HRGreen

HRGREEN.COM

Eastonville Road – Londonderry Drive to Rex Road
Segment 1 Improvements
Stationing 14+19.69 – 47+66.51

Final Drainage Report

January 2025

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

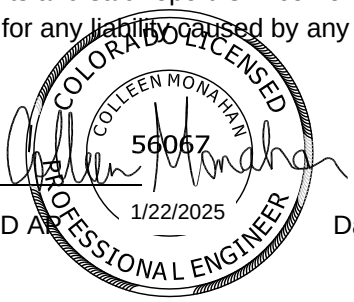
cmonahan@hrgreen.com

(719) 394-2433

EDARP File 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:

Table of Contents

Appendices

I. General Purpose, Location and Description

a. Purpose

The purpose of this Final Drainage Report (FDR) for the Eastonville Road from Londonderry Drive to Rex Road Segment 1 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 Drive to Grandview Filing No. 1 (Stations 14+19.69 to 47+66.51). Stations 47+00.00 to 79+31.62 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 development is considered a single project; however, the plan set has been broken into two segments to align with the Grandview Reserve Filings. A separate FDR describes Segment 2 of the project.

b. Location

Eastonville Road from Londonderry Drive to Grandview Filing No. 1, referred to as 'the site' herein, is an existing 26' wide treated gravel road in El Paso County, Colorado. The site lies in 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 0.61 miles (2.06 acres) of existing treated gravel roadway north of Londonderry Drive and south of Grandview Reserve Filing No. 1. Per field inspection the existing Eastonville Road section is treated gravel 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 approximately 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 that is just north of Segment 1. The channel is a mapped wetland and a wetland permit will be required for Segment 2 of this Eastonville Road improvement project. Channel A is not within a mapped FEMA floodplain.

Existing utilities include an underground gas line that runs along the east and west sides of Eastonville and underneath the length of the roadway, an existing raw water line that follows the west side of Eastonville north of Falcon Regional Park, an existing underground electric line along the west and portions of the east side of

Eastonville Road, and an existing aboveground electrical line along the east 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 Segment 1 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. Public, 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 – Public, 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.

Within the Gieck Ranch Drainage Basin, ranching has historically been the predominant land use, with rolling topography between 2%-4% slopes. Recent 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 1 Improvements project site.

b. Existing Subbasin Description

Basin E1 is 0.45 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 0.7 cfs Q_{100} = 1.7 cfs) is conveyed by an existing roadside swale on the northwest edge of Eastonville Road to DP1. Flows at DP1 then drain across Eastonville Road through an existing public 36" CMP culvert to DP2.

Basin E2.1 is 1.82 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 1.2 cfs Q_{100} = 4.8 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP2. Flows at DP2 then drain southeast offsite in historic drainage patterns.

Basin E2.2 is 0.40 acres of treated gravel from the Eastonville Road roadway and existing native landscaped area. Stormwater from this basin (Q_5 = 0.1 cfs Q_{100} = 1.0 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP2.2. Flows at DP2.2 then drain southwest offsite in historic drainage patterns.

Basin E3 is 0.72 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 1.0 cfs Q_{100} = 2.5 cfs) is conveyed by an existing roadside swale on the northwest edge of Eastonville Road to DP3. Flows at DP3 then drain across Eastonville Road through an existing public 24" CMP culvert do DP4.

Basin E4 is 3.17 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 1.9 cfs Q_{100} = 7.8 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP4. Flows at DP4 then drain southeast offsite in historic drainage patterns.

Basin E5 is 0.23 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 0.5 cfs Q_{100} = 1.1 cfs) is conveyed by an existing roadside swale on the northwest edge of Eastonville Road to DP5. Flows at DP5 then drain across Eastonville Road through an existing public 18" CMP culvert to DP6.

Basin E6 is 0.79 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 0.7 cfs Q_{100} = 2.6 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP6. Flows at DP6 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin E7 is 0.23 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 0.5 cfs Q_{100} = 1.2 cfs) is conveyed by an existing roadside swale on the northwest edge of Eastonville Road to DP7.1. Flows at DP7.1 then drain across Eastonville Road through an existing public 18" CMP culvert to DP8.1.

Basin E8 is 0.70 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 0.6 cfs Q_{100} = 2.1 cfs) is conveyed by an existing swale on

the southeast edge of Eastonville Road to DP8.1. Flows at DP8.1 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin E9 is 0.73 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 1.2 cfs Q_{100} = 2.8 cfs) is conveyed by an existing roadside swale on the northwest edge of Eastonville Road to DP7.2. Flows at DP7.2 then drain across Eastonville Road through an existing public 18" CMP culvert to DP8.2.

Basin E10.1 is 2.61 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 1.9 cfs Q_{100} = 7.0 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP8.2. Flows at DP8.2 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin E10.2 is 1.89 acres of existing native landscaped area. Stormwater from this basin (Q_5 = 0.7 cfs Q_{100} = 4.4 cfs) is conveyed via sheet flow southeast of Eastonville Road to DP8.3. Flows at DP8.3 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin OS1 is 1.58 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 0.5 cfs Q_{100} = 3.6 cfs) drains via sheet flow into an existing roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP1. Flows at DP1 then drain across Eastonville Road through an existing public 36" CMP culvert to DP2. Flows at DP2 then drain southeast offsite in historic drainage patterns.

Basin OS2 is 12.21 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 3.6 cfs Q_{100} = 24.3 cfs) drains via sheet flow into an existing roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP3. Flows at DP3 then drain across Eastonville Road through an existing public 24" CMP culvert to DP4. Flows at DP4 then drain southeast offsite in historic drainage patterns.

Basin OS3.1 is 1.51 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 0.5 cfs Q_{100} = 3.6 cfs) drains via sheet flow into an existing roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP5. Flows at DP5 then drain across Eastonville Road through an existing public 18" CMP culvert to DP6. Flows at DP6 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin OS3.2 is 2.86 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 1.0 cfs Q_{100} = 6.6 cfs) drains via sheet flow into an existing roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP7.1. Flows at DP7.1 then drain across Eastonville Road through an existing public 18" CMP culvert to DP8.1. Flows at DP8.1 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin OS3.3 is 21.12 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 6.4 cfs Q_{100} = 42.7 cfs) drains via sheet flow into an existing roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP7.2. Flows at DP7.2 then drain across Eastonville Road through an existing public 18" CMP culvert to DP8.2. Flows at DP8.2 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

c. Proposed Subbasin Description

Description of Proposed Project

The proposed project includes improvements to Eastonville Road from Londonderry Drive to the north part of Grandview Filing No. 1. As described above, the current condition of the existing roadway in this area consists of 26' wide treated gravel roadway with 4' wide gravel shoulders and native landscaped swales located on both sides of the roadway. Offsite stormwater is bypassed under the proposed roadway via proposed public RCP culverts.

The proposed improvements to Eastonville Road from Londonderry Drive to the north part of Grandview Filing No. 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).

Eastonville Road Basins

Basin EA1 is 0.62 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 2.6 cfs Q_{100} = 4.7 cfs) is conveyed by curb & gutter on the northwest side of Eastonville Road. Runoff is then captured in an on grade public 15' CDOT Type R Inlet at DP9. Flows from DP9 are conveyed through a proposed public storm sewer system which outfalls into sand filter basin D (SFB D). SFB D is located southeast of the proposed Eastonville Road Segment 1 improvements outside of the proposed right-of-way within a proposed drainage easement. WQ treatment and runoff reduction is provided for this basin within SFB D. Calculations for runoff reduction have been provided in Appendix B. SFB D has been coordinated with the "PPRTA Pond E" which will replace SFB D in the future and provide WQ treatment for the tributary basins. Refer to the drainage facility design section of this report for additional information on SFB D.

Basin EA2 is 1.21 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 2.5 cfs Q_{100} = 5.6 cfs) is conveyed by curb & gutter on the southeast side of Eastonville Road. Runoff is then captured in an on grade public 15' CDOT Type R Inlet at DP10. Flows from DP10 are conveyed through a proposed public storm sewer system which outfalls into SFB D. WQ treatment and runoff reduction is provided for this basin within SFB D. Calculations for runoff reduction have been provided in Appendix B. Refer to the drainage facility design section of this report for additional information on SFB D.

Basin EA3 is 0.44 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 1.8 cfs Q_{100} = 3.0 cfs) is conveyed by curb & gutter on the northwest side of Eastonville Road. Runoff is then captured in an on grade public 10' CDOT Type R Inlet at DP13. Flows at DP13 are conveyed across Eastonville Road through a public storm sewer system to sand filter basin A (SFB A). SFB A is located southeast of the proposed Eastonville Road Segment 1 improvements outside of the proposed right-of-way within a proposed drainage easement. WQ treatment and runoff reduction is provided for this basin within SFB A. Calculations for runoff reduction have been provided in Appendix B. Refer to the drainage facility design section of this report for additional information on SFB A.

Basin EA4 is 0.77 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 1.7 cfs Q_{100} = 2.9 cfs) is conveyed by curb & gutter on the southeast side of Eastonville Road. Runoff is then captured in an on grade public 10' CDOT Type R Inlet at DP14. Flows at DP14 are conveyed through a public storm sewer system to SFB A. WQ treatment and runoff reduction is

provided for this basin within SFB A. Calculations for runoff reduction have been provided in Appendix B. Refer to the drainage facility design section of this report for additional information on SFB A.

Basin EA5.1 is 0.37 acres of landscaped area, gravel access road, and contains the public full spectrum sand filter basin A (SFB A). Stormwater (Q_5 = 0.3 cfs Q_{100} = 0.4 cfs) from this basin sheet flows directly into SFB A. WQ treatment and runoff reduction is provided for this basin within SFB A. Calculations for runoff reduction have been provided in Appendix B. Refer to the drainage facility design section of this report for additional information on SFB A.

Basin EA5.2 is 0.52 acres of existing undisturbed/disturbed landscape area and the overflow path from SFB A. Stormwater (Q_5 = 0.2 cfs Q_{100} = 1.6 cfs) from this basin is conveyed via an existing drainage swale west to design point 4. The existing drainage swale drains southeast offsite is historic drainage patterns and ultimately combines with flows from design point 4.1. There is approximately 10,105 SF of disturbed landscape area within this basin, all of which will be re-stabilized as landscape area with native seeding & mulching. All disturbance within this basin is considered to be a separate pervious area (SPA). The required WQCV to be treated from this disturbance is 0 cf per the runoff reduction calculations provided in Appendix B of this report. The required treatment volume is 0 cf due to no impervious area being added or disturbed within this basin. This basin is a part of the Waterbury property and will ultimately be detained and treated by the Waterbury development.

Basin EA5.3 is 1.21 acres of existing undisturbed/disturbed landscape area on the east side of Eastonville Road. Stormwater (Q_5 = 0.4 cfs Q_{100} = 2.9 cfs) from this basin is conveyed via an existing drainage swale east to design point 4.1. Runoff to design point 4.1 drains offsite in historic patterns to the southeast and ultimately combines with flows from design point 4. There is approximately 20,228 SF of disturbed landscape area within this basin, all of which will be re-stabilized as landscape area with native seeding & mulching. All disturbance within this basin is considered to be a separate pervious area (SPA). The required WQCV to be treated from this disturbance is 0 cf per the runoff reduction calculations provided in Appendix B of this report. The required treatment volume is 0 cf due to no impervious area being added or disturbed within this basin. This basin is a part of the Waterbury property and will ultimately be detained and treated by the Waterbury development.

Basin EA5.4 is 0.41 acres of existing undisturbed/disturbed landscape area on the east side of Eastonville Road. Stormwater (Q_5 = 0.1 cfs Q_{100} = 1.0 cfs) from this basin is conveyed via an existing drainage swale east to design point 6. Runoff to design point 6 drains offsite in historic patterns to the southeast. There is approximately 5,422 SF of disturbed landscape area within this basin, all of which will be re-stabilized as landscape area with native seeding & mulching. All disturbance within this basin is considered to be a separate pervious area (SPA). The required WQCV to be treated from this disturbance is 0 cf per the runoff reduction calculations provided in Appendix B of this report. The required treatment volume is 0 cf due to no impervious area being added or disturbed within this basin. This basin is a part of the Waterbury property and will ultimately be detained and treated by the Waterbury development.

Basin EA6 is 1.09 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 3.1 cfs Q_{100} = 5.2 cfs) is conveyed by curb & gutter on the west side of Eastonville Road. Runoff is then captured in a sump public 10’ CDOT Type R Inlet at DP16. In the event of clogging at this inlet, overflows will overtop the street crown and drain into the sump public 10’ CDOT Type R Inlet at DP 17. If both sump inlets are clogged, overflow will overtop the east curb and sheet flow east offsite. Flows at DP16 are conveyed across Eastonville Road through a public storm sewer system to Extended Detention Basin B (EDB B). EDB B is located northeast of the proposed Eastonville Road Segment 1 improvements

outside of the proposed right-of-way within a proposed drainage easement. WQ treatment and runoff reduction is provided for this basin within EDB B. Calculations for runoff reduction have been provided in Appendix B. EDB B has been coordinated with the segment 2 improvements of Eastonville Road to provide treatment for the future tributary basins. Refer to the drainage facility design section of this report for additional information on EDB B.

Basin EA7 is 1.92 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 3.2 cfs Q_{100} = 5.4 cfs) is conveyed by curb & gutter on the east side of Eastonville Road. Runoff is then captured in a sump public 10' CDOT Type R Inlet at DP17. In the event of clogging at this inlet, overflows will overtop the street crown and drain into the sump public 10' CDOT Type R Inlet at DP 16. If both sump inlets are clogged, overflow will overtop the east curb and sheet flow east offsite. Flows at DP17 are conveyed through a public storm sewer system to EDB B. WQ treatment and runoff reduction is provided for this basin within EDB B. Calculations for runoff reduction have been provided in Appendix B. Refer to the drainage facility design section of this report for additional information on EDB B.

Basin EA8 is 0.94 acres of landscaped area, gravel access road, and contains extended detention basin B. Stormwater (Q_5 = 0.5 cfs Q_{100} = 0.9 cfs) from this basin sheet flows directly into EDB B. WQ treatment and runoff reduction is provided for this basin within EDB B. Calculations for runoff reduction have been provided in Appendix B. Refer to the drainage facility design section of this report for additional information on EDB B.

Basin EA9 is 0.88 acres of existing undisturbed/disturbed landscape area on the east side of Eastonville Road. Stormwater (Q_5 = 0.4 cfs Q_{100} = 0.6 cfs) from this basin sheet flows directly offsite towards DP20. Runoff to design point 20 drains southwest in historic patterns to design point 2, and ultimately offsite to the east in historic drainage patterns. There is approximately 14,605 SF of disturbed landscape area within this basin, all of which will be re-stabilized as landscape area with native seeding & mulching. All disturbance within this basin is considered to be a separate pervious area (SPA). The required WQCV to be treated from this disturbance is 0 cf per the runoff reduction calculations provided in Appendix B of this report. The required treatment volume is 0 cf due to no impervious area being added or disturbed within this basin. This basin is a part of the Waterbury property and will ultimately be detained and treated by the Waterbury development.

Basin EA10.1 is 0.36 acres of landscaped area and concrete/gravel trail. Stormwater (Q_5 = 0.4 cfs Q_{100} = 0.6 cfs) from this basin sheet flows directly east offsite towards DP8.1. Flows from design point 8.1 drain east offsite in historic patterns, ultimately combining with design point 8.2 & 8.3. WQ treatment is provided for the proposed concrete/gravel trail via a 10' wide grass buffer adjacent to the trail. There is approximately 2,715 SF of impervious area within this basin treated by the grass buffer. The grass buffer will provide a runoff reduction of 100% and treat all 113 cf of the required WQCV. The remaining basin area consists of existing landscaping, and 5,540 sf of disturbed landscape area. All disturbed landscape area east of the proposed trail is considered as SPA and will be re-stabilized as landscape area with native seeding & mulching. The required WQCV to be treated from the landscape disturbed area is 0 cf per the runoff reduction calculations provided in Appendix B of this report. The required treatment volume is 0 cf due to no impervious area being added. Calculations for runoff reduction have been provided in Appendix B. This basin is a part of the Grandview Reserve property and will ultimately be detained and treated by the Grandview Reserve development.

Basin EA10.2 is 1.06 acres of landscaped area and concrete/gravel trail. Stormwater (Q_5 = 1.4 cfs Q_{100} = 4.4 cfs) from this basin sheet flows directly offsite towards DP8.2. Flows from design point 8.2 drain east offsite in historic patterns, ultimately combining with design point 8.1 & 8.3. WQ treatment is provided for the proposed

concrete/gravel trail via a 10' wide grass buffer adjacent to the trail. There is approximately 11,050 SF of impervious area within this basin treated by the grass buffer. The grass buffer will provide a runoff reduction of 100% and treat all 460 cf of the required WQCV. The remaining basin area consists of existing landscaping, and 13,713 sf of disturbed landscape area. All disturbed landscape area east of the proposed trail is considered as SPA and will be re-stabilized as landscape area with native seeding & mulching. The required WQCV to be treated from the landscape disturbed area is 0 cf per the runoff reduction calculations provided in Appendix B of this report. The required treatment volume is 0 cf due to no impervious area being added. Calculations for runoff reduction have been provided in Appendix B. This basin is a part of the Grandview Reserve property and will ultimately be detained and treated by the Grandview Reserve development.

Basin EA11 is 1.23 acres of existing undisturbed/disturbed landscape area on the east side of Eastonville Road. Stormwater (Q_5 = 0.5 cfs Q_{100} = 0.9 cfs) from this basin sheet flows directly offsite towards DP22. Runoff to design point 22 drains offsite in historic patterns to the southeast and ultimately combines with flows from design point 8.3. There is approximately 5,412 SF of disturbed landscape area within this basin, all of which will be re-stabilized as landscape area with native seeding & mulching. All disturbance within this basin is considered to be a separate pervious area (SPA). The required WQCV to be treated from this disturbance is 0 cf per the runoff reduction calculations provided in Appendix B of this report. The required treatment volume is 0 cf due to no impervious area being added or disturbed within this basin. This basin is a part of the Grandview Reserve property and will ultimately be detained and treated by the Grandview Reserve development.

Basin EA12 is 0.47 acres of landscaped area and gravel maintenance access road. Stormwater (Q_5 = 0.6 cfs Q_{100} = 1.7 cfs) from this basin sheet flows directly into SFB D. WQ treatment and runoff reduction is provided for this basin within SFB D. Calculations for runoff reduction have been provided in Appendix B. Refer to the drainage facility design section of this report for additional information on SFB D.

Basin EA13 is 0.21 acres of existing undisturbed/disturbed landscape area on the east side of Eastonville Road. Stormwater (Q_5 = 0.3 cfs Q_{100} = 0.7 cfs) from this basin sheet flows directly offsite towards DP12. Runoff to design point 12 drains offsite in historic patterns to the southwest. There is approximately 544 SF of disturbed landscape area within this basin, all of which will be re-stabilized as landscape area with native seeding & mulching. All disturbance within this basin is considered to be a separate pervious area (SPA). The required WQCV to be treated from this disturbance is 0 cf per the runoff reduction calculations provided in Appendix B of this report. The required treatment volume is 0 cf due to no impervious area being added or disturbed within this basin. This basin is a part of the Waterbury property and will ultimately be detained and treated by the Waterbury development.

Basin OS1 is 1.63 acres of existing undisturbed/disturbed landscape area on the west side of Eastonville Road from the Falcon High School property. Stormwater from this basin (Q_5 = 0.5 cfs Q_{100} = 3.6 cfs) drains via sheet flow into a proposed roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP1. Runoff is then captured in a sump public CDOT Type C Inlet at DP1. Flows from DP1 are conveyed through a proposed public storm sewer system which outfalls into SFB D. WQ treatment and runoff reduction is provided for this basin within SFB D. Calculations for runoff reduction have been provided in Appendix B. Refer to the drainage facility design section of this report for additional information on SFB D.

Basin OS2 is 12.18 acres of existing undisturbed/disturbed landscape area on the west side of Eastonville Road from the Falcon High School property. Stormwater from this basin (Q_5 = 3.6 cfs Q_{100} = 24.2 cfs) drains via sheet flow into a proposed roadside swale on the northwest side of Eastonville Road. Stormwater then

See my comment about double treatment on the Drainage Map on pg 154. And then update all of the basin paragraphs up here that are impacted.

drains to DP3. Flows at DP3 then drain across Eastonville Road through a proposed public 24" RCP culvert to DP4. Flow at DP4 is conveyed via an existing drainage swale. The existing drainage swale drains southeast offsite is historic drainage patterns. There is approximately 13,994 SF of disturbed landscape area within this basin, all of which will be re-stabilized as landscape area with native seeding & mulching. All disturbance within this basin is considered to be a separate pervious area (SPA). The required WQCV to be treated from this disturbance is 0 cf per the runoff reduction calculations provided in Appendix B of this report. The required treatment volume is 0 cf due to no impervious area being added or disturbed within this basin. This basin drains onto the Waterbury property and will ultimately be detained and treated, or bypassed through, the Waterbury development.

Basin OS3 is 25.50 acres of existing undisturbed/disturbed landscape area on the west side of Eastonville Road from the Meridian Ranch property. Stormwater from this basin (Q_5 = 8.0 cfs Q_{100} = 53.6 cfs) drains via sheet flow into a proposed roadside swale on the northwest side of Eastonville Road. Stormwater then drains to a proposed public CDOT type D inlet at DP7. Flows at DP7 then drain across Eastonville Road through a proposed public storm sewer system. This storm sewer system outfalls at DP8.3 into the Gieck Ranch Tributary #1 where drainage will follow historic patterns. There is approximately 37,875 SF of disturbed landscape area within this basin, all of which will be re-stabilized as landscape area with native seeding & mulching. All disturbance within this basin is considered to be a separate pervious area (SPA). The required WQCV to be treated from this disturbance is 0 cf per the runoff reduction calculations provided in Appendix B of this report. The required treatment volume is 0 cf due to no impervious area being added or disturbed within this basin. This basin drains onto the Grandview Reserve property and will ultimately be detained and treated, or bypassed through, the Grandview Reserve development.

IV. Drainage Facility Design

a. General Concept

The proposed improvements to Eastonville Road from Londonderry Drive to the north part of Grandview Filing No. 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. Stormwater from this roadway will be piped to either a full spectrum detention basin or full spectrum sand filters. All detention basins and water quality features will discharge at less than historic rates. Runoff generated from the site will release at historic design points at less than historic flow rates. A flow comparison of existing/proposed stormwater release rates offsite from the project is below:

Table 1 – Flow Comparison

DESIGN POINT	EX Q_5 (cfs)	PR Q_5 (cfs)	EX Q_{100} (cfs)	PR Q_{100} (cfs)
DP2	2.3	0.7	9.3	5.0
DP4	6.3	4.1	33.9	28.6
DP6	1.5	0.4	6.7	2.0
DP8 (8.1, 8.2, & 8.3)	11.8	11.5	65.4	62.7
DP2.2/12	0.1	0.3	1.0	0.7
TOTAL	**22.0**	**17.0**	**116.0**	**99.0**

b. Water Quality & Detention

Sand Filter Basin A (Full Spectrum SFB)

Water quality and stormwater detention for Basins EA3-EA5 is provided in Sand Filter Basin A. SFB A is a public county owned, full spectrum sand filter basin within the ACM ALF VIII JV SUB II LLC (Waterbury) property within a proposed drainage easement. In SFB A, a total of 1.58 acres of disturbed area from the proposed project at 53% composite imperviousness will be detained and treated for water quality. The WQCV is 0.015 ac-ft, the EURV is 0.090 ac-ft, and the 100-year detention volume is 0.154 ac-ft. The WQCV, EURV and 100-year storms are released in 12, 41 and 49 hours, respectively. A 15' access and maintenance road is provided to the bottom of the pond to facilitate maintenance of the pond facilities. A 5' emergency overflow spillway is provided that conveys the developed, peak 100-yr flow rate with 1.0' of freeboard south toward DP4. SFB A outfalls towards DP4 at historic runoff rates. Runoff from DP4 will follow historic drainage patterns and not exceed historic flow rates.

SFB A Water Quality Treatment Summary Table

Basin ID	Total Area (ac)	Total Proposed Disturbed Area (ac)	Area Trib to SFB A (ac)
EA3	0.44	0.44	0.44
EA4	0.77	0.77	0.77
EA5.1	0.37	0.37	0.37
Total	1.58	1.58	1.58

Extended Detention Basin B (Full Spectrum EDB) – Interim Condition

Water quality and detention for Basins EA6 – EA8 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 3.95 acres of disturbed area from the proposed project at 53% composite imperviousness will be treated and detained by EDB B for this phase of the Eastonville Road Improvements. The pond has been sized with consideration for the future segments of Eastonville Road and provides water quality and detention for the ultimate conditions at a future date. The ultimate conditions of EDB B calculations have been provided in the Appendix of this report. Ultimate conditions include fully built sections of Eastonville Road from Londonderry Road to Rex Road and is anticipated for Spring 2025. The ultimate condition of EDB B is further described and analyzed in the segment 2 report. Interim condition pond sizing calculations have also been provided in the Appendix of this report. Interim conditions only include Eastonville road from Londonderry to Grandview Filing No.1. The interim conditions WQCV is 0.035 ac-ft, the EURV is 0.245 ac-ft, and the 100-year detention volume is 0.384 ac-ft. The WQCV, EURV and 100-year storms are released in 41, 69 and 81 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 DP8.3 at historic runoff rates. Runoff from DP8.3 will follow historic drainage patterns and not exceed historic flow rates.

EDB B Water Quality Treatment Summary Table – Interim Condition			
Basin ID	**Total Area (ac)**	**Total Proposed Disturbed Area (ac)**	**Area Trib to SFB A (ac)**
EA6	1.09	1.09	1.09
EA7	1.92	1.92	1.92
EA8	0.94	0.94	0.94
Total	3.95	3.95	3.95

Sand Filter Basin D (Full Spectrum SFB)

Water quality and stormwater detention for Basins EA1-EA2, EA12, & OS1 is provided in Sand Filter Basin D (SFB D). SFB D is a public county owned, full spectrum sand filter basin the ACM ALF VIII JV SUB II LLC (previous Waterbury) property within a proposed drainage easement. In SFB D, a total of 3.93 acres of disturbed area from the proposed project at 34% composite imperviousness will be detained and treated for water quality. The WQCV is 0.030 ac-ft, the EURV is 0.139 ac-ft, and the 100-year detention volume is 0.282 ac-ft. The WQCV, EURV and 100-year storms are released in 12, 43 and 47 hours, respectively. A 15' access and maintenance road is provided to the bottom of the pond to facilitate maintenance of the pond facilities. A 4' emergency overflow spillway is provided that conveys the developed, peak 100-yr flow rate with 1.0' of freeboard south toward DP2. SFB D outfalls towards DP2 at historic runoff rates. Runoff from DP2 will follow historic drainage patterns and not exceed historic flow rates.

SFB D is a temporary sand filter basin and has been coordinated with the future PPRTA Pond E, which will be constructed in the same location. The inflow pipes have been coordinated with Stanley Consulting to route drainage in the future condition to the future PPRTA Pond E. The temporary sand filter basin will be replaced with a full spectrum extended detention basin, and all temporary sand filter basin infrastructure will be removed. The inlet forebay to SFB D could remain for use in the PPRTA Pond E.

SFB D Water Quality Treatment Summary Table			
Basin ID	**Total Area (ac)**	**Total Proposed Disturbed Area (ac)**	**Area Trib to SFB A (ac)**
EA1	0.62	0.62	0.62
EA2	1.21	1.21	1.21
EA12	0.47	0.47	0.47
OS1	1.63	1.63	1.63
Total	3.93	3.93	3.93

This table shows that many basins are receiving double treatment. See my comment about double treatment on the Drainage Map on pg 154. And then update this table accordingly.

Call me if you'd like to talk high-level about general MS4 and ECM App I water quality treatment requirements. There seems to be a disconnect/misunderstanding about what is required. I'd just like to clear things up and keep this project moving along. Thanks.

From this table, it is unclear how much disturbed area is treated via the BMP listed to the left of this column. See the excel table that I attached to the drainage map for something that might be a bit more clear than this.

HRGreen

Runoff Reduction WQ Treatment Summary Table

Basin ID	Total Area (ac)	Disturbed Area (ac)	Disturbed Area Treatment BMP	Disturbed Area Treated via runoff reduction (ac)	WQCV Reduction %	Notes:
EA1	0.62	0.62	SFB D	0.62	33%	Treatment and detention by SFB D (public County sand filter basin) on Waterbury property.
EA2	1.21	1.21	SFB D	1.21	33%	Treatment and detention by SFB D (public County sand filter basin) on Waterbury property.
EA3	0.44	0.44	SFB A	0.44	46%	Treatment and detention by SFB A (public County sand filter basin) on Waterbury property.
EA4	0.77	0.77	SFB A	0.77	46%	Treatment and detention by SFB A (public County sand filter basin) on Waterbury property.
EA5.1	0.37	0.37	SFB A	0.37	46%	Treatment and detention by SFB A (public County sand filter basin) on Waterbury property.
EA5.2	0.52	0.23	SPA	0.23	100%	Future treatment and detention by Waterbury development.
EA5.3	1.21	0.46	SPA	0.46	100%	Future treatment and detention by Waterbury development.
EA5.4	0.41	0.12	SPA	0.12	100%	Future treatment and detention by Waterbury development.
EA6	1.09	1.09	EDB B	1.09	19%	Treatment and detention by EDB B (public County extended detention basin) on Grandview Reserve property.
EA7	1.92	1.92	EDB B	1.92	19%	Treatment and detention by EDB B (public County extended detention basin) on Grandview Reserve property.
EA8	0.94	0.94	EDB B	0.94	19%	Treatment and detention by EDB B (public County extended detention basin) on Grandview Reserve property.
EA9	0.88	0.34	SPA	0.34	100%	Future treatment and detention by Waterbury development.
EA10.1	0.36	0.26	RPA (10' GB)	0.26	100%	Future treatment and detention by Grandview Reserve development.
EA10.2	1.06	0.76	RPA (10' GB)	0.76	100%	Future treatment and detention by Grandview Reserve development.
EA11	1.23	0.12	SPA	0.12	100%	Future treatment and detention by Grandview Reserve development.
EA12	0.47	0.47	SFB D	0.47	33%	Treatment and detention by SFB D (public County sand filter basin) on Waterbury property.
EA13	0.21	0.01	SPA	0.01	100%	Future treatment and detention by Waterbury development.
OS1	1.63	0.44	SFB D	0.44	33%	Treatment and detention by SFB D (public County sand filter basin) on Waterbury property.
OS2	12.18	3.21	SPA	3.21	100%	
OS3	25.50	0.87	SPA	0.87	100%	

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 the Grandview Reserve Metropolitan District NO. 2 (DISTRICT), 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 are no wetlands in Segment 1 of the project and therefore no wetland permit is required for Segment 1.

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. Storm sewer outfalls have been designed at the upstream end of detention basins. This practice promotes infiltration in the detention basins and reduces peak runoff rates prior to runoff reaching outlet structures. Runoff reduction calculations have also been provided in Appendix B of this report.

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 sand filter basins & an extended detention basin provide 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.

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. No impact will be made to the Gieck Ranch Tributary #1 by this project that requires additional stream stabilization.

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 drainage infrastructure improvements. This includes cost estimates for the public full spectrum sand filter basin A, public full spectrum sand filter basin D and the public full spectrum extended detention basin B. All required stormwater infrastructure will be installed per El Paso County Requirements. The unit cost includes both materials and labor.

Public Infrastructure Cost Estimate				
Line Item	**Quantity**	**Unit Price**		**Cost**
18" Reinforced Concrete Pipe	226.5	$82	LF	$18,573
24" Reinforced Concrete Pipe	609	$98	LF	$59,682
36" Reinforced Concrete Pipe	42	$151	LF	$6,342
42" Reinforced Concrete Pipe	736	$201	LF	$147,936
24" CDOT FES	2	$588	EA	$1,176
42" CDOT FES	1	$1,206	EA	$1,206
Storm Manhole	8	$15,130	EA	$121,040
10' CDOT Type R Inlet	4	$9,925	EA	$39,700
15' CDOT Type R Inlet	2	$12,907	EA	$25,814
CDOT Type C Inlet	4	$6,037	EA	$24,148
Rip Rap, d50 size from 6"-24"	5	$104	Tons	$520
10% Contingency				$44,614
TOTAL:				**$490,751**

Public SFB A Cost Estimate				
Line Item	**Quantity**	**Unit Price**		**Cost**
Rip Rap, d50 size from 6"-24" (Inflow)	2	$104	Tons	$208
Sand Filter Media	78	$100	/CY	$7,800
4" Slotted PVC Underdrain	100	$10	/LF	$1,000
12" ABC Maintenance Access	25	$40	/CY	$1,000
Outlet Structure w/ Orifice Plate	1	$5,000	EA	$5,000
Rip Rap, d50 size from 6"-24" (Spillway)	60.5	$104	Tons	$6,292
18" RCP Outlet Pipe	42.5	$82	/LF	$3,485
18" RCP FES	1	$492	EA	$492
10% Contingency				$2,528
TOTAL:				**$27,805**

Public EDB B Cost Estimate				
Line Item	**Quantity**	**Unit Price**		**Cost**
Concrete Forebay	1	$5,000	EA	$5,000
Rip Rap, d50 size from 6"-24" (Inflow)	2.75	$104	Tons	$286
Concrete Trickle Channel	36	$100	/SY	$3,600
12" ABC Maintenance Access	147	$40	/CY	$5,880
Outlet Structure w/ Micropool, Trash Rack, Railng, Orifice Plate	1	$8,000	EA	$8,000
Rip Rap, d50 size from 6"-24" (Spillway)	87	$104	Tons	$9,048
18" RCP Outlet Pipe	31	$82	/LF	$2,542
10% Contingency				$3,436
TOTAL:				**$37,792**

Public SFB D Cost Estimate				
Line Item	**Quantity**	**Unit Price**		**Cost**
Rip Rap, d50 size from 6"-24" (Inflow)	2	$104	Tons	$208
Sand Filter Media	78	$100	/CY	$7,800
4" Slotted PVC Underdrain	86	$10	/LF	$860
12" ABC Maintenance Access	107	$40	/CY	$4,280
Outlet Structure w/ Orifice Plate	1	$5,000	EA	$5,000
Rip Rap, d50 size from 6"-24" (Spillway)	25	$104	Tons	$2,600
18" RCP Outlet Pipe	615	$82	/LF	$50,430
Storm Manhole	1	$15,130	EA	$15,130
18" RCP FES	1	$492	EA	$492
10% Contingency				$8,680
TOTAL:				**$95,480**

IX. Hydraulic Grade Line Analysis

Hydraulic grade line analysis and final pipe sizes were analyzed, and calculations are provided in Appendix C. All proposed storm sewer has been 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 proposed improvements is provided in full spectrum extended detention basins and two full spectrum sand filter basins, both within proposed drainage easements. There is one major drainageway that traverses north of the Segment 1 site: Gieck Ranch Tributary 1. This major drainage way will not be impacted by the proposed improvements. The water quality and detention ponds will be owned and maintained by El Paso County. All drainage facilities were sized per the El Paso County Drainage Criteria Manuals.

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

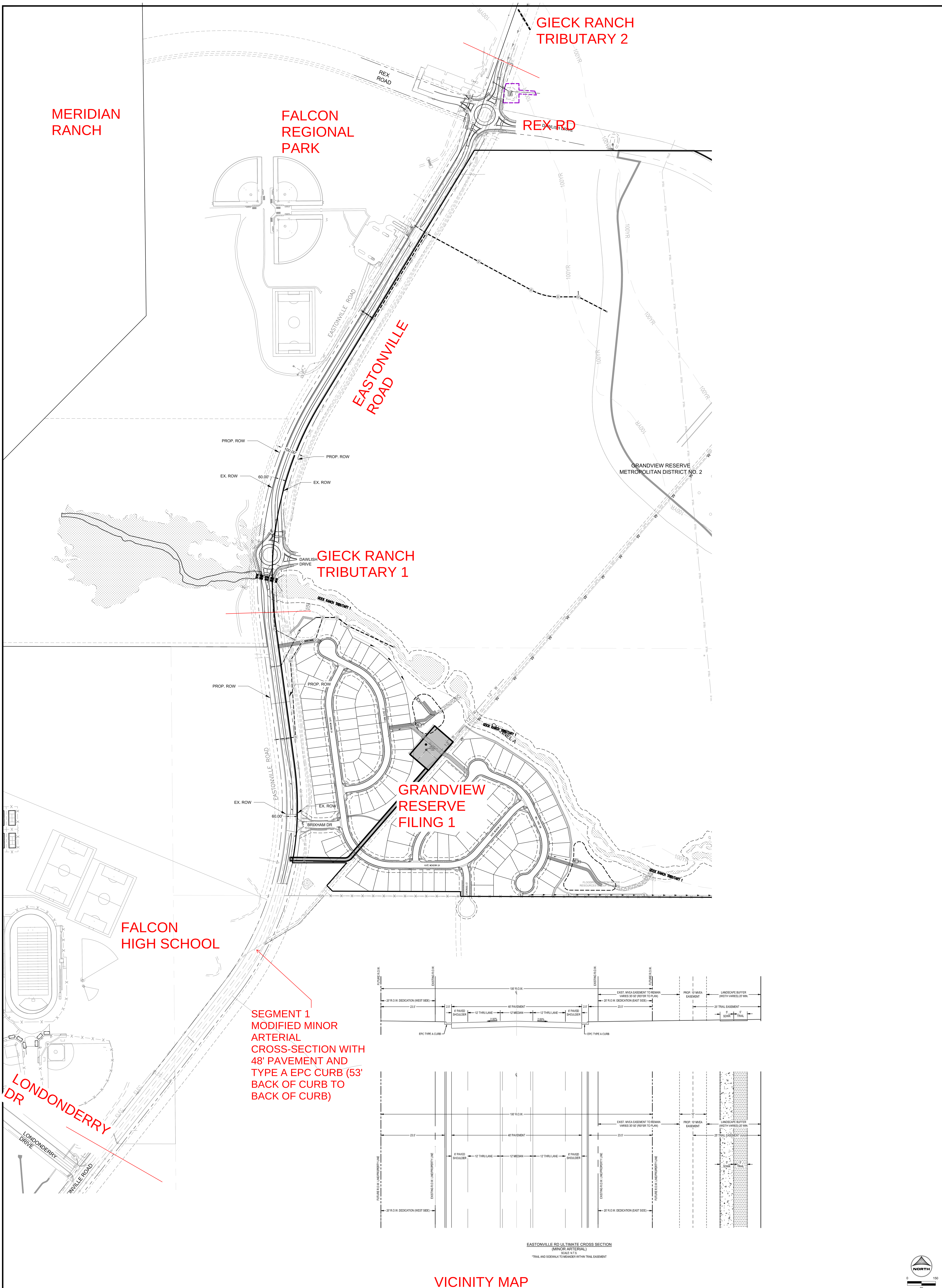
XI. Drawings

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



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

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

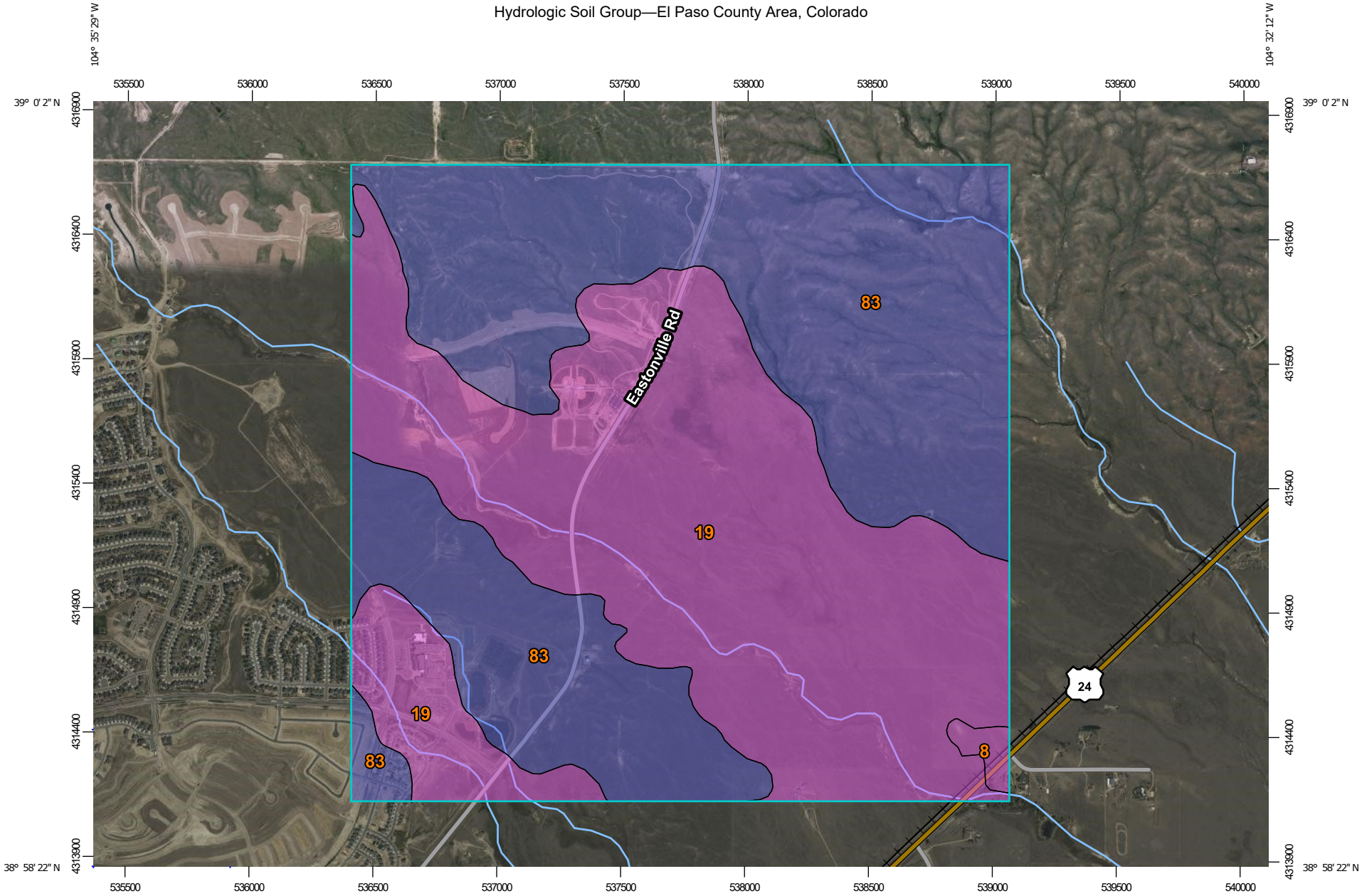
EASTONVILLE ROAD
DR HORTON
EL PASO COUNTY, CO

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/.

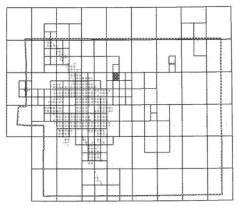
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

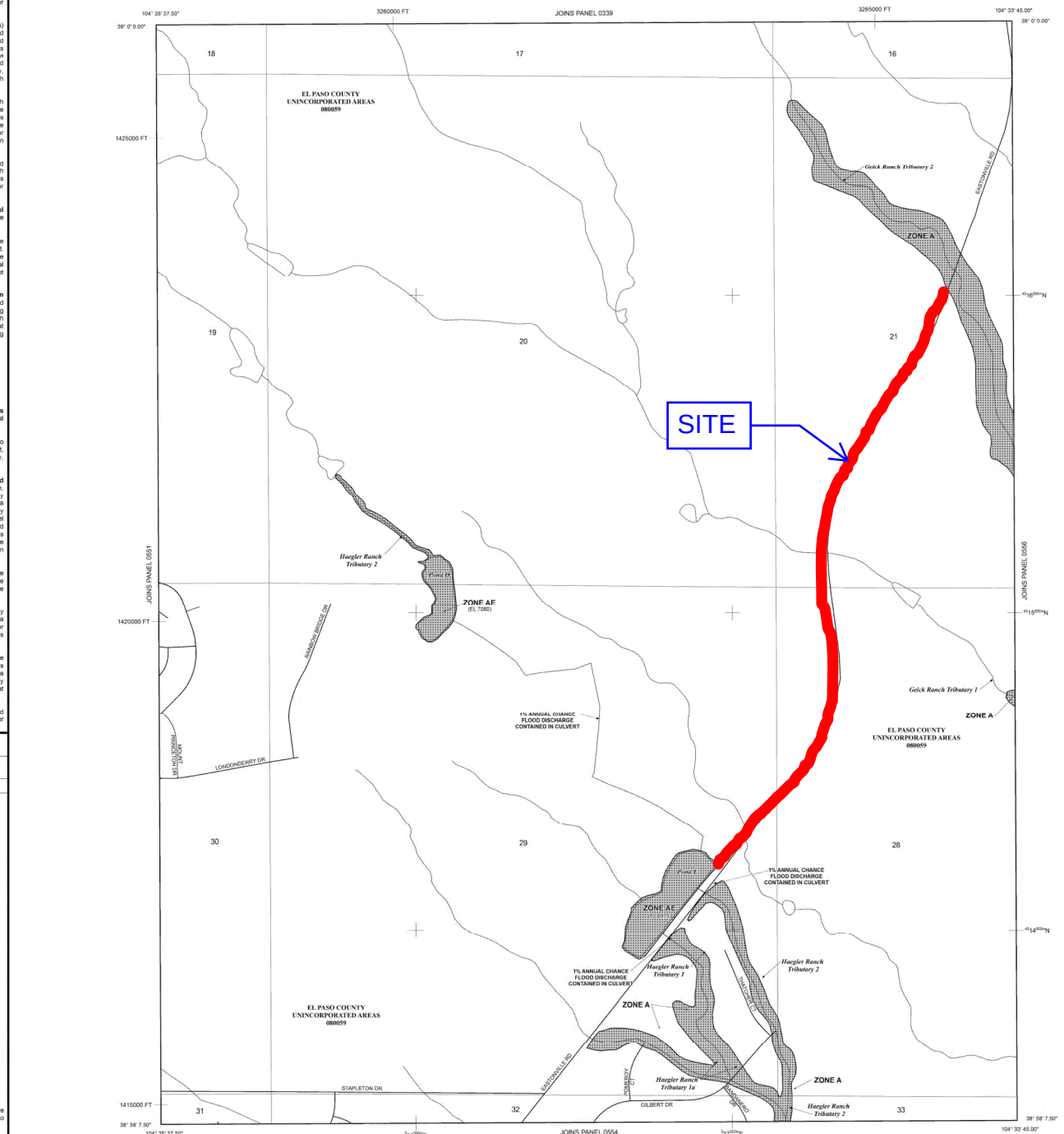
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

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)

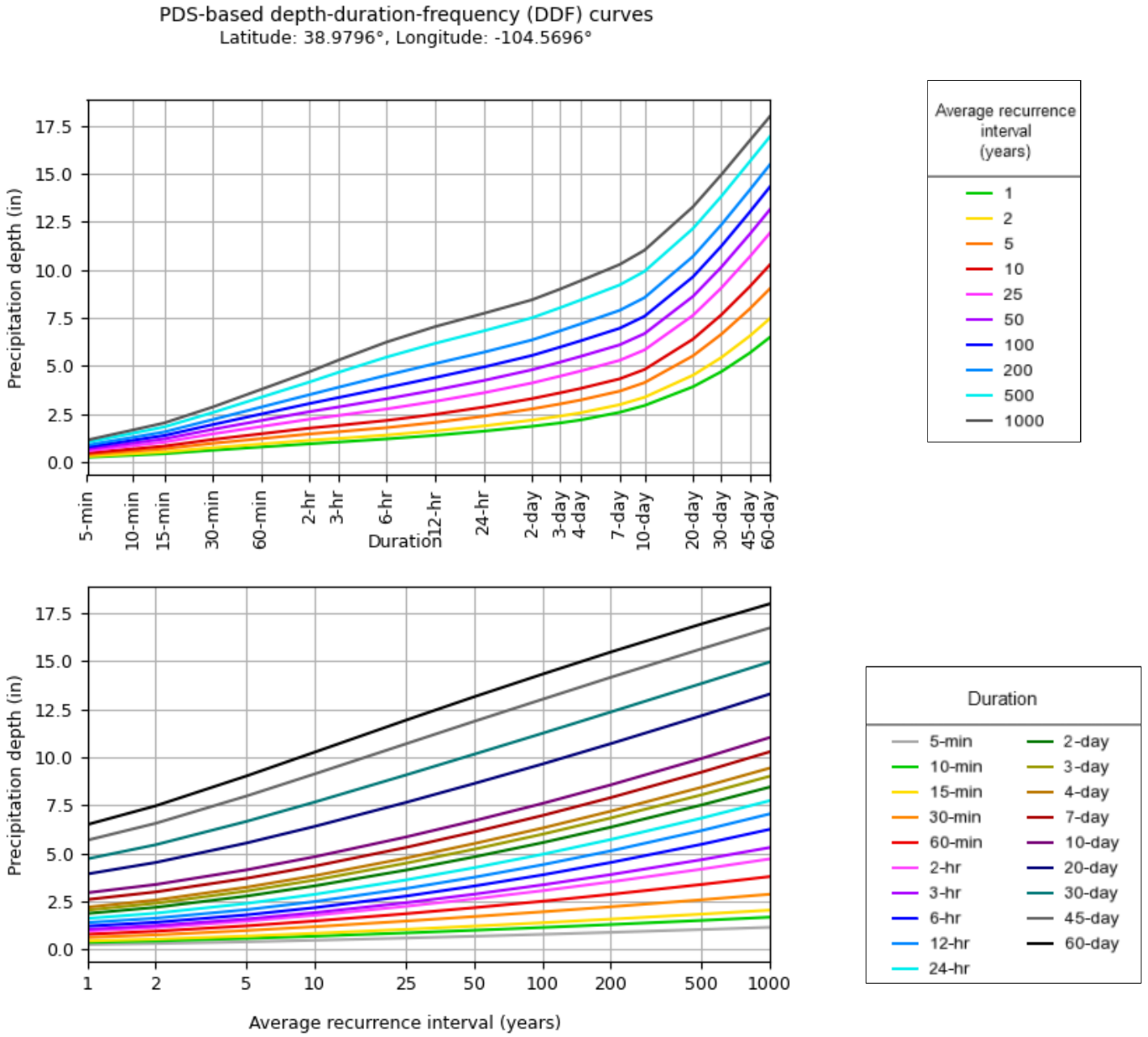
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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.

Back to Top

PF graphical



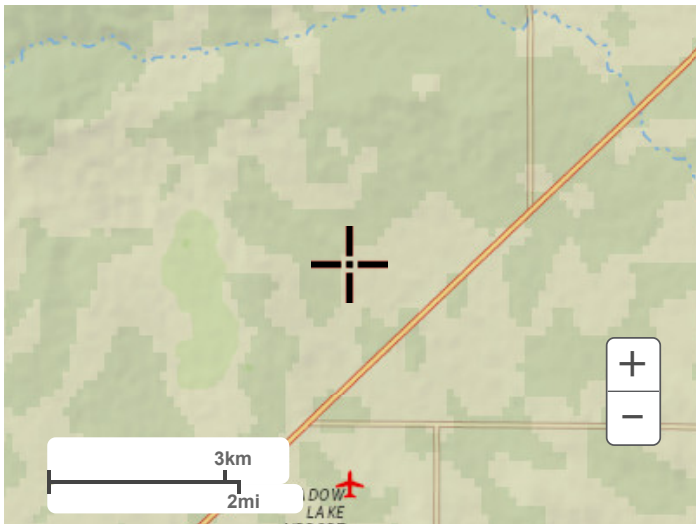
NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Wed Nov 22 20:22:49 2023

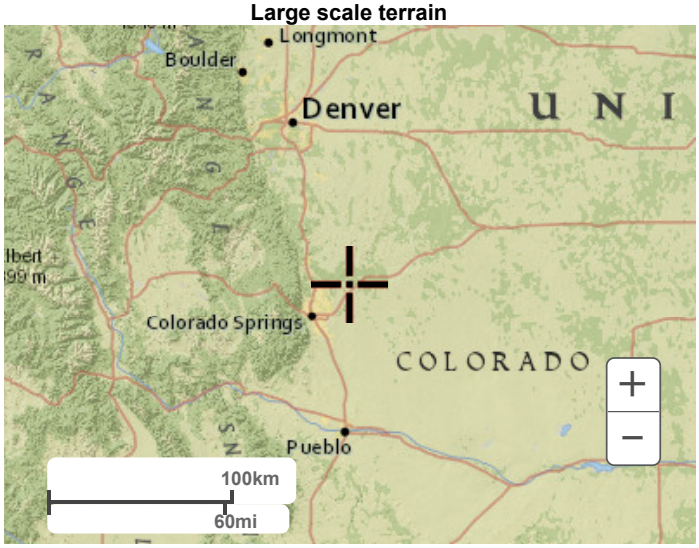
Back to Top

Maps & aerials

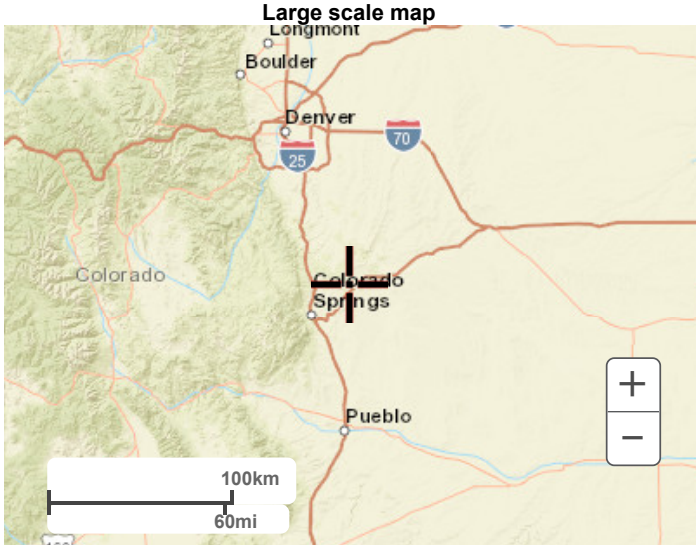
Small scale terrain



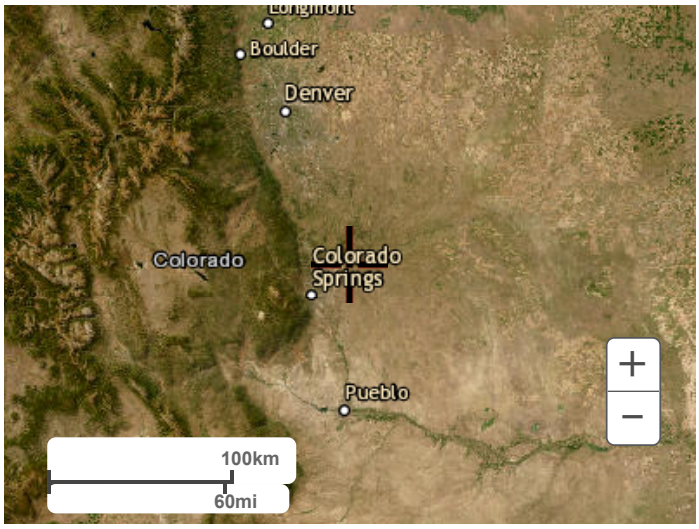
Large scale terrain



Large scale map



Large scale aerial



Back to Top

US Department of Commerce
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

HRGreen	**EASTONVILLE ROAD**	**Calc'd by:**	**SPC**
	EXISTING CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**10/2/2024**

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
E1	0.45	48	0.7	1.7
E2.1	1.82	13	1.2	4.8
E2.2	0.40	2	0.1	1.0
E3	0.72	39	1.0	2.5
E4	3.17	12	1.9	7.8
E5	0.23	45	0.5	1.1
E6	0.79	14	0.7	2.6
E7	0.23	45	0.5	1.2
E8	0.70	16	0.6	2.1
E9	0.73	45	1.2	2.8
E10.1	2.61	15	1.9	7.0
E10.2	1.89	2	0.7	4.4
OS1	1.58	2	0.5	3.6
OS2	12.21	2	3.6	24.3
OS3.1	1.51	2	0.5	3.6
OS3.2	2.86	2	1.0	6.6
OS3.3	21.12	2	6.4	42.7

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	E1,OS1	1.2	4.9
2	E2,DP1	2.3	9.3
2.2	E2.2	0.1	1.0
3	E3,OS2	4.6	26.6
4	DP3,E4	6.3	33.9
5	E5,OS3.1	0.9	4.5
6	DP5,E6	1.5	6.7
7.1	E7,OS3.2	1.4	7.5
8.1	DP7.1,E8	1.9	9.4
7.2	OS3.3,E9	7.5	45.3
8.2	DP7.2,E10.1	9.2	51.6
8.3	E10.2	0.7	4.4

HRGreen	**EASTONVILLE ROAD** **EXISTING CONDITIONS** **EL PASO COUNTY, CO**

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

SOIL TYPE:	**HSG A&B**

COMPOSITE 'C' FACTORS

	LAND USE TYPE															TOTAL	COMPOSITE IMPERVIOUSNESS & C FACTOR		
	Paved			Historic Flow Analysis--Greenbelts, Agriculture			Land Use Undefined			Land Use Undefined			Land Use Undefined						
	%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	0.00	0.00	0	0.00	0.00	0	0.00	0.00				
BASIN	**ACRES**			**ACRES**			**ACRES**			**ACRES**			**ACRES**			**ACRES**	%I	C_5	C_{100}
E1	0.21			0.24												0.45	48	0.47	0.64
E2.1	0.20			1.62												1.82	13	0.18	0.43
E2.2				0.40												0.40	2	0.09	0.36
E3	0.27			0.45												0.72	39	0.39	0.59
E4	0.31			2.86												3.17	12	0.17	0.42
E5	0.10			0.13												0.23	45	0.44	0.62
E6	0.10			0.69												0.79	14	0.19	0.44
E7	0.10			0.13												0.23	45	0.44	0.62
E8	0.10			0.60												0.70	16	0.21	0.45
E9	0.32			0.41												0.73	45	0.45	0.62
E10.1	0.35			2.26												2.61	15	0.20	0.44
E10.2				1.89												1.89	2	0.09	0.36
OS1				1.58												1.58	2	0.09	0.36
OS2				12.21												12.21	2	0.09	0.36
OS3.1				1.51												1.51	2	0.09	0.36
OS3.2				2.86												2.86	2	0.09	0.36
OS3.3				21.12												21.12	2	0.09	0.36

HRGreen	**EASTONVILLE ROAD**	**Calc'd by:**	**SPC**
	EXISTING CONDITIONS	**Checked by:**	
	EL PASO COUNTY, CO	**Date:**	**10/2/2024**

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)
E1	0.47	0.45	117	11.6	5.5	10	1162	3.4	1.8	10.5	16.0
E2.1	0.18	1.82	87	2.4	11.8	10	518	1.7	1.3	6.6	18.4
E2.2	0.09	0.40	92	2.0	14.1	10	89	3.4	1.8	0.8	14.9
E3	0.39	0.72	40	2.0	6.5	10	794	2.5	1.6	8.4	14.9
E4	0.17	3.17	113	5.5	10.3	10	830	2.5	1.6	8.7	19.0
E5	0.44	0.23	30	13.8	2.8	10	310	1.4	1.2	4.4	7.1
E6	0.19	0.79	30	13.8	3.8	10	310	1.4	1.2	4.4	8.2
E7	0.44	0.23	35	25.0	2.4	10	161	0.6	0.8	3.5	5.9
E8	0.21	0.70	25	1.0	8.2	10	161	0.6	0.8	3.5	11.7
E9	0.45	0.73	30	2.0	5.2	10	711	0.5	0.7	16.8	22.0
E10.1	0.20	2.61	30	2.0	7.2	10	711	0.5	0.7	16.8	23.9
E10.2	0.09	1.89	300	2.7	23.2	10	15	4.8	2.2	0.1	23.3
OS1	0.09	1.58	300	2.8	22.8	10	213	4.5	2.1	1.7	24.4
OS2	0.09	12.21	300	4.1	20.0	10	1042	3.4	1.8	9.4	29.5
OS3.1	0.09	1.51	136	3.9	13.7	10	150	8.9	3.0	0.8	14.6
OS3.2	0.09	2.86	174	8.6	11.9	10	267	4.4	2.1	2.1	14.0
OS3.3	0.09	21.12	300	6.0	17.7	10	930	3.4	1.8	8.4	26.1

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:
Date: 10/2/2024

			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	
		E1	0.45	0.47	16.0	0.21	3.42	0.7															BASIN E1 CAPTURED @ DP1
	1	OS1	1.58	0.09	12.9	0.14	3.75	0.5	16.0	0.35	3.42	**1.2**				1.2	0.35	0.6	3.0	73	7.5	0.16	BASIN E1 AND OS1 COMBINE @ DP1 CAPTURED IN 36" CMP CULVERT, PIPED TO BASIN E2
	2	E2.1	1.82	0.18	13.4	0.33	3.69	1.2	16.2	0.68	3.41	**2.3**											FLOW @ DP2 CONVEYED OFFSITE
	2.2	E2.2	0.40	0.09	11.0	0.04	3.99	0.1	11.0	0.04	3.99	**0.1**											FLOW @ DP2.2 CONVEYED OFFSITE
		E3	0.72	0.39	14.6	0.28	3.56	1.0															BASIN E3 CAPTURED @ DP3
	3	OS2	12.21	0.09	17.5	1.10	3.29	3.6	17.5	1.38	3.29	**4.6**				4.6	1.38	1.1	2.0	47	7.6	0.10	BASIN E3 AND OS2 COMBINE @ DP3 CAPTURED IN 24" CMP CULVERT, PIPED TO BASIN E4
	4	E4	3.17	0.17	15.2	0.54	3.50	1.9	17.6	1.92	3.28	**6.3**											FLOW @ DP4 CONVEYED OFFSITE
		E5	0.23	0.44	7.1	0.10	4.64	0.5															BASIN E5 CAPTURED @ DP5
	5	OS3.1	1.51	0.09	11.6	0.14	3.91	0.5	11.6	0.24	3.91	**0.9**				0.9	0.24	1.3	1.5	56	6.8	0.14	BASIN E5 AND OS3 COMBINE @ DP5 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E6
	6	E6	0.79	0.19	8.2	0.15	4.43	0.7	11.7	0.39	3.89	**1.5**											FLOW @ DP6 CONVEYED OFFSITE
		E7	0.23	0.44	5.9	0.10	4.92	0.5															BASIN E7 CAPTURED @ DP7
	7.1	OS3.2	2.86	0.09	12.5	0.26	3.80	1.0	12.5	0.36	3.80	**1.4**				1.4	0.36	0.2	1.5	53	2.3	0.38	BASIN E7 AND OS4.1 COMBINE @ DP7.1 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E8
	8.1	E8	0.70	0.21	11.0	0.14	3.98	0.6	12.8	0.50	3.75	**1.9**											FLOW @ DP8.1 CONVEYED OFFSITE
		E9	0.73	0.45	14.1	0.32	3.61	1.2															BASIN E9 CAPTURED @ DP7.2
	7.2	OS3.3	21.12	0.09	16.8	1.90	3.35	6.4	16.8	2.23	3.35	**7.5**				7.5	2.23	0.8	1.5	43	5.3	0.13	BASIN E9 AND OS 4.2 COMBINE @ DP7.2 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E10
	8.2	E10.1	2.61	0.20	14.1	0.52	3.61	1.9	17.0	2.74	3.34	**9.2**											FLOW @ DP8.2 CONVEYED OFFSITE
	8.3	E10.2	1.89	0.09	11.8	0.17	3.89	0.7	11.8	0.17	3.89	**0.7**											FLOW @ DP8.3 CONVEYED OFFSITE

HRGreen

EASTONVILLE ROAD

EXISTING CONDITIONS

DESIGN STORM: 100-YEAR

Calc'd by: SPC

Checked by:

Date: 10/2/2024

			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)	
		E1	0.45	0.64	16.0	0.29	5.74	1.7															BASIN E1 CAPTURED @ DP1
	1	OS1	1.58	0.36	12.9	0.57	6.30	3.6	16.0	0.86	5.74	**4.9**				4.9	0.86	0.6	3.0	73	7.5	0.16	BASIN E1 AND OS1 COMBINE @ DP1 CAPTURED IN 36" CMP CULVERT, PIPED TO BASIN E2
	2	E2.1	1.82	0.43	13.4	0.78	6.20	4.8	16.2	1.63	5.72	**9.3**											FLOW @ DP2 CONVEYED OFFSITE
	2.2	E2.2	0.40	0.36	11.0	0.14	6.69	1.0	11.0	0.14	6.69	**1.0**											FLOW @ DP2.2 CONVEYED OFFSITE
		E3	0.72	0.59	14.6	0.42	5.97	2.5															BASIN E3 CAPTURED @ DP3
	3	OS2	12.21	0.36	17.5	4.40	5.53	24.3	17.5	4.82	5.53	**26.6**				26.6	4.82	1.1	2.0	47	7.6	0.10	BASIN E3 AND OS2 COMBINE @ DP3 CAPTURED IN 24" CMP CULVERT, PIPED TO BASIN E4
	4	E4	3.17	0.42	15.2	1.33	5.87	7.8	17.6	6.14	5.51	**33.9**											FLOW @ DP4 CONVEYED OFFSITE
		E5	0.23	0.62	7.1	0.14	7.79	1.1															BASIN E5 CAPTURED @ DP5
	5	OS3.1	1.51	0.36	11.6	0.54	6.56	3.6	11.6	0.69	6.56	**4.5**				4.5	0.69	1.3	1.5	56	6.8	0.14	BASIN E5 AND OS3 COMBINE @ DP5 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E6
	6	E6	0.79	0.44	8.2	0.34	7.44	2.6	11.7	1.03	6.53	**6.7**											FLOW @ DP6 CONVEYED OFFSITE
		E7	0.23	0.62	5.9	0.14	8.26	1.2															BASIN E7 CAPTURED @ DP7
	7.1	OS3.2	2.86	0.36	12.5	1.03	6.38	6.6	12.5	1.17	6.38	**7.5**				7.5	1.17	0.2	1.5	53	2.3	0.38	BASIN E7 AND OS4.1 COMBINE @ DP7.1 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E8
	8.1	E8	0.70	0.45	11.0	0.31	6.68	2.1	12.8	1.48	6.30	**9.4**											FLOW @ DP8.1 CONVEYED OFFSITE
		E9	0.73	0.62	14.1	0.45	6.06	2.8															BASIN E9 CAPTURED @ DP7.2
	7.2	OS3.3	21.12	0.36	16.8	7.60	5.62	42.7	16.8	8.06	5.62	**45.3**				45.3	8.06	0.8	1.5	43	5.3	0.13	BASIN E9 AND OS 4.2 COMBINE @ DP7.2 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E10
	8.2	E10.1	2.61	0.44	14.1	1.15	6.06	7.0	17.0	9.21	5.60	**51.6**											FLOW @ DP8.2 CONVEYED OFFSITE
	8.3	E10.2	1.89	0.36	11.8	0.68	6.53	4.4	11.8	0.68	6.53	**4.4**											FLOW @ DP8.3 CONVEYED OFFSITE

HRGreen	**EASTONVILLE ROAD**	**Calc'd by:**	**SPC**
	PROPOSED CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**10/28/2024**

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
EA1	0.62	97	2.6	4.7
EA2	1.21	50	2.5	5.6
EA3	0.44	91	1.8	3.0
EA4	0.77	52	1.7	2.9
EA5.1	0.37	9	0.3	0.4
EA5.2	0.52	0	0.2	1.6
EA5.3	1.21	0	0.4	2.9
EA5.4	0.41	0	0.1	1.0
EA6	1.09	91	3.1	5.2
EA7	1.92	52	3.2	5.4
EA8	0.94	50	0.5	0.9
EA9	0.88	35	0.4	0.6
EA10.1	0.36	23	0.4	0.6
EA10.2	1.06	23	1.4	4.4
EA11	1.23	0	0.5	0.9
EA12	0.47	25	0.6	1.7
EA13	0.21	26	0.3	0.7
EA8 & EA9 *Per Segment 2 FDR	5.22	75	10.3	17.2
OS1	1.63	2	0.5	3.6
OS2	12.18	2	3.6	24.2
OS3	25.50	2	8.0	53.6

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	OS1	0.5	3.6
2	DP20, SFB D Release	0.7	5.0
3	OS2	3.6	24.2
4	EA 5.2, OS2, DP4.1, SFB A RELEASE	4.1	28.6
4.1	EA5.3	0.6	3.5
6	EA5.4	0.4	2.0
7	OS3	8.0	53.6
8.3	DP 22, OS3, EDB B RELEASE	9.7	58.1
8.2	EA10.2	1.4	4.0
9	DP1, EA1	3.3	9.3
10	DP9, EA2	5.4	13.9
11	DP10, EA12	5.8	15.2
12	EA13	0.3	0.7
13	EA3	1.8	3.0
14	DP13, EA4	3.3	5.6
15	DP14, EA5	3.5	5.9
16	EA6	3.1	5.2
17	DP16, EA7	6.2	10.3
18	DP17	6.2	10.3
19	DP18,EA8	6.6	11.1
18U	DP17, EA8 & EA9 *PER SEGMENT 2 FDR	15.5	26.1
19U	DP18U, EA8	15.9	26.6
20	EA9	0.4	0.6
8.1	EA10	0.4	0.6
22	EA11	0.5	0.9

NOTE: "U" DENOTES ULTIMATE CONDITION AFTER COMPLETION OF EASTONVILLE ROAD SEGMENT 2 CONSTRUCTION

EASTONVILLE ROAD
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	0.60						0.02									0.62	97	0.87	0.94
EA2	0.60						0.61									1.21	50	0.49	0.65
EA3	0.40						0.04									0.44	91	0.82	0.90
EA4	0.40						0.37									0.77	52	0.50	0.67
EA5.1							0.33			0.04						0.37	9	0.13	0.39
EA5.2							0.52									0.52	0	0.08	0.35
EA5.3							1.21									1.21	0	0.08	0.35
EA5.4							0.41									0.41	0	0.08	0.35
EA6	0.99						0.10									1.09	91	0.83	0.91
EA7	0.99						0.93									1.92	52	0.50	0.67
EA8							0.83			0.09			0.01			0.94	9	0.14	0.39
EA9							0.88									0.88	0	0.08	0.35
EA10.1							0.30			0.01			0.05			0.36	16	0.21	0.44
EA10.2							0.81			0.06			0.20			1.06	23	0.26	0.48
EA11							1.23									1.23	0	0.08	0.35
EA12	0.06						0.34			0.07						0.47	25	0.26	0.48
EA13	0.06						0.15									0.21	26	0.30	0.51
OS1				1.63												1.63	2	0.09	0.36
OS2				12.18												12.18	2	0.09	0.36
OS3				25.50												25.50	2	0.09	0.36

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}
EA8 & EA9 *Per Segment 2 FDR	3.94						1.28									5.22	75	0.70	0.81
EA10 *Per Segment 2 FDR	0.12						0.04									0.16	75	0.70	0.81
EA11 *Per Segment 2 FDR	0.10						0.05									0.15	67	0.63	0.76
SFB A	0.80			0.00			0.74			0.04			0.00			1.58	53		
EDB B	1.98			0.00			1.86			0.09			0.01			3.95	52		
EDB B (ULT)	6.14			0.00			3.23			0.09			0.01			9.48	66		
SFB D	1.26			1.63			0.97			0.07			0.00			3.93	34		

HRGreen	**EASTONVILLE ROAD**	**Calc'd by:**	**SPC**
	PROPOSED CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**10/28/2024**

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL	*tc=(L/180)+10*	**Design tc**
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)	*tc max*	*tc design (min)*
EA1	0.87	0.62	26	2.0	1.7	20	734	1.6	2.5	4.9	6.6	14.2	6.6
EA2	0.49	1.21	26	2.0	4.6	20	734	1.6	2.5	4.9	9.5	14.2	9.5
EA3	0.82	0.44	26	2.0	2.0	20	326	0.5	1.4	3.8	5.9	12.0	5.9
EA4	0.50	0.77	26	2.0	4.4	20	326	0.5	1.4	3.8	8.3	12.0	8.3
EA5.1	0.13	0.37	25	25.0	3.0	10	100	0.5	0.7	2.4	5.4	10.7	5.4
EA5.2	0.08	0.52	35	33.0	3.4	10	110	5.5	2.3	0.8	5.0	10.8	5.0
EA5.3	0.08	1.21	68	10.0	7.1	10	286	2.3	1.5	3.1	10.3	12.0	10.3
EA5.4	0.08	0.41	78	4.6	9.9	10	145	1.4	1.2	2.0	12.0	11.2	11.2
EA6	0.83	1.09	26	2.0	2.0	20	1304	0.6	1.5	14.0	16.1	17.4	16.1
EA7	0.50	1.92	26	2.0	4.4	20	1304	0.6	1.5	14.0	18.5	17.4	17.4
EA8	0.14	0.94	100	9.0	8.4	10	102	0.5	0.7	2.4	10.8	11.1	10.8
EA9	0.08	0.88	50	24.4	4.6	10	0	0	0.0	0.0	5.0	10.3	5.0
EA10.1	0.21	0.36	35	24.4	3.3	10	0	0	0.0	0.0	5.0	10.2	5.0
EA10.2	0.26	1.06	50	15.0	4.4	10	0	0	0.0	0.0	5.0	10.3	5.0
EA11	0.08	1.23	23	18.0	3.4	10	0	0	0.0	0.0	5.0	10.1	5.0
EA12	0.26	0.47	117	12.0	7.3	10	0	0	0.0	0.0	7.3	10.7	7.3
EA13	0.30	0.21	82	2.0	10.6	10	0	0	0.0	0.0	10.6	10.5	10.5
EA8 & EA9 *Per Segment 2 FDR	0.70	5.22	26	2.0	3.0	20	2500	0.7	1.7	24.9	27.9	24.0	24.0
OS1	0.09	1.63	100	2.7	13.3	10	633	1.5	1.2	8.6	22.0	14.1	14.1
OS2	0.09	12.18	100	4.3	11.4	10	1243	3.2	1.8	11.6	23.0	17.5	17.5
OS3	0.09	25.50	100	6.5	9.9	10	879	3.2	1.8	8.2	18.1	15.4	15.4

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
PROPOSED CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	10/28/2024

			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	OS1	1.63	0.09	14.1	0.15	3.62	0.5	14.1	0.15	3.62	**0.5**				0.5	0.15	0.5	1.5	10	4.2	0.04	BASIN OS1 @ DP1 CAPTURED IN 18" RCP CULVERT, DRAINS TO BASIN DP9
	2								0.1	0.07	3.62	**0.7**											**SFB D RELEASE @ 0.4 CFS AND DP 20 FLOW @ DP2 CONVEYED OFFSITE**
	3	OS2	12.18	0.09	17.5	1.10	3.29	3.6	17.5	1.10	3.29	**3.6**				3.6	1.10	2.6	2.5	186	13.5	0.23	BASIN OS2 @ DP3 CAPTURED IN 30" RCP CULVERT, DRAINS TO BASIN DP4
	4	EA5.2	0.52	0.08	5.0	0.04	5.17	0.2	17.7	1.23	3.29	**4.1**											**FLOW @ DP4 CONVEYED OFFSITE (INCLUDES DETENTION SFB A 5-YR RELEASE RATE @ 0.03 CFS)**
	4.1	EA5.3	1.21	0.08	10.3	0.10	4.09	0.4	10.3	0.10	3.29	**0.6**											FLOW @ DP4.1 DRAINS SOUTH TO ULTIMATELY COMBINE WITH DP4
	6	EA5.4	0.41	0.08	11.2	0.03	3.95	0.1	11.2	0.03	3.29	**0.4**											**FLOW @ DP6 DRAINS OFFSITE**
	7	OS3	25.50	0.09	15.4	2.30	3.48	8.0	15.4	2.30	3.48	**8.0**				8.0	2.30	0.6	3.0	445	7.3	1.01	BASIN OS3 FLOW @ DP7 CAPTURTED IN CDOT TYPE D INLET, PIPED TO DP8
	8.3								16.5	2.67	3.48	**9.7**											**FLOW @ DP8 CONVEYED OFFSITE (INCLUDES EDB POND B 5-YR RELEASE RATE @ 0.4 CFS, DP7, & DP22)**
	8.2	EA10.2	1.06	0.26	5.0	0.27	5.17	1.4	5.0	0.27	3.48	**1.4**											FLOW @ DP8.2 DRAINS NE TO ULTIMATELY COMBINE WITH DP8
	9	EA1	0.62	0.87	6.6	0.54	4.75	2.6	6.6	0.69	4.75	**3.3**				3.3	0.69	0.5	1.5	52	4.2	0.21	BASIN EA1 CAPTURED @ DP9 BY ON GRADE TYPE R INLET
	10	EA2	1.21	0.49	9.5	0.59	4.21	2.5	9.5	1.28	4.21	**5.4**				5.4	1.28	0.5	1.5	128	4.2	0.51	BASIN EA2 CAPTURED @ DP10 BY ON GRADE TYPE R INLET
	11	EA12	0.47	0.26	7.3	0.12	4.61	0.6	10.0	1.40	4.13	**5.8**				5.8	1.40	1.5	1.5	63	7.2	0.15	BASIN EA12 SHEEET FLOWS DIRECTLY TO SFB D
	12	EA13	0.21	0.30	10.5	0.06	4.06	0.3	10.5	0.06	4.13	**0.3**											**FLOW @ DP12 CONVEYED OFFSITE**
	13	EA3	0.44	0.82	5.9	0.36	4.92	1.8	5.9	0.36	4.92	**1.8**				1.8	0.36	1.3	1.5	56	6.8	0.14	BASIN EA3 CAPTURED @ DP13 BY ON GRADE TYPE R INLET
	14	EA4	0.77	0.50	8.3	0.39	4.42	1.7	8.3	0.75	4.42	**3.3**				3.3	0.75	1.3	1.5	56	6.8	0.14	BASIN EA4 CAPTURED @ DP14 BY ON GRADE TYPE R INLET
	15	EA5.1	0.37	0.13	5.4	0.05	5.06	0.3	8.4	0.80	4.39	**3.5**				3.5	0.80	0.5	1.5	36	4.2	0.14	BASIN EA5 SHEEET FLOWS DIRECTLY TO SFB A
	16	EA6	1.09	0.83	16.1	0.90	3.42	3.1	16.1	0.90	3.42	**3.1**				3.1	0.90	0.5	1.5	52	4.2	0.21	BASIN EA6 CAPTURED @ DP16 BY SUMP TYPE R INLET
	17	EA7	1.92	0.50	17.4	0.97	3.30	3.2	17.4	1.87	3.30	**6.2**				6.2	1.87	0.5	2.0	196	5.1	0.64	BASIN EA7 CAPTURED @ DP17 BY SUMP TYPE R INLET
	18								17.4	1.87	3.30	**6.2**				6.2	1.87	0.5	2.0	42	5.1	0.14	STORM MH @ D18, NO SEGMENT 2 FLOW
	19	EA8	0.94	0.14	10.8	0.13	4.01	0.5	17.5	2.00	3.29	**6.6**				6.6	2.00	0.5	2.0	196	5.1	0.64	BASIN EA8 SHEEET FLOWS DIRECTLY TO EDB B (NO SEGMENT 2 FLOWS)
	18U	EA8 & EA9 *Per Segment 2 FDR	5.22	0.70	24.0	3.65	2.81	10.3	24.0	5.52	2.81	**15.5**				15.5	5.52	0.5	2.0	42	5.1	0.14	SEGMENT 2 FLOW COMBINES @ DP18 WITH SEGMENT 1 FLOWS @ STORM MH
	19U	EA8	0.94	0.14	10.8	0.13	4.01	0.5	24.2	5.65	2.81	**15.9**											BASIN EA8 SHEEET FLOWS DIRECTLY TO EDB B INCLUDING FUTURE TRIBUTARY FLOW FROM SUBBASIN EA8 & EA9 PER THE EASTONVILLE ROAD SEGMENT 2 FDR
	20	EA9	0.88	0.08	5.0	0.07	5.17	0.4	5.0	0.07	5.17	**0.4**											**BASIN EA9 SHEET FLOWS OFFSITE**
	8.1	EA10.1	0.36	0.21	5.0	0.07	5.17	0.4	5.0	0.07	5.17	**0.4**											**BASIN EA10 SHEET FLOWS OFFFSITE**
	22	EA11	1.23	0.08	5.0	0.10	5.17	0.5	5.0	0.10	5.17	**0.5**											**BASIN EA11 SHEET FLOWS OFFSITE**

HRGreen

EASTONVILLE ROAD

PROPOSED CONDITIONS

DESIGN STORM: 100-YEAR

Calc'd by:	**SPC**
Checked by:	**CM**
Date:	**10/28/2024**

			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	OS1	1.63	0.36	14.1	0.59	6.07	3.6	14.1	0.59	6.07	**3.6**				3.6	0.59	0.5	1.5	115	4.2	0.46	BASIN OS1 @ DP1 CAPTURED IN 18" RCP CULVERT, DRAINS TO BASIN DP2
	2								0.1	0.07	6.07	**5.0**											**SFB D RELEASE @ 4.6 CFS AND DP 20 FLOW @ DP2 CONVEYED OFFSITE**
	3	OS2	12.18	0.36	17.5	4.38	5.53	24.2	17.5	4.38	5.53	**24.2**				24.2	4.38	2.6	2.5	186	13.5	0.23	BASIN OS2 @ DP3 CAPTURED IN 30" RCP CULVERT, DRAINS TO BASIN DP4
	4	EA5.2	0.52	0.35	5.0	0.18	8.68	1.6	17.7	4.99	5.53	**28.6**											**FLOW @ DP4 CONVEYED OFFSITE (INCLUDES DETENTION SFB A 100-YR RELEASE RATE @ 1.0 CFS)**
	4.1	EA5.3	1.21	0.35	10.3	0.42	6.86	2.9	10.3	0.42	5.53	**3.5**											FLOW @ DP4.1 DRAINS SOUTH TO ULTIMATELY COMBINE WITH DP4
	6	EA5.4	0.41	0.35	11.2	0.14	6.64	1.0	11.2	0.14	5.53	**2.0**											**FLOW @ DP6 DRAINS OFFSITE**
	7	OS3	25.50	0.36	15.4	9.18	5.84	53.6	15.4	9.18	5.84	**53.6**				53.6	9.18	0.6	3.0	445	7.3	1.01	BASIN OS3 FLOW @ DP7 CAPTURTED IN CDOT TYPE D INLET, PIPED TO DP8
	8.3								16.5	9.79	5.84	**58.1**											**FLOW @ DP8 CONVEYED OFFSITE (INCLUDES EDB POND B 100-YR RELEASE RATE @ 1.0 CFS, DP7, & DP22)**
	8.2	EA10.2	1.06	0.48	5.0	0.51	8.68	4.4	5.0	0.51	5.84	**4.0**											FLOW @ DP8.2 DRAINS NE TO ULTIMATELY COMBINE WITH DP8
	9	EA1	0.62	0.94	6.6	0.58	7.98	4.7	6.6	1.17	7.98	**9.3**				9.3	1.17	0.5	1.5	52	4.2	0.21	BASIN EA1 CAPTURED @ DP9 BY ON GRADE TYPE R INLET
	10	EA2	1.21	0.65	9.5	0.79	7.07	5.6	9.5	1.96	7.07	**13.9**				13.9	1.96	0.5	1.5	128	4.2	0.51	BASIN EA2 CAPTURED @ DP10 BY ON GRADE TYPE R INLET
	11	EA12	0.47	0.48	7.3	0.23	7.73	1.7	10.0	2.18	6.94	**15.2**				15.2	2.18	1.5	1.5	63	7.2	0.15	BASIN EA12 SHEEET FLOWS DIRECTLY TO SFB D
	12	EA13	0.21	0.51	10.5	0.11	6.82	0.7	10.5	0.11	6.94	**0.7**											**FLOW @ DP12 CONVEYED OFFSITE**
	13	EA3	0.44	0.82	5.9	0.36	8.27	3.0	5.9	0.36	8.27	**3.0**				3.0	0.36	1.3	1.5	56	6.8	0.14	BASIN EA3 CAPTURED @ DP13 BY ON GRADE TYPE R INLET
	14	EA4	0.77	0.50	8.3	0.39	7.42	2.9	8.3	0.75	7.42	**5.6**				5.6	0.75	1.3	1.5	56	6.8	0.14	BASIN EA4 CAPTURED @ DP14 BY ON GRADE TYPE R INLET
	15	EA5.1	0.37	0.13	5.4	0.05	8.49	0.4	8.4	0.80	7.37	**5.9**				5.9	0.80	0.5	1.5	36	4.2	0.14	BASIN EA5 SHEEET FLOWS DIRECTLY TO SFB A
	16	EA6	1.09	0.83	16.1	0.90	5.74	5.2	16.1	0.90	5.74	**5.2**				5.2	0.90	0.5	1.5	52	4.2	0.21	BASIN EA6 CAPTURED @ DP16 BY SUMP TYPE R INLET
	17	EA7	1.92	0.50	17.4	0.97	5.54	5.4	17.4	1.87	5.54	**10.3**				10.3	1.87	0.5	2.0	196	5.1	0.64	BASIN EA7 CAPTURED @ DP17 BY SUMP TYPE R INLET
	18								17.4	1.87	5.54	**10.3**				10.3	1.87	0.5	2.0	42	5.1	0.14	STORM MH @ D18, NO SEGMENT 2 FLOW
	19	EA8	0.94	0.14	10.8	0.13	6.73	0.9	17.5	2.00	5.52	**11.1**				11.1	2.00	0.5	2.0	196	5.1	0.64	BASIN EA8 SHEEET FLOWS DIRECTLY TO EDB B (NO SEGMENT 2 FLOWS)
	18U	EA8 & EA9 *Per Segment 2 FDR	5.22	0.70	24.0	3.65	4.72	17.2	24.0	5.52	4.72	**26.1**				26.1	5.52	0.5	2.0	42	5.1	0.14	SEGMENT 2 FLOW COMBINES @ DP18 WITH SEGMENT 1 FLOWS @ STORM MH
	19U	EA8	0.94	0.14	10.8	0.13	6.73	0.9	24.2	5.65	4.71	**26.6**											BASIN EA8 SHEEET FLOWS DIRECTLY TO EDB B INCLUDING FUTURE TRIBUTARY FLOW FROM SUBBASIN EA8 & EA9 PER THE EASTONVILLE ROAD SEGMENT 2 FDR
	20	EA9	0.88	0.08	5.0	0.07	8.68	0.6	5.0	0.07	8.68	**0.6**											**BASIN EA9 SHEET FLOWS OFFSITE**
	8.1	EA10.1	0.36	0.21	5.0	0.07	8.68	0.6	5.0	0.07	8.68	**0.6**											**BASIN EA10 SHEET FLOWS OFFFSITE**
	22	EA11	1.23	0.08	5.0	0.10	8.68	0.9	5.0	0.10	8.68	**0.9**											**BASIN EA11 SHEET FLOWS OFFSITE**

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: SPC
Company: HR GREEN
Date: October 1, 2024
Project: Eastonville Segment 1 - RR
Location: COLORADO SPRINGS, CO

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth = 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	SPA	SPA	SPA	SPA	SPA	UIA:RPA	SPA	SPA	SPA	UIA:RPA	UIA:RPA
Area ID	SFB D - RR	SFB D - SPA	EA9	OS2	EA5.2	EA5.3	SFB A - RR	SFB A - SPA	EA5.4	OS3	EDB B - RR (PART 1)	EDB B - RR (PART 2)
Downstream Design Point ID	11	11	20	3	4	4.1	15	15	6	7	19	19
Downstream BMP Type	SF	SF	None	None	None	None	SF	SF	None	None	EDB	EDB
DCIA (ft^2)	--	--	--	--	--	--	--	--	--	--	--	--
UIA (ft^2)	58,205	--	--	--	--	--	36,477	--	--	--	45,596	45,596
RPA (ft^2)	4,681	--	--	--	--	--	4,601	--	--	--	2,783	2,783
SPA (ft^2)	--	108,305	14,605	13,994	10,105	20,228	--	27,747	5,422	37,875	--	--
HSG A (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
HSG B (%)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HSG C/D (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Average Slope of RPA (ft/ft)	0.005	--	--	--	--	--	0.005	--	--	--	0.005	0.005
UIA:RPA Interface Width (ft)	50.00	--	--	--	--	--	48.00	--	--	--	70.00	70.00

CALCULATED RUNOFF RESULTS

Area ID	SFB D - RR	SFB D - SPA	EA9	OS2	EA5.2	EA5.3	SFB A - RR	SFB A - SPA	EA5.4	OS3	B - RR (PAR	B - RR (PART 2)
UIA:RPA Area (ft^2)	62,886	--	--	--	--	--	41,078	--	--	--	48,379	48,379
L / W Ratio	16.00	--	--	--	--	--	16.00	--	--	--	9.87	9.87
UIA / Area	0.9256	--	--	--	--	--	0.8880	--	--	--	0.9425	0.9425
Runoff (in)	0.34	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.38	0.38
Runoff (ft^3)	1778	0	0	0	0	0	966	0	0	0	1535	1535
Runoff Reduction (ft^3)	647	5415	730	700	505	1011	554	1387	271	1894	365	365

CALCULATED WQCV RESULTS

Area ID	SFB D - RR	SFB D - SPA	EA9	OS2	EA5.2	EA5.3	SFB A - RR	SFB A - SPA	EA5.4	OS3	B - RR (PAR	B - RR (PART 2)
WQCV (ft^3)	1940	0	0	0	0	0	1216	0	0	0	1900	1900
WQCV Reduction (ft^3)	647	0	0	0	0	0	554	0	0	0	365	365
WQCV Reduction (%)	33%	0%	0%	0%	0%	0%	46%	0%	0%	0%	19%	19%
Untreated WQCV (ft^3)	1293	0	0	0	0	0	662	0	0	0	1535	1535

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	11	11	20	3	4	4.1	15	15	6	7	19	19
DCIA (ft^2)	0	0	0	0	0	0	0	0	0	0	0	0
UIA (ft^2)	58,205	58,205	0	0	0	0	36,477	36,477	0	0	91,192	91,192
RPA (ft^2)	4,681	4,681	0	0	0	0	4,601	4,601	0	0	5,566	5,566
SPA (ft^2)	108,305	108,305	14,605	13,994	10,105	20,228	27,747	27,747	5,422	37,875	0	0
Total Area (ft^2)	171,191	171,191	14,605	13,994	10,105	20,228	68,825	68,825	5,422	37,875	96,758	96,758
Total Impervious Area (ft^2)	58,205	58,205	0	0	0	0	36,477	36,477	0	0	91,192	91,192
WQCV (ft^3)	1,940	1,940	0	0	0	0	1,216	1,216	0	0	3,800	3,800
WQCV Reduction (ft^3)	647	647	0	0	0	0	554	554	0	0	730	730
WQCV Reduction (%)	33%	33%	0%	0%	0%	0%	46%	46%	0%	0%	19%	19%
Untreated WQCV (ft^3)	1,293	1,293	0	0	0	0	662	662	0	0	3,070	3,070

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	775,777
Total Impervious Area (ft^2)	371,748
WQCV (ft^3)	6,956
WQCV Reduction (ft^3)	1,930
WQCV Reduction (%)	28%
Untreated WQCV (ft^3)	5,026

Note: I will take a more detailed look at these calcs compared to the RR areas shown on the drainage map once it is sorted out how much RPAs and SPAs are actually necessary per my comments throughout this report about double WQ treatment.

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: SPC
Company: HR GREEN
Date: October 7, 2024
Project: Eastonville Segment 1 - RR
Location: COLORADO SPRINGS, CO

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	SPA	SPA	SPA	UIA:RPA	SPA	UIA:RPA	SPA					
Area ID	EDB B - SPA	EA11	EA13	EA10.1	EA10.1 SPA	EA10.2	EA10.2 SPA					
Downstream Design Point ID	19	22	12	8.1	8.1	8.2	8.2					
Downstream BMP Type	EDB	None	None	None	None	None	None					
DCIA (ft^2)	--	--	--	--	--	--	--					
UIA (ft^2)	--	--	--	2,715	--	11,050	--					
RPA (ft^2)	--	--	--	2,930	--	8,500	--					
SPA (ft^2)	75,304	5,412	544	--	5,540	--	13,713					
HSG A (%)	0%	0%	0%	0%	0%	0%	0%					
HSG B (%)	100%	100%	100%	100%	100%	100%	100%					
HSG C/D (%)	0%	0%	0%	0%	0%	0%	0%					
Average Slope of RPA (ft/ft)	--	--	--	0.020	--	0.100	--					
UIA:RPA Interface Width (ft)	--	--	--	293.00	--	850.00	--					

CALCULATED RUNOFF RESULTS

Area ID	EDB B - SPA	EA11	EA13	EA10.1	EA10.1 SPA	EA10.2	EA10.2 SPA					
UIA:RPA Area (ft^2)	--	--	--	5,645	--	19,550	--					
L / W Ratio	--	--	--	0.07	--	0.06	--					
UIA / Area	--	--	--	0.4810	--	0.5652	--					
Runoff (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Runoff (ft^3)	0	0	0	0	0	0	0					
Runoff Reduction (ft^3)	3765	271	27	113	277	460	686					

CALCULATED WQCV RESULTS

Area ID	EDB B - SPA	EA11	EA13	EA10.1	EA10.1 SPA	EA10.2	EA10.2 SPA					
WQCV (ft^3)	0	0	0	113	0	460	0					
WQCV Reduction (ft^3)	0	0	0	113	0	460	0					
WQCV Reduction (%)	0%	0%	0%	100%	0%	100%	0%					
Untreated WQCV (ft^3)	0	0	0	0	0	0	0					

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	19	22	12	8.1	8.1	8.2	8.2					
DCIA (ft^2)	0	0	0	0	0	0	0					
UIA (ft^2)	0	0	0	2,715	2,715	11,050	11,050					
RPA (ft^2)	0	0	0	2,930	2,930	8,500	8,500					
SPA (ft^2)	75,304	5,412	544	5,540	5,540	13,713	13,713					
Total Area (ft^2)	75,304	5,412	544	11,185	11,185	33,263	33,263					
Total Impervious Area (ft^2)	0	0	0	2,715	2,715	11,050	11,050					
WQCV (ft^3)	0	0	0	113	113	460	460					
WQCV Reduction (ft^3)	0	0	0	113	113	460	460					
WQCV Reduction (%)	0%	0%	0%	100%	100%	100%	100%					
Untreated WQCV (ft^3)	0	0	0	0	0	0	0					

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	170,156
Total Impervious Area (ft^2)	27,530
WQCV (ft^3)	574
WQCV Reduction (ft^3)	574
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

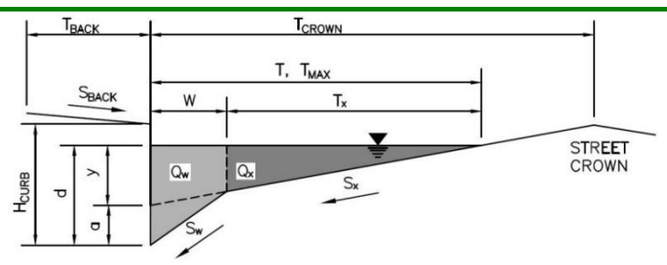
APPENDIX C – HYDRAULIC CALCULATIONS

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

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

Project: **Eastonville Road - Segment 1 Improvements**

Inlet ID: **Inlet DP9**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.5	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 =	0.005	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} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

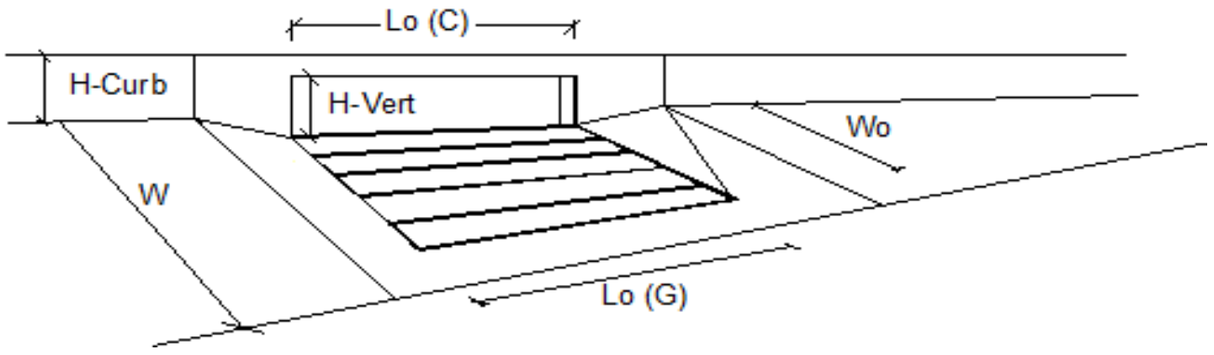
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.0**	**17.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.60 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.70 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.6**	**4.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

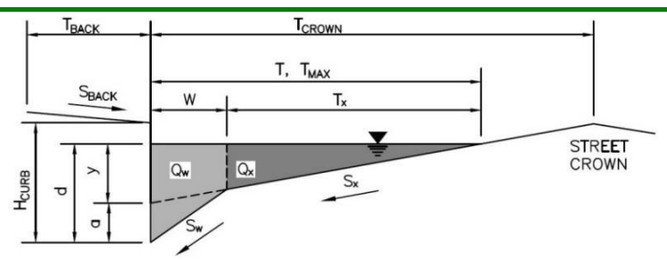
Unresolved:
Per DP summary table, flows at DP 9 are 3.3 and 9.3 cfs. Based on those flows, should be flowby and less than 100% interception rate. What happens with flowby?

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

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

Project: **Eastonville Road - Segment 1 Improvements**

Inlet ID: **Inlet DP10**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.5	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 =	0.005	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} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

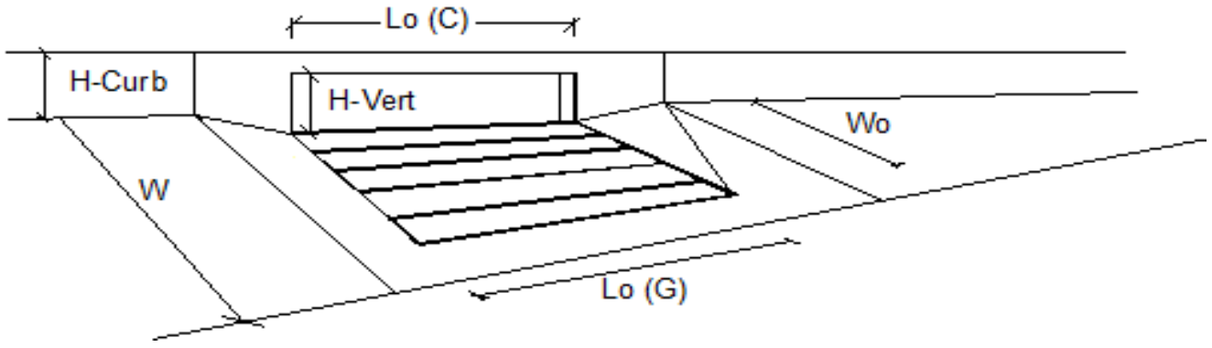
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.0**	**17.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.50 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.60 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.5**	**5.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

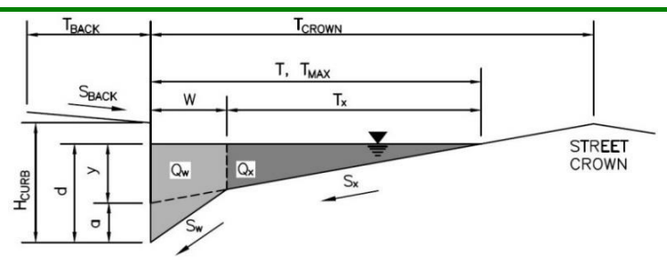
Unresolved:
Per DP summary table, flows at DP 10 are 5.4 and 13.9 cfs. Based on those flows, there should be flowby and a less than 100% interception rate. What happens with flowby?

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

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

Project: **Eastonville Road - Segment 1 Improvements**

Inlet ID: **Inlet DP13**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.5	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 =	0.018	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} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

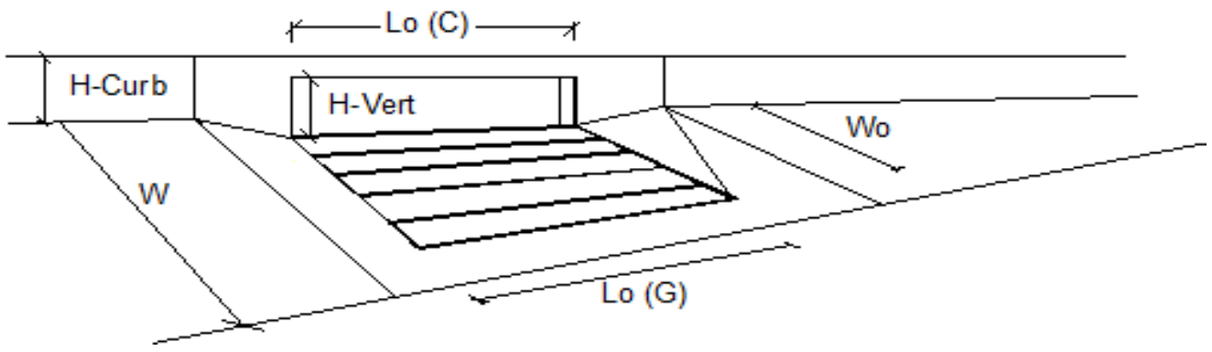
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**24.6**	**29.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.80 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.00 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

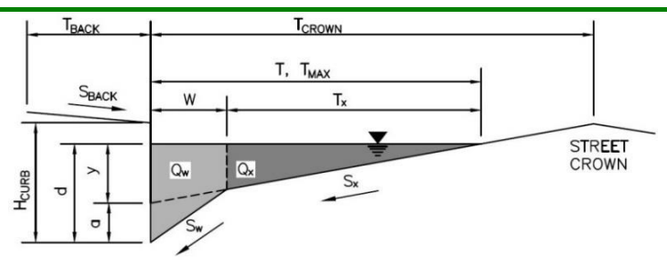
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.8**	**3.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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

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

Project: **Eastonville Road - Segment 1 Improvements**

Inlet ID: **Inlet DP14**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.5	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 =	0.018	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} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

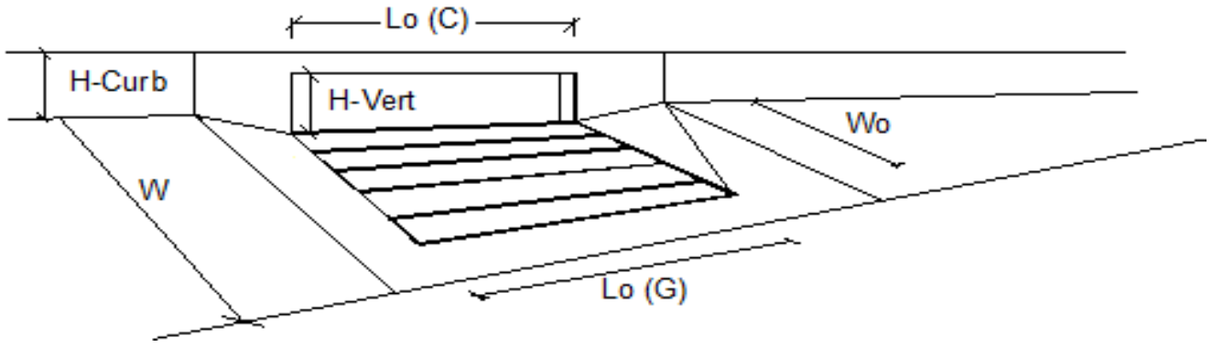
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**24.6**	**29.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.70 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.7**	**2.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

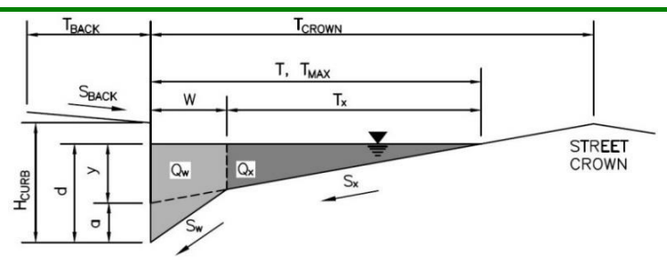
Unresolved:
Per DP summary table, flows at DP 14 are 3.3 and 5.6 cfs. Based on those flows, there should be flowby and a less than 100% interception rate. What happens with flowby?

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

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

Project: **Eastonville Road - Segment 1 Improvements**

Inlet ID: **Inlet DP16**



Gutter Geometry:

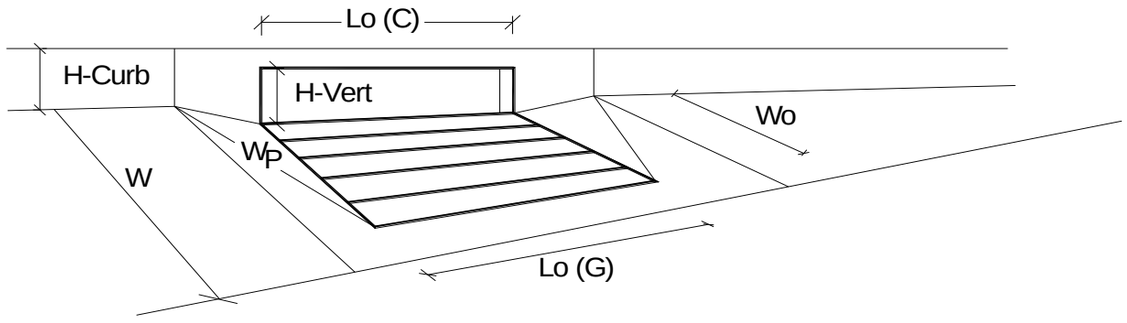
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
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} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	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 =	6.0	6.5	inches

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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	

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	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} =	0.33	0.38	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	0.96	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

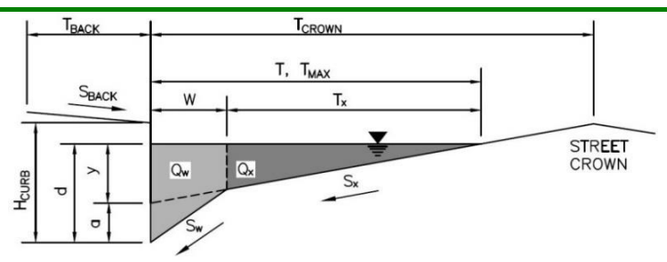
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**10.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.1	5.2	cfs

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

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

Project: **Eastonville Road - Segment 1 Improvements**

Inlet ID: **Inlet DP17**



Gutter Geometry:

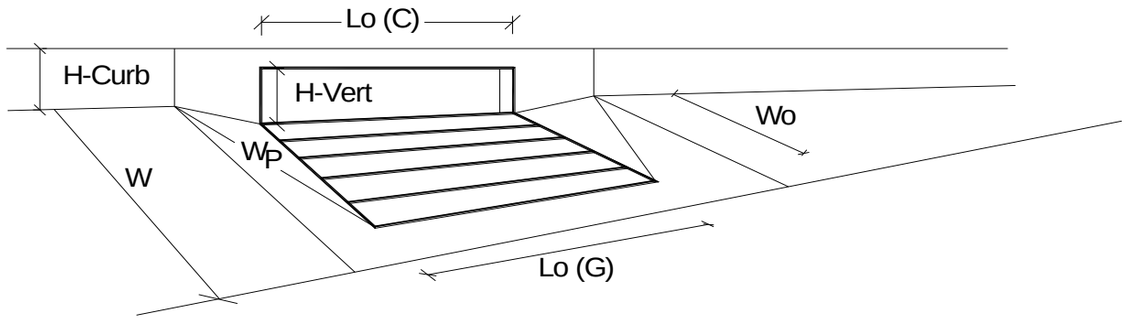
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
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} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	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 =	6.0	6.5	inches

Override Depths

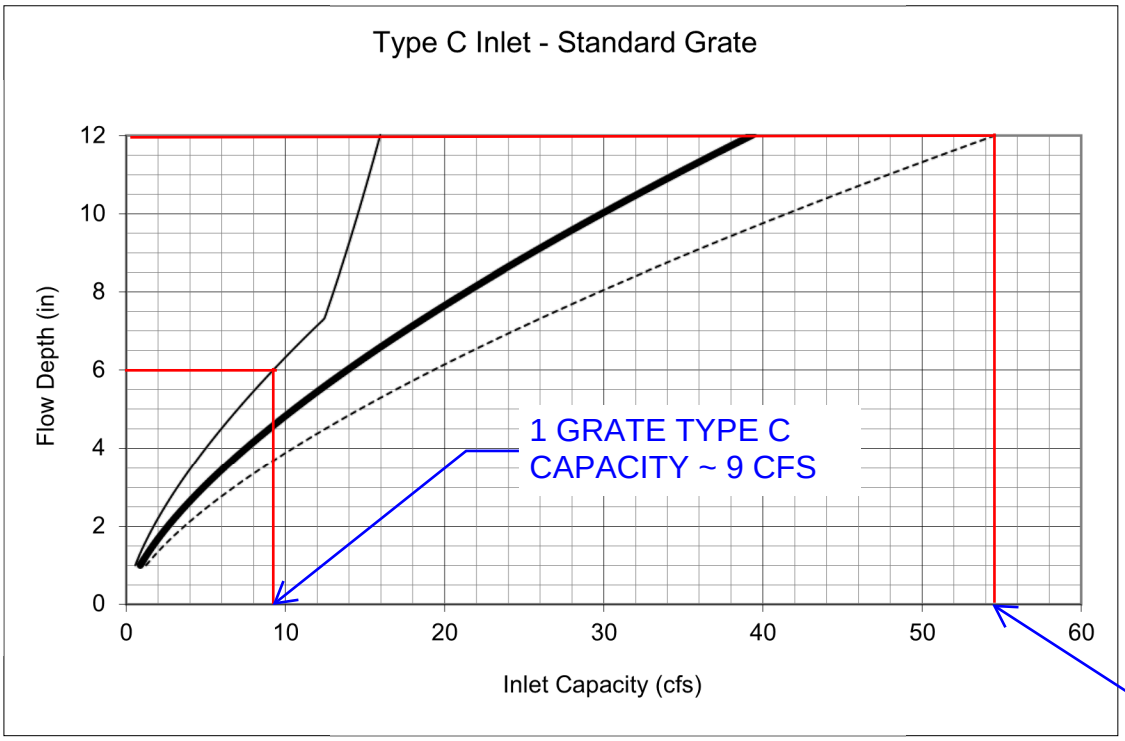
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	

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	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} =	0.33	0.38	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	0.96	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**10.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.2	5.4	cfs

Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet



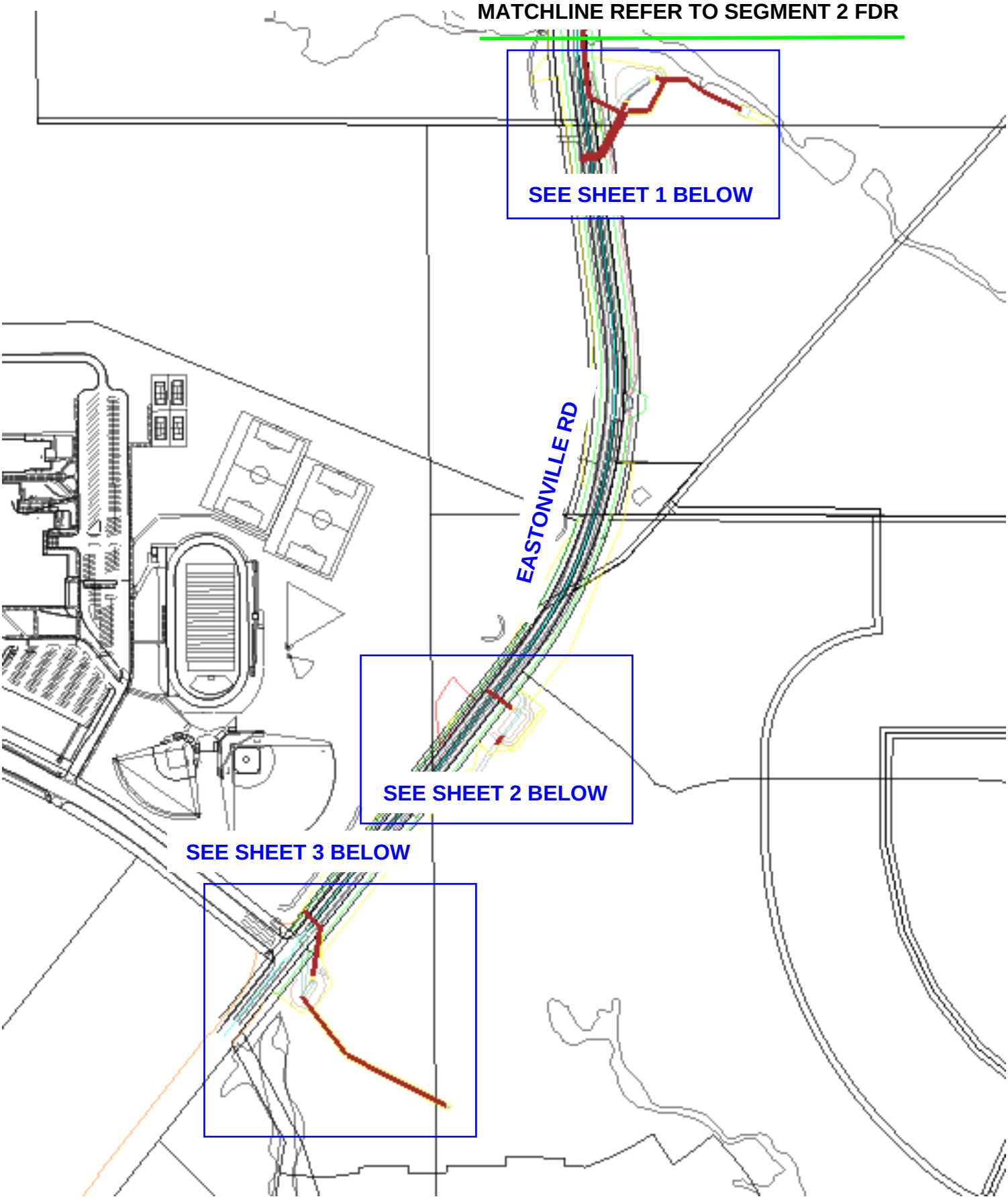
DP1 Q100 = 3.6 CFS -> 1 GRATE TYPE C INLET
DP7 Q100 = 53.6 CFS -> 3 GRATE TYPE C INLET

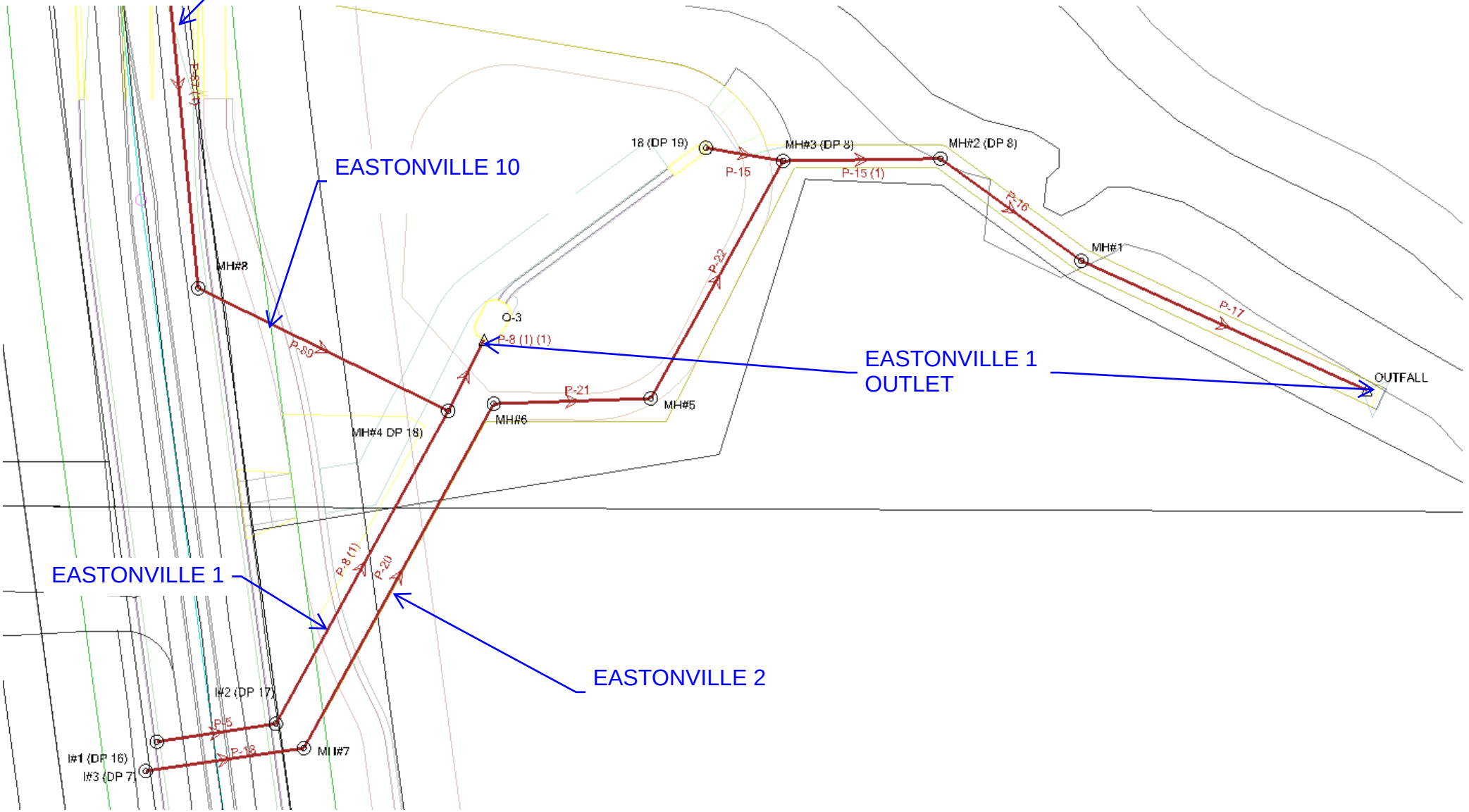
3 GRATE TYPE C
CAPACITY ~ 54 CFS

One Grate Two Grates Three Grates

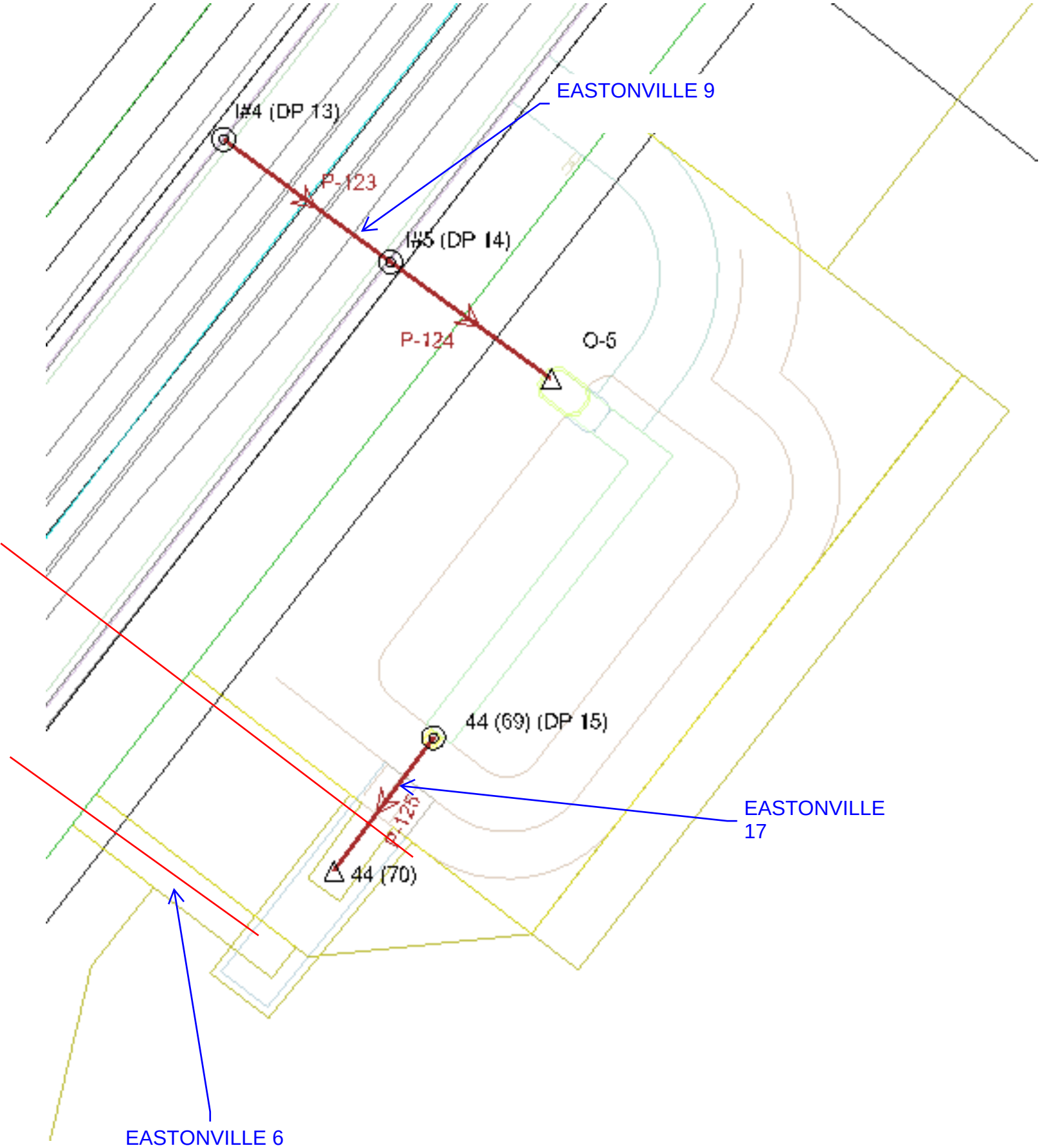
Notes:
1. The standard inlet parameters must apply to use these charts.

STORMCAD NETWORK LAYOUT: SEGMENT 1

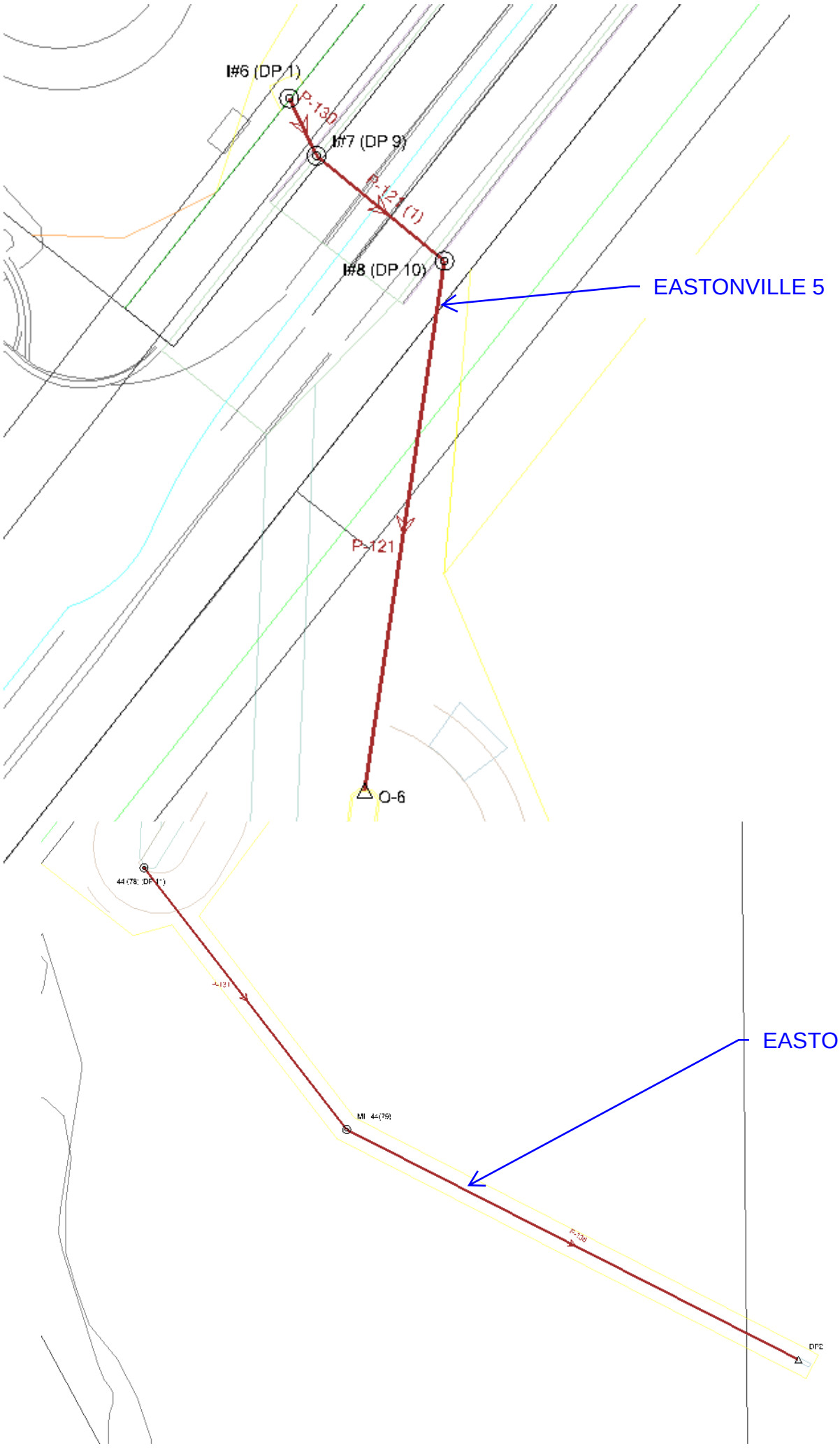



REFER TO
SEGMENT 2 FDR
FOR CALCS
EASTONVILLE 10
EASTONVILLE 1
OUTLET
EASTONVILLE 1
EASTONVILLE 2
MH#8
P-8 (1)
P-8 (1) (1)
O-3
18 (DP 19)
P-15
MH#3 (DP 8)
P-15 (1)
MH#2 (DP 8)
P-16
MH#1
P-17
OUTFALL
P-22
P-21
MH#5
MH#6
MH#4 DP 18)
P-8 (1)
P-20
I#2 (DP 17)
P-19
P-18
I#1 (DP 16)
I#3 (DP 7)
MH#7

SHEET 1


EASTONVILLE 9
I#4 (DP 13)
P-123
I#5 (DP 14)
P-124
O-5
44 (69) (DP 15)
EASTONVILLE 17
P-125
44 (70)
EASTONVILLE 6 (Analyzed via Hydraflow Express, not in this model.)

SHEET 2


I#6 (DP 1)
P-130
I#7 (DP 9)
P-121 (1)
I#8 (DP 10)
EASTONVILLE 5
P-121
O-6
EASTONVILLE 4

SHEET 3

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)
66: P-8 (1) (1)	MH#4 DP 18)	6,985.02	O-3	6,984.82	35.3	0.006	36.0	0.013	26.00	3.68	50.23	51.8	6,988.24	6,988.19
67: P-124	I#5 (DP 14)	6,983.07	O-5	6,981.82	52.9	0.024	18.0	0.013	5.60	8.31	16.15	34.7	6,983.98	6,982.44
69: P-18	I#3 (DP 7)	6,986.04	MH#7	6,985.68	71.3	0.005	42.0	0.013	53.60	8.15	71.48	75.0	6,988.34	6,988.30
70: P-20	MH#7	6,985.37	MH#6	6,983.61	175.6	0.010	42.0	0.013	53.60	10.63	100.73	53.2	6,987.66	6,986.34
71: P-5	I#1 (DP 16)	6,989.53	I#2 (DP 17)	6,989.27	52.7	0.005	18.0	0.013	5.20	4.52	7.38	70.5	6,990.51	6,990.40
72: P-8 (1)	I#2 (DP 17)	6,988.77	MH#4 DP 18)	6,986.02	147.0	0.019	24.0	0.013	10.30	8.86	30.94	33.3	6,989.92	6,988.62
73: P-21	MH#6	6,983.41	MH#5	6,982.59	82.2	0.010	42.0	0.013	53.60	10.61	100.49	53.3	6,985.70	6,985.32
74: P-22	MH#5	6,982.39	MH#3 (DP 8)	6,981.23	115.7	0.010	42.0	0.013	53.60	10.63	100.72	53.2	6,984.68	6,984.45
75: P-15	18 (DP 19)	6,983.25	MH#3 (DP 8)	6,983.03	30.8	0.007	18.0	0.013	2.90	4.50	8.88	32.7	6,984.46	6,984.45
76: P-15 (1)	MH#3 (DP 8)	6,981.03	MH#2 (DP 8)	6,980.65	75.1	0.005	42.0	0.013	57.20	8.26	71.57	79.9	6,983.73	6,983.60
77: P-16	MH#2 (DP 8)	6,980.55	MH#1	6,980.16	78.1	0.005	42.0	0.013	57.20	8.22	71.10	80.4	6,982.93	6,982.54
78: P-123	I#4 (DP 13)	6,983.43	I#5 (DP 14)	6,983.17	52.0	0.005	18.0	0.013	3.00	3.98	7.43	40.4	6,984.40	6,984.38
79: P-17	MH#1	6,980.06	OUTFALL	6,979.36	139.8	0.005	42.0	0.013	57.20	8.23	71.18	80.4	6,982.44	6,981.73
80: P-125	44 (69) (DP 15)	6,978.42	44 (70)	6,978.21	42.5	0.005	18.0	0.013	1.00	2.94	7.45	13.4	6,978.80	6,978.58
84: P-121	I#8 (DP 10)	6,964.14	O-6	6,963.31	166.4	0.005	24.0	0.013	13.90	5.73	15.98	87.0	6,965.58	6,964.94
85: P-130	I#6 (DP 1)	6,966.33	I#7 (DP 9)	6,965.90	21.3	0.020	18.0	0.013	3.60	6.95	14.93	24.1	6,967.81	6,967.79
87: P-121 (1)	I#7 (DP 9)	6,965.70	I#8 (DP 10)	6,964.64	53.0	0.020	18.0	0.013	9.30	8.87	14.86	62.6	6,966.88	6,966.10
88: P-131	44 (78) (DP 11)	6,960.12	MH-44(79)	6,958.89	245.4	0.005	18.0	0.013	4.60	4.43	7.44	61.9	6,960.97	6,959.86
127: P-89	MH#8	6,986.76	MH#4 DP 18)	6,986.02	116.1	0.006	24.0	0.013	19.90	6.33	18.06	110.2	6,989.51	6,988.62
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	6,989.91
244: P-136	MH-44(79)	6,958.69	DP2	6,955.81	373.7	0.008	18.0	0.013	4.60	5.22	9.22	49.9	6,959.51	6,956.56

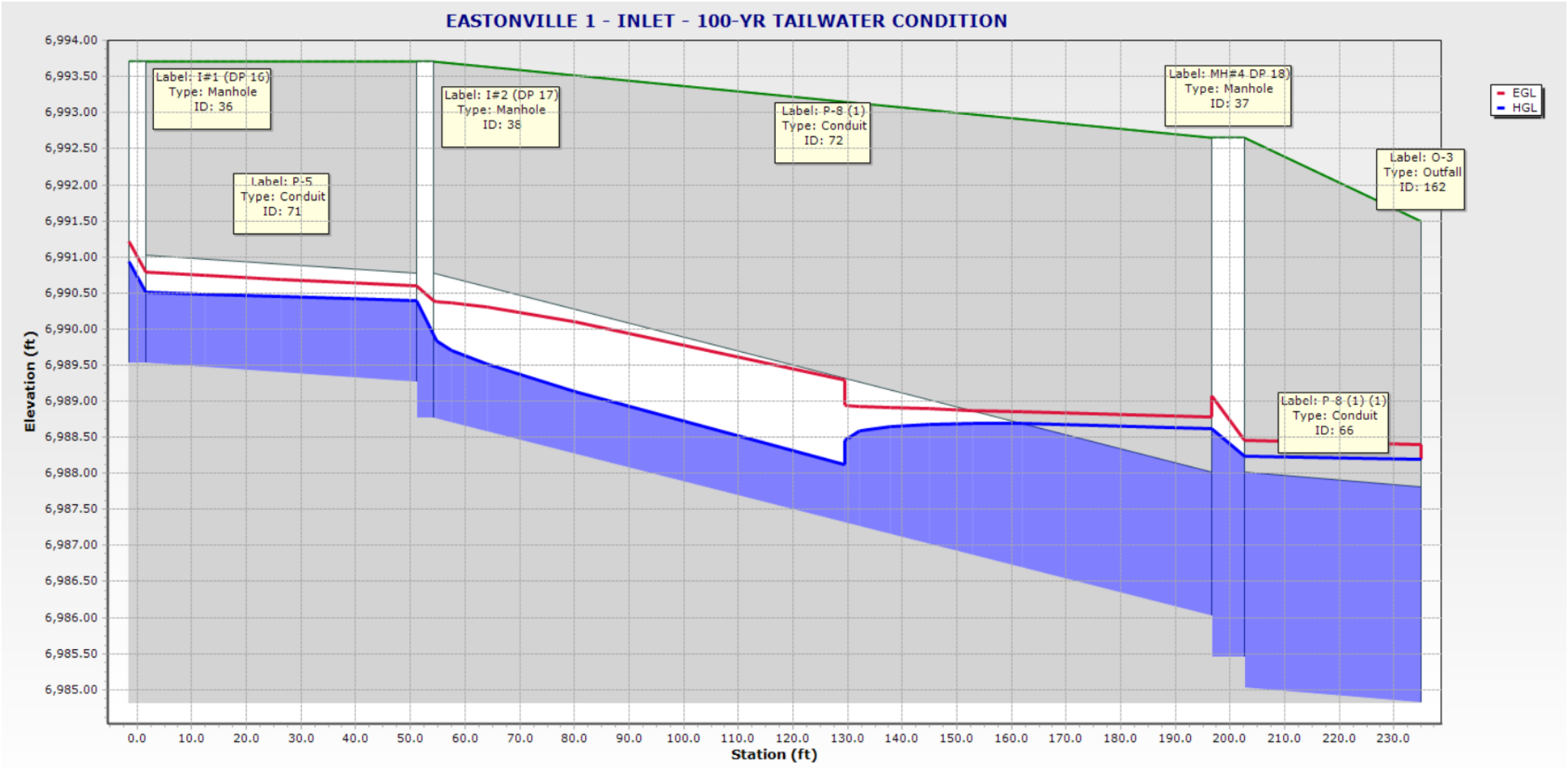
NOTE: EASTONVILLE 1, 5, & 9 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 2 PIPES & STRUCTURES INCLUDED IN TABLE, REFER TO FDR FOR COMPLETE ANALYSIS.

100 YEAR TAILWATER CONDITION: STRUCTURE SUMMARY TABLE

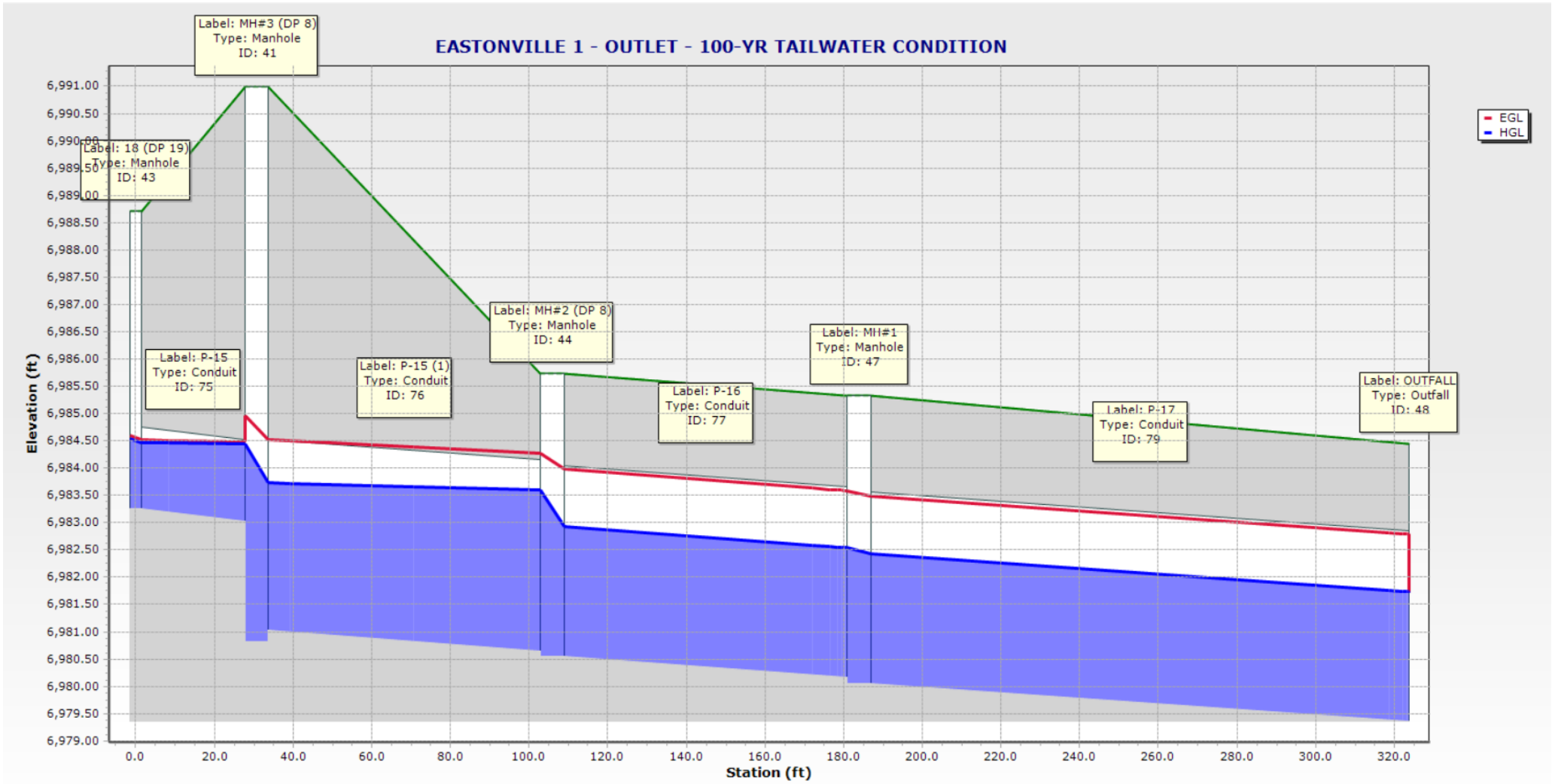
	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)
35: MH#7	6,993.84	6,993.84	6,985.68	53.60	6,987.66	Standard	6,988.30
36: I#1 (DP 16	6,993.71	6,993.71	(N/A)	5.20	6,990.51	Standard	6,990.93
37: MH#4 DP	6,992.66	6,992.66	6,986.02	26.00	6,988.24	Standard	6,988.62
38: I#2 (DP 17	6,993.71	6,993.71	6,989.27	10.30	6,989.92	Standard	6,990.40
39: MH#6	6,992.82	6,992.82	6,983.61	53.60	6,985.70	Standard	6,986.34
40: MH#5	6,991.57	6,991.57	6,982.59	53.60	6,984.68	Standard	6,985.32
41: MH#3 (DP	6,990.99	6,990.99	6,981.23	57.20	6,983.73	Standard	6,984.45
42: I#3 (DP 7)	6,991.04	6,991.04	(N/A)	53.60	6,988.34	Standard	6,989.83
43: 18 (DP 19)	6,988.70	6,988.70	(N/A)	2.90	6,984.46	Standard	6,984.54
44: MH#2 (DP	6,985.73	6,985.73	6,980.65	57.20	6,982.93	Standard	6,983.60
45: I#4 (DP 13	6,987.25	6,987.25	(N/A)	3.00	6,984.40	Standard	6,984.54
46: I#5 (DP 14	6,987.25	6,987.25	6,983.17	5.60	6,983.98	Standard	6,984.38
47: MH#1	6,985.33	6,985.33	6,980.16	57.20	6,982.44	Standard	6,982.54
49: 44 (69) (D	6,982.25	6,982.25	(N/A)	1.00	6,978.80	Standard	6,978.81
57: I#7 (DP 9)	6,976.23	6,976.23	6,965.90	9.30	6,966.88	Standard	6,967.79
58: I#8 (DP 10	6,976.19	6,976.19	6,964.64	13.90	6,965.58	Standard	6,966.10
59: I#6 (DP 1)	6,975.72	6,975.72	(N/A)	3.60	6,967.81	Standard	6,967.91
60: 44 (78) (D	6,965.00	6,965.00	(N/A)	4.60	6,960.97	Standard	6,961.43
120: MH#8	6,995.46	6,995.46	6,986.86	19.90	6,989.51	Standard	6,989.91
243: MH-44(79	6,963.81	6,963.81	6,958.89	4.60	6,959.51	Standard	6,959.86

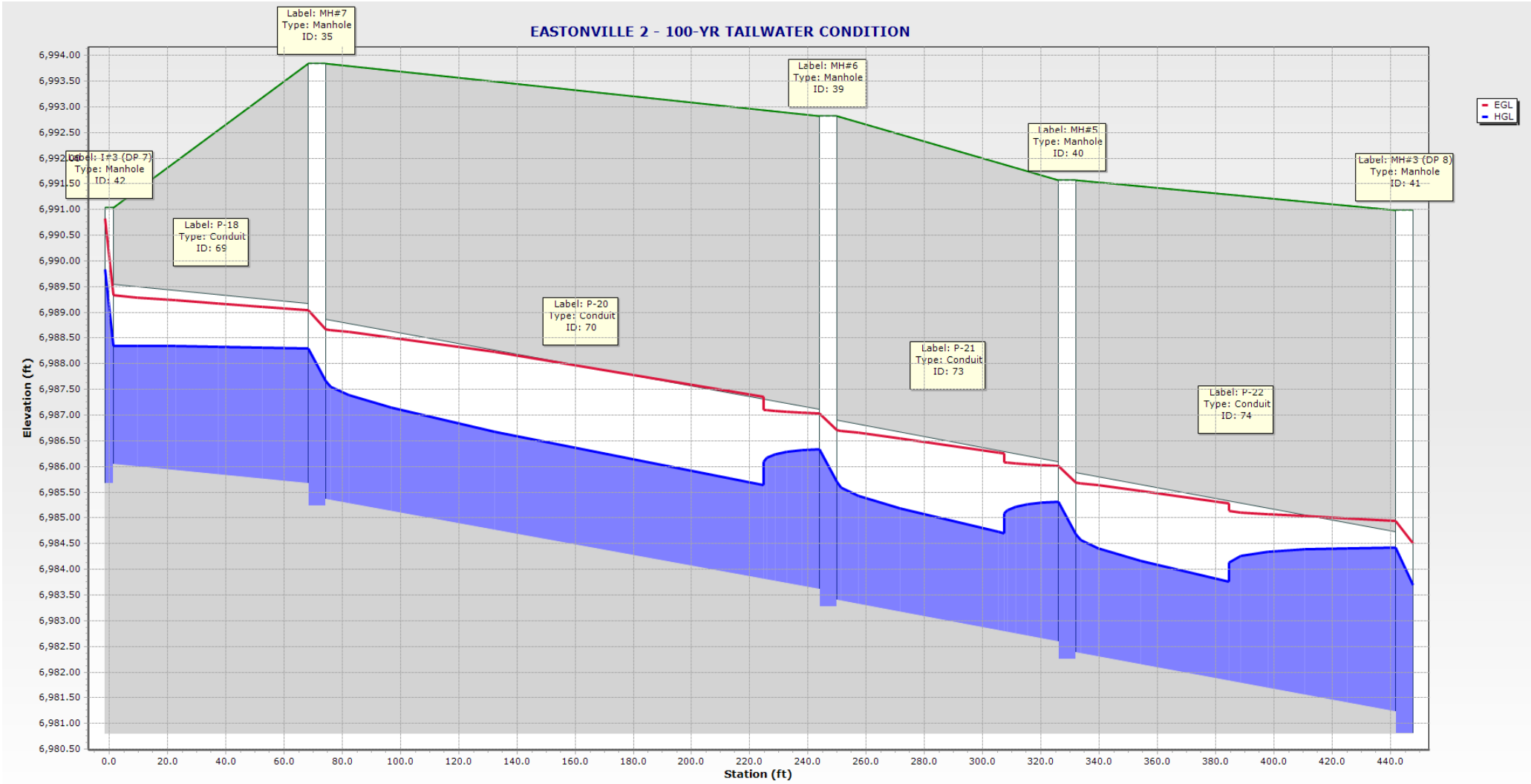
	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
48: OUTFALL	6,984.45	6,979.36	Free Outfall		6,981.73	57.20
53: 44 (70)	6,979.71	6,978.21	Free Outfall		6,978.58	1.00
162: O-3	6,991.50	6,984.82	User Defined Tailwater	6,988.19	6,988.19	26.00
164: O-5	6,984.50	6,981.82	User Defined Tailwater	6,982.14	6,982.44	5.60
165: O-6	6,970.50	6,963.31	User Defined Tailwater	6,964.94	6,964.94	13.90
242: DP2	6,957.52	6,955.81	Free Outfall		6,956.56	4.60

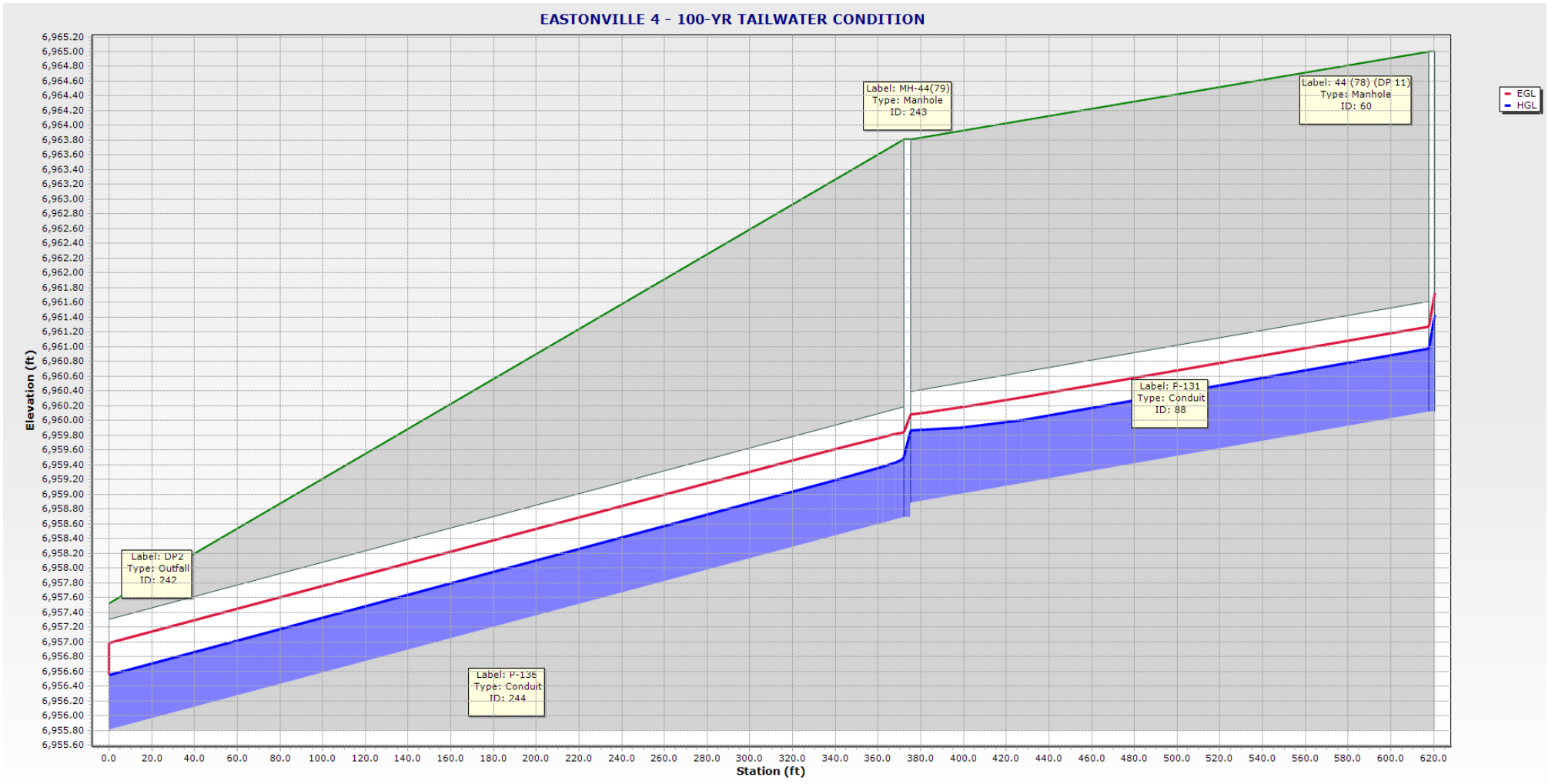
NOTE: EASTONVILLE 1, 5 & 9 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 2 PIPES & STRUCTURES INCLUDED IN TABLE, REFER TO FDR FOR COMPLETE ANALYSIS.

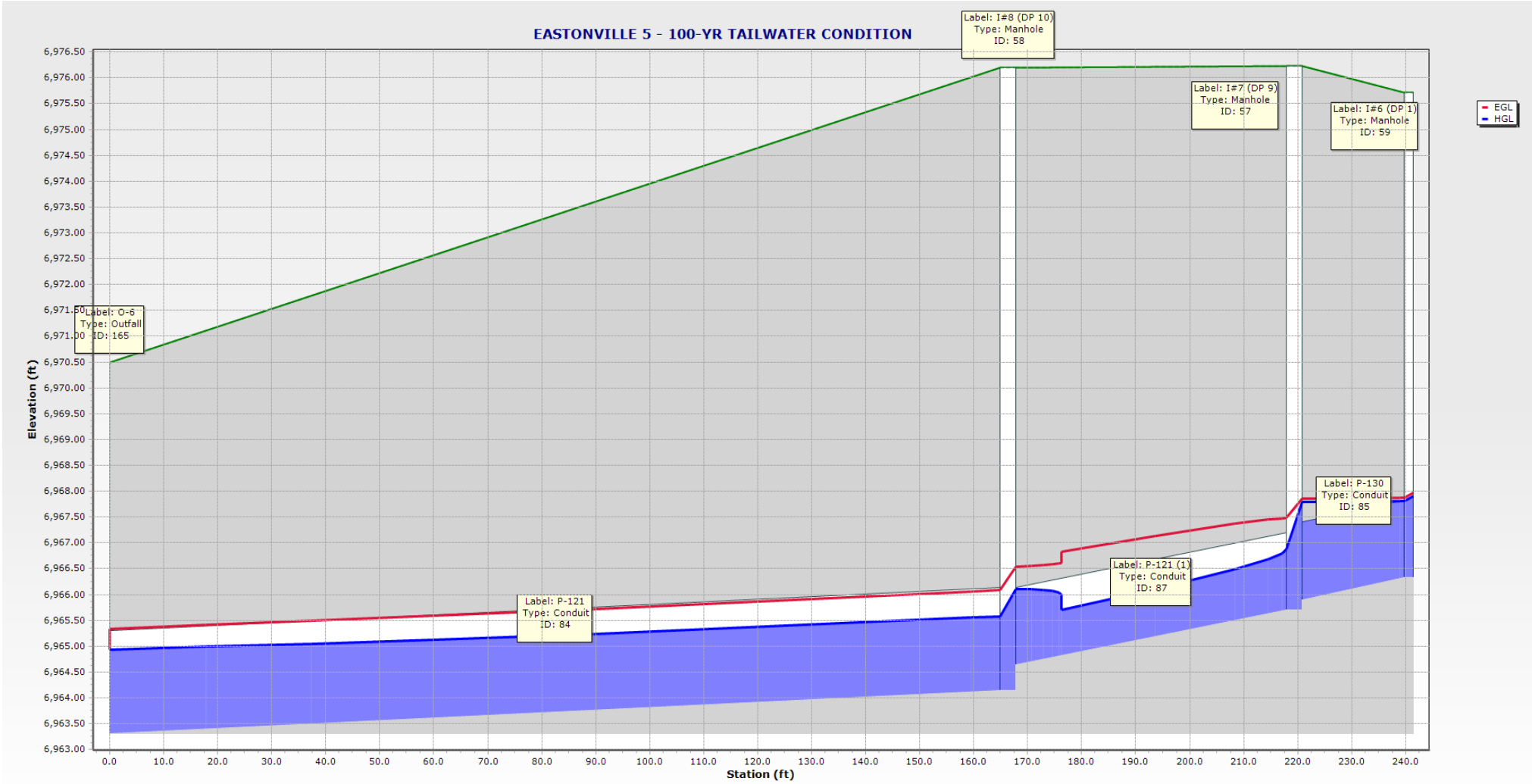


NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

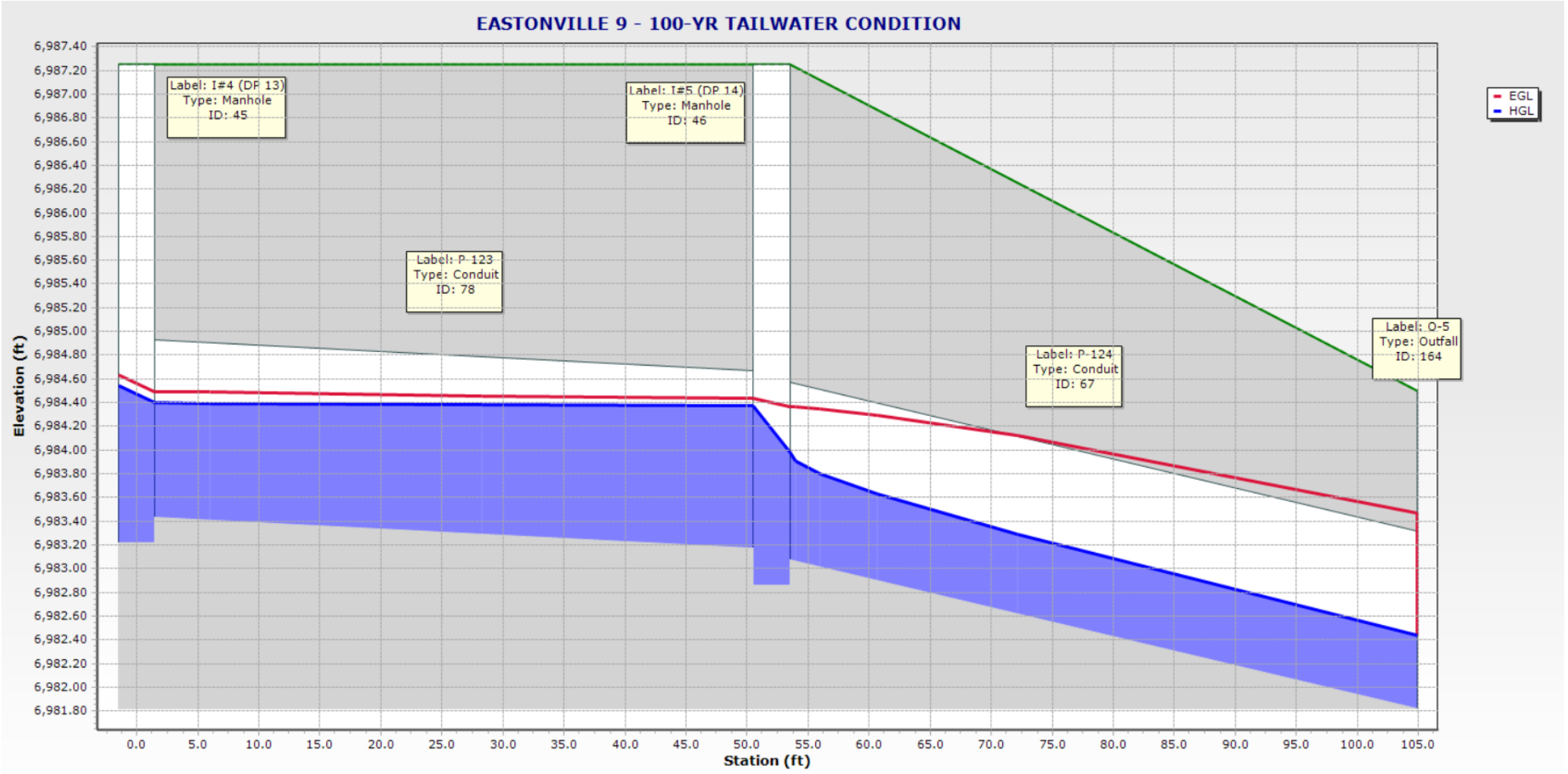

EASTONVILLE 1 - OUTLET - 100-YR TAILWATER CONDITION
Label: MH#3 (DP 8)
Type: Manhole
ID: 41
Label: 18 (DP 19)
Type: Manhole
ID: 43
Label: P-15
Type: Conduit
ID: 75
Label: P-15 (1)
Type: Conduit
ID: 76
Label: MH#2 (DP 8)
Type: Manhole
ID: 44
Label: P-16
Type: Conduit
ID: 77
Label: MH#1
Type: Manhole
ID: 47
Label: P-17
Type: Conduit
ID: 79
Label: OUTFALL
Type: Outfall
ID: 48
EGL
HGL
Elevation (ft)
6,991.00
6,990.50
6,990.00
6,989.50
6,989.00
6,988.50
6,988.00
6,987.50
6,987.00
6,986.50
6,986.00
6,985.50
6,985.00
6,984.50
6,984.00
6,983.50
6,983.00
6,982.50
6,982.00
6,981.50
6,981.00
6,980.50
6,980.00
6,979.50
6,979.00
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
280.0
300.0
320.0
Station (ft)


EASTONVILLE 2 - 100-YR TAILWATER CONDITION
Label: MH#7
Type: Manhole
ID: 35
Label: MH#6
Type: Manhole
ID: 39
Label: MH#5
Type: Manhole
ID: 40
Label: MH#3 (DP 8)
Type: Manhole
ID: 41
Label: I#3 (DP 7)
Type: Manhole
ID: 42
Label: P-18
Type: Conduit
ID: 69
Label: P-20
Type: Conduit
ID: 70
Label: P-21
Type: Conduit
ID: 73
Label: P-22
Type: Conduit
ID: 74
EGL
HGL
Elevation (ft)
Station (ft)
6,994.00
6,993.50
6,993.00
6,992.50
6,992.00
6,991.50
6,991.00
6,990.50
6,990.00
6,989.50
6,989.00
6,988.50
6,988.00
6,987.50
6,987.00
6,986.50
6,986.00
6,985.50
6,985.00
6,984.50
6,984.00
6,983.50
6,983.00
6,982.50
6,982.00
6,981.50
6,981.00
6,980.50
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
280.0
300.0
320.0
340.0
360.0
380.0
400.0
420.0
440.0


EASTONVILLE 4 - 100-YR TAILWATER CONDITION
Elevation (ft)
Station (ft)
EGL
HGL
Label: MH-44(79)
Type: Manhole
ID: 243
Label: 44 (78) (DP 11)
Type: Manhole
ID: 60
Label: P-131
Type: Conduit
ID: 88
Label: DP2
Type: Outfall
ID: 242
Label: P-136
Type: Conduit
ID: 244

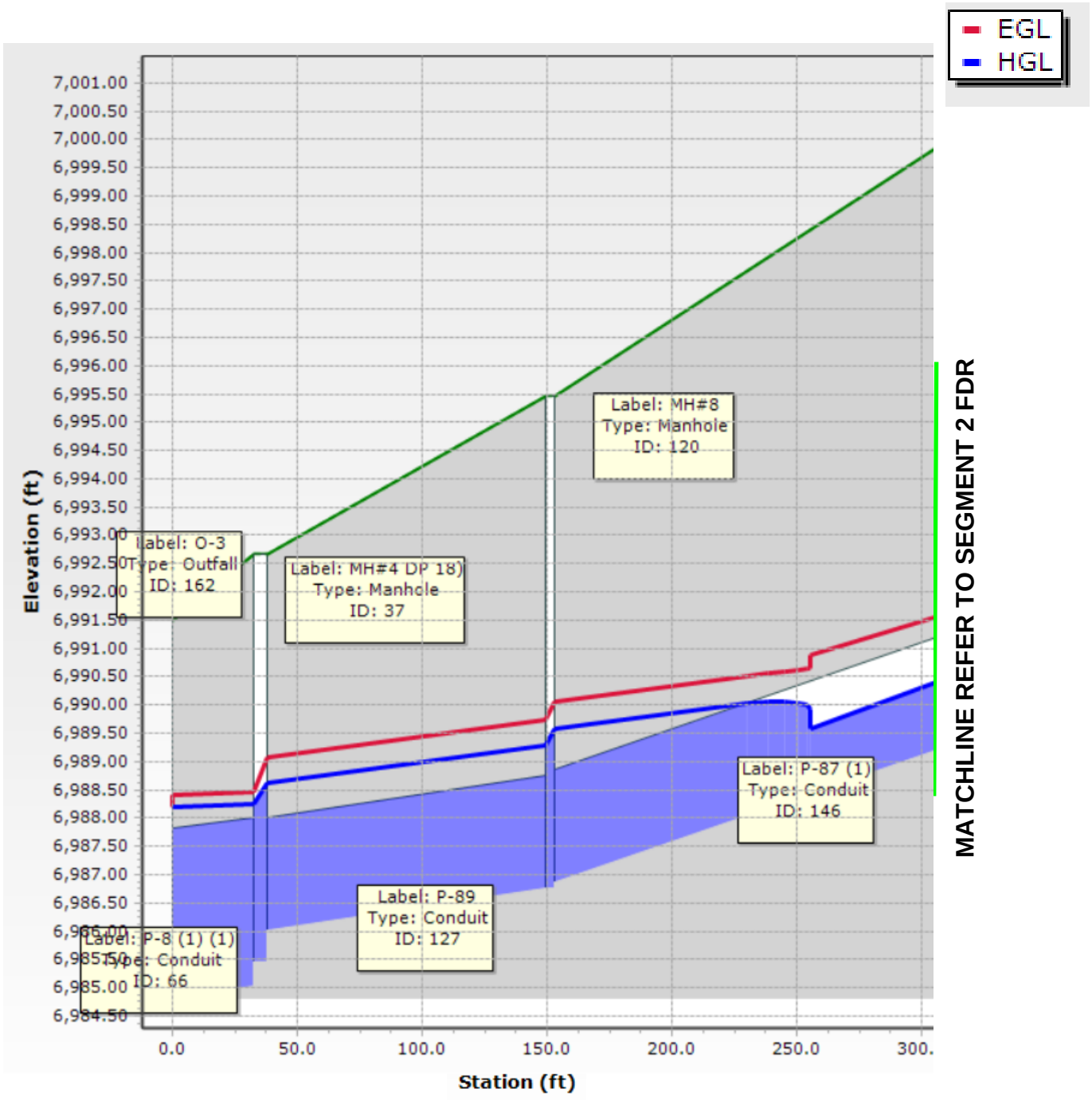


NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

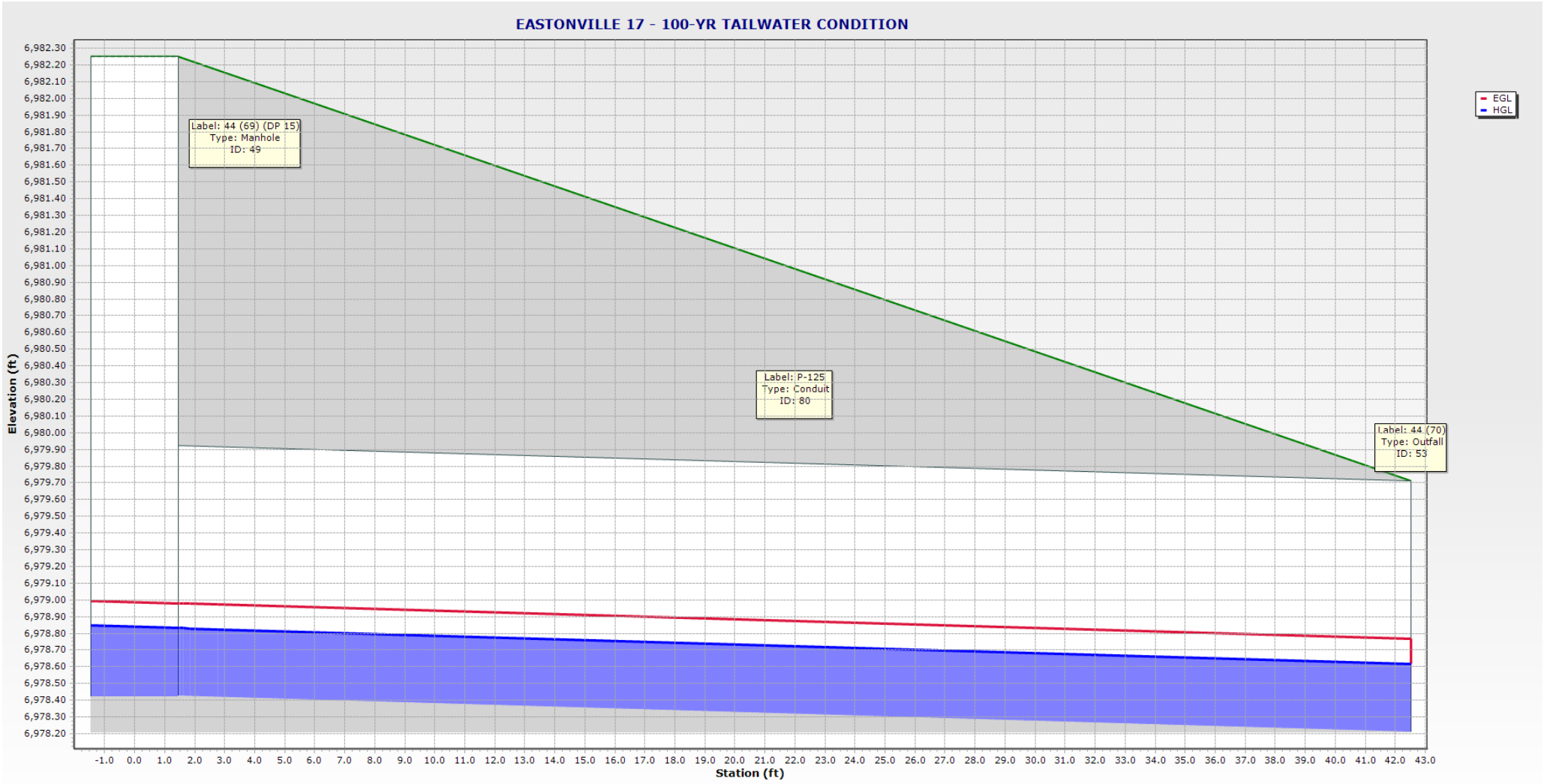


NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

EASTONVILLE 10 - 100-YR TAILWATER CONDITION



MATCHLINE REFER TO SEGMENT 2 FDR


EASTONVILLE 17 - 100-YR TAILWATER CONDITION
Elevation (ft)
Station (ft)
EGL
HGL
Label: 44 (69) (DP 15)
Type: Manhole
ID: 49
Label: P-125
Type: Conduit
ID: 80
Label: 44 (70)
Type: Outfall
ID: 53

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)
66: P-8 (1) (1)	MH#4 DP 18)	6,985.02	O-3	6,984.82	35.3	0.006	36.0	0.013	15.50	6.26	50.23	30.9	6,987.07	6,987.07
67: P-124	I#5 (DP 14)	6,983.07	O-5	6,981.82	52.9	0.024	18.0	0.013	3.30	7.18	16.15	20.4	6,983.76	6,982.28
69: P-18	I#3 (DP 7)	6,986.04	MH#7	6,985.68	71.3	0.005	42.0	0.013	8.00	4.91	71.48	11.2	6,986.89	6,986.47
70: P-20	MH#7	6,985.37	MH#6	6,983.61	175.6	0.010	42.0	0.013	8.00	6.26	100.73	7.9	6,986.22	6,984.28
71: P-5	I#1 (DP 16)	6,989.53	I#2 (DP 17)	6,989.27	52.7	0.005	18.0	0.013	3.10	3.99	7.38	42.0	6,990.21	6,989.99
72: P-8 (1)	I#2 (DP 17)	6,988.77	MH#4 DP 18)	6,986.02	147.0	0.019	24.0	0.013	6.20	7.69	30.94	20.0	6,989.65	6,987.32
73: P-21	MH#6	6,983.41	MH#5	6,982.59	82.2	0.010	42.0	0.013	8.00	6.25	100.49	8.0	6,984.26	6,983.26
74: P-22	MH#5	6,982.39	MH#3 (DP 8)	6,981.23	115.7	0.010	42.0	0.013	8.00	6.26	100.72	7.9	6,983.24	6,982.24
75: P-15	18 (DP 19)	6,983.25	MH#3 (DP 8)	6,983.03	30.8	0.007	18.0	0.013	0.30	2.33	8.88	3.4	6,983.45	6,983.22
76: P-15 (1)	MH#3 (DP 8)	6,981.03	MH#2 (DP 8)	6,980.65	75.1	0.005	42.0	0.013	9.20	5.12	71.57	12.9	6,981.95	6,981.68
77: P-16	MH#2 (DP 8)	6,980.55	MH#1	6,980.16	78.1	0.005	42.0	0.013	9.20	5.09	71.10	12.9	6,981.47	6,981.01
78: P-123	I#4 (DP 13)	6,983.43	I#5 (DP 14)	6,983.17	52.0	0.005	18.0	0.013	1.80	3.46	7.43	24.2	6,984.04	6,984.03
79: P-17	MH#1	6,980.06	OUTFALL	6,979.36	139.8	0.005	42.0	0.013	9.20	5.10	71.18	12.9	6,980.98	6,980.21
80: P-125	44 (69) (DP 15)	6,978.42	44 (70)	6,978.21	42.5	0.005	18.0	0.013	0.06	1.27	7.45	0.8	6,978.52	6,978.30
84: P-121	I#8 (DP 10)	6,964.14	O-6	6,963.31	166.4	0.005	24.0	0.013	5.40	4.59	15.98	33.8	6,964.96	6,964.47
85: P-130	I#6 (DP 1)	6,966.33	I#7 (DP 9)	6,965.90	21.3	0.020	18.0	0.013	0.50	3.91	14.93	3.3	6,966.78	6,966.79
87: P-121 (1)	I#7 (DP 9)	6,965.70	I#8 (DP 10)	6,964.64	53.0	0.020	18.0	0.013	3.30	6.76	14.86	22.2	6,966.39	6,965.12
88: P-131	44 (78) (DP 11)	6,960.12	MH-44(79)	6,958.89	245.4	0.005	18.0	0.013	0.40	2.24	7.44	5.4	6,960.36	6,959.12
127: P-89	MH#8	6,986.76	MH#4 DP 18)	6,986.02	116.1	0.006	24.0	0.013	10.20	5.92	18.06	56.5	6,987.90	6,987.32
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
244: P-136	MH-44(79)	6,958.69	DP2	6,955.81	373.7	0.008	18.0	0.013	0.40	2.60	9.22	4.3	6,958.92	6,956.02

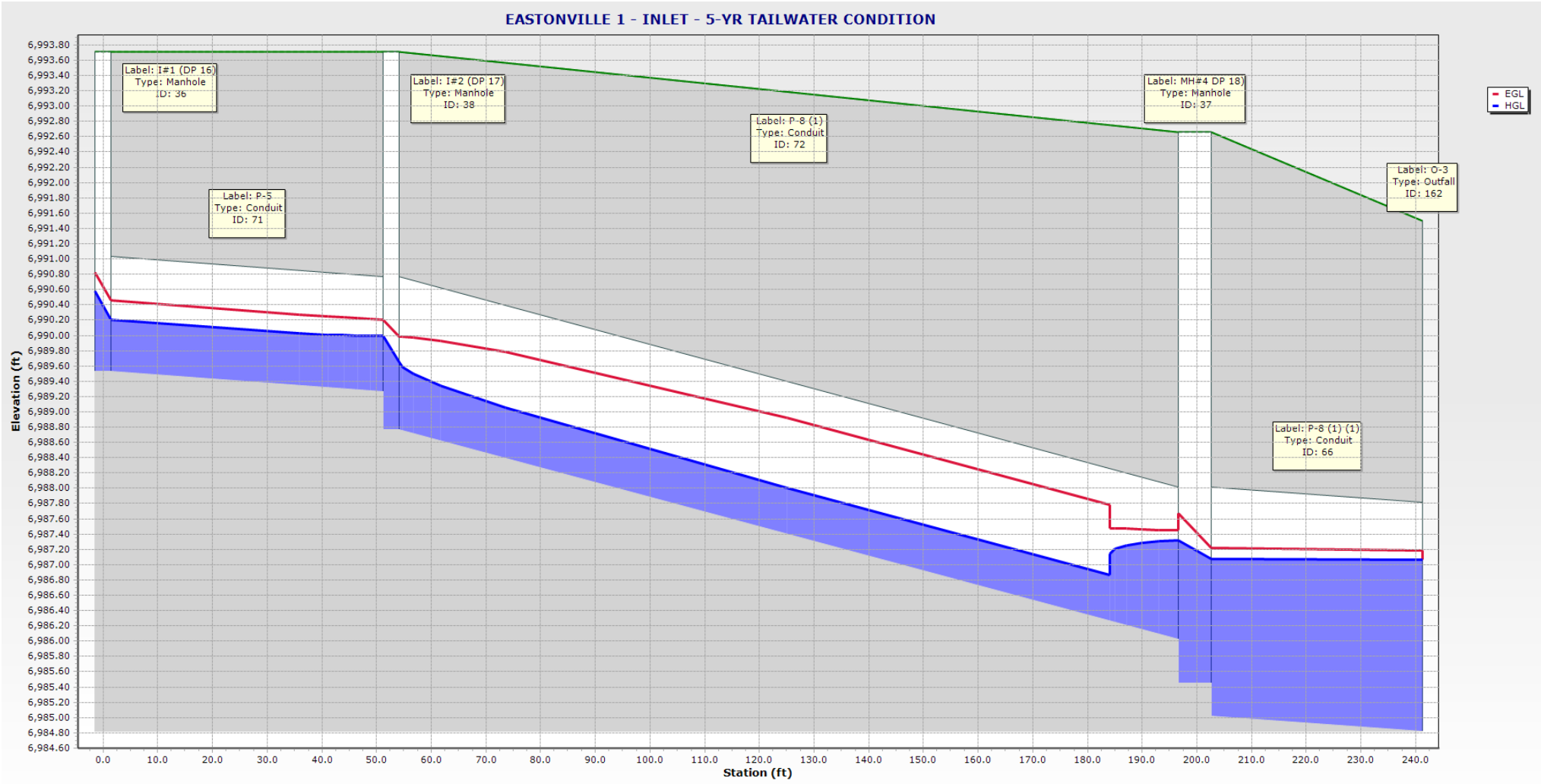
NOTE: EASTONVILLE 1, 5 & 9 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 2 PIPES & STRUCTURES INCLUDED IN TABLE, REFER TO FDR FOR COMPLETE ANALYSIS.

5 YEAR TAILWATER CONDITION: STRUCTURE SUMMARY TABLE

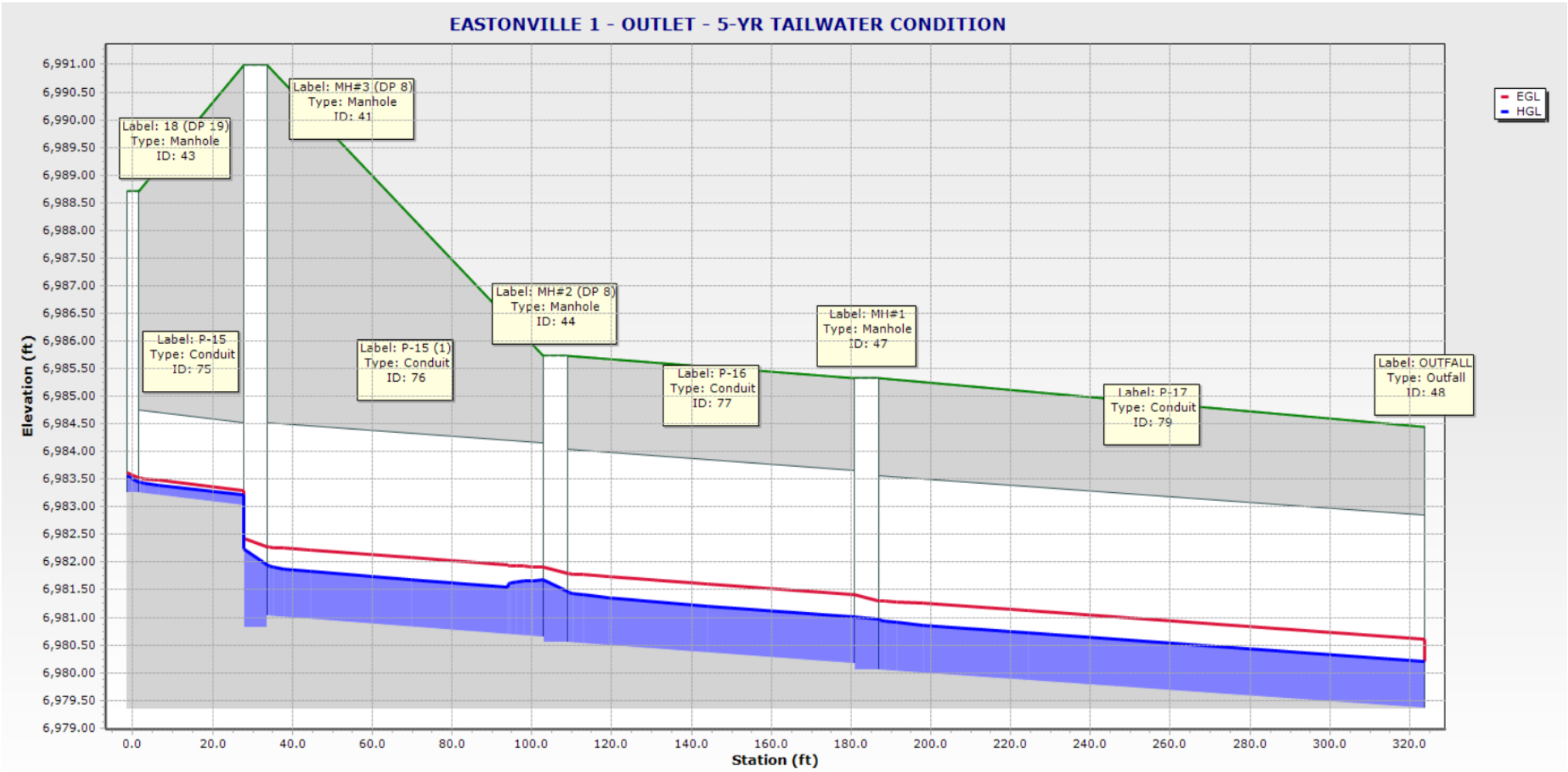
	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)
35: MH#7	6,993.84	6,993.84	6,985.68	8.00	6,986.22	Standard	6,986.42
36: I#1 (DP 16	6,993.71	6,993.71	(N/A)	3.10	6,990.21	Standard	6,990.58
37: MH#4 DP	6,992.66	6,992.66	6,986.02	15.50	6,987.07	Standard	6,987.32
38: I#2 (DP 17	6,993.71	6,993.71	6,989.27	6.20	6,989.65	Standard	6,989.99
39: MH#6	6,992.82	6,992.82	6,983.61	8.00	6,984.26	Standard	6,984.46
40: MH#5	6,991.57	6,991.57	6,982.59	8.00	6,983.24	Standard	6,983.44
41: MH#3 (DP	6,990.99	6,990.99	6,981.23	9.20	6,981.95	Standard	6,982.24
42: I#3 (DP 7)	6,991.04	6,991.04	(N/A)	8.00	6,986.89	Standard	6,987.35
43: 18 (DP 19)	6,988.70	6,988.70	(N/A)	0.30	6,983.45	Standard	6,983.56
44: MH#2 (DP	6,985.73	6,985.73	6,980.65	9.20	6,981.47	Standard	6,981.68
45: I#4 (DP 13	6,987.25	6,987.25	(N/A)	1.80	6,984.04	Standard	6,984.21
46: I#5 (DP 14	6,987.25	6,987.25	6,983.17	3.30	6,983.76	Standard	6,984.03
47: MH#1	6,985.33	6,985.33	6,980.16	9.20	6,980.98	Standard	6,981.01
49: 44 (69) (D	6,982.25	6,982.25	(N/A)	0.06	6,978.52	Standard	6,978.52
57: I#7 (DP 9)	6,976.23	6,976.23	6,965.90	3.30	6,966.39	Standard	6,966.79
58: I#8 (DP 10	6,976.19	6,976.19	6,964.64	5.40	6,964.96	Standard	6,965.27
59: I#6 (DP 1)	6,975.72	6,975.72	(N/A)	0.50	6,966.78	Standard	6,966.81
60: 44 (78) (D	6,965.00	6,965.00	(N/A)	0.40	6,960.36	Standard	6,960.47
120: MH#8	6,995.46	6,995.46	6,986.86	10.20	6,987.90	Standard	6,988.20
243: MH-44(79	6,963.81	6,963.81	6,958.89	0.40	6,958.92	Standard	6,959.01

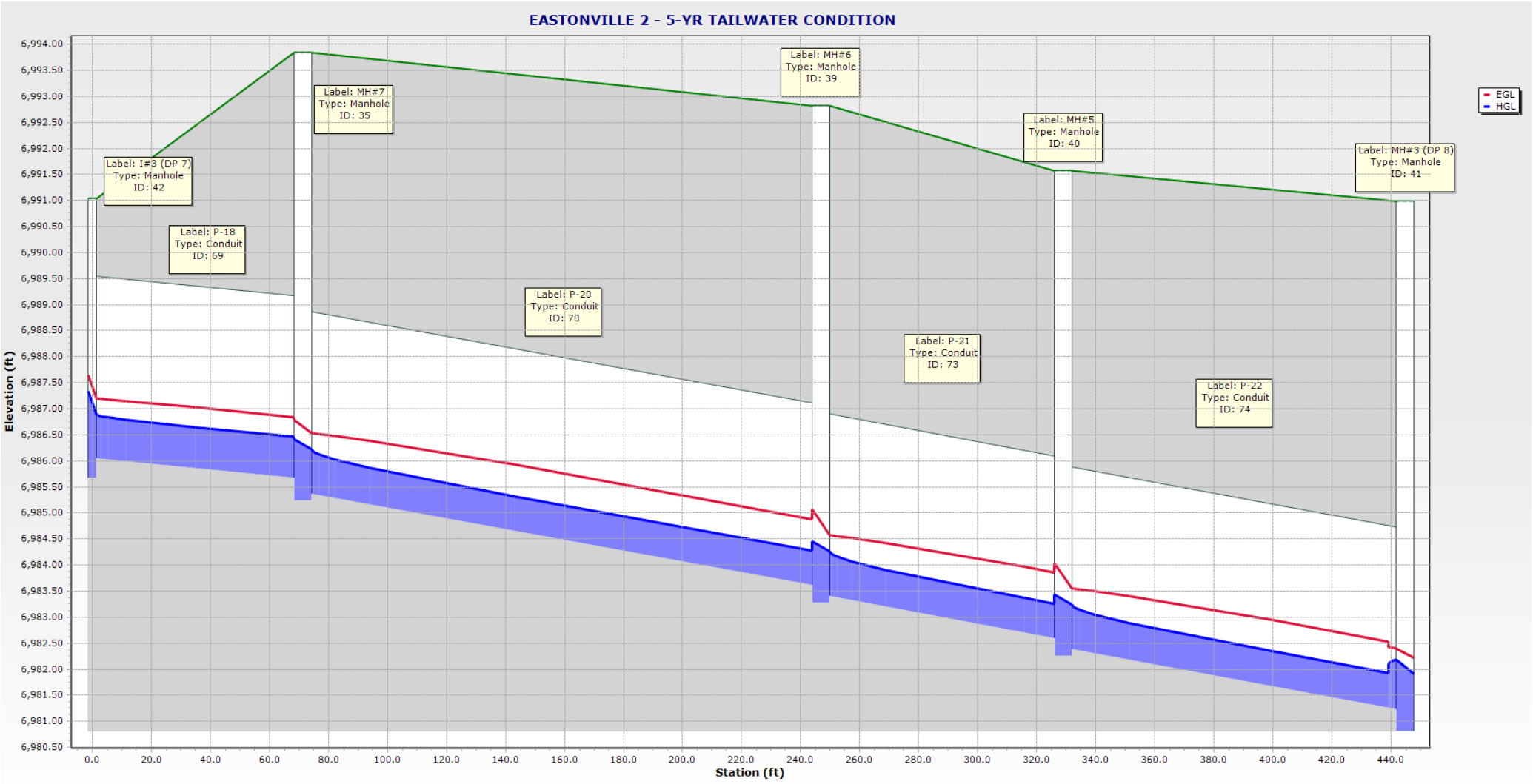
	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
48: OUTFALL	6,984.45	6,979.36	Free Outfall		6,980.21	9.20
53: 44 (70)	6,979.71	6,978.21	Free Outfall		6,978.30	0.06
162: O-3	6,991.50	6,984.82	User Defined Tailwater	6,987.07	6,987.07	15.50
164: O-5	6,984.50	6,981.82	User Defined Tailwater	6,981.93	6,982.28	3.30
165: O-6	6,970.50	6,963.31	User Defined Tailwater	6,964.47	6,964.47	5.40
242: DP2	6,957.52	6,955.81	Free Outfall		6,956.02	0.40

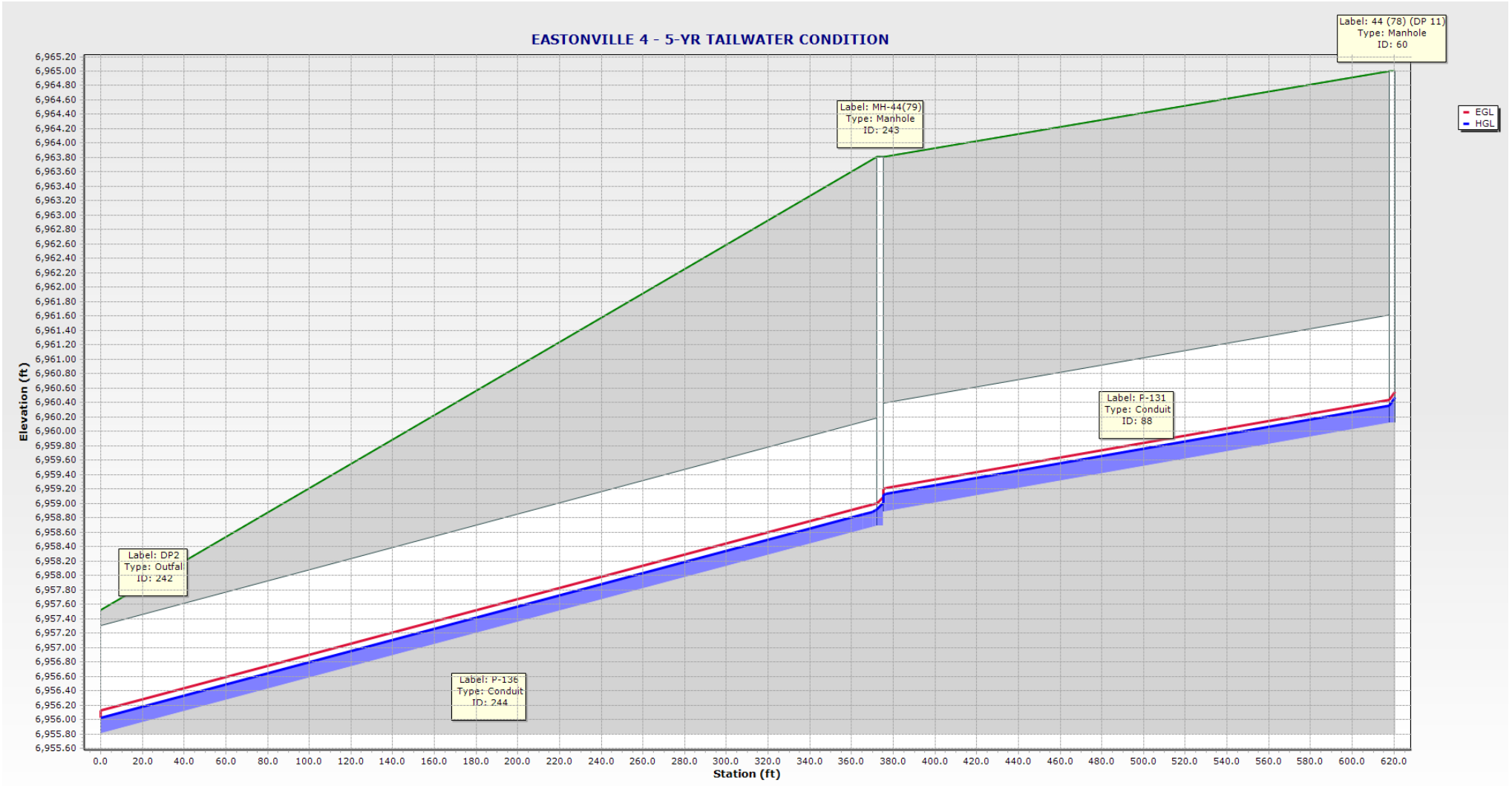
NOTE: EASTONVILLE 1, 5 & 9 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 2 PIPES & STRUCTURES INCLUDED IN TABLE, REFER TO FDR FOR COMPLETE ANALYSIS.

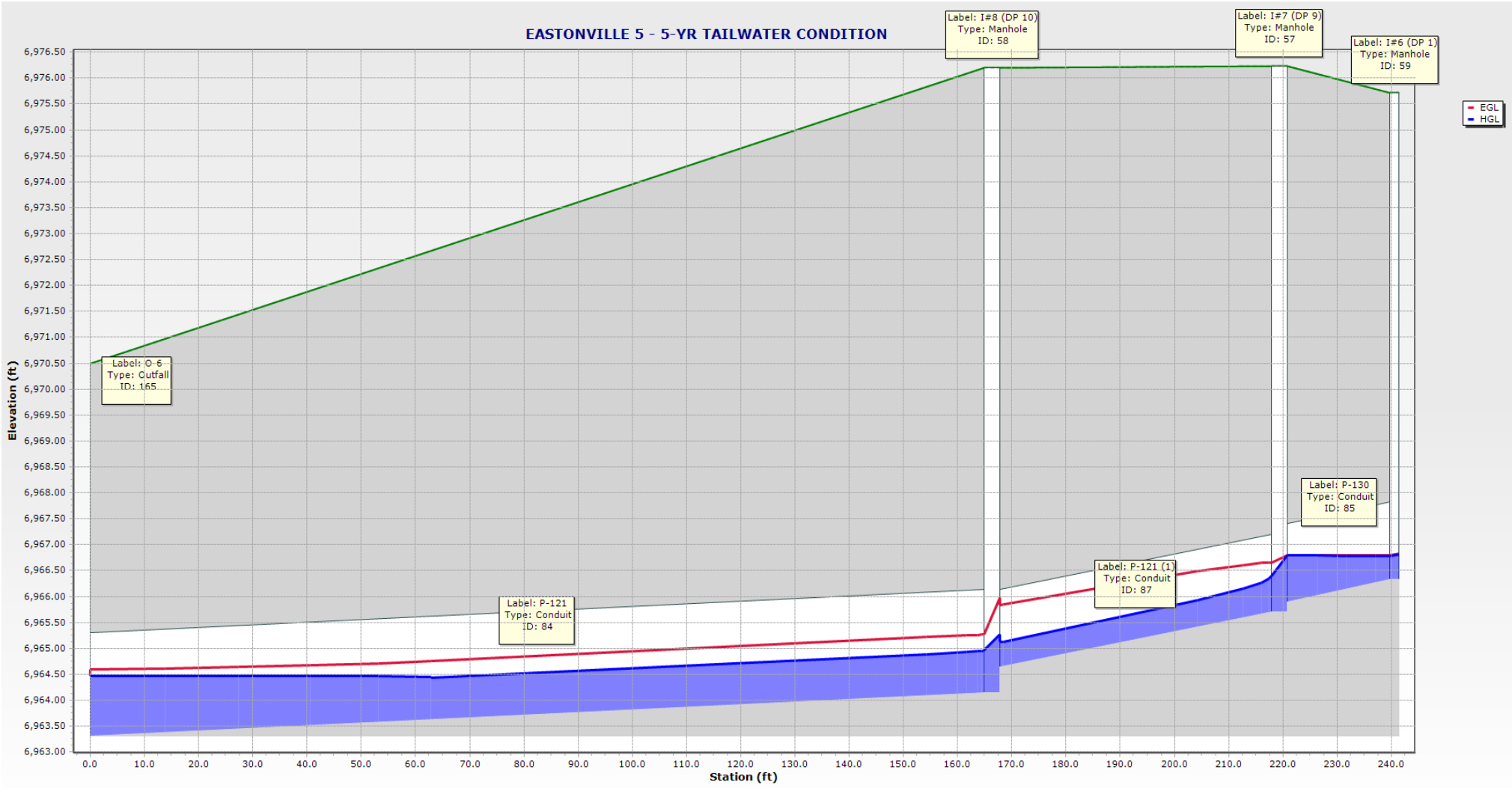


NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

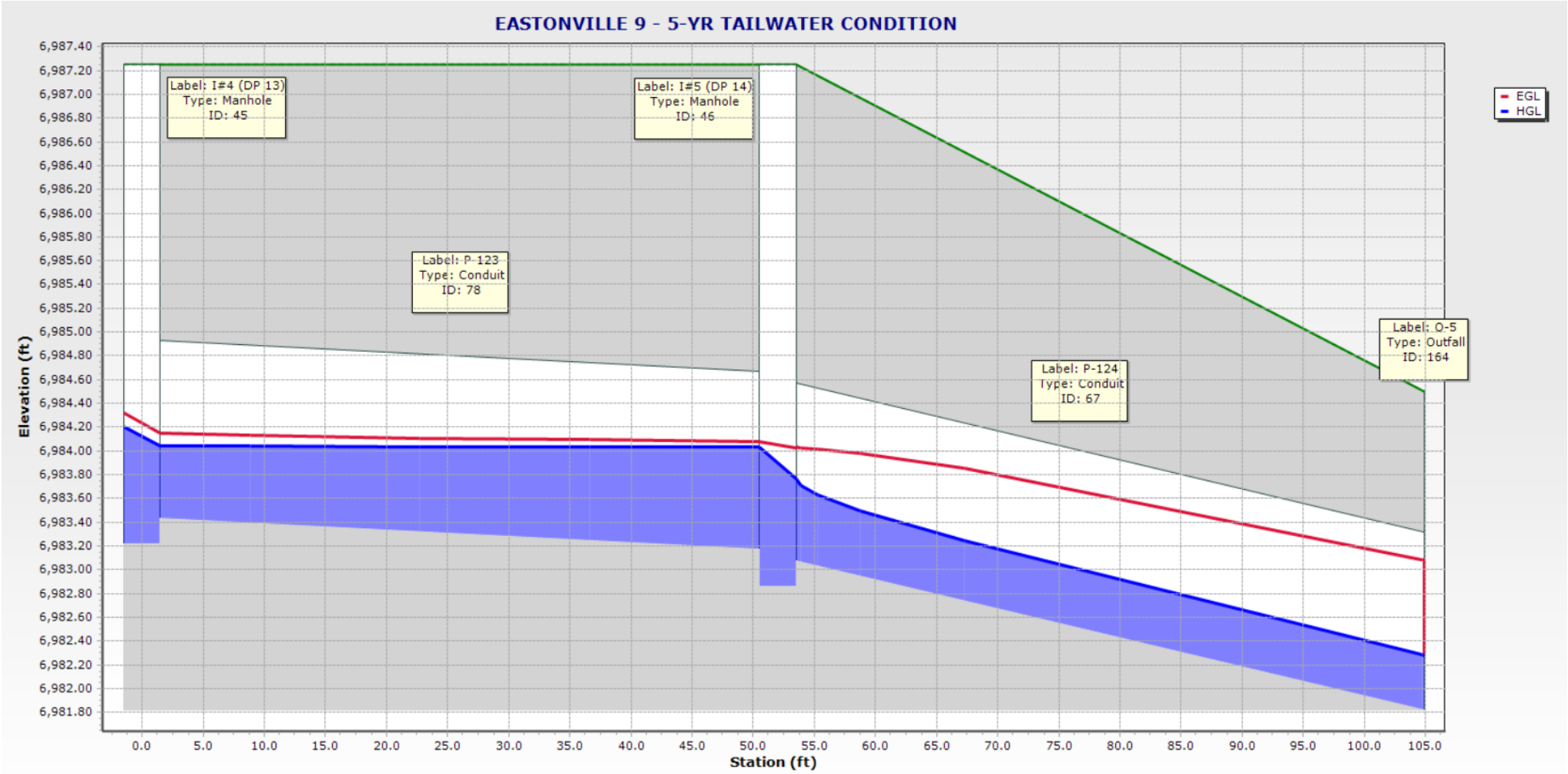

EASTONVILLE 1 - OUTLET - 5-YR TAILWATER CONDITION
Elevation (ft)
6,991.00
6,990.50
6,990.00
6,989.50
6,989.00
6,988.50
6,988.00
6,987.50
6,987.00
6,986.50
6,986.00
6,985.50
6,985.00
6,984.50
6,984.00
6,983.50
6,983.00
6,982.50
6,982.00
6,981.50
6,981.00
6,980.50
6,980.00
6,979.50
6,979.00
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
280.0
300.0
320.0
Station (ft)
Label: 18 (DP 19)
Type: Manhole
ID: 43
Label: MH#3 (DP 8)
Type: Manhole
ID: 41
Label: MH#2 (DP 8)
Type: Manhole
ID: 44
Label: MH#1
Type: Manhole
ID: 47
Label: OUTFALL
Type: Outfall
ID: 48
Label: P-15
Type: Conduit
ID: 75
Label: P-15 (1)
Type: Conduit
ID: 76
Label: P-16
Type: Conduit
ID: 77
Label: P-17
Type: Conduit
ID: 79
EGL
HGL


EASTONVILLE 2 - 5-YR TAILWATER CONDITION
Label: I#3 (DP 7)
Type: Manhole
ID: 42
Label: MH#7
Type: Manhole
ID: 35
Label: MH#6
Type: Manhole
ID: 39
Label: MH#5
Type: Manhole
ID: 40
Label: MH#3 (DP 8)
Type: Manhole
ID: 41
Label: P-18
Type: Conduit
ID: 69
Label: P-20
Type: Conduit
ID: 70
Label: P-21
Type: Conduit
ID: 73
Label: P-22
Type: Conduit
ID: 74
EGL
HGL
Elevation (ft)
Station (ft)
6,994.00
6,993.50
6,993.00
6,992.50
6,992.00
6,991.50
6,991.00
6,990.50
6,990.00
6,989.50
6,989.00
6,988.50
6,988.00
6,987.50
6,987.00
6,986.50
6,986.00
6,985.50
6,985.00
6,984.50
6,984.00
6,983.50
6,983.00
6,982.50
6,982.00
6,981.50
6,981.00
6,980.50
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
280.0
300.0
320.0
340.0
360.0
380.0
400.0
420.0
440.0


EASTONVILLE 4 - 5-YR TAILWATER CONDITION
Label: 44 (78) (DP 11)
Type: Manhole
ID: 60
Label: MH-44(79)
Type: Manhole
ID: 243
Label: P-131
Type: Conduit
ID: 88
Label: DP2
Type: Outfall
ID: 242
Label: P-136
Type: Conduit
ID: 244
EGL
HGL
Elevation (ft)
Station (ft)
6,965.20
6,965.00
6,964.80
6,964.60
6,964.40
6,964.20
6,964.00
6,963.80
6,963.60
6,963.40
6,963.20
6,963.00
6,962.80
6,962.60
6,962.40
6,962.20
6,962.00
6,961.80
6,961.60
6,961.40
6,961.20
6,961.00
6,960.80
6,960.60
6,960.40
6,960.20
6,960.00
6,959.80
6,959.60
6,959.40
6,959.20
6,959.00
6,958.80
6,958.60
6,958.40
6,958.20
6,958.00
6,957.80
6,957.60
6,957.40
6,957.20
6,957.00
6,956.80
6,956.60
6,956.40
6,956.20
6,956.00
6,955.80
6,955.60
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
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

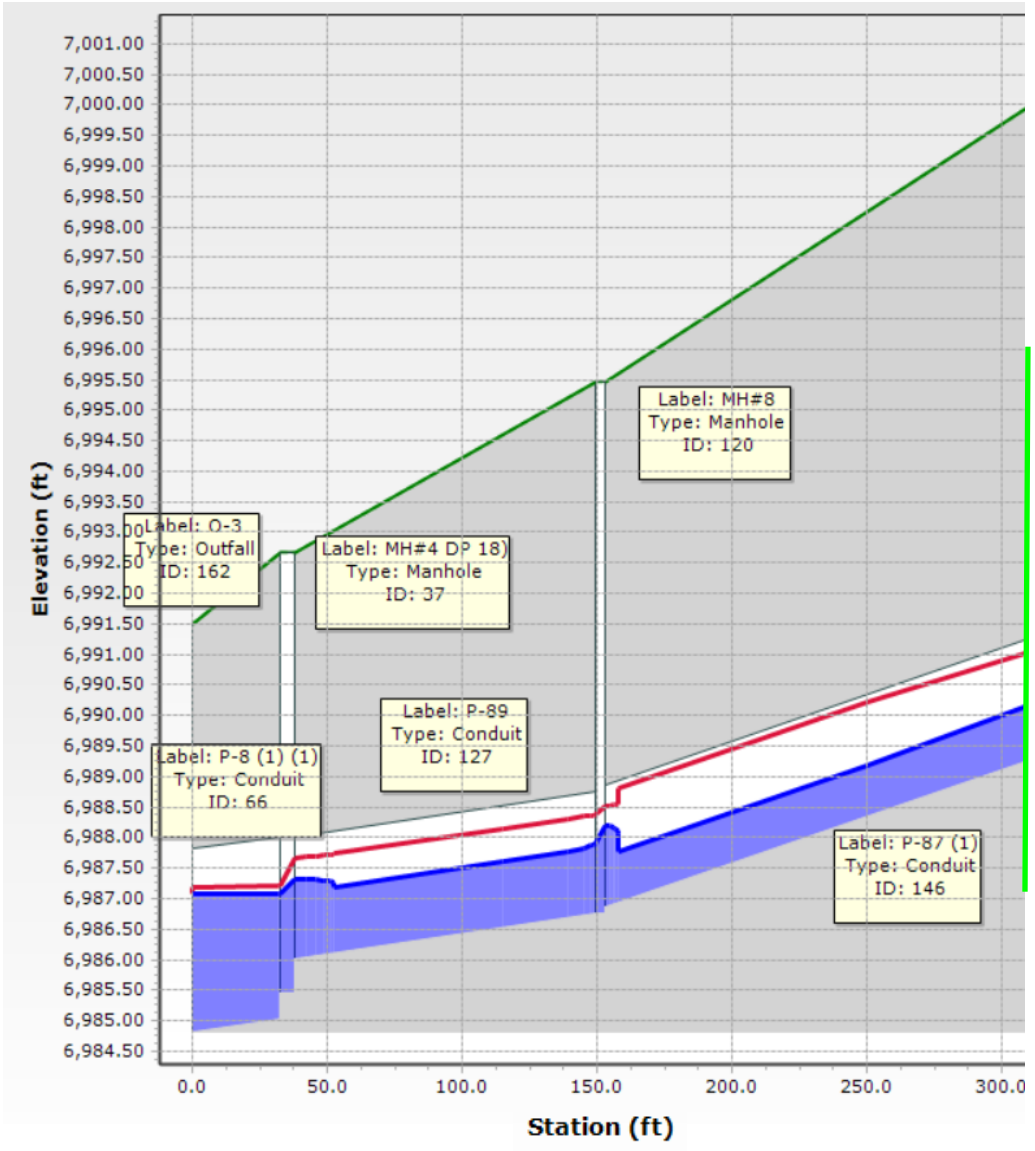


NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

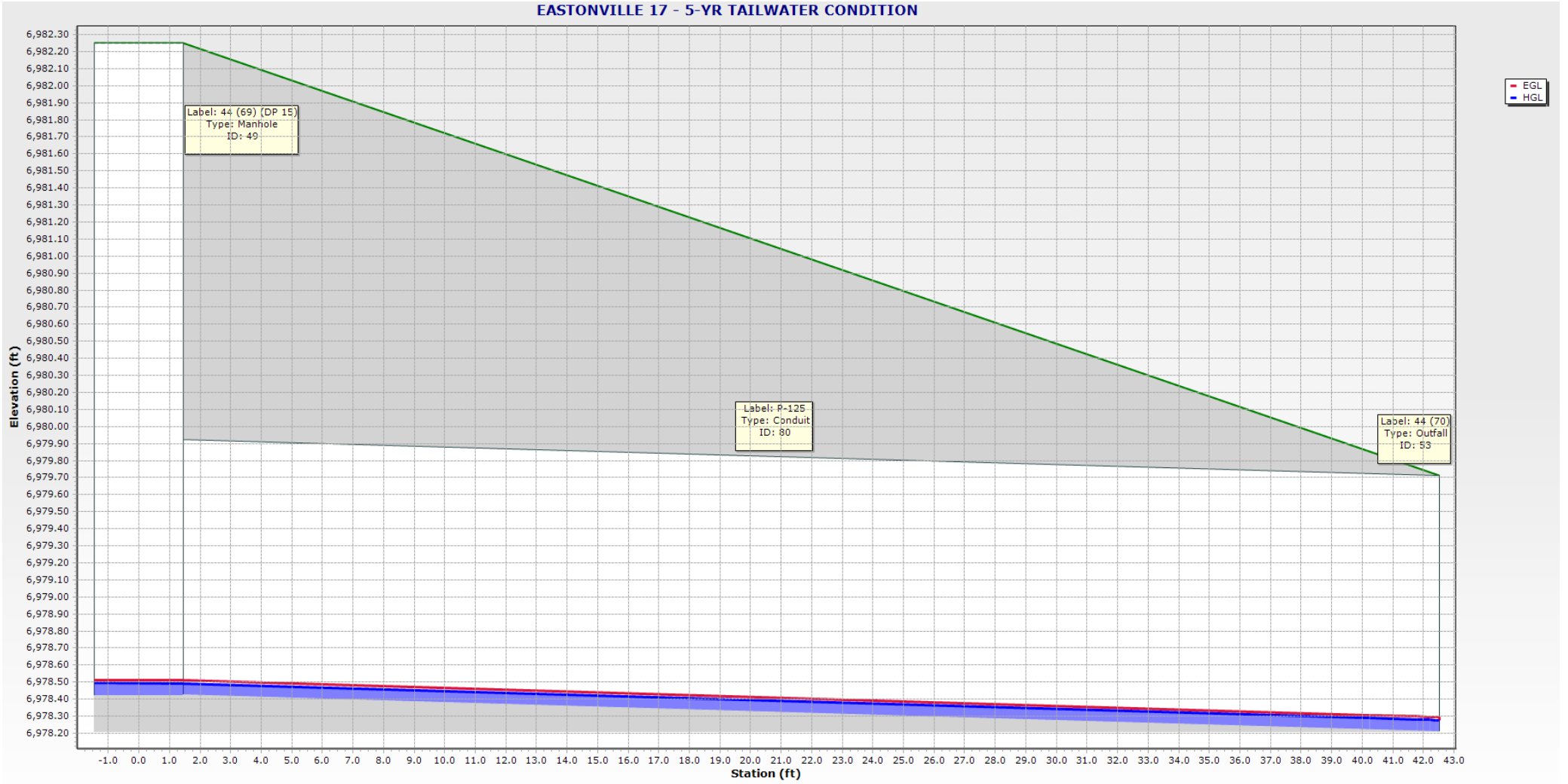


NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

EASTONVILLE 10 - 5-YR TAILWATER CONDITION



MATCHLINE REFER TO SEGMENT 2 FDR


EASTONVILLE 17 - 5-YR TAILWATER CONDITION
Elevation (ft)
6,982.30
6,982.20
6,982.10
6,982.00
6,981.90
6,981.80
6,981.70
6,981.60
6,981.50
6,981.40
6,981.30
6,981.20
6,981.10
6,981.00
6,980.90
6,980.80
6,980.70
6,980.60
6,980.50
6,980.40
6,980.30
6,980.20
6,980.10
6,980.00
6,979.90
6,979.80
6,979.70
6,979.60
6,979.50
6,979.40
6,979.30
6,979.20
6,979.10
6,979.00
6,978.90
6,978.80
6,978.70
6,978.60
6,978.50
6,978.40
6,978.30
6,978.20
Label: 44 (69) (DP 15)
Type: Manhole
ID: 49
Label: P-125
Type: Conduit
ID: 80
Label: 44 (70)
Type: Outfall
ID: 53
EGL
HGL
-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
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)
66: P-8 (1) (1)	MH#4 DP 18)	6,985.02	O-3	6,984.82	35.3	0.006	36.0	0.013	26.00	7.17	50.23	51.8	6,986.67	6,986.36
67: P-124	I#5 (DP 14)	6,983.07	O-5	6,981.82	52.9	0.024	18.0	0.013	5.60	8.31	16.15	34.7	6,983.98	6,982.44
69: P-18	I#3 (DP 7)	6,986.04	MH#7	6,985.68	71.3	0.005	42.0	0.013	53.60	8.15	71.48	75.0	6,988.34	6,988.30
70: P-20	MH#7	6,985.37	MH#6	6,983.61	175.6	0.010	42.0	0.013	53.60	10.63	100.73	53.2	6,987.66	6,986.34
71: P-5	I#1 (DP 16)	6,989.53	I#2 (DP 17)	6,989.27	52.7	0.005	18.0	0.013	5.20	4.52	7.38	70.5	6,990.51	6,990.40
72: P-8 (1)	I#2 (DP 17)	6,988.77	MH#4 DP 18)	6,986.02	147.0	0.019	24.0	0.013	10.30	8.86	30.94	33.3	6,989.92	6,987.84
73: P-21	MH#6	6,983.41	MH#5	6,982.59	82.2	0.010	42.0	0.013	53.60	10.61	100.49	53.3	6,985.70	6,985.32
74: P-22	MH#5	6,982.39	MH#3 (DP 8)	6,981.23	115.7	0.010	42.0	0.013	53.60	10.63	100.72	53.2	6,984.68	6,984.45
75: P-15	18 (DP 19)	6,983.25	MH#3 (DP 8)	6,983.03	30.8	0.007	18.0	0.013	2.90	4.50	8.88	32.7	6,984.46	6,984.45
76: P-15 (1)	MH#3 (DP 8)	6,981.03	MH#2 (DP 8)	6,980.65	75.1	0.005	42.0	0.013	57.20	8.26	71.57	79.9	6,983.73	6,983.60
77: P-16	MH#2 (DP 8)	6,980.55	MH#1	6,980.16	78.1	0.005	42.0	0.013	57.20	8.22	71.10	80.4	6,982.93	6,982.54
78: P-123	I#4 (DP 13)	6,983.43	I#5 (DP 14)	6,983.17	52.0	0.005	18.0	0.013	3.00	3.98	7.43	40.4	6,984.40	6,984.38
79: P-17	MH#1	6,980.06	OUTFALL	6,979.36	139.8	0.005	42.0	0.013	57.20	8.23	71.18	80.4	6,982.44	6,981.73
80: P-125	44 (69) (DP 15)	6,978.42	44 (70)	6,978.21	42.5	0.005	18.0	0.013	1.00	2.94	7.45	13.4	6,978.80	6,978.58
84: P-121	I#8 (DP 10)	6,964.14	O-6	6,963.31	166.4	0.005	24.0	0.013	13.90	5.73	15.98	87.0	6,965.58	6,964.65
85: P-130	I#6 (DP 1)	6,966.33	I#7 (DP 9)	6,965.90	21.3	0.020	18.0	0.013	3.60	6.95	14.93	24.1	6,967.81	6,967.79
87: P-121 (1)	I#7 (DP 9)	6,965.70	I#8 (DP 10)	6,964.64	53.0	0.020	18.0	0.013	9.30	8.87	14.86	62.6	6,966.88	6,966.10
88: P-131	44 (78) (DP 11)	6,960.12	MH-44(79)	6,958.89	245.4	0.005	18.0	0.013	4.60	4.43	7.44	61.9	6,960.97	6,959.86
127: P-89	MH#8	6,986.76	MH#4 DP 18)	6,986.02	116.1	0.006	24.0	0.013	19.90	6.33	18.06	110.2	6,988.65	6,987.84
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	6,989.07
244: P-136	MH-44(79)	6,958.69	DP2	6,955.81	373.7	0.008	18.0	0.013	4.60	5.22	9.22	49.9	6,959.51	6,956.56

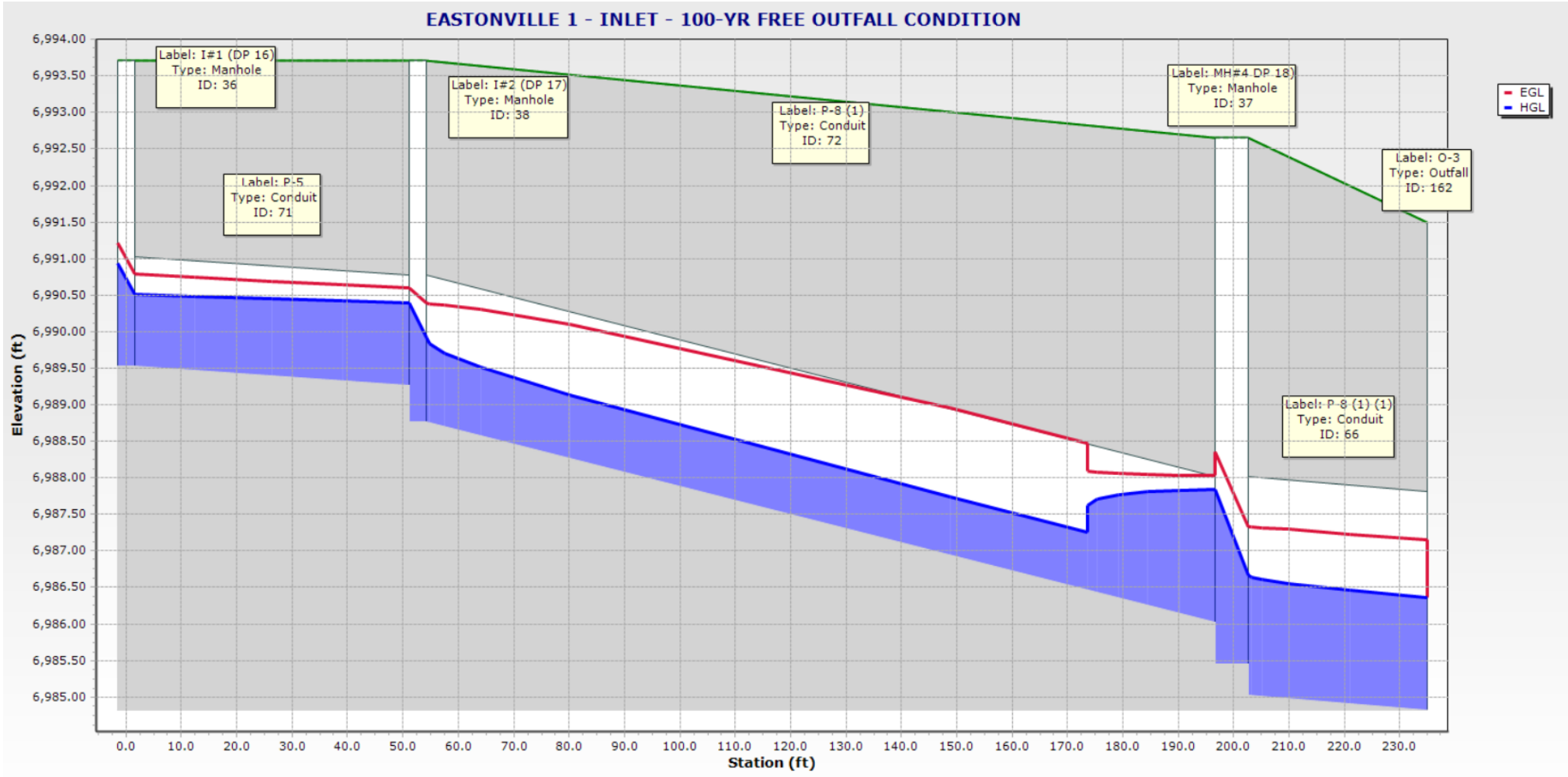
NOTE: SEE PROFILES FOR PIPES STUDIED WITH THIS ANALYSIS

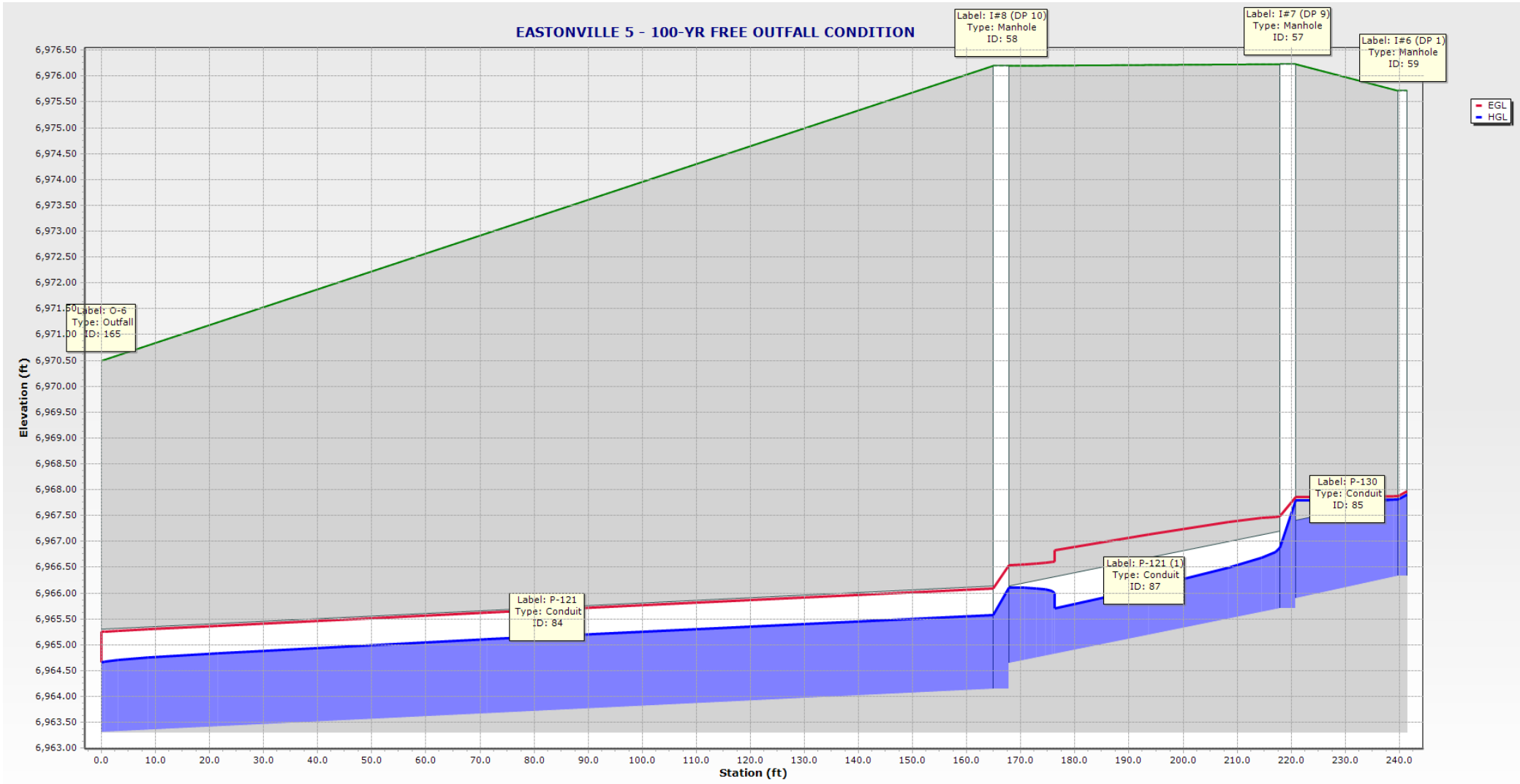
100 YEAR FREE OUTFALL CONDITION: STRUCTURE SUMMARY TABLE

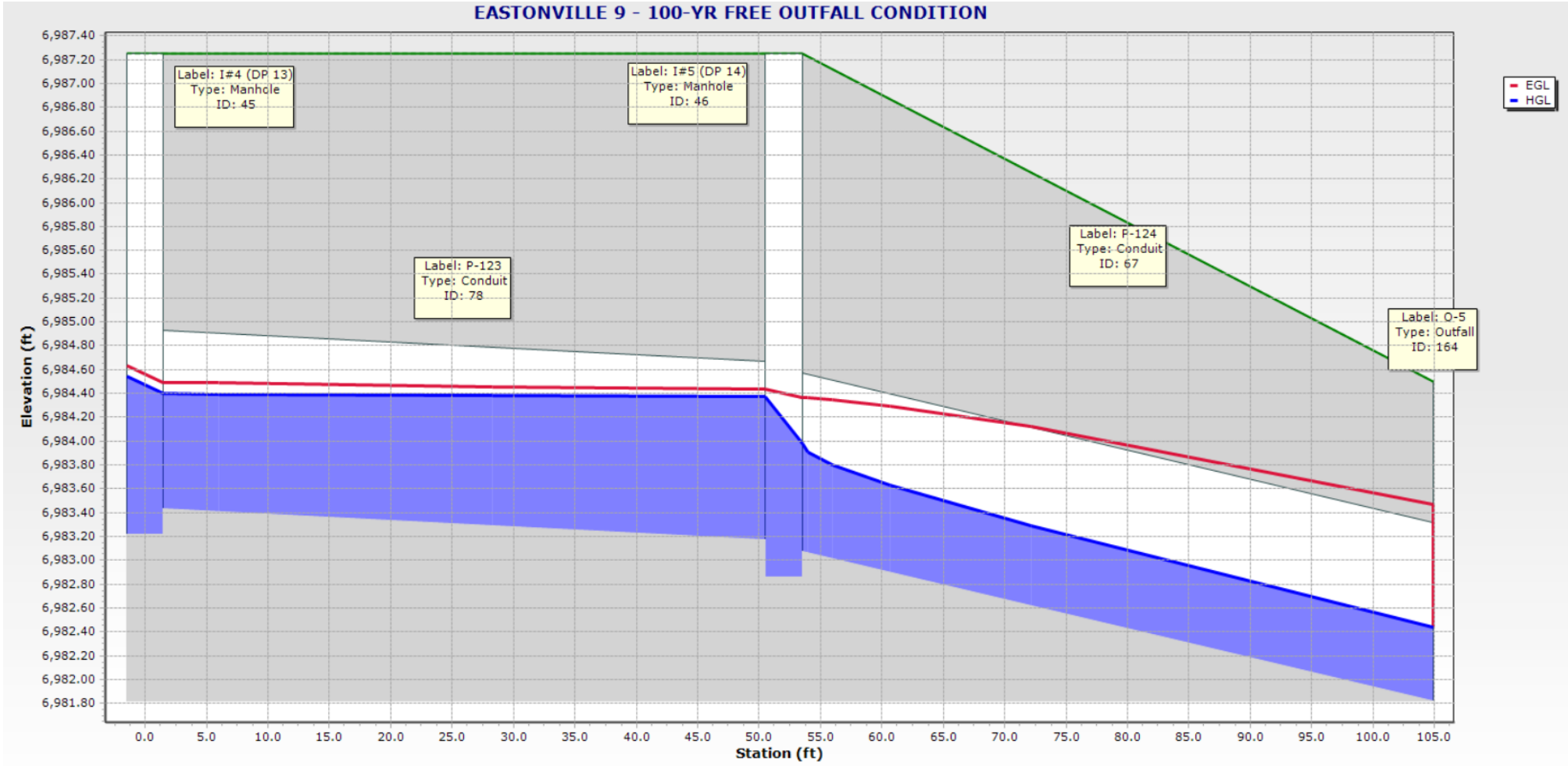
	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)
35: MH#7	6,993.84	6,993.84	6,985.68	53.60	6,987.66	Standard	6,988.30
36: I#1 (DP 16	6,993.71	6,993.71	(N/A)	5.20	6,990.51	Standard	6,990.93
37: MH#4 DP	6,992.66	6,992.66	6,986.02	26.00	6,986.67	Standard	6,987.84
38: I#2 (DP 17	6,993.71	6,993.71	6,989.27	10.30	6,989.92	Standard	6,990.40
39: MH#6	6,992.82	6,992.82	6,983.61	53.60	6,985.70	Standard	6,986.34
40: MH#5	6,991.57	6,991.57	6,982.59	53.60	6,984.68	Standard	6,985.32
41: MH#3 (DP	6,990.99	6,990.99	6,981.23	57.20	6,983.73	Standard	6,984.45
42: I#3 (DP 7)	6,991.04	6,991.04	(N/A)	53.60	6,988.34	Standard	6,989.83
43: 18 (DP 19)	6,988.70	6,988.70	(N/A)	2.90	6,984.46	Standard	6,984.54
44: MH#2 (DP	6,985.73	6,985.73	6,980.65	57.20	6,982.93	Standard	6,983.60
45: I#4 (DP 13	6,987.25	6,987.25	(N/A)	3.00	6,984.40	Standard	6,984.54
46: I#5 (DP 14	6,987.25	6,987.25	6,983.17	5.60	6,983.98	Standard	6,984.38
47: MH#1	6,985.33	6,985.33	6,980.16	57.20	6,982.44	Standard	6,982.54
49: 44 (69) (D	6,982.25	6,982.25	(N/A)	1.00	6,978.80	Standard	6,978.81
57: I#7 (DP 9)	6,976.23	6,976.23	6,965.90	9.30	6,966.88	Standard	6,967.79
58: I#8 (DP 10	6,976.19	6,976.19	6,964.64	13.90	6,965.58	Standard	6,966.10
59: I#6 (DP 1)	6,975.72	6,975.72	(N/A)	3.60	6,967.81	Standard	6,967.91
60: 44 (78) (D	6,965.00	6,965.00	(N/A)	4.60	6,960.97	Standard	6,961.43
120: MH#8	6,995.46	6,995.46	6,986.86	19.90	6,988.65	Standard	6,989.07
243: MH-44(79	6,963.81	6,963.81	6,958.89	4.60	6,959.51	Standard	6,959.86

	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
48: OUTFALL	6,984.45	6,979.36	Free Outfall		6,981.73	57.20
53: 44 (70)	6,979.71	6,978.21	Free Outfall		6,978.58	1.00
162: O-3	6,991.50	6,984.82	Free Outfall		6,986.36	26.00
164: O-5	6,984.50	6,981.82	Free Outfall		6,982.44	5.60
165: O-6	6,970.50	6,963.31	Free Outfall		6,964.65	13.90
242: DP2	6,957.52	6,955.81	Free Outfall		6,956.56	4.60

NOTE: SEE PROFILES FOR PIPES STUDIED WITH THIS ANALYSIS


EASTONVILLE 1 - INLET - 100-YR FREE OUTFALL CONDITION
Label: I#1 (DP 16)
Type: Manhole
ID: 36
Label: I#2 (DP 17)
Type: Manhole
ID: 38
Label: P-8 (1)
Type: Conduit
ID: 72
Label: MH#4 DP 18)
Type: Manhole
ID: 37
Label: O-3
Type: Outfall
ID: 162
Label: P-5
Type: Conduit
ID: 71
Label: P-8 (1) (1)
Type: Conduit
ID: 66
EGL
HGL
Elevation (ft)
Station (ft)
6,994.00
6,993.50
6,993.00
6,992.50
6,992.00
6,991.50
6,991.00
6,990.50
6,990.00
6,989.50
6,989.00
6,988.50
6,988.00
6,987.50
6,987.00
6,986.50
6,986.00
6,985.50
6,985.00
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
210.0
220.0
230.0


EASTONVILLE 5 - 100-YR FREE OUTFALL CONDITION
Label: I#8 (DP 10)
Type: Manhole
ID: 58
Label: I#7 (DP 9)
Type: Manhole
ID: 57
Label: I#6 (DP 1)
Type: Manhole
ID: 59
EGL
HGL
Label: O-6
Type: Outfall
ID: 165
Label: P-121
Type: Conduit
ID: 84
Label: P-121 (1)
Type: Conduit
ID: 87
Label: P-130
Type: Conduit
ID: 85
Elevation (ft)
6,976.50
6,976.00
6,975.50
6,975.00
6,974.50
6,974.00
6,973.50
6,973.00
6,972.50
6,972.00
6,971.50
6,971.00
6,970.50
6,970.00
6,969.50
6,969.00
6,968.50
6,968.00
6,967.50
6,967.00
6,966.50
6,966.00
6,965.50
6,965.00
6,964.50
6,964.00
6,963.50
6,963.00
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
210.0
220.0
230.0
240.0
Station (ft)


EASTONVILLE 9 - 100-YR FREE OUTFALL CONDITION
Label: I#4 (DP 13)
Type: Manhole
ID: 45
Label: I#5 (DP 14)
Type: Manhole
ID: 46
Label: P-123
Type: Conduit
ID: 78
Label: P-124
Type: Conduit
ID: 67
Label: O-5
Type: Outfall
ID: 164
EGL
HGL
Elevation (ft)
Station (ft)
6,987.40
6,987.20
6,987.00
6,986.80
6,986.60
6,986.40
6,986.20
6,986.00
6,985.80
6,985.60
6,985.40
6,985.20
6,985.00
6,984.80
6,984.60
6,984.40
6,984.20
6,984.00
6,983.80
6,983.60
6,983.40
6,983.20
6,983.00
6,982.80
6,982.60
6,982.40
6,982.20
6,982.00
6,981.80
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

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)
66: P-8 (1) (1)	MH#4 DP 18)	6,985.02	O-3	6,984.82	35.3	0.006	36.0	0.013	15.50	6.26	50.23	30.9	6,986.28	6,985.97
67: P-124	I#5 (DP 14)	6,983.07	O-5	6,981.82	52.9	0.024	18.0	0.013	3.30	7.18	16.15	20.4	6,983.76	6,982.28
69: P-18	I#3 (DP 7)	6,986.04	MH#7	6,985.68	71.3	0.005	42.0	0.013	8.00	4.91	71.48	11.2	6,986.89	6,986.47
70: P-20	MH#7	6,985.37	MH#6	6,983.61	175.6	0.010	42.0	0.013	8.00	6.26	100.73	7.9	6,986.22	6,984.28
71: P-5	I#1 (DP 16)	6,989.53	I#2 (DP 17)	6,989.27	52.7	0.005	18.0	0.013	3.10	3.99	7.38	42.0	6,990.21	6,989.99
72: P-8 (1)	I#2 (DP 17)	6,988.77	MH#4 DP 18)	6,986.02	147.0	0.019	24.0	0.013	6.20	7.69	30.94	20.0	6,989.65	6,986.63
73: P-21	MH#6	6,983.41	MH#5	6,982.59	82.2	0.010	42.0	0.013	8.00	6.25	100.49	8.0	6,984.26	6,983.26
74: P-22	MH#5	6,982.39	MH#3 (DP 8)	6,981.23	115.7	0.010	42.0	0.013	8.00	6.26	100.72	7.9	6,983.24	6,982.24
75: P-15	18 (DP 19)	6,983.25	MH#3 (DP 8)	6,983.03	30.8	0.007	18.0	0.013	0.30	2.33	8.88	3.4	6,983.45	6,983.22
76: P-15 (1)	MH#3 (DP 8)	6,981.03	MH#2 (DP 8)	6,980.65	75.1	0.005	42.0	0.013	9.20	5.12	71.57	12.9	6,981.95	6,981.68
77: P-16	MH#2 (DP 8)	6,980.55	MH#1	6,980.16	78.1	0.005	42.0	0.013	9.20	5.09	71.10	12.9	6,981.47	6,981.01
78: P-123	I#4 (DP 13)	6,983.43	I#5 (DP 14)	6,983.17	52.0	0.005	18.0	0.013	1.80	3.46	7.43	24.2	6,984.04	6,984.03
79: P-17	MH#1	6,980.06	OUTFALL	6,979.36	139.8	0.005	42.0	0.013	9.20	5.10	71.18	12.9	6,980.98	6,980.21
80: P-125	44 (69) (DP 15)	6,978.42	44 (70)	6,978.21	42.5	0.005	18.0	0.013	0.06	1.27	7.45	0.8	6,978.52	6,978.30
84: P-121	I#8 (DP 10)	6,964.14	O-6	6,963.31	166.4	0.005	24.0	0.013	5.40	4.59	15.98	33.8	6,964.96	6,964.11
85: P-130	I#6 (DP 1)	6,966.33	I#7 (DP 9)	6,965.90	21.3	0.020	18.0	0.013	0.50	3.91	14.93	3.3	6,966.78	6,966.79
87: P-121 (1)	I#7 (DP 9)	6,965.70	I#8 (DP 10)	6,964.64	53.0	0.020	18.0	0.013	3.30	6.76	14.86	22.2	6,966.39	6,965.12
88: P-131	44 (78) (DP 11)	6,960.12	MH-44(79)	6,958.89	245.4	0.005	18.0	0.013	0.40	2.24	7.44	5.4	6,960.36	6,959.12
127: P-89	MH#8	6,986.76	MH#4 DP 18)	6,986.02	116.1	0.006	24.0	0.013	10.20	5.92	18.06	56.5	6,987.90	6,987.10
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
244: P-136	MH-44(79)	6,958.69	DP2	6,955.81	373.7	0.008	18.0	0.013	0.40	2.60	9.22	4.3	6,958.92	6,956.02

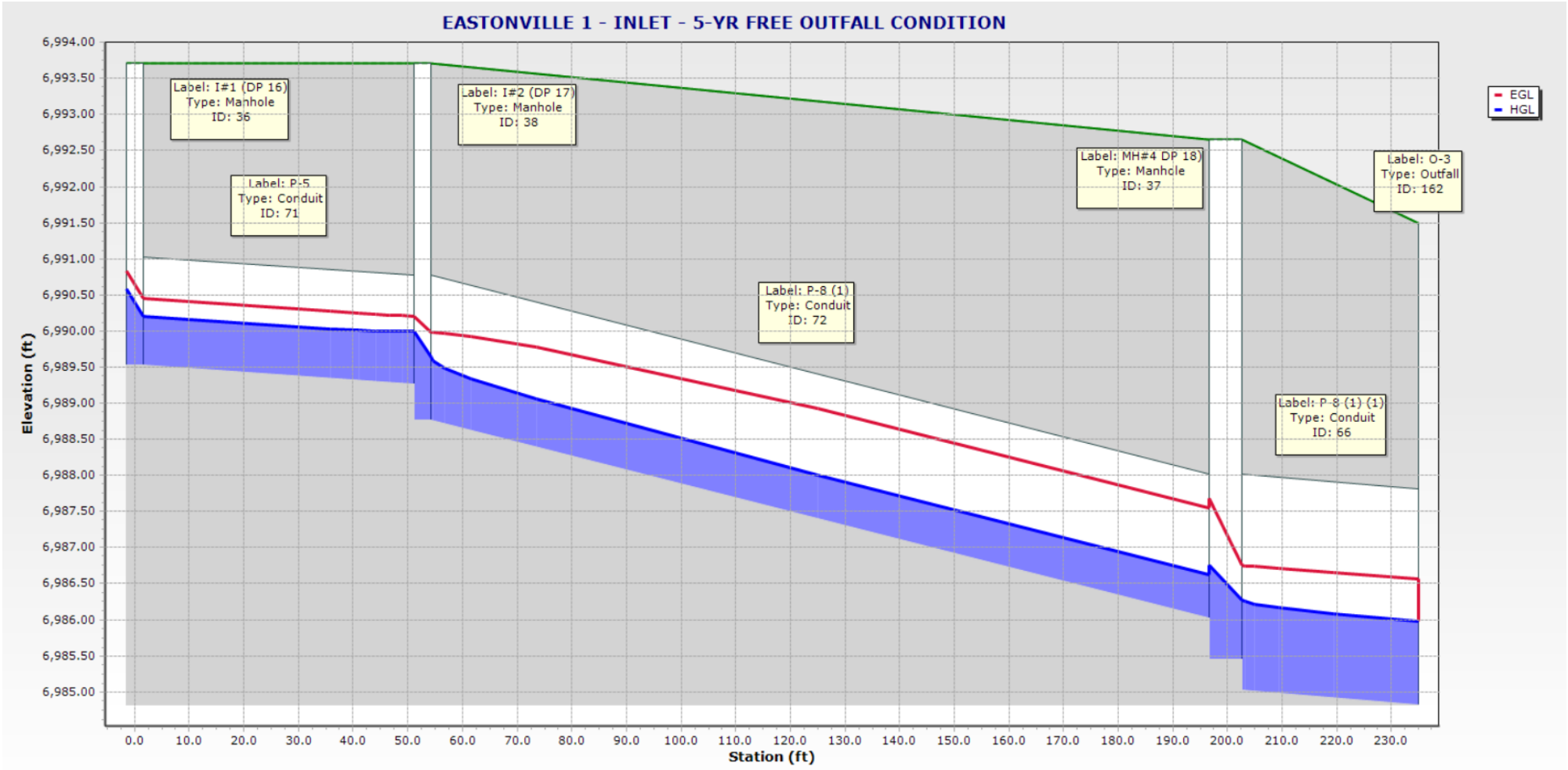
NOTE: SEE PROFILES FOR PIPES STUDIED WITH THIS ANALYSIS

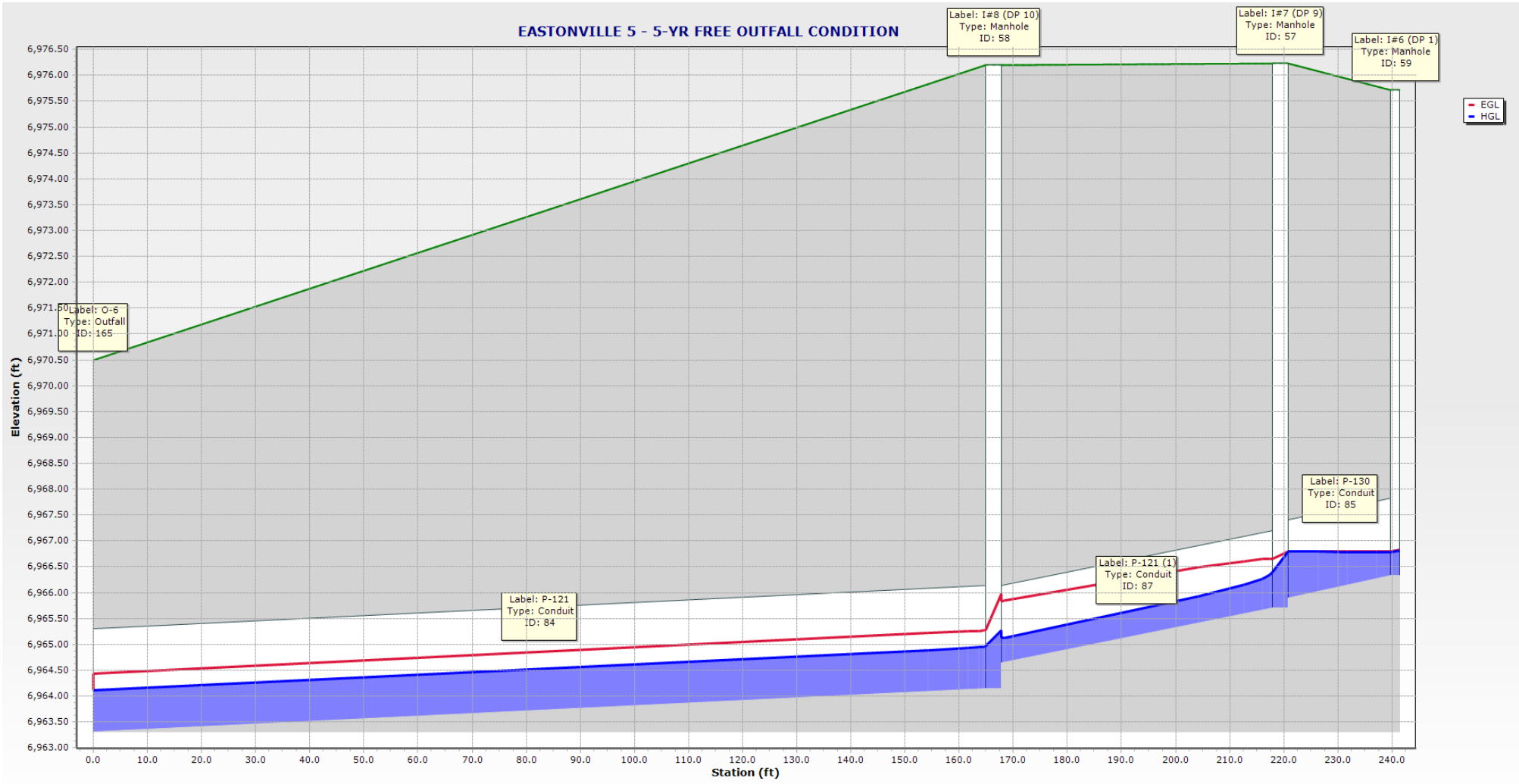
5 YEAR FREE OUTFALL CONDITION: STRUCTURE SUMMARY TABLE

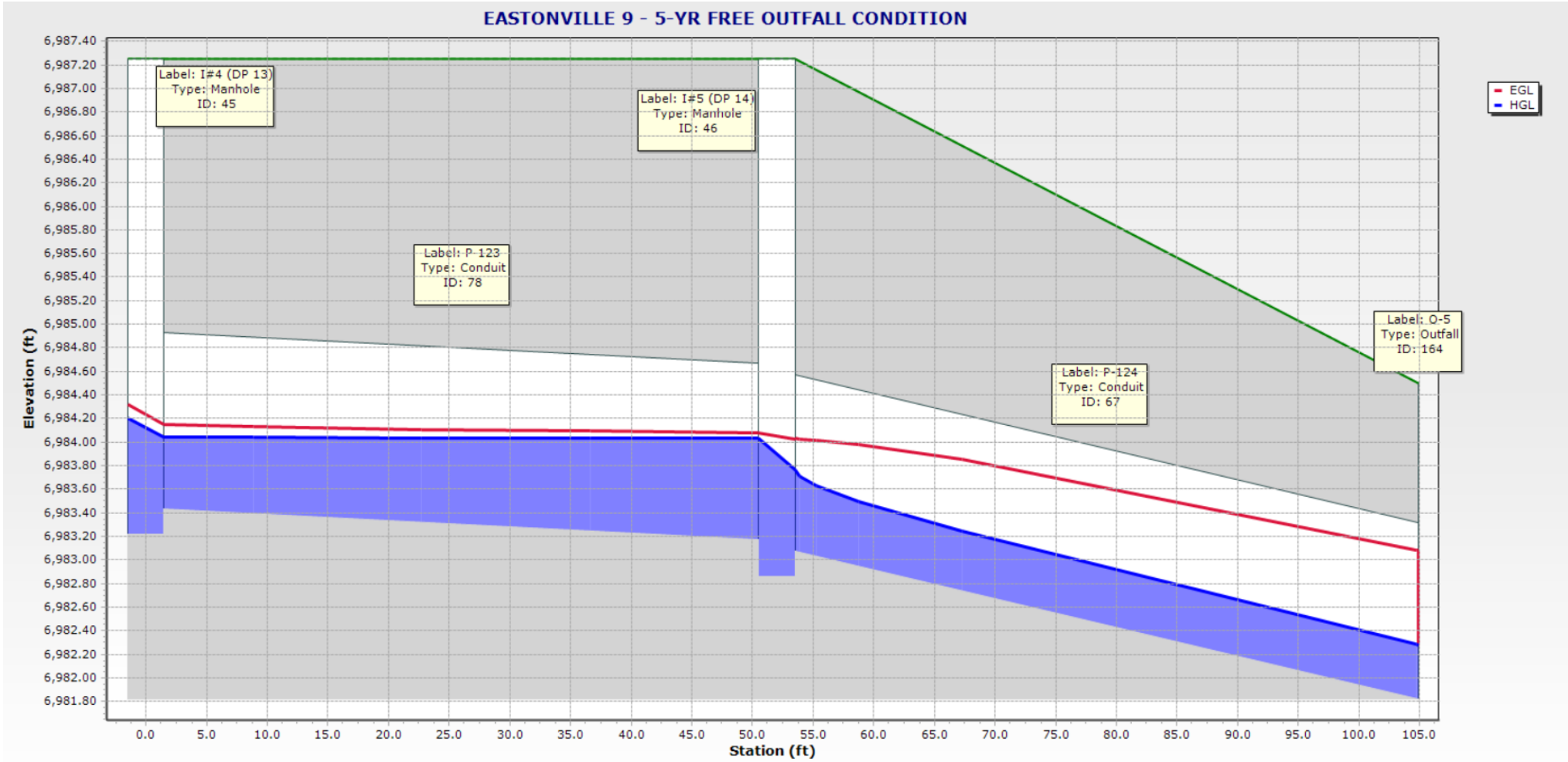
	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)
35: MH#7	6,993.84	6,993.84	6,985.68	8.00	6,986.22	Standard	6,986.42
36: I#1 (DP 16	6,993.71	6,993.71	(N/A)	3.10	6,990.21	Standard	6,990.58
37: MH#4 DP	6,992.66	6,992.66	6,986.02	15.50	6,986.28	Standard	6,986.76
38: I#2 (DP 17	6,993.71	6,993.71	6,989.27	6.20	6,989.65	Standard	6,989.99
39: MH#6	6,992.82	6,992.82	6,983.61	8.00	6,984.26	Standard	6,984.46
40: MH#5	6,991.57	6,991.57	6,982.59	8.00	6,983.24	Standard	6,983.44
41: MH#3 (DP	6,990.99	6,990.99	6,981.23	9.20	6,981.95	Standard	6,982.24
42: I#3 (DP 7)	6,991.04	6,991.04	(N/A)	8.00	6,986.89	Standard	6,987.35
43: 18 (DP 19)	6,988.70	6,988.70	(N/A)	0.30	6,983.45	Standard	6,983.56
44: MH#2 (DP	6,985.73	6,985.73	6,980.65	9.20	6,981.47	Standard	6,981.68
45: I#4 (DP 13	6,987.25	6,987.25	(N/A)	1.80	6,984.04	Standard	6,984.21
46: I#5 (DP 14	6,987.25	6,987.25	6,983.17	3.30	6,983.76	Standard	6,984.03
47: MH#1	6,985.33	6,985.33	6,980.16	9.20	6,980.98	Standard	6,981.01
49: 44 (69) (D	6,982.25	6,982.25	(N/A)	0.06	6,978.52	Standard	6,978.52
57: I#7 (DP 9)	6,976.23	6,976.23	6,965.90	3.30	6,966.39	Standard	6,966.79
58: I#8 (DP 10	6,976.19	6,976.19	6,964.64	5.40	6,964.96	Standard	6,965.27
59: I#6 (DP 1)	6,975.72	6,975.72	(N/A)	0.50	6,966.78	Standard	6,966.81
60: 44 (78) (D	6,965.00	6,965.00	(N/A)	0.40	6,960.36	Standard	6,960.47
120: MH#8	6,995.46	6,995.46	6,986.86	10.20	6,987.90	Standard	6,988.20
243: MH-44(79	6,963.81	6,963.81	6,958.89	0.40	6,958.92	Standard	6,959.01

	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
48: OUTFALL	6,984.45	6,979.36	Free Outfall		6,980.21	9.20
53: 44 (70)	6,979.71	6,978.21	Free Outfall		6,978.30	0.06
162: O-3	6,991.50	6,984.82	Free Outfall		6,985.97	15.50
164: O-5	6,984.50	6,981.82	Free Outfall		6,982.28	3.30
165: O-6	6,970.50	6,963.31	Free Outfall		6,964.11	5.40
242: DP2	6,957.52	6,955.81	Free Outfall		6,956.02	0.40

NOTE: SEE PROFILES FOR PIPES STUDIED WITH THIS ANALYSIS


EASTONVILLE 1 - INLET - 5-YR FREE OUTFALL CONDITION
Elevation (ft)
Station (ft)
6,994.00
6,993.50
6,993.00
6,992.50
6,992.00
6,991.50
6,991.00
6,990.50
6,990.00
6,989.50
6,989.00
6,988.50
6,988.00
6,987.50
6,987.00
6,986.50
6,986.00
6,985.50
6,985.00
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
210.0
220.0
230.0
Label: I#1 (DP 16)
Type: Manhole
ID: 36
Label: I#2 (DP 17)
Type: Manhole
ID: 38
Label: MH#4 DP 18)
Type: Manhole
ID: 37
Label: O-3
Type: Outfall
ID: 162
Label: P-5
Type: Conduit
ID: 71
Label: P-8 (1)
Type: Conduit
ID: 72
Label: P-8 (1) (1)
Type: Conduit
ID: 66
EGL
HGL


EASTONVILLE 5 - 5-YR FREE OUTFALL CONDITION
Label: I#8 (DP 10)
Type: Manhole
ID: 58
Label: I#7 (DP 9)
Type: Manhole
ID: 57
Label: I#6 (DP 1)
Type: Manhole
ID: 59
EGL
HGL
Label: O-6
Type: Outfall
ID: 165
Label: P-121
Type: Conduit
ID: 84
Label: P-121 (1)
Type: Conduit
ID: 87
Label: P-130
Type: Conduit
ID: 85
Elevation (ft)
Station (ft)
6,976.50
6,976.00
6,975.50
6,975.00
6,974.50
6,974.00
6,973.50
6,973.00
6,972.50
6,972.00
6,971.50
6,971.00
6,970.50
6,970.00
6,969.50
6,969.00
6,968.50
6,968.00
6,967.50
6,967.00
6,966.50
6,966.00
6,965.50
6,965.00
6,964.50
6,964.00
6,963.50
6,963.00
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
210.0
220.0
230.0
240.0


EASTONVILLE 9 - 5-YR FREE OUTFALL CONDITION
Elevation (ft)
6,987.40
6,987.20
6,987.00
6,986.80
6,986.60
6,986.40
6,986.20
6,986.00
6,985.80
6,985.60
6,985.40
6,985.20
6,985.00
6,984.80
6,984.60
6,984.40
6,984.20
6,984.00
6,983.80
6,983.60
6,983.40
6,983.20
6,983.00
6,982.80
6,982.60
6,982.40
6,982.20
6,982.00
6,981.80
Label: I#4 (DP 13)
Type: Manhole
ID: 45
Label: I#5 (DP 14)
Type: Manhole
ID: 46
Label: P-123
Type: Conduit
ID: 78
Label: P-124
Type: Conduit
ID: 67
Label: O-5
Type: Outfall
ID: 164
EGL
HGL
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
Station (ft)

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Aug 23 2024

DP3

Invert Elev Dn (ft)	=	6976.11
Pipe Length (ft)	=	160.34
Slope (%)	=	1.27
Invert Elev Up (ft)	=	6978.15
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

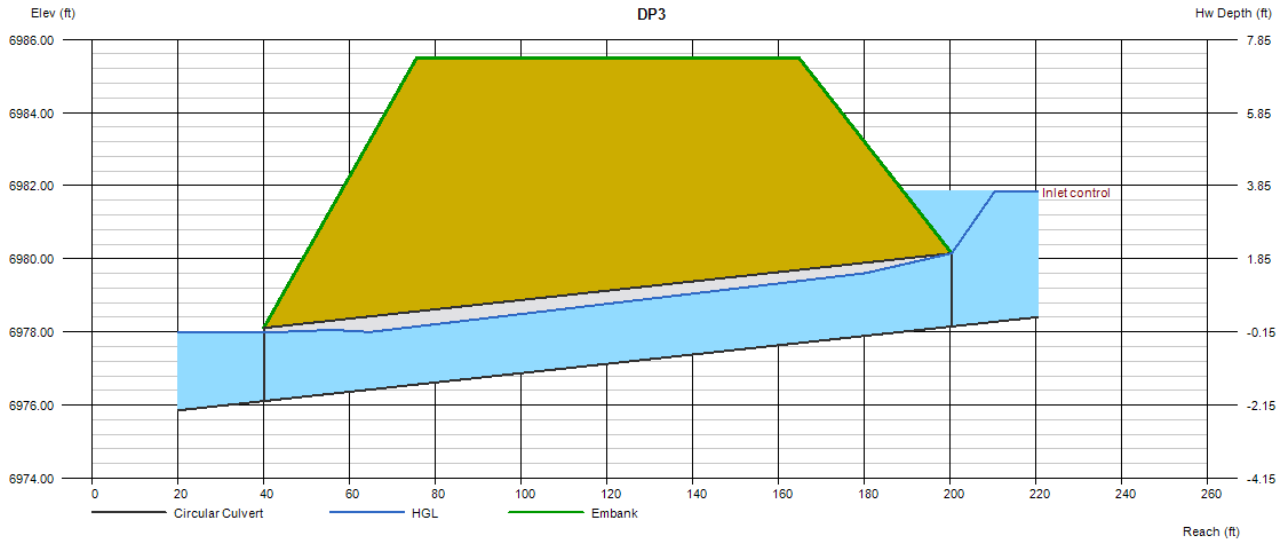
Top Elevation (ft)	=	6985.50
Top Width (ft)	=	89.00
Crest Width (ft)	=	15.00

Calculations

Qmin (cfs)	=	24.20
Qmax (cfs)	=	24.20
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	24.20
Qpipe (cfs)	=	24.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.92
Veloc Up (ft/s)	=	8.34
HGL Dn (ft)	=	6977.98
HGL Up (ft)	=	6979.89
Hw Elev (ft)	=	6981.84
Hw/D (ft)	=	1.84
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Aug 23 2024

Roadside Swale Capacity DP1

Triangular

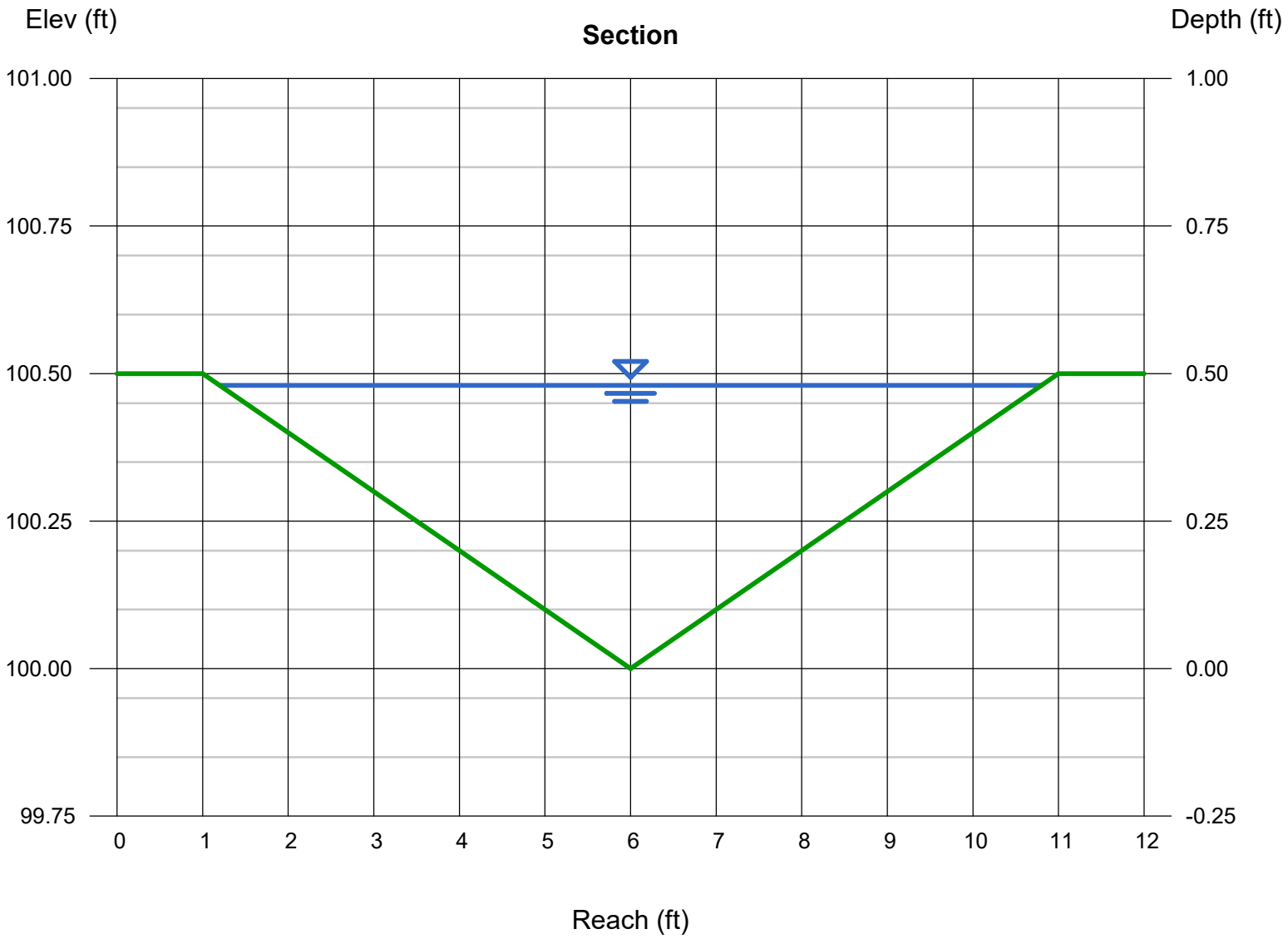
Side Slopes (z:1)	= 10.00, 10.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.60

Highlighted

Depth (ft)	= 0.48
Q (cfs)	= 3.600
Area (sqft)	= 2.30
Velocity (ft/s)	= 1.56
Wetted Perim (ft)	= 9.65
Crit Depth, Yc (ft)	= 0.39
Top Width (ft)	= 9.60
EGL (ft)	= 0.52



FROUDE NUMBER CALCULATIONS			CALCULATED BY:	SPC	DATE:	10/4/2024
PROJECT: EASTONVILLE RD SEGMENT 1			CHECKED BY:	CM		
Froude Number Calculations: 100-YR						
DP	Velocity	Gravitational Constant	Hydraulic depth	Xsectional Area	top Width	Froude #
-	ft/s	ft/s^2	ft	ft^2	ft	N/A
8.3	3.42	32.17	1.00	17.54	17.62	0.60
4	5.31	32.17	0.34	5.39	16.08	1.62
4-DOWNSTREAM	1.99	32.17	0.25	12.62	50.47	0.70
1	1.56	33.17	0.24	2.3	9.6	0.55
3	3.6	34.17	0.73	6.72	9.2	0.72
7	4.4	35.17	0.99	12.19	12.26	0.74

SHEAR STRESS & CHANNEL LININGS		CALCULATED BY:	SPC	DATE:	10/4/2024
PROJECT: EASTONVILLE RD SEGMENT 1		CHECKED BY:	CM		

Shear Stress Calculations: 100-YR				
DP	unit weight of water	Depth of flow	Slope	Shear Stress
-	lb/ft^3	ft	ft/ft	lb/ft^2
8.3	62.43	1.27	0.006	0.48
4	62.43	0.67	0.050	2.09
4-DOWNS	62.43	0.50	0.029	0.91
1	63.43	0.48	0.005	0.15
3	64.43	1.20	0.006	0.46
7	65.43	1.71	0.006	0.67

Channel Lining Determination					
Calculated Values			P300 Max Values		
DP	Shear Stress	Velocity	Shear Stress	Velocity	Lining Required
8.3	0.48	3.42	3	9	NO LINING RQD
4	2.09	5.31	3	9	P300
4-DOWNST	0.91	1.99	3	9	NO LINING RQD
1	0.15	1.56	3	9	NO LINING RQD
3	0.46	3.60	3	9	NO LINING RQD
7	0.67	4.40	3	9	NO LINING RQD

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Aug 23 2024

Roadside Swale Capacity DP3

Trapezoidal

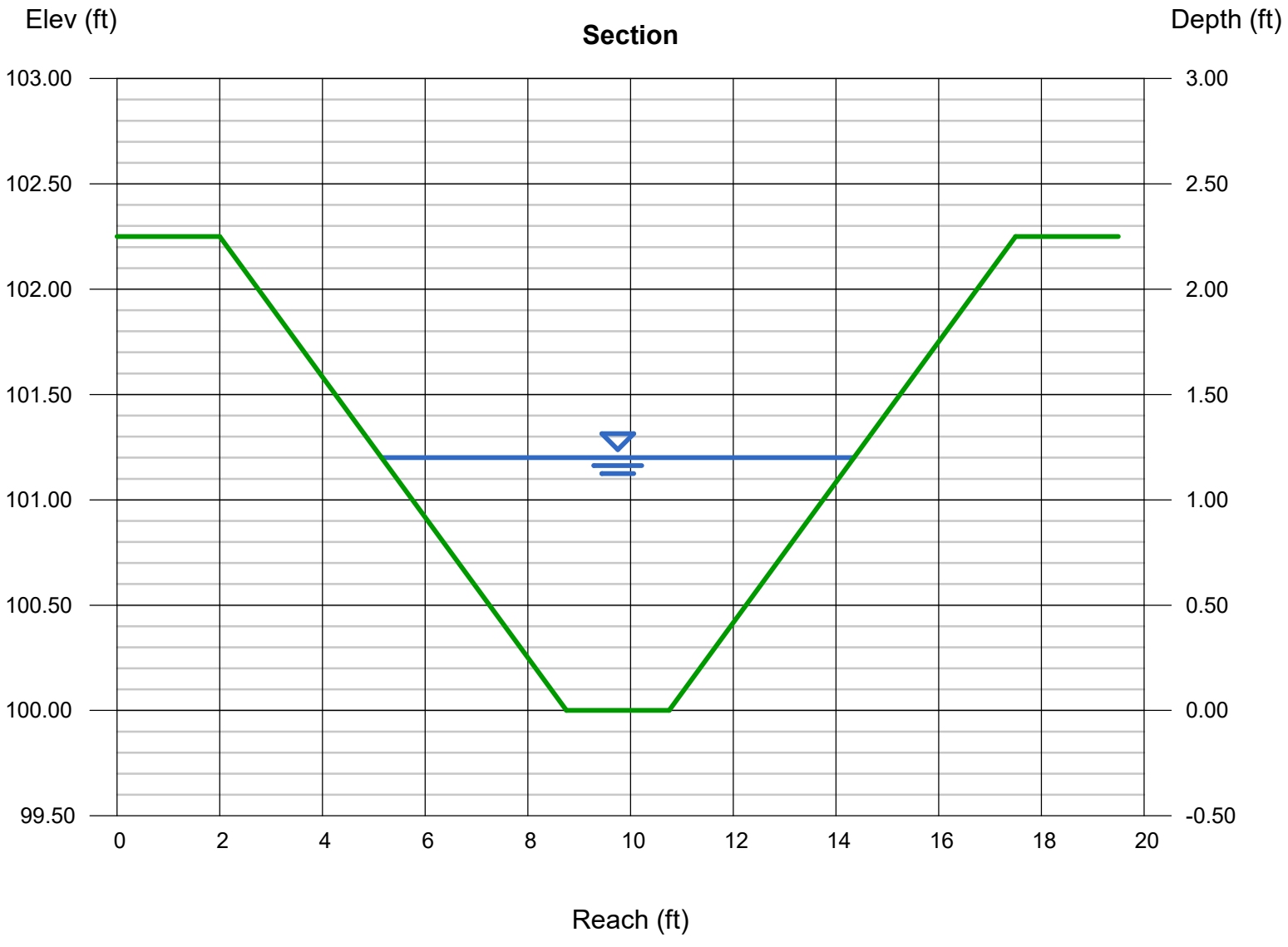
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.25
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cfs)	= 24.20

Highlighted

Depth (ft)	= 1.20
Q (cfs)	= 24.20
Area (sqft)	= 6.72
Velocity (ft/s)	= 3.60
Wetted Perim (ft)	= 9.59
Crit Depth, Yc (ft)	= 1.04
Top Width (ft)	= 9.20
EGL (ft)	= 1.40



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 1 2024

SFB A - OUTLET SWALE

Triangular

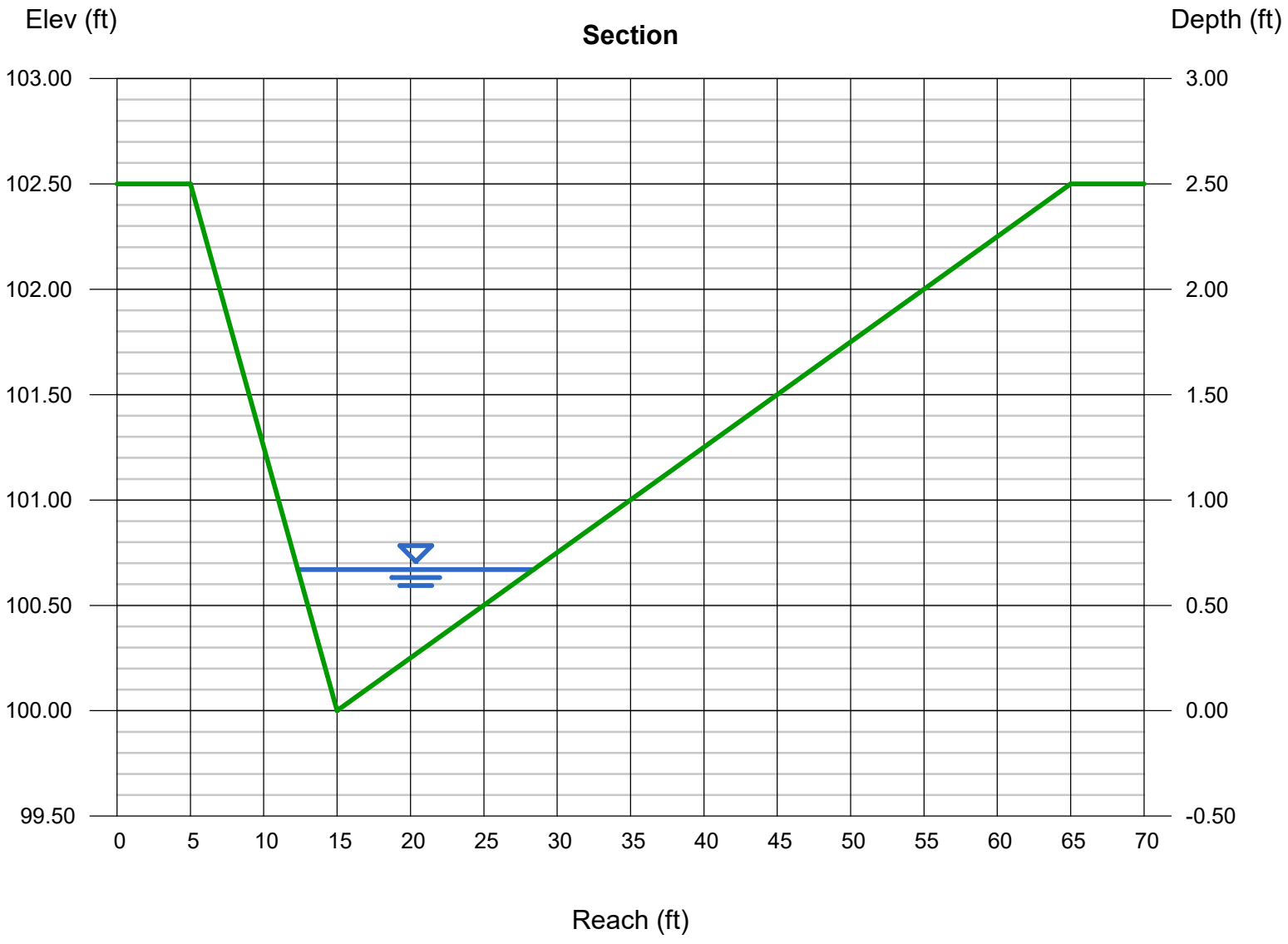
Side Slopes (z:1)	= 4.00, 20.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 100.00
Slope (%)	= 5.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 28.60

Highlighted

Depth (ft)	= 0.67
Q (cfs)	= 28.60
Area (sqft)	= 5.39
Velocity (ft/s)	= 5.31
Wetted Perim (ft)	= 16.18
Crit Depth, Yc (ft)	= 0.82
Top Width (ft)	= 16.08
EGL (ft)	= 1.11



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 2 2024

Larger Mannings N used for downstream channel area that appears to have more dense brush, weeds, and grass.

EX CHANNEL DOWNSTREAM OF DP 4

User-defined

Invert Elev (ft)	= 6971.51
Slope (%)	= 2.90
N-Value	= 0.050

Calculations

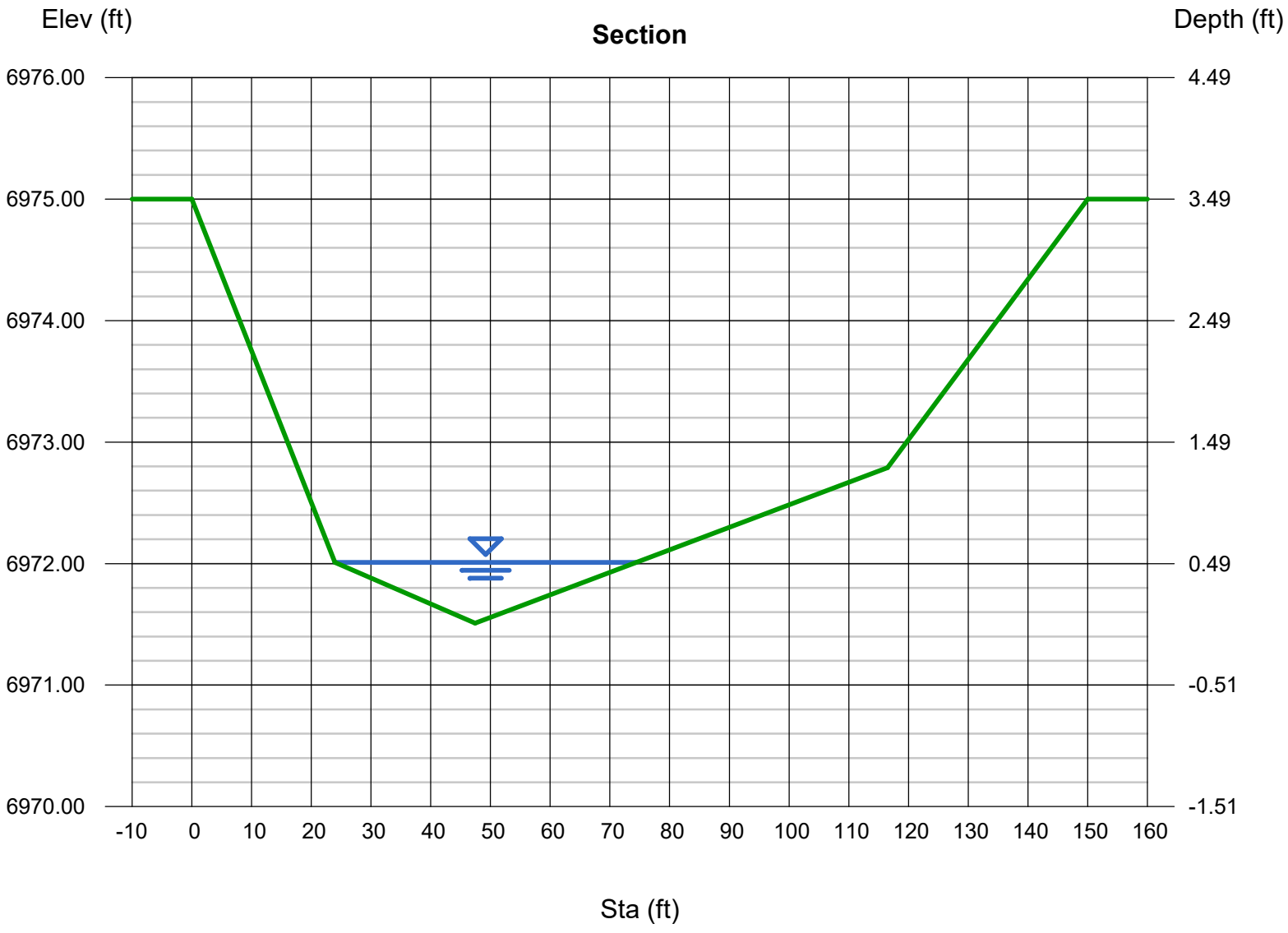
Compute by:	Known Q
Known Q (cfs)	= 25.10

Highlighted

Depth (ft)	= 0.50
Q (cfs)	= 25.10
Area (sqft)	= 12.62
Velocity (ft/s)	= 1.99
Wetted Perim (ft)	= 50.48
Crit Depth, Yc (ft)	= 0.44
Top Width (ft)	= 50.47
EGL (ft)	= 0.56

(Sta, El, n)-(Sta, El, n)...

(0.00, 6975.00)-(23.95, 6972.01, 0.050)-(47.45, 6971.51, 0.050)-(116.51, 6972.79, 0.050)-(150.00, 6975.00, 0.050)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Aug 23 2024

Roadside Swale Capacity DP7

Trapezoidal

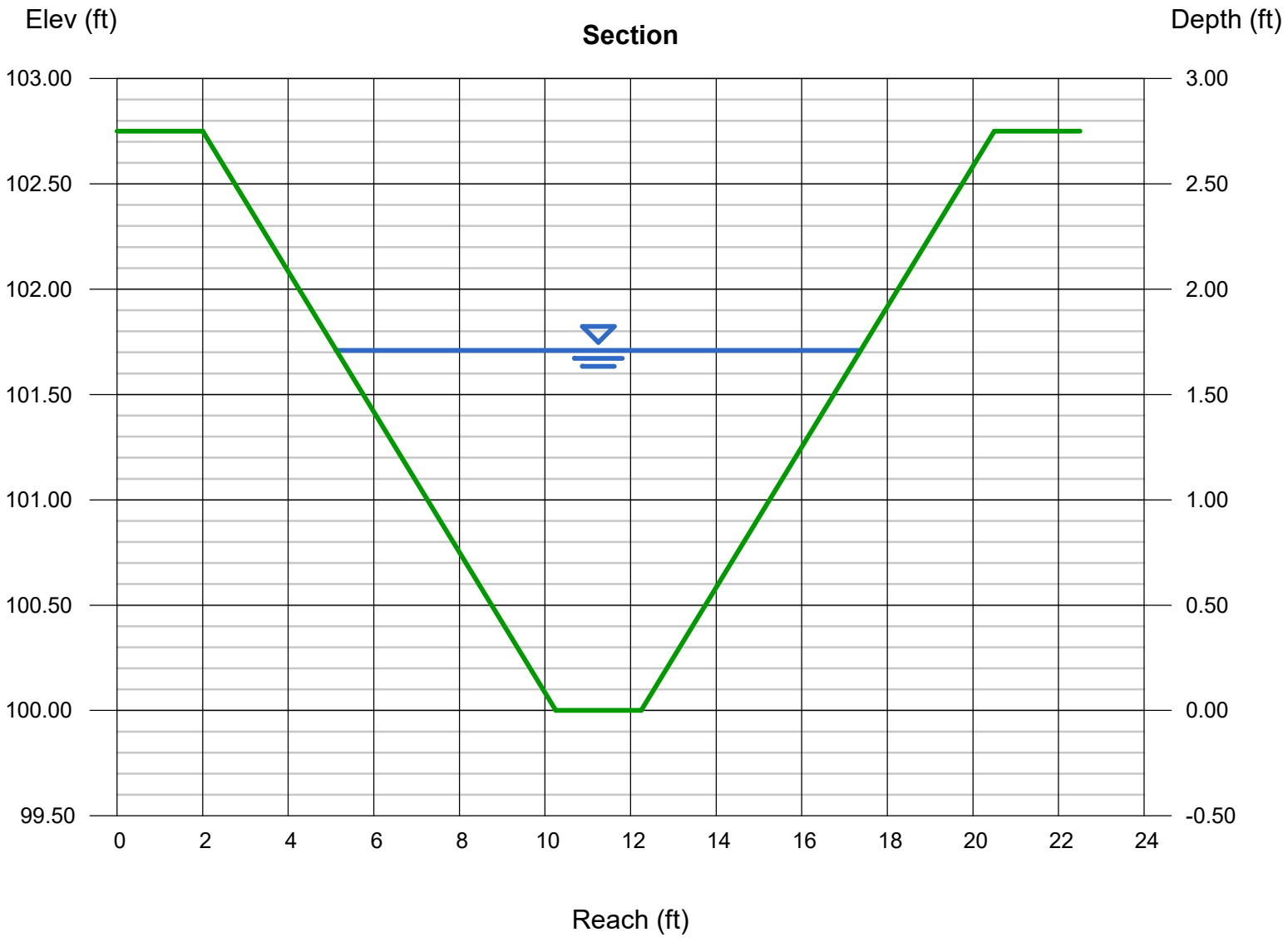
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.75
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cfs)	= 53.60

Highlighted

Depth (ft)	= 1.71
Q (cfs)	= 53.60
Area (sqft)	= 12.19
Velocity (ft/s)	= 4.40
Wetted Perim (ft)	= 12.81
Crit Depth, Yc (ft)	= 1.53
Top Width (ft)	= 12.26
EGL (ft)	= 2.01



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 1 2024

EDB B - OUTLET SWALE

Trapezoidal

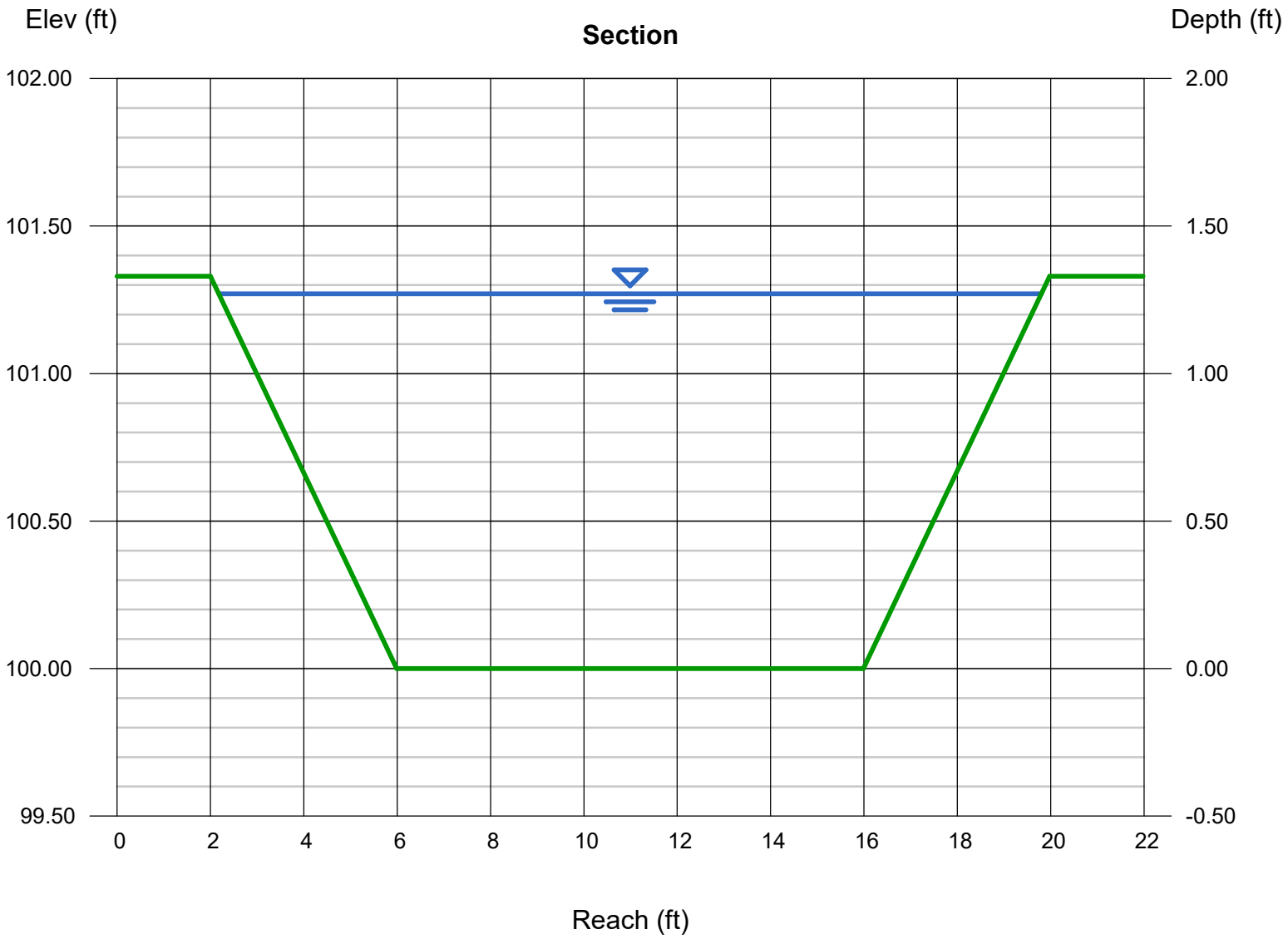
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.33
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 60.00

Highlighted

Depth (ft)	= 1.27
Q (cfs)	= 60.00
Area (sqft)	= 17.54
Velocity (ft/s)	= 3.42
Wetted Perim (ft)	= 18.03
Crit Depth, Yc (ft)	= 0.95
Top Width (ft)	= 17.62
EGL (ft)	= 1.45



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Mar 15 2024

EDB B Trickle Channel Capacity

Rectangular

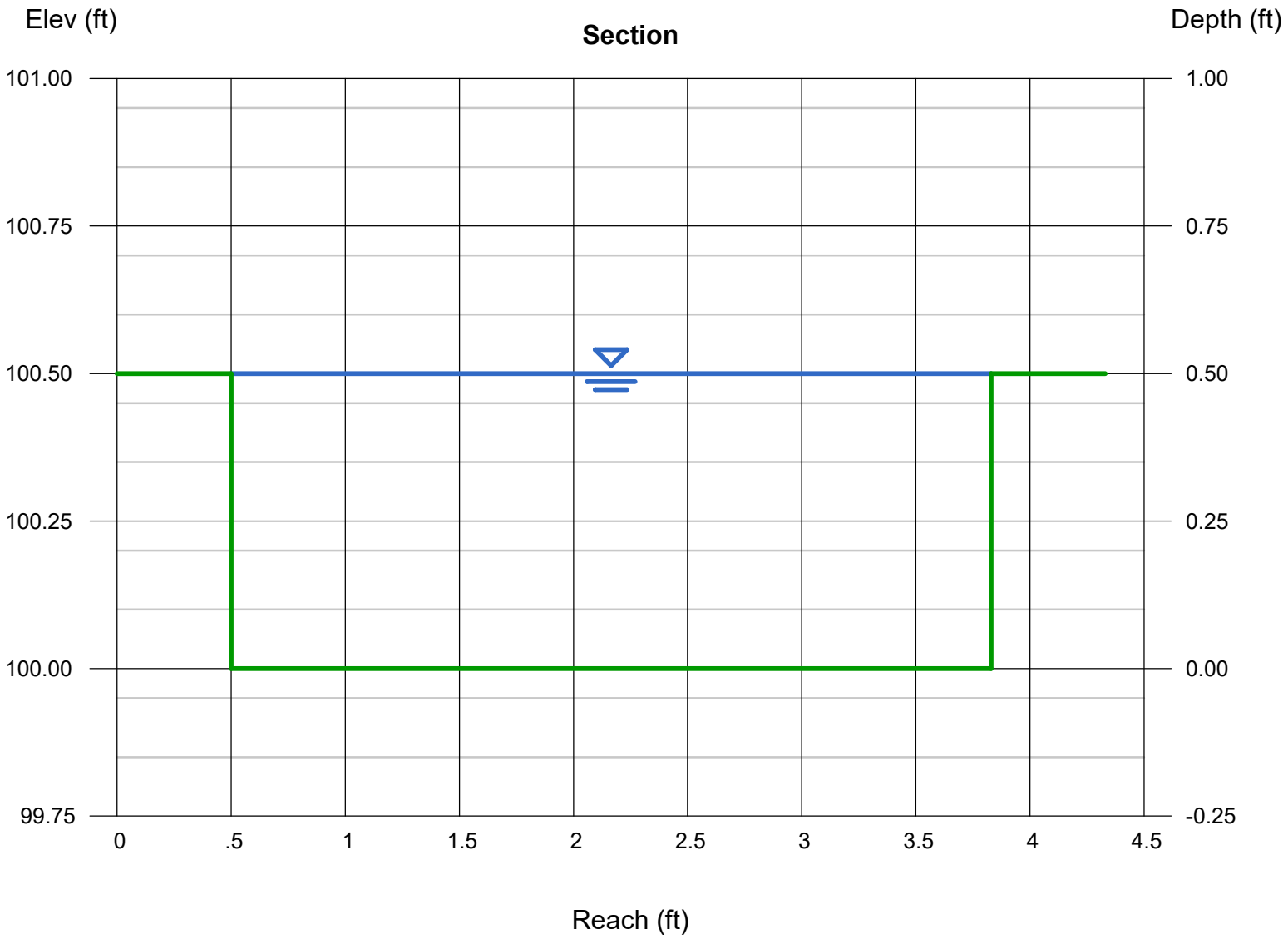
Bottom Width (ft)	= 3.33
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.012

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 0.50

Highlighted

Depth (ft)	= 0.50
Q (cfs)	= 7.707
Area (sqft)	= 1.67
Velocity (ft/s)	= 4.63
Wetted Perim (ft)	= 4.33
Crit Depth, Yc (ft)	= 0.50
Top Width (ft)	= 3.33
EGL (ft)	= 0.83



HRGreen	EASTONVILLE RD SEG 1	Calc'd by:	SPC
	201662.08	Checked by:	CM
	DP2 (SFB D OUTLET)	Date:	10/29/2024

Input Parameters		
Flow (Q)	4.6	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	6	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	1.67	
D_{50} =	2.08	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron (L_p) =	5	ft
Minimum Width of Apron (T) =	2	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

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

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

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)

Calculated minimum width of apron was calculated using Equations 9-14 in the USDCM Vol. 2

$$T = 2(L_p \tan\theta) + W$$ Equation 9-14

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. The minimum width of Apron (T) should not be less than the outlet pipe diameter.

HRGreen	EASTONVILLE RD SEG 1	Calc'd by:	SPC
	201662.08	Checked by:	CM
	DP4 (24" RCP CULVERT OUTLET)	Date:	10/29/2024

Input Parameters		
Flow (Q)	24.2	cfs
Tailwater depth (Y_t)	0.80	ft
Conduit Diameter (D_c)	24	in
Expansion Factor (per Fig. 9-35)	3.25	
Soil Type	Non-Cohesive Soils	

Unresolved: Summary table shows 28.6 cfs as flow at DP4.

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	4.28	
D_{50} =	7.09	in
UDFCD Riprap Type =	Type L	
Design D_{50} =	9	in
Minimum Mantle Thickness =	18	in
Minimum Length of Apron (L_p) =	14	ft
Minimum Width of Apron (T) =	7	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

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

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

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)

Calculated minimum width of apron was calculated using Equations 9-14 in the USDCM Vol. 2

$$T = 2(L_p \tan\theta) + W$$ Equation 9-14

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. The minimum width of Apron (T) should not be less than the outlet pipe diameter.

HRGreen	EASTONVILLE RD SEG 1	Calc'd by:	SPC
	201662.08	Checked by:	CM
	DP4 (SFB A OUTLET)	Date:	10/29/2024

Input Parameters		
Flow (Q)	1	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 ($Q/D^{2.5}$)	0.36	
D_{50} =	0.45	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron (L_p) =	5	ft
Minimum Width of Apron (T) =	6	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

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

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

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)

Calculated minimum width of apron was calculated using Equations 9-14 in the USDCM Vol. 2

$$T = 2(L_p \tan\theta) + W$$ Equation 9-14

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. The minimum width of Apron (T) should not be less than the outlet pipe diameter.

HRGreen	EASTONVILLE RD SEG 1	Calc'd by:	SPC
	201662.08	Checked by:	CM
	DP8.3 (EDB B Outlet)	Date:	10/29/2024

Input Parameters			
Flow (Q)	60	cfs	*ULTIMATE
Tailwater depth (Y_t)	1.40	ft	FLOW TO DP8
Conduit Diameter (D_c)	42	in	
Expansion Factor (per Fig. 9-35)	5		
Soil Type	Non-Cohesive Soils		

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	2.62	
D_{50} =	7.59	in
UDFCD Riprap Type =	Type L	
Design D_{50} =	9	in
Minimum Mantle Thickness =	18	in
Minimum Length of Apron (L_p) =	26	ft
Minimum Width of Apron (T) =	35	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

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

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

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)

Calculated minimum width of apron was calculated using Equations 9-14 in the USDCM Vol. 2

$$T = 2(L_p \tan\theta) + W$$ Equation 9-14

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. The minimum width of Apron (T) should not be less than the outlet pipe diameter.

	Riprap Sizing - Spillway				
	q (cfs/ft)	S (ft/ft)	C_f	n	D_{50} min. (in)
SFB-A	0.50	0.33	3	0.025	4.82
EDB-B	1.14	0.33	3	0.025	7.65
SFB-D	1.78	0.33	3	0.025	9.80

Type L Riprap (D_{50} = 9") will be utilized for the spillway protection for SFB A. Type L Riprap (D50 = 9") will be utilized for the spillway protection for EDB B.Type M Riprap (D50 = 12") will be utilized for the spillway protection for SFB D.

$$D_{50} = 5.23\ S^{0.43}\ (1.35 C_f\ q)^{0.56}$$ 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) **Sheet 1 of 2**

Designer: SPC
Company: HR Green
Date: October 2, 2024
Project: Eastonville Road - Segment 1 Improvements SFB A
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 = 53.0 %

B) Tributary Area's Imperviousness Ratio (i = I_a/100)
i = 0.530

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 = 68,825 sq ft

E) Water Quality Capture Volume (WQCV) Design Volume
V_{WQCV} = WQCV / 12 * Area
V_{WQCV} = cu ft

F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
d_6 = 0.42 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)
$V_{WQCV\ USER}$ = 662 cu ft

2. Basin Geometry

A) WQCV Depth
D_{WQCV} = 0.4 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} = 456 sq ft

D) Actual Filter Area
✓ A_{Actual} = 902 sq ft

E) Volume Provided
V_T = 22300 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

Refer to MHFD Detention Calcs

i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice

ii) Volume to Drain in 12 Hours

iii) Orifice Diameter, 3/8" Minimum

Design Procedure Form: Sand Filter (SF)

Designer: SPC
Company: HR Green
Date: October 2, 2024
Project: Eastonville Road - Segment 1 Improvements SFB A
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/forebay, 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:

THIS SHEET USED FOR
FOREBAY CALCULATIONS ONLY.

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: SPC
Company: HR Green
Date: October 2, 2024
Project: Eastonville Road - Segment 1 Improvements SFB A
Location: EL PASO COUNTY, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 53.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.530

C) Contributing Watershed Area — Area = 1.580 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
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$
$V_{DESIGN\ OTHER}$ = ____ ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)
$V_{DESIGN\ USER}$ = 0.015 ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = 0 %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = 100 %
- 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: $EURV_{C/D} = 1.20 * i^{1.08}$
$EURV_{DESIGN}$ = 0.090 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} = 0% of the WQCV)
V_{FMIN} = 0.000 ac-ft — **A FOREBAY MAY NOT BE NECESSARY FOR THIS SIZE SITE**

B) Actual Forebay Volume
V_F = 0.001 ac-ft

C) Forebay Depth
(D_F = 12 inch maximum)
D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge
Q_{100} = 2.50 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$)
Q_F = 0.05 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

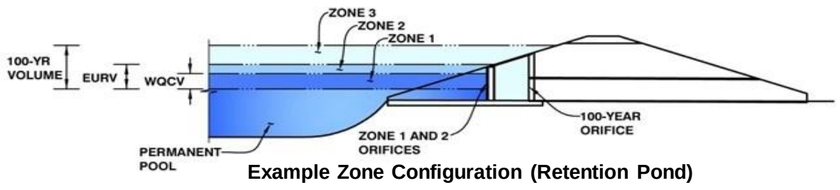
G) Rectangular Notch Width ✓
Calculated W_N = 2.6 in

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road SEGMENT 1**

Basin ID: **SFB A**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**SF**		**Note: L / W Ratio > 8**
Watershed Area =	1.58	acres	**L / W Ratio = 17.58**
Watershed Length =	1,100	ft	
Watershed Length to Centroid =	500	ft	
Watershed Slope =	0.030	ft/ft	
Watershed Imperviousness =	53.00%	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) =	0.015	acre-feet	0.015	acre-feet
Excess Urban Runoff Volume (EURV) =	0.090	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.084	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.119	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.150	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.190	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.223	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.264	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	0.423	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.068	acre-feet		
Approximate 5-yr Detention Volume =	0.093	acre-feet		
Approximate 10-yr Detention Volume =	0.122	acre-feet		
Approximate 25-yr Detention Volume =	0.133	acre-feet		
Approximate 50-yr Detention Volume =	0.139	acre-feet		
Approximate 100-yr Detention Volume =	0.154	acre-feet		

Define Zones and Basin Geometry

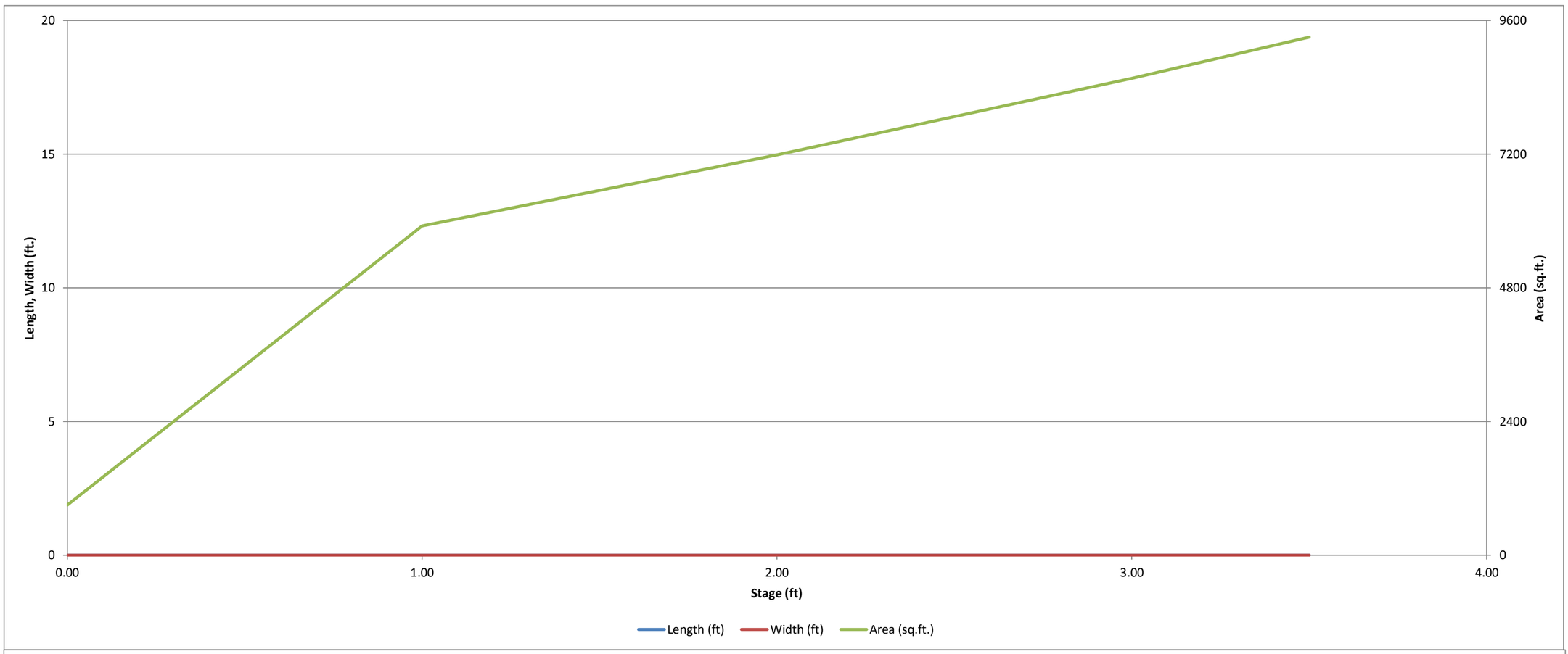
Zone 1 Volume (WQCV) =	0.015	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.075	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.064	acre-feet
Total Detention Basin Volume =	0.154	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (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	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

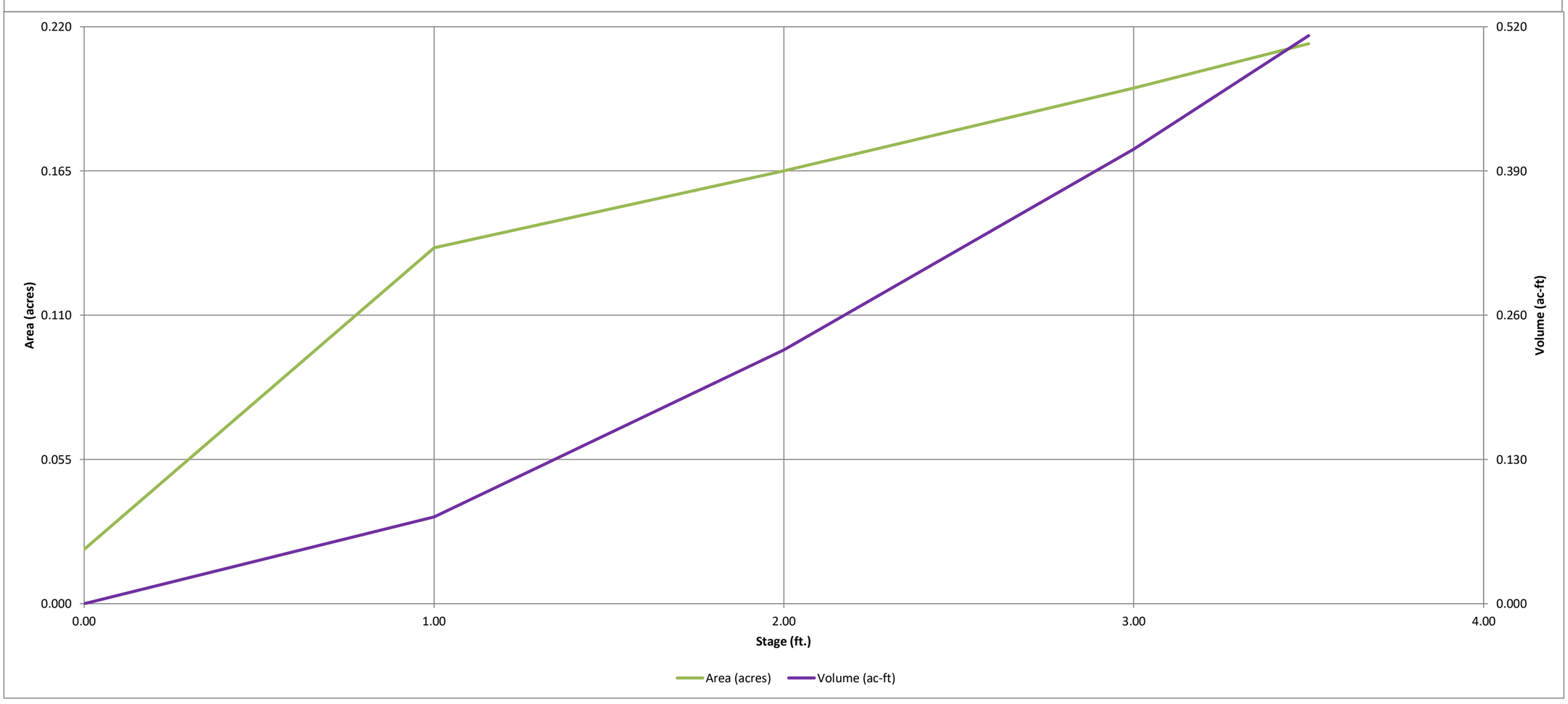
Depth Increment = ft

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)
6981 **Media Surface**	--	0.00	--	--	--	902	0.021		
6982	--	1.00	--	--	--	5,914	0.136	3,408	0.078
6983	--	2.00	--	--	--	7,188	0.165	9,959	0.229
6984	--	3.00	--	--	--	8,563	0.197	17,834	0.409
6984.5	--	3.50	--	--	--	9,301	0.214	22,300	0.512

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



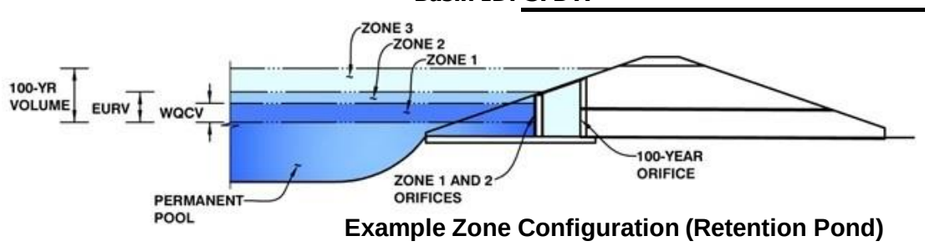


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road SEGMENT 1**

Basin ID: **SFB A**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.37	0.015	Filtration Media
Zone 2 (EURV)	1.09	0.075	Circular Orifice
Zone 3 (100-year)	1.53	0.064	Weir&Pipe (Restrict)
Total (all zones)		0.154	

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

✓ Underdrain Orifice Invert Depth =	2.33	ft (distance below the filtration media surface)	
✓ Underdrain Orifice Diameter =	0.60	inches	

Calculated Parameters for Underdrain

Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Centroid =	0.03	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	0.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	1.09	N/A	ft (relative to basin bottom at Stage = 0 ft)
✓ Vertical Orifice Diameter =	1.33	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.01	N/A	ft^2
Vertical Orifice Centroid =	0.06	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 =	1.25	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 =	1.25	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	58.36	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 =	2.58	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 =	2.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.11	N/A	ft^2
Outlet Orifice Centroid =	0.10	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.68	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

✓ Spillway Invert Stage=	2.24	ft (relative to basin bottom at Stage = 0 ft)
✓ Spillway Crest Length =	5.00	feet
✓ Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.26	feet
Stage at Top of Freeboard =	3.50	feet
Basin Area at Top of Freeboard =	0.21	acres
Basin Volume at Top of Freeboard =	0.51	acre-ft

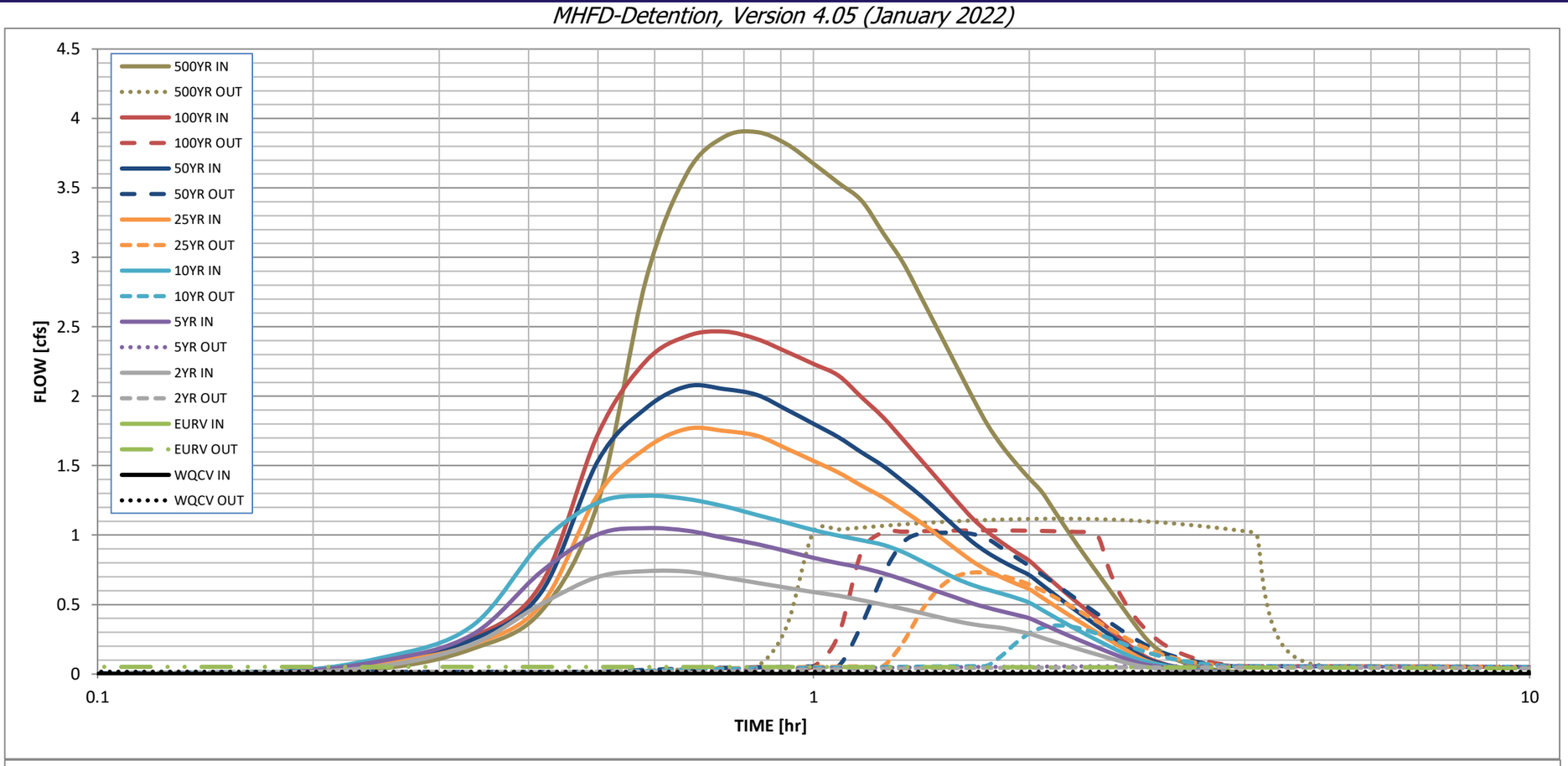
Routed Hydrograph Results

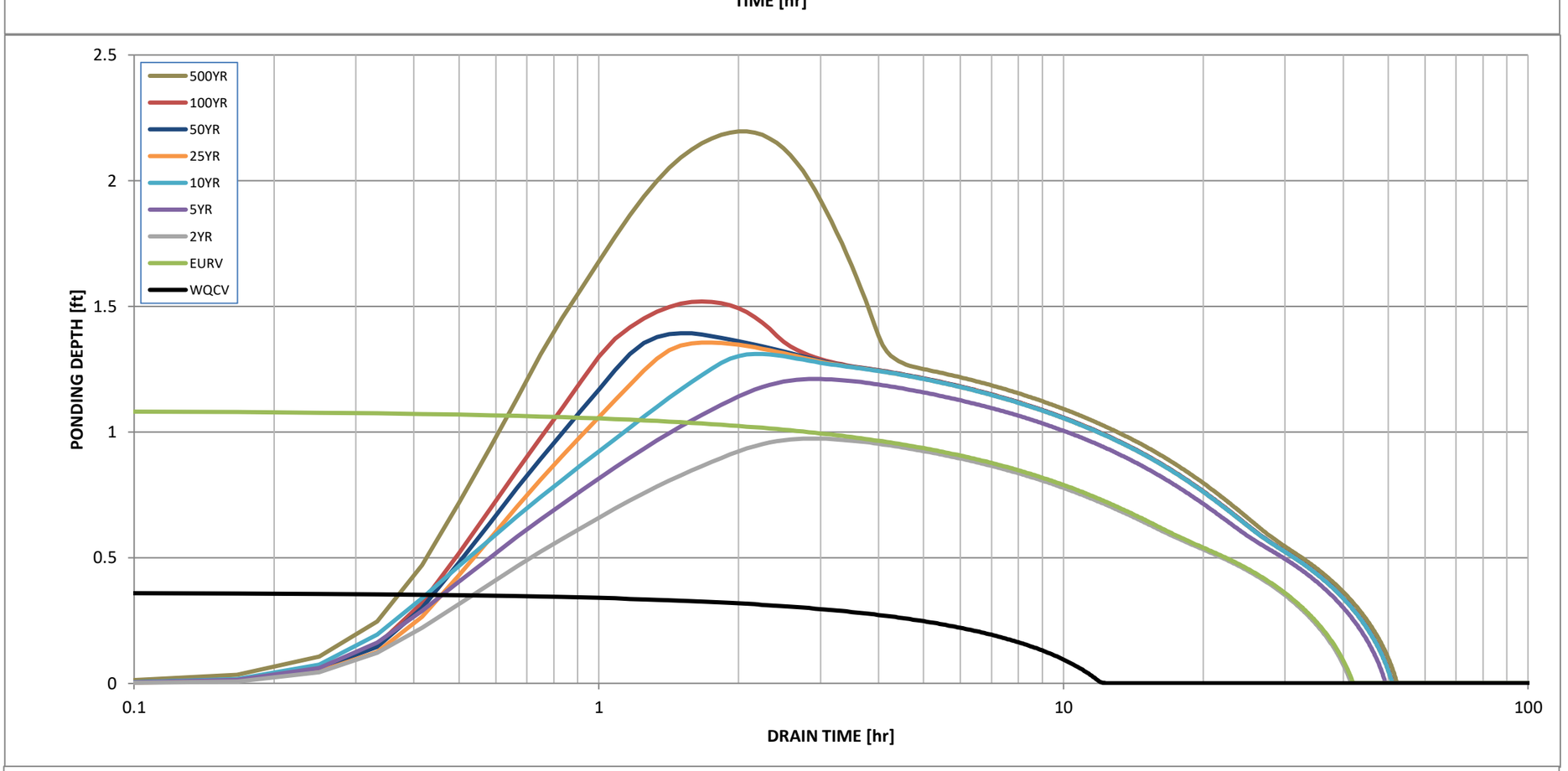
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

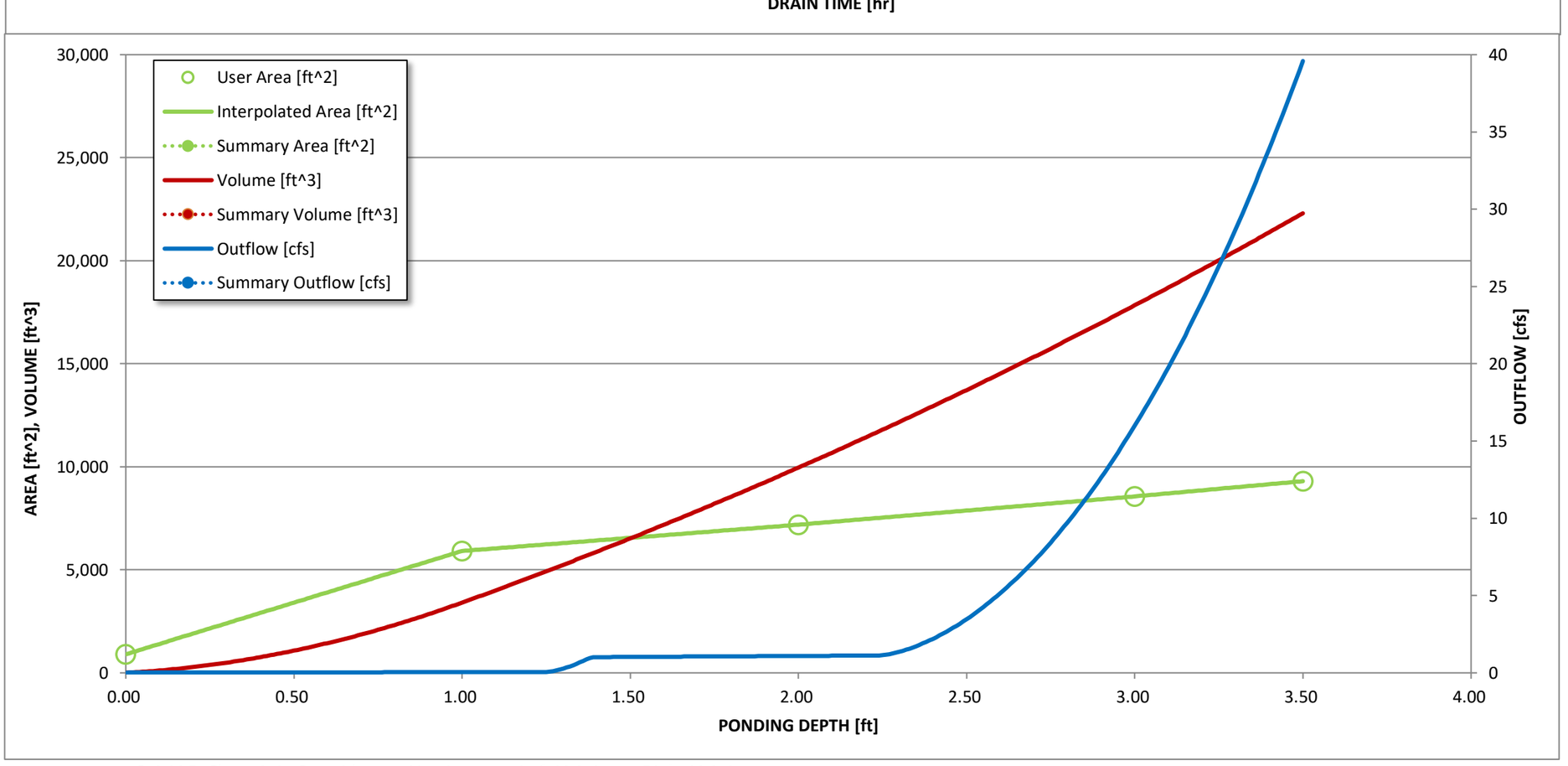
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.015	0.090	0.084	0.119	0.150	0.190	0.223	0.264	0.423
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.084	0.119	0.150	0.190	0.223	0.264	0.423
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.4	0.7	0.8	1.1	1.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.05	0.14	0.22	0.41	0.52	0.68	1.22
Peak Inflow Q (cfs) =	N/A	N/A	0.7	1.0	1.3	1.8	2.1	2.5	3.9
Peak Outflow Q (cfs) =	0.0	0.1	0.0	0.06	0.3	0.7	1.0	1.0	1.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	1.0	1.1	1.2	1.0	0.6
Structure Controlling Flow =	Filtration Media	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.1	0.2	0.2	0.2
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	40	40	46	47	46	46	45	42
Time to Drain 99% of Inflow Volume (hours) =	**12**	41	41	48	50	50	49	49	49
Maximum Ponding Depth (ft) =	0.37	1.09	0.97	1.21	1.31	1.36	1.39	1.52	2.20
Area at Maximum Ponding Depth (acres) =	0.06	0.14	0.13	0.14	0.14	0.15	0.15	0.15	0.17
Maximum Volume Stored (acre-ft) =	0.016	0.091	0.074	0.107	0.122	0.128	0.133	0.151	0.261

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	0.01	0.00	0.04
	0:15:00	0.00	0.00	0.06	0.10	0.12	0.08	0.10	0.10	0.18
	0:20:00	0.00	0.00	0.21	0.28	0.35	0.21	0.25	0.26	0.45
	0:25:00	0.00	0.00	0.50	0.74	0.95	0.50	0.59	0.65	1.24
	0:30:00	0.00	0.00	0.70	1.01	1.23	1.29	1.54	1.73	2.84
	0:35:00	0.00	0.00	0.74	1.05	1.28	1.63	1.91	2.25	3.61
	0:40:00	0.00	0.00	0.74	1.03	1.26	1.77	2.07	2.43	3.87
	0:45:00	0.00	0.00	0.70	0.98	1.21	1.75	2.05	2.47	3.90
	0:50:00	0.00	0.00	0.66	0.94	1.15	1.72	2.01	2.41	3.82
	0:55:00	0.00	0.00	0.62	0.88	1.09	1.62	1.90	2.32	3.67
	1:00:00	0.00	0.00	0.59	0.84	1.04	1.53	1.80	2.23	3.54
	1:05:00	0.00	0.00	0.56	0.80	1.00	1.45	1.70	2.15	3.41
	1:10:00	0.00	0.00	0.53	0.77	0.96	1.36	1.60	1.99	3.18
	1:15:00	0.00	0.00	0.50	0.73	0.93	1.27	1.50	1.85	2.96
	1:20:00	0.00	0.00	0.47	0.68	0.88	1.18	1.39	1.69	2.70
	1:25:00	0.00	0.00	0.44	0.63	0.81	1.09	1.28	1.53	2.45
	1:30:00	0.00	0.00	0.41	0.59	0.75	0.99	1.16	1.39	2.22
	1:35:00	0.00	0.00	0.38	0.55	0.69	0.90	1.05	1.25	1.99
	1:40:00	0.00	0.00	0.36	0.51	0.64	0.81	0.95	1.12	1.79
	1:45:00	0.00	0.00	0.34	0.48	0.61	0.75	0.87	1.02	1.64
	1:50:00	0.00	0.00	0.33	0.45	0.58	0.69	0.81	0.94	1.52
	1:55:00	0.00	0.00	0.31	0.43	0.55	0.65	0.76	0.88	1.41
	2:00:00	0.00	0.00	0.29	0.40	0.51	0.61	0.71	0.82	1.31
	2:05:00	0.00	0.00	0.26	0.36	0.46	0.55	0.64	0.73	1.18
	2:10:00	0.00	0.00	0.23	0.32	0.41	0.49	0.58	0.66	1.05
	2:15:00	0.00	0.00	0.21	0.29	0.36	0.44	0.51	0.58	0.93
	2:20:00	0.00	0.00	0.18	0.25	0.32	0.39	0.45	0.52	0.82
	2:25:00	0.00	0.00	0.16	0.22	0.28	0.34	0.39	0.45	0.72
	2:30:00	0.00	0.00	0.14	0.19	0.24	0.29	0.34	0.39	0.62
	2:35:00	0.00	0.00	0.12	0.16	0.20	0.25	0.29	0.33	0.52
	2:40:00	0.00	0.00	0.10	0.13	0.17	0.20	0.24	0.27	0.42
	2:45:00	0.00	0.00	0.08	0.10	0.13	0.16	0.19	0.21	0.33
	2:50:00	0.00	0.00	0.06	0.08	0.11	0.13	0.14	0.16	0.25
	2:55:00	0.00	0.00	0.05	0.07	0.09	0.10	0.11	0.12	0.19
	3:00:00	0.00	0.00	0.04	0.06	0.07	0.07	0.09	0.09	0.15
	3:05:00	0.00	0.00	0.03	0.05	0.06	0.06	0.07	0.07	0.12
	3:10:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.09
	3:15:00	0.00	0.00	0.03	0.03	0.04	0.04	0.05	0.04	0.07
	3:20:00	0.00	0.00	0.02	0.03	0.04	0.03	0.04	0.04	0.06
	3:25:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.04
	3:30:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.04
	3:35:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	3:40:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.01	0.02
	3:45:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	3:50:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	3:55:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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: October 28, 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 = 66.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.660

C) Contributing Watershed Area — Area = 9.480 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
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$
$V_{DESIGN\ OTHER}$ = 0.199 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: $EURV_{C/D} = 1.20 * i^{1.08}$
$EURV_{DESIGN}$ = 0.780 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: October 28, 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} = 26 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: October 28, 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

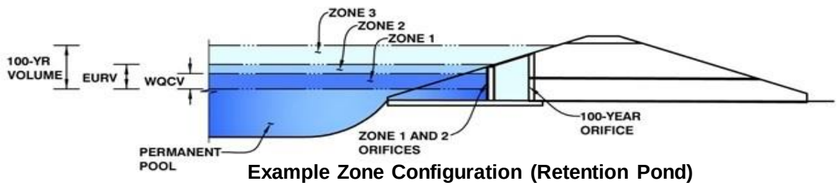
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road - Segment 1 Improvements**

Basin ID: **EDB B: INTERIM CONDITION, BASINS [EA6 - EA8]**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**		
Watershed Area =	3.95	acres	
Watershed Length =	1,750	ft	
Watershed Length to Centroid =	500	ft	
Watershed Slope =	0.009	ft/ft	
Watershed Imperviousness =	53.00%	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		

Note: L / W Ratio > 8

L / W Ratio = 17.8

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) =	0.035	acre-feet	0.035	acre-feet
Excess Urban Runoff Volume (EURV) =	0.245	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.184	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.244	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.292	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.364	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.435	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.524	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	0.895	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.158	acre-feet		
Approximate 5-yr Detention Volume =	0.208	acre-feet		
Approximate 10-yr Detention Volume =	0.253	acre-feet		
Approximate 25-yr Detention Volume =	0.308	acre-feet		
Approximate 50-yr Detention Volume =	0.343	acre-feet		
Approximate 100-yr Detention Volume =	0.384	acre-feet		

Define Zones and Basin Geometry

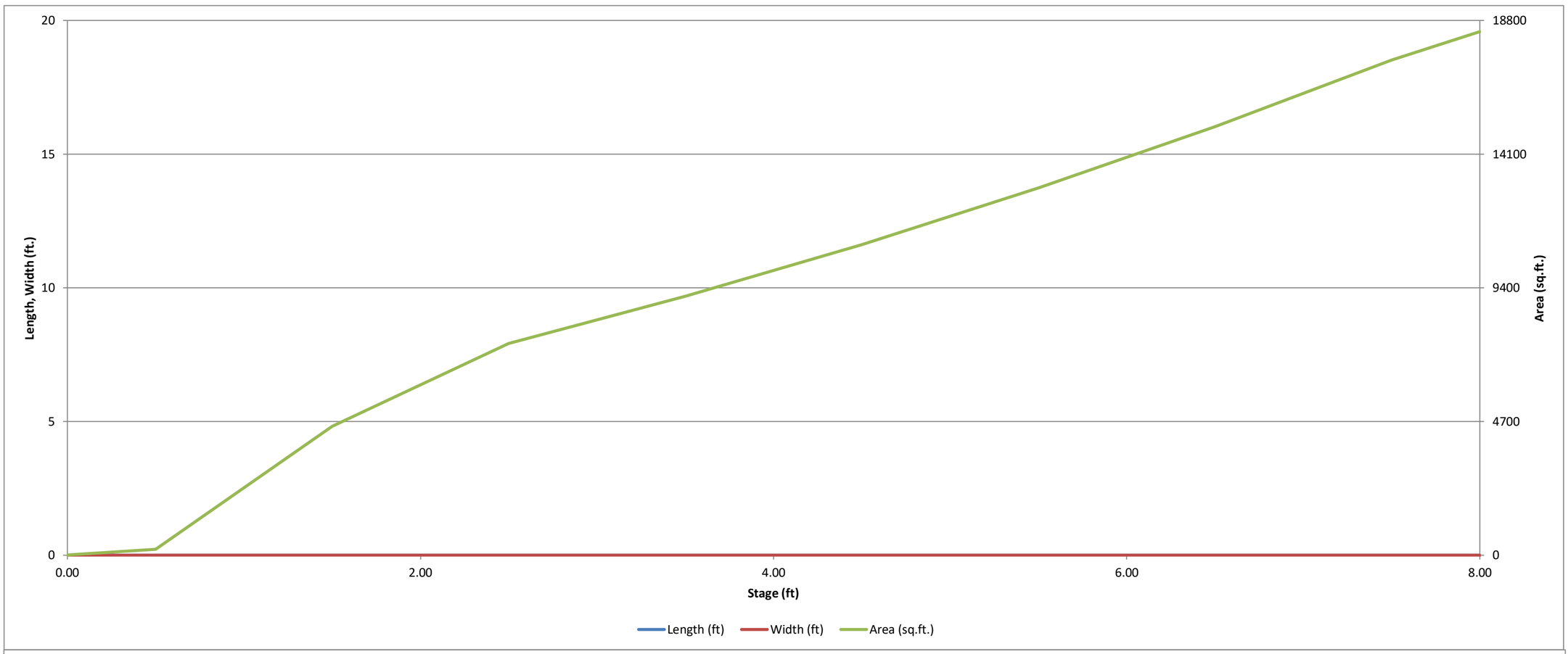
Zone 1 Volume (WQCV) =	0.035	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.210	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.139	acre-feet
Total Detention Basin Volume =	0.384	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

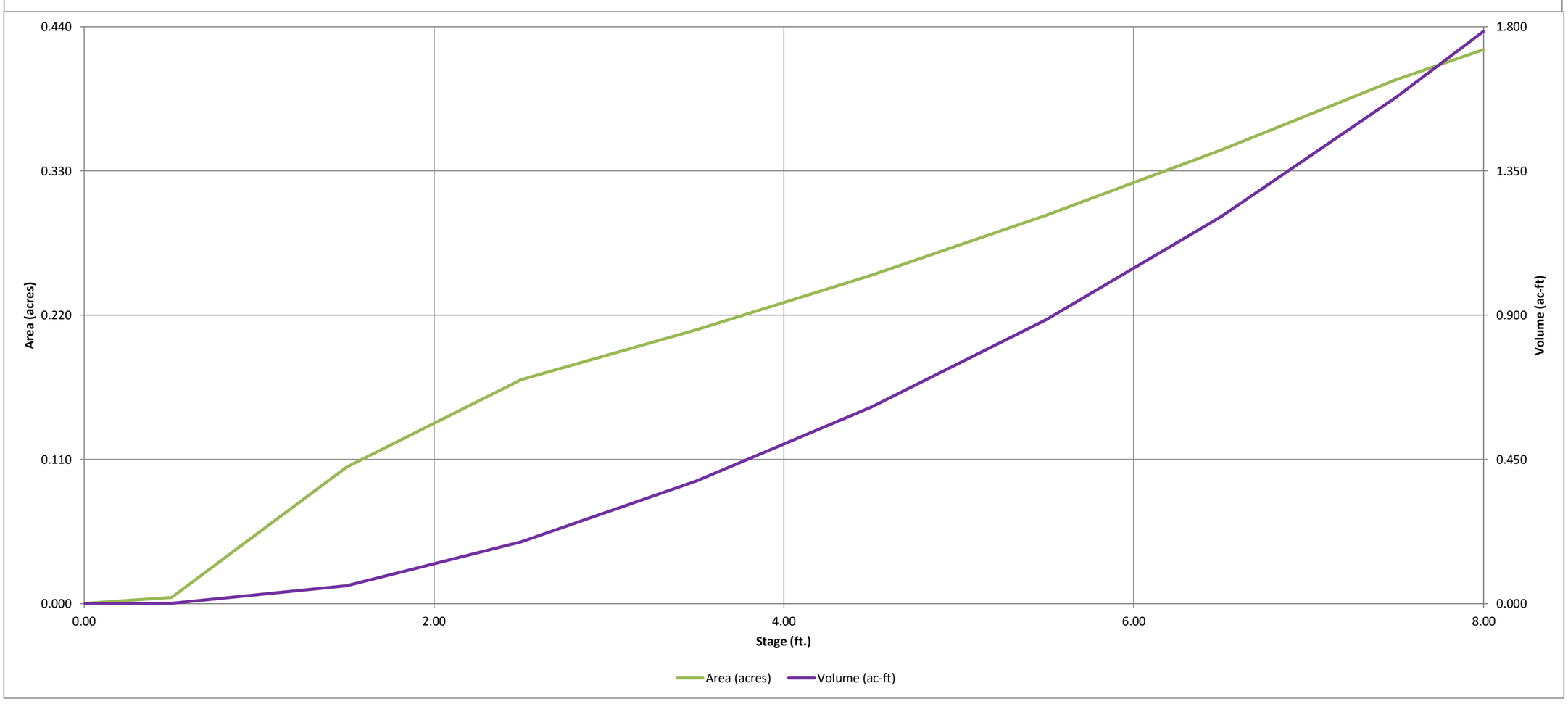
Depth Increment = ft

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)





✓ = calcs match details in plans

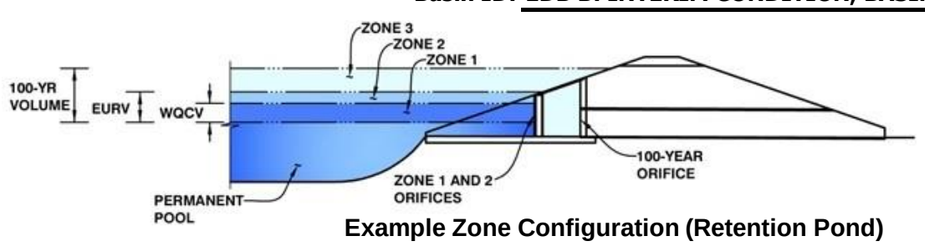
X = calcs do not match details in plans

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: Eastonville Road - Segment 1 Improvements

Basin ID: EDB B: INTERIM CONDITION, BASINS [EA6 - EA8]



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.28	0.035	Orifice Plate
Zone 2 (EURV)	2.80	0.210	Rectangular Orifice
Zone 3 (100-year)	3.51	0.139	Weir&Pipe (Restrict)
Total (all zones)		0.384	

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 =	1.28	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	0.18	sq. inches (diameter = 1/2 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.250E-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	0.50	1.00					
✓ Orifice Area (sq. inches)	0.18	0.18	0.18					

	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 Rectangular	Not Selected	
✓ Invert of Vertical Orifice =	1.33	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.80	N/A	ft (relative to basin bottom at Stage = 0 ft)
✓ Vertical Orifice Height =	4.00	N/A	inches
✓ Vertical Orifice Width =	1.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.03	N/A	ft^2
Vertical Orifice Centroid =	0.17	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 =	3.54	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 =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.77	N/A	ft^2
Outlet Orifice Centroid =	0.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	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

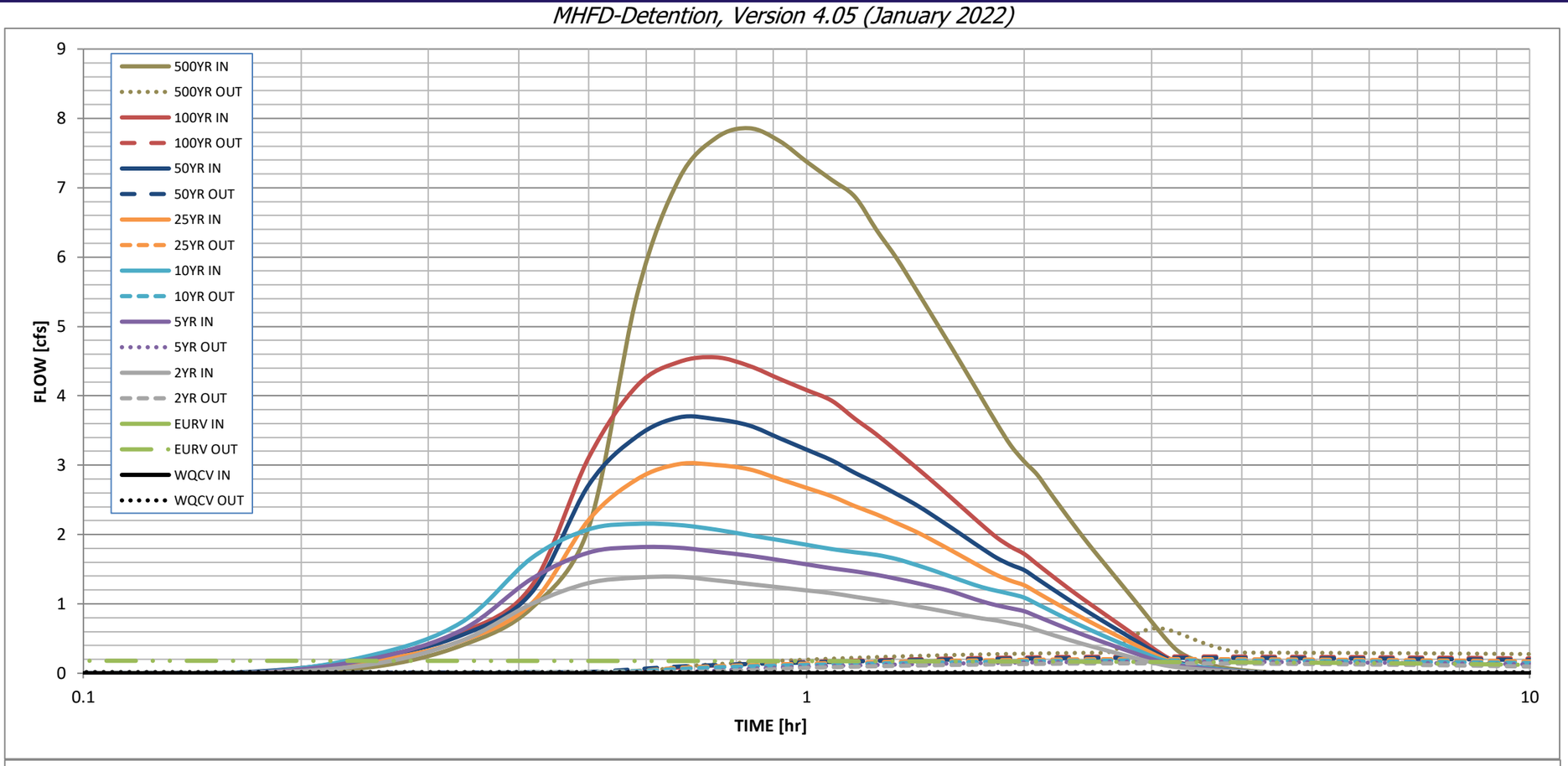
Routed Hydrograph Results

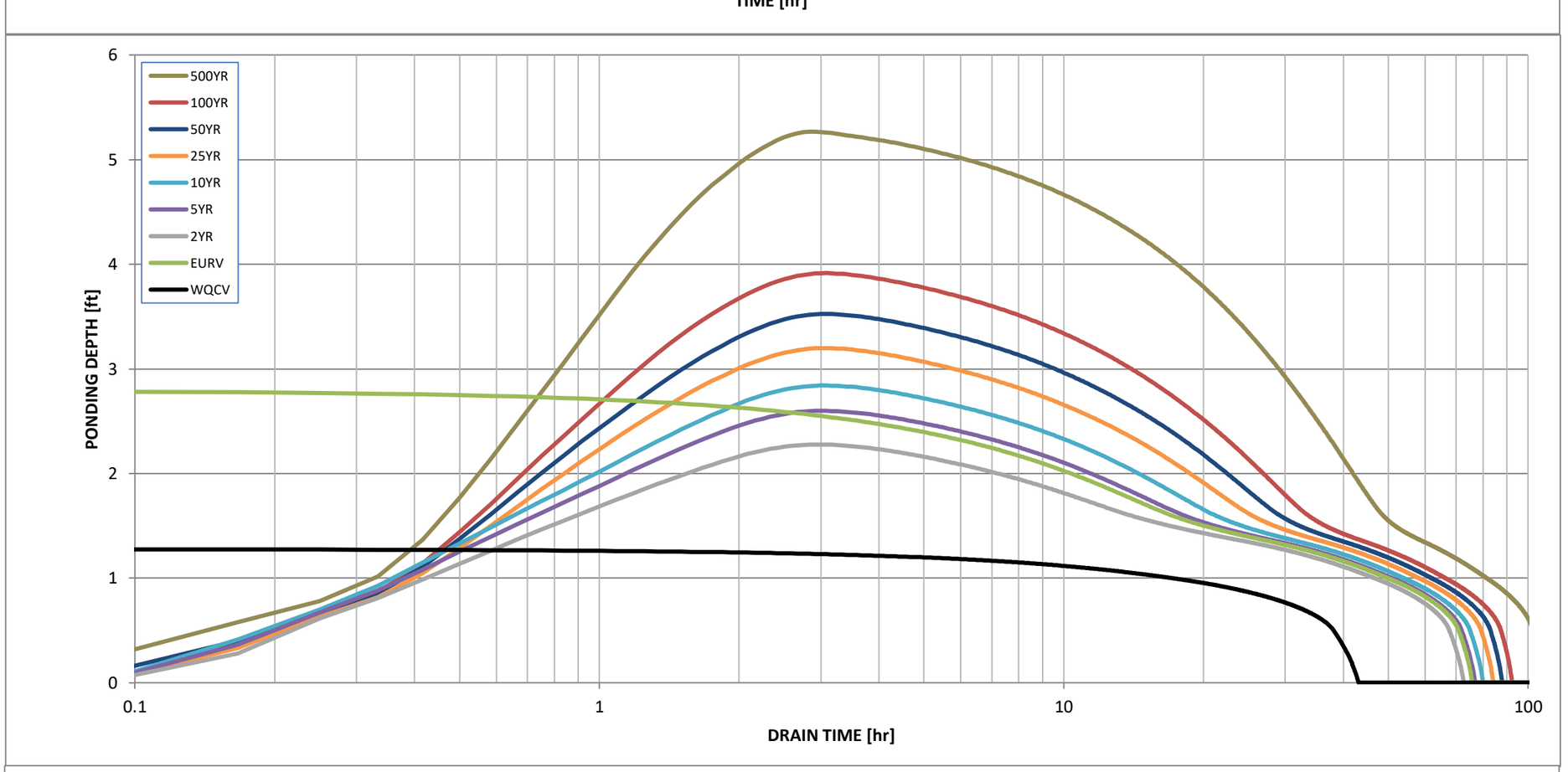
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

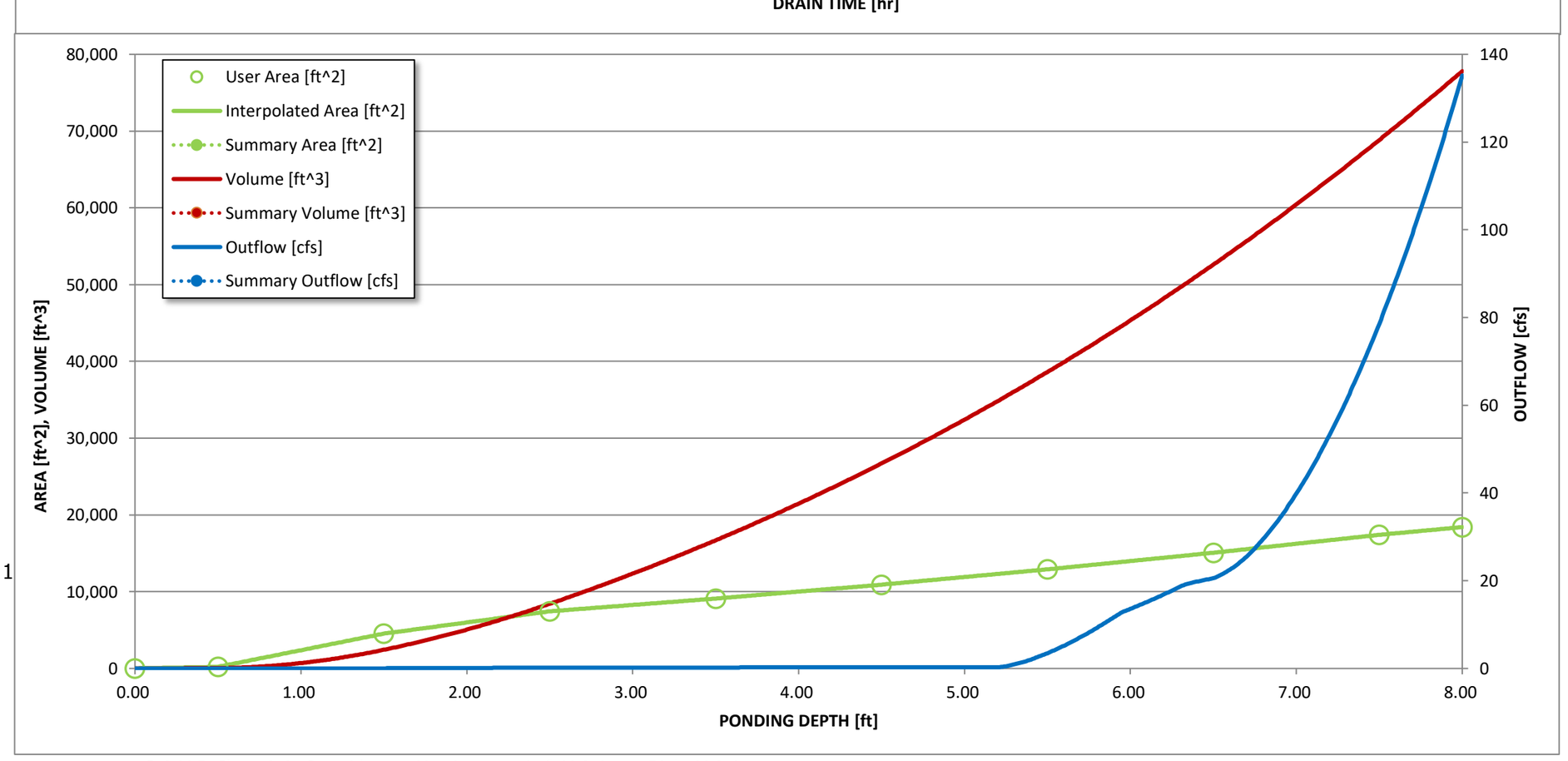
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.035	0.245	0.184	0.244	0.292	0.364	0.435	0.524	0.895
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.184	0.244	0.292	0.364	0.435	0.524	0.895
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.3	0.6	1.0	2.8
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	0.08	0.15	0.26	0.70
Peak Inflow Q (cfs) =	N/A	N/A	1.4	1.8	2.2	3.0	3.7	4.6	7.9
Peak Outflow Q (cfs) =	0.0	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	7.2	5.6	0.7	0.4	0.2	0.2
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	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) =	39	61	60	62	63	65	66	67	71
Time to Drain 99% of Inflow Volume (hours) =	**41**	69	67	70	72	75	77	81	90
Maximum Ponding Depth (ft) =	1.28	2.80	2.28	2.60	2.84	3.20	3.53	3.92	5.27
Area at Maximum Ponding Depth (acres) =	0.08	0.18	0.16	0.17	0.18	0.20	0.21	0.23	0.29
Maximum Volume Stored (acre-ft) =	0.035	0.246	0.156	0.209	0.254	0.322	0.387	0.472	0.817

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	0.01	0.00	0.09
	0:15:00	0.00	0.00	0.13	0.21	0.26	0.17	0.22	0.21	0.40
	0:20:00	0.00	0.00	0.47	0.62	0.73	0.47	0.55	0.58	0.94
	0:25:00	0.00	0.00	1.00	1.36	1.66	1.00	1.16	1.26	2.11
	0:30:00	0.00	0.00	1.30	1.74	2.07	2.21	2.72	3.11	5.47
	0:35:00	0.00	0.00	1.38	1.82	2.15	2.80	3.42	4.15	7.13
	0:40:00	0.00	0.00	1.39	1.81	2.14	3.02	3.69	4.49	7.72
	0:45:00	0.00	0.00	1.34	1.75	2.07	3.00	3.66	4.55	7.86
	0:50:00	0.00	0.00	1.29	1.69	1.99	2.94	3.57	4.43	7.68
	0:55:00	0.00	0.00	1.24	1.63	1.92	2.80	3.39	4.25	7.38
	1:00:00	0.00	0.00	1.19	1.57	1.85	2.67	3.22	4.08	7.11
	1:05:00	0.00	0.00	1.15	1.51	1.79	2.55	3.07	3.93	6.87
	1:10:00	0.00	0.00	1.10	1.47	1.74	2.41	2.89	3.67	6.39
	1:15:00	0.00	0.00	1.05	1.42	1.71	2.29	2.74	3.44	5.98
	1:20:00	0.00	0.00	1.01	1.36	1.65	2.16	2.58	3.20	5.54
	1:25:00	0.00	0.00	0.96	1.30	1.56	2.04	2.43	2.97	5.12
	1:30:00	0.00	0.00	0.92	1.24	1.48	1.91	2.27	2.75	4.71
	1:35:00	0.00	0.00	0.87	1.18	1.39	1.77	2.10	2.54	4.33
	1:40:00	0.00	0.00	0.83	1.11	1.31	1.65	1.95	2.33	3.95
	1:45:00	0.00	0.00	0.79	1.03	1.24	1.52	1.80	2.13	3.60
	1:50:00	0.00	0.00	0.76	0.98	1.19	1.41	1.66	1.96	3.28
	1:55:00	0.00	0.00	0.72	0.94	1.14	1.33	1.56	1.82	3.05
	2:00:00	0.00	0.00	0.68	0.89	1.09	1.27	1.49	1.72	2.87
	2:05:00	0.00	0.00	0.62	0.82	1.00	1.16	1.36	1.57	2.62
	2:10:00	0.00	0.00	0.57	0.75	0.91	1.06	1.24	1.44	2.38
	2:15:00	0.00	0.00	0.51	0.68	0.82	0.97	1.13	1.30	2.16
	2:20:00	0.00	0.00	0.47	0.61	0.74	0.87	1.02	1.18	1.95
	2:25:00	0.00	0.00	0.42	0.55	0.67	0.79	0.92	1.06	1.76
	2:30:00	0.00	0.00	0.38	0.50	0.60	0.71	0.83	0.96	1.58
	2:35:00	0.00	0.00	0.34	0.44	0.53	0.63	0.74	0.85	1.40
	2:40:00	0.00	0.00	0.30	0.39	0.47	0.56	0.65	0.75	1.23
	2:45:00	0.00	0.00	0.26	0.34	0.41	0.49	0.57	0.65	1.07
	2:50:00	0.00	0.00	0.22	0.29	0.35	0.42	0.49	0.56	0.90
	2:55:00	0.00	0.00	0.19	0.25	0.30	0.35	0.41	0.47	0.75
	3:00:00	0.00	0.00	0.16	0.21	0.25	0.29	0.33	0.37	0.59
	3:05:00	0.00	0.00	0.13	0.17	0.20	0.23	0.26	0.29	0.45
	3:10:00	0.00	0.00	0.10	0.14	0.17	0.18	0.20	0.22	0.34
	3:15:00	0.00	0.00	0.09	0.12	0.14	0.14	0.16	0.17	0.26
	3:20:00	0.00	0.00	0.08	0.10	0.12	0.12	0.13	0.14	0.21
	3:25:00	0.00	0.00	0.06	0.09	0.11	0.10	0.11	0.11	0.17
	3:30:00	0.00	0.00	0.06	0.07	0.09	0.08	0.09	0.09	0.13
	3:35:00	0.00	0.00	0.05	0.06	0.08	0.07	0.08	0.07	0.11
	3:40:00	0.00	0.00	0.04	0.05	0.06	0.06	0.06	0.06	0.09
	3:45:00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.05	0.07
	3:50:00	0.00	0.00	0.03	0.04	0.04	0.04	0.04	0.04	0.06
	3:55:00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.03	0.04
	4:00:00	0.00	0.00	0.02	0.02	0.03	0.02	0.03	0.03	0.04
	4:05:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	4:10:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.01	0.02
	4:15:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	4:20:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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'.

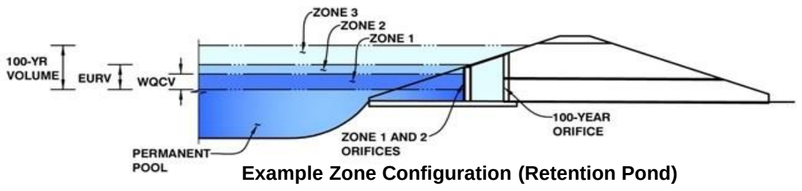
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

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 - EA11]**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	9.48	acres
Watershed Length =	1,750	ft
Watershed Length to Centroid =	500	ft
Watershed Slope =	0.009	ft/ft
Watershed Imperviousness =	66.00%	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) =	0.058	acre-feet	0.058	acre-feet
Excess Urban Runoff Volume (EURV) =	0.780	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.574	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.752	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.895	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.080	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.262	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.482	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	2.400	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.508	acre-feet		
Approximate 5-yr Detention Volume =	0.663	acre-feet		
Approximate 10-yr Detention Volume =	0.799	acre-feet		
Approximate 25-yr Detention Volume =	0.961	acre-feet		
Approximate 50-yr Detention Volume =	1.058	acre-feet		
Approximate 100-yr Detention Volume =	1.158	acre-feet		

Define Zones and Basin Geometry

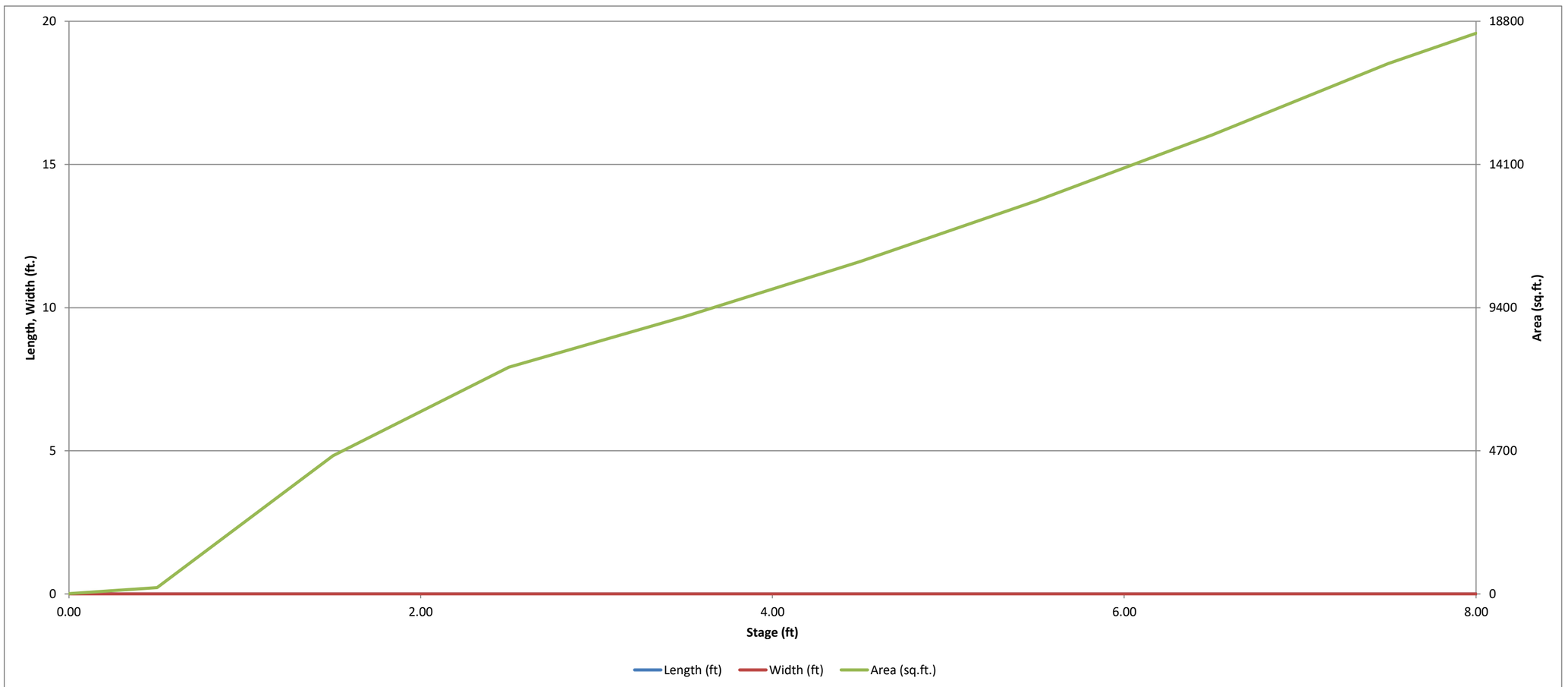
Zone 1 Volume (WQCV) =	0.058	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.722	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.378	acre-feet
Total Detention Basin Volume =	1.158	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

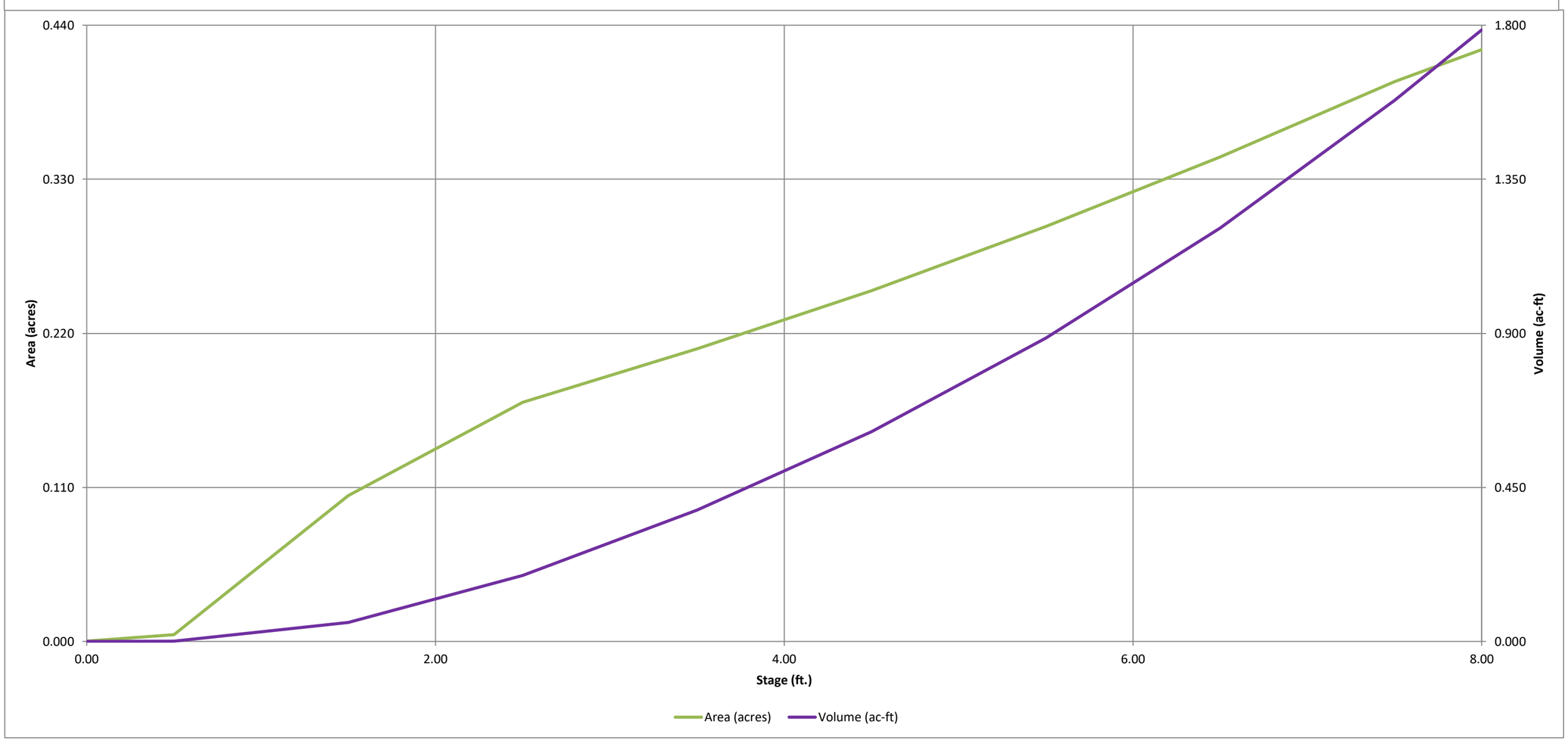
Depth Increment = ft

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)



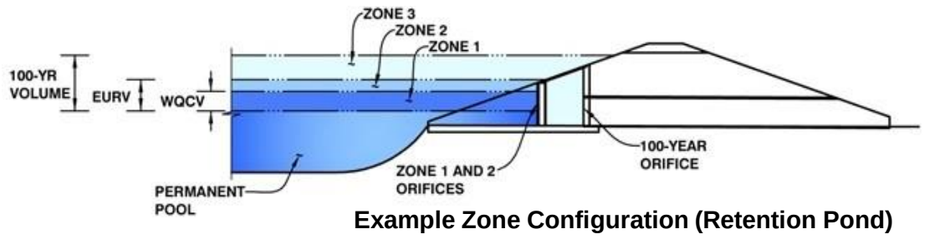


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road**

Basin ID: **POND B: Ultimate Conditions (INCLUDES SEGMENT 2 FLOW) [BASINS EA6 - EA11]**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.52	0.058	Orifice Plate
Zone 2 (EURV)	5.13	0.722	Circular Orifice
Zone 3 (100-year)	6.36	0.378	Weir&Pipe (Restrict)
Total (all zones)		1.158	

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

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	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)

			Calculated Parameters for Plate		
Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.736E-03	ft^2
Depth at top of Zone using Orifice Plate =	1.52	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.25	sq. inches (diameter = 9/16 inch)	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	0.50	1.00					
Orifice Area (sq. inches)	0.25	0.25	0.25					

	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		Calculated Parameters for Vertical Orifice	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	1.60	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.05	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	5.13	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.13	N/A	feet
Vertical Orifice Diameter =	3.00	N/A	inches				

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		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.20	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.20	N/A	feet
Overflow Weir Front Edge Length =	3.00	N/A	feet	Overflow Weir Slope Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	21.42	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	3.13	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	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 Orifice Area =	0.29	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.20	N/A	feet
Restrictor Plate Height Above Pipe Invert =	4.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	0.98	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

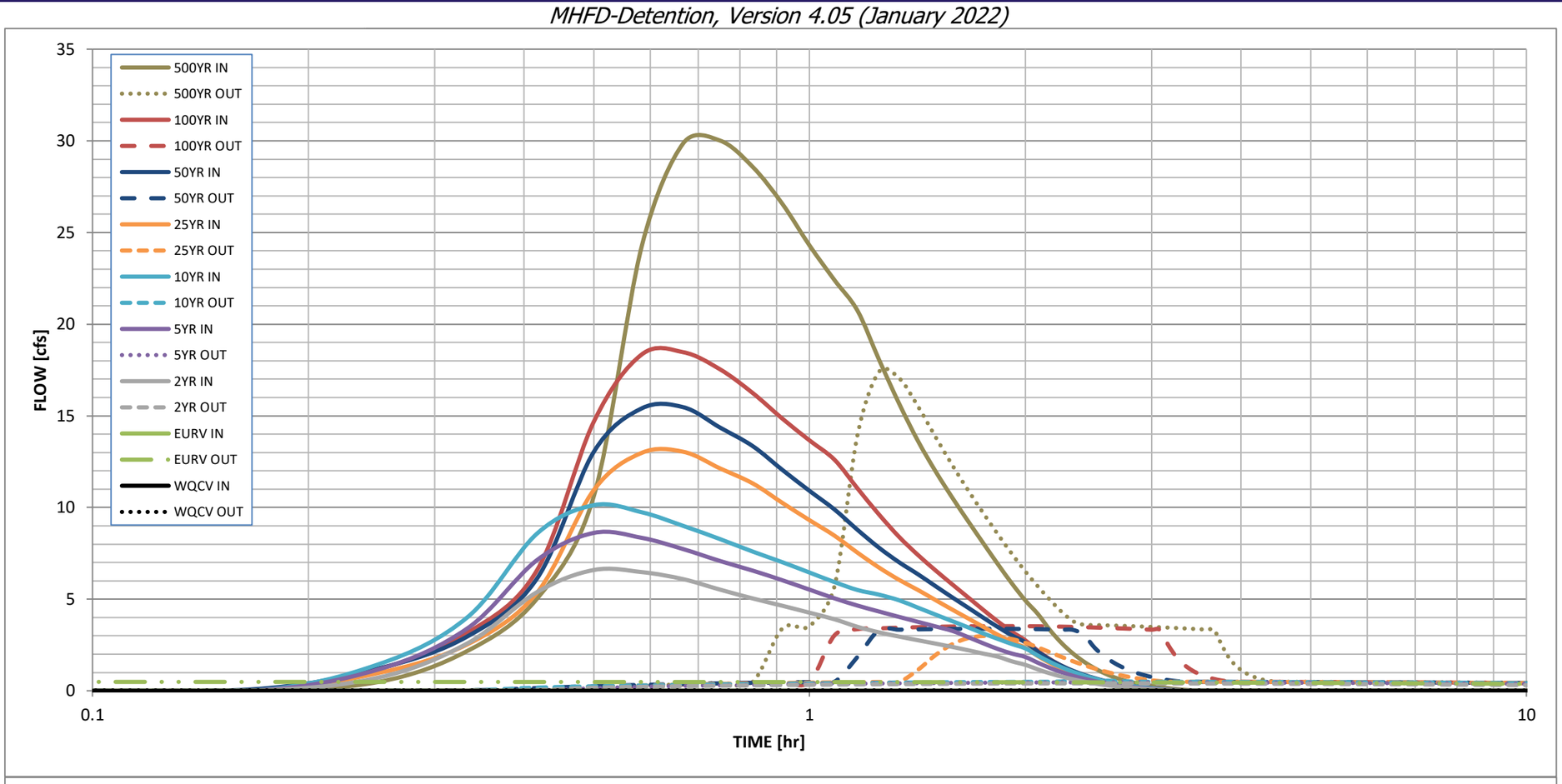
			Calculated Parameters for Spillway		
Spillway Invert Stage=	6.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.50	feet
Spillway Crest Length =	15.50	feet	Stage at Top of Freeboard =	8.00	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.42	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.79	acre-ft

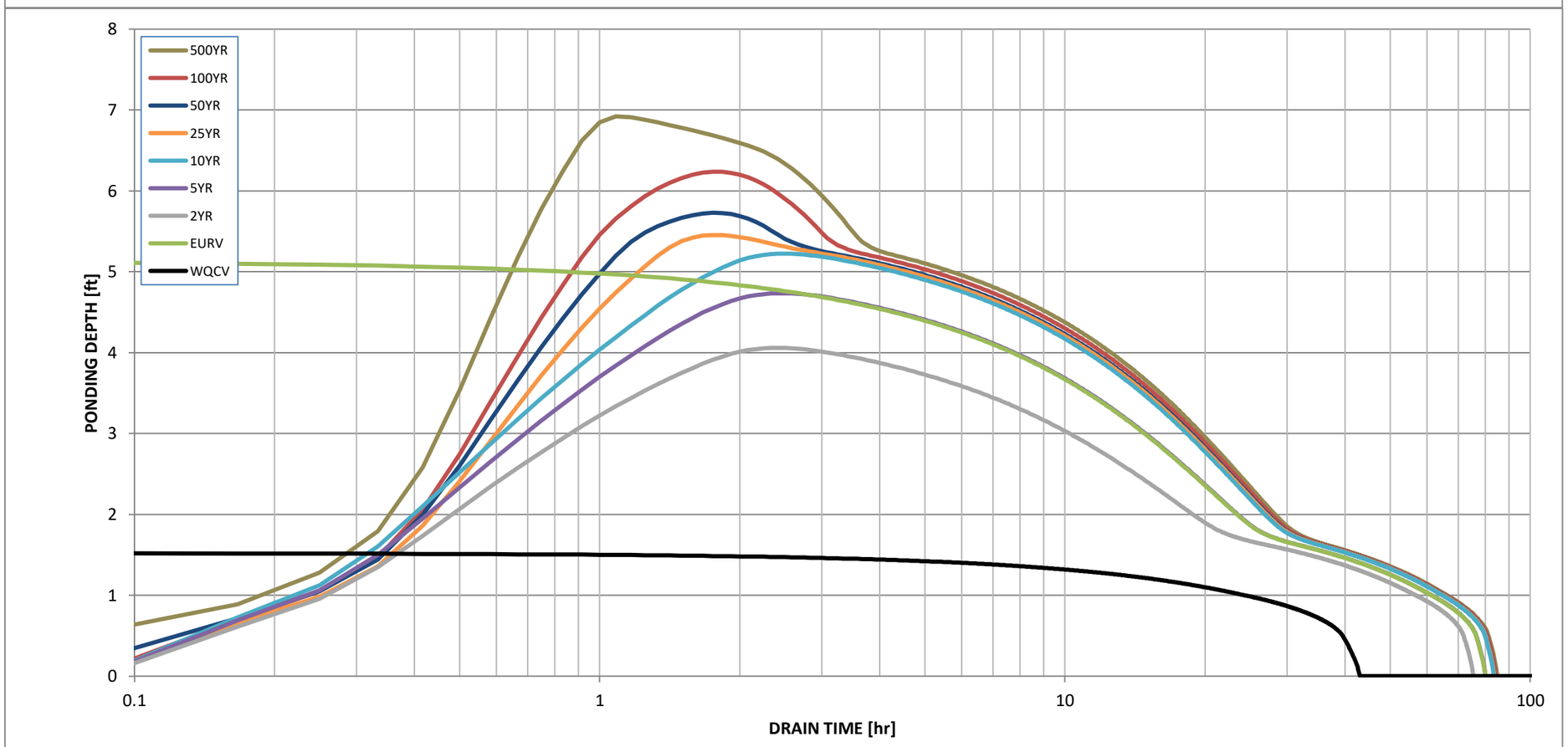
Routed Hydrograph Results — *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

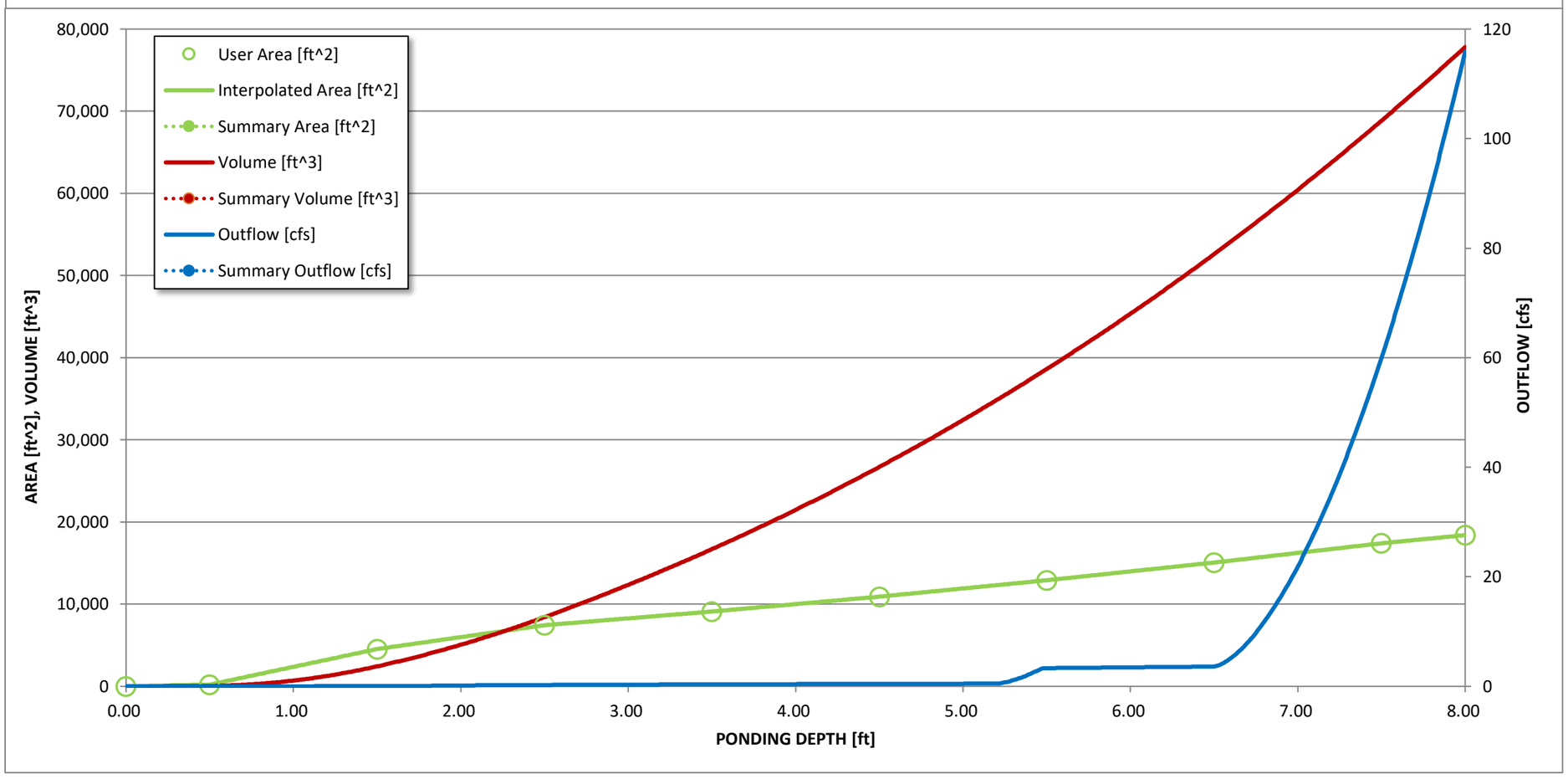
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.058	0.780	0.574	0.752	0.895	1.080	1.262	1.482	2.400
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.574	0.752	0.895	1.080	1.262	1.482	2.400
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.1	1.0	2.1	3.5	9.4
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	0.37	0.99
Peak Inflow Q (cfs) =	N/A	N/A	6.6	8.6	10.1	13.0	15.5	18.5	30.0
Peak Outflow Q (cfs) =	0.0	0.5	0.4	0.5	0.6	3.0	3.4	3.5	17.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	5.6	4.9	2.9	1.6	1.0	1.9
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.5	0.5	0.5
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) =	39	56	56	57	57	54	51	48	35
Time to Drain 99% of Inflow Volume (hours) =	**41**	69	66	69	71	70	68	67	61
Maximum Ponding Depth (ft) =	1.53	5.14	4.06	4.73	5.22	5.45	5.73	6.24	6.92
Area at Maximum Ponding Depth (acres) =	0.11	0.28	0.23	0.26	0.28	0.29	0.31	0.33	0.37
Maximum Volume Stored (acre-ft) =	0.059	0.783	0.504	0.672	0.805	0.872	0.953	1.116	1.354

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	0.48
	0:15:00	0.00	0.00	0.71	1.16	1.44	0.97	1.21	1.18	2.18
	0:20:00	0.00	0.00	2.59	3.41	4.01	2.54	2.97	3.17	5.02
	0:25:00	0.00	0.00	5.38	7.13	8.57	5.34	6.11	6.57	10.59
	0:30:00	0.00	0.00	6.59	8.61	10.13	10.94	13.02	14.66	24.23
	0:35:00	0.00	0.00	6.48	8.35	9.74	12.98	15.41	18.34	29.86
	0:40:00	0.00	0.00	6.09	7.73	9.00	13.04	15.47	18.47	30.02
	0:45:00	0.00	0.00	5.52	7.08	8.28	12.14	14.36	17.54	28.58
	0:50:00	0.00	0.00	5.04	6.56	7.60	11.32	13.35	16.24	26.56
	0:55:00	0.00	0.00	4.64	6.03	7.02	10.25	12.05	14.85	24.30
	1:00:00	0.00	0.00	4.26	5.52	6.45	9.31	10.91	13.66	22.41
	1:05:00	0.00	0.00	3.90	5.05	5.93	8.47	9.90	12.61	20.74
	1:10:00	0.00	0.00	3.49	4.65	5.50	7.54	8.78	11.04	18.07
	1:15:00	0.00	0.00	3.19	4.33	5.25	6.73	7.81	9.62	15.67
	1:20:00	0.00	0.00	2.96	4.03	4.94	6.06	7.01	8.40	13.63
	1:25:00	0.00	0.00	2.76	3.76	4.54	5.50	6.36	7.41	11.96
	1:30:00	0.00	0.00	2.57	3.51	4.15	4.94	5.70	6.56	10.51
	1:35:00	0.00	0.00	2.39	3.27	3.80	4.42	5.09	5.79	9.22
	1:40:00	0.00	0.00	2.21	2.92	3.45	3.94	4.52	5.08	8.02
	1:45:00	0.00	0.00	2.03	2.58	3.12	3.48	3.97	4.40	6.88
	1:50:00	0.00	0.00	1.86	2.28	2.82	3.05	3.47	3.77	5.85
	1:55:00	0.00	0.00	1.61	2.03	2.55	2.66	3.02	3.22	4.93
	2:00:00	0.00	0.00	1.42	1.85	2.31	2.35	2.65	2.75	4.18
	2:05:00	0.00	0.00	1.17	1.53	1.92	1.89	2.13	2.18	3.30
	2:10:00	0.00	0.00	0.95	1.24	1.57	1.51	1.70	1.72	2.58
	2:15:00	0.00	0.00	0.77	1.01	1.28	1.21	1.36	1.35	2.02
	2:20:00	0.00	0.00	0.62	0.82	1.03	0.97	1.08	1.06	1.58
	2:25:00	0.00	0.00	0.50	0.66	0.83	0.77	0.87	0.83	1.23
	2:30:00	0.00	0.00	0.40	0.53	0.66	0.61	0.69	0.65	0.95
	2:35:00	0.00	0.00	0.32	0.42	0.52	0.48	0.54	0.50	0.73
	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	0.31	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	0.13	0.15	0.14	0.20
	3:05:00	0.00	0.00	0.06	0.08	0.10	0.10	0.11	0.10	0.14
	3:10:00	0.00	0.00	0.04	0.05	0.07	0.06	0.07	0.07	0.10
	3:15:00	0.00	0.00	0.02	0.03	0.04	0.04	0.04	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

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: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 2**

Designer: SPC
Company: HR Green
Date: December 2, 2024
Project: Eastonville Road - Segment 1 Improvements SFB D
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 = 34.0 %

B) Tributary Area's Imperviousness Ratio (i = I_a/100) — i = 0.340

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 = 0.13 watershed inches

D) Contributing Watershed Area (including sand filter area) — Area = 171,191 sq ft

E) Water Quality Capture Volume (WQCV) Design Volume
V_{WQCV} = WQCV / 12 * Area — V_{WQCV} = cu ft

F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.42 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) — $V_{WQCV\ USER}$ = 1,293 cu ft

2. Basin Geometry

A) WQCV Depth — D_{WQCV} = 0.8 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} = 728 sq ft

D) Actual Filter Area — ✓ A_{Actual} = 791 sq ft

E) Volume Provided — V_T = 46068 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 = 2.3 ft

ii) Volume to Drain in 12 Hours — Vol_{12} = 1,293 cu ft

iii) Orifice Diameter, 3/8" Minimum — D_O = 13/16 in

Design Procedure Form: Sand Filter (SF)

Designer: SPC
Company: HR Green
Date: December 2, 2024
Project: Eastonville Road - Segment 1 Improvements SFB D
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/forebay, 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:

clarify that this sheet is provided for forebay sizing only

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: SPC
Company: HR Green
Date: October 4, 2024
Project: Eastonville Road - Segment 1 Improvements SFB D
Location: EL PASO COUNTY, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 34.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.340

C) Contributing Watershed Area — Area = 3.930 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
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$ = 0.030 ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = 0 %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = 100 %
- 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: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.139 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} = 1% of the WQCV) — V_{FMIN} = 0.0000 ac-ft

B) Actual Forebay Volume — V_F = 0.0008 ac-ft

C) Forebay Depth (D_F = 12 inch maximum) — D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 7.10 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.14 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

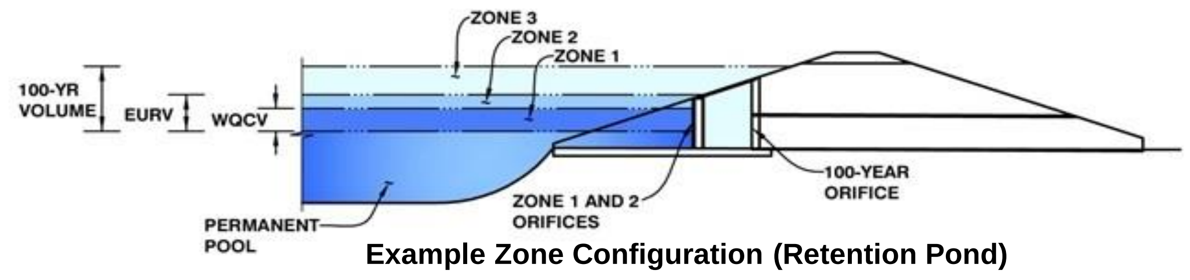
G) Rectangular Notch Width — Calculated W_N = 2.9 in

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road**

Basin ID: **SFB D**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**SF**	
Watershed Area =	3.93	acres
Watershed Length =	895	ft
Watershed Length to Centroid =	243	ft
Watershed Slope =	0.016	ft/ft
Watershed Imperviousness =	34.00%	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) =	0.030	acre-feet	0.030	acre-feet
Excess Urban Runoff Volume (EURV) =	0.139	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.136	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.212	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.282	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.385	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.465	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.569	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	0.954	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.100	acre-feet		
Approximate 5-yr Detention Volume =	0.142	acre-feet		
Approximate 10-yr Detention Volume =	0.202	acre-feet		
Approximate 25-yr Detention Volume =	0.230	acre-feet		
Approximate 50-yr Detention Volume =	0.242	acre-feet		
Approximate 100-yr Detention Volume =	0.282	acre-feet		

Define Zones and Basin Geometry

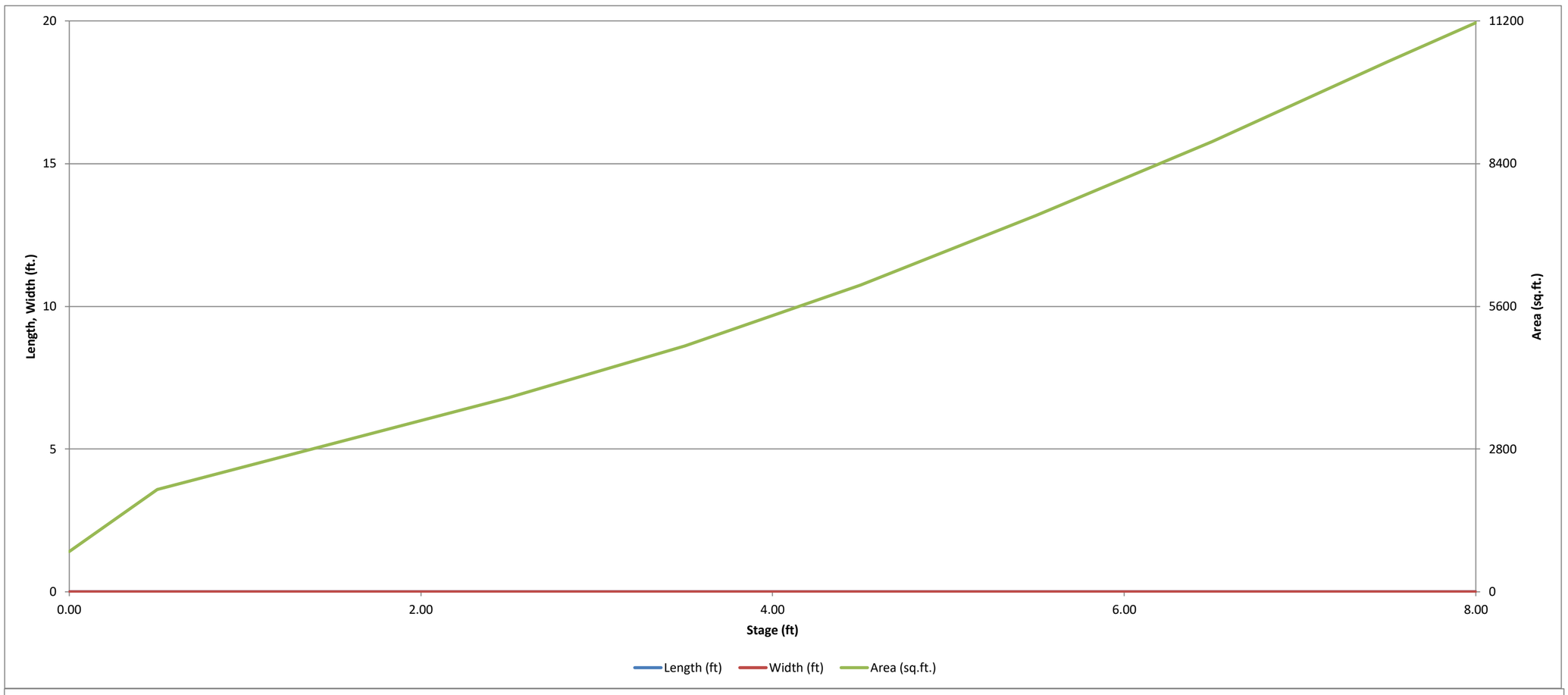
Zone 1 Volume (WQCV) =	0.030	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.109	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.144	acre-feet
Total Detention Basin Volume =	0.282	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (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	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

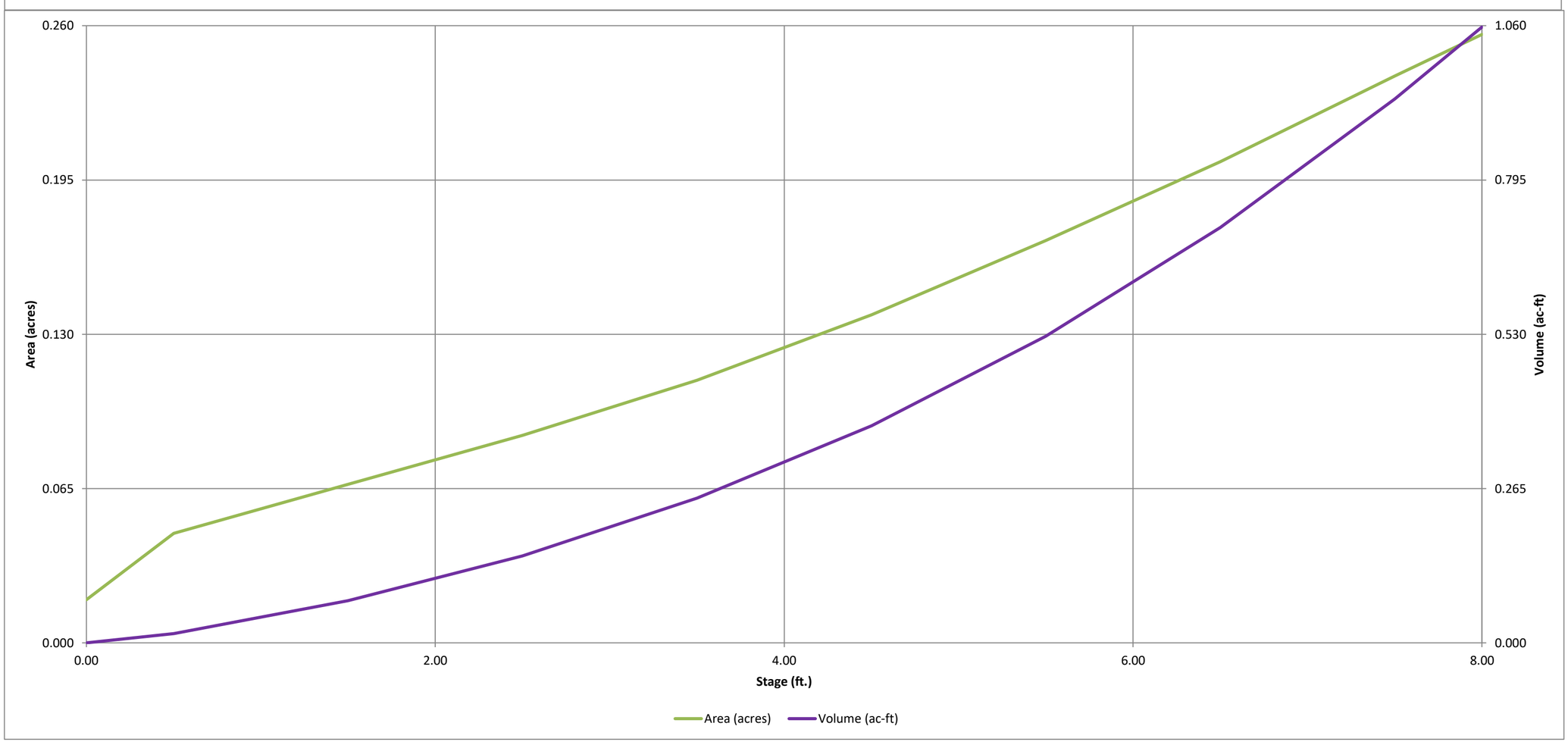
Depth Increment = ft

	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)
6962.5	**Media Surface**	--	0.00	--	--	--	791	0.018		
	6963	--	0.50	--	--	--	2,006	0.046	699	0.016
		--	1.50	--	--	--	2,909	0.067	3,157	0.072
		--	2.50	--	--	--	3,809	0.087	6,516	0.150
		--	3.50	--	--	--	4,821	0.111	10,831	0.249
	6,967.00	--	4.50	--	--	--	6,018	0.138	16,250	0.373
		--	5.50	--	--	--	7,383	0.169	22,951	0.527
		--	6.50	--	--	--	8,831	0.203	31,058	0.713
		--	7.50	--	--	--	10,405	0.239	40,676	0.934
	6,970.50	--	8.00	--	--	--	11,164	0.256	46,068	1.058
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				
		--		--	--	--				

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



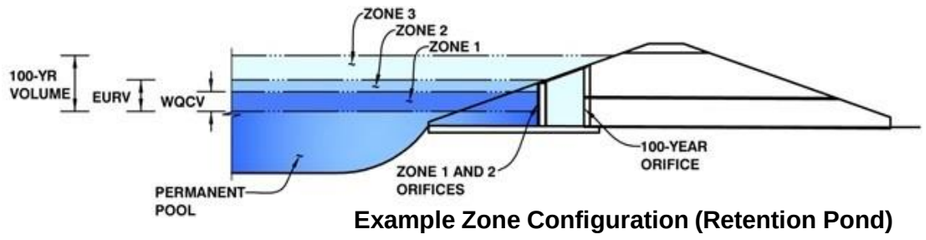


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road**

Basin ID: **SFB D**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.79	0.030	Filtration Media
Zone 2 (EURV)	2.38	0.109	Circular Orifice
Zone 3 (100-year)	3.80	0.144	Weir&Pipe (Restrict)
Total (all zones)		0.282	

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

✓ Underdrain Orifice Invert Depth =	2.13	ft (distance below the filtration media surface)
✓ Underdrain Orifice Diameter =	0.85	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Centroid =	0.04	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)

	Zone 2 Circular	Not Selected	
✓ Invert of Vertical Orifice =	0.80	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.38	N/A	ft (relative to basin bottom at Stage = 0 ft)
✓ Vertical Orifice Diameter =	0.50	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.00	N/A	ft^2
Vertical Orifice Centroid =	0.02	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 =	2.50	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 =	2.50	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	15.21	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 =	2.38	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 =	5.10		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.41	N/A	ft^2
Outlet Orifice Centroid =	0.25	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.12	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.50	feet
Stage at Top of Freeboard =	8.00	feet
Basin Area at Top of Freeboard =	0.26	acres
Basin Volume at Top of Freeboard =	1.06	acre-ft

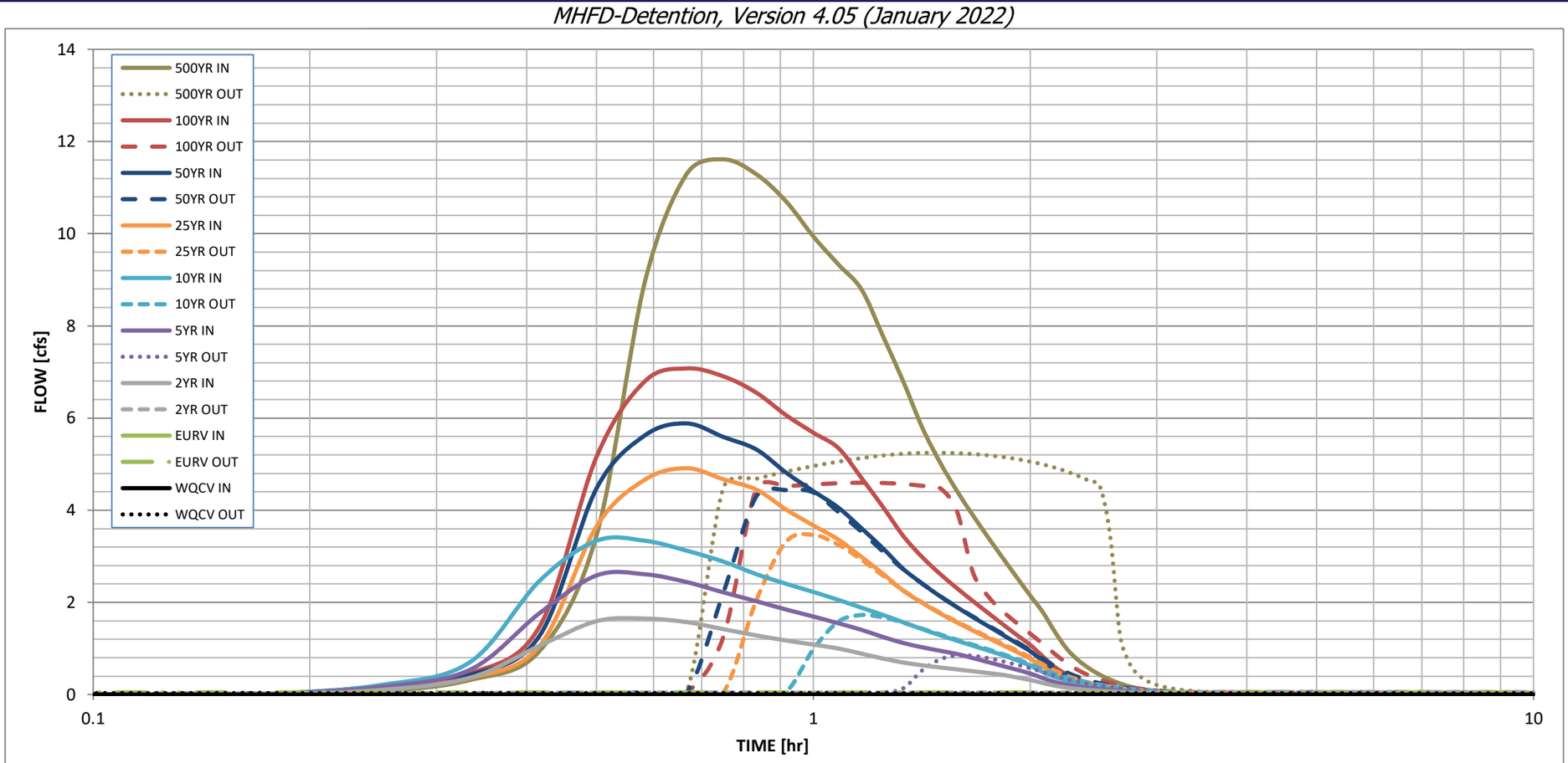
Routed Hydrograph Results

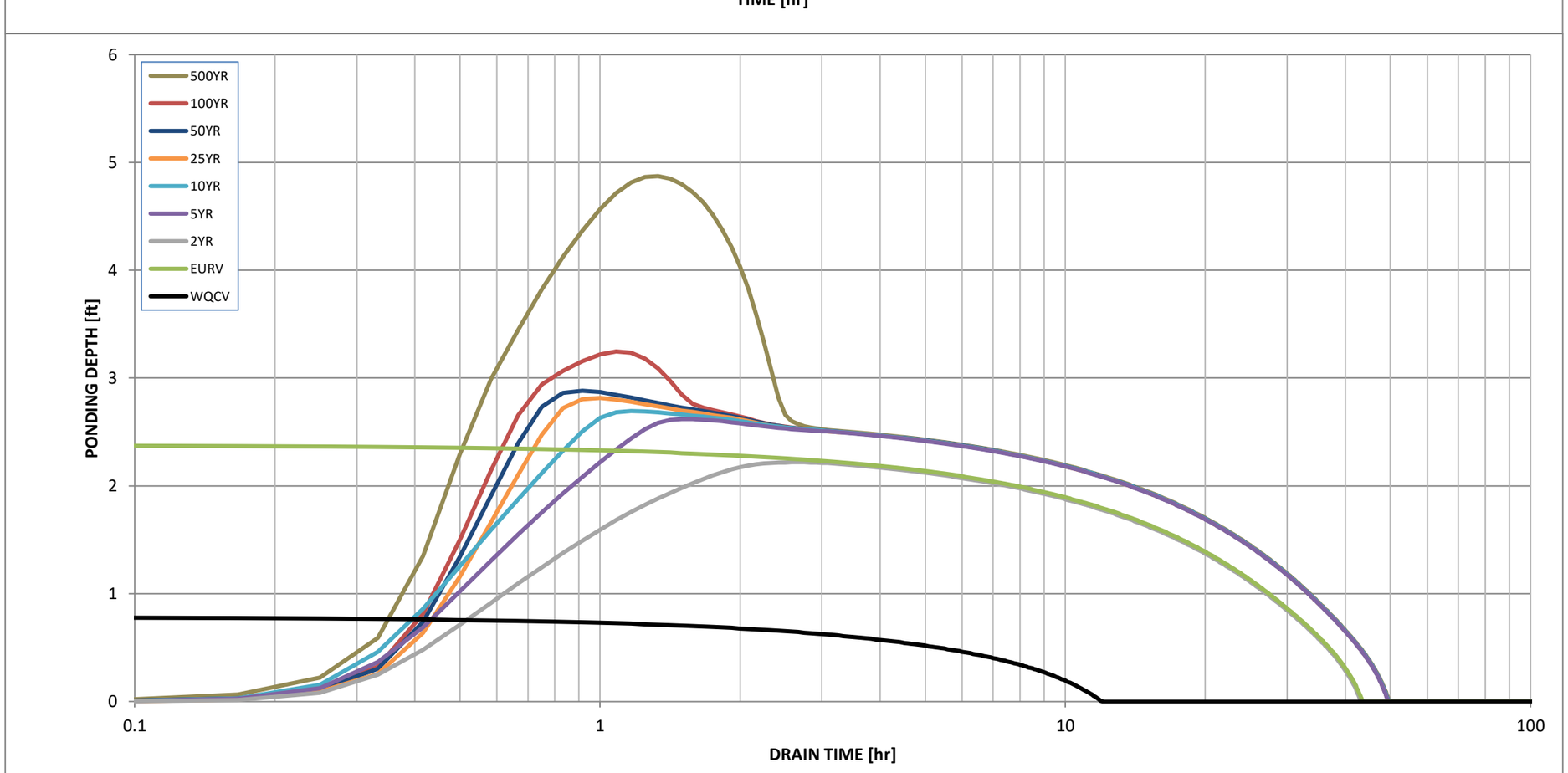
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

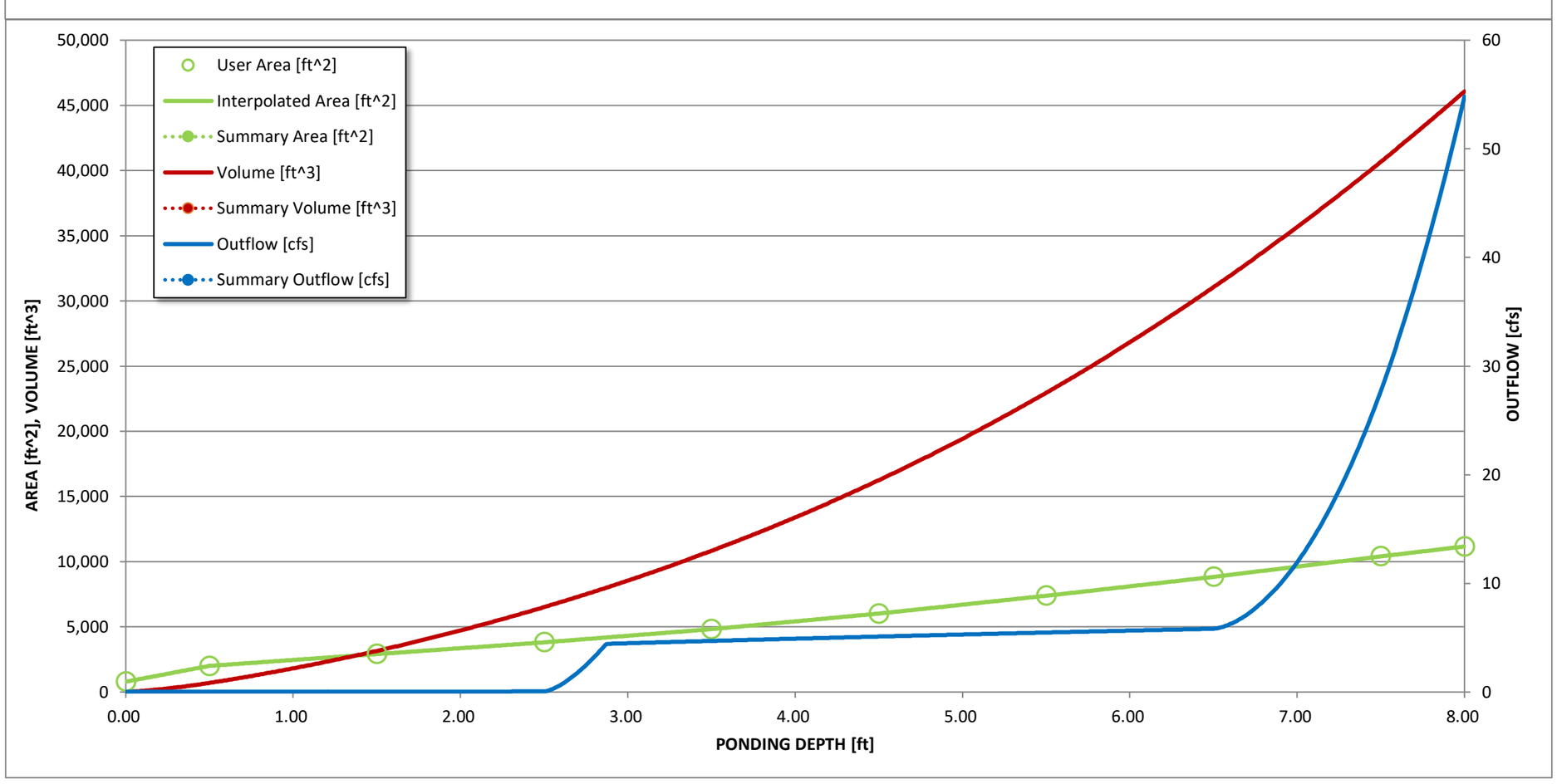
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.030	0.139	0.136	0.212	0.282	0.385	0.465	0.569	0.954
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.136	0.212	0.282	0.385	0.465	0.569	0.954
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	1.1	1.6	2.9	3.6	4.6	8.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.27	0.41	0.73	0.92	1.18	2.07
Peak Inflow Q (cfs) =	N/A	N/A	1.6	2.6	3.3	4.9	5.9	7.1	11.6
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.8	1.7	3.5	4.4	4.6	5.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.1	1.2	1.2	1.0	0.6
Structure Controlling Flow =	Filtration Media	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.3	0.5	0.7	0.7	0.8
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	42	47	46	45	44	43	38
Time to Drain 99% of Inflow Volume (hours) =	**12**	43	43	49	48	48	48	47	46
Maximum Ponding Depth (ft) =	0.79	2.38	2.22	2.62	2.70	2.81	2.88	3.25	4.87
Area at Maximum Ponding Depth (acres) =	0.05	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.15
Maximum Volume Stored (acre-ft) =	0.030	0.139	0.125	0.159	0.167	0.178	0.184	0.221	0.426

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	0.01	0.00	0.07
	0:15:00	0.00	0.00	0.10	0.16	0.20	0.14	0.17	0.17	0.31
	0:20:00	0.00	0.00	0.36	0.54	0.70	0.36	0.42	0.46	0.95
	0:25:00	0.00	0.00	1.06	1.77	2.47	1.06	1.27	1.47	3.46
	0:30:00	0.00	0.00	1.59	2.58	3.34	3.65	4.47	5.16	8.94
	0:35:00	0.00	0.00	1.65	2.61	3.34	4.66	5.62	6.80	11.29
	0:40:00	0.00	0.00	1.57	2.44	3.12	4.91	5.88	7.08	11.61
	0:45:00	0.00	0.00	1.42	2.22	2.89	4.67	5.59	6.91	11.29
	0:50:00	0.00	0.00	1.28	2.03	2.61	4.45	5.32	6.55	10.70
	0:55:00	0.00	0.00	1.17	1.85	2.40	4.02	4.82	6.06	9.94
	1:00:00	0.00	0.00	1.08	1.69	2.23	3.67	4.41	5.68	9.33
	1:05:00	0.00	0.00	1.00	1.55	2.05	3.36	4.06	5.35	8.79
	1:10:00	0.00	0.00	0.89	1.40	1.88	2.99	3.61	4.70	7.77
	1:15:00	0.00	0.00	0.78	1.25	1.73	2.62	3.17	4.07	6.79
	1:20:00	0.00	0.00	0.70	1.12	1.57	2.25	2.72	3.44	5.79
	1:25:00	0.00	0.00	0.64	1.03	1.42	1.99	2.41	2.98	5.03
	1:30:00	0.00	0.00	0.59	0.95	1.29	1.76	2.13	2.62	4.42
	1:35:00	0.00	0.00	0.55	0.88	1.17	1.56	1.90	2.31	3.89
	1:40:00	0.00	0.00	0.51	0.79	1.06	1.39	1.68	2.03	3.40
	1:45:00	0.00	0.00	0.47	0.70	0.95	1.23	1.48	1.77	2.96
	1:50:00	0.00	0.00	0.43	0.62	0.85	1.07	1.30	1.52	2.54
	1:55:00	0.00	0.00	0.37	0.54	0.75	0.92	1.11	1.29	2.15
	2:00:00	0.00	0.00	0.32	0.46	0.63	0.78	0.94	1.08	1.79
	2:05:00	0.00	0.00	0.25	0.36	0.49	0.60	0.73	0.83	1.35
	2:10:00	0.00	0.00	0.19	0.27	0.38	0.44	0.53	0.59	0.99
	2:15:00	0.00	0.00	0.15	0.21	0.30	0.32	0.39	0.44	0.74
	2:20:00	0.00	0.00	0.12	0.17	0.25	0.25	0.30	0.33	0.57
	2:25:00	0.00	0.00	0.10	0.14	0.20	0.19	0.23	0.24	0.43
	2:30:00	0.00	0.00	0.08	0.12	0.17	0.15	0.18	0.18	0.32
	2:35:00	0.00	0.00	0.07	0.09	0.13	0.11	0.14	0.14	0.24
	2:40:00	0.00	0.00	0.05	0.08	0.11	0.09	0.11	0.10	0.18
	2:45:00	0.00	0.00	0.04	0.06	0.08	0.07	0.08	0.07	0.13
	2:50:00	0.00	0.00	0.03	0.05	0.06	0.05	0.06	0.06	0.10
	2:55:00	0.00	0.00	0.03	0.04	0.05	0.04	0.05	0.04	0.08
	3:00:00	0.00	0.00	0.02	0.03	0.04	0.03	0.04	0.04	0.06
	3:05:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.05
	3:10:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.04
	3:15:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.02	0.03
	3:20:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	3:25:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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).

APPENDIX E – REFERENCE MATERIAL

NEW DOC

Final Drainage Report

for

Meridian Ranch Filing 11A

MERIDIAN RANCH

A GOLF & RECREATIONAL COMMUNITY

EL PASO COUNTY, COLORADO

Prepared For:

GTL DEVELOPMENT, INC.
3575 Kenyon Street
San Diego, CA 92110

March 2014

Prepared By:
Tech Contractors
12311 Rex Road
Falcon, CO 80831
719.495.7444

As a part of the analysis, the pond was modeled using the as-built contours and recalculation of the WQCV stand pipe. The Pond D Stage Storage Table and WQCV calculation can be found in Appendix E - Detention Pond Information.

Two models were calculated for Pond D, the interim and future final, to determine the storage volume and maximum storage elevation with the pond for the 5-year storm event and the 100-year event. The current future maximum storage volume is determined to be 21.1 ac-ft at an elevation of 7056.4 ft. This elevation leaves sufficient freeboard below the emergency overflow spillway; the maximum volume of Pond D to the spillway is 32.0 ac-ft providing 50 percent additional capacity at final build out. Another model was created using current condition plus the Filing 11A downstream of Pond D. This model was used to help design the second pond constructed with this filing. This interim model used the as-build topographic survey information for Pond D and the upstream area tributary to the pond was modeled under its current existing state. This model yielded a maximum storage volume of 16.3 ac-ft with a maximum surface elevation of 7055.7 feet, leaving ample space for future upstream development.

A WQCV analysis was also performed on account of the changed conditions shown by the as-built survey of the pond after its construction. The analysis showed that a different water quality stand pipe could be installed with the construction of the permanent concrete outfall structure. These calculations can be found in the appendix and have been incorporated into the construction plans.

The storm drain outfall system including the permanent concrete outfall structure and the storm drain pipe from Pond D to Lambert Drive will be constructed ahead of the improvements for Meridian Ranch Filing 11A. This construction is necessary to complete the system associated with a CLOMR on file with FEMA so that the process can move forward to complete LOMR and remove the floodplain from the maps in this area. The design and construction of the Pond D outfall system is based on the calculations and analysis found in this report.

Table 2: Pond D Summary Data

POND D						
	PEAK INFLOW	PEAK OUTFLOW	TOTAL INFLOW	TOTAL OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	AC-FT	AC-FT	FT
INTERIM CONDITIONS - FILING 11A						
100-YEAR STORM	361	64	34.5	29.6	16.3	7055.7
5-YEAR STORM	95	8	11.2	8.0	6.0	7053.5
FUTURE CONDITIONS						
100-YEAR STORM	495	105	45.7	40.3	21.1	7056.4
5-YEAR STORM	153	15.0	16.3	12.8	8.4	7054.1

Pond E Detention Storage Criteria

Detention Pond E is located south of Londonderry and west of Eastonville, southeast of the project site and will be owned and maintained by the Meridian Service Metropolitan District

(MSMD). A maintenance agreement between the Meridian Service Metropolitan District and El Paso County will be executed and recorded as a part of the Meridian Ranch Filing 11A Final Plat process.

The SCS calculation method was used to determine inflow and outflow from the detention pond to ensure that the additional runoff does not overcharge the pond and the discharges do not adversely impact drainage patterns downstream of Eastonville Road. Storm drainage runoff will enter the pond from the project site via an existing pipe network and overland through existing drainage swales. The ultimate future build-out design of the pond was analyzed to insure that additional grading and sizing of the pond would be unnecessary after development of Meridian Ranch Filing 11A other areas tributary to the detention pond. This SCS calculation can be found in the appendix.

The pond is designed to accommodate the final inflow from Meridian Ranch Filing 11A as well as the ultimate build out of all the tributary areas. Concrete control structures have been preliminarily designed to reduce the developed flows to at or below the historic peak flow rates and will be installed at a later date. Temporary CMP control structures that were installed with the grading operation will continue to be used in the interim to reduce the flow rates that will cross Eastonville Road at Design Points H08 and H09. The control structures will be analyzed with each development that is tributary to the pond.

The temporary control structure at DP H08 consists of a 12" CMP water quality control riser with a trash grate having a top elevation of 6968.00. The water quality control riser will be connected to a 54" CMP control riser with a 12" CMP pipe at 1%. The temporary control structure will consist of a 54" CMP with a top elevation of 6970.95 in order to accept storm flows from larger events. The pipe is to be equipped with a welded trash rack. The riser also has a 1.5'x 8' slot opening (elev. = 6969.45) is proposed along the front of the control structure to pass lower flows.

Table 3: Pond E Summary Data

POND E						
	PEAK INFLOW	PEAK OUTFLOW	TOTAL INFLOW	TOTAL OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	AC-FT	AC-FT	FT
INTERIM CONDITIONS - FILING 11A						
Design Point H08						
100-YEAR STORM	333	74	70.9	65.2	17.6	6971.2
5-YEAR STORM	66	12	20.6	18.4	6.2	6969.7
Design Point H09						
100-YEAR STORM	333	67	70.9	65.2	17.6	6971.2
5-YEAR STORM	66	6.3	20.6	18.4	6.2	6969.7
FUTURE CONDITIONS						
Design Point H08						
100-YEAR STORM	707	155	107.3	91.9	33.5	6972.6
5-YEAR STORM	233	15.8	38.2	27.4	17.5	6971.2
Design Point H09						
100-YEAR STORM	707	62	107.3	91.9	33.5	6972.6
5-YEAR STORM	233	8.7	38.2	27.4	17.5	6971.2

The temporary control structure at DP H09 consists of a 12" CMP water quality control riser with a trash grate having a top elevation of 6968.00. The water quality control riser will be connected to a 54" CMP control riser with a 12" CMP pipe at 1%. The temporary control structure will consist of a 54" CMP with a top elevation of 6970.95 in order to accept storm flows from larger events. The pipe is to be equipped with a welded trash rack. The riser also has a 1.2'x 5' slot opening (elev. = 6969.75) is proposed along the front of the control structure to pass lower flows.

An analysis of the SCS calculations show that with the control structures in place for the developed flows, the flow rates are reduced sufficiently to reduce the peak rates below the target of 80-percent of historic at Eastonville Road during the post grading condition.

Table 4: Eastonville Road at DP H08 and H09

EASTONVILLE FLOW RATES					
EVENT	HISTORIC PEAK FLOW (CFS)	FILING 11A PEAK FLOW (CFS)	PERCENT OF HISTORIC	FUTURE PEAK FLOW (CFS)	PERCENT OF HISTORIC
H08					
100-YEAR	232	74	32%	155	67%
5-YEAR	22	12	55%	15.8	72%
H09					
100-YEAR	87	67	77%	62	71%
5-YEAR	11	6.3	57%	8.7	79%

A water quality capture volume (WQCV) was added to the required storage volume for the final build out condition. The purpose of the WQCV is to allow particulates to settle out and accumulate over time to improve water quality and to maintain full volume for detention during the life of the facility for a major storm event. 332 acres are tributary to the detention pond during the developed condition resulting in a required WQCV of 1.6 ac-ft.

The WQCV of 1.6 ac-ft. was added to the detention of the minor storm and half (0.8 ac-ft.) was added to the detention volume of the major storm. This was accomplished with respect to the HEC-HMS computer run by providing a starting detention volume of 1.6 ft. for the 5-year storm and 0.8 ft. for the 100-year storm. The resulting storage elevations remain well below the emergency spillway elevation. See Appendix B for more information.

The WQCV was calculated by using the equations found in Volume 2, of the Drainage Criteria Manual (DCM). The release rate from the WQCV is generally very small, which helps minimize downstream impacts. Detaining the WQCV also serves to cleanse the "first flush" of runoff from the higher initial concentration of sediment and pollutants by allowing for settlement to occur. This greatly improves the quality of runoff, leaving the facility and reduces the potential for erosion. The positive impact on water quality is expected to be significant, particularly during the construction phase of the development.

Future Condition - SCS Calculation Method

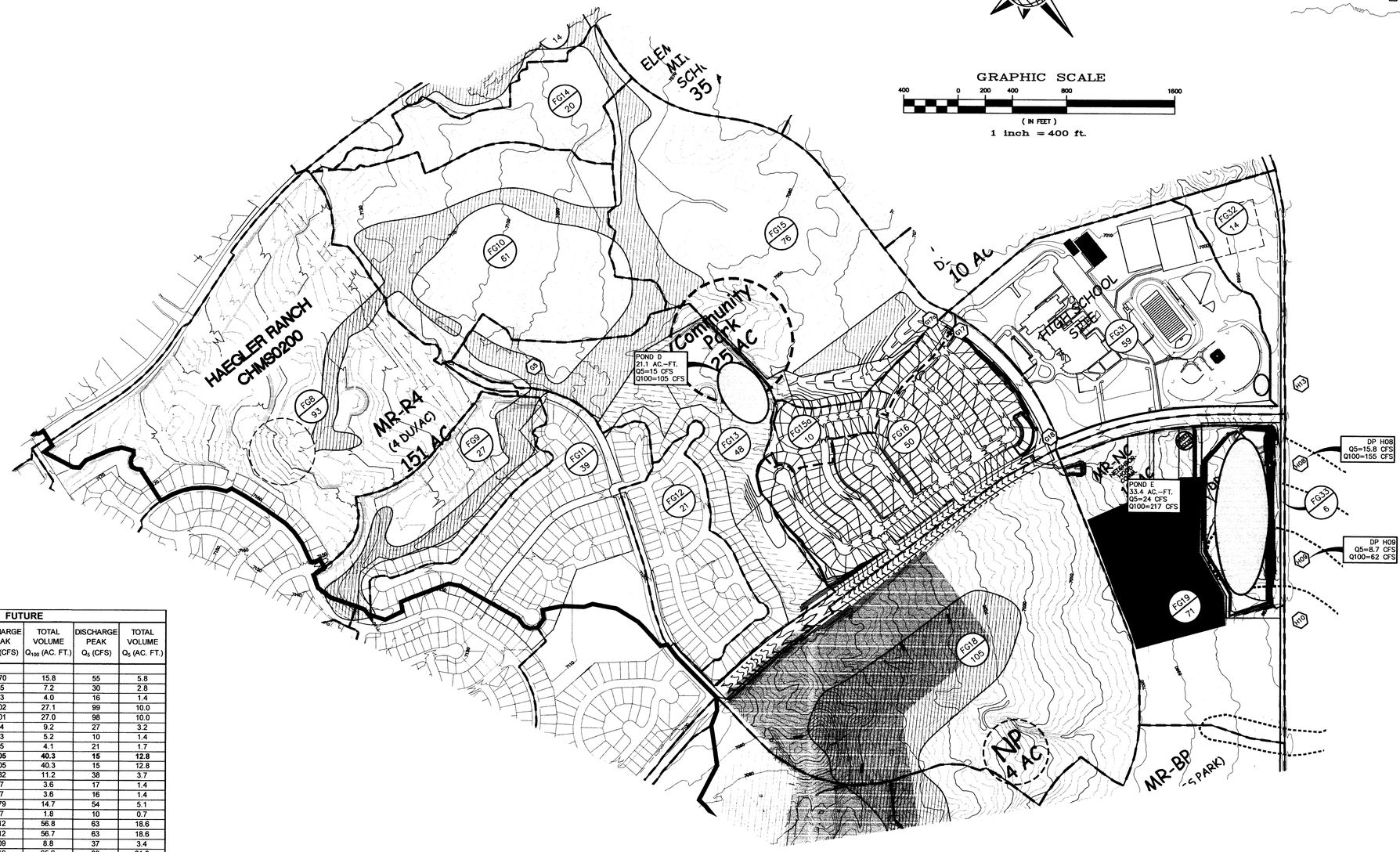
Following is a tabulation of the surface drainage characteristics for the future developed conditions using the SCS calculation method. Please refer to Figure 6 - Meridian Ranch SCS Calculations – Future Basins Map

Table 7: Future Drainage Basins-SCS

FUTURE					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
FG08	0.1453	170	15.8	55	5.8
FG11	0.0608	85	7.2	30	2.8
FG09	0.0416	53	4.0	16	1.4
G05	0.2477	302	27.1	99	10.0
G05-POND D	0.2477	301	27.0	98	10.0
FG10	0.0953	94	9.2	27	3.2
FG13	0.075	53	5.2	10	1.4
FG12	0.0328	55	4.1	21	1.7
POND D	**0.4508**	**105**	**40.3**	**15**	**12.8**
POND D-G17	0.4508	105	40.3	15	12.8
FG15	0.1188	132	11.2	38	3.7
FG14	0.0313	47	3.6	17	1.4
FG14-G17	0.0313	47	3.6	16	1.4
G17a	0.1501	179	14.7	54	5.1
FG15a	0.0156	27	1.8	10	0.7
G17	0.6165	212	56.8	63	18.6
G17-G18	0.6165	212	56.7	63	18.6
FG16	0.0773	109	8.8	37	3.4
G18	0.6938	319	65.6	99	21.9
G18-POND E	0.6938	317	65.6	99	21.9
FG18	0.1641	198	16.9	62	6.0
FG18-POND E	0.1641	198	16.9	62	6.0
FG19	0.0977	203	13.2	83	5.6
FG31	0.0922	123	11.6	45	4.7
POND HS	0.0922	79	11.6	25	4.7
POND E	**1.0478**	**217**	**92.1**	**24**	**27.7**
FG33	0.0109	15	1.0	4	0.3
H08	1.0587	**155**	93.1	**15.8**	28
H09		**62**		**8.7**	
*** FROM OUTLET STAGE-STORAGE CALCULATION**					

A comparison of the peak flow rates at Eastonville Road for the design storms may be found in Table 5 – Eastonville Road at DP H08 and H09 (below). As a result of the development of Meridian Ranch Filing 11A and future development, the calculations do show that the project does not adversely affect the existing drainage facilities.

SCS DRAINAGE MAP
MERIDIAN RANCH FILING 11A



FUTURE					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
FG08	0.1453	170	15.8	55	5.8
FG11	0.0608	85	7.2	30	2.8
FG09	0.0416	53	4.0	16	1.4
G05	0.2477	302	27.1	99	10.0
G05-POND D	0.2477	301	27.0	98	10.0
FG10	0.0953	94	9.2	27	3.2
FG13	0.075	53	5.2	10	1.4
FG12	0.0328	55	4.1	21	1.7
POND D	**0.4508**	**105**	**40.3**	**15**	**12.8**
POND D-G17	0.4508	105	40.3	15	12.8
FG15	0.1188	132	11.2	38	3.7
FG14	0.0313	47	3.6	17	1.4
FG14-G17	0.0313	47	3.6	16	1.4
G17a	0.1501	179	14.7	54	5.1
FG15a	0.0156	27	1.8	10	0.7
G17	0.6165	212	56.8	63	18.6
G17-G18	0.6165	212	56.7	63	18.6
FG16	0.0773	109	8.8	37	3.4
G18	0.6938	319	65.6	99	21.9
G18-POND E	0.6938	317	65.6	99	21.9
FG18	0.1641	198	16.9	62	6.0
FG18-POND E	0.1641	198	16.9	62	6.0
FG19	0.0977	203	13.2	83	5.6
FG31	0.0922	123	11.6	45	4.7
POND HS	0.0922	79	11.6	25	4.7
POND E	**1.0478**	**217**	**92.1**	**24**	**27.7**
FG33	0.0109	15	1.0	4	0.3
H08	1.0587	**155**	93.1	**15.8**	28
H09		**62**		**8.7**	
* FROM OUTLET STAGE-STORAGE CALCULATION					

FINAL DRAINAGE REPORT
FUTURE CONDITIONS

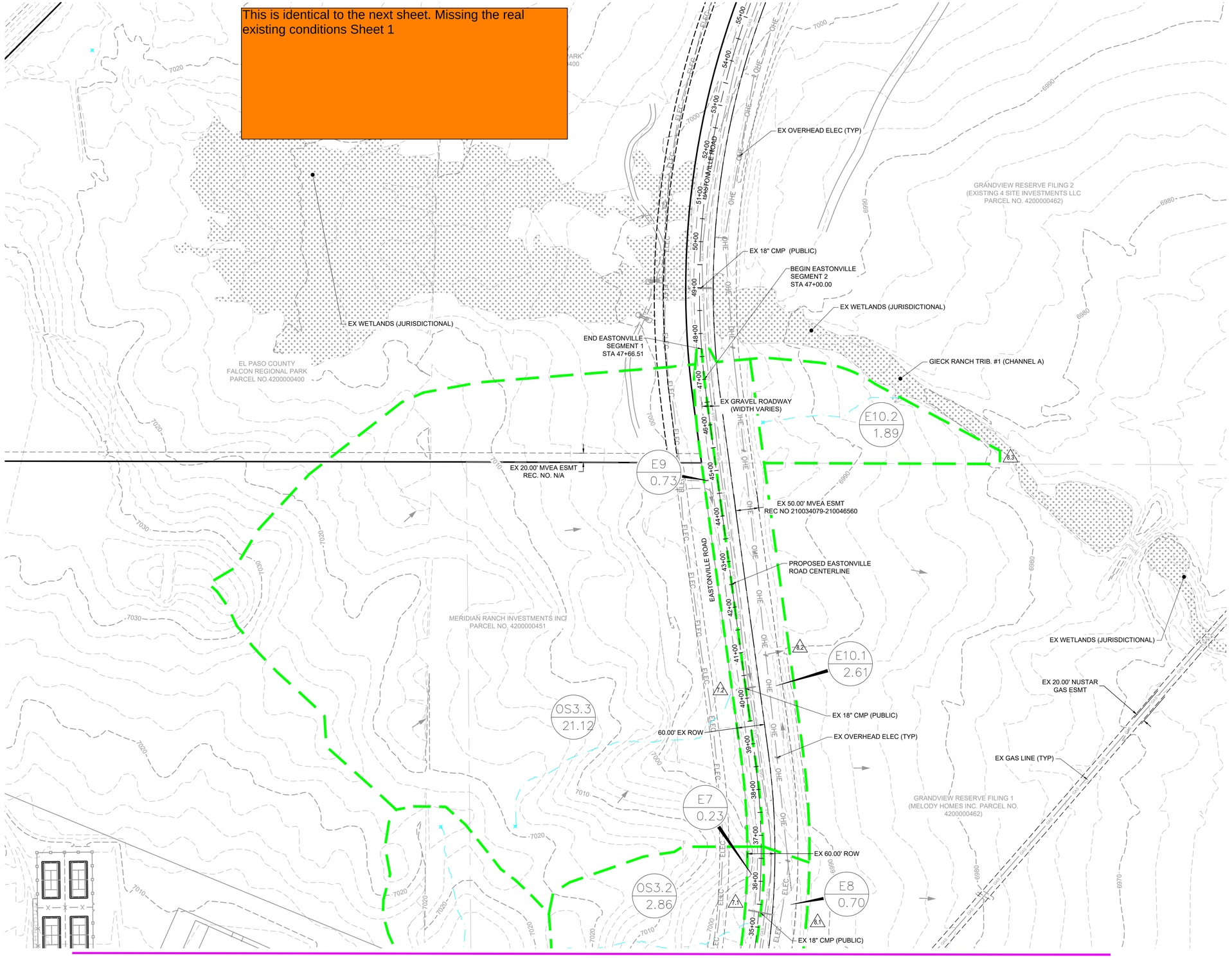
TECH CONSTRUCTION CORP.
12311 REX ROAD
PEYTON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MAR 2014

FIGURE 7

APPENDIX F – DRAINAGE MAPS

This is identical to the next sheet. Missing the real existing conditions 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	Q5 (cfs)	Q100 (cfs)
E1	0.45	48	0.7	1.7
E2.1	1.82	13	1.2	4.8
E2.2	0.40	2	0.1	1.0
E3	0.72	39	1.0	2.5
E4	3.17	12	1.9	7.8
E5	0.23	45	0.5	1.1
E6	0.79	14	0.7	2.6
E7	0.23	45	0.5	1.2
E8	0.70	16	0.6	2.1
E9	0.73	45	1.2	2.8
E10.1	2.61	15	1.9	7.0
E10.2	1.89	2	0.7	4.4
OS1	1.58	2	0.5	3.6
OS2	12.21	2	3.6	24.3
OS3.1	1.51	2	0.5	3.6
OS3.2	2.86	2	1.0	6.6
OS3.3	21.12	2	6.4	42.7

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	E1,OS1	1.2	4.9
2	E2,DP1	2.3	9.3
2.2	E2.2	0.1	1.0
3	E3,OS2	4.6	26.6
4	DP3,E4	6.3	33.9
5	E5,OS3.1	0.9	4.5
6	DP5,E6	1.5	6.7
7.1	E7,OS3.2	1.4	7.5
8.1	DP7.1,E8	1.9	9.4
7.2	OS3.3,E9	7.5	45.3
8.2	DP7.2,E10.1	9.2	51.6
8.3	E10.2	0.7	4.4

NORTH
0 100
50

DRAWN BY: _____ JOB DATE: _____
APPROVED: _____ JOB NUMBER: _____
CAD DATE: _____
CAD FILE: _____

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
PHONE: 719.300.4140
FAX: 713.965.0044

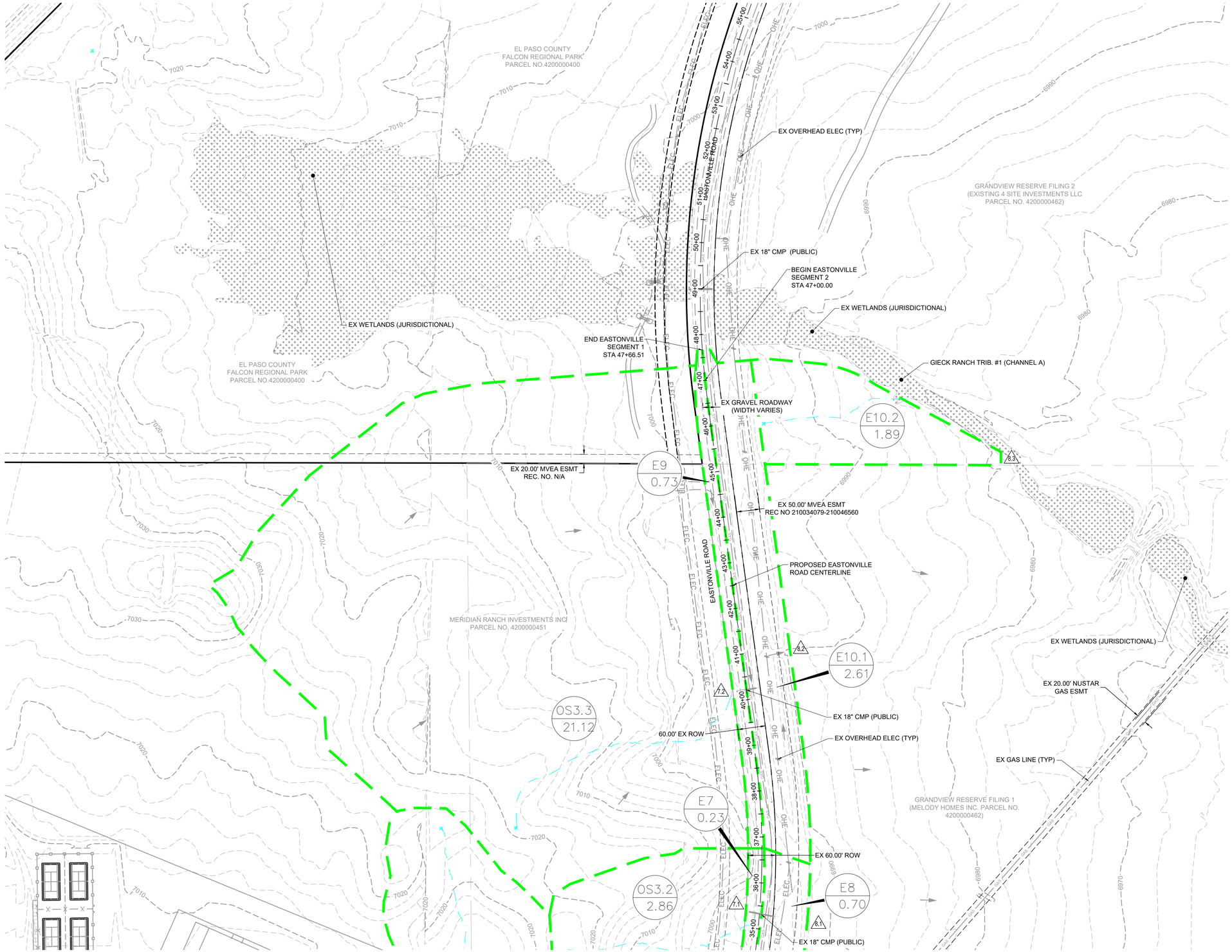
EASTONVILLE ROAD
D.R. HORTON
EL PASO COUNTY, CO

D·R·HORTON America's Builder

EXISTING CONDITIONS - DRAINAGE MAP

SHEET EX-DRN

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	Q5 (cfs)	Q100 (cfs)
E1	0.45	48	0.7	1.7
E2.1	1.82	13	1.2	4.8
E2.2	0.40	2	0.1	1.0
E3	0.72	39	1.0	2.5
E4	3.17	12	1.9	7.8
E5	0.23	45	0.5	1.1
E6	0.79	14	0.7	2.6
E7	0.23	45	0.5	1.2
E8	0.70	16	0.6	2.1
E9	0.73	45	1.2	2.8
E10.1	2.61	15	1.9	7.0
E10.2	1.89	2	0.7	4.4
OS1	1.58	2	0.5	3.6
OS2	12.21	2	3.6	24.3
OS3.1	1.51	2	0.5	3.6
OS3.2	2.86	2	1.0	6.6
OS3.3	21.12	2	6.4	42.7

DESIGN POINT SUMMARY TABLE			
DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	E1,OS1	1.2	4.9
2	E2,DP1	2.3	9.3
2.2	E2.2	0.1	1.0
3	E3,OS2	4.6	26.6
4	DP3,E4	6.3	33.9
5	E5,OS3.1	0.9	4.5
6	DP5,E6	1.5	6.7
7.1	E7,OS3.2	1.4	7.5
8.1	DP7.1,E8	1.9	9.4
7.2	OS3.3,E9	7.5	45.3
8.2	DP7.2,E10.1	9.2	51.6
8.3	E10.2	0.7	4.4

DRAWN BY: _____ JOB DATE: _____
APPROVED: _____ JOB NUMBER: _____
CAD DATE: _____
CAD FILE: _____

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
PHONE: 719.300.4140
FAX: 713.965.0044

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

D·R·HORTON America's Builder

EXISTING CONDITIONS - DRAINAGE MAP

SHEET EX-DRN

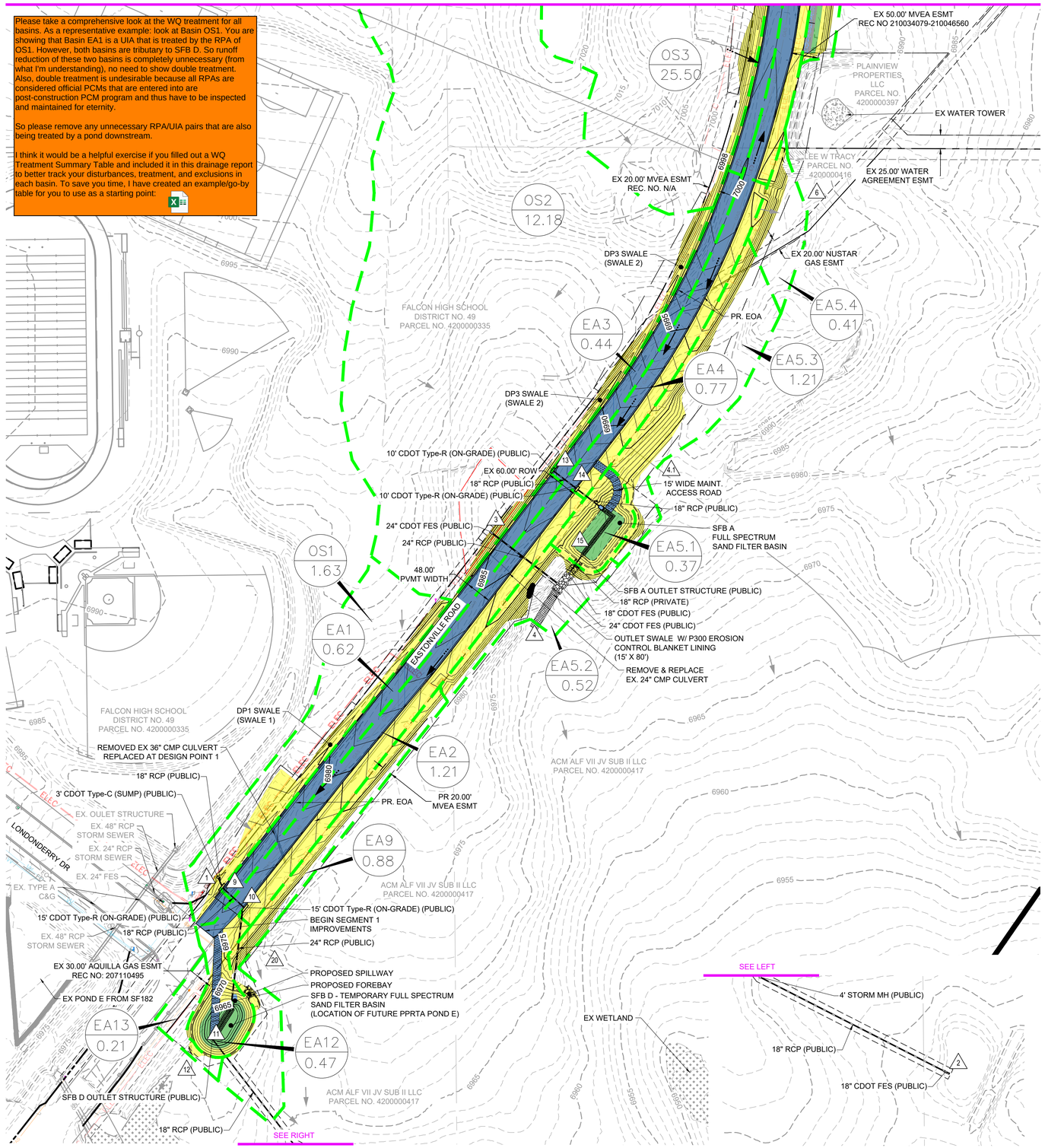
2

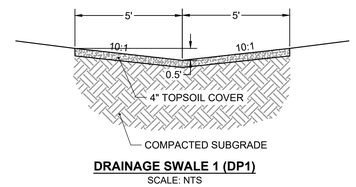
SEE SHEET 2

Please take a comprehensive look at the WQ treatment for all basins. As a representative example: look at Basin OS1. You are showing that Basin EA1 is a UIA that is treated by the RPA of OS1. However, both basins are tributary to SFB D. So runoff reduction of these two basins is completely unnecessary (from what I'm understanding), no need to show double treatment. Also, double treatment is undesirable because all RPAs are considered official PCMs that are entered into are post-construction PCM program and thus have to be inspected and maintained for eternity.

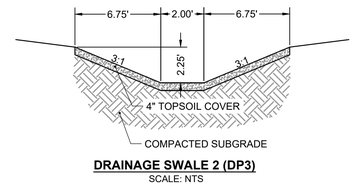
So please remove any unnecessary RPA/UIA pairs that are also being treated by a pond downstream.

I think it would be a helpful exercise if you filled out a WQ Treatment Summary Table and included it in this drainage report to better track your disturbances, treatment, and exclusions in each basin. To save you time, I have created an example/go-by table for you to use as a starting point:

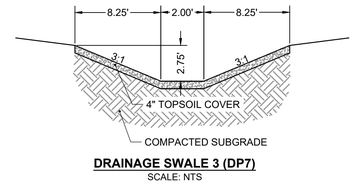




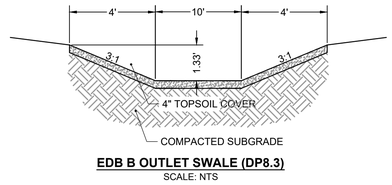
DRAINAGE SWALE 1 (DP1)
SCALE: NTS



DRAINAGE SWALE 2 (DP3)
SCALE: NTS



DRAINAGE SWALE 3 (DP7)
SCALE: NTS



EDB B OUTLET SWALE (DP8.3)
SCALE: NTS

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

- UNCONNECTED IMPERVIOUS AREA (UIA)
- RECEIVING PERVIOUS AREA (RPA)
- WQ EXCLUSION AREA
- SEPARATE PERVIOUS AREA (SPA)

Create another color for areas trib to each pond. All of those areas trib to a pond would not need to be one of the UIA, RPA, or SPA colors above, as long as the respective pond was sized to treat those areas.

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q5 (cfs)	Q100 (cfs)
EA1	0.62	97	2.6	4.7
EA2	1.21	50	2.5	5.6
EA3	0.44	91	1.8	3.0
EA4	0.77	52	1.7	2.9
EA5.1	0.37	9	0.3	0.4
EA5.2	0.52	0	0.2	1.6
EA5.3	1.21	0	0.4	2.9
EA5.4	0.41	0	0.1	1.0
EA6	1.09	91	3.1	5.2
EA7	1.92	52	3.2	5.4
EA8	0.94	50	0.5	0.9
EA9	0.88	35	0.4	0.6
EA10.1	0.36	23	0.4	0.6
EA10.2	1.06	23	1.4	4.4
EA11	1.23	0	0.5	0.9
EA12	0.47	25	0.6	1.7
EA13	0.21	26	0.3	0.7
EA8 & EA9 *Per Segment 2 FDR	5.07	78	10.2	17.2
OS1	1.63	2	0.5	3.6
OS2	12.18	2	3.6	24.2
OS3	25.50	2	8.0	53.6

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	OS1	0.5	3.6
2	DP20, SFB D Release	0.7	5.0
3	OS2	3.6	24.2
4	EA 5.2, OS2, DP4.1, SFB A RELEASE	4.1	28.6
4.1	EA5.3	0.6	3.5
6	EA5.4	0.4	2.0
7	OS3	8.0	53.6
8.3	DP 22, OS3, EDB B RELEASE	9.7	58.1
8.2	EA10.2	1.4	4.0
9	DP1, EA1	3.3	9.3
10	DP9, EA2	5.4	13.9
11	DP10, EA12	5.8	15.2
12	EA13	0.3	0.7
13	EA3	1.8	3.0
14	DP13, EA4	3.3	5.6
15	DP14, EA5	3.5	5.9
16	EA6	3.1	5.2
17	DP16, EA7	6.2	10.3
18	DP17	6.2	10.3
19	DP18,EA8	6.6	11.1
18U	DP17, EA8 & EA9 *PER SEGMENT 2 FDR	15.5	26.0
19U	DP18U, EA8	15.8	26.6
20	EA9	0.4	0.6
8.1	EA10	0.4	0.6
22	EA11	0.5	0.9

NOTE: "U" DESIGNATION INDICATES ULTIMATE CONDITION AFTER CONSTRUCTION OF SEGMENT 2

DRAWN BY:	NQJ	JOB DATE:	10/4/2024
APPROVED:	CM	JOB NUMBER:	201662.08
CAD DATE:	12/3/2024		
CAD FILE:	J:\2020\201662\CAD\Dwgs\C\Eastonville_Road_662.08\Drainage\201662.08_FDR_map_Seg1		

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

NO.	DATE	BY	REVISION DESCRIPTION

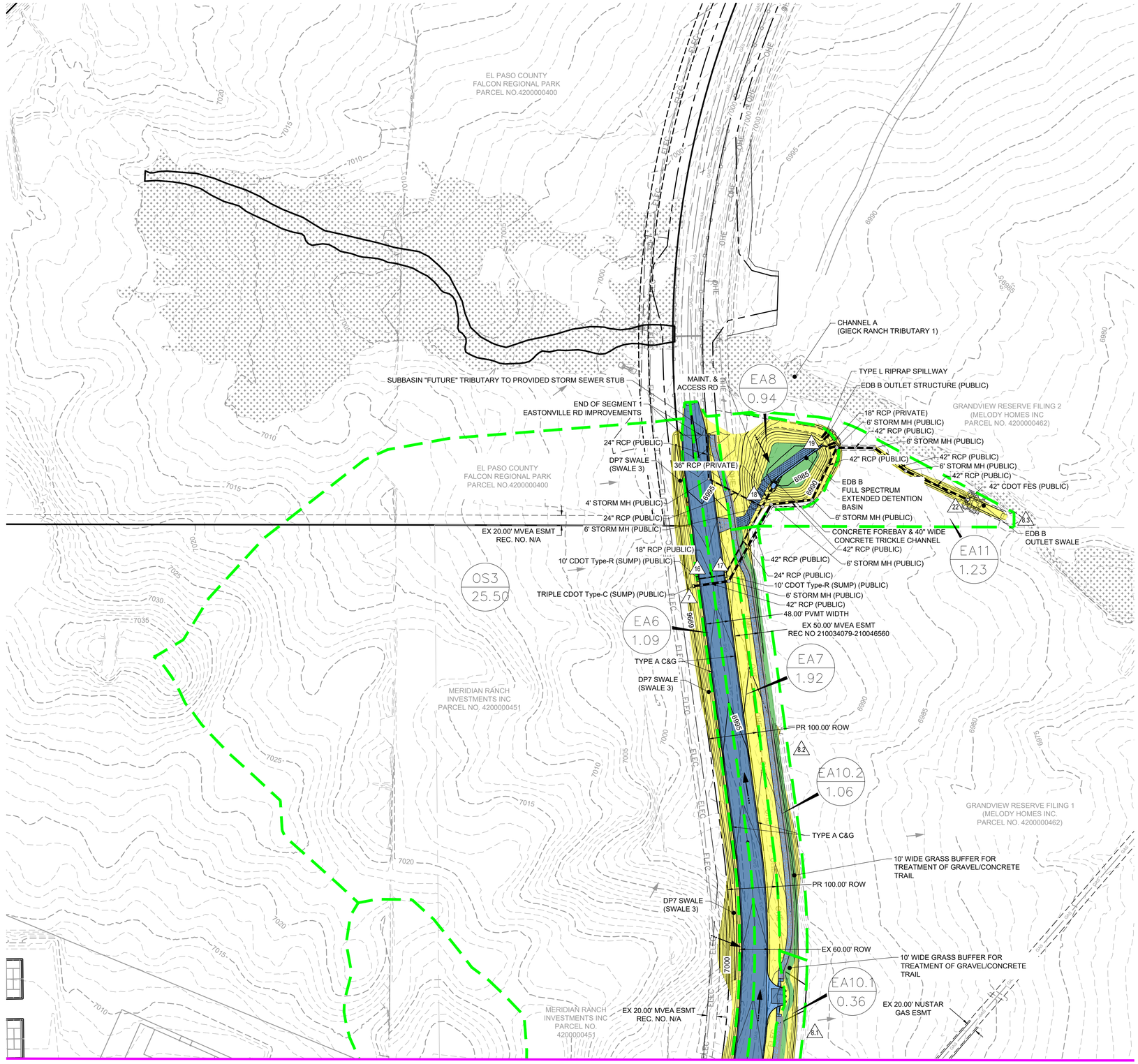
HRGreen
HR GREEN - COLORADO SPRINGS
1975 RESEARCH PKWY SUITE 230
COLORADO SPRINGS CO 80920
PHONE: 719.300.4140
FAX: 713.965.0044

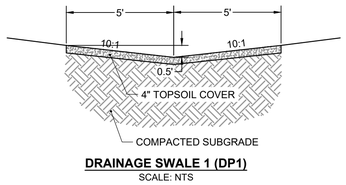
EASTONVILLE ROAD
D.R. HORTON
EL PASO COUNTY, CO

D·R·HORTON America's Builder

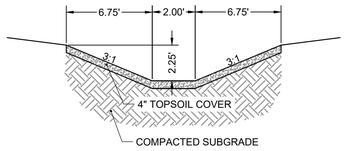
EASTONVILLE ROAD - SEGMENT 1
PROPOSED CONDITIONS DRAINAGE MAP

SHEET DRN 1

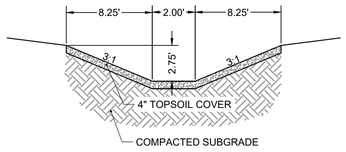




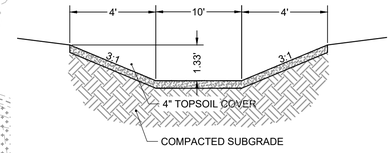
DRAINAGE SWALE 1 (DP1)
SCALE: NTS



DRAINAGE SWALE 2 (DP3)
SCALE: NTS



DRAINAGE SWALE 3 (DP7)
SCALE: NTS



EDB B OUTLET SWALE (DP8.3)
SCALE: NTS

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	
UNCONNECTED IMPERVIOUS AREA (UIA)	
RECEIVING PERVIOUS AREA (RPA)	
WQ EXCLUSION AREA	
SEPARATE PERVIOUS AREA (SPA)	

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q5 (cfs)	Q100 (cfs)
EA1	0.62	97	2.6	4.7
EA2	1.21	50	2.5	5.6
EA3	0.44	91	1.8	3.0
EA4	0.77	52	1.7	2.9
EA5.1	0.37	9	0.3	0.4
EA5.2	0.52	0	0.2	1.6
EA5.3	1.21	0	0.4	2.9
EA5.4	0.41	0	0.1	1.0
EA6	1.09	91	3.1	5.2
EA7	1.92	52	3.2	5.4
EA8	0.94	50	0.5	0.9
EA9	0.88	35	0.4	0.6
EA10.1	0.36	23	0.4	0.6
EA10.2	1.06	23	1.4	4.4
EA11	1.23	0	0.5	0.9
EA12	0.47	25	0.6	1.7
EA13	0.21	26	0.3	0.7
EA8 & EA9 *Per Segment 2 FDR	5.07	78	10.2	17.2
OS1	1.63	2	0.5	3.6
OS2	12.18	2	3.6	24.2
OS3	25.50	2	8.0	53.6

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	OS1	0.5	3.6
2	DP20, SFB D Release	0.7	5.0
3	OS2	3.6	24.2
4	EA 5.2, OS2, DP4.1, SFB A RELEASE	4.1	28.6
4.1	EA5.3	0.6	3.5
6	EA5.4	0.4	2.0
7	OS3	8.0	53.6
8.3	DP 22, OS3, EDB B RELEASE	9.7	58.1
8.2	EA10.2	1.4	4.0
9	DP1, EA1	3.3	9.3
10	DP9, EA2	5.4	13.9
11	DP10, EA12	5.8	15.2
12	EA13	0.3	0.7
13	EA3	1.8	3.0
14	DP13, EA4	3.3	5.6
15	DP14, EA5	3.5	5.9
16	EA6	3.1	5.2
17	DP16, EA7	6.2	10.3
18	DP17	6.2	10.3
19	DP18,EA8	6.6	11.1
18U	DP17, EA8 & EA9 *PER SEGMENT 2 FDR	15.5	26.0
19U	DP18U, EA8	15.8	26.6
20	EA9	0.4	0.6
8.1	EA10	0.4	0.6
22	EA11	0.5	0.9

NOTE: "U" DESIGNATION INDICATES ULTIMATE CONDITION AFTER CONSTRUCTION OF SEGMENT 2

NORTH
0 50 100

DRAWN BY: NQJ JOB DATE: 10/4/2024
APPROVED: CM JOB NUMBER: 201662.08
CAD DATE: 10/7/2024
CAD FILE: J:\2020\201662\CAD\Dwgs\C\Eastonville_Road_662.08\Drainage\201662.08_FDR_map_Seg1

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
PHONE: 719.300.4140
FAX: 713.965.0044

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

D·R·HORTON America's Builder

EASTONVILLE ROAD - SEGMENT 1
PROPOSED CONDITIONS DRAINAGE MAP

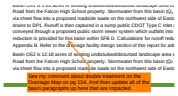
SHEET DRN 2

V4_Drainage Report Final - Segment 1.pdf Markup Summary

11 (2)

Subject: SW - Highlight
Page Index: 11
Date: 2/6/2025 5:06:53 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 11

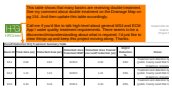
WQ treatment and runoff
reduction is provided for this basin within SFB D



Subject: SW - Textbox with Arrow
Page Index: 11
Date: 2/6/2025 5:14:14 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 11

See my comment about double treatment on the Drainage Map on pg 154. And then update all of the basin paragraphs up here that are impacted.

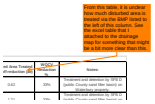
15 (2)



Subject: SW - Textbox with Arrow
Page Index: 15
Date: 2/10/2025 2:27:46 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 15

This table shows that many basins are receiving double treatment. See my comment about double treatment on the Drainage Map on pg 154. And then update this table accordingly.

Call me if you'd like to talk high-level about general MS4 and ECM App I water quality treatment requirements. There seems to be a disconnect/misunderstanding about what is required. I'd just like to clear things up and keep this project moving along. Thanks.



Subject: SW - Textbox with Arrow
Page Index: 15
Date: 2/10/2025 2:30:38 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 15

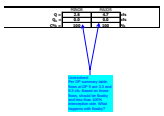
From this table, it is unclear how much disturbed area is treated via the BMP listed to the left of this column. See the excel table that I attached to the drainage map for something that might be a bit more clear than this.

45 (1)

Subject: SW - Textbox
Page Index: 45
Date: 2/10/2025 2:25:55 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 34

Note: I will take a more detailed look at these calcs compared to the RR areas shown on the drainage map once it is sorted out how much RPAs and SPAs are actually necessary per my comments throughout this report about double WQ treatment.

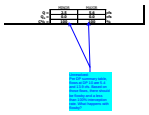
48 (1)



Subject: Callout
Page Index: 48
Date: 2/10/2025 11:46:35 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 37

Unresolved:
Per DP summary table, flows at DP 9 are 3.3 and 9.3 cfs. Based on those flows, should be flowby and less than 100% interception rate. What happens with flowby?

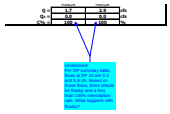
50 (1)



Subject: Callout
Page Index: 50
Date: 2/10/2025 11:47:51 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 39

Unresolved:
Per DP summary table, flows at DP 10 are 5.4 and 13.9 cfs. Based on those flows, there should be flowby and a less than 100% interception rate. What happens with flowby?

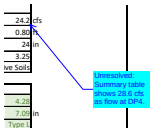
54 (1)



Subject: Callout
Page Index: 54
Date: 2/10/2025 11:48:15 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 43

Unresolved:
Per DP summary table, flows at DP 14 are 3.3 and 5.6 cfs. Based on those flows, there should be flowby and a less than 100% interception rate. What happens with flowby?

105 (1)



Subject: Callout
Page Index: 105
Date: 2/10/2025 2:15:06 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 94

Unresolved:
Summary table shows 28.6 cfs as flow at DP4.

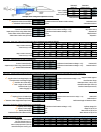
110 (1)

Subject: Checkmark
Page Index: 110
Date: 2/10/2025 4:29:50 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 99

112 (1)

Subject: Checkmark
Page Index: 112
Date: 2/10/2025 12:50:40 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 101

115 (1)

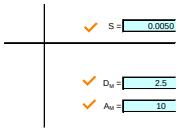


Subject: Checkmark
Page Index: 115
Date: 2/10/2025 4:30:17 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 104

119 (1)

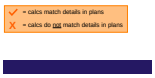
Subject: Checkmark
Page Index: 119
Date: 2/10/2025 1:04:54 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 108

121 (1)

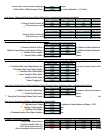


Subject: Checkmark
Page Index: 121
Date: 2/10/2025 4:29:03 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 110

125 (2)



Subject: MHFD Calcs
Page Index: 125
Date: 2/10/2025 1:08:34 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 114

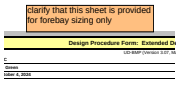


Subject: Checkmark
Page Index: 125
Date: 2/10/2025 4:29:10 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 114

135 (1)

Subject: Checkmark
Page Index: 135
Date: 2/10/2025 1:19:34 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 124

137 (2)

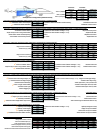


Subject: SW - Textbox
Page Index: 137
Date: 2/10/2025 1:21:33 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 126

clarify that this sheet is provided for forebay sizing only

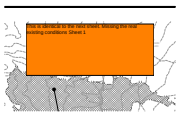
Subject: Checkmark
Page Index: 137
Date: 2/10/2025 1:21:52 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 126

140 (1)



Subject: Group
Page Index: 140
Date: 2/10/2025 4:29:23 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: 129

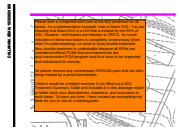
152 (1)



Subject: SW - Textbox
Page Index: 152
Date: 2/6/2025 5:17:45 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: [1] Existing drainage map (2)

This is identical to the next sheet. Missing the real existing conditions Sheet 1

154 (3)

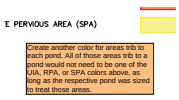


Subject: SW - Textbox
Page Index: 154
Date: 2/10/2025 2:25:36 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: [1] Segment-1

Please take a comprehensive look at the WQ treatment for all basins. As a representative example: look at Basin OS1. You are showing that Basin EA1 is a UIA that is treated by the RPA of OS1. However, both basins are tributary to SFB D. So runoff reduction of these two basins is completely unnecessary (from what I'm understanding), no need to show double treatment. Also, double treatment is undesirable because all RPAs are considered official PCMs that are entered into are post-construction PCM program and thus have to be inspected and maintained for eternity.

So please remove any unnecessary RPA/UIA pairs that are also being treated by a pond downstream.

I think it would be a helpful exercise if you filled out a WQ Treatment Summary Table and included it in this drainage report to better track your disturbances, treatment, and exclusions in each basin. To save you time, I have created an example/go-by table for you to use as a starting point:



Subject: SW - Textbox
Page Index: 154
Date: 2/10/2025 2:19:40 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: [1] Segment-1

Create another color for areas trib to each pond. All of those areas trib to a pond would not need to be one of the UIA, RPA, or SPA colors above, as long as the respective pond was sized to treat those areas.

Subject: File Attachment
Page Index: 154
Date: 2/10/2025 2:25:19 PM
Author: Glenn Reese - EPC Stormwater
Color:
Layer:
Space:
Page Label: [1] Segment-1