2	0.6	4.0

* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	G18*	28.3	365.2
2	FG36*	1.7	18.8
3	G16*	6.1	112.1
4	G06*	22.4	491.0
O3	EX7	6.5	114.6
O3.1	EX7	0.1	0.9
O4	EX7	23.0	495.0
13.1	EX7	2.7	18.0

* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

DRAWN BY: SPC JOB DATE: 8/28/2024
APPROVED: CM JOB NUMBER: 201662.08
CAD DATE: 8/28/2024
CAD FILE: J:\2020\201662\CAD\Dwgs\C\Eastonville_Road_662.08\Drainage\201662.08_FDR_map_ex_Sag2

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EASTONVILLE ROAD
D.R. HORTON
EL PASO COUNTY, CO

D·R·HORTON America's Builder

EXISTING CONDITIONS - DRAINAGE MAP

SHEET DRN 2

SEE SHEET 2

SEE EXISTING CONDITIONS DRAINAGE MAP

EX MVEA ABOVE GROUND ELECTRICAL BOX TO REMAIN

EX WELL STATION

GRANDVIEW RESERVE FILING 1 (EXISTING 4 SITE INVESTMENTS LLC PARCEL NO. 4200000462)

EX 50.00' MVEA ESMT REC NO 210034079-210046560

EA8 2.08

EA9 3.14

DP4 SWALE

EA14 1.48

G12

DESIGN POINT G12 (MERIDIAN RANCH MDDP) Q5 = 21 CFS Q100 = 450 CFS DRAINS TO DP16

EL PASO COUNTY FALCON REGIONAL PARK PARCEL NO.4200000400

OS6 60.83

FUTURE GRANDVIEW RESERVE

24" RCP (PUBLIC)

EX STORM PIPE TO BE REMOVED

18" RCP (PUBLIC)

DESIGN POINT G06 = DP4 (THE SANCTUARY FILING 1 FDR) AREA=832.7 AC. Q5 = 22.4 CFS Q100 = 491 CFS DRAINS TO DP4

G06

GRANDVIEW RESERVE TO DETAIN REMAINING ROUNDABOUT AREA

GRANDVIEW RESERVE FILING 2 (EXISTING 4 SITE INVESTMENTS LLC PARCEL NO. 4200000462)

EA13 0.45

EA12 0.34

EX CULVERTS TO REMAIN

DUAL 10' X 3.5' RCBC (PUBLIC)

EA11 0.15

TYPE L RIPRAP SPILLWAY

GEICK RANCH TRIBUTARY 1

GRANDVIEW RESERVE FILING 2 (MELODY HOMES INC PARCEL NO. 4200000462)

24" RCP (PUBLIC)

18" RCP (PUBLIC)

42" RCP (PUBLIC)

EA10 0.16

EL PASO COUNTY FALCON REGIONAL PARK PARCEL NO.4200000400

42" RCP (PUBLIC)

EDB B FULL SPECTRUM EXTENDED DETENTION BASIN

EX 20.00' MVEA ESMT REC. NO. N/A

CONCRETE FOREBAY & 40" WIDE CONCRETE TRICKLE CHANNEL

24" RCP (PUBLIC)

18" RCP (PUBLIC)

10' CDOT Type-R

6' CDOT Type-D

42" RCP (PUBLIC)

REFER TO THE FINAL DRAINAGE REPORT FOR "EASTONVILLE ROAD SEGMENT 1" FOR SUBBASIN DETAILS AND CALCULATIONS SOUTH OF STATION 47+00.00

42" RCP (PUBLIC)

10' CDOT Type-R

6' STORM MH (PUBLIC)

48.00' PVMT WIDTH

EX 50.00' MVEA ESMT REC NO 210034079-210046560

TYPE A C&G

MERIDIAN RANCH INVESTMENTS INC PARCEL NO. 4200000451

REFER TO EASTONVILLE ROAD SEGMENT 1 FDR

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM SEWER
- PROPOSED DRAINAGE SWALE
- PROPERTY LINE
- PROPOSED FLOW DIRECTION
- EXISTING FLOW DIRECTION
- PROPOSED DRAINAGE BASIN
- DESIGN POINT
- PROPOSED BASIN LABEL — NAME / AREA
- PRELIMINARY 100-YR FLOODPLAIN
- WETLANDS
- DESIGN POINT PER MERIDIAN RANCH — XX

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q5 (cfs)	Q100 (cfs)
EA1	0.22	73	0.8	1.5
EA2	0.25	72	0.9	1.7
EA3	0.20	70	0.7	1.3
EA4	0.17	65	0.5	1.1
EA5	0.16	0	0.1	0.4
EA6	0.25	76	0.8	1.4
EA7	0.20	50	0.4	1.0
EA8	2.08	99	5.2	8.8
EA9	3.14	60	5.0	10.6
EA10	0.16	75	0.6	1.1
EA11	0.15	67	0.5	1.0
EA12	0.34	0	0.1	1.0
EA13	0.45	73	1.4	2.8
EA14	1.48	21	1.2	3.8
EA15	0.76	24	0.7	2.1
EA16	1.18	0	0.3	2.5
EA17	0.30	0	0.1	0.7
*G18	321.53	-	28.3	365.2
*FG36	18.88	-	1.7	18.8
OS3	1.00	2	0.3	2.2
OS4	9.60	9	4.8	21.6
*G16	131.26	-	6.1	112.1
*G06	832.70	-	22.4	491.0
OS7	11.29	3	3.9	24.6

* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	G18	28.3	365.2
2	FG36	1.7	18.8
2.1	EA1	0.8	1.5
3	G16	6.1	112.1
3.1	EA2, DP2.1	1.6	3.2
4	G06	22.4	491.0
4.1	EA5, DP3.1	1.7	3.4
5	EA3	0.7	1.3
6	DP5, EA4	1.2	2.4
6.1	DP6, DP8	2.9	22.4
7	OS3	0.3	2.2
8	DP2, DP7	2.0	21.0
9	DP6.1	2.9	22.4
10	EA6, EA7	1.2	2.3
11	OS4, DP9	7.5	44.0
12	OS7	3.9	24.6
13	DP11.1, DP12	10.0	180.6
14	EA8	5.2	8.8
15	EA9	5.0	10.6
15.1	DP14, DP15	10.2	19.3
16.1	EA10	0.6	1.1
17.1	EA11	0.5	1.0
O3	EA15	0.7	2.1
O3.1	-	0.0	0.0
O4	EA12, DP4	22.5	492.0
O4.1	EA13	1.4	2.8
O4.2	EA14	1.2	3.8
10.1	EA17	0.1	0.7
11.1	DP3, DP11	13.6	156.1
13.1	EA16, DP13	0.3	183.1

NORTH

0 100

50

DRAWN BY: SPC JOB DATE: 8/28/2024

APPROVED: CM JOB NUMBER: 201662.08

CAD DATE: 8/28/2024

CAD FILE: J:\2020\201662\CAD\Dwgs\C\Eastonville_Road_662.08\Drainage\201662.08_FDR_map_Seg2

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NO.	DATE	BY	REVISION DESCRIPTION

HRGreen

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FAX: 713.965.0044

EASTONVILLE ROAD

D.R. HORTON
EL PASO COUNTY, CO

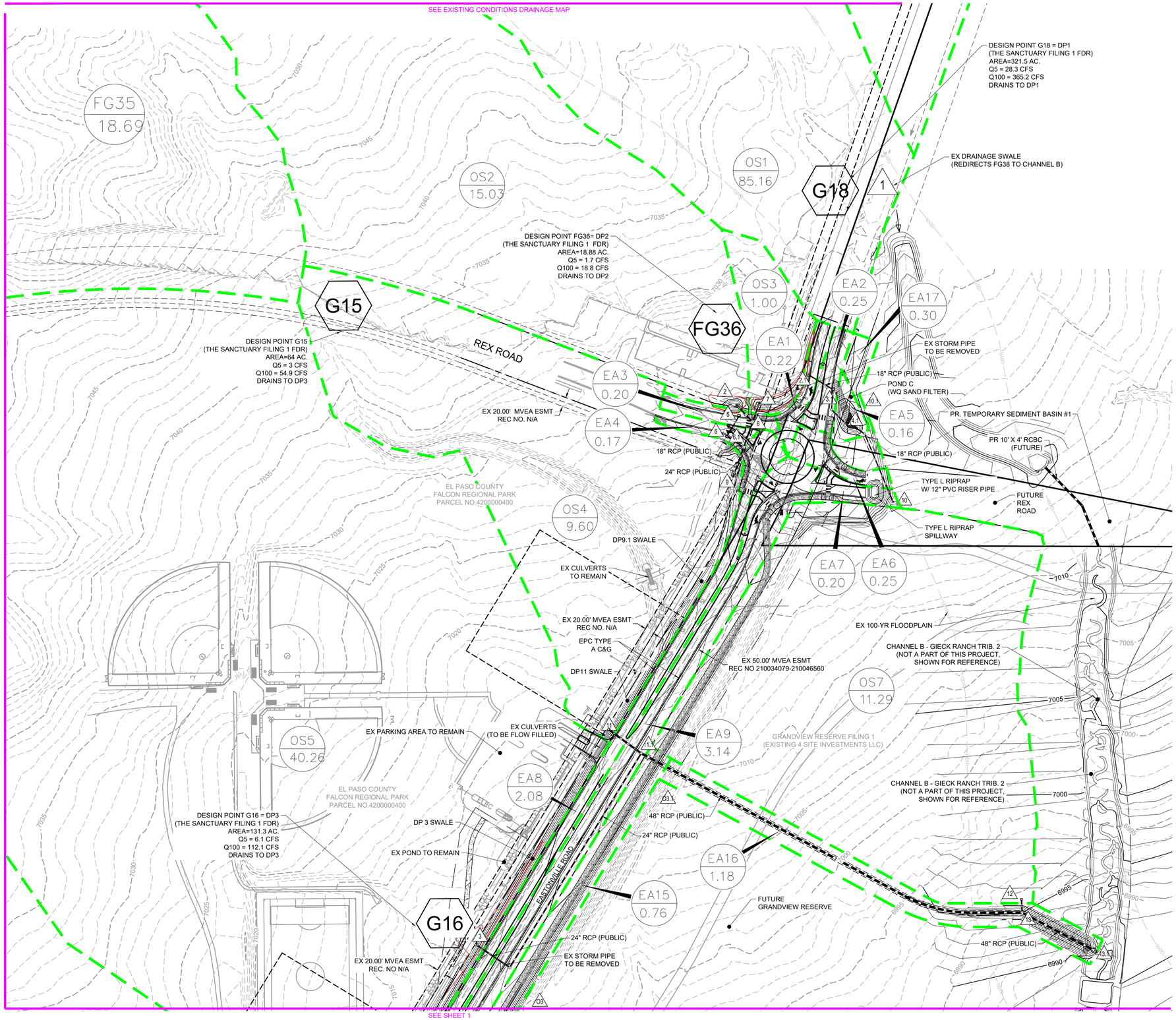
D·R·HORTON America's Builder

PROPOSED CONDITIONS - DRAINAGE MAP

SHEET DRN 1

SEE EXISTING CONDITIONS DRAINAGE MAP

SEE EXISTING CONDITIONS DRAINAGE MAP



LEGEND:

PROPOSED MAJOR CONTOUR	5250
PROPOSED MINOR CONTOUR	
EXISTING MAJOR CONTOUR	5250
EXISTING MINOR CONTOUR	
PROPOSED STORM SEWER	
PROPOSED DRAINAGE SWALE	
PROPERTY LINE	
PROPOSED FLOW DIRECTION	
EXISTING FLOW DIRECTION	
PROPOSED DRAINAGE BASIN	
DESIGN POINT	1
PROPOSED BASIN LABEL	NAME / AREA
PRELIMINARY 100-YR FLOODPLAIN	
WETLANDS	
DESIGN POINT PER MERIDIAN RANCH	XX

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q5 (cfs)	Q100 (cfs)
EA1	0.22	73	0.8	1.5
EA2	0.25	72	0.9	1.7
EA3	0.20	70	0.7	1.3
EA4	0.17	65	0.5	1.1
EA5	0.16	0	0.1	0.4
EA6	0.25	76	0.8	1.4
EA7	0.20	50	0.4	1.0
EA8	2.08	99	5.2	8.8
EA9	3.14	60	5.0	10.6
EA10	0.16	75	0.6	1.1
EA11	0.15	67	0.5	1.0
EA12	0.34	0	0.1	1.0
EA13	0.45	73	1.4	2.8
EA14	1.48	21	1.2	3.8
EA15	0.76	24	0.7	2.1
EA16	1.18	0	0.3	2.5
EA17	0.30	0	0.1	0.7
*G18	321.53	-	28.3	365.2
*FG36	18.88	-	1.7	18.8
OS3	1.00	2	0.3	2.2
OS4	9.60	9	4.8	21.6
*G16	131.26	-	6.1	112.1
*G06	832.70	-	22.4	491.0
OS7	11.29	3	3.9	24.6

* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	G18	28.3	365.2
2	FG36	1.7	18.8
2.1	EA1	0.8	1.5
3	G16	6.1	112.1
3.1	EA2, DP2.1	1.6	3.2
4	G06	22.4	491.0
4.1	EA5, DP3.1	1.7	3.4
5	EA3	0.7	1.3
6	DP5, EA4	1.2	2.4
6.1	DP6, DP8	2.9	22.4
7	OS3	0.3	2.2
8	DP2, DP7	2.0	21.0
9	DP6.1	2.9	22.4
10	EA6, EA7	1.2	2.3
11	OS4, DP9	7.5	44.0
12	OS7	3.9	24.6
13	DP11.1, DP12	10.0	180.6
14	EA8	5.2	8.8
15	EA9	5.0	10.6
15.1	DP14, DP15	10.2	19.3
16.1	EA10	0.6	1.1
17.1	EA11	0.5	1.0
O3	EA15	0.7	2.1
O3.1	-	0.0	0.0
O4	EA12, DP4	22.5	492.0
O4.1	EA13	1.4	2.8
O4.2	EA14	1.2	3.8
10.1	EA17	0.1	0.7
11.1	DP3, DP11	13.6	156.1
13.1	EA16, DP13	0.3	183.1

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EASTONVILLE ROAD
D.R. HORTON
EL PASO COUNTY, CO

PROPOSED CONDITIONS - DRAINAGE MAP

SHEET DRN 2