FINAL DRAINAGE REPORT

for

HAVEN VALLEY

El Paso County, Colorado

September 2023

EL PASO COUNTY PCD FILE NO. PUDSP-21-007

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Prepared for:

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for

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Security, Colorado

1.0 CERTIFICATION STATEMENTS

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 El Paso County for drainage reports, and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omission on my part in preparing this report.

Tim D. McConnell, P.E. Date
Colorado P.E. License No. 33797
For and on Behalf of Drexel, Barrell & Co.

DEVELOPER'S STATEMENT

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

Business Name: Midco Investments, LLC

By: 9/20/23
Robert C. Irwin Date

Title: Manager
Address: P.O. Box 60069
Colorado Springs, CO 80960

EL PASO COUNTY

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

Jennifer Irvine, P.E. Date
County Engineer/ECM Administrator
CONDITIONS:

Revise to Joshua Palmer, PE

FINAL DRAINAGE REPORT

for

HAVEN VALLEY

Security, Colorado

2.0 PURPOSE

This report is prepared by Drexel, Barrell & Co in support of the Haven Valley in Security, CO. The purpose of this report is to identify onsite and offsite drainage patterns, storm sewer, inlet locations, and areas tributary to the site, and to safely route developed storm water runoff to adequate outfall facilities.

3.0 GENERAL SITE DESCRIPTION

Location

Haven Valley is a 11.768 acre subdivision within the northwest quarter of Section 12, Township 15 South, Range 66 West of the 6th Principle Meridian in El Paso County, Colorado. The site is located southwest of Cable Ln and west of Hunters Run. The site is bounded on the north by Calvary Fellowship Fountain Valley church and Cable Ln, the west by Good Shepherd United Methodist church, and the south and the east by residential subdivision Pheasant Run Ranch Filing No. 1. See Vicinity Map in Appendix.

Existing Site Conditions

The site is approximately 11.768 acres in size surrounded by existing development. There are no existing structures on the site, only native grasses, a few invasive trees and shrubs. There are no existing irrigation facilities on the project site. The project site slopes moderately from the northeast to southwest at approximately 5-7%. Existing drainage flows to the southwest where it drains overland between two houses to Pecos Drive, then south on Widefield Drive. Severe flooding has been observed between these two houses and one of the houses has experienced mold issues in the past.

Proposed Site Conditions

Haven Valley is a small lot single-family development, consisting of approximately 98 lots, streets, landscape areas and open space. A proposed full-spectrum detention pond is proposed to be constructed in an existing off-site drainage easement adjacent to the west side of the site. The flows will be released from the detention pond and be carried by pipe between the two houses and outlet via a bubbler in Widefield Drive. There is an existing drainage and utility easement located between the two houses.

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is underlain by the Blakeland loamy sand (Soil No. 8). This soil is a type 'A' hydrologic soil group. This type of soil typically

exhibits rapid infiltration rates and slow runoff characteristics with moderate erosion potential. See appendix for Soil Map.

Climate

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel 08041C0763G (December 7, 2018), the site does not lie within a designated 100-year floodplain. The site is in Zone X, an area of minimal flood hazard. See Appendix for FIRMette map.

Previous Drainage Studies

The site is located within the Security Drainage Basin, as studied in the Little Johnson/Security Drainage Basin Planning Study, prepared by Simons Li & Associates, Inc., 1987.

4.0 EXISTING CONDITIONS HYDROLOGY SUMMARY

Basin OS-1 is an offsite basin to the north. This basin drains the Elm Grove Subdivision (town homes, age restricted) and several commercial buildings on the east side of Main St. and the Wilson Elementary School on the west side of Main St. The runoff path begins on Main Street near the intersection of Bradley Road, then flows southerly down Main Street via curb and gutter. The runoff at this intersection is collected by a storm sewer constructed as part of the 1993 Main Street reconstruction by El Paso County. The storm drain system conveys runoff east underground via storm sewer and discharges in to a valley gutter within the Elm Grove Subdivision. The valley gutter drains south to an existing detention pond (roughly 3-4' deep) where it is detained slightly. The pond discharges via a 24" CMP to the south. The 24" CMP is undersized for the 100-year which overtops the pond and drains into a swale which in turn drains south overland between two houses in the Security Colorado Addition 4, then south to the curb and gutter in Pecos Drive and Widefield Drive. The runoff generated by Basin OS1 is calculated to be 46.0 cfs and 88.8 cfs for the 5-year and 100-year storm respectively into the detention pond. After detention, the pond outflows are 18.1 cfs and 52.3 cfs respectively for the 5-year and 100-year storms.

Basin OS-2 is an offsite basin to the north of the site. Runoff from this basin is primarily generated from roof, parking lot and vacant land. The runoff path begins on Cable Lane and generally flows southerly along the west property line until it reaches Design Point A. Design Point A collects the flow from Basin OS2 and the release from the detention pond in Basin OS1. This flow is routed southerly through a small swale that divides Basins OS3 and H1. The calculated runoff from Basin OS2 is 11.8 cfs and 21.5 cfs for the 5-year and 100-

year storm respectively.

Design Point A. The drainage swale previously mentioned conveys the flow from Design Point A to Design Point B. The calculated flow at Design Point A is 29.9 cfs and 73.8 cfs for the 5-year and 100-year storm respectively. This flow includes detained flow from the Elm Grove pond and from Basin OS-2 which is conveyed south in an existing swale to a historic low point just north of Security Colorado Addn. No. 4 (Des. Pt. B).

Basin OS-3 is an offsite basin to the west of the site. Runoff from this basin is generated from roof, street, parking lot and vacant land. The runoff path flows southerly down Main Street via curb and gutter and then easterly onto Leta Drive. The flow then continues south through a parking lot until it empties onto vacant land, then travels to the southeast to Design Point B. Design Point B collects the flow from all basins; OS1, OS2, OS3 and H1 and drains them overland between two houses in the Security Colorado Addition 4, then south to the curb and gutter in Pecos Drive and Widefield Drive. Severe flooding between these houses has been observed on numerous occasions in the past. The calculated runoff from Basin OS3 is 15.6 cfs and 37.4 cfs for the 5-year and 100-year storm respectively.

Basin H-1 is an onsite basin which drains the site plus street runoff from Alturas Drive and Cable Lane. The east half of Alturas Drive drains is not included in this basin which drains overland eastward into the Windmill Creek Subdivision per the approved drainage report by Jefferies Engineering, October 10, 2001. Runoff from the undeveloped lot west of Alturas Drive is currently collected in a swale west of the ROW and directed south into a detention pond which outlets into the FMIC superditch. Future conditions for this undeveloped lot will need to remain the same as existing since additional runoff down Alturas would severely affect downstream properties. Runoff from Alturas Drive is included in this basin per existing conditions. The runoff path for Basin H1 begins near the intersection of Alturas Drive and Bradley Road (west half), and then flows southwesterly via an asphalt curb southward and over the top of the FMIC superditch. The flow then crosses Cable Lane and generally flows southwesterly through vacant land to Design Point B. The calculated runoff for Basin H1 is 6.9 cfs and 30.4 cfs for the 5-year and 100-year storm respectively.

Design Point B includes flow from Design Point A, Basin OS-3, and H-1. Design Point B discharges through the Security Colorado Addition No. 4 Refile Subdivision overland between two houses, then to the curb and gutter on the north side of Pecos Drive and the east side of Widefield Drive. The total flow at Design Point B is 46.1 cfs and 129.0 cfs for the 5-year and 100-year storm respectively between the two houses. Both of these two homeowners have indicated that they have experienced severe flooding of the backyard and crawl spaces of their homes.

Basin OS-4 is an offsite basin to the west of the site including Main Street and a portion of land west of Main Street. Runoff from this basin is generated from roof, street, and parking lot. The runoff path flows southerly down Main Street via curb and gutter to the intersection of Pecos Drive. An existing storm sewer system was constructed in 1993 as part of the 1993 Main Street reconstruction project by El Paso County. The storm system picks up street flow and discharges it to a 15' bubbler located just east of the intersection of Pecos Drive and Main Street. From the bubbler, all runoff is carried overland east to Widefield Drive (Design Pt C), then south on Widefield Drive via curb and gutter. There is no existing storm sewer

system within Pecos or Widefield Drive. None of the storm infrastructure east of this bubbler or within Widefield Dr. shown on the DBPS were ever installed. The existing bubbler was not proposed in the DBPS. The calculated runoff from Basin OS4 is 39.6 cfs and 82.3 cfs for the 5-year and 100-year storm respectively. The existing street capacity of Widefield Drive as it flows south from Pecos Drive is 7 cfs and 41 cfs for the 5-year and 100-year storm respectively. As shown, the flow from this basin alone exceeds the street capacity of Widefield Drive. Therefore, the flows from Basin OS-4 are split between the curb and gutter on each side of the street.

Design Point C is located at the intersection of Pecos Drive and Widefield Drive and includes flow from Design Point B and Basin OS-4. At Design Point C the existing flow with detention from the Elm Grove pond is 80.3 cfs and 200.0 cfs for the 5-year and 100-year storms respectively, which is all overland flow.

Per the ½ street section street capacity chart Figure 7-9, the existing street capacity of Widefield Drive as it flows south from Pecos Drive is approximately 7 cfs and 41 cfs for the 5-year and 100-year storm events respectively. Per the MHFD-Inlet_v.01 spreadsheet for street capacity, the existing street capacity of Widefield Drive as it flows south from Pecos Drive is 8.9 cfs and 39.6 cfs for the 5-year and 100-year storm events respectively. As shown, the existing street capacity is severely exceeded in existing conditions which is echoed by the residents in this area experiencing chronic flooding at this intersection. This development is proposing to reduce the flooding issues in this area which will be discussed later in this report. Since street capacity is being exceeded, the flows at DP-C are split evenly on each side of the street. Therefore, the west side of the street carries 40.1 cfs and the east side of the street carries 40.1 cfs for the 5-year storm and the west side of the street carries 100.0 cfs and the east side of the street carries 100.0 cfs for the 100-year storm. Per the ½ street section street capacity chart Figure 7-9, the capacity of the existing streets is exceeded by 33.1 cfs for the 5-year storm and by 59.0 cfs for the 100-year storm. Per the MHFD-Inlet_v.01 spreadsheet for street capacity, the capacity of the existing streets is exceeded by 31.2 cfs for the 5-year storm and by 60.4 cfs for the 100-year storm. These existing excess flows are currently being conveyed via the street and adjacent sidewalks and front yards.

5.0 PROPOSED HYDROLOGY (RATIONAL METHOD) & HYDRAULIC SUMMARY

The Rational Method was used to determine runoff quantities for the 5- and 100-year storm recurrence intervals. Urban Drainage UD-Detention and Flowmaster were used to determine pond and storm system sizing. UD-Inlet and UD-Sewer were also used to identify pond and storm system sizing (see appendix for calculations). See below for a summary runoff table of the basins and for descriptions of each design point. See appendix for Proposed Drainage Map showing the proposed drainage basin locations.

Rational Method Runoff Summary

BASIN	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A	0.44	0.5	1.5
OS-1	16.90	46.0	88.8
OS-2	2.85	11.8	21.5
B	1.42	3.2	6.6
C	3.43	6.4	14.0
D	0.98	1.2	3.5
E	3.09	6.4	14.0
F	0.69	1.4	3.1
G	1.61	2.8	6.2
OS-3	9.74	15.6	37.4
H	0.84	1.0	2.9
OS-4	20.04	39.6	82.3
OS-5	0.15	0.3	0.7
OS-6	0.41	0.9	2.0
I	0.69	0.6	2.2

North Swale carries the flows from Basin A, 1.5 cfs, and Basin OS-2, 21.5 cfs, for a total of 23 cfs to the proposed private area inlet at DP-1. The velocity within this swale is greater than allowable per DCM 6.5.2, therefore the swale will need to be lined. See Appendix for swale calculations.

Design Point 1 (DP-1) represents flows generated from existing Elm Grove pond release in offsite basin OS-1, as well as flows from offsite basin OS-2 and onsite Basin A. The flows are conveyed via a swale and are then captured by a proposed private Double Type D area inlet. The flows leave this inlet via a proposed private 36" RCP storm pipe and are conveyed to the proposed Extended Detention Basin to the south. The total flow at DP-1 is 28.1 cfs and 71.0 cfs for the 5-year and 100-year storm respectively. The Double Type D area inlet can capture all of the DP-1 flows.

Design Point 2 (DP-2) represents flows generated from onsite Basin B. The flows are captured by a proposed private at-grade 5' Type R inlet in Basin B. The flows leave this inlet via a proposed private 18" RCP storm pipe and are carried south to DP-J1. The total flow at DP-2 is 3.2 cfs and 6.6 cfs for the 5-year and 100-year storm respectively.

Design Point 3 (DP-3) represents flows generated from Basin C. The flows are captured by a proposed private at-grade 15' Type R inlet in Basin C. The flows leave this inlet via a proposed private 24" RCP storm pipe and are carried west to DP-J1. The total flow at DP-3 is 6.4 cfs and 14.0 cfs for the 5-year and 100-year storm respectively.

Design Point J1 (DP-J1) represents flows generated from Basins B and C. This design point is located at a proposed junction with a Type II manhole in Basin C. The flows leave this

manhole via a proposed private 24" RCP storm pipe and are carried south to DP-J2. The total flow at DP-J1 is 9.5 cfs and 20.3 cfs for the 5-year and 100-year storm respectively.

East Swale carries the flows from Basin D, 3.5 cfs, to the proposed private area inlet at DP-4. The Froude number within this swale is greater than allowable per DCM 6.5.2, therefore the swale will need to be lined. See Appendix for swale calculations.

Please provide a detail in the CDs for this swale that shows the lining.

Design Point 4 (DP-4) represents flows generated from Basin D. The flows are conveyed via a swale and are then captured by a proposed private sump condition Type C area inlet in Basin D. The flows leave this inlet via a proposed private 18" RCP storm pipe and are carried west to DP-J2. The total flow at DP-4 is 1.2 cfs and 3.5 cfs for the 5-year and 100-year storm respectively.

Design Point 5 (DP-5) represents flows generated from Basin E, which includes a portion of Cable Ln as shown on the proposed drainage map in the Appendix. This design point represents the flows at the intersection of New Haven Point and Hawk Haven View. The street capacity is sufficient at this point for these flows as can be seen in the street capacity charts included in the Appendix. These flows continue to the west where they are captured by the proposed inlet at DP-6. The total flow at DP-5 is 6.4 cfs and 14.0 cfs for the 5-year and 100-year storm respectively. Cable Lane is an existing public two-lane paved roadway. As part of this project, the roadway will be widened and curb and gutter added. Basin E will collect runoff from a portion the existing and proposed Cable Lane. The remainder of the roadway drainage will follow historic patterns.

Design Point J2 (DP-J2) represents flows generated from Basins B, C and D. This design point is located at a proposed junction with a Type II manhole in Basin E. The flows leave this manhole via a proposed private 30" RCP storm pipe and are carried west to DP-J3. The total flow at DP-J2 is 10.6 cfs and 23.4 cfs for the 5-year and 100-year storm respectively.

Design Point 6 (DP-6) represents flows generated from Basin F. The flows are captured by a proposed private at-grade 15' Type R inlet in Basin F. The flows leave this inlet via a proposed private 24" RCP storm pipe and are carried south to DP-J3. The total flow at DP-6 is 7.7 cfs and 17.0 cfs for the 5-year and 100-year storm respectively.

Design Point J3 (DP-J3) represents flows generated from Basins B, C, D, E and F. This design point is located at a proposed junction with a Type II manhole in Basin G. The flows leave this manhole via a proposed private 36" RCP storm pipe and are carried west to DP-J4. The total flow at DP-J3 is 17.4 cfs and 38.4 cfs for the 5-year and 100-year storm respectively.

Design Point 7 (DP-7) represents flows generated from Basin G. The flows are captured by a proposed private sump 5' Type R inlet in Basin G. The flows leave this inlet via a proposed private 18" RCP storm pipe and are carried north to DP-J4. The total flow at DP-7 is 2.8 cfs and 6.2 cfs for the 5-year and 100-year storm respectively.

Design Point J4 (DP-J4) represents flows generated from Basins B, C, D, E, F and G. This design point is located at a proposed junction with a Type II manhole in Basin G. The flows leave this manhole via a proposed private 36" RCP storm pipe and are carried west

drainage plan shows a 30" pipe. revise so that they are consistent

to the proposed private full-spectrum Extended Detention Basin. The total flow at DP-J4 is 20.0 cfs and 44.1 cfs for the 5-year and 100-year storm respectively.

Design Point 8 (DP-8) represents flows generated from Basin H only. The flows from the existing Elm Grove pond release are captured by the proposed private area inlet in Basin A at DP-1. See DP-1 discussion above. The flows from Basin H are captured by a proposed east swale and are carried to the proposed Extended Detention Basin. The total flow at DP-8 is 1.0 cfs and 2.9 cfs for the 5-year and 100-year storm respectively.

Design Point P1 (DP-P1) represents all of the flows generated from Basins OS-1, Exist. Elm Pond release and Basins A through G. These are all of the flows that are captured by the proposed Extended Detention Basin. Further detail is provided on the EDB in the following section of this report. The total flows at DP-P1 is 63.9 cfs and 153.8 cfs for the 5-year and 100-year storm respectively.

South Swale carries the flows from Basin I, 2.2 cfs, Basin OS-5, 0.7 cfs, and Basin OS-6, 2.0 cfs, for a total of 5.0 cfs to the proposed private area inlet at DP-9. The Froude number within this swale is greater than allowable per DCM 6.5.2, therefore the swale will need to be lined. See Appendix for swale calculations.

Please provide a detail in CDs for this swale that shows the lining.and the retaining wall. Detail on Sht 8 of CDs is lacking detail.

Design Point 9 (DP-9) represents flows generated from Basin I, OS-5 and OS-6 combined with the released flows from the proposed EDB. The flows are conveyed via a swale and are then captured by a proposed private sump condition Type C area inlet in Basin I. The flows leave this inlet via a proposed public 24" RCP storm pipe and are carried south to DP-J5. This pipe system is identified as a public reimbursable facility in the DBPS. By piping these flows between the two houses, flooding for these two existing residences will be eliminated in this area. In the event of a storm event that overtops the EDB spillway, a concrete channel is proposed between the two existing residences to help prevent flooding. The concrete channel is to be 2.5' high x 6.5' wide and is directly over the 24" RCP pipe below. The total flow at DP-9 is 2.8 cfs and 36.4 cfs for the 5-year and 100-year storm respectively. Basin I is not being captured for water quality control, however it is under 1 acre, which is acceptable per ECM Appendix I.7.1.C.1. Basins OS-5 and OS-6 will also not be captured in the EDB. It is not necessary for these flows to be treated because they are offsite basins that will not mix with runoff that needs to be treated.

Design Point O4 (DP-O4) represents flows generated from Basin OS-4. A proposed public at-grade 15' Type R inlet is to be installed on existing Pecos Dr/Widefield Dr. knuckle. This inlet will not be able to capture all of the flows generated from the existing basin but will capture some of the street flows and relieve some of the flooding experienced by the residents in this area. The total flow at DP-O4 is 39.6 cfs and 82.3 cfs for the 5-year and 100-year storms respectively. These flows are split evenly on each side of the street due to the existing street capacity of Pecos Dr. and Widefield Dr. being exceeded, so the flows on the north side of Pecos Dr. approaching the proposed inlet are 19.8 cfs and 41.1 cfs for the 5-year and 100-year storm respectively. The proposed 15' Type R inlet can capture approximately 7 cfs of the 5-yr storm flows and 20 cfs of the 100-yr storm flows. The remaining approximate 12.8 cfs for the 5-yr and 21.1 cfs for the 100-yr will continue to the south along the east curb and gutter of Widefield Drive along historic drainage routes as outlined in the DBPS.

Per the ½ street section street capacity chart Figure 7-9, the street capacity of Pecos Dr. and Widefield Dr. is 7 cfs for the 5-year storm and 41 cfs for the 100-yr storm. Therefore, the street capacity will be exceeded by 5.8 cfs for the 5-yr storm (down from 33.1 cfs at DP-C in the existing condition) and will not be exceeded at all in the 100-yr condition. See street capacity charts in the Appendix.

Per the MHFD-Inlet_v.01 spreadsheet for street capacity, the capacity of Pecos Dr. and Widefield Dr. is 8.9 cfs for the 5-year storm and 39.6 cfs for the 100-yr storm. Therefore, the street capacity will be exceeded by 3.9 cfs for the 5-year storm (down from 33.1 cfs at DP-C in the existing condition) and will not be exceeded at all in the 100-yr condition. See spreadsheet with capacity calculations in the Appendix.

The depth of gutter flow for the existing conditions, 100 cfs, is 0.93' and for the proposed conditions, 21.1 cfs, is 0.45'. See flow depth calculations in the Appendix.

Design Point J5 (DP-J5) represents flows generated from Basins I, OS-4 (captured by the proposed inlet), OS-5, OS-6 and the flows released from the proposed EDB. This design point is located at a proposed junction with a Type I manhole in Basin OS-4. The total flow at DP-J5 is 9.8 cfs and 56.4 cfs for the 5-year and 100-year storm respectively. The flows leave this manhole via a proposed public 36" RCP storm pipe (or equivalent elliptical pipe - this pipe system was also identified in the DBPS as public and reimbursable) and are carried south where they will outlet via a proposed 25' Type R inlet to be used as a bubbler in Widefield Drive and continue to the south along historic drainage routes as outlined in the DBPS. The bubbler inlet will serve to release the developed upstream flows into Widefield Drive as street flow at the end of the storm sewer system. The inlet will fill and overtop/exit the inlet throat into the street. A small pipe will be provided at the bottom of the inlet to release nuisance flows and allow the inlet to drain after filling. This pipe will daylight downstream and release flows to the curb and gutter in Widefield Dr. The small pipe to drain the bubbler inlet is planned to be designed similar to a grease interceptor to avoid clogging issues experienced by the county on other similar facilities. Design detail will be provided with the construction documents.

Design Point 10 (DP-10) is located at the bubbler outfall pipes. It represents the flows from the bubbler itself, the flows released through the (2) 4" PVC bubbler outfall pipes, and the flows in the curb and gutter that previously bypassed DP-O4. The flows that bypass the inlet at DP-O4 and flow south along the east curb and gutter of Widefield Dr. are approximately12.8 cfs for the 5-year storm and 21.1 cfs for the 100-yr storm. The flows being conveyed via the 36" RCP storm pipe exiting the manhole at DP-J5 is 9.8 cfs for the 5-yr storm (DP-9 flows are 2.8 cfs plus the 7 cfs captured by the inlet at DP-O4 equals 9.8 cfs) and 56.4 cfs for the 100-yr storm (DP-9 flows are 36.4 cfs plus the 20 cfs captured by the inlet at DP-O4 equals 56.4 cfs). See Rational Method calculations for each basin and design point in the Appendix. Therefore, the combined flows just past the bubbler are 22.6 cfs for the 5-yr storm and 77.5 cfs for the 100-yr storm. The existing flows at this point are 40.1 cfs for the 5-yr storm and 100.0 cfs for the 100-yr storm. Therefore, the development of Haven Valley will not increase but decrease the flows and flooding issues in the area and downstream on Widefield Drive due to the proposed detention facility which has been sized to not just handle the development of Haven Valley, but all surrounding areas that had no detention required of them in the DBPS. None of the storm infrastructure along Pecos Dr. or Widefield Dr. shown on the DBPS was ever installed. The

existing street capacities are exceeded and the homes along Widefield Dr. currently experience flooding. See previous discussion in Existing Conditions DP-C. Since the proposed flows will be less than the existing flows, no new flooding issues will be created, but instead alleviated to the same extent. Also, since the proposed flows are being decreased from the existing flows, there will be no negative impact from our proposed development to the outfall of the existing County pond (in Pheasant Run Ranch Filing No. 1) south of the proposed bubbler. For the 100-yr storm the depth of flow for the existing condition, 100 cfs, is 0.93' at the curb flowline. The depth of flow for the proposed condition, 77.5 cfs, is 0.84'. This depth has a spread of 23' from the centerline of Widefield Dr. to the east, which is within the 60' ROW (30' on each side). While both existing and proposed conditions exceed street capacity (See street capacity discussion under DP-O4), the proposed conditions are an improvement from the existing conditions. See Depth of Flow calculations in the Appendix.

None of the proposed on-site streets exceed capacity, see Appendix for Street Capacity Charts. See also inlet capacity charts for inlet sizing in the Appendix.

A portion of Cable Ln. will be reconstructed and its drainage patterns shall remain the same as existing. The runoff from much of Cable Lane adjacent to the Haven Valley site (with the exception of flows captured by Basins B, C & E) will not be captured by the project's detention facility. This roadway redevelopment falls under the exclusions listed in the ECM I.7.1.B.2 & 3. The total added paved area will be 0.10 acres, which is under the 1 acre of added paved area per 1 mile of roadway. The average width of the existing paved roadway is 22'+, the proposed mat width is 30', which is also less than the 8.25' added width requirement. The roadway width is also not being increased by 2 times or more of the original roadway.

6.0 PROPOSED DETENTION/WATER QUALITY FACILITIES

The proposed private full spectrum Extended Detention Basin (EDB) is located southwest of the project site within a 1.29 acre drainage easement. This detention pond will fulfill on-site detention needs as well as providing detention for upstream properties, since there is a lack of detention facilities upstream which has caused chronic flooding issues between the two residences that the flows currently pass between on their way to Widefield Dr. The 1.29 acre easement is proposed to be a private drainage/detention easement and the pond to be maintained by Homeowners Association. The Security DBPS does not address the need for a pond in this area, rather it shows roughly 188 cfs (100-year storm) passing between the two houses with only a 24" storm sewer and no swale to convey the flow. The developed peak 100-year flow calculated in this report is 152.1 cfs at this location. The difference in flow is attributed to the DBPS bypassing Elm Grove Pond. The proposal shown in the DBPS does not work and will flood the two residences. Even though the DBPS does not adequately address flooding issues in this area, we are proposing to construct a facility nearly three times the size of a facility necessary to detain runoff from our project site alone.

The proposed detention facility has been designed to capture flows from Basins OS-1, OS-2, OS-3, OS-4 and Basins A through H. A total of 41.99 acres is tributary to this EDB with a composite imperviousness of 57.8%. The required pond volume for 100-year detention is

at this stage of the development it shall be decided what will be installed. Please indicate what will be installed.

4.464 acre-feet. The actual pond volume will be 4.542 acre-feet. Concrete forebays with energy dissipaters will be placed where the flows enter the pond on the northeast and the east sides of the pond. The combined volume of the two forebays will be 3% of the WQCV volume for the pond and will be divided proportionally. The flows will exit the forebays through a notch and into the concrete trickle channel at the bottom of the pond that conveys the flows to the micropool. It will capture then release the flows at a reduced flow rate with the use of a plate with orifice holes into a proposed 24" pipe with a restrictor plate. This pipe connects to an area inlet, then a 24" pipe continues to the south, between the two existing residences, and outfalls into a bubbler in Widefield Dr. where they continue in historic patterns to the south.

In accordance with El Paso County criteria, the modified Type C outlet structure with a permanent micropool will release the WQCV over a 40-hour period. The outlet structure will result in release rates of 0.9 cfs and 31.4 cfs for the 5-year and 100-year storm respectively.

Provide a detail in the CDs for this.

A 40-ft wide riprap emergency spillway will be located on the south side of the pond. In the event that water overtops the spillway, flow will discharge into a 2.5' high x 6.5' wide concrete channel between the two residences before discharging into Widefield Dr. curb and gutter and continuing to the south. A riprap berm or concrete wall will be installed on the west end of the spillway down to the concrete channel to guide the flows as well as to the east of the concrete channel to guide the flows and prevent flows from entering existing residential properties adjacent to the spillway and concrete channel. Riprap or concrete will be installed between the end of the channel and the back of the existing sidewalk. Final design and details of these items will be provided with the construction documents. In order to design the concrete channel conservatively, the flows from existing DP-B were used, which is 129.0 cfs. The depth of this flow would be 1.3', as can be seen in the calculations included in the Appendix.

Pond calculations are provided in the appendix as well as forebay volumes, micropool sizing, outlet structure design, discharge pipe and spillway design.

The pond will have a 15' wide maintenance road that will provide access to the pond bottom. The maintenance road can be accessed at the west end of New Haven Point. It then ramps down at 12% to the bottom of the pond and around its perimeter. Private maintenance agreements and O&M manuals will be established for this pond as required by the County.

7.0 FOUR-STEP PROCESS

This project conforms to the City of Colorado Springs/El Paso County Four Step Process. The process focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

1. ***Employ Runoff Reduction Practices:*** Proposed impervious areas on this site (roofs, asphalt/sidewalk) will sheet flow across landscaped ground as much as possible to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets and storm sewer system. This will minimize directly

connected impervious areas within the project site.

2. ***Implement BMP's that provide a Water Quality Capture Volume with slow release:*** Runoff from this project will be treated through capture and slow release of the WQCV in a permanent Extended Detention Basin facility designed per current City of Colorado Springs/El Paso County drainage criteria.

3. ***Stabilize Drainage Ways:*** Flows from the pond are released into Widefield Dr. curb and gutter and no stabilization will be necessary.

4. ***Implement Site Specific and Other Source Control BMP's:*** The site is proposed as a residential development, and as such standard household source control will be utilized in order to minimize potential pollutants entering the storm system. Example source control measures consist of: garages for storage of household chemicals, trash receptacles for individual households and in common areas for pet waste. The need for Industrial and Commercial BMP's was considered, however per ECM I.7.2.A the need for industrial and commercial BMPs are not applicable for this project.

8.0 GEOTECHNICAL HAZARDS

In accordance with geotechnical recommendations, the project design is intended to direct runoff away from structures at a minimum slope of six inches over ten feet, and into the receiving water quality basin. This will be accomplished by a variety of means, i.e. curb and gutter and storm sewer.

9.0 DRAINAGE & BRIDGE FEES

Revise drainage fees to use impervious percentage calculated after basin areas are adjusted.

2023 Drainage and Bridge Fees

The project lies within the Security Drainage Basin and is previously un-platted. The following fees are required at time of plat recordation:

Impervious area = 11.768 acres x 58.1% = 6.84 acres

Drainage Fees
$23,078 x 6.84 Impervious Acres = $157,853.52

provide excerpts of the costs of these improvements from the DBPS.

Bridge Fees
None

Reimbursement for construction of some of the drainage facilities for Haven Valley and the storm sewer outfall in accordance with DCM Section 3.3, is anticipated as identified by the Little Johnson/Security Drainage Basin Planning Study. See Appendix for Sheet 22 of this DBPS for the reimbursable facilities. Construction costs are listed below and the drainage fee is requested to be adjusted accordingly.

Are the fees requested to be deferred? if so, please clearly state that and state what the total estimated reimbursable costs are and whether it will cover all drainage fees and that the developer will seek reimbursement (i assume they will) once constructed.

Does not match value shown in FAE form. Revise to remove discrepancy.

10.0 CONSTRUCTION COST ESTIMATE

Private (Non-Reimbursable)

Description	Quantity	Unit Cost	Cost
Type C Area Inlet	2 EA	$4,800/EA	$9,600
Double Type D Area Inlet	1 EA	$11,800/EA	$11,800
5' Type R Inlet	2 EA	$5,700/EA	$11,400
15' Type R Inlet	2 EA	$10,300/EA	$20,600
Type I Manhole	1 EA	$7,000/EA	$7,000
Type II Manhole	5 EA	$5,000/EA	$25,000
18" RCP storm	930 LF	$67/LF	$62,310
24" RCP storm	49 LF	$81/LF	$3,969
30" RCP storm	152 LF	$100/LF	$15,200
36" RCP storm	391 LF	$124/LF	$48,484
Extended Detention Basin	0.5 EA	$100,000/EA	$50,000
		Subtotal	$265,363
		Engineering & Contingency (10%)	$26,536
		TOTAL	$291,899

Public (Reimbursable) – Facilities identified in the DBPS

Description	Quantity	Unit Cost	Cost
15' Type R Inlet	1 EA	$20,600/EA	$20,600
25' Type R Inlet	1 EA	$30,000/EA	$30,000
Type I Manhole	2 EA	$14,000/EA	$28,000
30" RCP storm	15 LF	$200/LF	$3,000
36" RCP storm	335 LF	$248/LF	$83,080
		Subtotal	$164,680
		Engineering & Contingency (10%)	$16,468
		TOTAL	$181,148

Private (Reimbursable) – per ECM Appendix L (see below)

Description	Quantity	Unit Cost	Cost
*24" RCP storm	105 LF	$162/LF	$17,010
**Extended Detention Basin	0.5 EA	$100,000/EA	$50,000
		Subtotal	$67,010
		Engineering & Contingency (10%)	$6,701
		TOTAL	$73,711

*This pipe is identified in the DBPS as being reimbursable.

**Per ECM Appendix L 3.10.4a, the proposed detention facility qualifies for a 50% reimbursement. The following requirements for the reimbursement have been met:

1. Allowed only where regional system is not yet in place.
2. The pond is less than 15 acre-feet in volume from the lowest outlet structure to the

please provide discussion on how each of the required items are met. for example, state that the DBPS infrastructure is along Widefeild is not in place, identify the proposed pond acre-ft volume, etc

crest of the emergency spillway.

3. The on-site pond is not part of the regional plan.
4. The outlet of the pond must be designed to release at historical levels for all precipitation events from the 2-year storm to the 100-year storm. A smaller outlet may be required by the County if adequate downstream channel improvements are not in place to protect residents from the 2-year storm flows.
5. County approved design and construction.
6. Landowners assume responsibility for maintenance.

11.0 CONCLUSIONS

The Haven Valley project has been designed in accordance with El Paso County criteria. The detention pond and water quality basin have been designed to limit the release of storm runoff to less than historic flows. This development will not negatively impact the downstream facilities. This development will improve the downstream conditions by lessening the flows where there are currently flooding issues.

12.0 REFERENCES

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs/El Paso County Drainage Criteria Manual, May 2014.

2. Urban Storm Drainage Criteria Manuals, Urban Drainage and Flood Control District. June 2001, Revised April 2008.

3. Preliminary & Final Drainage Report for Patriot Village. Prepared by Core Engineering Group, LLC, December 2013.

4. Natural Resources Conservation Service (NRCS) Web Soil Survey

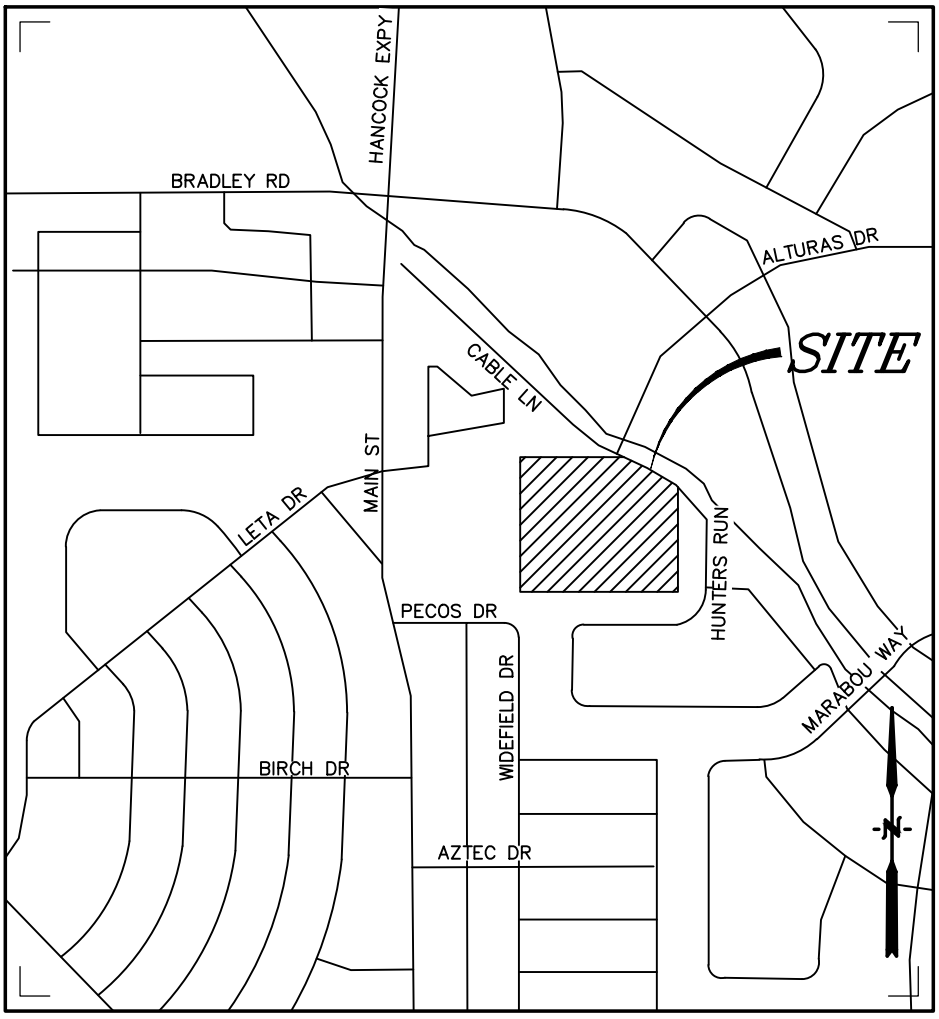
5. Federal Emergency Management Agency, Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Map Number 08041C0763G, Effective Date December 7, 2018

6. EL Paso County Board Resolution No 15-042: El Paso County adoption of Chapter 6 and Section 3.2.1, Chapter 13 of the City of Colorado Springs Drainage Criteria Manual, May 2014.

7. Little Johnson/Security Drainage Basin Planning Study. Prepared by Simons Li & Associates, Inc., 1988.

8. Soil Investigation Report for Patriot Village. Prepared by Colorado Enginering & Geotechnical Group, Inc., November 15, 2004.

APPENDIX



Vicinity Map

Not to scale

HAVEN HILLS
COLORADO SPRINGS, CO
VICINITY MAP

Drexel, Barrell & Co.
Engineers • Surveyors

DATE:

JOB NO: 21085-03CSCV

DWG. NO. VMAP

SHEET 1 OF 1

Map Scale: 1:1,860 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

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.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	12.7	100.0%
Totals for Area of Interest			**12.7**	**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

National Flood Hazard Layer FIRMette

FEMA

104°44'26"W 38°46'14"N

104°43'49"W 38°45'46"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

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

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

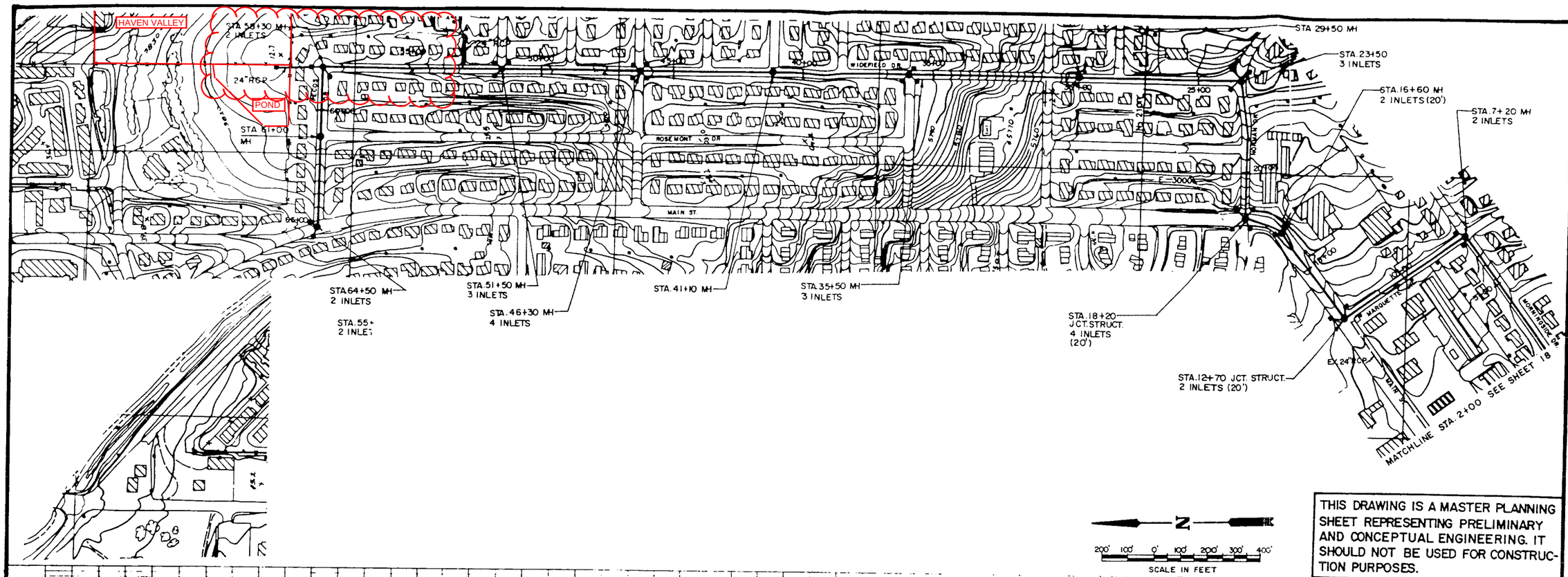
N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

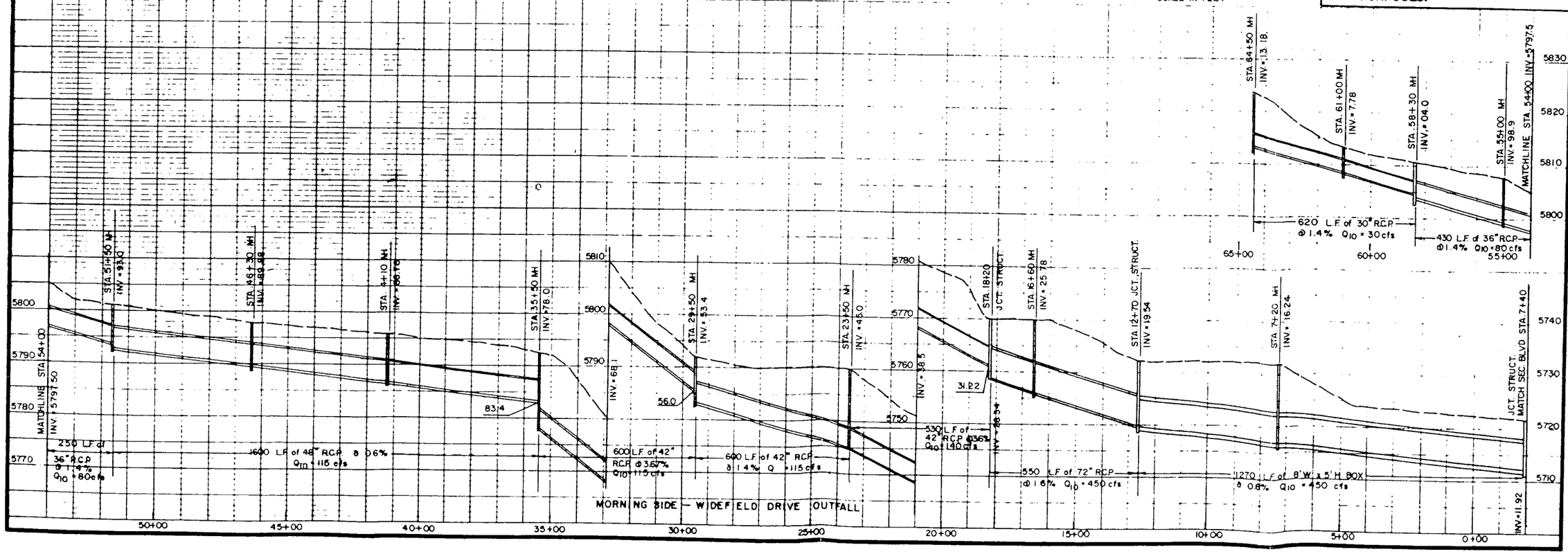
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/8/2021 at 1:19 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.



Simons, Li & Associates, Inc.
419 West Bijou, Colorado Springs, Colorado 80905 Phone 303-630-7746

LITTLE JOHNSON/SECURITY CREEK

DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN

PLAN & PROFILE: MORNINGSIDE - WIDEFIELD DRIVE OUTFALL

Project No.	PCO-EPC-01
Date:	10/87
Design:	TCF
Drawn:	EAK
Check:	TCF
Revisions:	

SHEET 22

PROJECT INFORMATION

Drexel, Barrell & Co.

PROJECT:	Haven Valley
PROJECT NO:	21085-03
DESIGN BY:	SBN
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	2/3/2022
Soil Type: A	

	C2*	C5*	C10*	C100*	% IMPERV
Pasture/Meadow		0.08		0.35	0
Commercial		0.81		0.88	95
1/8 Acre Residential		0.45		0.59	65
Asphalt/Sidewalk		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 6-6, El Paso County "Drainage Criteria Manual"

EXISTING

SUB-BASIN	SURFACE DESIGNATION	AREA	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV
		ACRE	C2	C5	C10	C100	
OS-1	Pasture/Meadow	0.00		0.08		0.35	0
	Commercial	8.10		0.81		0.88	95
	1/8 Acre Residential	7.20		0.45		0.59	65
	Asphalt/Sidewalk	1.60		0.90		0.96	100
	WEIGHTED AVERAGE			0.67		0.76	83%
TOTAL OS-1		16.90					
OS-2	Pasture/Meadow	0.00		0.08		0.35	0
	Commercial	2.85		0.81		0.88	95
	1/8 Acre Residential	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.81		0.88	95%
TOTAL OS-2		2.85					
OS-3	Pasture/Meadow	4.93		0.08		0.35	0
	Commercial	4.05		0.81		0.88	95
	1/8 Acre Residential	0.76		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.41		0.59	45%
TOTAL OS-3		9.74					
OS-4	Pasture/Meadow	0.00		0.08		0.35	0
	Commercial	4.20		0.81		0.88	95
	1/8 Acre Residential	15.84		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.53		0.65	71%
TOTAL OS-4		20.04					
H-1	Pasture/Meadow	12.03		0.08		0.35	0
	Commercial	0.00		0.81		0.88	95
	1/8 Acre Residential	0.39		0.45		0.59	65
	Asphalt/Sidewalk	1.02		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.40	9%
TOTAL H-1		13.44					
TOTAL SITE		**62.97**		**0.48**		**0.63**	**58.1%**

PROJECT INFORMATION

PROJECT: Haven Valley
PROJECT NO: 21085-03
DESIGN BY: SBN
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 2/3/2022

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

EXISTING TIME OF CONCENTRATION STANDARD FORM SF-2

SUB-BASIN DATA					INITIAL/OVERLAND TIME (t_i)				TRAVEL TIME (t_t)					TIME OF CONC. t_c		FINAL t_c
BASIN	DESIGN PT:	C_5	C_{100}	AREA	LENGTH	HT	SLOPE	t_i	LENGTH	HT	SLOPE	VEL.	t_t	COMP.	MINIMUM	
				Ac	Ft	FT	%	Min	Ft	FT	%	FPS	Min	t_c	t_c	**Min**
OS-1		0.67	0.76	16.90	100	2	2.0	6.5	1600	26	1.6	7.4	3.6	10.1	5	**10.1**
OS-2		0.81	0.88	2.85	100	2	2.0	4.3	400	13	3.3	10.6	0.6	4.9	5	**5.0**
	A	0.69	0.78	19.75										10.1	5	**10.1**
OS-3		0.41	0.59	9.74	100	2.5	2.5	9.5	1200	34	2.8	9.8	2.0	11.5	5	**11.5**
H-1		0.15	0.40	13.44	100	2	2.0	14.1	1600	73	4.6	12.5	2.1	16.2	5	**16.2**
	B	0.32	0.52	26.03					700	20	2.9	5.28	2.2	16.2	5	**16.2**
OS-4		0.53	0.65	20.04	100	2	2.0	8.5	2000	41	2.1	8.48	3.9	12.5	5	**12.5**
	C	0.41	0.58	46.07					100	1	1	3.10	0.5	16.7	5	**16.7**

PROJECT INFORMATION

PROJECT: Haven Valley
PROJECT NO: 21085-03
DESIGN BY: SBN
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 2/3/2022

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

EXISTING **RUNOFF** **5 YR STORM** **P1=** **1.50**

			DIRECT RUNOFF				
BASIN (S)	**DESIGN POINT**	**AREA (AC)**	**RUNOFF COEFF**	**t_c (MIN)**	**C * A**	**I (IN/HR)**	**Q (CFS)**
OS-1		16.90	0.67	10.1	11.24	4.09	**46.0**
Exist. Elm Grove Pond Release							**18.1**
OS-2		2.85	0.81	5.0	2.31	5.10	**11.8**
	A						**29.9**
OS-3		9.74	0.41	11.5	4.02	3.88	**15.6**
H-1		13.44	0.15	16.2	2.06	3.34	**6.9**
	B	26.03	0.32	16.2	8.38	3.34	**46.1**
OS-4		20.04	0.53	12.5	10.53	3.76	**39.6**
	C	46.07	0.41	16.7	18.91	3.29	**80.3**

PROJECT INFORMATION

PROJECT: Haven Valley
PROJECT NO: 21085-03
DESIGN BY: SBN
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 2/3/2022

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

EXISTING **RUNOFF** **100 YR STORM** **P1=** **2.52**

			DIRECT RUNOFF				
BASIN (S)	**DESIGN POINT**	**AREA (AC)**	**RUNOFF COEFF**	**t_c (MIN)**	**C * A**	**I (IN/HR)**	**Q (CFS)**
OS-1		16.90	0.76	10.1	12.91	6.88	**88.8**
Exist. Elm Grove Pond Release							**52.3**
OS-2		2.85	0.88	5.0	2.51	8.58	**21.5**
	A						**73.8**
OS-3		9.74	0.59	11.5	5.74	6.52	**37.4**
H-1		13.44	0.40	16.2	5.42	5.62	**30.4**
	B	26.03	0.52	16.2	13.67	5.62	**129.0**
OS-4		20.04	0.65	12.5	13.04	6.31	**82.3**
	C	46.07	0.58	16.7	26.71	5.53	**200.0**

It appears impervious areas in noted here do not match the drainage map. Revise to account for all impervious areas, and fix the scale the drainage map has because it is wrong.

PROJECT INFORMATION

PROJECT:	Haven Valley
PROJECT NO:	21085-03
DESIGN BY:	SBN
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	2/3/2022
Soil Type: A	

	C2*	C5*	C10*	C100*	% IMPERV
Pasture/Meadow		0.08		0.35	0
1/8 acre Residential		0.45		0.59	65
Asphalt/Sidewalk		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 6-6, El Paso County "Drainage Criteria Manual"

PROPOSED

SUB-BASIN	SURFACE DESIGNATION	AREA	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV
		ACRE	C2	C5	C10	C100	
A	Pasture/Meadow	0.20		0.08		0.35	0
	1/8 acre Residential	0.24		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.28		0.48	35%
TOTAL A		0.44					
B	Pasture/Meadow	0.00		0.08		0.35	0
	1/8 acre Residential	1.11		0.45		0.59	65
	Asphalt/Sidewalk	0.31		0.90		0.96	100
	WEIGHTED AVERAGE			0.55		0.67	73%
TOTAL B		1.42					
C	Pasture/Meadow	0.32		0.08		0.35	0
	1/8 acre Residential	2.69		0.45		0.59	65
	Asphalt/Sidewalk	0.42		0.90		0.96	100
	WEIGHTED AVERAGE			0.47		0.61	63%
TOTAL C		3.43					
D	Pasture/Meadow	0.43		0.08		0.35	0
	1/8 acre Residential	0.55		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.29		0.48	36%
TOTAL D		0.98					
E	Pasture/Meadow	0.16		0.08		0.35	
	1/8 acre Residential	2.72		0.45		0.59	
	Asphalt/Sidewalk	0.21		0.90		0.96	
	WEIGHTED AVERAGE			0.46		0.60	
TOTAL E		3.09					
F	Pasture/Meadow	0.00		0.08		0.35	
	1/8 acre Residential	0.69		0.45		0.59	
	Asphalt/Sidewalk	0.00		0.90		0.96	
	WEIGHTED AVERAGE			0.45		0.59	
TOTAL F		0.69					
G	PROPOSED	0.00		0.00		0.00	
	1/8 acre Residential	1.61		0.45		0.59	
	Asphalt/Sidewalk	0.00		0.90		0.96	
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL G		1.61					
H	Pasture/Meadow	0.40		0.08		0.35	0
	1/8 acre Residential	0.44		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.27		0.48	34%
TOTAL H		0.84					
I	Pasture/Meadow	0.47		0.08		0.35	0
	1/8 acre Residential	0.22		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.20		0.43	21%
TOTAL I		0.69					
TOTAL		**13.19**		**0.43**		**0.58**	**57.7%**
TOTAL POND TRIBUTARY		**41.99**		**0.55**		**0.68**	**57.8%**

Square footage of impervious in basin E exceeds the 0.21 acres that have been accounted for here. Adjust impervious amounts per what is shown in the drainage report.

Per the drainage map basin F has impervious areas where Hawk Haven View is located. Revise to account for area.

PROJECT INFORMATION

PROJECT: Haven Valley
PROJECT NO: 21085-03
DESIGN BY: SBN
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 2/3/2022

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED TIME OF CONCENTRATION STANDARD FORM SF-2

SUB-BASIN DATA					INITIAL/OVERLAND TIME (t_i)				TRAVEL TIME (t_t)					PIPE TRAVEL TIME (t_p)				TIME OF CONC. t_c		FINAL t_c
BASIN	DESIGN PT:	C_5	C_{100}	AREA	LENGTH	HT	SLOPE	t_i	LENGTH	HT	SLOPE	VEL.	t_t	LENGTH	SLOPE	VEL.	t_t	COMP.	MINIMUM	
				Ac	Ft	FT	%	Min	Ft	FT	%	FPS	Min	Ft	%	FPS	Min	t_c	t_c	**Min**
A	1	0.28	0.48	0.44	100	8	8.0	7.7	350	14	4.0	6.2	0.9					8.6	5	**8.6**
OS-1		0.67	0.76	16.90	100	2	2	6.5	1600	26	1.6	7.4	3.6					10.1	5	**10.1**
OS-2		0.81	0.88	2.85	100	2	2	4.3	400	13	3.3	10.6	0.6					4.9	5	**5.0**
B	2	0.55	0.67	1.42	100	2	2.0	8.2	1300	57.0	4.4	12.3	1.8					10.0	5	**10.0**
C	3	0.47	0.61	3.43	100	2	2.0	9.3	250	11	4.4	6.5	0.6	600	3.3	10.6	0.9	10.9	5	**10.9**
	J1	0.49	0.63	4.85										5	0.5	3.4	0.0	10.9	5	**10.9**
D	4	0.29	0.48	0.98	100	7	7.0	7.9	250	9	3.6	5.9	0.7					8.6	5	**8.6**
E	5	0.46	0.60	3.09	55	1.5	2.7	6.3	915	28	3.1	10.3	1.5					7.8	5	**7.8**
	J2	0.46	0.61	5.83										40	2.0	8.3	0.1	11.0	5	**11.0**
F		0.45	0.59	0.69	50	1	2.0	6.8	470	16	3.4	10.8	0.7					7.5	5	**7.5**
	6	0.46	0.60	3.78										50	3.1	10.3	0.1	7.9	5	**7.9**
	J3	0.46	0.60	9.61										40	2.5	9.3	0.1	11.1	5	**11.1**
G	7	0.45	0.59	1.61	80	1	1.3	10.1	720	17	2.4	9.1	1.3					11.4	5	**11.4**
	J4	0.46	0.60	11.22										20	1.0	5.9	0.1	11.5	5	**11.5**
OS-3		0.41	0.59	9.74	100	2.5	2.5	9.5	1200	34	2.8	9.8	2.0					11.5	5	**11.5**
H	8	0.27	0.48	0.84	100	7	7.0	8.1	350	17	4.9	6.9	0.8					8.9	5	**8.9**
	P1	0.55	0.68	41.99														11.5	5	**11.5**
OS-5		0.45	0.59	0.15	50	2	4.0	5.4										5.4	5	**5.4**
OS-6		0.45	0.59	0.41	70	4	5.7	5.7										5.7	5	**5.7**
I		0.20	0.43	0.69	20	1	5.0	4.4	850	18	2.1	4.5	3.2					7.6	5	**7.6**
	9	0.31	0.50	1.25														13.3	5	**13.3**
OS-4	O4	0.53	0.65	20.04	100	2	2	8.5	2000	41	2.1	8.5	3.9					12.5	5	**12.5**

PROJECT INFORMATION

PROJECT:	Haven Valley
PROJECT NO:	21085-03
DESIGN BY:	SBN
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	9/20/2023

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED RUNOFF 5 YR STORM P1= **1.50**

			DIRECT RUNOFF				
BASIN (S)	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)
A		0.44	0.28	8.6	0.12	4.34	0.5
OS-1		16.90	0.67	10.1	11.24	4.09	46.0
Exist. Elm Grove Pond Release							18.1
OS-2		2.85	0.81	5.0	2.31	5.10	11.8
	1	3.29	0.74	10.1	2.43	4.09	28.1
B	2	1.42	0.55	10.0	0.78	4.11	3.2
C	3	3.43	0.47	10.9	1.61	3.96	6.4
	J1	4.85	0.49	10.9	2.39	3.96	9.5
D	4	0.98	0.29	8.6	0.28	4.33	1.2
E	5	3.09	0.46	7.8	1.43	4.48	6.4
	J2	5.83	0.46	11.0	2.67	3.95	10.6
F		0.69	0.45	7.5	0.31	4.53	1.4
	6	3.78	0.46	7.9	1.74	4.46	7.7
	J3	9.61	0.46	11.1	4.41	3.94	17.4
G	7	1.61	0.45	11.4	0.72	3.89	2.8
	J4	11.22	0.46	11.5	5.14	3.89	20.0
OS-3		9.74	0.41	11.5	4.02	3.88	15.6
H	8	0.84	0.27	8.9	0.23	4.28	1.0
	P1	25.10	0.47	11.5	11.80	3.88	63.9
POND RELEASE							0.9
OS-5		0.15	0.45	5.4	0.07	5.00	0.3
OS-6		0.41	0.45	5.7	0.18	4.93	0.9
I		0.69	0.20	7.6	0.14	4.53	0.6
	9						2.8
OS-4	O4	20.04	0.53	12.5	10.53	3.76	39.6
	J5						9.8
	10						22.6

PROJECT INFORMATION

PROJECT:	Haven Valley
PROJECT NO:	21085-03
DESIGN BY:	SBN
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	9/20/2023

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED RUNOFF 100 YR STORM P1= **2.52**

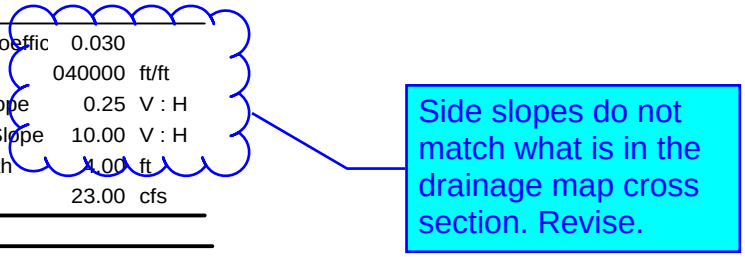
			DIRECT RUNOFF					PIPE SIZING		
BASIN (S)	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	n	Slope (ft/ft)	Pipe Diameter (in)
A		0.44	0.48	8.6	0.21	7.29	1.5			
OS-1		16.90	0.76	10.1	12.91	6.88	88.8			
Exist. Elm Grove Pond Release							52.3			
OS-2		2.85	0.88	5.0	2.51	8.58	21.5			
	1	3.29	0.83	10.1	2.72	6.88	71.0	0.016	0.038	36
B	2	1.42	0.67	10.0	0.95	6.90	6.6	0.016	0.035	18
C	3	3.43	0.61	10.9	2.10	6.66	14.0	0.016	0.005	24
	J1	4.85	0.63	10.9	3.05	6.65	20.3	0.016	0.035	24
D	4	0.98	0.48	8.6	0.48	7.27	3.5	0.016	0.023	18
E	5	3.09	0.60	7.8	1.86	7.52	14.0			
	J2	5.83	0.61	11.0	3.53	6.63	23.4	0.016	0.023	24
F		0.69	0.59	7.5	0.41	7.61	3.1			
	6	3.78	0.60	7.9	2.27	7.50	17.0	0.016	0.005	24
	J3	9.61	0.60	11.1	5.80	6.62	38.4	0.016	0.023	24
G	7	1.61	0.59	11.4	0.95	6.54	6.2	0.016	0.005	18
	J4	11.22	0.60	11.5	6.75	6.53	44.1	0.016	0.125	24
OS-3		9.74	0.59	11.5	5.74	6.52	37.4			
H	8	0.84	0.48	8.9	0.40	7.19	2.9			
	P1	25.10	0.62	11.5	15.56	6.52	153.8			
POND RELEASE							31.4	0.016	0.006	24
OS-5		0.15	0.59	5.4	0.09	8.40	0.7			
OS-6		0.41	0.59	5.7	0.24	8.29	2.0			
I		0.69	0.43	7.6	0.29	7.61	2.2			
	9						36.4	0.016	0.029	24
OS-4	O4	20.04	0.65	12.5	13.04	6.31	82.3	0.016	0.005	30
	J5						**56.4**	0.016	0.006	36 or elp. eqvlt
	10						77.5			

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	North Swale
Flow Element	Trapezoidal Cha
Method	Manning's Formı
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	040000	ft/ft
Left Side Slope	0.25	V : H
Right Side Slope	10.00	V : H
Bottom Width	1.00	ft
Discharge	23.00	cfs

Results		
Depth	0.69	ft
Flow Area	3.7	ft²
Wetted Perim	7.52	ft
Top Width	6.82	ft
Critical Depth	0.86	ft
Critical Slope	0.017463	ft/ft
Velocity	6.19	ft/s
Velocity Head	0.60	ft
Specific Energ	1.28	ft
Froude Numb	1.48	
Flow Type	Supercritical	



Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	East Swale
Flow Element	Trapezoidal Cha
Method	Manning's Formı
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	030000	ft/ft
Left Side Slope	0.25	V : H
Right Side Slope	0.25	V : H
Bottom Width	2.00	ft
Discharge	3.50	cfs

Results		
Depth	0.33	ft
Flow Area	1.1	ft²
Wetted Perim	4.70	ft
Top Width	4.62	ft
Critical Depth	0.36	ft
Critical Slope	0.021252	ft/ft
Velocity	3.23	ft/s
Velocity Head	0.16	ft
Specific Energ	0.49	ft
Froude Numb	1.17	
Flow Type	Supercritical	

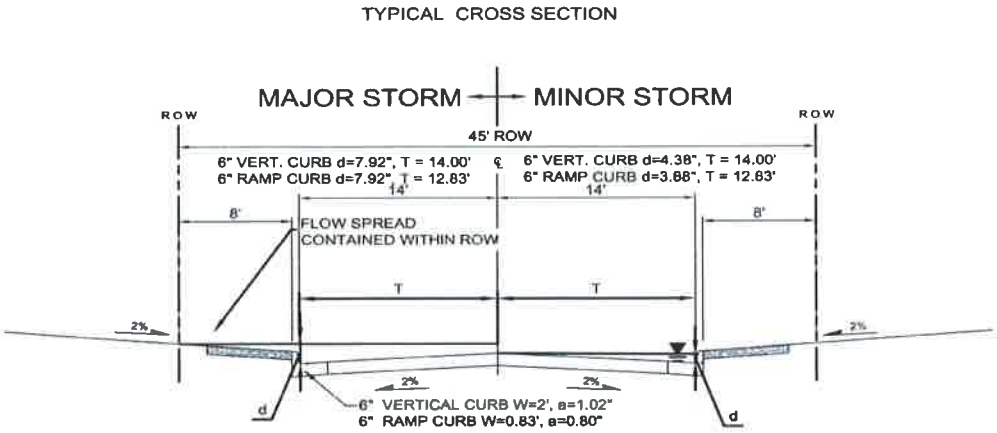
Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	South Swale
Flow Element	Trapezoidal Cha
Method	Manning's Formu
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	020000	ft/ft
Left Side Slope	0.15	V : H
Right Side Slope	0.25	V : H
Bottom Width	4.00	ft
Discharge	5.00	cfs

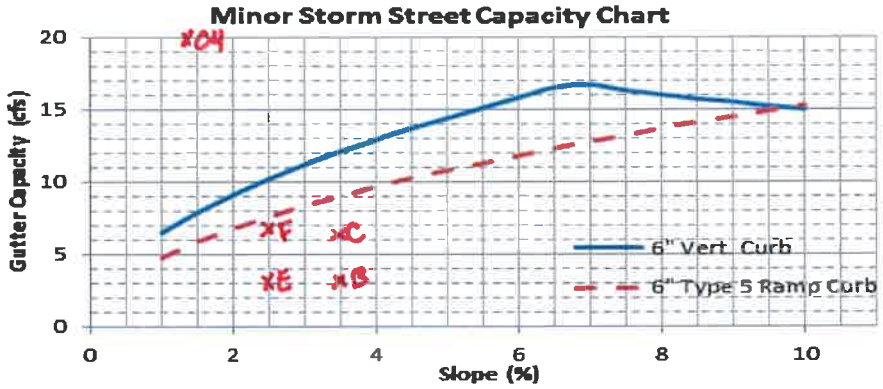
Results		
Depth	0.32	ft
Flow Area	1.8	ft²
Wetted Perim	7.48	ft
Top Width	7.41	ft
Critical Depth	0.31	ft
Critical Slope	0.021254	ft/ft
Velocity	2.74	ft/s
Velocity Head	0.12	ft
Specific Energ	0.44	ft
Froude Numb	0.97	
Flow Type	Subcritical	

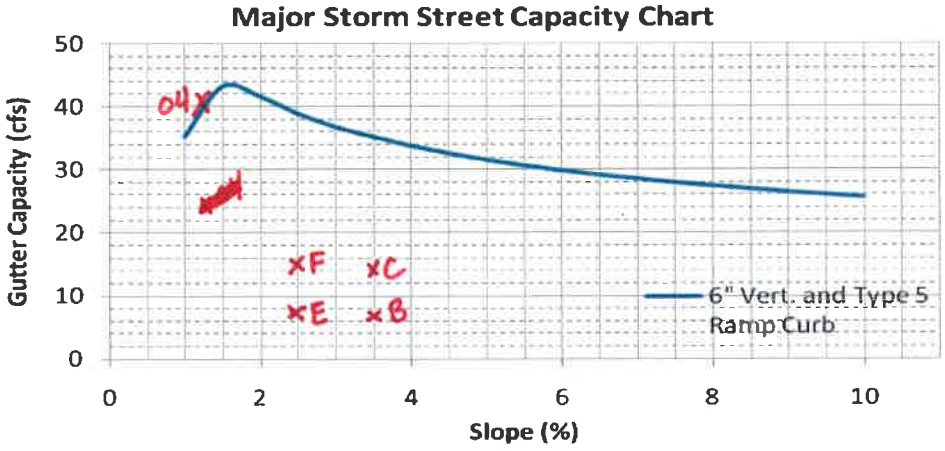
Figure 7-9. Street Capacity Charts Minor Residential (Attached Sidewalk)



Points correspond to proposed Basin flows. See proposed drainage map for locations.

x Letter or number represents Basin flows





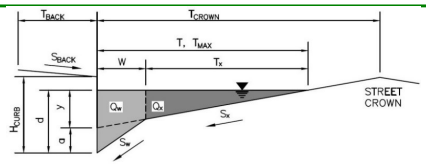
These charts shall only be used for the standard street sections as shown. The capacity shown is based on ½ the street section as calculated by the UD-Inlet spreadsheets. Minor storm capacities are based on no crown overtopping, curb height or maximum allowable spread widths. Major storm capacities are based on flow being containing within the public right-of-way, including conveyance capacity behind the curb. The UDFCD Safety Reduction Factor was applied. An 'n_{STREET}' of 0.016 and 'n_{BACK}' of 0.020 was used. Calculations were done using UD-Inlet 3.00.xls, March, 2011.

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

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

Project:

Inlet ID: **Inlet OS-4**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.5	ft
Gutter Width	W =	1.00	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 =	0.006	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.5	16.5	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**8.9**	**39.6**	**cfs**

WARNING: MINOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

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

Exist. depth of flow on Widefield Dr.
Worksheet for Irregular Channel

Project Description	
Worksheet	Irregular Channel
Flow Element	Irregular Channel
Method	Manning's Formul
Solve For	Channel Depth

Input Data		
Slope	012500	ft/ft
Discharg	100.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.017	
Water Surface Elev	0.93	ft
Elevation Range	.00 to 0.66	
Flow Area	14.6	ft²
Wetted Perimeter	24.05	ft
Top Width	23.00	ft
Actual Depth	0.93	ft
Critical Elevation	1.14	ft
Critical Slope	0.005095	ft/ft
Velocity	6.84	ft/s
Velocity Head	0.73	ft
Specific Energy	1.66	ft
Froude Number	1.51	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.65343054 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
-0+09	-0+01	0.020
-0+01	0+14	0.016

Natural Channel Points

Station (ft)	Elevation (ft)
-0+09	0.66
-0+01	0.50
0+00	0.00
0+14	0.28

Prop. depth of flow just past DP-O4
Worksheet for Irregular Channel

Project Description	
Worksheet	Irregular Channel
Flow Element	Irregular Channel
Method	Manning's Formul
Solve For	Channel Depth

Input Data		
Slope	012500	ft/ft
Discharg	21.10	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	0.45	ft
Elevation Range	0.00 to 0.66	
Flow Area	4.5	ft²
Wetted Perimeter	15.18	ft
Top Width	14.90	ft
Actual Depth	0.45	ft
Critical Elevation	0.56	ft
Critical Slope	0.005457	ft/ft
Velocity	4.65	ft/s
Velocity Head	0.34	ft
Specific Energy	0.79	ft
Froude Number	1.48	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.1699811 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
-0+09	-0+01	0.020
-0+01	0+14	0.016

Natural Channel Points

Station (ft)	Elevation (ft)
-0+09	0.66
-0+01	0.50
0+00	0.00
0+14	0.28

Prop. depth of flow at DP-10
Worksheet for Irregular Channel

Project Description	
Worksheet	Irregular Channel
Flow Element	Irregular Channel
Method	Manning's Formul
Solve For	Channel Depth

Input Data		
Slope	012500	ft/ft
Discharg	77.50	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.017	
Water Surface Elev	0.84	ft
Elevation Range	0.00 to 0.66	
Flow Area	12.5	ft²
Wetted Perimeter	23.87	ft
Top Width	23.00	ft
Actual Depth	0.84	ft
Critical Elevation	1.00	ft
Critical Slope	0.005312	ft/ft
Velocity	6.20	ft/s
Velocity Head	0.60	ft
Specific Energy	1.44	ft
Froude Number	1.48	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.56152969 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
-0+09	-0+01	0.020
-0+01	0+14	0.016

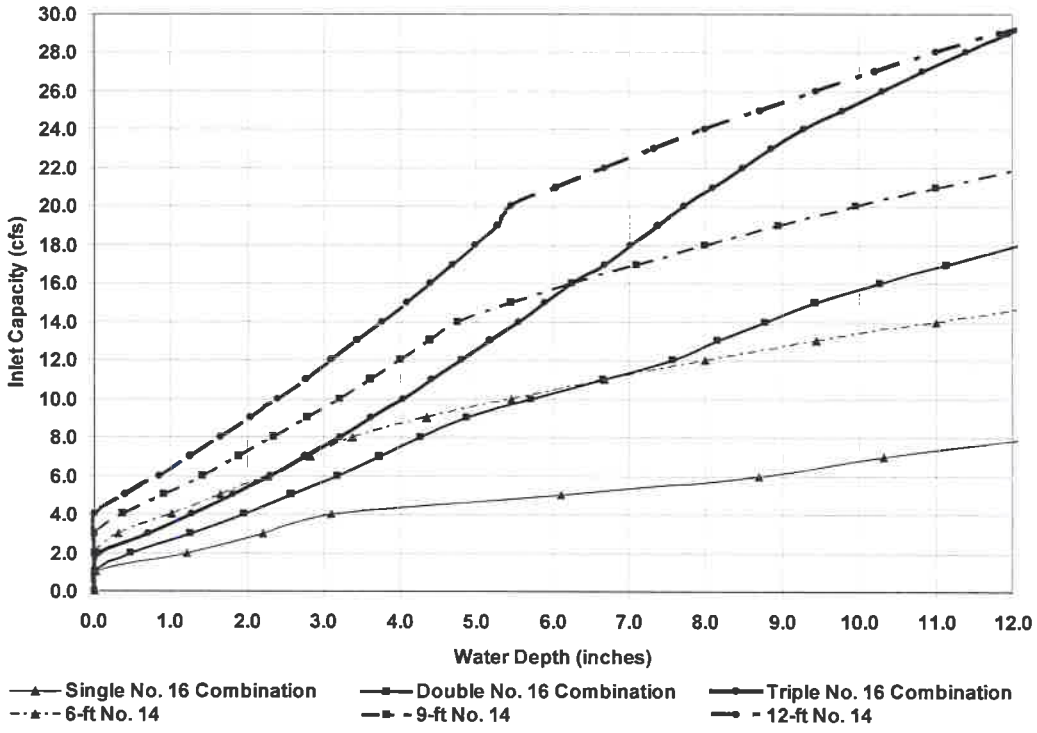
Natural Channel Points

Station (ft)	Elevation (ft)
-0+09	0.66
-0+01	0.50
0+00	0.00
0+14	0.28

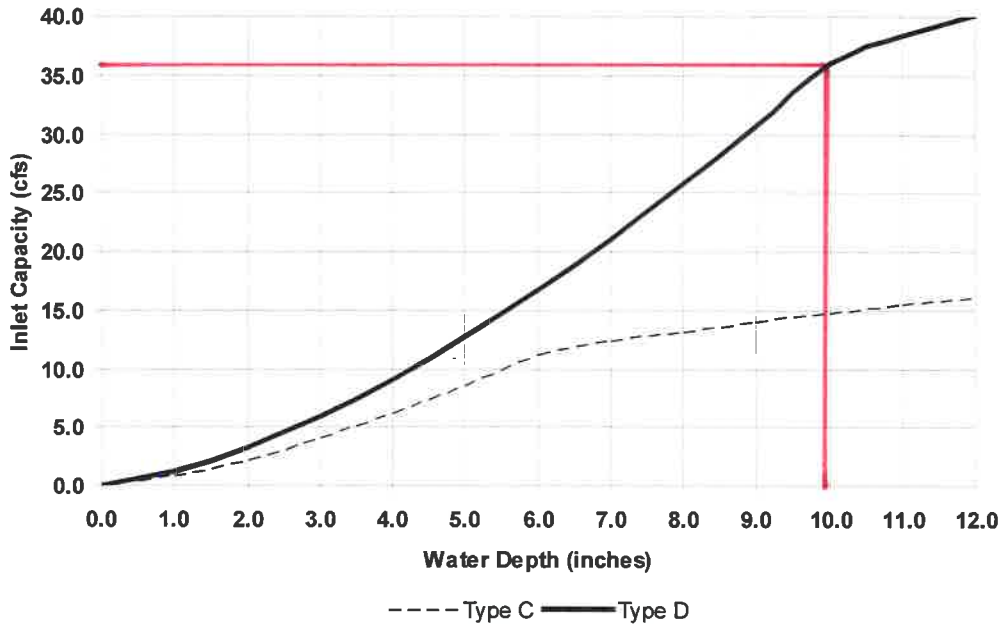
Figure 8.1. Allowable Inlet Capacity— Sump Conditions

Note: See Section 8.3.2 for assumptions.

Type 16 and Type 14 Inlets for Sump Conditions



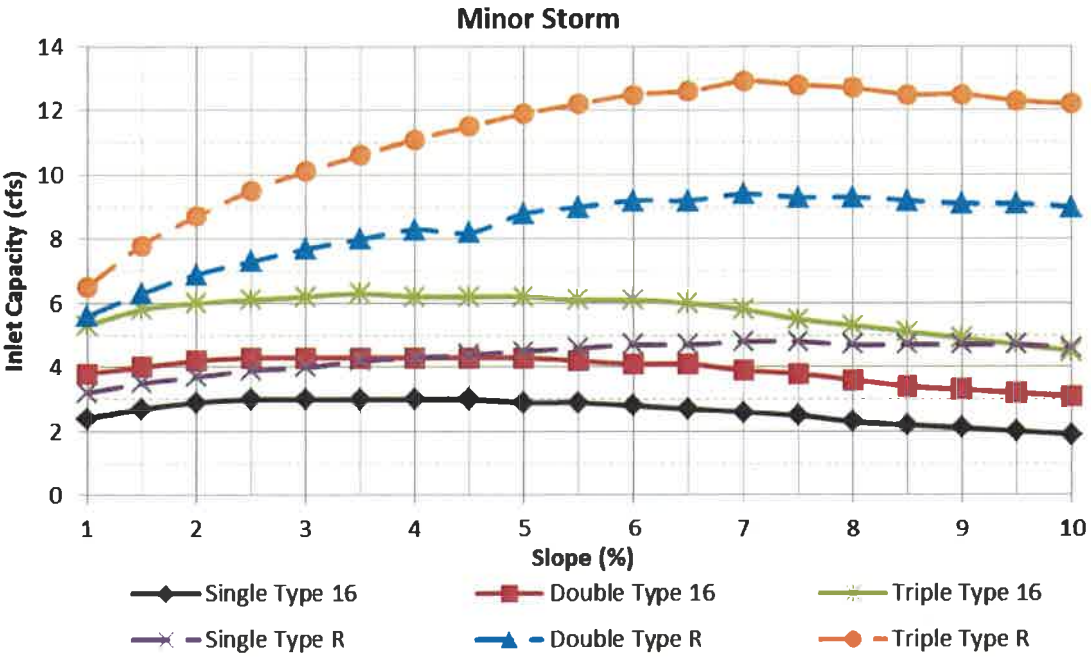
Allowable Inlet Capacity for Type C and D Inlets for Sump Conditions

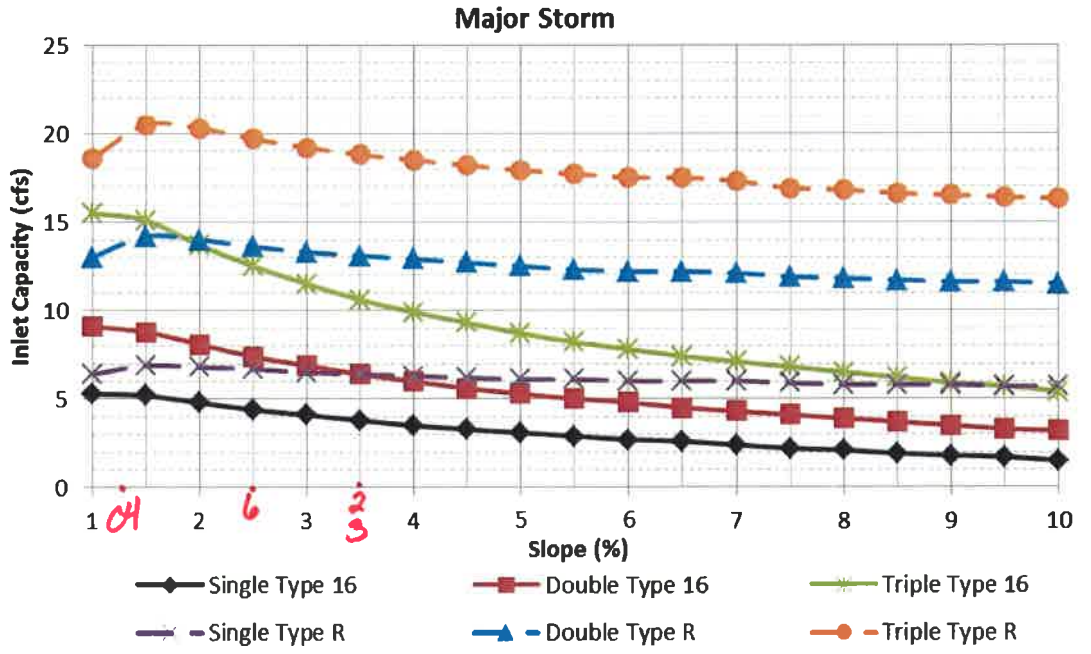


DP-1: Q_{100} = 71.0 cfs → Double Type D inlet

Figure 8-9. Inlet Capacity Chart Continuous Grade Conditions, Minor Residential (Local)
(Attached Sidewalk)

Street Section Data: Street Width Flowline to Flowline = 28'
Type of Curb and Gutter = 6" vertical

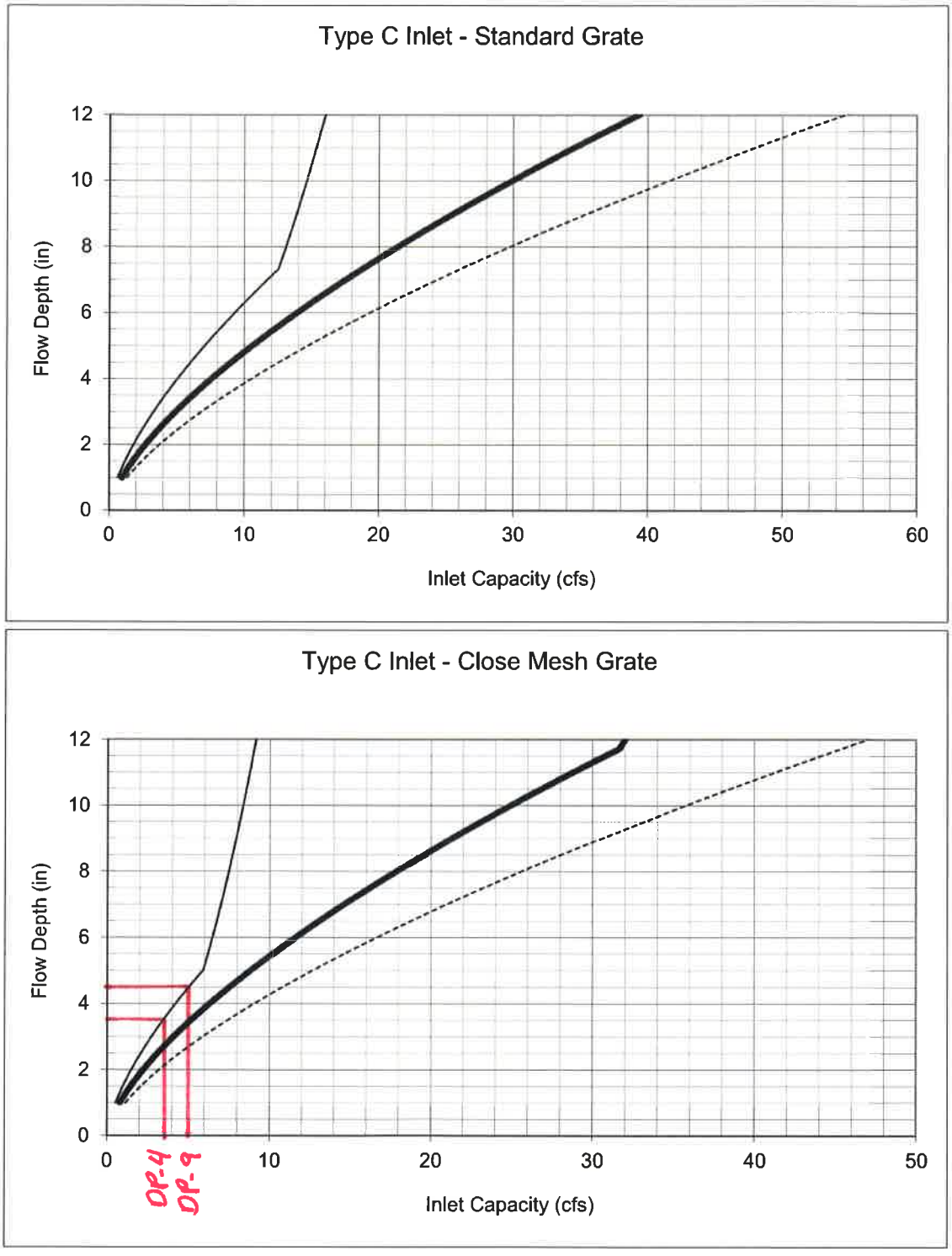




DP-2: Q_{100} = 6.6 cfs → Single Type R
DP-3: Q_{100} = 14.0 cfs → Triple Type R
DP-6: Q_{100} = 17.0 cfs → Triple Type R
DP-CH: Q_{100} = 41.1 cfs → Triple Type R

The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

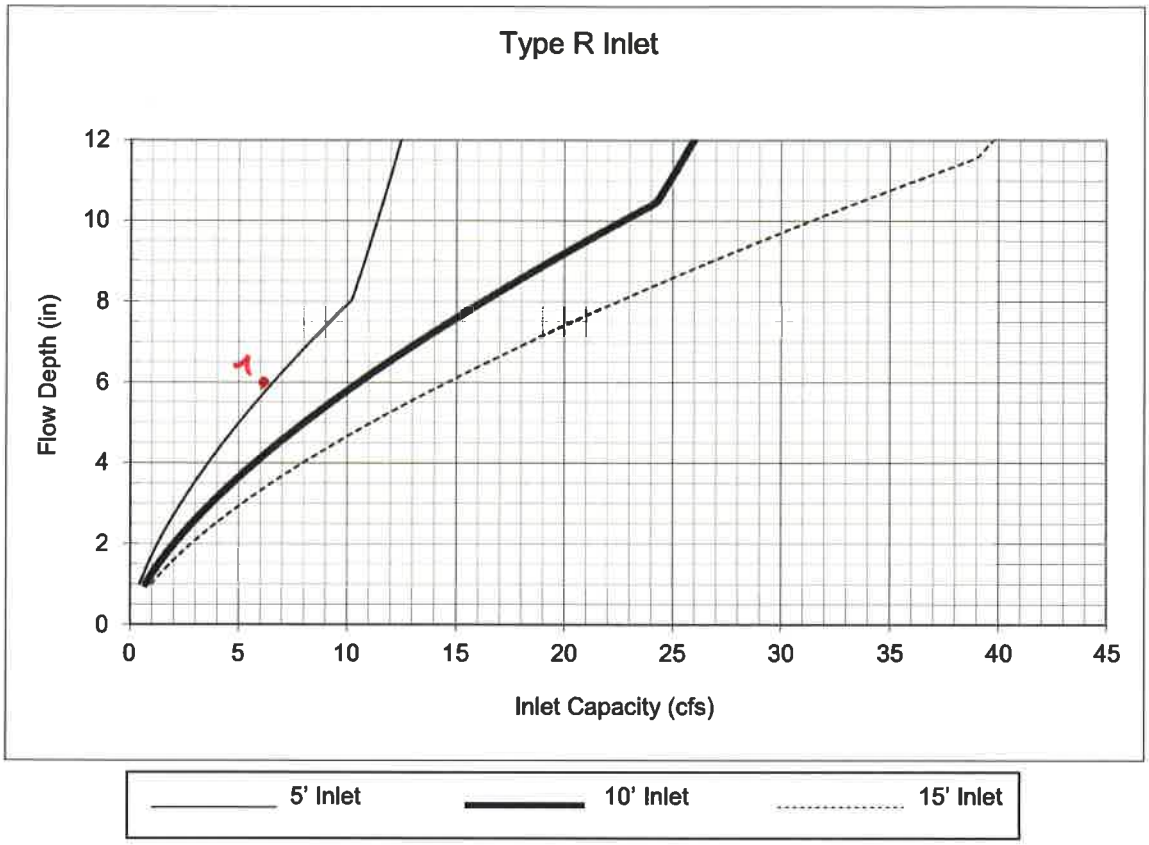
Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet



DP-4: $Q_{100} = 3.5$ cfs
DP-9: $Q_{100} = 4.9$ cfs

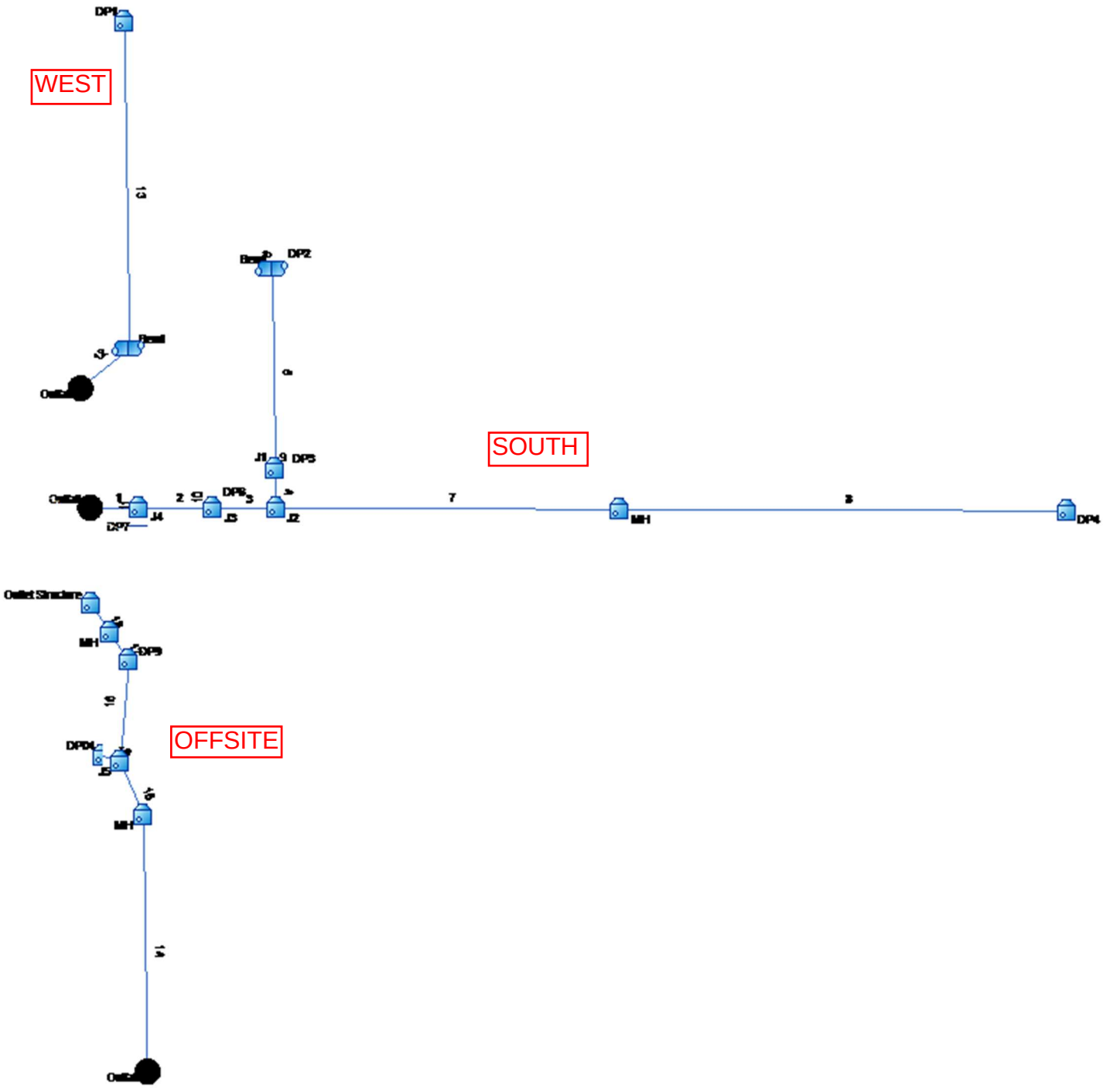
Notes:
1. The standard inlet parameters must apply to use these charts.

Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet



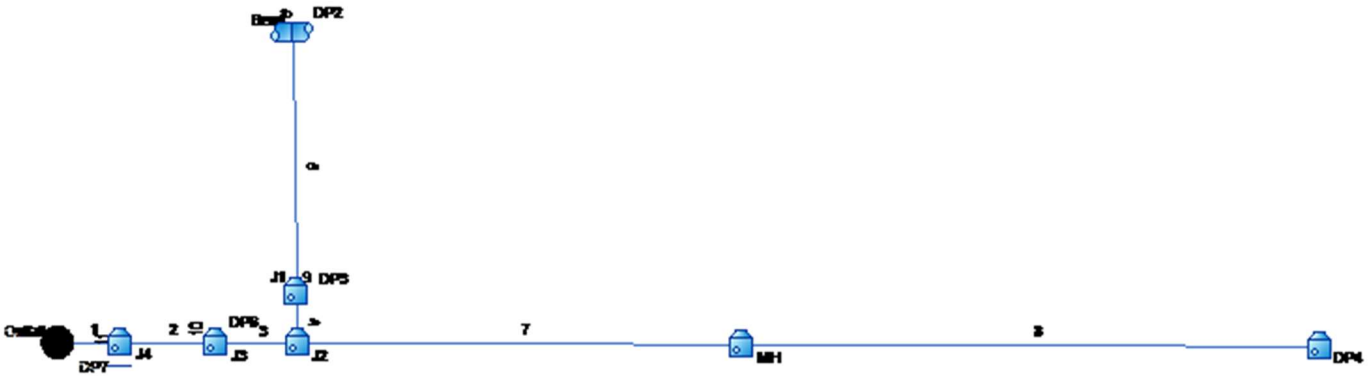
OP-7 : Q_{100} = 6.2 cfs → single Type R

Notes:
1. The standard inlet parameters must apply to use this chart.


WEST
SOUTH
OFFSITE
DP1
DP2
DP3
DP4
DP5
DP6
DP7
DP8
DP9
J1
J2
J3
J4
J5
MH
MH
MH
Outlet
Outlet
Outlet
Outlet Structure
Flared
Beveled
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

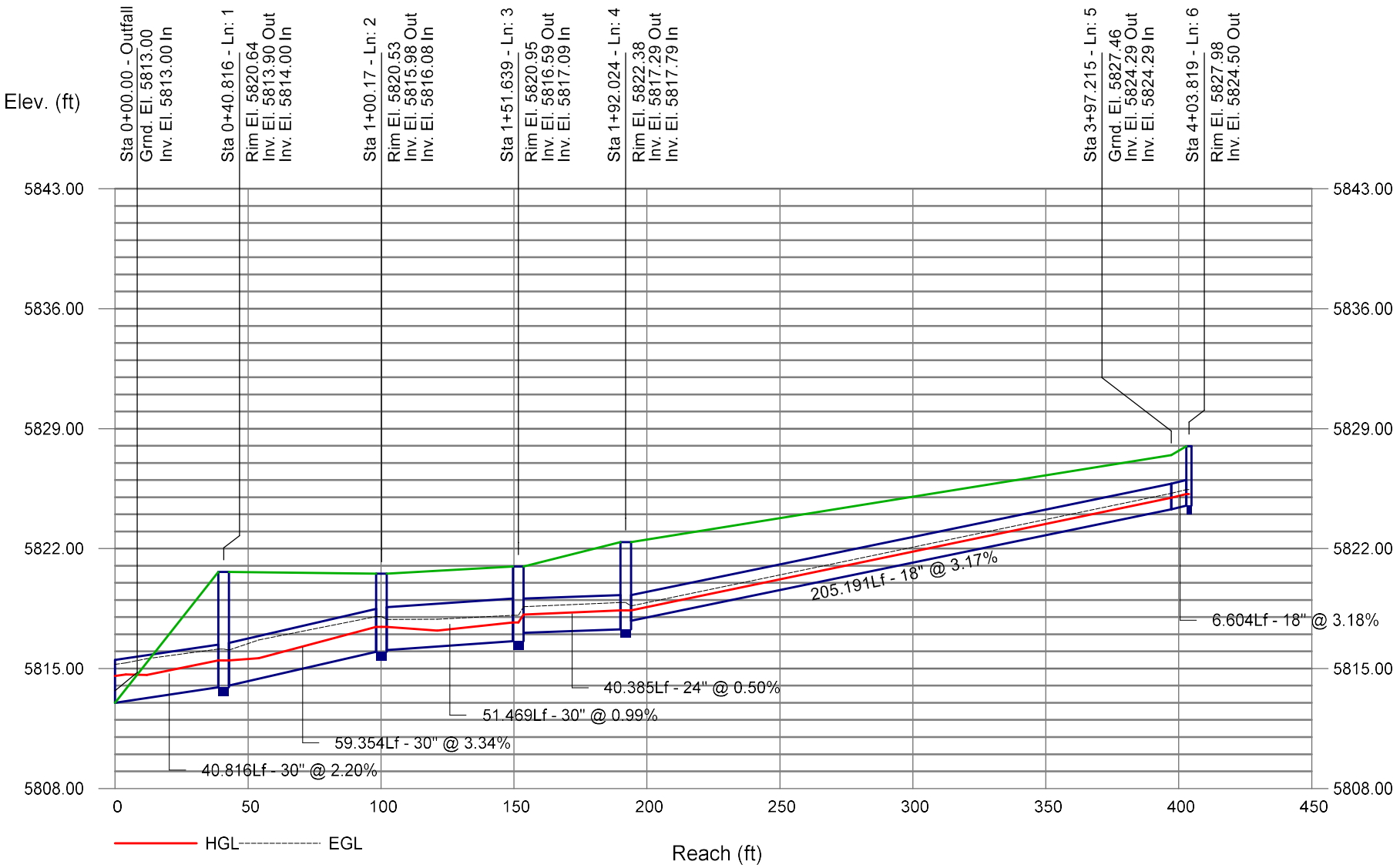
Hydraflow Storm Sewer Extension for Autodesk Civil 3D

SOUTH
LINES 1-11



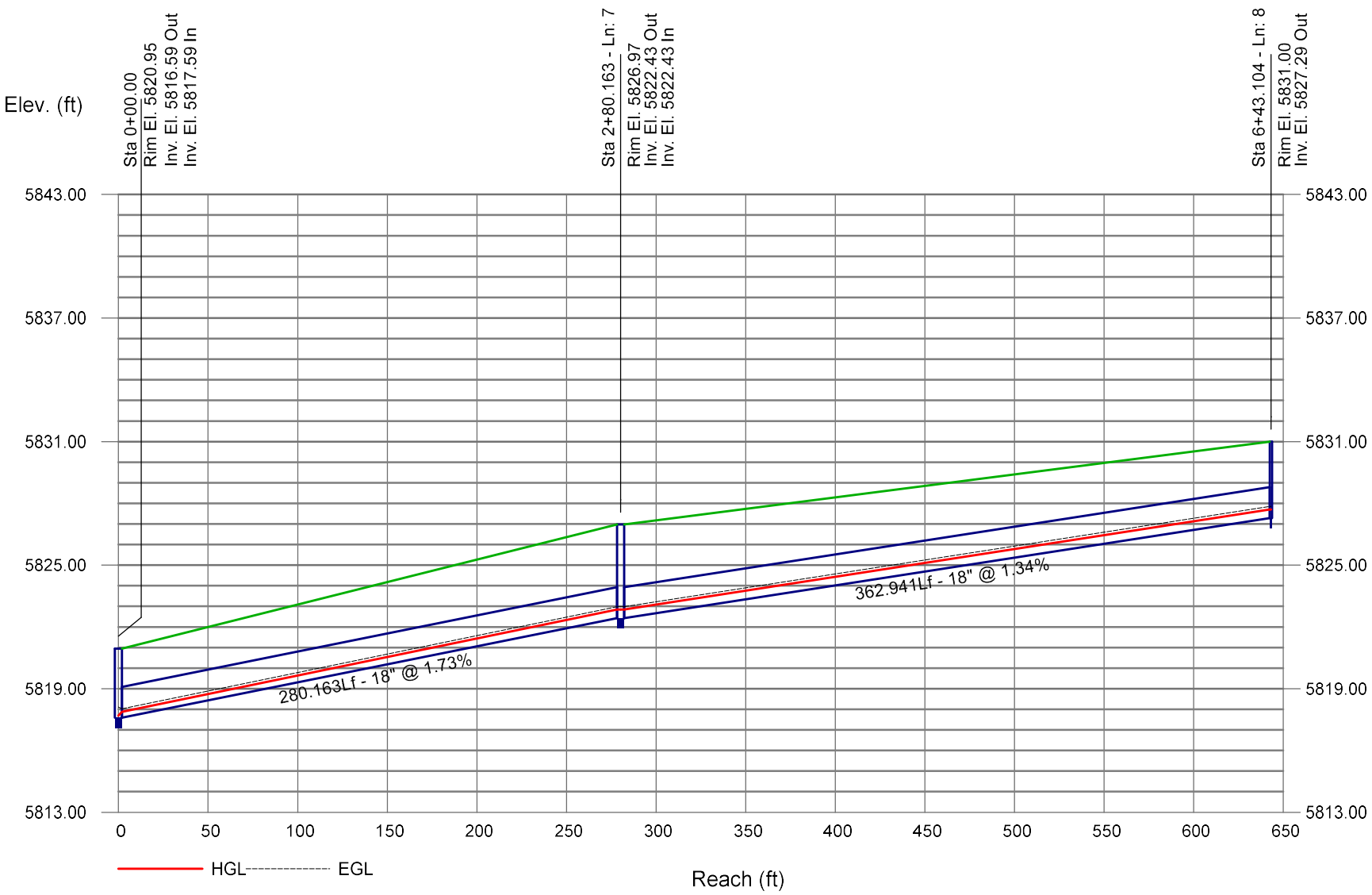
Storm Sewer Profile

Proj. file: 5 yr.stm



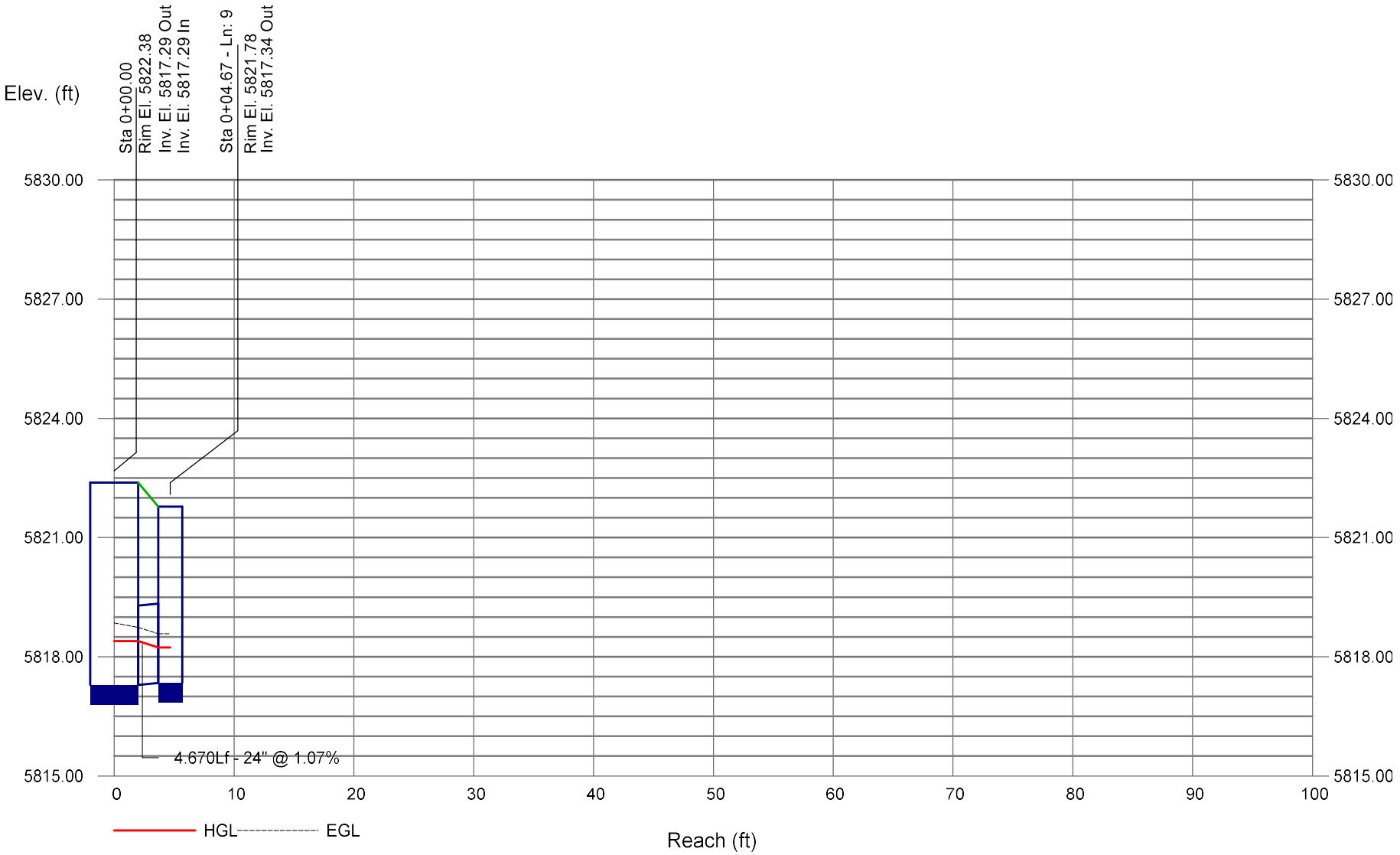
Storm Sewer Profile

Proj. file: 5 yr.stm



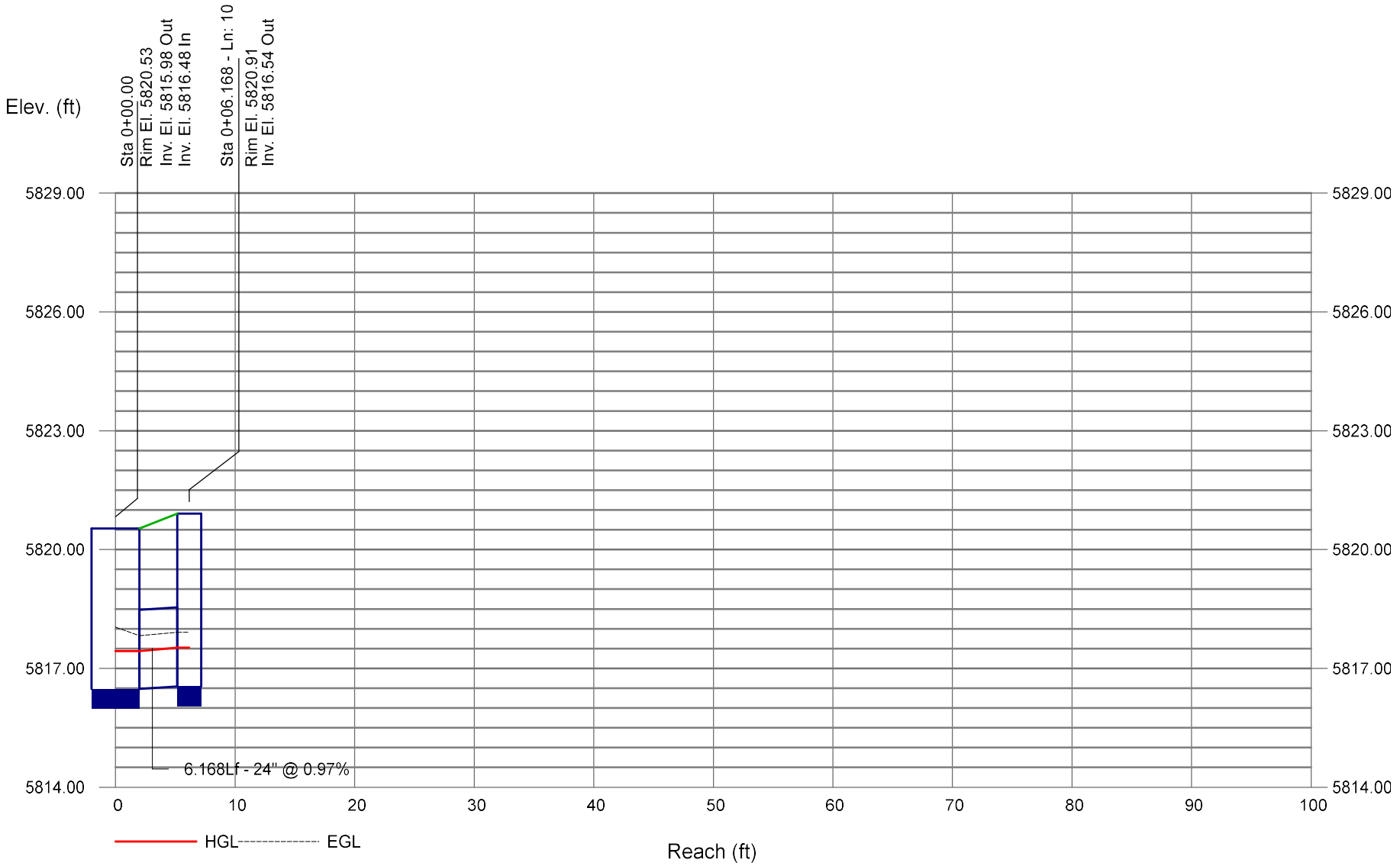
Storm Sewer Profile

Proj. file: 5 yr.stm



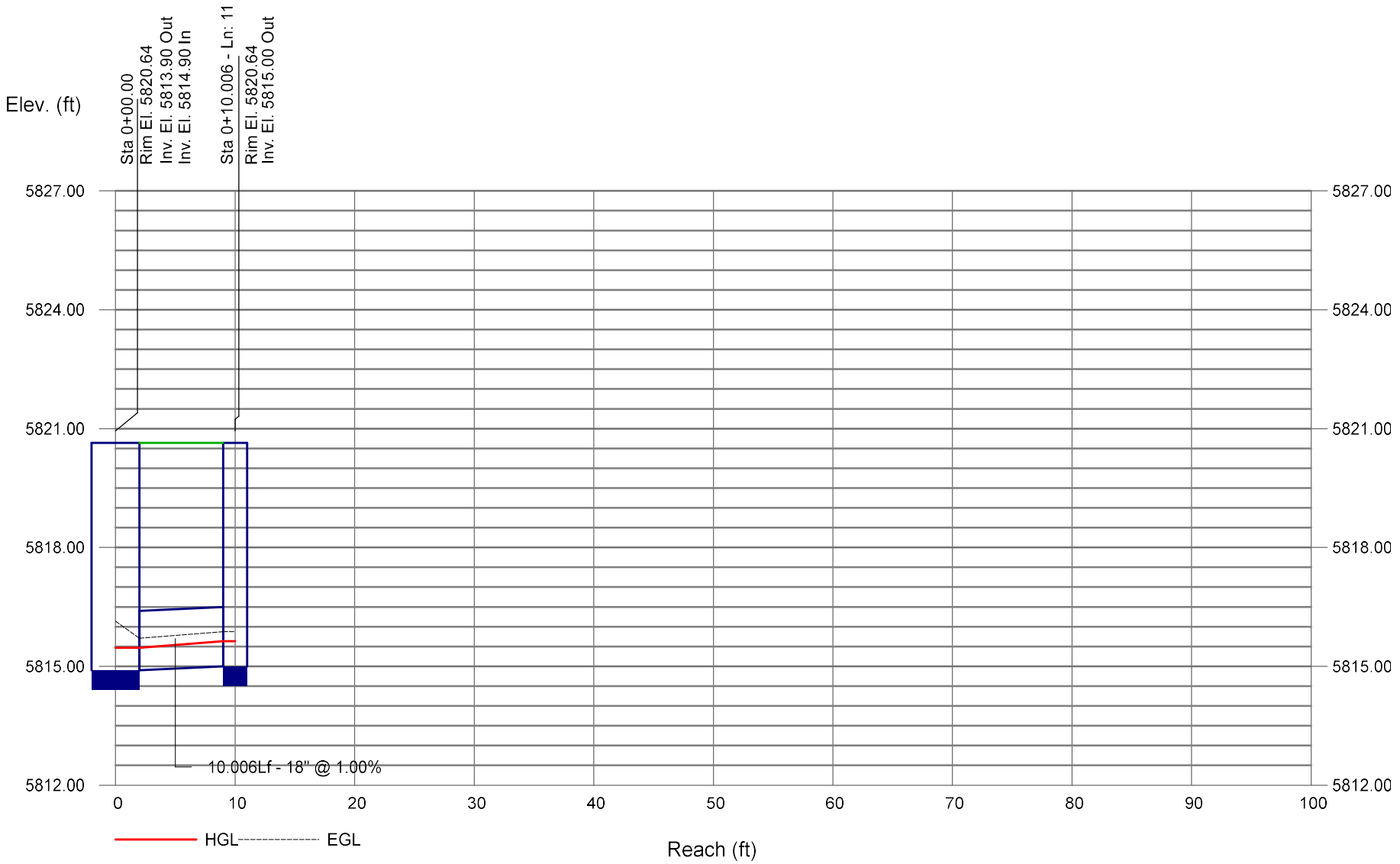
Storm Sewer Profile

Proj. file: 5 yr.stm



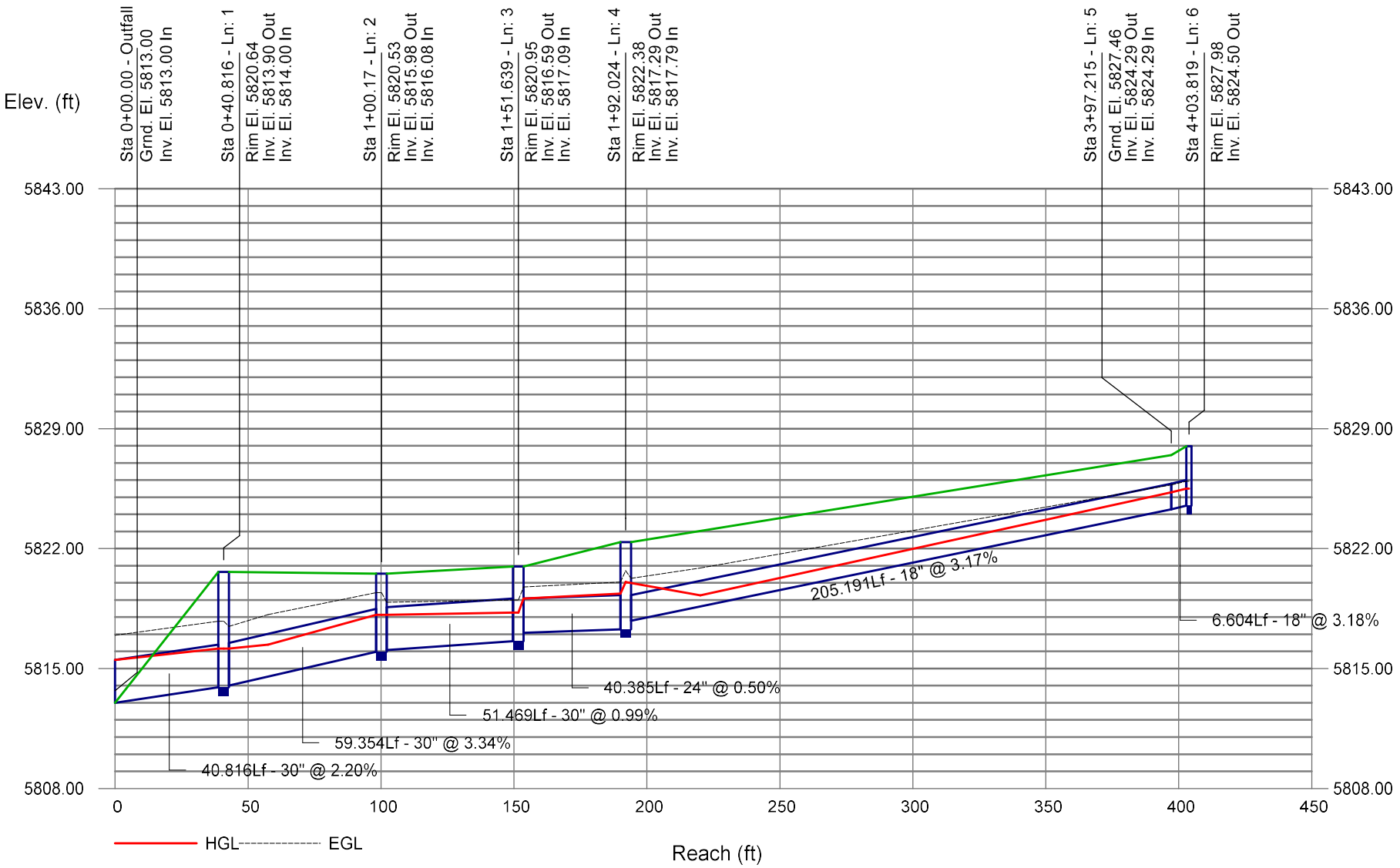
Storm Sewer Profile

Proj. file: 5 yr.stm



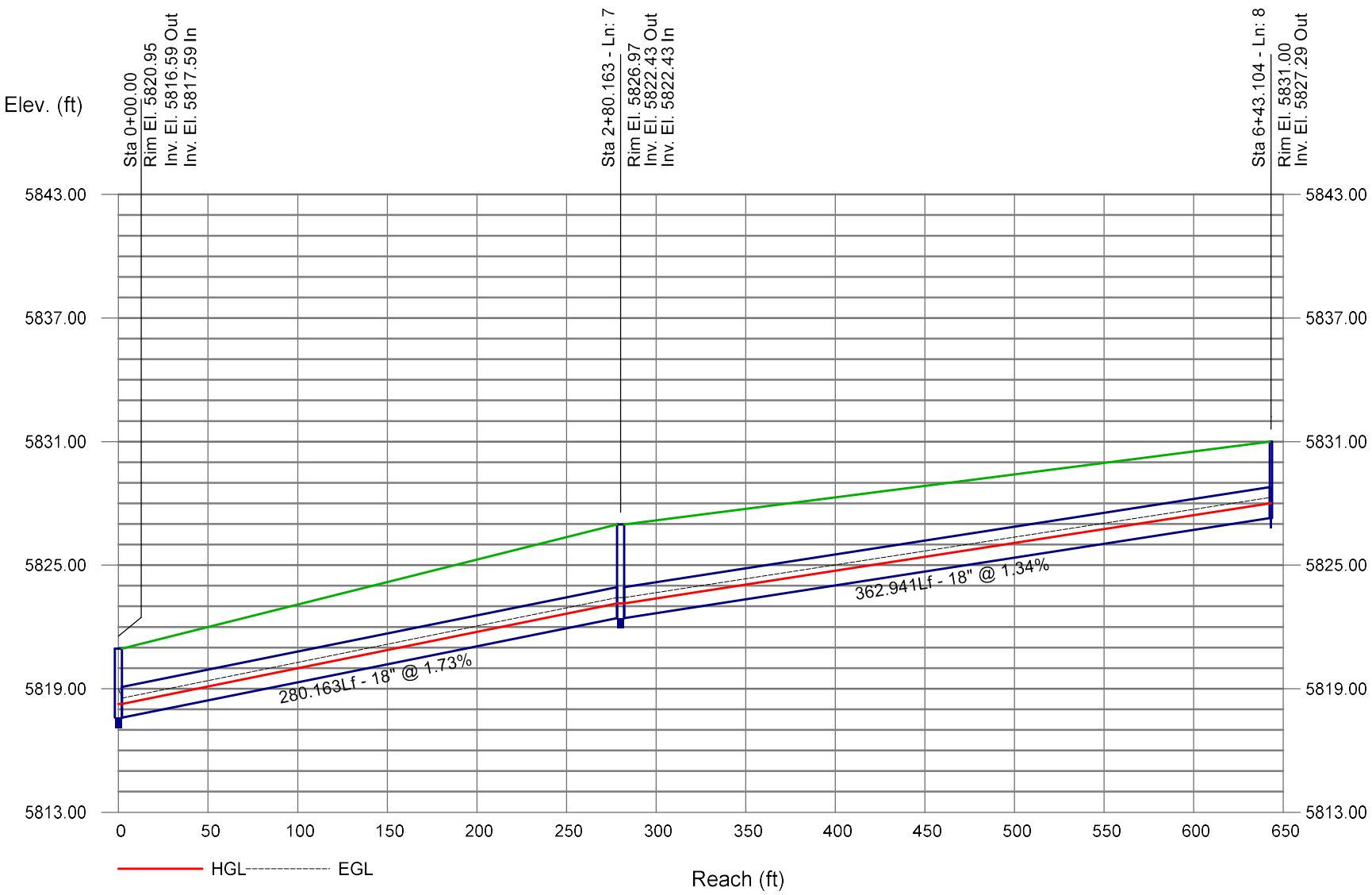
Storm Sewer Profile

Proj. file: 100 yr.stm



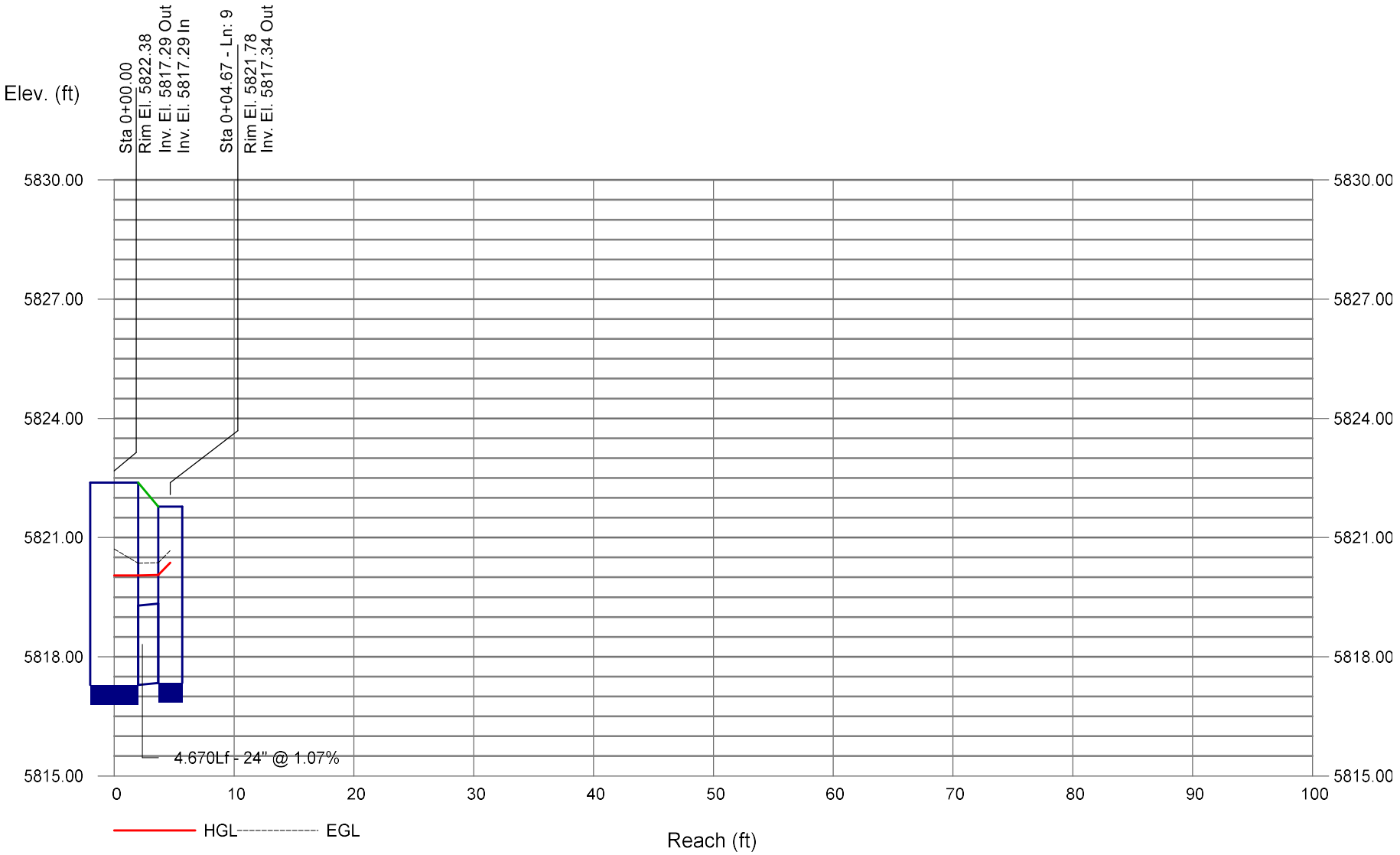
Storm Sewer Profile

Proj. file: 100 yr.stm



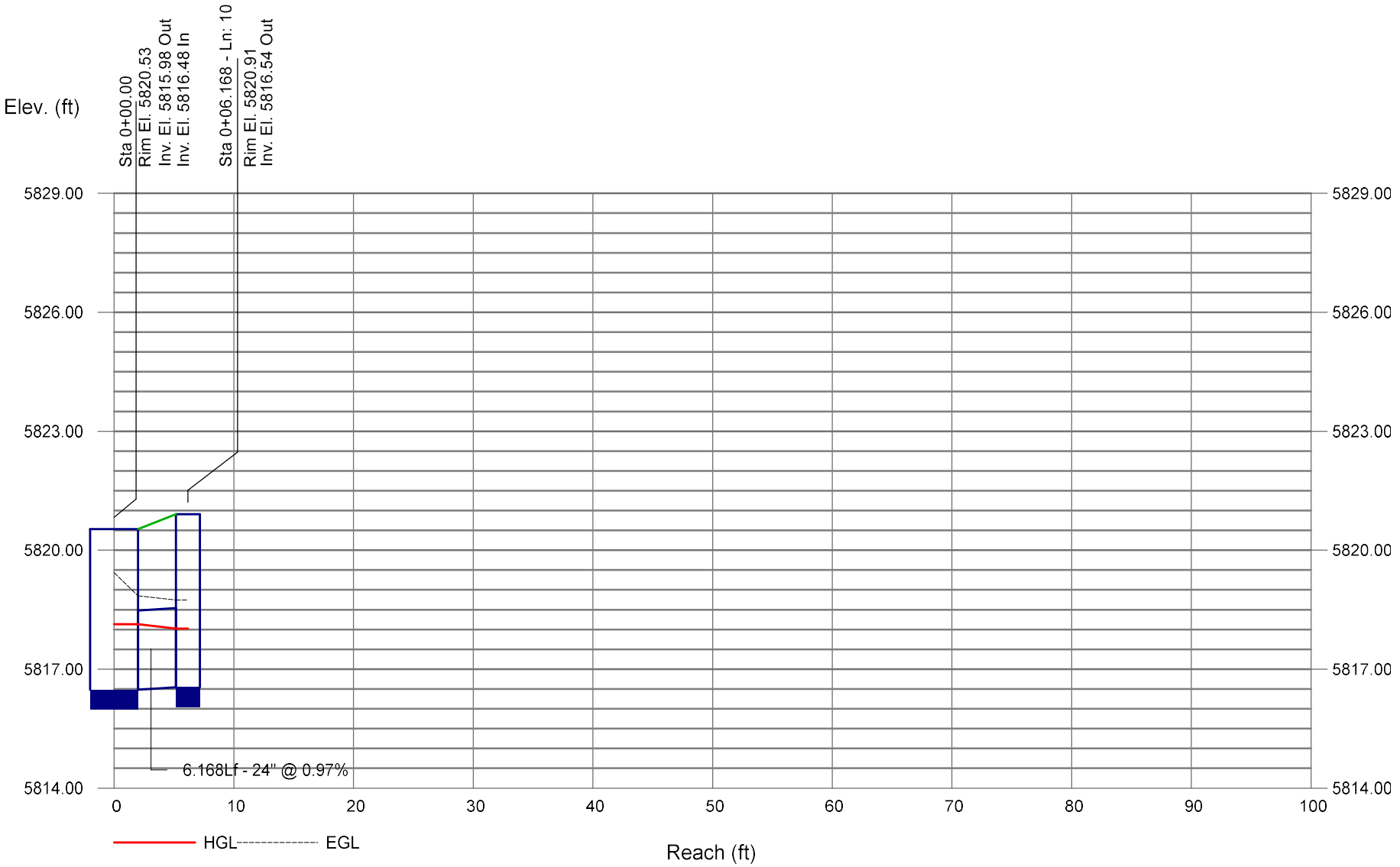
Storm Sewer Profile

Proj. file: 100 yr.stm



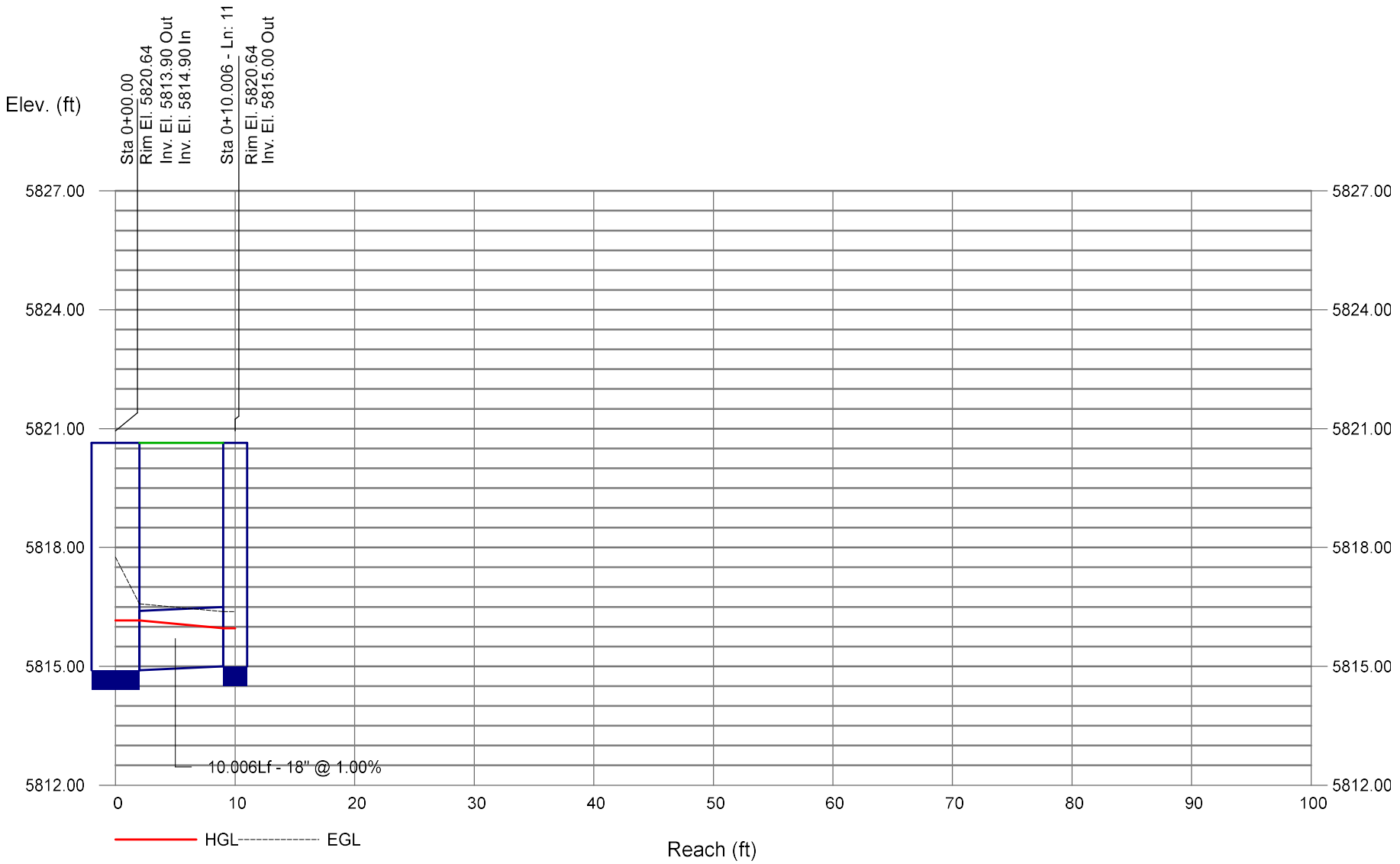
Storm Sewer Profile

Proj. file: 100 yr.stm



Storm Sewer Profile

Proj. file: 100 yr.stm



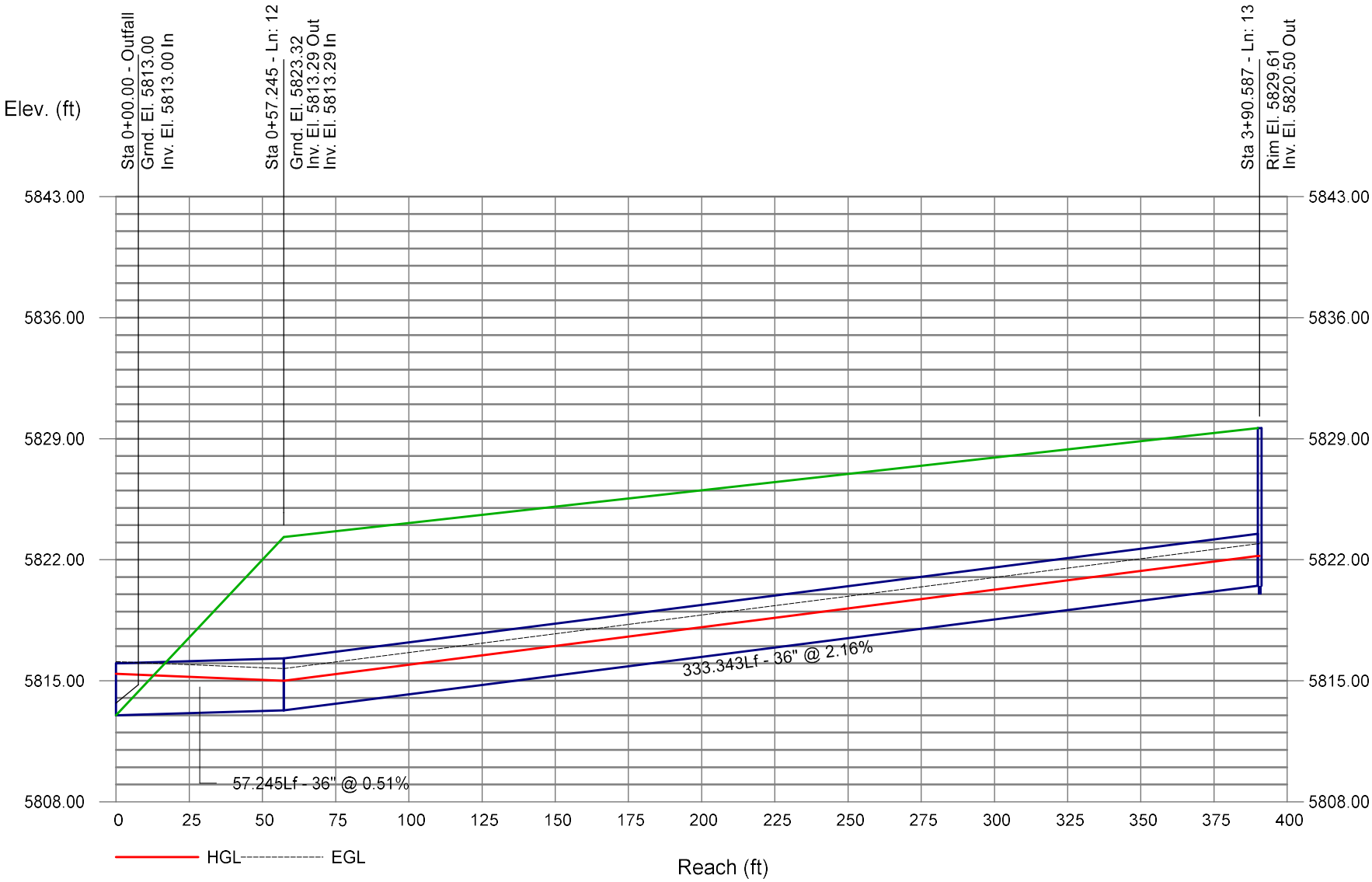
Hydraflow Storm Sewer Extension for Autodesk Civil 3D

WEST

LINES 12-13

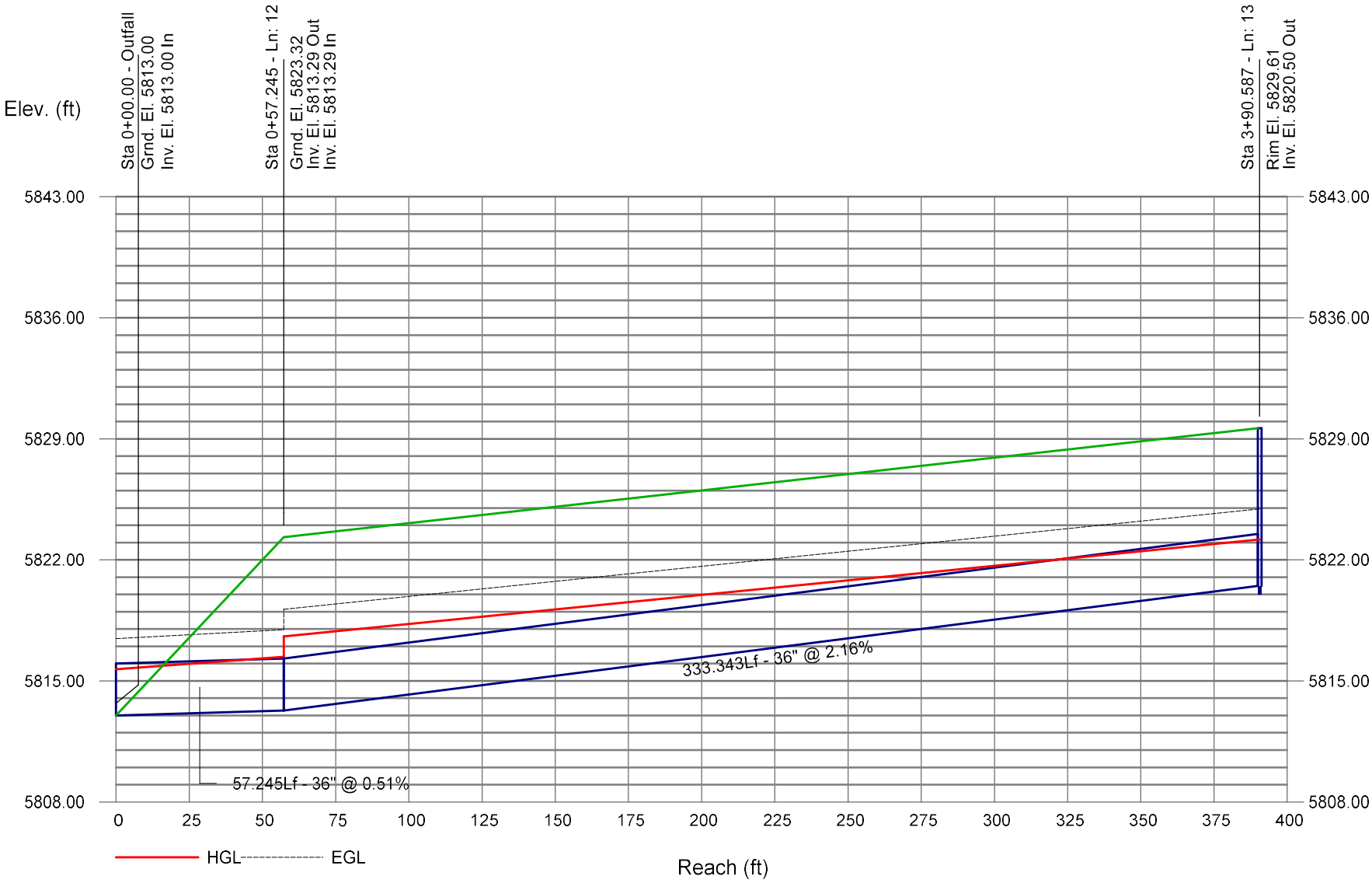
Storm Sewer Profile

Proj. file: 5 yr.stm



Storm Sewer Profile

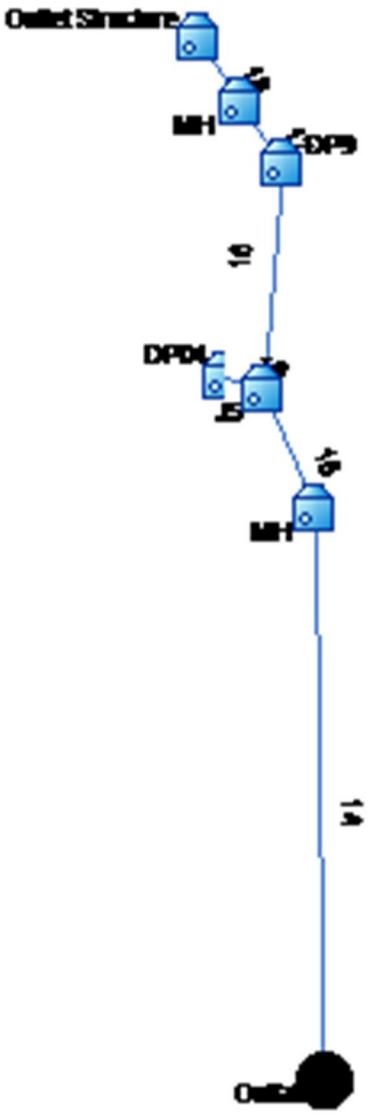
Proj. file: 100 yr.stm



Hydraflow Storm Sewer Extension for Autodesk Civil 3D

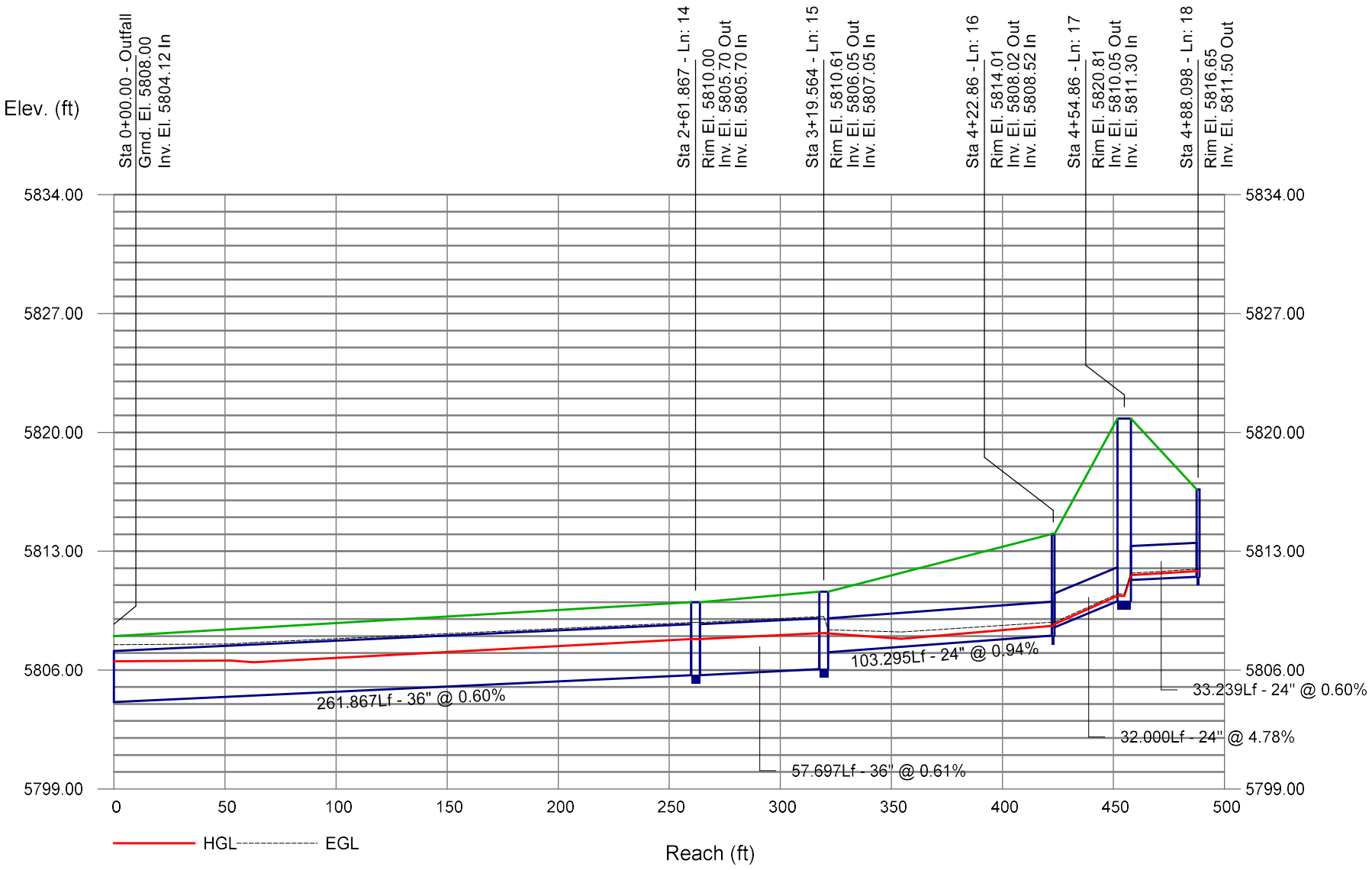
OFFSITE

LINES 14-19



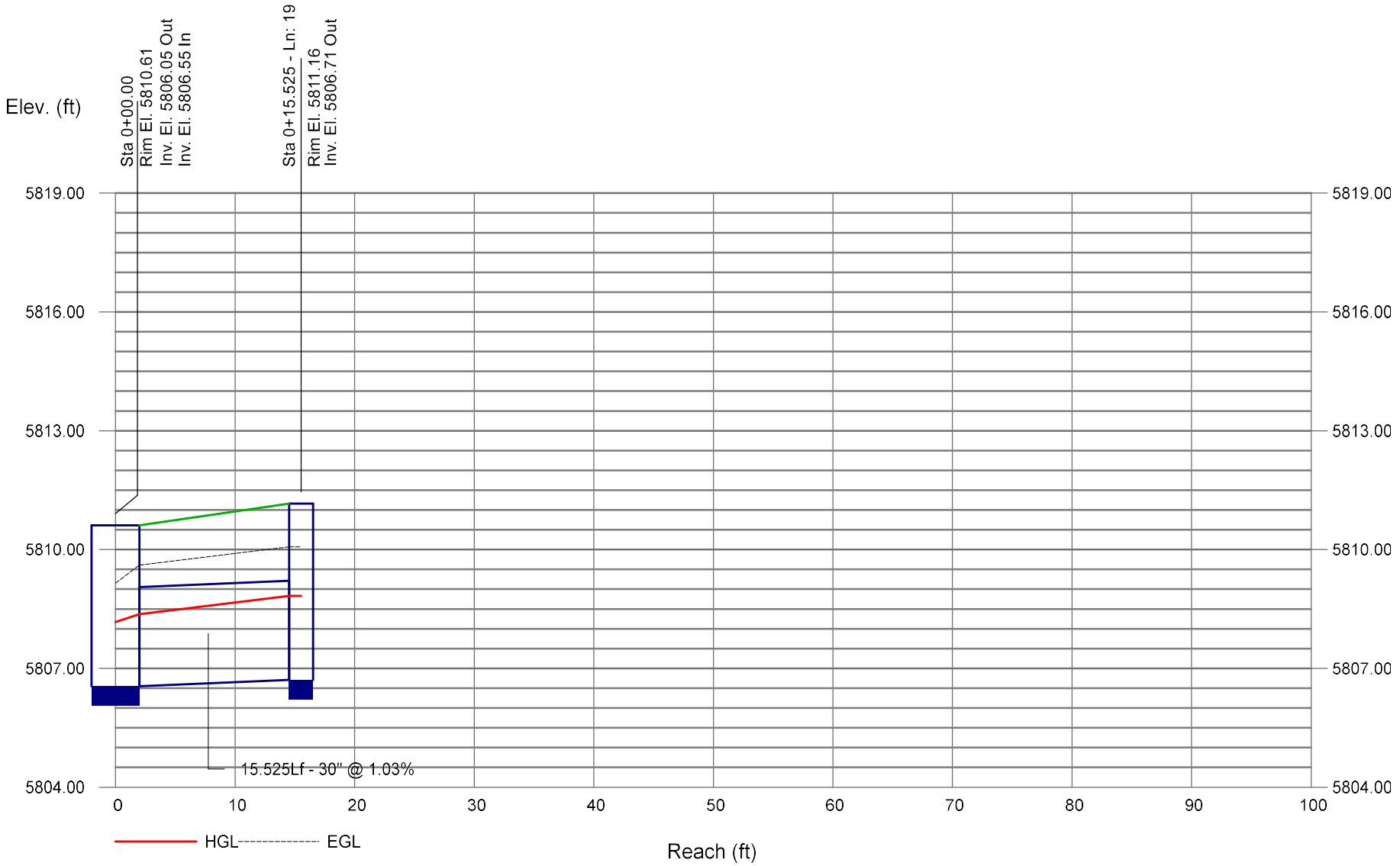
Storm Sewer Profile

Proj. file: 5 yr.stm



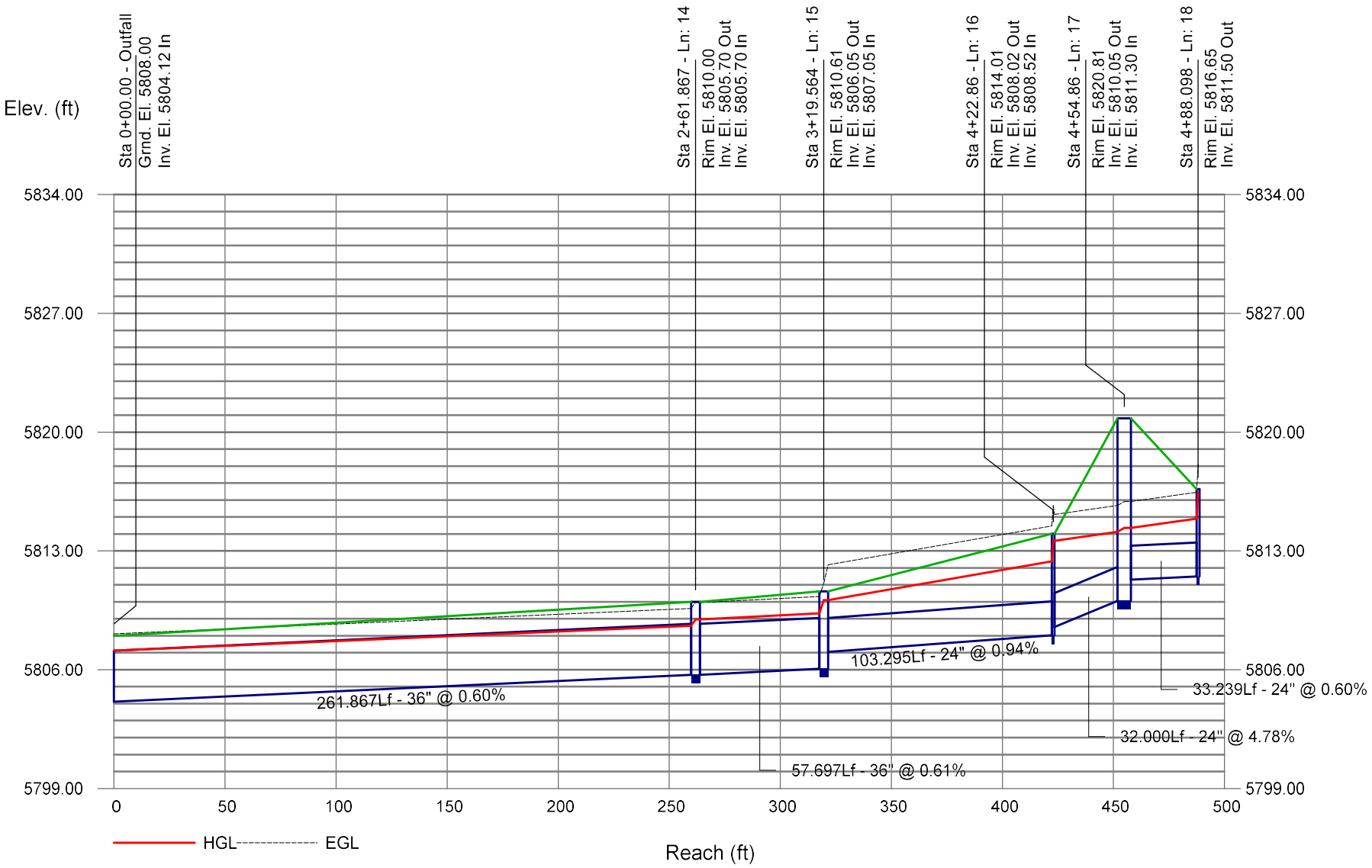
Storm Sewer Profile

Proj. file: 5 yr.stm



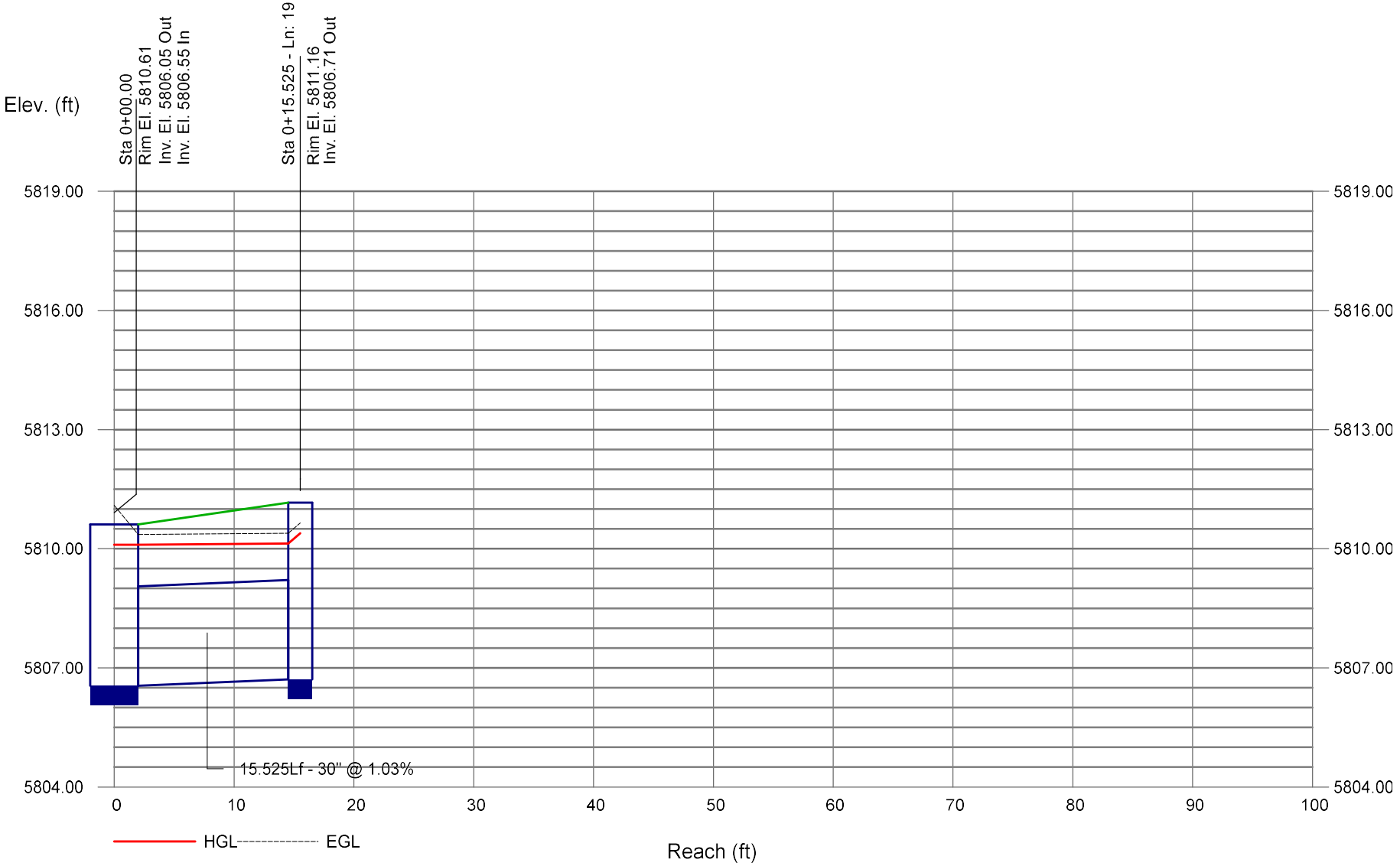
Storm Sewer Profile

Proj. file: 100 yr.stm



Storm Sewer Profile

Proj. file: 100 yr.stm



5-yr

Line No.	Flow Rate	Line Size	Line Type	Line Length	Invert Dn	Invert Up	Line Slope	HGL Up	HGL Dn	Minor Loss	HGL Jnct	Vel Ave	J-Loss Coeff
	(cfs)	(in)		(ft)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
1	21.30	30	Cir	40.816	5813.00	5813.90	2.20	5815.47 j	5814.57	n/a	5815.47	6.57	1.00 z
2	18.50	30	Cir	59.354	5814.00	5815.98	3.34	5817.44 j	5815.47	n/a	5817.44	6.21	1.00 z
3	10.80	30	Cir	51.469	5816.08	5816.59	0.99	5817.69 j	5817.44	n/a	5817.69	4.59	1.00 z
4	9.60	24	Cir	40.385	5817.09	5817.29	0.50	5818.40	5818.16	n/a	5818.40	5.51	1.00 z
5	3.20	18	Cir	205.191	5817.79	5824.29	3.17	5824.97	5818.40	0.20	5824.97	4.44	0.75 z
6	3.20	18	Cir	6.604	5824.29	5824.50	3.18	5825.18	5824.97	0.26	5825.18	4.10	1.00 z
7	1.20	18	Cir	280.163	5817.59	5822.43	1.73	5822.84	5817.88	0.02	5822.84	4.07	0.15 z
8	1.20	18	Cir	362.941	5822.43	5827.29	1.34	5827.70	5822.84	0.15	5827.70	3.07	1.00 z
9	6.40	24	Cir	4.670	5817.29	5817.34	1.07	5818.24	5818.40	0.34	5818.24	4.15	1.00 z
10	7.70	24	Cir	6.168	5816.48	5816.54	0.97	5817.53	5817.44	0.39	5817.53	5.09	1.00 z
11	2.80	18	Cir	10.006	5814.90	5815.00	1.00	5815.64	5815.47	0.24	5815.64	4.25	1.00 z
12	28.10	36	Cir	57.245	5813.00	5813.29	0.51	5815.00	5815.40	0.53	5815.00	5.69	0.75 z
13	28.10	36	Cir	333.343	5813.29	5820.50	2.16	5822.21	5815.00	0.71	5822.21	6.73	1.00 z
14	42.40	36	Cir	261.867	5804.12	5805.70	0.60	5807.82 j	5806.52	n/a	5807.82	7.47	0.37 z
15	42.40	36	Cir	57.697	5805.70	5806.05	0.61	5808.17	5807.82	n/a	5808.17	7.94	0.79 z
16	2.80	24	Cir	103.295	5807.05	5808.02	0.94	5808.60 j	5808.17	n/a	5808.60	2.61	0.58 z
17	0.90	24	Cir	32.000	5808.52	5810.05	4.78	5810.38	5808.70	n/a	5810.38	4.55	0.15 z
18	0.90	24	Cir	33.239	5811.30	5811.50	0.60	5811.83	5811.60	n/a	5811.83	2.90	1.00 z
19	39.60	30	Cir	15.525	5806.55	5806.71	1.03	5808.83	5808.37	1.24	5808.83	9.65	1.00 z
	Notes: j-Line contains hyd. jump; z-Zero Junction Loss												

100-yr

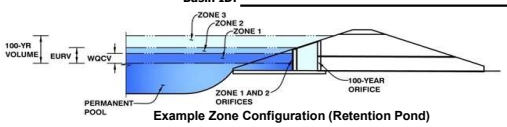
Line No.	Flow Rate	Line Size	Line Type	Line Length	Invert Dn	Invert Up	Line Slope	HGL Up	HGL Dn	Minor Loss	HGL Jnct	Vel Ave	J-Loss Coeff
	(cfs)	(in)		(ft)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
1	47.30	30	Cir	40.816	5813.00	5813.90	2.20	5816.16	5815.50	1.60	5816.16	9.88	1.00 z
2	41.10	30	Cir	59.354	5814.00	5815.98	3.34	5818.13 j	5816.16	n/a	5818.13	9.13	1.00 z
3	24.10	30	Cir	51.469	5816.08	5816.59	0.99	5818.26	5818.13	n/a	5818.26	6.25	1.00 z
4	20.60	24	Cir	40.385	5817.09	5817.29	0.50	5819.38	5819.09	0.67	5820.04	6.56	1.00
5	6.60	18	Cir	205.191	5817.79	5824.29	3.17	5825.28 j	5820.04	n/a	5825.28	4.53	0.75 z
6	6.60	18	Cir	6.604	5824.29	5824.50	3.18	5825.49	5825.28	0.44	5825.49	5.31	1.00 z
7	3.50	18	Cir	280.163	5817.59	5822.43	1.73	5823.14	5818.26	n/a	5823.14	4.40	0.15 z
8	3.50	18	Cir	362.941	5822.43	5827.29	1.34	5828.00	5823.14	n/a	5828.00	4.23	1.00 z
9	14.00	24	Cir	4.670	5817.29	5817.34	1.07	5820.06	5820.04	0.31	5820.37	4.46	1.00
10	17.00	24	Cir	6.168	5816.48	5816.54	0.97	5818.03	5818.13	0.72	5818.03	6.46	1.00 z
11	6.20	18	Cir	10.006	5814.90	5815.00	1.00	5815.96	5816.16	0.42	5815.96	4.55	1.00 z
12	71.00	36	Cir	57.245	5813.00	5813.29	0.51	5816.40	5815.67	1.18	5817.58	10.36	0.75
13	71.00	36	Cir	333.343	5813.29	5820.50	2.16	5823.17	5817.58	n/a	5823.17	10.37	1.00 z
14	56.40	36	Cir	261.867	5804.12	5805.70	0.60	5808.59	5807.12	0.37	5808.97	8.03	0.37
15	56.40	36	Cir	57.697	5805.70	5806.05	0.61	5809.32	5808.97	0.78	5810.10	7.98	0.79
16	36.40	24	Cir	103.295	5807.05	5808.02	0.94	5812.38	5810.10	1.21	5813.59	11.59	0.58
17	31.40	24	Cir	32.000	5808.52	5810.05	4.78	5814.12	5813.59	0.23	5814.35	10.00	0.15
18	31.40	24	Cir	33.239	5811.30	5811.50	0.60	5814.90	5814.35	1.55	5816.45	10.00	1.00
19	20.00	30	Cir	15.525	5806.55	5806.71	1.03	5810.13	5810.10	0.26	5810.39	4.07	1.00
	Notes: j-Line contains hyd. jump; z-Zero Junction Loss												

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Haven Valley

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	41.99	acres
Watershed Length =	2,000	ft
Watershed Length to Centroid =	500	ft
Watershed Slope =	0.023	ft/ft
Watershed Imperviousness =	57.80%	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) =	0.801	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.914	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.123	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.801	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.345	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	4.111	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	4.864	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	5.798	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.49 in.) =	9.040	acre-feet	3.49	inches
Approximate 2-yr Detention Volume =	1.886	acre-feet		
Approximate 5-yr Detention Volume =	2.473	acre-feet		
Approximate 10-yr Detention Volume =	2.998	acre-feet		
Approximate 25-yr Detention Volume =	3.634	acre-feet		
Approximate 50-yr Detention Volume =	4.026	acre-feet		
Approximate 100-yr Detention Volume =	4.464	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.801	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.113	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.550	acre-feet
Total Detention Basin Volume =	4.464	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)
Top of Micropool	--	0.00	--	--	--	120	0.003		
12	--	0.50	--	--	--	120	0.003	60	0.001
13	--	1.50	--	--	--	21,871	0.502	11,055	0.254
14	--	2.50	--	--	--	23,886	0.548	33,934	0.779
15	--	3.50	--	--	--	25,960	0.596	58,857	1.351
16	--	4.50	--	--	--	28,090	0.645	85,882	1.972
17	--	5.50	--	--	--	30,279	0.695	115,066	2.642
18	--	6.50	--	--	--	32,525	0.747	146,468	3.362
19	--	7.50	--	--	--	34,829	0.800	180,145	4.136
19.5-Spillway	--	8.00	--	--	--	36,003	0.827	197,853	4.542
20	--	8.50	--	--	--	37,191	0.854	216,152	4.962
21	--	9.50	--	--	--	39,611	0.909	254,553	5.844
21.5	--	10.00	--	--	--	40,842	0.938	274,666	6.305

Per page 3 of the Soils Report, groundwater is estimated to rise to a depth of only ~6ft below grade, which would mean it could surface into the pond. See excerpts from MHFD's DCM volume 2 and 3 on the page below for potential concerns with groundwater in an EDB and the recommended mitigation options (like a clay or geomembrane liner).

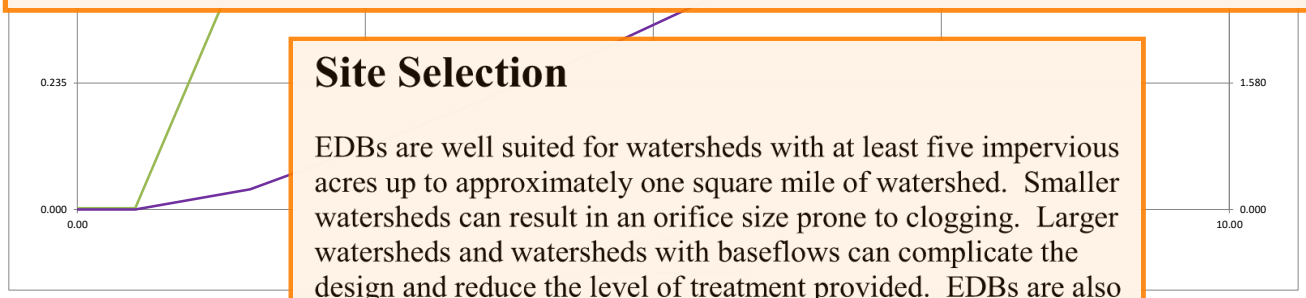
Per CDPHE's "Low Risk Discharge Guidance - Discharges of Uncontaminated Groundwater to Land," discharging groundwater to a pond or other SW conveyance is prohibited unless properly permitted through CDPHE. Please review this guidance and the applicable permits. The guidance is linked below, the permits can be found on CDPHE's website.

Please discuss this potential shallow groundwater in the report text above. If you decide not to design for mitigation now and shallow groundwater appears during construction (or at PA/FA), proper mitigation and permitting will need to be implemented at that time.

- **Groundwater**: Shallow groundwater on a site presents challenges for BMPs that rely on infiltration and for BMPs that are intended to be dry between storm events. Shallow groundwater may limit the ability to infiltrate runoff or result in unwanted groundwater storage in areas intended for storage of the WQCV (e.g., porous sub-base of a permeable pavement system or in the bottom of an otherwise dry facility such as an extended detention basin). Conversely, for some types of BMPs such as wetland channels or constructed wetland basins, groundwater can be beneficial by providing saturation of the root zone and/or a source of baseflow. Groundwater quality protection is an issue that should be considered for infiltration-based BMPs. Infiltration BMPs may not be appropriate for land uses that involve storage or use of materials that have the potential to contaminate groundwater underlying a site (i.e., "hot spot" runoff from fueling stations, materials storage areas, etc.). If groundwater or soil contamination exists on a site and it will not be remediated or removed as a part of construction, it may be necessary to avoid infiltration-based BMPs or use a durable liner to prevent infiltration into contaminated areas.

5.12 Linings

Sometimes an impermeable clay or synthetic liner is necessary. Stormwater detention and retention facilities have the potential to raise the groundwater level in the vicinity of the basin. Where there is concern for damage to adjacent structures due to rising ground water, consider lining the basin with an impermeable liner. An impermeable liner may also be warranted for a retention pond where the designer seeks to limit seepage from the permanent pool. Note that if left uncovered, synthetic lining on side slopes creates a serious impediment to egress and a potential drowning hazard. See the Retention Pond Fact Sheet in Volume 3 of the USDCM for guidance and benefits associated with the constructing a safety wetland bench.



Site Selection

EDBs are well suited for watersheds with at least five impervious acres up to approximately one square mile of watershed. Smaller watersheds can result in an orifice size prone to clogging. Larger watersheds and watersheds with baseflows can complicate the design and reduce the level of treatment provided. EDBs are also well suited where flood detention is incorporated into the same basin. The depth of groundwater should be investigated. Groundwater depth should be 2 or more feet below the bottom of the basin in order to keep this area dry and maintainable.

- Design foundation drains and other groundwater drains to bypass the water quality plate directing these drains to a conveyance element downstream of the EDB. This will reduce baseflows and help preserve storage for the WQCV.

Assign a name/number to the pond and then update all submitted text and drawings accordingly with consistent labeling throughout (example: “Pond A” or “Pond 1”).

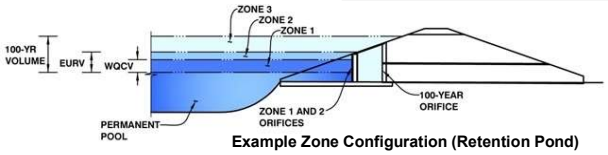
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Please use the latest MHFD-Detention spreadsheet (v4.06)

Project: Haven Valley

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.55	0.801	Orifice Plate
Zone 2 (EURV)	5.89	2.113	Orifice Plate
Zone 3 (100-year)	7.91	1.550	Weir&Pipe (Restrict)
Total (all zones)		4.464	

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 Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	5.89	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 =	N/A	inches	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.00	4.00					
Orifice Area (sq. inches)	5.22	5.22	3.10					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.25	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.25	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	7.31	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	17.40	N/A	ft²
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	8.70	N/A	ft²
Debris Clogging % =	50%	N/A	%				

grate is only 4'x4' in CDs

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	2.38	N/A	ft²
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.79	N/A	feet
Restrictor Plate Height Above Pipe Invert =	17.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.00	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.95	feet
Spillway Crest Length =	40.00	feet	Stage at Top of Freeboard =	9.95	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.93	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.26	acre-ft

Calculated Parameters for Spillway

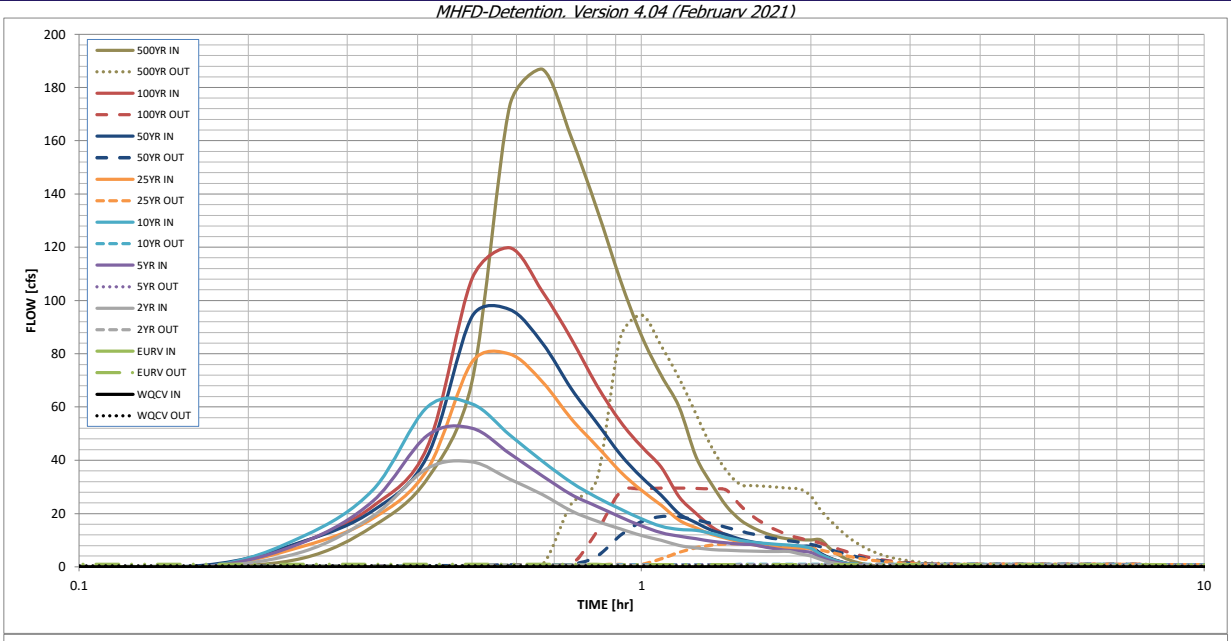
Routed Hydrograph Results

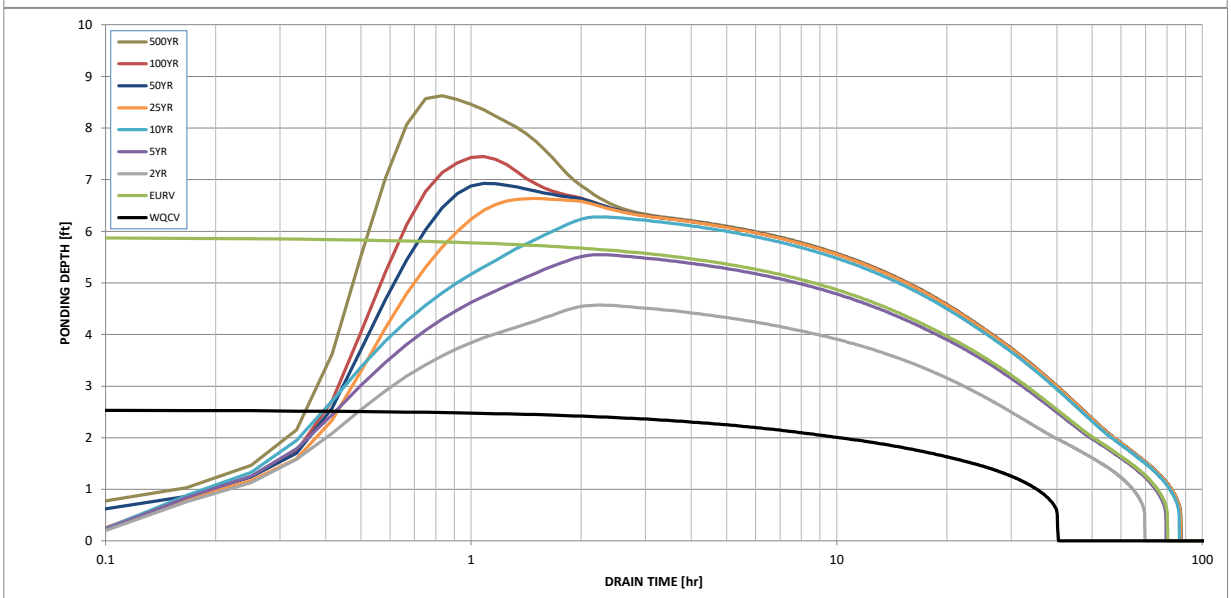
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

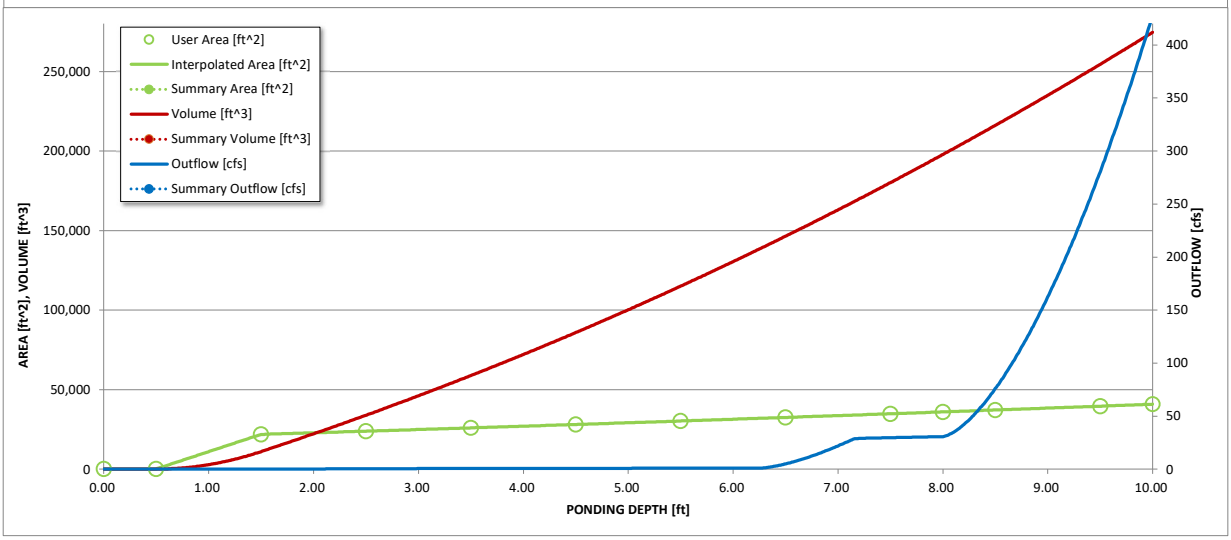
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
CUHP Runoff Volume (acre-ft) =	0.801	2.914	2.123	2.801	3.345	4.111	4.864	5.798	9.040
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.123	2.801	3.345	4.111	4.864	5.798	9.040
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	0.8	1.1	10.1	19.9	32.7	74.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.24	0.47	0.78	1.76
Peak Inflow Q (cfs) =	N/A	N/A	39.4	52.0	61.2	79.9	96.6	119.8	186.8
Peak Outflow Q (cfs) =	0.4	0.9	0.7	0.9	1.1	8.6	18.9	29.6	94.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.1	1.0	0.9	0.9	0.9	1.3
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	1.0	1.6	1.8
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) =	38	74	65	73	79	78	77	75	70
Time to Drain 99% of Inflow Volume (hours) =	**40**	78	68	77	84	84	84	83	81
Maximum Ponding Depth (ft) =	2.55	5.89	4.57	5.54	6.28	6.63	6.92	7.45	8.63
Area at Maximum Ponding Depth (acres) =	0.55	0.72	0.65	0.70	0.73	0.75	0.77	0.80	0.86
Maximum Volume Stored (acre-ft) =	0.806	2.917	2.017	2.669	3.192	3.460	3.681	4.088	5.065

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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	0.64	0.06	3.20
	0:15:00	0.00	0.00	5.66	9.19	11.41	7.68	9.48	9.37	15.23
	0:20:00	0.00	0.00	19.11	24.72	29.00	18.23	21.11	22.81	33.20
	0:25:00	0.00	0.00	37.00	49.38	60.10	36.67	41.73	45.18	69.52
	0:30:00	0.00	0.00	39.40	52.03	61.16	76.89	94.01	108.19	173.19
	0:35:00	0.00	0.00	32.97	42.49	49.49	79.88	96.63	119.78	186.79
	0:40:00	0.00	0.00	27.10	34.15	39.65	69.44	84.01	103.39	161.36
	0:45:00	0.00	0.00	21.04	27.13	31.70	55.59	66.87	85.63	134.48
	0:50:00	0.00	0.00	17.15	22.76	26.07	45.35	54.02	68.14	107.93
	0:55:00	0.00	0.00	14.28	18.76	21.73	35.78	42.31	54.61	86.75
	1:00:00	0.00	0.00	11.78	15.36	18.03	28.72	33.64	45.15	71.94
	1:05:00	0.00	0.00	9.95	12.80	15.20	23.18	26.91	37.49	60.07
	1:10:00	0.00	0.00	8.10	11.54	14.02	17.52	19.99	26.37	41.37
	1:15:00	0.00	0.00	7.10	10.53	13.66	14.62	16.58	20.06	31.05
	1:20:00	0.00	0.00	6.54	9.58	12.55	12.19	13.76	15.05	22.85
	1:25:00	0.00	0.00	6.21	8.96	10.97	10.74	12.09	11.87	17.59
	1:30:00	0.00	0.00	6.02	8.55	9.91	9.22	10.37	10.04	14.57
	1:35:00	0.00	0.00	5.88	8.31	9.19	8.25	9.28	8.80	12.53
	1:40:00	0.00	0.00	5.78	7.32	8.72	7.63	8.58	8.01	11.21
	1:45:00	0.00	0.00	5.73	6.61	8.41	7.21	8.11	7.53	10.42
	1:50:00	0.00	0.00	5.72	6.15	8.19	6.98	7.85	7.36	10.19
	1:55:00	0.00	0.00	4.78	5.84	7.78	6.84	7.69	7.28	10.08
	2:00:00	0.00	0.00	4.11	5.44	6.97	6.77	7.62	7.28	10.08
	2:05:00	0.00	0.00	2.72	3.60	4.63	4.50	5.05	4.84	6.69
	2:10:00	0.00	0.00	1.73	2.30	2.98	2.91	3.27	3.13	4.31
	2:15:00	0.00	0.00	1.10	1.44	1.89	1.85	2.08	1.98	2.72
	2:20:00	0.00	0.00	0.64	0.87	1.13	1.12	1.25	1.19	1.63
	2:25:00	0.00	0.00	0.36	0.53	0.67	0.68	0.76	0.72	0.98
	2:30:00	0.00	0.00	0.16	0.27	0.33	0.35	0.39	0.36	0.49
	2:35:00	0.00	0.00	0.06	0.10	0.11	0.13	0.14	0.13	0.16
	2:40:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TOTAL FOREBAY VOLUME

V=3% x WQCV

WQCV=	0.801	ac-ft
V=	0.0240	ac-ft

Qin NE=	71	cfs
Qin E=	44.1	cfs
Qtotal=	115.1	cfs

NORTHEAST FOREBAY VOLUME

$$\frac{71 \text{ cfs}}{115.1 \text{ cfs}} = \frac{x \text{ ac-ft}}{0.0240 \text{ ac-ft}}$$

x = 0.0148 ac-ft

= 645.7 ft^3

FOREBAY RELEASE NOTCH WIDTH

$Q=CLH^{2/3}$

Q_{100}=	71	cfs
2% of Q=	1.42	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	7	in

EAST FOREBAY VOLUME

$$\frac{44.1 \text{ cfs}}{115.1 \text{ cfs}} = \frac{x \text{ ac-ft}}{0.0240 \text{ ac-ft}}$$

x = 0.0092 ac-ft

= 401.1 ft^3

FOREBAY RELEASE NOTCH WIDTH

$Q=CLH^{2/3}$

Q_{100}=	44.1	cfs
2% of Q=	0.88	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	4	in

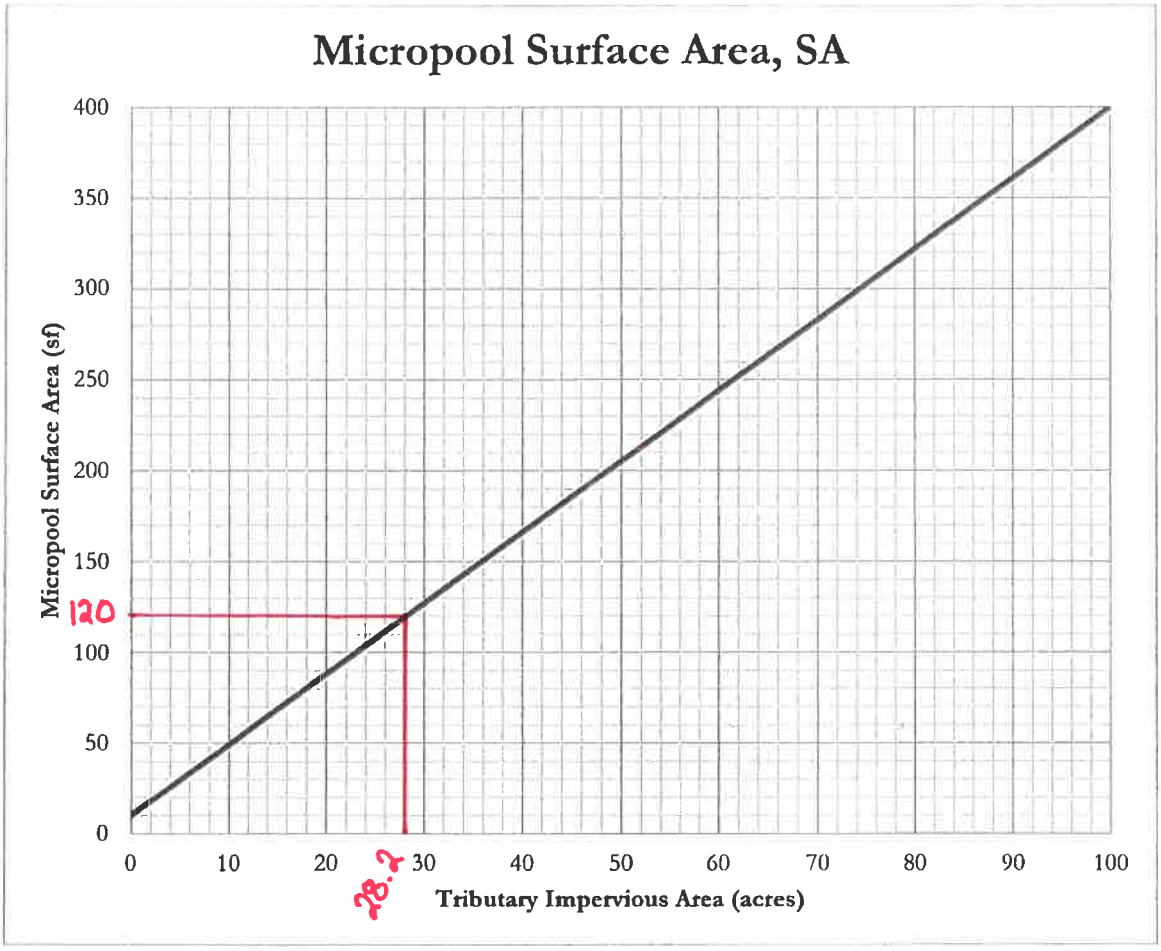


Figure 1 – Micropool surface area (SA) determination chart

The tributary impervious area is the effective number of impervious acres that will be treated by the extended detention basin (EDB). It is calculated by multiplying the tributary area to be treated by the impervious fraction of that area.

$$TIA = I \times A$$

$\frac{68}{100} \times 41.47 = 28.2$ ac

TIA = Tributary impervious area (acres)
I = Imperviousness (fraction)
A = Tributary catchment area upstream (acres)

For EDBs with tributary impervious areas greater than 100 acres, the micropool surface area is 400 sf. The initial surcharge depth (ISD) is defined as the depth of the initial surcharge volume (ISV). The surface area determined using Figure 1 assumes an ISD of 4 inches. The initial surcharge volume is thus calculated by multiplying the micropool surface area by 4 inches.

$$ISV = SA \times 4\ inches$$

ISV = Initial surcharge volume (cf)
SA = Surface area (from Figure 1, sf)

Worksheet
Worksheet for Rectangular Channel

Concrete channel between existing homes

Project Description	
Worksheet	Rectangular Chann
Flow Element	Rectangular Chann
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.016	
Slope	030000	ft/ft
Bottom Width	6.50	ft
Discharge	129.00	cfs

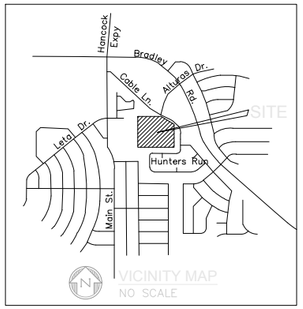
Results		
Depth	1.30	ft
Flow Area	8.4	ft²
Wetted Perim	9.09	ft
Top Width	6.50	ft
Critical Depth	2.30	ft
Critical Slope	0.005771	ft/ft
Velocity	15.30	ft/s
Velocity Head	3.64	ft
Specific Energ	4.93	ft
Froude Numb	2.37	
Flow Type	Supercritical	

Per ECM 3.3.4.A, ditches in developments (roadside ditches excluded) that convey more than 15cfs should be in drainage easements. Please create drainage easements and reflect them on the plat.

Per DCMv2 – Chap 4.2, trickle channel should at a minimum provide capacity equal to twice the release capacity at the upstream forebay outlet. Provide these calcs in the drainage report and revise plans as needed.

LEGEND

- EX. MINOR CONTOUR
- EX. MAJOR CONTOUR (6800)
- PR. MINOR CONTOUR
- PR. MAJOR CONTOUR (6800)
- PROPERTY LINE
- CURB FLOWLINE
- R.O.W.
- BASIN BOUNDARY
- FLOW DIRECTION
- DESIGN POINT (A)
- BASIN: AREA / Q5 (cfs) / Q100 (cfs) — OS-1 | 16.90 AC | 46.0 | 88.8



DP	Q5 (cfs)	Q100 (cfs)
A	29.9	73.8
B	46.1	129.0
C	80.3	200.0

EX. FMIC DITCH (SNPER DITCH)
EX. SWALE TO DETENTION POND
ALTURAS DR.
EXIST. DETENTION POND
PHEASANT RUN RANCH FILING NO. 4
HUNTERS RUN
H-1 | 13.44 AC | 6.9 | 30.4
SECURITY WATER DISTRICT
SECURITY CHURCH OF CHRIST
OS-2 | 2.85 AC | 11.8 | 21.5
EX. EPC POND TRACT A PHEASANT RUN RANCH FILING NO. 1
CONCENTRATED FLOW BETWEEN HOUSES
EX. 24"RCP
EXIST. ELM GROVE DET. POND
WIDEFIELD DR.
EPC POND OUTFALL CONCRETE CHASE
PECOS DR.
ROSEMONT DR.
EX. FMIC DITCH (SUPER DITCH)
ELM GROVE TOWNHOME OWNERS ASSOC., INC.
OS-3 | 9.74 AC | 15.6 | 37.4
CABLE LN.
ELM GROVE DR.
OS-1 | 16.90 AC | 46.0 | 88.8
GOOD SHEPHERD UNITED METHODIST CHURCH
EX. GUTTER
SECURITY COLO. ADD. NO. 4 REFILE
EX. 4"PVC DRAIN LINE(2)
EX. 15'TYPE R OUTLET (BUBBLER)
EX. 24"x38"ELL. RCP
EX. 10'TYPE R INLET
OS-4 | 20.04 AC | 39.6 | 82.3
MAIN ST.
BRADLEY ROAD
EX. 30"RCP
EX. CROSSPAN
EX. 24"RCP
LETA DR.
EX. 18"RCP
EX. 20'TYPE R INLET
HANCOCK XPRESSWAY
MAIN ST.
EX. 20'TYPE R INLET
EX. 15'TYPE R INLET
GLADIATOR DR.
CREST PL.
WILSON ELEMENTARY SCHOOL
LETA DR.
ROSE DR.

811 Know what's **below.** **Call** before you dig.
CALL 3-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

N
100 50 0 100 200
SCALE: 1"=100'

PREPARED BY:

DREXEL, BARRELL & CO.
Engineers • Surveyors
3 SOUTH 7TH STREET
COLORADO SPGS, COLORADO 80905
CONTACT: TIM D. McCONNELL, P.E.
(719)260-0887
BOULDER • COLORADO SPRINGS • GREELEY

CLIENT:

RICHMOND AMERICAN HOMES
4350 S. MONACO ST.
DENVER, CO 80237
CONTACT: MATTHEW JENKINS
(720) 977-3686

DRAINAGE PLANS FOR:

HAVEN VALLEY

(LETA DR.) BRADLEY RD/ALTURAS DR.
SECURITY, EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	4/29/21
LATEST ISSUE	9/20/23

DESIGNED BY:	TDM
DRAWN BY:	GES
CHECKED BY:	TDM
FILE NAME:	21085-03DR01

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: N/A

EXISTING CONDITIONS DRAINAGE PLAN

PROJECT NO. 21085-03CSCV

DRAWING NO.

DR01

SHEET: 1 OF 3

H:\21085-03CSCV\Reports\Drainage\21085-03DR01.dwg, 9/20/2023 1:11:30 PM

Scale for drainage maps appears to be off. Revise.

Assign a name/number to the pond and then update all submitted text and drawings accordingly with consistent labeling throughout (example: "Pond A" or "Pond 1").

the narrative indicates 36" RCP's at these junctions. revise for consistency

indicate what will be chosen. Identify the height and analyze/state whether it is enough to contain the flow. Provide details on the CD's.

Revise so callout matches CD/GEC spillway section elevations.

We need to know how much of the proposed disturbed (not impervious) area is treated vs untreated and if there are any exclusions that apply to the untreated areas. So please create a basic overview map (or modify an existing drainage map) with color shading/hatching that shows areas tributary to each PBMP (pond, runoff reduction, etc.) and those disturbed areas that are not treated by a PBMP, with the applicable exclusion labeled (ex: 20% up to 1ac of development can be excluded per ECM App I.7.1.C.1 and exclusions listed in ECM App I.7.1.B.#). An accompanying summary table on this map would also be very helpful (example provided):

LEGEND

- EX. MINOR CONTOUR
- EX. MAJOR CONTOUR (6800)
- PR. MINOR CONTOUR
- PR. MAJOR CONTOUR (6800)
- PROPERTY LINE
- CURB FLOWLINE
- R.O.W.
- BASIN BOUNDARY
- FLOW DIRECTION
- DESIGN POINT (A)
- BASIN: AREA / Q5 (cfs) / OS-1 16.90 AC 46.0 | 88.8 / Q100 (cfs)

SEE REPORT SECTION 5.0 FOR CABLE LN EXEMPTIONS

VICINITY MAP
NO SCALE

DP	Q5 (cfs)	Q100 (cfs)
1	28.1	71.0
2	3.2	6.6
3	6.4	14.0
J1	9.5	20.3
4	1.2	3.5
5	6.4	14.0
J2	10.6	23.4
6	7.7	17.0
J3	17.4	38.4
7	2.8	6.2
J4	20.0	44.1
8	1.0	2.9
9	2.8	36.4
O4	39.6	82.3
J5	9.8	56.4
10	22.6	77.5

50 20 0 50 100
SCALE: 1"=50'

PBMP SUMMARY TABLE

BASINS	PBMP TRIBUTARY AREA (AC)	PBMP
A1.1	1.43	RG-A1.1
A3.1	1.87	RG-A3.1
B1,B2	8.60	EDB-B
OA2,A2	0.95	EXCLUDED*

* EXCLUDED BASED ON < 1-ACRE OF DEVELOPED ROADWAY AREA PER ECM APP. I.7.C.1.a

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DREXEL, BARRELL & CO.
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DRAINAGE PLANS FOR:
HAVEN VALLEY
(LETA DR.) BRADLEY RD/ALTURAS DR.
SECURITY, EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	4/29/21
LATEST ISSUE	9/20/23

DESIGNED BY:	TDM
DRAWN BY:	SBN
CHECKED BY:	TDM
FILE NAME:	21085-03DR02

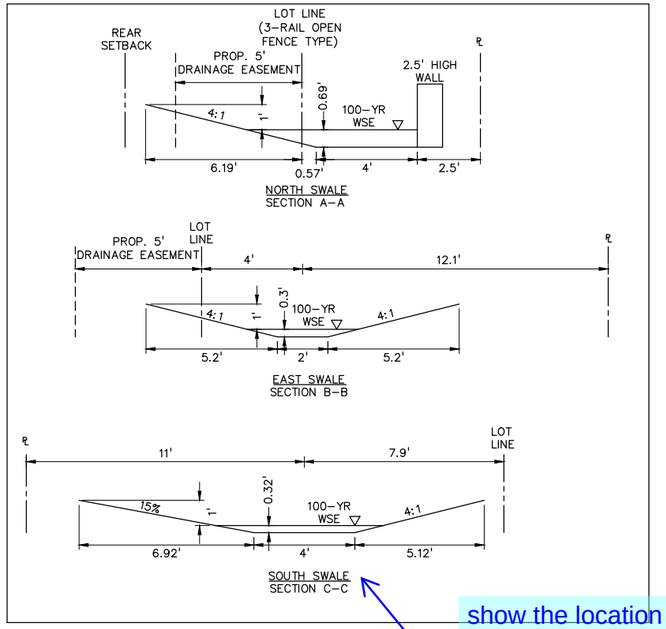
PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

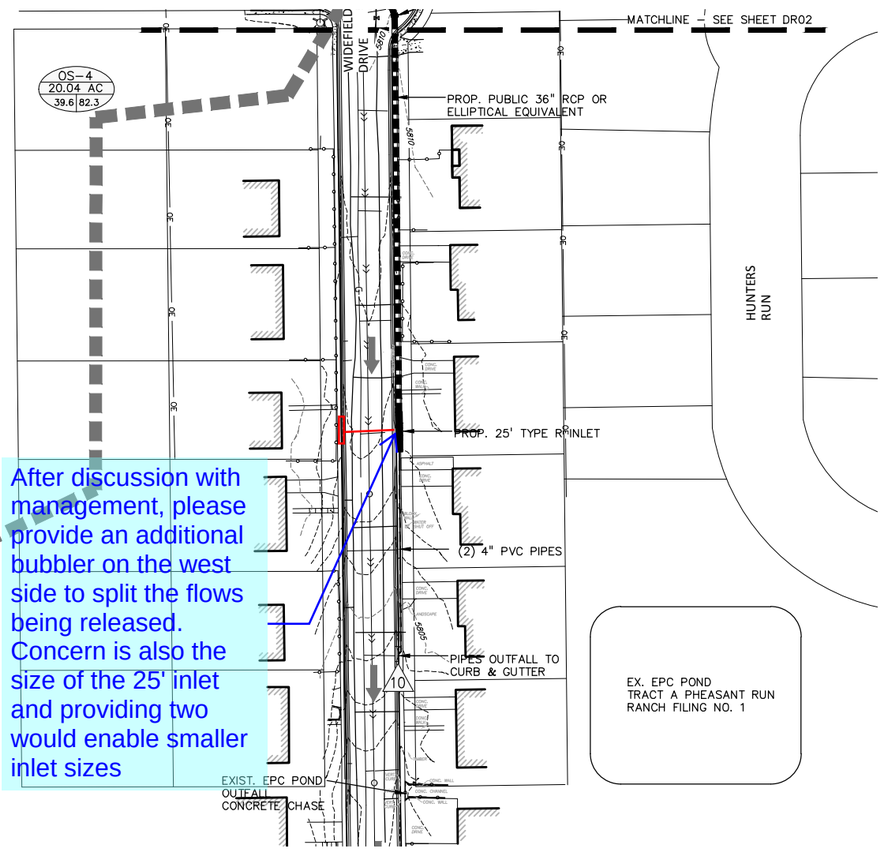
PROPOSED CONDITIONS DRAINAGE PLAN

PROJECT NO. 21085-03CSCV
DRAWING NO.
DR02
SHEET: 2 OF 3

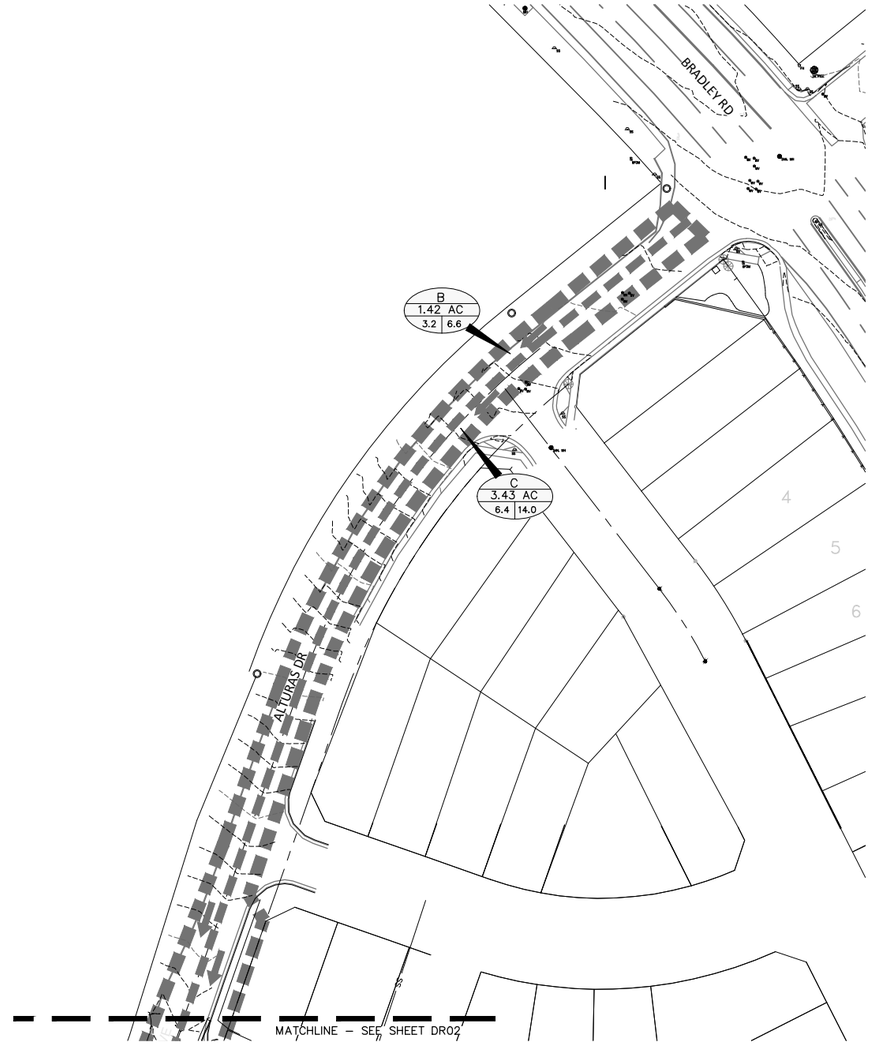
H:\21085-03CSCV\Reports\Drainage\21085-03DR02.dwg



show the location of the retaining wall on this cross section

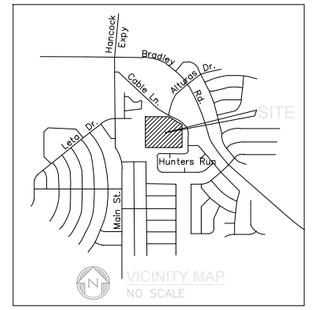


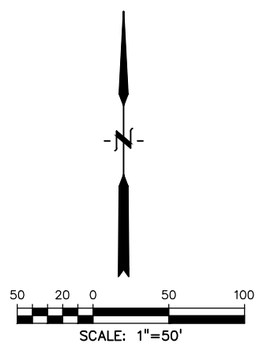
After discussion with management, please provide an additional bubbler on the west side to split the flows being released. Concern is also the size of the 25' inlet and providing two would enable smaller inlet sizes



LEGEND

- EX. MINOR CONTOUR
- 6800 EX. MAJOR CONTOUR
- PR. MINOR CONTOUR
- 6800 PR. MAJOR CONTOUR
- PROPERTY LINE
- CURB FLOWLINE
- R.O.W.
- BASIN BOUNDARY
- FLOW DIRECTION
- A DESIGN POINT
- BASIN
- AREA — OS-1 — 16.90 AC
- Q5 (cfs) — 46.0 88.8 — Q100 (cfs)





811 Know what's **below.** **Call** before you dig.

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PREPARED BY:

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CLIENT:

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DENVER, CO 80237
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(720) 977-3686

DRAINAGE PLANS FOR:

HAVEN VALLEY

(LETA DR.) BRADLEY RD/ALTURAS DR.
SECURITY, EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	4/29/21
LATEST ISSUE	9/20/23

DESIGNED BY:	TDM
DRAWN BY:	SBN
CHECKED BY:	TDM
FILE NAME:	21085-03DR02

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

PROPOSED CONDITIONS DRAINAGE PLAN

PROJECT NO. 21085-03CSCV

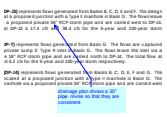
DRAWING NO.

DR03

SHEET: 3 OF 3

v1_Drainage Report - Final.pdf Markup Summary 10-19-2023

Daniel Torres (11)



Author: Daniel Torres
Subject: Callout
Page Label: 9
Date: 10/19/2023 10:10:21 AM
Status:
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Space:

drainage plan shows a 30" pipe. revise so that they are consistent

---

Author: Daniel Torres
Subject: Callout
Page Label: 13
Date: 10/19/2023 10:27:14 AM
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Layer:
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at this stage of the development it shall be decided what will be installed. Please indicate what will be installed.

Author: Daniel Torres
Subject: Callout
Page Label: 14
Date: 10/19/2023 11:27:01 AM
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Are the fees requested to be deferred? If so, please clearly state that and state what the total estimated reimbursable costs are and whether it will cover all drainage fees and that the developer will seek reimbursement (I assume they will) once constructed.

Author: Daniel Torres
Subject: Callout
Page Label: 14
Date: 10/19/2023 10:56:18 AM
Status:
Color:
Layer:
Space:

provide excerpts of the costs of these improvements from the DBPS.

Author: Daniel Torres
Subject: Callout
Page Label: 15
Date: 10/19/2023 10:55:23 AM
Status:
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Space:

please provide discussion on how each of the required items are met. for example, state that the DBPS infrastructure is along Widefeild is not in place, identify the proposed pond acre-ft volume, etc

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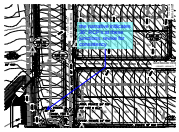

Author: Daniel Torres
Subject: Callout
Page Label: 75
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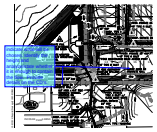
the narrative indicates 36" RCP's at these junctions. revise for consistency



Author: Daniel Torres
Subject: Callout
Page Label: 75
Date: 10/19/2023 2:43:40 PM
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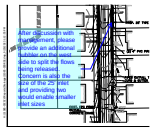
indicate what will be chosen. Identify the height and analyze/state whether it is enough to contain the flow. Provide details on the CD's.



Author: Daniel Torres
Subject: Callout
Page Label: 76
Date: 10/19/2023 12:07:59 PM
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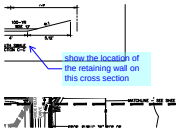
After discussion with management, please provide an additional bubbler on the west side to split the flows being released. Concern is also the size of the 25' inlet and providing two would enable smaller inlet sizes

---



Author: Daniel Torres
Subject: Callout
Page Label: 76
Date: 10/19/2023 2:44:52 PM
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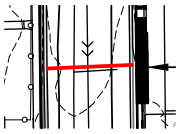
Space:

show the location of the retaining wall on this cross section

---



Author: Daniel Torres
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Page Label: 76
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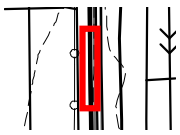

Author: Daniel Torres
Subject: Rectangle
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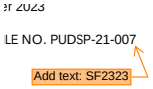
Date: 10/19/2023 3:03:44 PM
Status:
Color:
Layer:
Space:

Glenn Reese - EPC Stormwater (23)



Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox with Arrow
Page Label: 1
Date: 10/11/2023 11:36:04 AM
Status:
Color:
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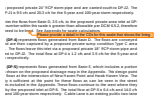
Add text: SF2323



Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox with Arrow
Page Label: 9
Date: 10/11/2023 5:52:45 PM
Status:
Color:
Layer:
Space:

Please provide a detail in the CDs for this swale that shows the lining.

RC
stc
un

Author: Glenn Reese - EPC Stormwater
Subject: Checkmark
Page Label: 10
Date: 10/11/2023 3:20:45 PM
Status:
Color:
Layer:
Space:

Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox with Arrow
Page Label: 10
Date: 10/11/2023 5:56:23 PM
Status:
Color:
Layer:
Space:

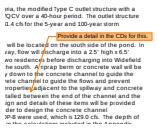
Please provide a detail in CDs for this swale that shows the lining.and the retaining wall. Detail on Sht 8 of CDs is lacking detail.

A
sa
(v

Author: Glenn Reese - EPC Stormwater
Subject: Checkmark
Page Label: 12
Date: 10/11/2023 3:20:56 PM
Status:
Color:
Layer:
Space:

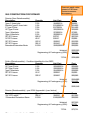
Author: Glenn Reese - EPC Stormwater
Subject: SW - Highlight
Page Label: 13
Date: 10/11/2023 12:46:57 PM
Status:
Color:
Layer:
Space:

Riprap or concrete will be installed between the end of the channel and the
back of the existing sidewalk.



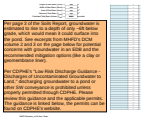
Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox with Arrow
Page Label: 13
Date: 10/11/2023 5:58:03 PM
Status:
Color:
Layer:
Space:

Provide a detail in the CDs for this.



Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox with Arrow
Page Label: 15
Date: 10/11/2023 12:52:02 PM
Status:
Color:
Layer:
Space:

Does not match value shown in FAE form. Revise to remove discrepancy.

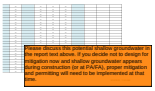


Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox
Page Label: 66
Date: 10/12/2023 7:10:08 AM
Status:
Color:
Layer:
Space:

Per page 3 of the Soils Report, groundwater is estimated to rise to a depth of only ~6ft below grade, which would mean it could surface into the pond. See excerpts from MHFD's DCM volume 2 and 3 on the page below for potential concerns with groundwater in an EDB and the recommended mitigation options (like a clay or geomembrane liner).

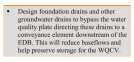
Per CDPHE's "Low Risk Discharge Guidance - Discharges of Uncontaminated Groundwater to Land," discharging groundwater to a pond or other SW conveyance is prohibited unless properly permitted through CDPHE. Please review this guidance and the applicable permits. The guidance is linked below, the permits can be found on CDPHE's website.

Author: Glenn Reese - EPC Stormwater
Subject: File Attachment
Page Label: 66
Date: 10/12/2023 7:10:10 AM
Status:
Color:
Layer:
Space:



Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox
Page Label: 66
Date: 10/12/2023 7:19:03 AM
Status:
Color:
Layer:
Space:

Please discuss this potential shallow groundwater in the report text above. If you decide not to design for mitigation now and shallow groundwater appears during construction (or at PA/FA), proper mitigation and permitting will need to be implemented at that time.



Author: Glenn Reese - EPC Stormwater
Subject: Image
Page Label: 67
Date: 10/12/2023 6:59:51 AM
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Layer:
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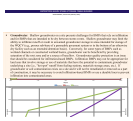

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Subject: Image
Page Label: 67
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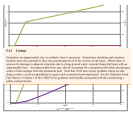

Author: Glenn Reese - EPC Stormwater
Subject: Image
Page Label: 67
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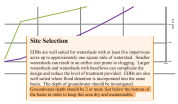

Author: Glenn Reese - EPC Stormwater
Subject: Image
Page Label: 67
Date: 10/12/2023 6:59:50 AM
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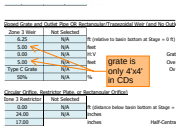
Color:
Layer:
Space:



Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox with Arrow
Page Label: 68
Date: 10/11/2023 5:59:02 PM
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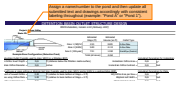
grate is only 4'x4' in CDs



Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox with Arrow
Page Label: 68
Date: 10/11/2023 5:58:36 PM
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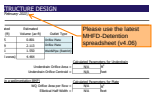
Assign a name/number to the pond and then update all submitted text and drawings accordingly with consistent labeling throughout (example: "Pond A" or "Pond 1").



Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox with Arrow
Page Label: 68
Date: 10/11/2023 5:13:54 PM
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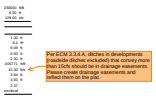
Please use the latest MHFD-Detention spreadsheet (v4.06)



Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox with Arrow
Page Label: 73
Date: 10/11/2023 2:20:55 PM
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Per ECM 3.3.4.A, ditches in developments (roadside ditches excluded) that convey more than 15cfs should be in drainage easements. Please create drainage easements and reflect them on the plat.

Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox
Page Label: 73
Date: 10/11/2023 5:13:15 PM
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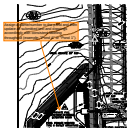
Per DCMv2 – Chap 4.2, trickle channel should at a minimum provide capacity equal to twice the release capacity at the upstream forebay outlet. Provide these calcs in the drainage report and revise plans as needed.



Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox with Arrow
Page Label: 75
Date: 10/16/2023 12:40:16 PM
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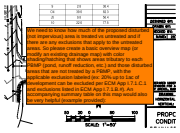
Assign a name/number to the pond and then update all submitted text and drawings accordingly with consistent labeling throughout (example: “Pond A” or “Pond 1”).



Author: Glenn Reese - EPC Stormwater
Subject: SW - Textbox
Page Label: 75
Date: 10/11/2023 3:19:09 PM
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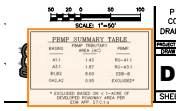
We need to know how much of the proposed disturbed (not impervious) area is treated vs untreated and if there are any exclusions that apply to the untreated areas. So please create a basic overview map (or modify an existing drainage map) with color shading/hatching that shows areas tributary to each PBMP (pond, runoff reduction, etc.) and those disturbed areas that are not treated by a PBMP, with the applicable exclusion labeled (ex: 20% up to 1ac of development can be excluded per ECM App I.7.1.C.1 and exclusions listed in ECM App I.7.1.B.#). An accompanying summary table on this map would also be very helpful (example provided):



Author: Glenn Reese - EPC Stormwater
Subject: Image
Page Label: 75
Date: 10/11/2023 3:19:13 PM
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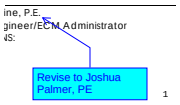
lpackman (8)



Author: lpackman
Subject: Callout
Page Label: 3
Date: 10/11/2023 3:28:33 PM
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Color:
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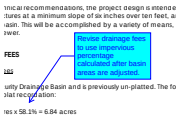
Revise to Joshua Palmer, PE



Author: lpackman
Subject: Callout
Page Label: 14
Date: 10/16/2023 1:37:50 PM
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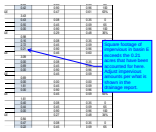
Revise drainage fees to use impervious percentage calculated after basin areas are adjusted.



Author: lpackman
Subject: Callout
Page Label: 28
Date: 10/16/2023 1:10:28 PM
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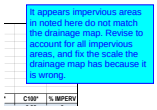
Square footage of impervious in basin E exceeds the 0.21 acres that have been accounted for here. Adjust impervious amounts per what is shown in the drainage report.



Author: lpackman
Subject: Text Box
Page Label: 28
Date: 10/16/2023 1:12:55 PM
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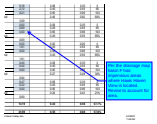
It appears impervious areas in noted here do not match the drainage map. Revise to account for all impervious areas, and fix the scale the drainage map has because it is wrong.



Author: lpackman
Subject: Callout
Page Label: 28
Date: 10/16/2023 1:14:01 PM
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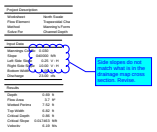
Per the drainage map basin F has impervious areas where Hawk Haven View is located. Revise to account for area.



Author: lpackman
Subject: Cloud+
Page Label: 32
Date: 10/12/2023 3:23:08 PM
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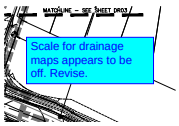
Side slopes do not match what is in the drainage map cross section. Revise.



Author: lpackman
Subject: Text Box
Page Label: 75
Date: 10/16/2023 10:13:11 AM
Status:
Color:
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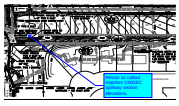
Space:

Scale for drainage maps appears to be off. Revise.



Author: lpackman
Subject: Callout
Page Label: 75
Date: 10/16/2023 10:41:54 AM
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Color:
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Revise so callout matches CD/GEC spillway section elevations.