

FINAL DRAINAGE REPORT FOR HOMESTEAD AT STERLING RANCH FILING NO.2

EL PASO COUNTY, COLORADO

March 2020

Prepared for:
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Prepared by:



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Project #09-007
SF-19-004

**FINAL DRAINAGE REPORT FOR
HOMESTEAD AT STERLING RANCH FILING NO. 2**

DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

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



Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc

DEVELOPER'S STATEMENT

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

BY: _____

James F Morley

TITLE: _____

DATE: 3-31-2020

ADDRESS: SR Land, LLC
20 Boulder Crescent, Suite 210
Colorado Springs, CO 80903

EL PASO COUNTY'S STATEMENT

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

BY: _____

Jennifer Irvine, P.E.

County Engineer / ECM Administrator

DATE: _____

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FINAL DRAINAGE REPORT FOR HOMESTEAD AT STERLING RANCH FILING NO. 2

PURPOSE

This document is the Final Drainage Report for Homestead at Sterling Ranch Filing No. 2. This report was previously discussed, as a preliminary drainage report, in the “Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1” prepared by MS Civil Consultants, dated April 2017. The purpose of this document is to identify and analyze the on and offsite drainage patterns and to ensure that post development runoff is routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County Drainage Criteria Manual. The following report is an analysis of the drainage for Homestead at Sterling Ranch Filing No. 2, single family lots, onsite and offsite drainage.

GENERAL LOCATION AND DESCRIPTION

Homestead at Sterling Ranch Filing No. 2 is located in the SE $\frac{1}{4}$ of the NW $\frac{1}{4}$, the SW $\frac{1}{4}$ of the NE $\frac{1}{4}$, and the NW $\frac{1}{4}$ of the NE $\frac{1}{4}$ of Section 33, Township 12 South, Range 65 West of the 6th Principal Meridian, and the NE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 33, Township 12 South, Range 65 West of the 6th Principal Meridian within unincorporated El Paso County, Colorado. The site is bound on the south by an existing detention pond, to the north by Briargate Parkway and to the east by Sand Creek. Existing Dines Boulevard runs along the western site boundary. An existing residential development, Homestead at Sterling Ranch Filing No. 1, bounds the site to the west and a future commercial parcel bounds the site to the northwest. Sterling Ranch lies within the Sand Creek Drainage Basin. Flows from this site are tributary to Sand Creek.

Homestead at Sterling Ranch Filing No. 2 consists of 29.658 acres and is presently undeveloped. Vegetation is sparse, consisting of native grasses. Existing site terrain generally slopes from north to southwest at grade rates that vary between 2% and 6%.

Land use for Homestead at Sterling Ranch Filing No. 2 is currently listed as AG (Grazing Land). Improvements proposed for the site include paved streets, trails, a full spectrum detention pond, and utilities as normally constructed for a residential development.

SOILS

Soils for this project are delineated by the map in the appendix as Pring Coarse Sandy Loam (71) and is characterized as Hydrologic Soil Types "B". Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area". Vegetation is sparse, consisting of native grasses and weeds.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. The relevant data sheets can be found in the "Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1" prepared by MS Civil Consultants, dated April 2017 and in the appendix of this report.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain as determined by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0533G, effective date December 7, 2018. An annotated FIRM Panel is included in the Appendix.

DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual, Volumes I & II, dated November 1991, including subsequent updates. El Paso County has also adopted Chapter 6 and Section 3.2.1 of Chapter 13 in the City of Colorado Springs & El Paso County Drainage Criteria Manual Volumes I and II, dated May 2014. (Appendix I of the El Paso County's Engineering Criteria Manual (ECM), 2008). In addition to the ECM, the Urban Storm Drainage Criteria Manuals, Volumes 1-3, published by the Urban Drainage and Flood Control District (Volumes 1 & 2 dated January 2016, Volume 3 dated November 2010 and updates. Calculations were performed to determine runoff quantities for the 5-year and 100-year frequency storms for developed conditions using the Rational Method. July 2019 ECM updated for MS4 permit.

FOUR STEP PROCESS

Step 1 Employ Runoff Reduction Practices. Roof drains will be directed to side yard swales and as possible to grass lined swales to aid in minimizing direct connection of impervious surfaces.

Step 2 Implement BMPs that provide a water quality capture volume with slow release. – An existing Full Spectrum Detention Facility (see Sterling Ranch Filing Nos. 1&2 MDDP, Pond 4) was planned and constructed to handle tributary flows for the southwest portion of the site. All remaining tributary areas from the site will be treated in a proposed temporary Full Spectrum Detention Facility, Interim Pond 1. Both ponds will incorporate water quality capture volumes that are intended to slowly drain in 40 hours and excess urban runoff volumes that are intended to drain within 72 hours.

Step 3 Stabilize streams. – With the full spectrum detention facilities in place, the runoff from the proposed residential development will be reduced to predevelopment conditions. The developed discharge from the site is less than existing and therefore is not anticipated to have negative effects on downstream drainageways. Additionally, the Sand Creek Channel will be reinforced with selected areas of rip rap bank protection, vegetative slope stabilization, check structures and drop structures.

Step 4 Consider need for Industrial and Commercial BMPs. – No industrial or commercial land uses are proposed with this development. The proposed residential development area will implement a Stormwater Management Plan (SWMP) incorporating proper housekeeping procedures. Onsite drainage will be routed through proposed private temporary Full Spectrum Detention Facility (FSD), Interim Pond 1, to minimize introduction of contaminants to the county's public drainage systems.

EXISTING DRAINAGE CONDITIONS

The Homestead at Sterling Ranch Filing No. 2 site consists of 29.658 acres and is situated west of the Sand Creek Watershed. This area was previously studied in the "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996. More recently the area was studied in the "Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1" prepared by MS Civil Consultants, dated April 2017 (henceforth referred to as "Sterling Ranch Filing Nos. 1&2 MDDP").

See the Historic conditions map, the Homestead at Sterling Ranch Filing No. 2 site lies within the Basin EX-4 ($Q_5 = 71$ cfs, $Q_{100} = 352$ cfs) and is a 330 acre area of land located on the western portion of the site, including the Sand Creek channel. A portion of this basin extends off-site to the northwest of Vollmer Road, and at the time this map was created was undeveloped property. Runoff from the basin generally travels from north to south until it reaches the northern boundary of the site, being conveyed in the Sand Creek channel. Homestead at Sterling Ranch Filing No. 2 and the surrounding areas, with the exception of the existing Barbarick Subdivision, have already been graded during the overlot of the subdivision. Please refer to the Sterling Ranch Filing Nos. 1&2 MDDP by MS Civil Consultants for information on existing conditions and overlot drainage patterns. A copy of the historic and existing conditions map has been provided in the appendix.

PROPOSED DRAINAGE CHARACTERISTICS

General Concept Drainage Discussion

The following is a description of the onsite basins, offsite bypass flows and the overall drainage characteristics for the development of Sterling Ranch Filing No. 2. The development of Sterling Ranch Filing No. 2 consists of residential streets and cul-de-sacs, proposed storm drainage improvements, and lots located within the filing boundary. The proposed development results in drainage patterns and flow values that are the same or less than those in the Sterling Ranch Filing Nos. 1&2 MDDP. Surface flow is designated as Design Points (DP). The following DPs and Basins were determined using the Rational Method since this method offers a more conservative approach to drainage. It should be noted that all calculations and drainage basins have been revised to reflect the new criteria updates by the El Paso County/City of Colorado Springs Drainage Criteria Manual. For comparison, the **asterisk (*)** symbol in the detailed drainage discussions below represents each Basin or Design Point as labeled in the Sterling Ranch Filing Nos. 1&2 MDDP. Asterisk symbols on the Proposed Drainage Map in the appendix also represent Basins, Design Points and Pipe Runs as presented in the Sterling Ranch Filing Nos. 1&2 MDDP.

Detailed Drainage Discussion (Design Points)

DP2*, 5.39 acres, consists of Basin B* planned residential lots and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of $Q_5=8.0$ cfs and $Q_{100}=19.3$ cfs has been calculated for DP2*. The surface runoff is routed via overlot grading and planned swales to two existing 15' CDOT Type R at-grade inlets. The flows are routed east via a 36" RCP to DP5.

DP3*, 2.92 acres, consists of Basin C* residential lots within Homestead at Sterling Ranch Filing No. 1, and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of $Q_5=4.2$ cfs and $Q_{100}=10.1$ cfs has been calculated for DP3*. The surface runoff is routed via overlot grading and proposed swales to an existing 5' CDOT type R sump inlet. The flows captured by the inlet are routed to existing Detention Pond 4.

DP4*, 9.36 acres, consists of Basin D* and Basin E* residential lots within Homestead at Sterling Ranch Filing No. 1 and streets with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year and Basin F* (Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=16.1 cfs and Q100=36.7 cfs has been calculated for DP4. The surface runoff is routed via overlot grading and curb and gutter to DP4* which will be collected by a 15' CDOT type R at-grade inlet. The intercepted flow (Q5=13.3 cfs and Q100=20.0 cfs) will combine with flows from DP3* and be routed east via a 30" RCP (PR6*, Q5=16.8 cfs and Q100=29.4 cfs) to existing Detention Pond 4.

DP5*, 0.80 acres, consists of Basin G* residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Basin H* existing Dines Boulevard, with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year and flowby from Sterling Ranch Filing Nos. 1&2 MDDP DP4*. Developed runoff of Q5=4.2 and Q100=19.7 cfs has been calculated for DP5*. The surface runoff is routed via overlot grading and curb and gutter to DP5* which is collected by an existing 15' CDOT type R at-grade inlet. DP5* has an intercepted flow of (Q5=4.2 cfs and Q100=14.7 cfs) and of flowby of (Q5=0.0 cfs and Q100=5.0 cfs). Flowby from DP5* continues on to Pond FSD13, east of Dines Boulevard. See, Sterling Ranch Filing MDDP Proposed Hydrologic Conditions Map.

DP6*, 4.68 acres, consists of Sterling Ranch Filing Nos. 1&2 MDDP Basins J* and K* planned residential lots with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, Sterling Ranch Filing Nos. 1&2 MDDP Basin I* (Wheatland Drive) and Basin L* (Dines Boulevard) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year. Developed runoff of Q5=14.1 cfs and Q100=26.7 cfs has been calculated for DP6*. The surface runoff is routed via overlot grading and curb and gutter to DP6* which is collected by an existing 15' CDOT type R at-grade inlet. DP6* has an intercepted flow of (Q5=12.1 cfs and Q100=17.2 cfs) and of flowby of (Q5=2.0 cfs and Q100=9.5 cfs). Flowby from DP6* continues on to Pond FSD13, east of Dines Boulevard. See, Sterling Ranch Filing MDDP Proposed Hydrologic Conditions Map.

DP7, 4.42 acres, consists of Basin P proposed residential lots with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=5.7 and Q100=13.8 cfs has been calculated for DP7. Surface runoff is routed via overlot grading and curb and gutter to DP7 which is collected by a proposed 10' CDOT type R sump inlet. Flows captured by the proposed 10' CDOT type R sump inlet are routed to existing Detention Pond 4 by proposed RCP storm sewer. The flows from DP7 were anticipated in the sizing of Pond 4 per the Sterling Ranch Filing No. 1 Final Drainage Report.

DP8, 3.78, acres, consists of Basin Q proposed residential lots with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=4.9 and Q100=11.8 cfs has been calculated for DP8. Surface runoff is routed via overlot grading and curb and gutter to DP8 which is collected by a proposed 10' CDOT type R sump inlet. Flows captured by the proposed 10' CDOT type R sump inlet are routed to existing Detention Pond 4 by proposed RCP storm sewer. The flows from DP8 were anticipated in the sizing of Pond 4 per the Sterling Ranch Filing No. 1 Final Drainage Report.

DP9, acres, consists of Basin R proposed residential lots with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of Q5=2.2 and Q100=5.4 cfs has been calculated for DP9. Surface runoff is routed via overlot grading and curb and gutter to DP9 which is collected by a proposed 5' CDOT type R sump inlet. Flows captured by the proposed 10' CDOT type R sump inlet combine with captured flows contributed from Design Points 7 & 8 and are routed to existing Detention Pond 4 by Pipe Run 4 (Q5=12.4 and Q100=30.1 cfs). Pipe Run 4 connects to existing Sterling Ranch Filing Nos. 1&2 MDDP Pipe Run 10* (Q5=12.5 and Q100=30.4 cfs) and is discharged into the forebay of existing Detention Pond 4. Flows contributed to the forebay of existing Pond 4 are approximately equal to those anticipated by the MDDP, therefore Pond 4 has the capacity for SWQ and Full Spectrum Detention for these flows.

DP10, 9.14, acres, consists of Basin T proposed residential lots with runoff coefficients of 0.30 for the 5-year and 0.50 for the 100-year. Developed runoff of Q5=9.4 and Q100=15.6 cfs has been calculated for

DP10. Surface runoff is routed via overlot grading and curb and gutter to DP10 which is collected by a proposed 15' CDOT type R at-grade inlet. DP10 has an intercepted flow of ($Q_5=9.1$ cfs and $Q_{100}=12.7$ cfs) and of flowby of ($Q_5=0.3$ cfs and $Q_{100}=2.9$ cfs). Flows captured by the proposed 15' CDOT type R at-grade inlet are routed southwest to the proposed full spectrum detention Pond 1 by proposed RCP storm sewer.

DP11, 1.48, acres, consists of Basin V1 proposed residential lots with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year. Developed runoff of $Q_5=1.9$ and $Q_{100}=15.6$ cfs has been calculated for DP11. Surface runoff is routed via overlot grading and curb and gutter to DP11 which is collected by a proposed 15' CDOT type R at-grade inlet. DP11 has an intercepted flow of ($Q_5=1.9$ cfs and $Q_{100}=12.7$ cfs) and of flowby of ($Q_5=0.0$ cfs and $Q_{100}=2.9$ cfs). Flows captured by the proposed 15' CDOT type R at-grade inlet are routed southwest to the proposed full spectrum detention Pond 1 by proposed RCP storm sewer.

DP12, 4.50, acres, consists of Basin U proposed residential lots with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year and flowby from DP10. Developed runoff of $Q_5=6.2$ cfs and $Q_{100}=17.2$ cfs has been calculated for DP12. Surface runoff is routed via overlot grading and curb and gutter to DP12 which is collected by a proposed 10' CDOT type R sump inlet. Flows captured by the proposed 10' CDOT type R sump inlet are routed to the proposed full spectrum detention Pond 1 by proposed RCP storm sewer.

DP13, 0.83, acres, consists of Basin V2 proposed residential lots with runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year and flowby from DP11. Developed runoff of $Q_5=1.2$ and $Q_{100}=5.9$ cfs has been calculated for DP13. Surface runoff is routed via overlot grading and curb and gutter to DP13 which is collected by a proposed modified 5' length by 4.5' wide CDOT type R sump inlet.

DP14, 0.56, acres, consists of Basin W3 proposed full spectrum detention Pond 1 with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year and contributed flow from pipe run 9. Developed runoff of $Q_5=19.6$ cfs and $Q_{100}=52.4$ cfs has been calculated for DP14. All flows captured by inlets at Design Points DP10, DP11, DP12 and DP13 are routed by Pipe Run 9 (PR9, $Q_5=17.9$ and $Q_{100}=47.1$ cfs) to the forebay in Pond 1 and combine with surface runoff within Basin W1. An outlet structure with an orifice plate and restrictor plate regulates release rates and provides treatment to all flows tributary to DP14. See the Water Quality Provisions discussion in this report for more information on Pond 1.

Basins labeled on the Proposed Drainage Map marked with a "*", were previously analyzed and shown in the Final Drainage report for Sterling Ranch Filing No. 1. These basins are; B*, C*, D*, E*, F*, G*, H*, I*, L*, & S*. They are shown on the Proposed Drainage Map for continuity. Basins K & J additionally contribute to Design Points 3, 4, 5 & 6. Therefore, the inlets sizing at these design points has been verified.

Detailed Drainage Discussion (Drainage Basins)

Basins X1, X2, W1, and Y1 (0.78, 1.04, 0.86 and 0.084 acres respectively), consists of proposed residential backyard lots located along the eastern boundary of the site with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed runoff of ($Q_5=0.8$, 1.1, 0.2, and 0.8 cfs and $Q_{100}=2.8$, 3.7, 1.7, and 3.0 cfs respectively) has been calculated for the basins. Runoff produced within the residential backyard lots, of Basins X1, X2, W1 and Y1 will be conveyed in backyard swales and as sheet flow to a Sand Filter Basin within each lot. The treated flows will be collected by private storm sewer systems and discharged into the Sand Creek Channel. A 20' wide typical drainage easement is provided within the lots to accommodate the BMP's. The facilities constructed are to be privately maintained by the Sterling Ranch metro district.

Basins X, W2, and Y (0.22, 0.26, and 0.09 acres respectively), consists primarily of vegetated tracts and portion of residential backyards that will discharge as sheet flow to the Sand Creek Channel. The developed flow rates from Basins X, W2, and Y are $Q_5=0.2$, 0.1, 0.1 cfs and $Q_{100}=0.8$, 0.8, and 0.3 respectively. The total combined developed area being discharge to the channel is less than one acre. It

is not practicable to provide WQCV for these areas, as stated earlier in this paragraph, areas consists primarily of vegetated tracts with no development.

CHANNEL IMPROVEMENTS

Slope grading and intermittent channel bank lining has been proposed for portions of the developable areas adjacent to Sand Creek to protect the developed lots and prevent excessive erosion until the DBPS recommended Sand Creek Channel improvements are installed. The proposed slope grading is intended to reduce outer bankgrades and bring uniformity to areas where significant riling and destabilization has occurred. Proposed channel stabilization improvements includes placement of soil riprap and turf reinforcement matting along embankment toes and along embankment slopes, both of which will function to retain soils and vegetation during heavy rains or larger flood flow events. All disturbed areas, not hardscaped will be re-vegetated with native species grasses, per El Paso County erosion control standards. Storm sewer outfalls into Sand Creek shall be protected by low-tailwater riprap basins. The outfall protection is shown on the accompanying drainage map in the appendix. Refer to the Homestead Filing No.2 Grading and Erosion Control Plans for riprap and turf reinforcement map placement and construction details.

Permanently installed check structures and rip-rap channel lining will be installed within Sand Creek Channel to handle the runoff from fully developed Sterling Ranch and up-gradient watershed in accordance with the Sand Creek DBPS. A discussion regarding the timing of these channel improvements is provided in a subsequent paragraph titled Sterling Ranch Filing No. 1 Subdivision Improvement agreement which follows the Construction Costs segment of this report. Financial Assurance shall be posted for the proposed Sand Creek Channel Improvements and Bank Stabilization (Slope Protection and grade control structures).

WATER QUALITY PROVISIONS

The proposed Full Spectrum Detention Facility, Pond 1 functions to provide detention storage and water quality facility for runoff produced onsite from tributary Basins T, U, V1, V2 and W3. This water quality facility is designed to treat 0.245 ac-ft of water quality storage (WQCV), 0.741 ac-feet of excess urban runoff volume (EURV) and 1.331 ac-ft of 100-year storage. A rolled erosion control blanketed emergency spillway, concrete forebay, trickle channel and outlet structure, and gravel maintenance access road has been designed for Pond 1.

A 24" RCP pipe extending from the proposed modified 6'x2.9' CDOT Type D sump inlet (see Design Point 13) will convey discharge from the pond to Sand Creek. Runoff discharged to Sand Creek is anticipated to reach peak flow rates of $Q_5=0.7$ cfs and $Q_{100}=23.4$ cfs. A soil riprap stilling basin has been provided at the termination of the pipe to arrest erosion.

Runoff produced within the residential backyard lots, of Basins X1, X2, W1 and Y1 will be conveyed in backyard swales and as sheet flow to a Sand Filter Basin within each lot. The treated flows will be collected by private storm sewer systems and discharged into the Sand Creek Channel. This water quality facility, for each Sand Filter Basin, is designed to treat 0.001 ac-ft of water quality storage (WQCV), 0.005 ac-feet of excess urban runoff volume (EURV) and 0.014 ac-ft of 100-year storage. A 20' wide typical drainage easement is provided within the lots to accommodate the BMP's. The facilities constructed are to be privately maintained by the Sterling Ranch Metropolitan District. Access to maintain these sand filter basins is from the regional trail along sand creek.

The WQCV and EURV required for the site has been determined using the guidelines set forth in the City of Colorado Springs/El Paso County Drainage Criteria Manual - Volume II. Refer to the water quality

facility sizing calculations located within the appendix of this report(see UD-Detention Worksheet in appendix).

As previously discussed, refer to Sterling Ranch Filing Nos. 1&2 MDDP for additional information regarding existing FSD Pond 4. The previously approved FSD Pond was constructed with the Sterling Ranch Filing No. 1 construction drawings in 2018-2019.

EROSION CONTROL

It is the policy of the El Paso County that a grading and erosion control plan be submitted with the drainage report. EPC approved “Early Grading Plan for Sterling Ranch Phase I Onsite Grading & Erosion Control”, November 18, 2015. And “Early Grading Plan for Sterling Ranch Phase I Offsite Grading & Erosion Control”, December 3, 2015. Grading and Erosion control operations are currently underway (July 2019). Grading and Erosion Control will cease with the final development of the site in the next 6-12 months.

CONSTRUCTION COST OPINION – HOMESTEAD AT STERLING RANCH FIL. NO. 2

Drainage Facilities:

Drainage improvements are planned with the development of Homestead at Sterling Ranch Filing No. 2. A majority of the construction costs have been accounted for in the “Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2, and Final Drainage Report for Sterling Ranch Filing No.1” prepared by MS Civil Consultants, dated April 2017. Any additional improvements and costs are listed below.

The following list of drainage improvements are **Non-Reimbursable**. The Reimbursable facilities are outlined in the Sterling Ranch Filing No. 1 Final Drainage Report and Sterling Ranch MDDP. Refer to the MDDP for Sterling Ranch Cost and Fee Analysis Report (February 2019).

Item	Description	Quantity	Unit Cost	Cost
1.	18" RCP	31 LF	\$40 /LF	\$1,240.00
2.	24" RCP	127 LF	\$50 /LF	\$6,350.00
3.	30" RCP	998 LF	\$85 /LF	\$84,830.00
4.	36" RCP	8 LF	\$105 /LF	\$840.00
5.	42" RCP	699 LF	\$185 /LF	\$129,315.00
6.	24" FES	1 EA	\$750 /EA	\$750.00
8.	42" FES	1 EA	\$1,250 /EA	\$1,250.00
9.	5.0'x4.5' CDOT Type R Sump Inlet	1 EA	\$4,000 /EA	\$4,000.00
10.	10' CDOT Type R Sump Inlet	4 EA	\$4,700 /EA	\$18,800.00
11.	15' CDOT Type R At-Grade Inlet	2 EA	\$6,000 /EA	\$12,000.00
12.	4.0' Type II MH	1 EA	\$3,500 /EA	\$3,500.00
13.	5.0' Type II MH	2 EA	\$4,000 /EA	\$8,000.00
14.	6.0' Type II MH	1 EA	\$4,500 /EA	\$4,500.00
17.	5.0'x6.0' MH	2 EA	\$6,500 /EA	\$13,000.00
18.	5.5'x5.5' MH	1 EA	\$6,500 /EA	\$6,500.00
19.	Headwall/Wingwall	1 EA	\$6,000 /EA	\$6,000.00
20.	Full Spectrum Det. Pond 1	1 EA	\$15,000 /EA	\$15,000.00

21.	FSD Pond 1 Outlet Structure	1	EA	\$12,600	/EA	\$12,600.00
22.	Ind. Lot Sand Filter Basins w/6" Pipe	26	EA	\$2,000	/EA	\$52,000.00
23	18" Drain Basin Manholes w/Lids	27	EA	\$1,000	/EA	27,000.00
24	12" ADS Pipe	1,658		\$26	/LF	43,108.00
Total \$						\$450,583.00

The following list of drainage improvements are **Reimbursable** for the improvements to the Sand Creek Channel adjacent to Homestead at Sterling Ranch Filing No.2. The reimbursement is up to the amount as shown in the DBPS or as adjusted through the City/EPC Drainage Board.

Sand Creek Channel Improvements

Item	Description	Quantity	Unit Cost	Cost
1.	Rip Rap Protection	390 Ton	\$80 /Ton	\$31,200.00
2.	Drop/Check Structures	5 EA	\$75,000 /EA	\$375,000.00
3.	Slope Stabilization Blankets	7,435 SY	\$6 /SY	\$44,610.00
Total				\$450,810.00

DRAINAGE & BRIDGE FEES – HOMESTEAD AT STERLING RANCH FIL. NO. 2

This site is within the Sand Creek Drainage Basin. The 2019 Drainage and Bridge Fees per El Paso County for the HOMESTEAD AT STERLING RANCH FILING NO. 2 site are as follows:

Per Homestead at Sterling Ranch Filing No. 2 Plat – **Total Area 29.658 Acres**

HOMESTEAD AT STERLING RANCH FILING NO. 2 FEES:

Drainage Fees:	29.658	x	46%	\$	18,940.00	=	\$ 258,392.36
Bridge Fees:	29.658	x	46%	\$	5,559.00	=	\$ 75,839.66
Total							\$ 334,232.02

STERLING RANCH FILING NO. 1 - SUBDIVISION IMPROVEMENTS AGREEMENT

Sterling Ranch Filing No. 1 final plat and SIA has been recorded, and addressed the following drainage improvements Not located/and located in the Sand Creek Channel. The following SIA paragraphs outlined drainage for Sterling Ranch in the following manner;

2. Drainage and Landscaping Tracts: Improvements on Tracts A, B, F, H, I, J, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA and CC as identified on the final plat of Filing No. 1 will be completed to the satisfaction of the County and District and, upon said completion, the improvements will be dedicated to and accepted by the District. Improvements on Tract D (Sand Creek) will be completed to the satisfaction of the County and upon said completion; the improvements will be dedicated to and accepted by the County. The ownership and maintenance of storm drain facilities and structures not located on the foregoing tracts shall be determined as follows. All storm pipes shall be owned and maintained by the District except where located in County road rights of way (see Paragraph 5 below), in which case the County shall own and maintain the storm drain facilities and structures, including but not limited to, inlets and manholes. A typical cross section describing the ownership and maintenance responsibilities of drainage improvements within County rights of way is attached as Exhibit C hereto.

7. Timing of Construction and Acceptance:

a. **Drainage Improvements Not Located in Sand Creek Channel:** Except as set forth below in subsection 6.b. (drainage improvements located in Sand Creek Channel), all drainage improvements described in Exhibit A and constructed within the Drainage and Landscaping Tracts identified in paragraph 2 above shall be completed by the

Subdivider and District, meeting all applicable standards for preliminary acceptance, prior to the recording of the first replat of Tracts C, E, G, K or BB. In the event that a portion of the drainage improvements are not completed prior to the recording of the first replat, then prior to such recording collateral sufficient in the opinion of the County to assure completion of the improvements must be posted by the Subdivider and a deadline by which such drainage improvements shall be completed shall be established by written agreement.

*b. **Drainage Improvements Located in Sand Creek Channel (Tract D):** The District agrees that it will construct or cause the construction of all drainage improvements to be located in Tract D as well as future tracts within Sterling Ranch containing the Sand Creek Channel in accordance with the following:*

- i. Bank stabilization of the Sand Creek channel shall be required prior to any replats or other final plats adjacent to the channel. The design and installation of said improvements shall be accomplished and guaranteed through the normal subdivision review and collateralization process.*
- ii. Other drainage improvements in Tract D and future tracts containing the Sand Creek Channel, such as drop structures, check structures and similar stabilization or protection improvements, will be designed and constructed by the District with the final construction drawings to be approved by the County no later than the final platting of the 700th single family lot within the boundaries of the approved Sterling Ranch Sketch Plan and the completion of all said improvements no later than the 800th single family lot with the boundaries of the approved Sterling Ranch Sketch Plan.*
- iii. In order to assure completion of the drainage improvements required in Subsection 6.b.ii above as well as a fair apportionment of the costs of said drainage improvements amongst adjacent Sterling Ranch subdividers, the District agrees to establish a Sand Creek Channel Drainage Fee to be paid into a District Escrow Fund by adjacent subdividers at the time of final platting. The amount of the fee shall be a minimum of One Thousand Dollars (\$1,000.00) per single family lot. The details of the proposed Sand Creek Channel Drainage Fee and the District Escrow Fund shall be agreed to by the parties in advance of the submittal of the first replat of or subdivision of the Master Pad Sites or other property located within Sterling Ranch.*

A full copy of the recorded SIA is located in the files of El Paso County and EPC Clerk and Records office under Reception No. 218714151

SUMMARY

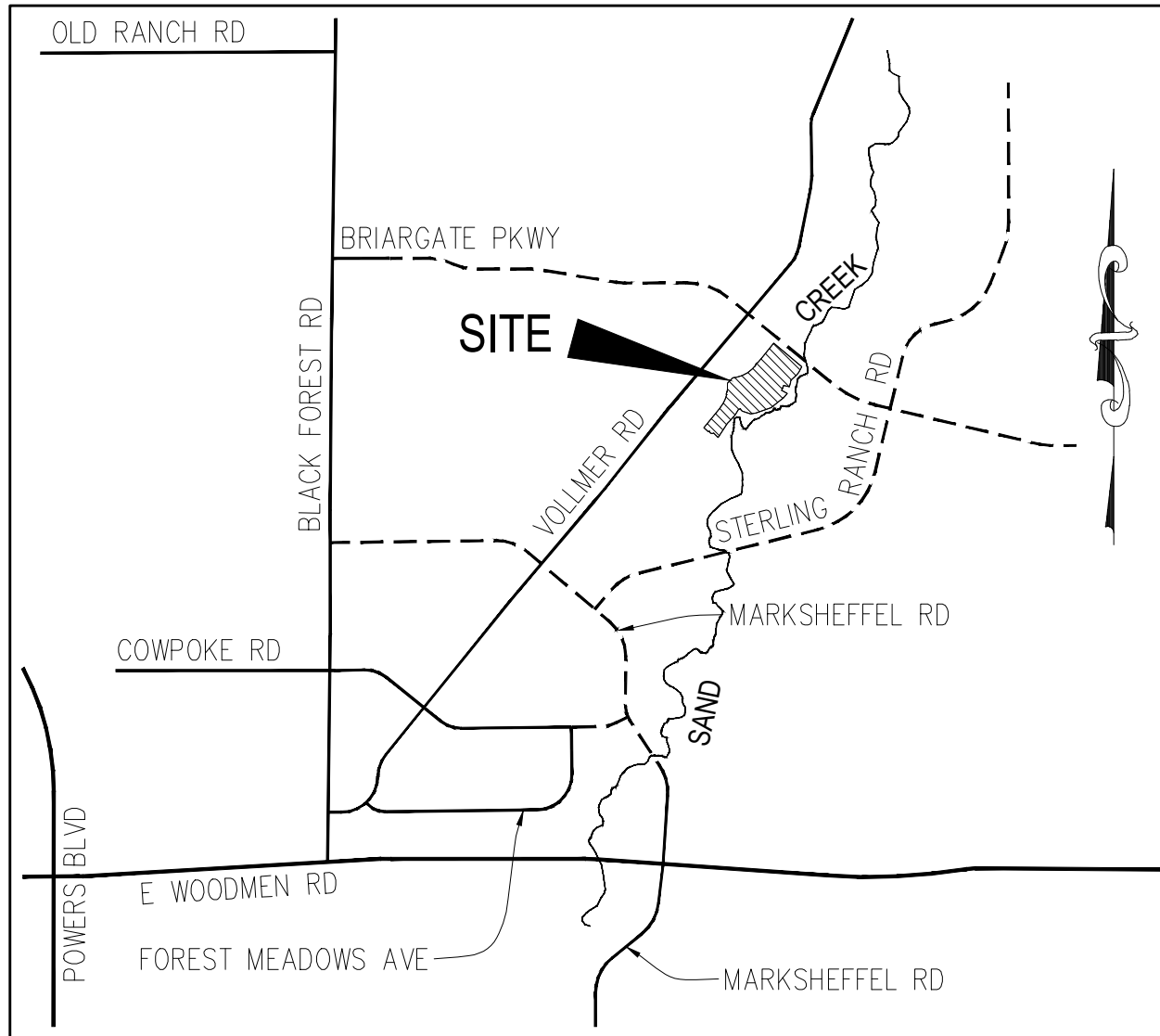
Development of this site will not adversely affect the surrounding development per this final drainage report with no negative impacts to the neighboring developments. The existing and proposed drainage facilities will adequately convey, detain and route runoff from tributary and onsite flows to the Sand Creek Drainage channel. Full Spectrum Detention and Water Quality Ponds will be used to discharge developed flows into Sand Creek per the Urban Drainage criteria flow rates, which are at or less than the historic flow. Care will be taken during construction to accommodate overland flow routes onsite and temporary drainage conditions. The development of the HOMESTEAD AT STERLING RANCH FILING NO. 2 project(s) shall not adversely affect adjacent or downstream property.

REFERENCES

- 1.) "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".
- 2.) "Urban Storm Drainage Criteria Manuals, Volumes 1-3"
- 3.) NRSC Web Soil Survey Map for El Paso County. <http://websoilsurvey.nrcs.usda.gov>
- 4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date December 7, 2018.
- 5.) "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996
- 6.) "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015
- 7.) "Sterling Ranch-Phase 1 Onsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015
- 8.) "Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2 and Final Drainage Report for Sterling Ranch Filing No. 1", prepared by M&S Civil Consultants, Inc., dated April 2017
- 9.) "Sterling Ranch Filing Nos. 1&2 MDDP" prepared by MS Civil Consultants, Inc., dated October 2018.

APPENDIX

VICINITY MAP

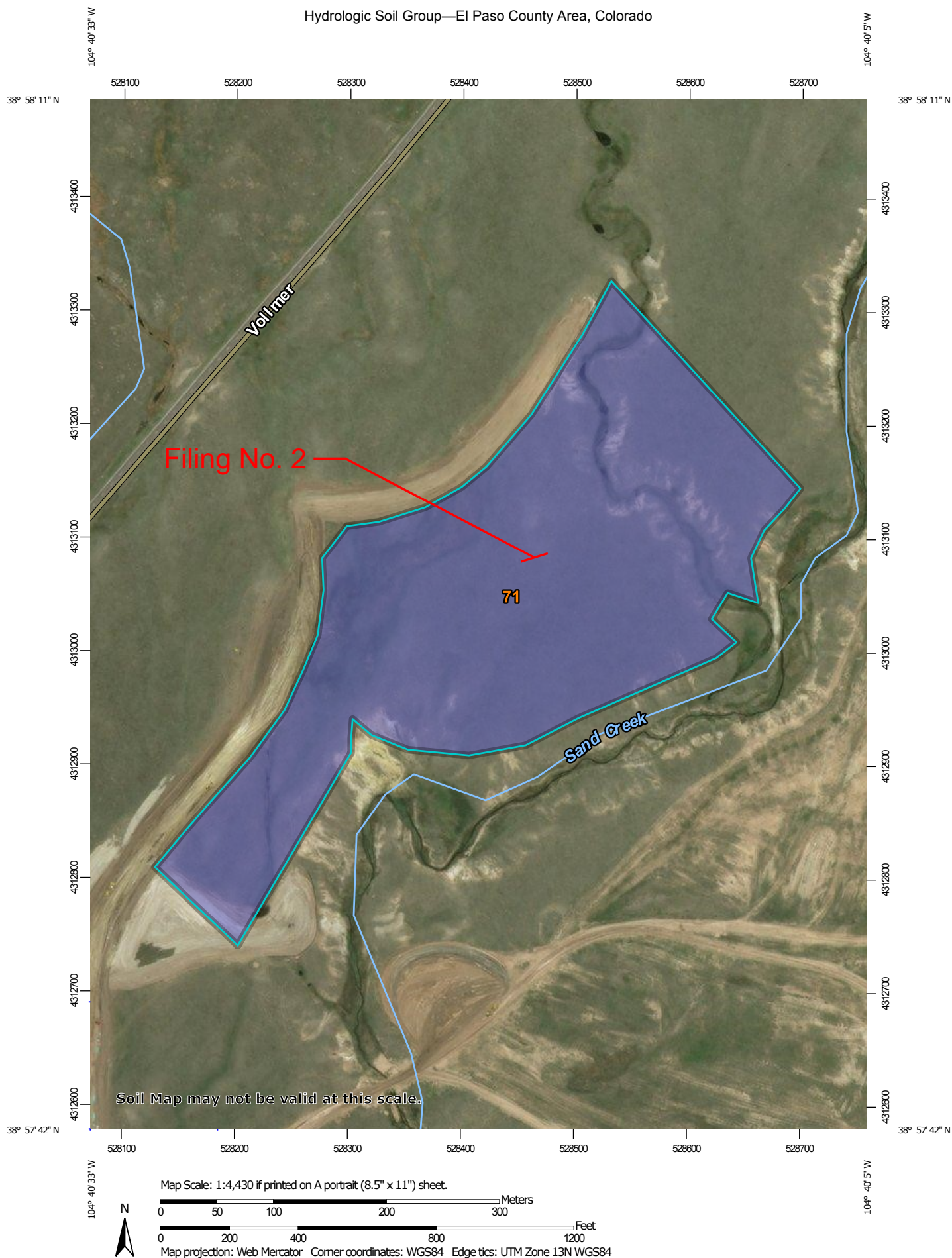


VICINITY MAP

N.T.S.


SOILS MAP

Hydrologic Soil Group—El Paso County Area, Colorado



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 15, Oct 10, 2017

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

Date(s) aerial images were photographed: May 22, 2016—Mar 9, 2017

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
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	29.0	100.0%
Totals for Area of Interest			29.0	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

FIRM PANEL W/ REVISED LOMR

**EL PASO COUNTY
UNINCORPORATED AREAS
080059**

REVISOR'S NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET

1,000 0 1,000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

**EL PASO COUNTY,
COLORADO AND
INCORPORATED
AREAS**

PANEL 535 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0035 F

**REVISED TO
REFLECT LOMR
EFFECTIVE: July 23, 2009**

**MAP NUMBER
08041C0535 F**

**EFFECTIVE DATE:
MARCH 17, 1997**

Federal Emergency Management Agency

Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

**EL PASO COUNTY,
COLORADO AND
INCORPORATED
AREAS**

PANEL 535 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

NUMBER PANEL SUFFIX

EL PASO COUNTY,
UNINCORPORATED AREAS

**REVISED TO
REFLECT LOMR
EFFECTIVE: July 23, 2009**

MAP NUMBER
08041C0535 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette



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		Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

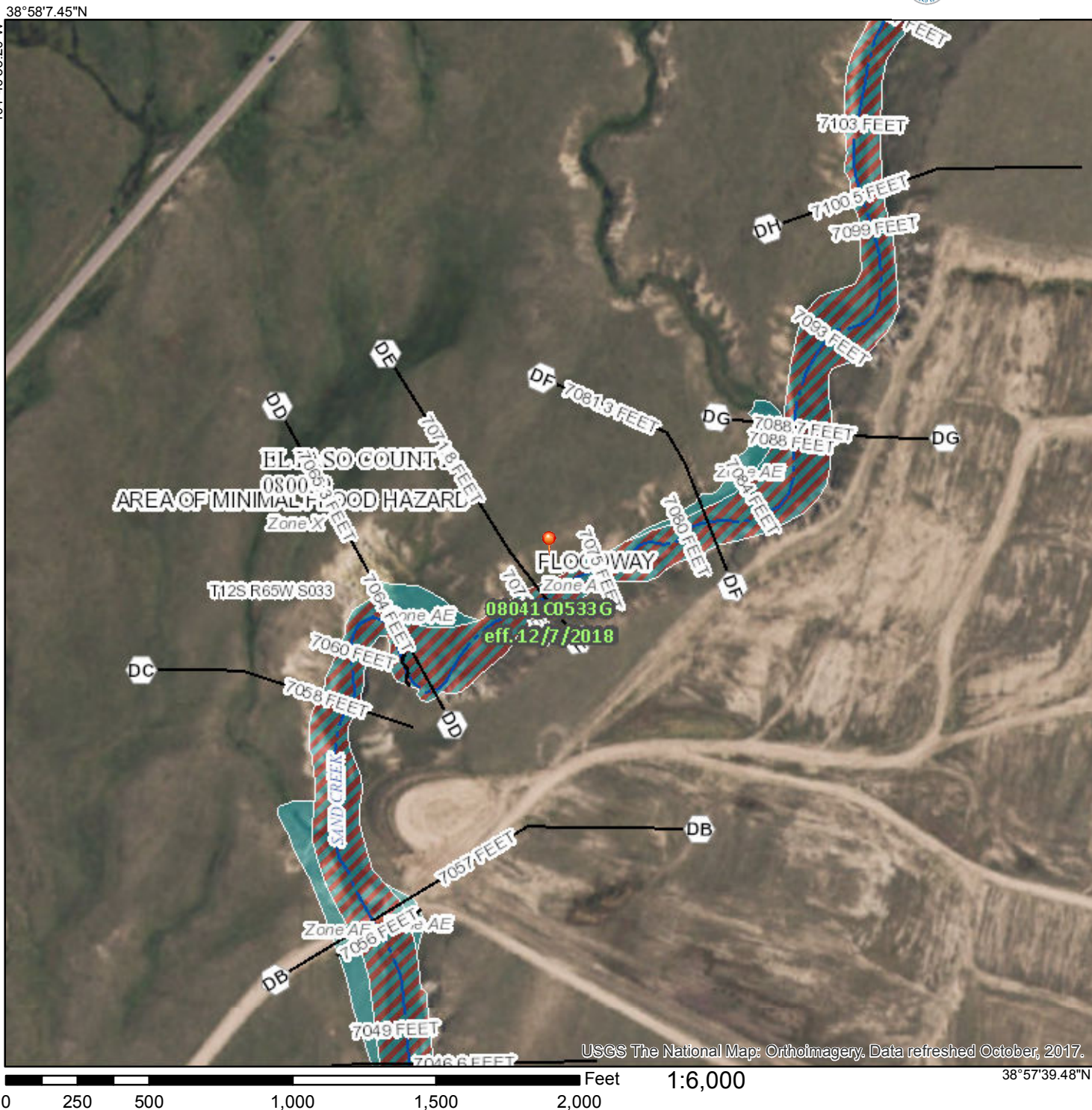


The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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 1/23/2019 at 7:09:44 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.



Questions concerning the VERTCON process may be mailed to [NGS](#)

Latitude: 38.964784

Longitude: 104.67180

NGVD 29 height:

Datum shift (NAVD 88 minus NGVD 29): 1.196 meter

1.196 meters = 3.92 feet

NAVD88 - 3.92 feet = NGVD29

STORM 4 Outfall to Sand Creek Channel

Cross Section DE = 7071.8 NAVD88

7071.8 NAVD88 - 3.92 feet = 7067.88 NGVD29

HYDROLOGIC CALCULATIONS

HOMESTEAD AT STERLING RANCH FILING NO. 2

FINAL DRAINAGE REPORT

(Area Drainage Summary)

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T _t)		INTENSITY **		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _C (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	CHECK (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
Proposed Area Drainage Summary																	
ONSITE BASINS																	
J	0.43	0.22	0.46	0.22	90	1.8	12.0	0	2.0%	3.0	0.0	12.0	10.5	4.1	6.8	0.4	1.3
K	0.61	0.22	0.46	0.22	75	1.5	10.9	0	2.0%	3.0	0.0	10.9	10.4	4.1	6.8	0.5	1.9
P	4.42	0.38	0.55	0.38	100	2	10.3	1100	2.5%	3.0	6.0	16.4	16.7	3.4	5.7	5.7	13.8
Q	3.78	0.38	0.55	0.38	100	2	10.3	1100	2.5%	3.0	6.0	16.4	16.7	3.4	5.7	4.9	11.8
R	1.57	0.38	0.55	0.38	100	2	10.3	450	1.6%	3.0	2.5	12.8	13.1	3.8	6.3	2.2	5.4
T	9.14	0.30	0.50	0.30	100	2	11.5	942	2.1%	3.0	5.2	16.7	15.8	3.4	5.8	9.4	26.4
U	4.50	0.38	0.55	0.38	100	2	10.3	457	1.5%	3.0	2.5	12.9	13.1	3.8	6.3	6.4	15.6
V1	1.48	0.38	0.55	0.38	100	2	10.3	600	2.0%	3.0	3.3	13.6	13.9	3.7	6.2	2.1	5.0
V2	0.83	0.38	0.55	0.38	100	2	10.3	360	1.6%	3.0	2.0	12.3	12.6	3.8	6.4	1.2	2.9
W1	0.86	0.22	0.46	0.22	80	6	7.3	0	0.0%	2.3	0.0	7.3	10.4	4.6	7.7	0.9	3.1
W2	0.26	0.08	0.35	0.08	35	8	3.9	0	0.3%	2.3	0.0	5.0	10.2	5.2	8.7	0.1	0.8
W3	0.56	0.08	0.35	0.08	35	8	3.9	160	0.5%	2.3	1.2	5.1	11.1	5.2	8.7	0.2	1.7
X	0.22	0.22	0.46	0.22	80	6	7.3	0	2.5%	2.3	0.0	7.3	10.4	4.6	7.7	0.2	0.8
X1	0.78	0.22	0.46	0.22	80	6	7.3	0	2.5%	2.3	0.0	7.3	10.4	4.6	7.7	0.8	2.8
X2	1.04	0.22	0.46	0.22	80	6	7.3	0	2.5%	2.3	0.0	7.3	10.4	4.6	7.7	1.1	3.7
Y	0.09	0.22	0.46	0.22	80	6	7.3	0	2.5%	2.3	0.0	7.3	10.4	4.6	7.7	0.1	0.3
Y1	0.84	0.22	0.46	0.22	80	6	7.3	0	2.5%	2.3	0.0	7.3	10.4	4.6	7.7	0.8	3.0
Y2	0.21	0.22	0.46	0.22	80	6	7.3	0	2.5%	2.3	0.0	7.3	10.4	4.6	7.7	0.2	0.7
OFFSITE BASINS*																	
B*	5.39	0.38	0.55	0.38	60	1.2	8.0	1381	2.8%	3.0	7.6	16.3	18.0	3.4	5.7	8.0	19.3
C*	2.92	0.38	0.55	0.38	100	1.2	12.2	411	3.0%	3.0	2.3	14.5	12.8	3.8	6.3	4.2	10.1
D*	2.90	0.38	0.55	0.38	100	2	10.3	245	2.1%	3.0	1.3	11.7	11.9	3.9	6.5	4.3	10.4
E*	5.34	0.38	0.55	0.38	100	2	10.3	61	3.3%	3.0	0.3	10.7	10.9	4.0	6.8	8.2	19.9
F*	1.12	0.90	0.96	0.90	10	0.2	0.9	1525	2.8%	3.0	8.4	9.3	18.5	4.2	7.1	4.3	7.7
G*	0.61	0.22	0.46	0.22	100	2	12.6	0	2.2%	3.0	0.0	12.6	10.6	4.0	6.8	0.5	1.9
H*	0.19	0.90	0.96	0.90	10	0.2	0.9	280	2.1%	3.0	1.5	5.0	11.6	5.2	8.7	0.9	1.6
I*	2.10	0.90	0.96	0.90	10	0.2	0.9	1082	2.5%	3.0	5.9	6.9	16.1	4.7	7.9	8.9	15.9
L*	1.54	0.90	0.96	0.90	10	0.2	0.9	1805	2.1%	3.0	9.9	10.8	20.1	4.0	6.7	5.6	10.0
S*	1.97	0.08	0.35	0.08	60	10	5.6	270	0.5%	2.3	2.0	7.6	11.8	4.5	7.6	0.7	5.3

* For detailed information on Desing Points, Basins, Flowby, or Pipe Runs see Sterling Ranch Filing Nos. 1&2 MDDP prepared by MS Civil Consultants, dated April 2017

** Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: ET/CMN

Date: 1/14/2020

Checked by: VAS

HOMESTEAD AT STERLING RANCH FILING NO. 2 **FINAL DRAINAGE REPORT** **(Basin Routing Summary)**

From Area Runoff Coefficient Summary				OVERLAND				PIPE / CHANNEL FLOW				Time of Travel (T _t)	INTENSITY **		TOTAL FLOWS		COMMENTS
DESIGN POINT	CONTRIBUTING BASINS	CA ₅	CA ₁₀₀	C ₅	Length (ft)	Height (ft)	T _C (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)	
PROPOSED DRAINAGE BASIN ROUTING SUMMARY																	
2*	B*	2.34	3.39									16.3	3.4	5.7	8.0	19.3	(2) EX. 15' AT-GRADE INLETS
3*	C*	1.11	1.61									12.8	3.8	6.3	4.2	10.1	EX. 6' SUMP INLET
4*	D*, E*, F*	4.14	5.61									11.7	3.9	6.5	16.1	36.7	EX. 15' AT-GRADE INLET
5*	G*, H*, FLOWBY DP4*	1.07	3.02									11.7	3.9	6.5	4.2	19.7	EX. 15' AT-GRADE INLET
6*	I*, J, K, L*	3.50	3.97									10.8	4.0	6.7	14.1	26.7	EX. 15' AT-GRADE INLET
7	P	1.68	2.43									16.4	3.4	5.7	5.7	13.8	PROP. 10' SUMP INLET
8	Q	1.44	2.08									16.4	3.4	5.7	4.9	11.8	PROP. 10' SUMP INLET
9	R	0.60	0.86									12.8	3.8	6.3	2.2	5.4	PROP. 10' SUMP INLET
10	T	2.74	2.69									15.8	3.4	5.8	9.4	15.6	PROP. 15' AT-GRADE INLET Total CA100=3.86 Split Between DP10 & DP11 For Crown Overflow
11	V1	0.56	2.69									15.8	3.4	5.8	1.9	15.6	PROP. 15' AT-GRADE INLET Total CA100=3.86 Split Between DP10 & DP11 For Crown Overflow
12	U, FLOWBY DP10	1.80	2.98									15.8	3.4	5.8	6.2	17.2	PROP. 10' SUMP INLET
13	V2, FLOWBY DP11	0.32	0.96									13.6	3.7	6.2	1.2	5.9	PROP. MODIFIED 5'x4.5' SUMP INLET
14	W3, PR9	5.35	8.52									13.6	3.7	6.2	19.6	52.4	CUMULATIVE DETENTION POND

* For detailed information on Design Points, Basins, Flowby, or Pipe Runs see Sterling Ranch Filing Nos. 1&2 MDDP prepared by MS Civil Consultants, dated April 2017

** Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: ET/CMN
Date: 1/14/2020
Checked by: VAS

HOMESTEAD AT STERLING RANCH FILING NO. 2
DRAINAGE CALCULATIONS
(Storm Sewer Routing Summary)

PIPE RUN	Contributing Pipes/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity**		Flow		PIPE SIZE
					I_5	I_{100}	Q_5	Q_{100}	
1	DP7	1.68	2.43	16.4	3.4	5.7	5.7	13.8	24" RCP
2	DP8	1.44	2.08	16.4	3.4	5.7	4.9	11.8	18" RCP
3	PR1, PR2	3.12	4.51	16.4	3.4	5.7	10.6	25.7	24" RCP
4	DP9, PR3	3.71	5.37	17.0	3.3	5.6	12.4	30.1	30" RCP
5	DP10	2.64	2.20	15.8	3.4	5.8	9.1	12.7	18" RCP
6	DP11	0.55	2.20	15.8	3.4	5.8	1.9	12.7	18" RCP
7	PR5, PR6	3.19	4.39	16.0	3.4	5.7	10.9	25.3	30" RCP
8	DP12	1.80	2.98	15.8	3.4	5.8	6.2	17.2	24" RCP
9	DP13, PR7, PR8	5.31	8.33	16.6	3.4	5.7	17.9	47.1	42" RCP
10	UD-Detention_v3.07						0.7	23.4	Outlet Structure & 18" CMP
11	Pipe Run continued from MDDP DP15* to Sand Creek. Flow values are that of MDDP Pipe Run 15* (PR15*).						42.1	76.8	42" RCP
12	Lots 36-41						0.0	1.3	12" ADS
13	Lots 28-35						0.0	1.6	12" ADS
14	Lots 19-24						0.0	1.5	12" ADS
15	Lots 13-18						0.0	1.4	12" ADS

* For detailed information on Desing Points, Basins, Flowby, or Pipe Runs see Sterling Ranch Filing Nos. 1&2 MDDP prepared by MS Civil Consultants, dated April 2017

** Intensity equations assume a minimum travel time of 5 minutes.

DP - Design Point

EX - Existing Design Point

FB- Flow By from Design Point

INT- Intercepted Flow from Design Point

Calculated by: CMN

Date: 1/14/2020

Checked by: VAS

HYDRAULIC CALCULATIONS

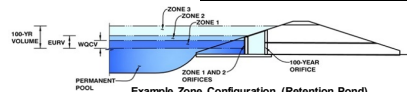
<i>Weighted Percent Imperviousness of FSD Pond 1</i>				
<i>Contributing Basins</i>	<i>Area (Acres)</i>	<i>C_s</i>	<i>Impervious % (I)</i>	<i>(Acres)*(I)</i>
<i>T</i>	9.14	0.30	40	365.60
<i>U</i>	4.50	0.38	53	238.50
<i>V1</i>	1.48	0.38	53	78.44
<i>V2</i>	0.83	0.38	53	43.99
<i>W1</i>	0.56	0.08	2	1.12
<i>Totals</i>	16.51			727.65
<i>Imperviousness of FSD Pond 1</i>	44.1	%		

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Homestead At Sterling Ranch Filings Nos. 2

Basin ID: FSD Pond 1



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	16.51	acres
Watershed Length =	875	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	44.10%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C-D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depth =	User Input	
Water Quality Capture Volume (WQCV) =	0.612	ac-ft
Excess Urban Runoff Volume (EURV) =	0.771	ac-ft
2-yr RRTV Volume (P1 = 1.5%) =	0.864	ac-ft
5-yr Runoff Volume (P1 = 1.5%) =	0.847	ac-ft
25-yr Runoff Volume (P1 = 1.75%) =	1.177	ac-ft
50-yr Runoff Volume (P1 = 2.0%) =	1.710	ac-ft
50-yr Runoff Volume (P1 = 2.25%) =	2.073	ac-ft
100-yr Runoff Volume (P1 = 2.52%) =	2.550	ac-ft
50-yr Runoff Volume (P1 = 0.0%) =	0.000	ac-ft
Approximate 2-yr Detention Volume =	0.574	ac-ft
Approximate 5-yr Detention Volume =	0.795	ac-ft
Approximate 10-yr Detention Volume =	1.075	ac-ft
Approximate 25-yr Detention Volume =	1.190	ac-ft
Approximate 50-yr Detention Volume =	1.247	ac-ft
Approximate 100-yr Detention Volume =	1.412	ac-ft

Water Quality Capture Volume (WQCV) =	0.262	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.771	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.614	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.847	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.177	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.710	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.073	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.550	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	

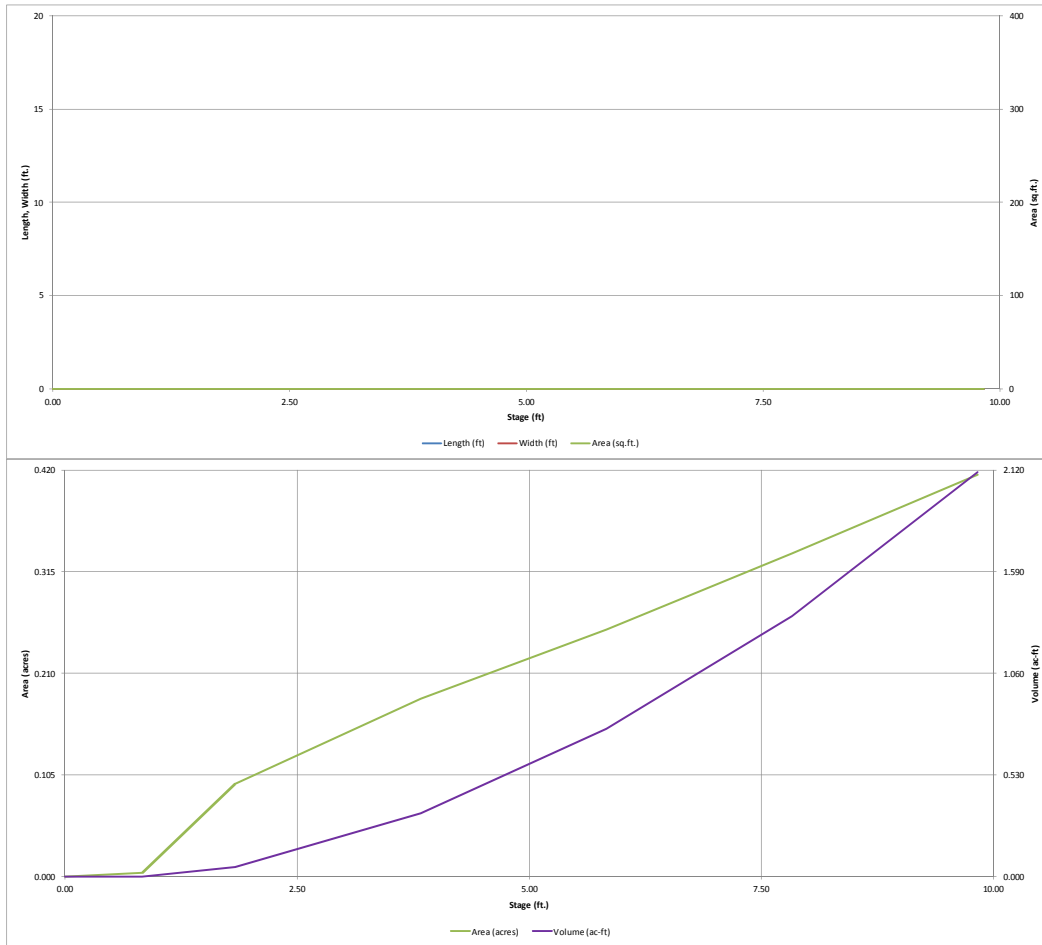
Stage-Storage Calculation

Zone 1 Volume (V_{WC1})	0.262	acre-feet
Zone 2 Volume (EURV - Zone 1)	0.508	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2)	0.642	acre-feet
Total Detention Basin Volume	1.412	acre-feet
Initial Surcharge Volume (ISV)	user	ft ³
Initial Surcharge Depth (ISD)	user	ft
Total Available Detention Depth (H_{DAV})	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_{IS})	user	ft ²
Surcharge Volume Length (L_{SV})	user	ft
Surcharge Volume Width (W_{SV})	user	ft
Depth of Basin Floor (H_{100CB})	user	ft
Length of Basin Floor (L_{100CB})	user	ft
Width of Basin Floor (W_{100CB})	user	ft
Area of Basin Floor (V_{100CB})	user	ft ²
Volume of Basin Floor (V_{100CB})	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

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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

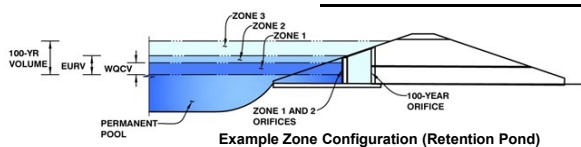


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: _____

Basin ID: _____



	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.45	0.262	Orifice Plate
Zone 2 (EURV)	5.84	0.508	Orifice Plate
Zone 3 (100-year)	8.00	0.642	Weir&Pipe (Restrict)
		1.412	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = feet

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

Invert of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches (diameter = 1-3/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.95	3.89					
Orifice Area (sq. inches)	1.19	1.19	1.19					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H _o =	5.84	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.91	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H _t =	6.81	N/A	feet
Over Flow Weir Slope Length =	3.07	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.21	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	12.88	N/A	ft ²
Overflow Grate Open Area w/ Debris =	6.44	N/A	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	13.30		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.79	N/A	ft ²
Outlet Orifice Centroid =	0.63	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.68	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

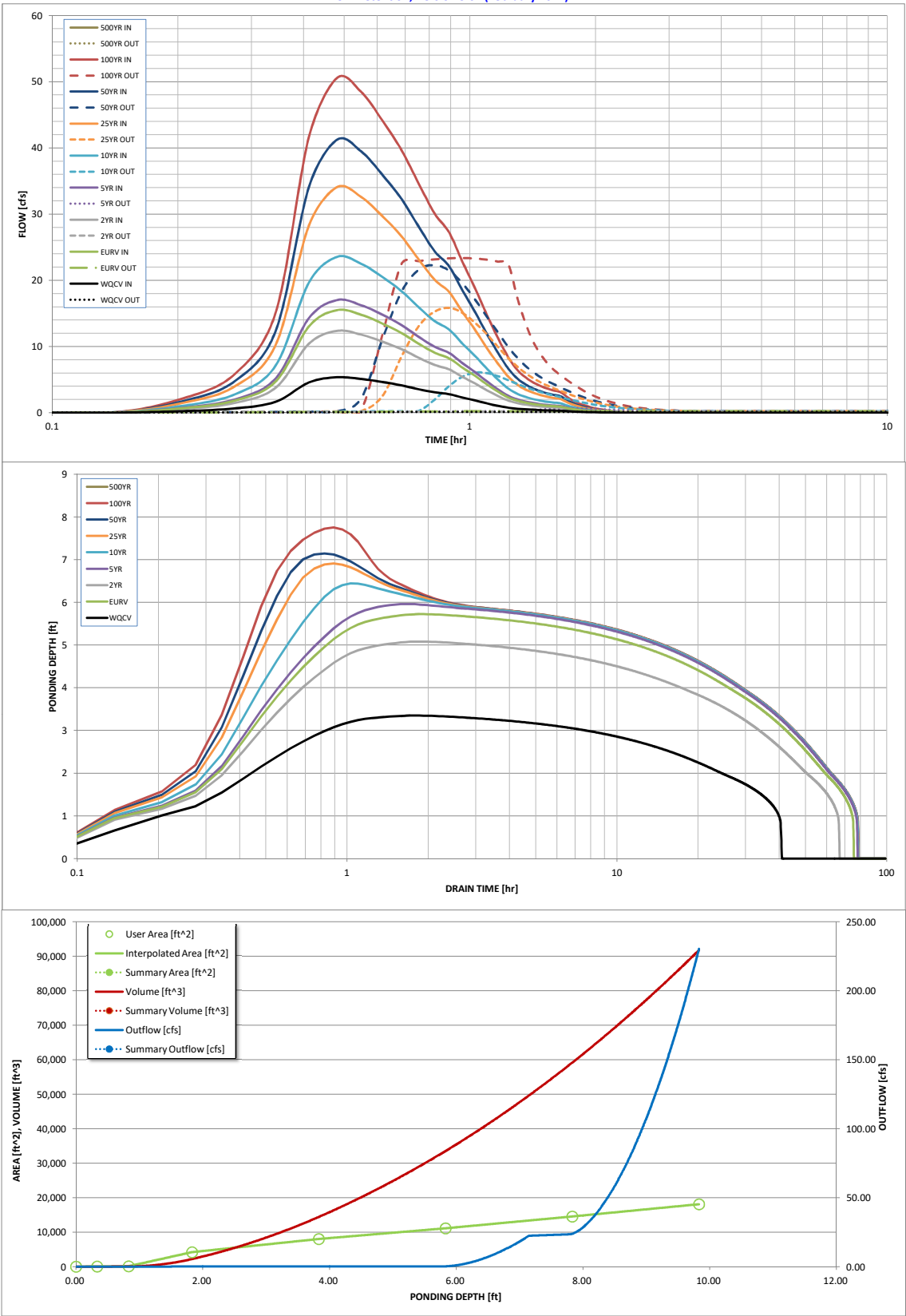
Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.262	0.771	0.614	0.847	1.177	1.710	2.073	2.550	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.262	0.771	0.614	0.847	1.176	1.710	2.074	2.551	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.03	0.27	0.84	1.16	1.55	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	0.4	4.4	13.9	19.2	25.5	0.0
Peak Inflow Q (cfs) =	5.3	15.5	12.4	17.0	23.5	34.1	41.2	50.5	#N/A
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.7	6.0	15.8	22.3	23.4	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.5	1.4	1.1	1.2	0.9	#N/A
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.4	1.2	1.7	1.8	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	39	69	62	71	69	66	63	61	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	73	65	76	75	74	73	72	#N/A
Maximum Ponding Depth (ft) =	3.35	5.72	5.08	5.96	6.44	6.91	7.15	7.75	#N/A
Area at Maximum Ponding Depth (acres) =	0.16	0.25	0.23	0.26	0.28	0.30	0.31	0.33	#N/A
Maximum Volume Stored (acre-ft) =	0.245	0.741	0.588	0.802	0.932	1.067	1.137	1.331	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



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

PROJECT: Homestead Filing No. 2

DATE: _____

Micropool Surface Area

$$TIA = I \times A$$

$$(0.441 \times 16.51)$$

$$TIA = 7.3 \sim 8.0$$

From Micropool Sizing Chart (SA) Micropool SA = 440 sf →

Forebay Volume for F&D Pond

$$\text{Tributary Area} = 16.51 \text{ ac}$$

Min. Forebay Volume = 3.0% of WQCV (UOFED T-5, EDB-4)

$$\text{WQCV for F&D Pond} = 0.262 \text{ ac-ft}$$

$$\text{Total Volume Req'd} = 0.03 (0.262) \frac{43560}{1 \text{ ac-ft}} = 342 \text{ cf}$$

$$\text{Area} = 283 - 7 (\text{wall}) = 276 \text{ sf}$$

$$276 \times 1.25 \text{ ft} = 345 > 342$$

(forebay area) (depth) (volume provided)

Forebay 15" depth →

Size notch in forebay to accommodate 2% of 100 yr. (UOFED T-5 EDB)

$$Q_{100} = 47.1 \text{ cfs} \Rightarrow 0.02 \times 47.1 = 0.94$$

$$\text{Using Ret. Weir Egn. } Q = \frac{3.247 L \cdot H^{1.48} - 0.566 \cdot L^{1.9} H^{1.9}}{1 + 2 L^{0.87}}$$

$$\text{Solve for } L = 2.6'' \quad Q = 0.94$$

Use a 2.6" notch →

PROJECT: Homestead Filing No. 2

DATE: _____

Riprap Apron For Pond 1

Riprap Sizing

$$Q_{100} = 47.1 \text{ cfs (Pipe Run 9')}$$

$$D_c = 42" = 3.5'$$

$$\frac{Q}{D^{2.5}} < 6 \quad \text{Then use Figure 9-38 (UDFCO Vol. 2)}$$

$$\frac{47.1}{(3.5)^{2.5}} = 2.05 < 6 \quad \text{Therefore use Figure 9-38}$$

and $Y/D_c = 0.40 \quad \& \quad \frac{Q}{D^{1.5}} = \frac{47.1}{(3.5)^{1.5}} = 7.19$

Use Type L $D_{50} = 9"$

Riprap Depth

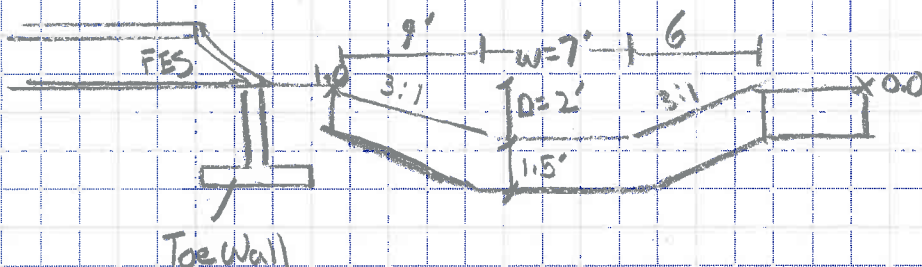
$$T = 2 D_{50}$$

$$= 2 (9")$$

$$T = 18" \text{ or } 1.5'$$

Low Tailwater Riprap Basin

42" Pipe

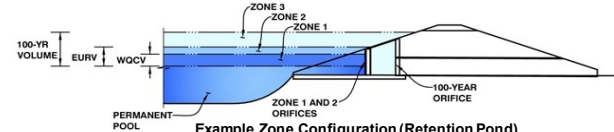


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Homestead at Sterling Ranch Filing No.2

Basin ID: Lots 14, 15, 21-24, 41 Lot size 10,319 sq ft-15,049 sq ft



Example Zone Configuration (Retention Pond)

Required Volume Calculation 706

Selected BMP Type =	SF		
Watershed Area =	0.18	acres	Note: L / W R
Watershed Length =	82	ft	L / W Ratio =
Watershed Slope =	0.080	ft/ft	
Watershed Imperviousness =	42.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	12.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.002	acre-feet	Optional User Override
Excess Urban Runoff Volume (EURV) =	0.008	acre-feet	1-hr Precipitation
2-yr Runoff Volume (P1 = 1.19 in.) =	0.006	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.009	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.012	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.018	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.022	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.027	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	
Approximate 2-yr Detention Volume =	0.006	acre-feet	
Approximate 5-yr Detention Volume =	0.008	acre-feet	
Approximate 10-yr Detention Volume =	0.011	acre-feet	
Approximate 25-yr Detention Volume =	0.012	acre-feet	
Approximate 50-yr Detention Volume =	0.013	acre-feet	
Approximate 100-yr Detention Volume =	0.015	acre-feet	

Watershed Area =	0.18	acres	Note: L / W R	7
Watershed Length =	82	ft	L / W Ratio =	706

Water Quality Capture Volume (WQCV) =	0.002	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.008	acre-feet	

2-yr Runoff Volume (P1 = 1.19 in.)	0.006	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.)	0.009	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.)	0.012	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.)	0.018	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.)	0.022	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.)	0.027	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.)	0.000	acre-feet		inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.002	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.006	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.007	acre-feet
Total Detention Basin Volume =	0.015	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft ³
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V

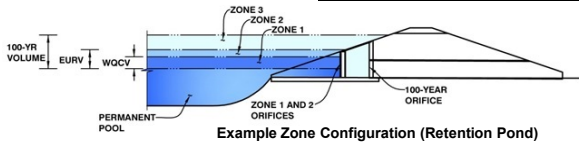
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Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Homestead at Sterling Ranch Filing No.2

Basin ID: Lot 14, 15, 21-24, 41



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.71	0.002	Filtration Media
Zone 2 (EURV)	1.41	0.006	Rectangular Orifice
Zone 3 (100-year)	1.90	0.007	Rectangular Orifice
		0.015	Total

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

Underdrain Orifice Invert Depth = 2.10 ft (distance below the filtration media surface)
Underdrain Orifice Diameter = 0.13 inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = 0.0 ft²
Underdrain Orifice Centroid = 0.01 feet

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

Invert of Lowest Orifice = N/A ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = N/A ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = N/A inches
Orifice Plate: Orifice Area per Row = N/A inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Zone 3 Rectangular	
Invert of Vertical Orifice =	0.71	1.41	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	1.41	1.90	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	2.00	inches
Vertical Orifice Width =	1.00	6.00	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Zone 3 Rectangular	
Vertical Orifice Area =	0.01	0.08	ft ²
Vertical Orifice Centroid =	0.08	0.08	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Not Selected	Not Selected	
Overflow Weir Front Edge Height, H _o =	1.88	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	1.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	1.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	% grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Not Selected	Not Selected	
Height of Grate Upper Edge, H _t =	1.88	N/A	feet
Over Flow Weir Slope Length =	1.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	N/A	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	0.70	N/A	ft ²
Overflow Grate Open Area w/ Debris =	0.35	N/A	ft ²

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

	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	N/A	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Not Selected	Not Selected	
Outlet Orifice Area =	N/A	N/A	ft ²
Outlet Orifice Centroid =	N/A	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 1.90 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 2.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 0.25 feet

Calculated Parameters for Spillway

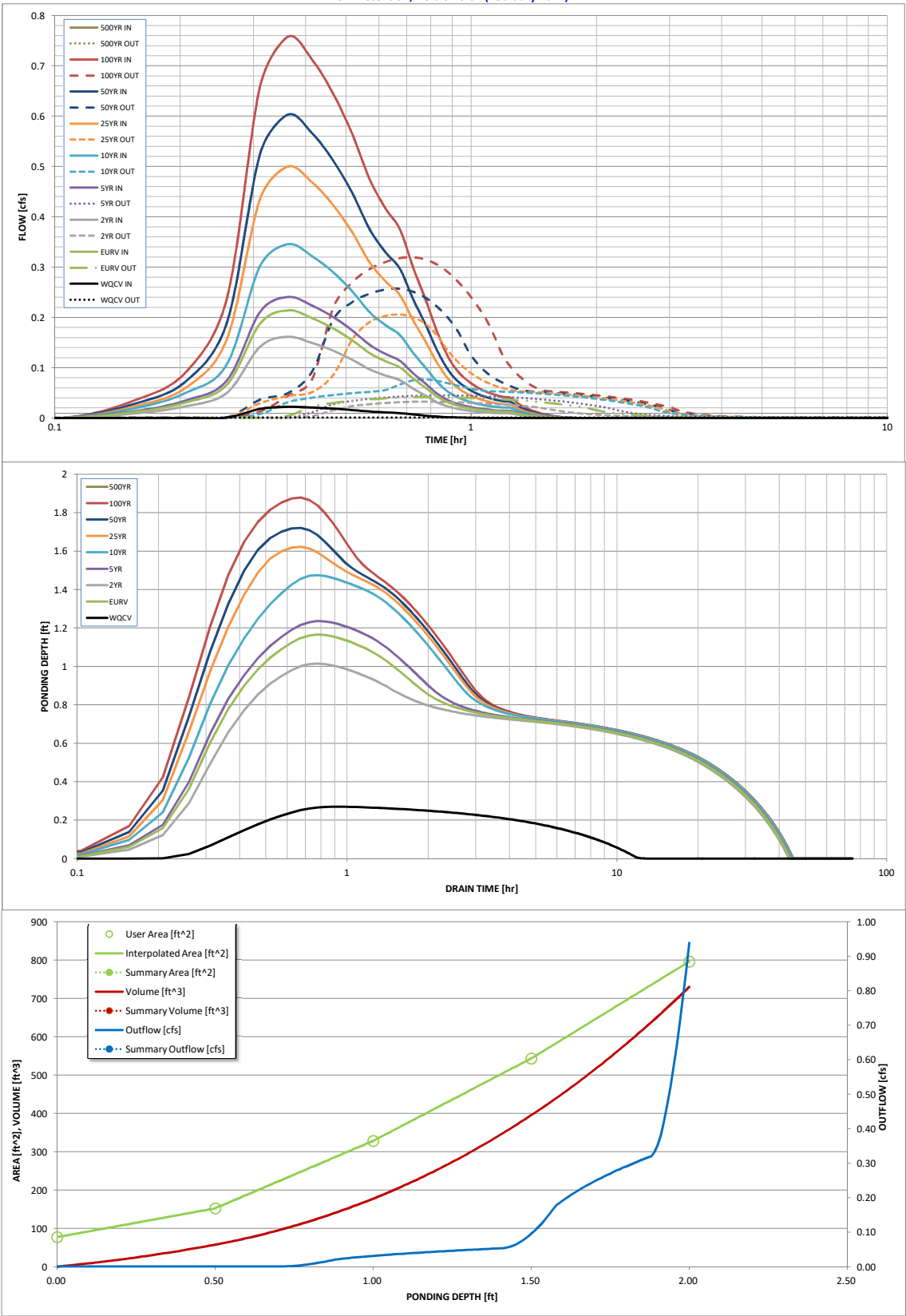
Spillway Design Flow Depth = 0.14 feet
Stage at Top of Freeboard = 2.29 feet
Basin Area at Top of Freeboard = 0.02 acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.002	0.008	0.006	0.009	0.012	0.018	0.022	0.027	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.001	0.007	0.006	0.008	0.012	0.018	0.021	0.027	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.03	0.32	0.97	1.34	1.78	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.3	0.0
Peak Inflow Q (cfs) =	0.0	0.2	0.2	0.2	0.3	0.5	0.6	0.8	#N/A
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	8.1	1.4	1.2	1.1	1.0	#N/A
Structure Controlling Flow =	Filtration Media	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 2	Vertical Orifice 2	Vertical Orifice 2	Vertical Orifice 2	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	12	40	40	39	38	35	33	30	#N/A
Time to Drain 99% of Inflow Volume (hours) =	12	43	43	43	43	42	41	40	#N/A
Maximum Ponding Depth (ft) =	0.27	1.17	1.01	1.24	1.47	1.62	1.72	1.88	#N/A
Area at Maximum Ponding Depth (acres) =	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	#N/A
Maximum Volume Stored (acre-ft) =	0.001	0.005	0.004	0.006	0.009	0.011	0.012	0.014	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



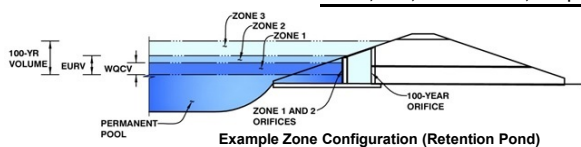
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Homestead at Sterling Ranch Filing No.2

Basin ID: Lots 13, 16-20, 28-40 Lots size 7,800 sq-ft -9830 sq-ft



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.40	0.002	Filtration Media
Zone 2 (EURV)	0.89	0.004	Rectangular Orifice
Zone 3 (100-year)	1.24	0.005	Rectangular Orifice
		0.010	Total

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

Underdrain Orifice Invert Depth = 2.10 ft (distance below the filtration media surface)
Underdrain Orifice Diameter = 0.13 inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = 0.0 ft²
Underdrain Orifice Centroid = 0.01 feet

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

Invert of Lowest Orifice = N/A ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = N/A ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = N/A inches
Orifice Plate: Orifice Area per Row = N/A inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Zone 3 Rectangular	
Invert of Vertical Orifice =	0.40	0.89	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	0.89	1.24	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	2.00	inches
Vertical Orifice Width =	1.00	3.50	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Zone 3 Rectangular	
Vertical Orifice Area =	0.01	0.05	ft ²
Vertical Orifice Centroid =	0.08	0.08	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.24	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	1.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	1.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	% grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Not Selected	Not Selected	
Height of Grate Upper Edge, H ₁ =	1.24	N/A	feet
Over Flow Weir Slope Length =	1.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	N/A	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	0.70	N/A	ft ²
Overflow Grate Open Area w/ Debris =	0.35	N/A	ft ²

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

	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	N/A	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Not Selected	Not Selected	
Outlet Orifice Area =	N/A	N/A	ft ²
Outlet Orifice Centroid =	N/A	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 1.24 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 2.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 0.25 feet

Calculated Parameters for Spillway

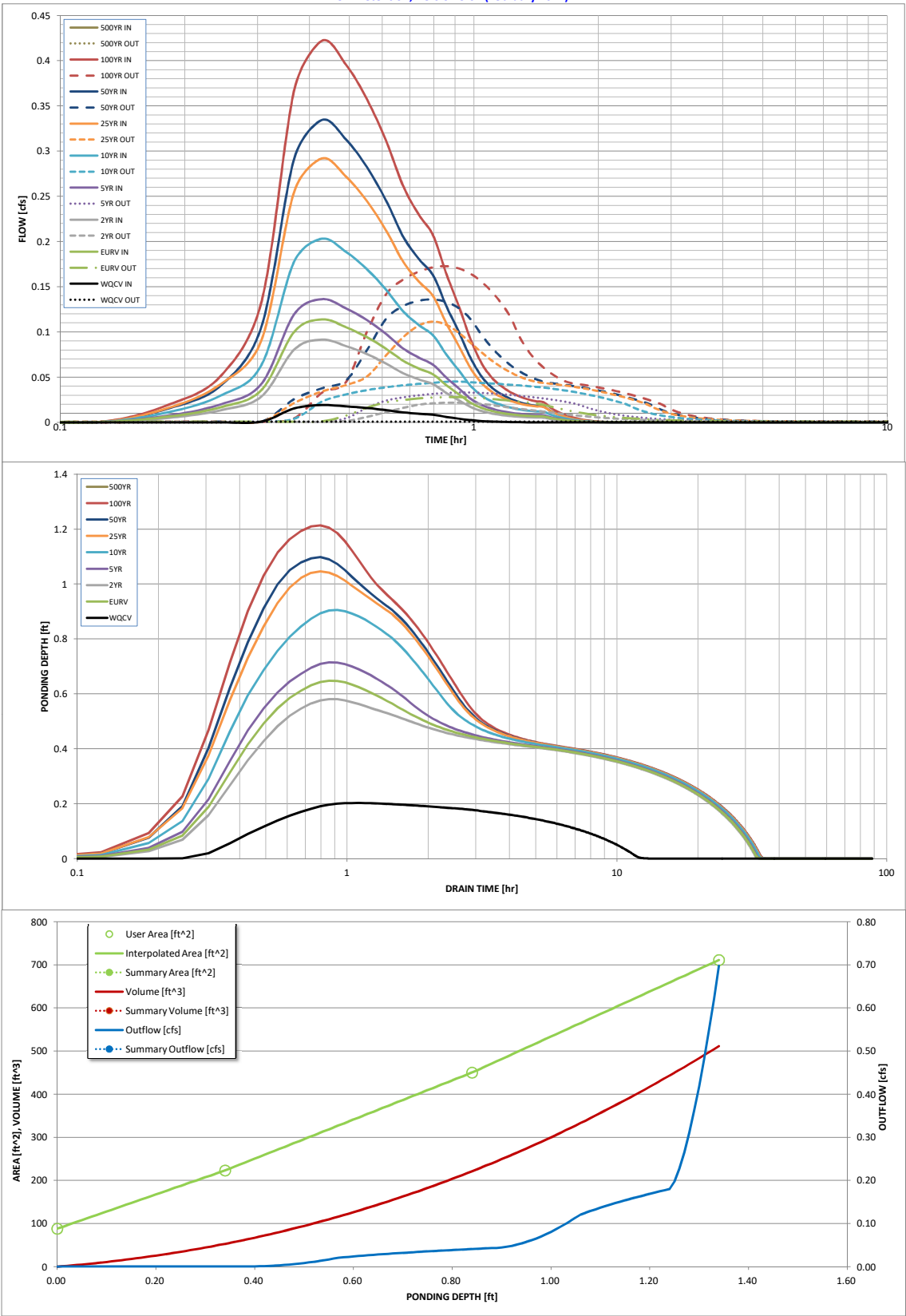
Spillway Design Flow Depth = 0.14 feet
Stage at Top of Freeboard = 1.63 feet
Basin Area at Top of Freeboard = 0.02 acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.002	0.006	0.004	0.006	0.008	0.012	0.015	0.018	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.001	0.005	0.004	0.006	0.008	0.012	0.014	0.018	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.03	0.28	0.88	1.21	1.61	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0
Peak Inflow Q (cfs) =	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.4	#N/A
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	10.1	1.4	1.1	1.0	0.9	#N/A
Structure Controlling Flow =	Filtration Media	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 2	Vertical Orifice 2	Vertical Orifice 2	Vertical Orifice 2	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	12	31	31	30	29	28	27	25	#N/A
Time to Drain 99% of Inflow Volume (hours) =	12	32	32	32	33	32	32	31	#N/A
Maximum Ponding Depth (ft) =	0.20	0.65	0.58	0.71	0.91	1.05	1.10	1.21	#N/A
Area at Maximum Ponding Depth (acres) =	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	#N/A
Maximum Volume Stored (acre-ft) =	0.001	0.003	0.003	0.004	0.006	0.007	0.008	0.010	#N/A

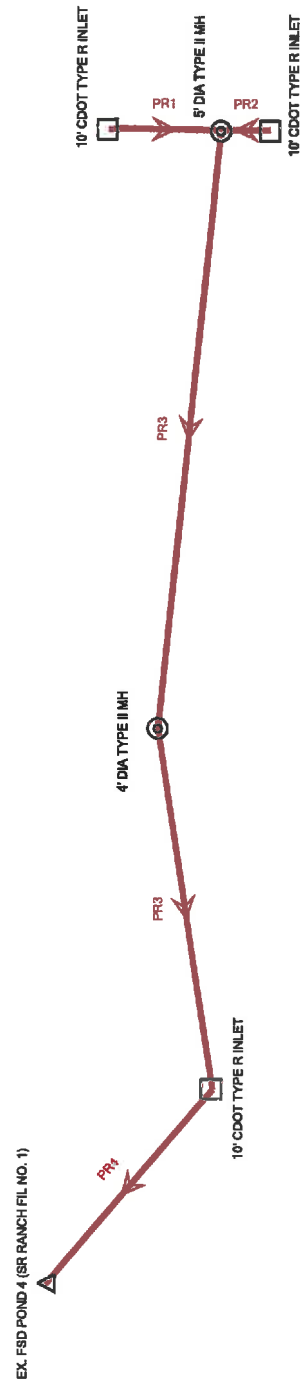
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



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

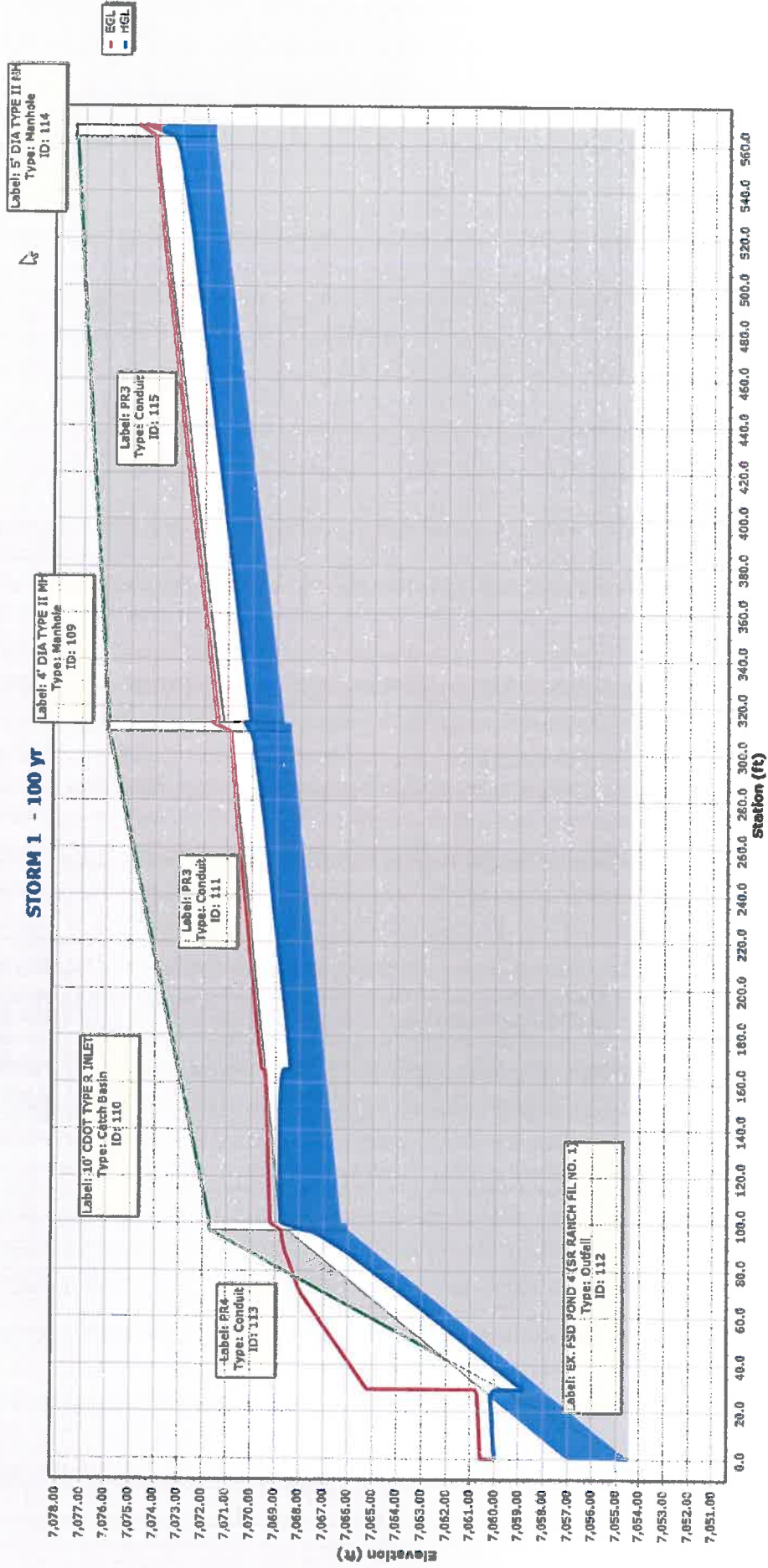
Scenario: 100 yr
STRM 1 & 2

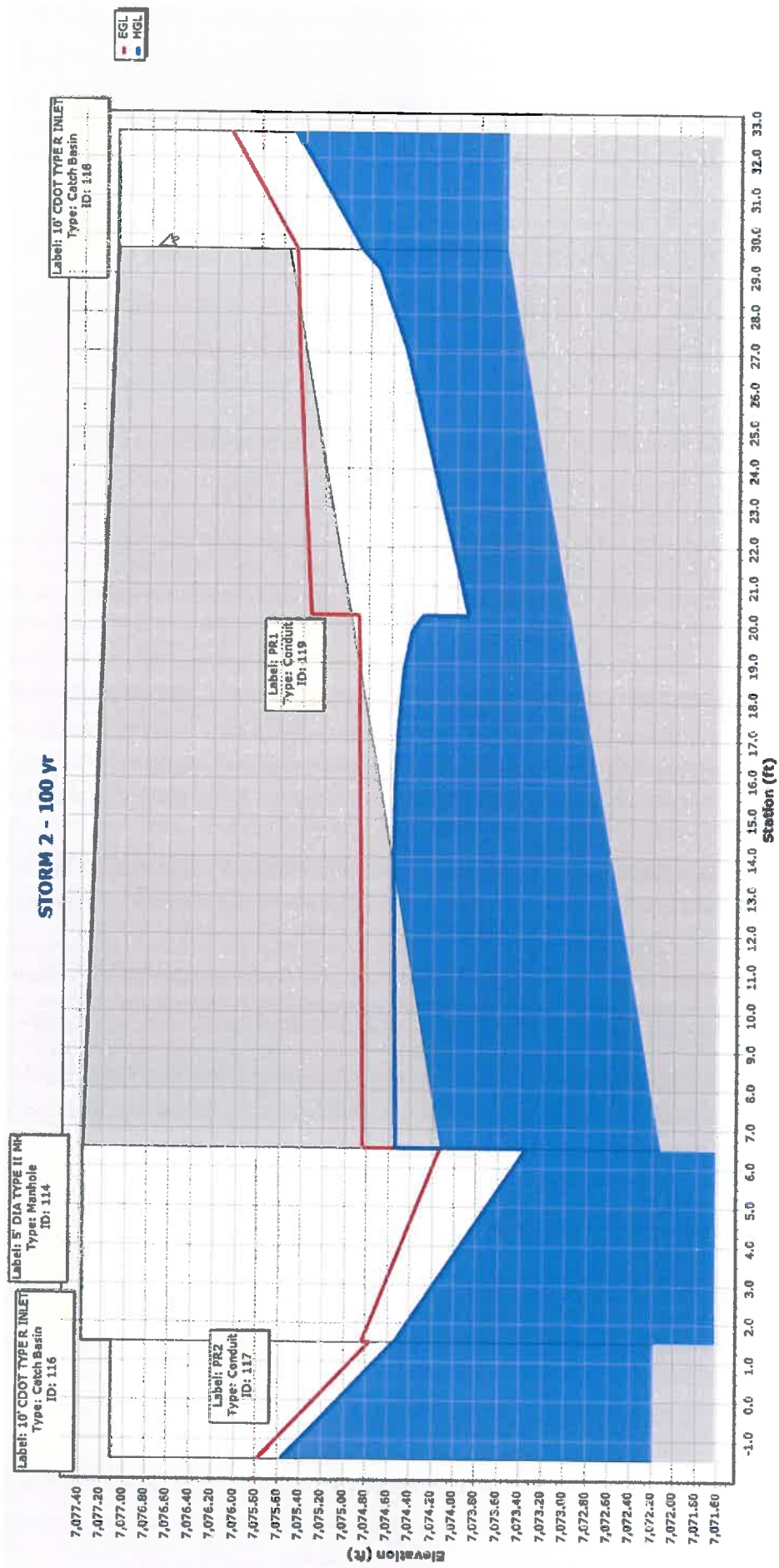


Conduit FlexTable: Table - 1 STRM 1&2

Label	Upstream Structure	Rise (ft)	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)
PR3	4' DIA TYPE II MH		25.70	62.7	213.1	8.82	1.432	1.43	1.73
PR4	10' CDOT TYPE R INLET		30.10	21.5	98.7	22.71	5.300	0.79	1.87
PR3	5' DIA TYPE II MH		25.70	58.4	254.1	9.31	1.557	1.37	1.73
PR2	10' CDOT TYPE R INLET		11.80	37.9	3.2	3.76	2.023	0.85	1.23
PR1	10' CDOT TYPE R INLET		13.80	26.6	27.2	13.97	3.425	0.70	1.34
Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)	Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)
7,070.13	7,068.77	1.36	7,070.34	9.31	0.270	0.21	7,075.93	7,068.40	7,066.27
7,067.84	7,060.00	7.84	7,068.77	5.24	1.020	0.93	7,071.69	7,065.97	7,054.50
7,073.35	7,070.07	3.27	7,074.54	4.39	1.520	1.19	7,077.37	7,071.62	7,068.70
7,074.55	7,074.54	0.01	7,075.57	3.76	1.000	1.02	7,077.10	7,072.18	7,072.12
7,074.89	7,074.54	0.35	7,075.49	6.18	1.020	0.61	7,077.10	7,073.55	7,072.12

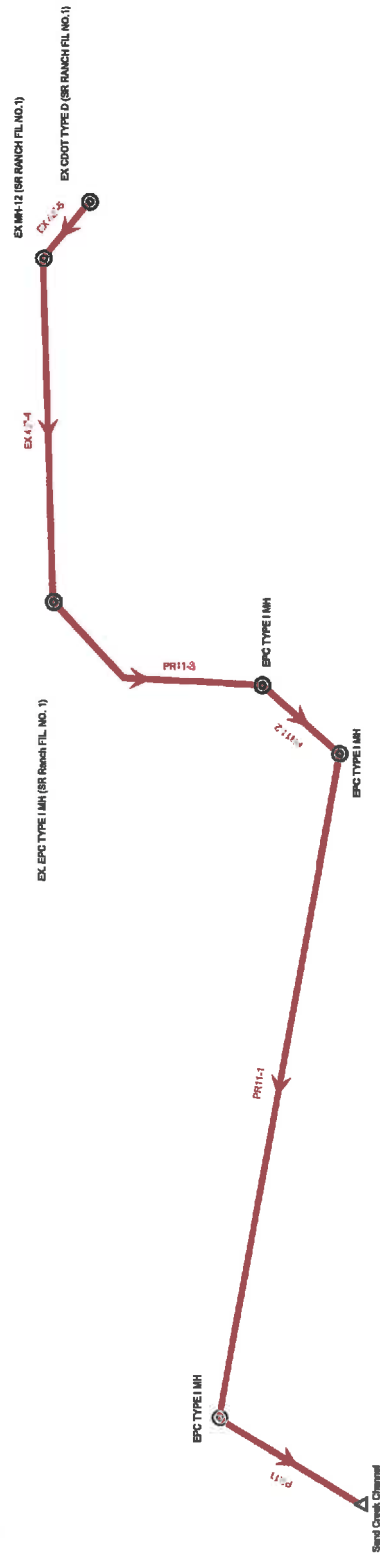
STORM 1 - 100 YR





Scenario: 100 yr

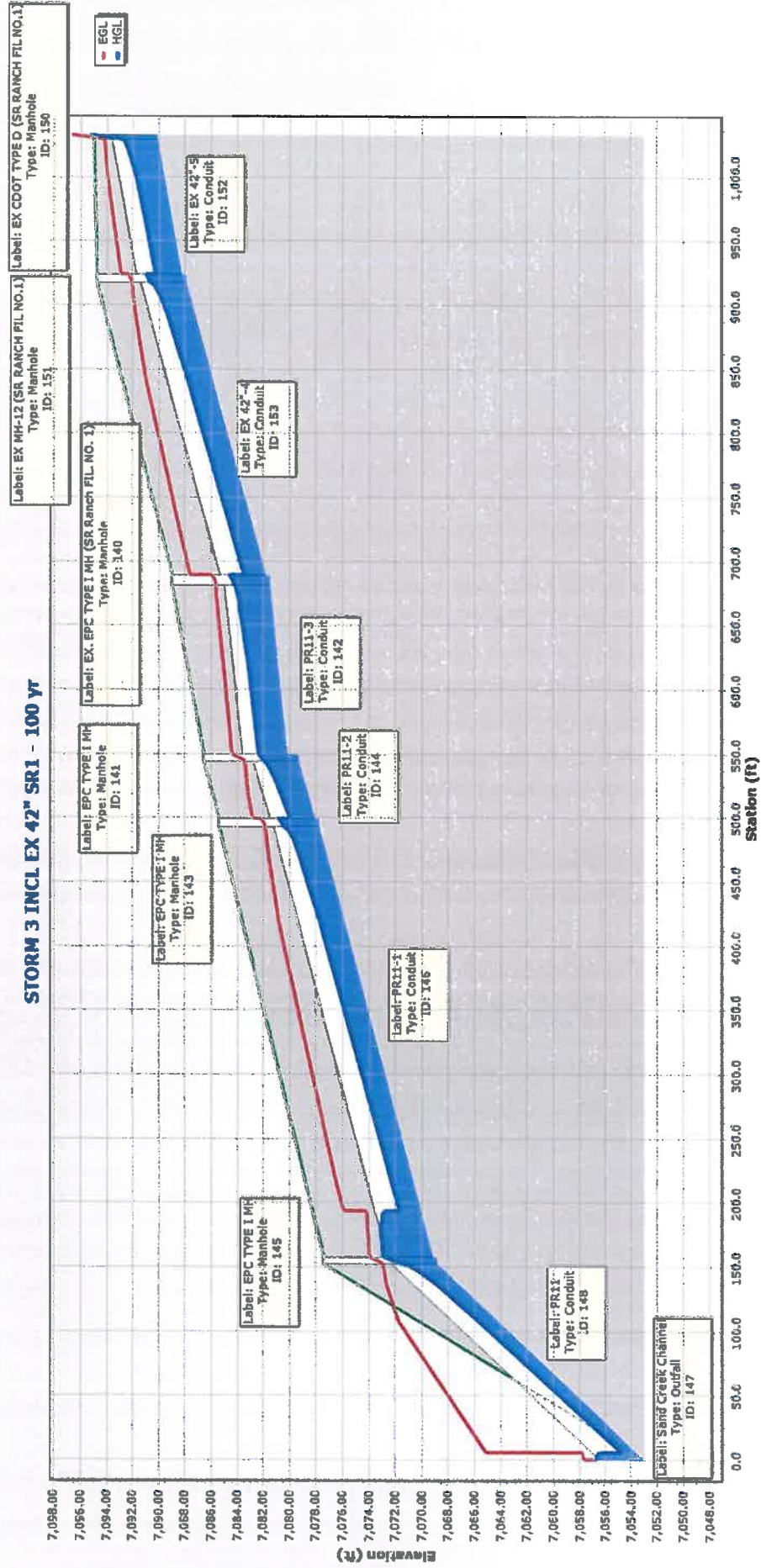
Storm 3 incl Ex42" SR1



Conduit FlexTable: Table - 1 STRM 3 INCL 42" SR1

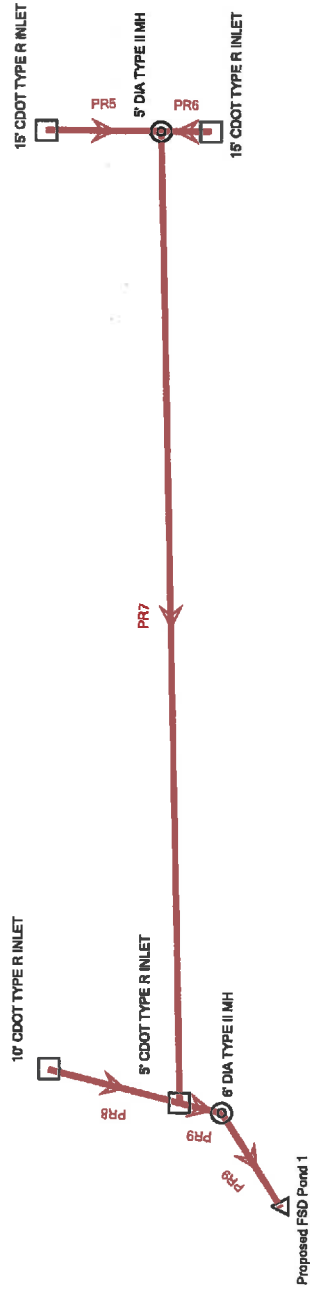
Label	Upstream Structure	Rise (ft)	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unifed) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)
PR11-3	EX. EPC TYPE I MH (SR Ranch FIL NO. 1)		76.80	76.4	138.4	11.50	1.432	2.29	2.74
PR11-2	EPC TYPE I MH		76.80	47.5	50.8	16.58	2.541	1.70	2.74
PR11-1	EPC TYPE I MH		76.80	48.1	341.2	16.43	2.507	1.71	2.74
PR11	EPC TYPE I MH		76.80	23.9	155.1	27.41	5.244	1.16	2.74
EX 42"-5	EX CDOT TYPE D (SR RANCH FIL NO.1)		76.80	58.8	110.4	14.12	1.992	1.93	2.74
EX 42"-4	EX MH-12 (SR RANCH FIL NO.1)		76.80	47.3	235.2	16.64	2.553	1.69	2.74
Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)	Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)
7,084.23	7,082.43	1.80	7,084.61	9.24	0.270	0.38	7,088.97	7,081.49	7,080.11
7,082.05	7,080.82	1.23	7,082.43	11.32	0.270	0.38	7,086.56	7,079.31	7,078.00
7,080.44	7,072.98	7.46	7,080.82	9.24	0.270	0.38	7,085.36	7,077.70	7,069.11
7,071.55	7,056.70	14.85	7,072.98	7.98	1.020	1.43	7,077.40	7,068.81	7,053.00
7,092.81	7,091.03	1.78	7,095.29	9.50	1.770	2.48	7,095.00	7,090.07	7,088.21
7,090.65	7,084.61	6.04	7,091.03	9.24	0.270	0.38	7,094.77	7,087.91	7,081.79

STORM 3 INCL EX 42" SR1 - 100 Yr



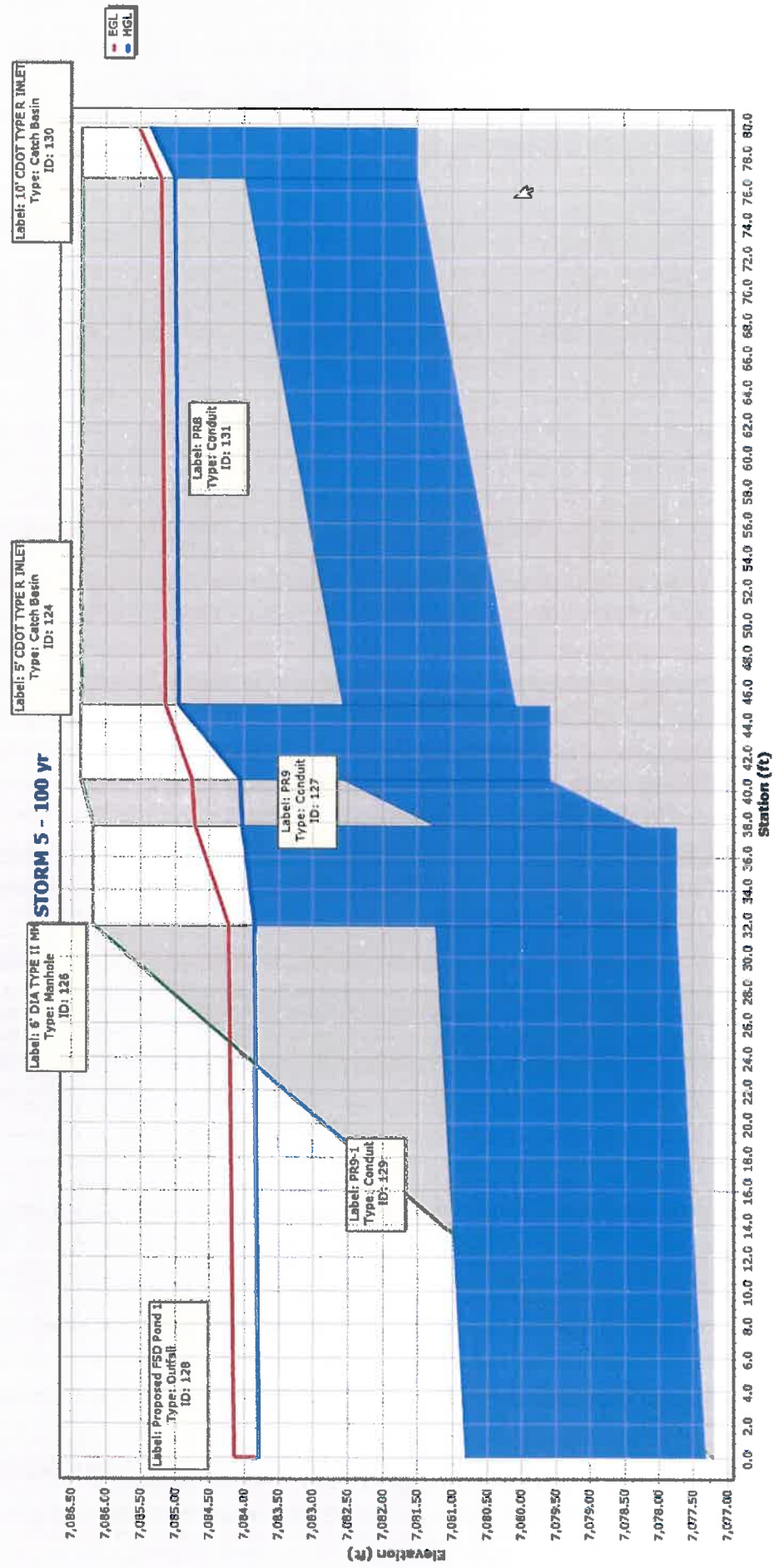
Scenario: 100 yr

STRM 5,6,7

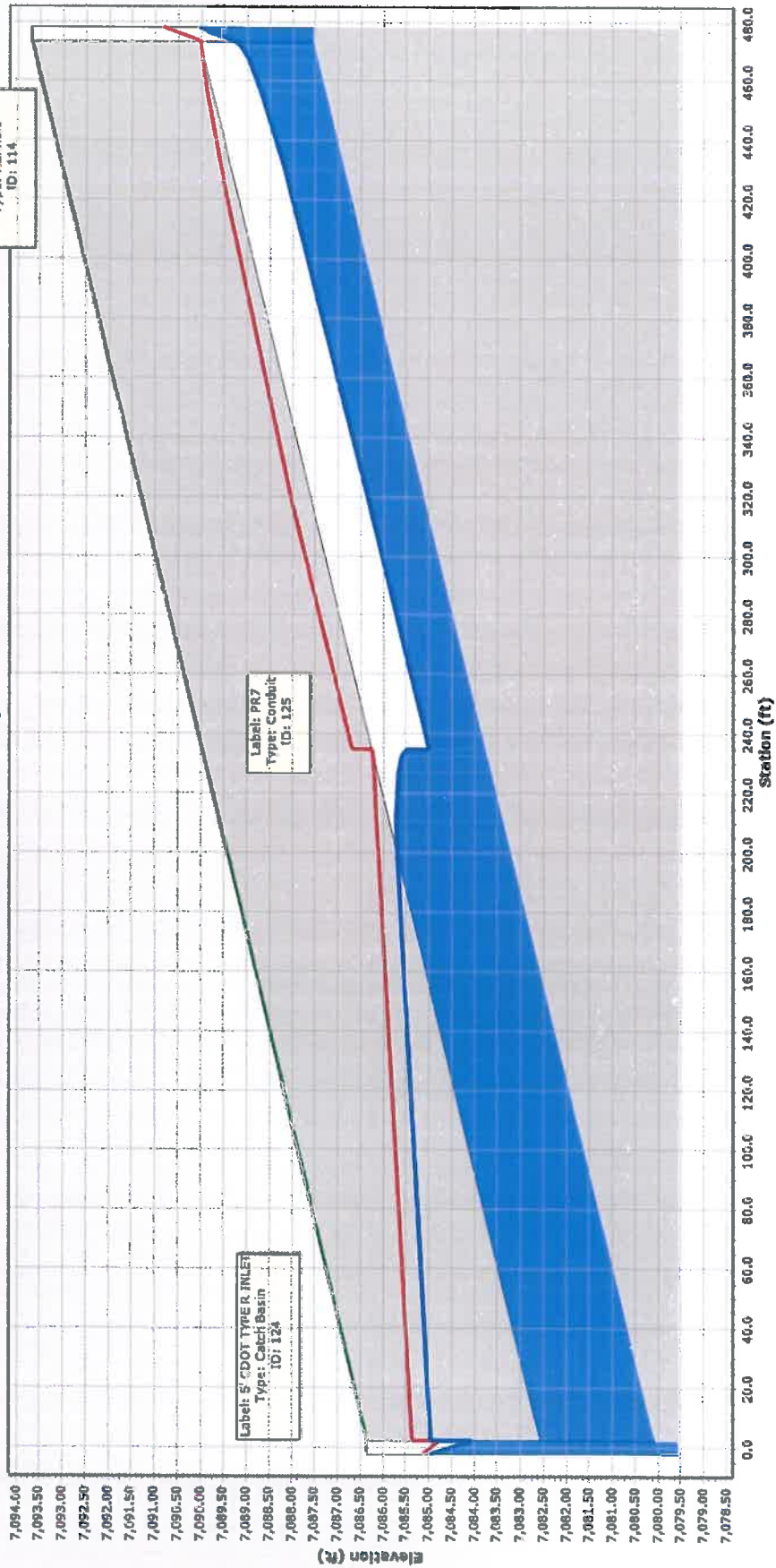


Conduit FlexTable: Table - 1 STRM 5,6,7

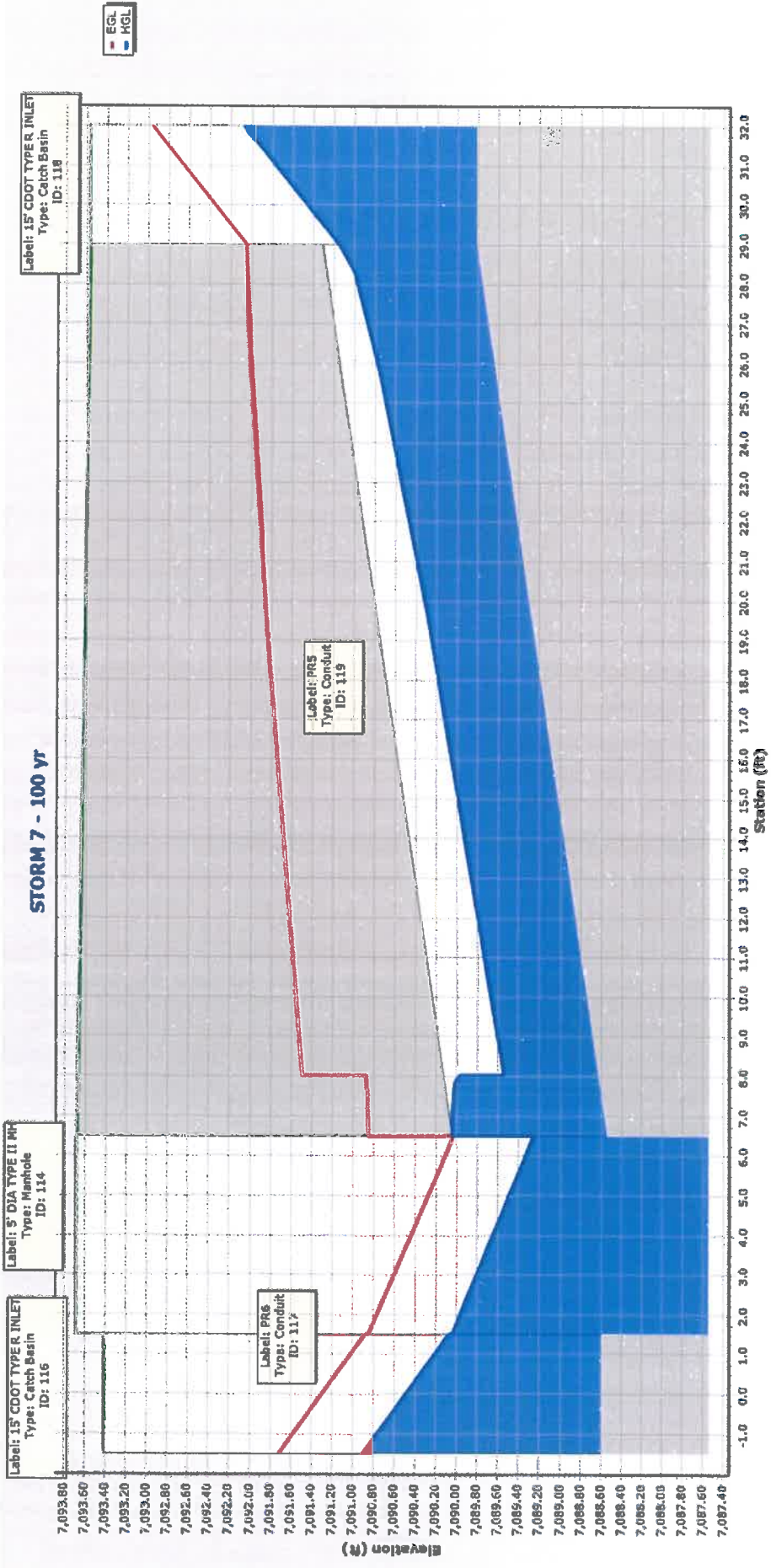
Label	Upstream Structure	Rise (ft)	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)
PR6	15' CDOT TYPE R INLET		12.70	85.5	2.5	7.19	1.674	1.07	1.34
PR5	15' CDOT TYPE R INLET		12.70	55.2	26.5	13.34	2.948	0.80	1.34
PR7	5' DIA TYPE II MH		25.30	49.2	475.5	10.43	1.867	1.24	1.71
PR9	5' CDOT TYPE R INLET		47.10	17.3	8.0	6.66	6.560	0.84	2.24
PR9-1	6' DIA TYPE II MH		47.10	42.6	34.9	4.90	1.755	1.60	2.14
PR8	10' CDOT TYPE R INLET		17.20	20.9	35.4	3.50	3.114	0.78	1.40
Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)	Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)
7,090.47	7,090.43	0.04	7,091.28	7.19	1.020	0.82	7,093.41	7,088.59	7,088.54
7,091.15	7,090.43	0.72	7,092.07	7.62	1.020	0.92	7,093.57	7,089.81	7,088.54
7,089.25	7,084.94	4.31	7,090.43	7.19	1.520	1.17	7,093.68	7,087.54	7,080.07
7,084.06	7,084.02	0.04	7,084.94	3.50	1.280	0.88	7,086.36	7,079.57	7,078.23
7,083.85	7,083.77	0.08	7,084.02	6.66	0.470	0.18	7,086.18	7,077.73	7,077.31
7,085.01	7,084.94	0.06	7,085.34	3.50	1.770	0.34	7,086.34	7,081.49	7,080.07



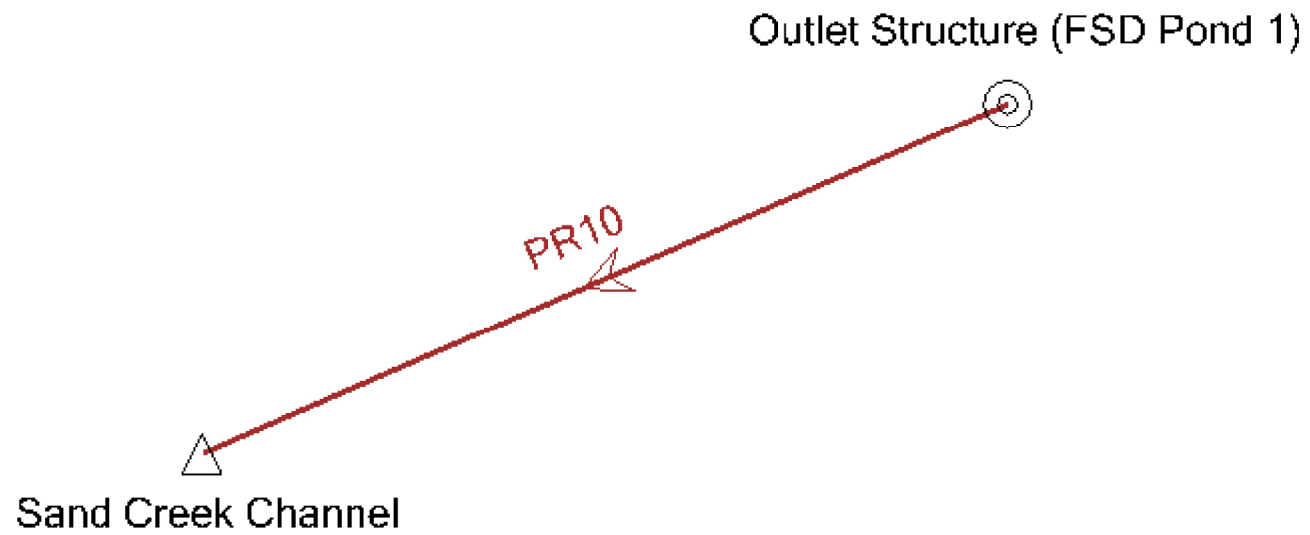
STORM 6 - 100 YR



STORM 7 - 100 Yr



STRM 4 POND 1 OUTFALL INDEX MAP



Conduit FlexTable: STRM 4 POND 1 7-30-19

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)
PR10	129	Outlet Structure (FSD Pond 1)	23.50	40.3	78.2	17.56	3.772	0.88	1.72	7,078.68	7,074.39	7,077.64	7,069.91	7.73	7,079.20
Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)										
8.17	1.500	1.56	7,083.40	7,075.92	7,069.00										

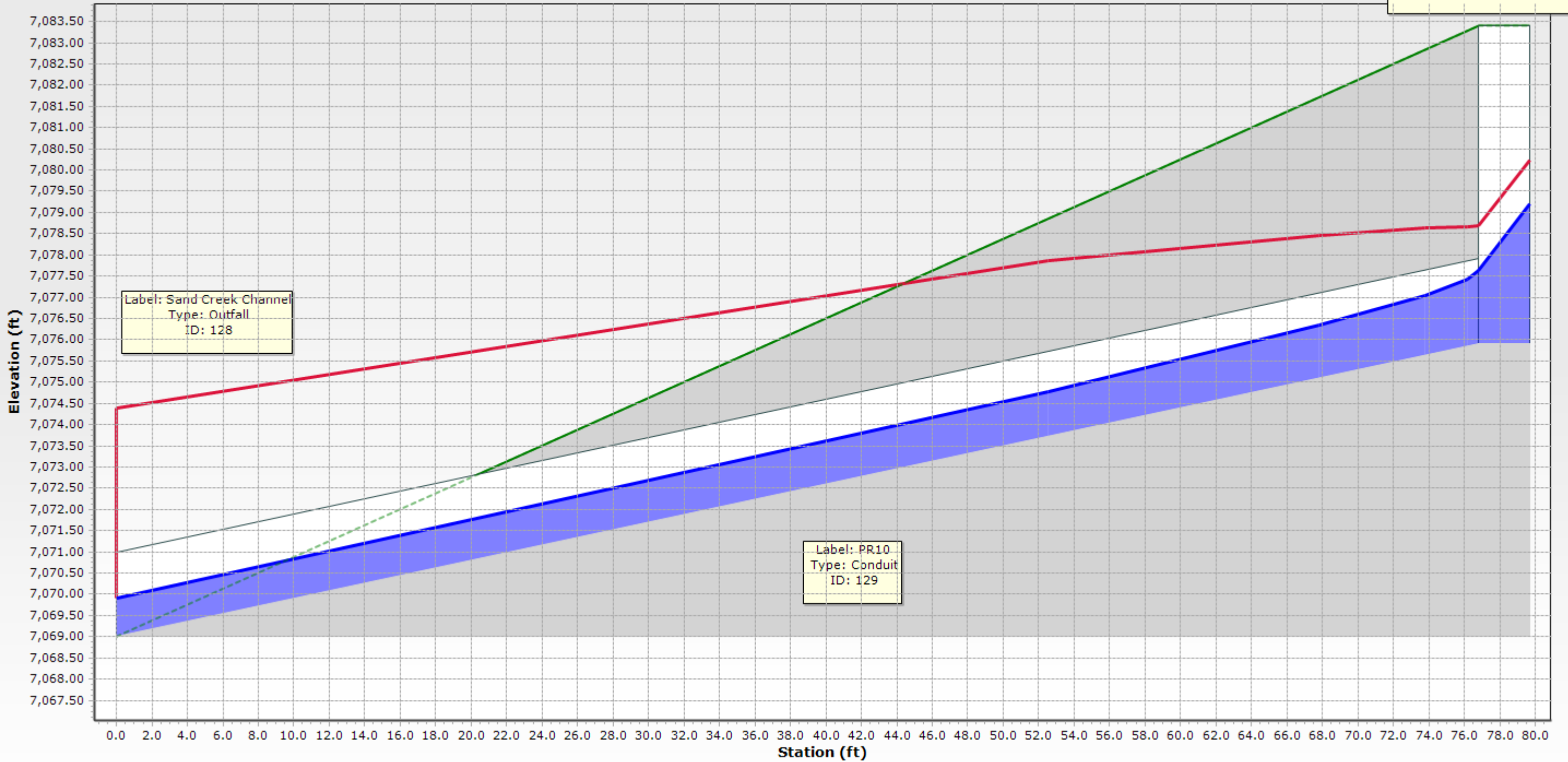
STORM 4 - 100 yr

Label: Outlet Structure (FSD Pond 1)
Type: Manhole
ID: 126

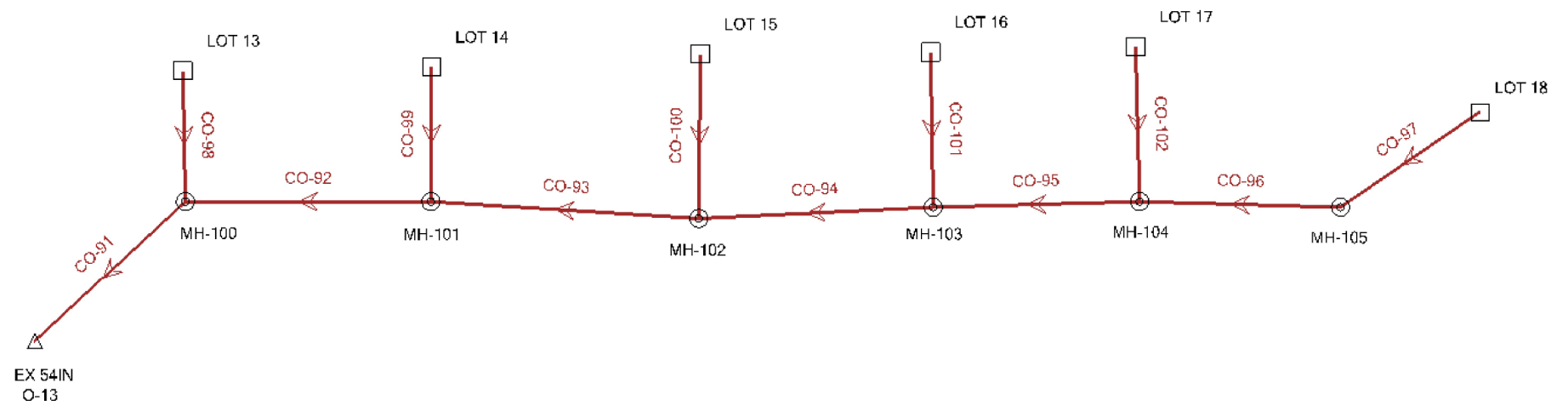
EGL
HGL

Label: Sand Creek Channel
Type: Outfall
ID: 128

Label: PR10
Type: Conduit
ID: 129



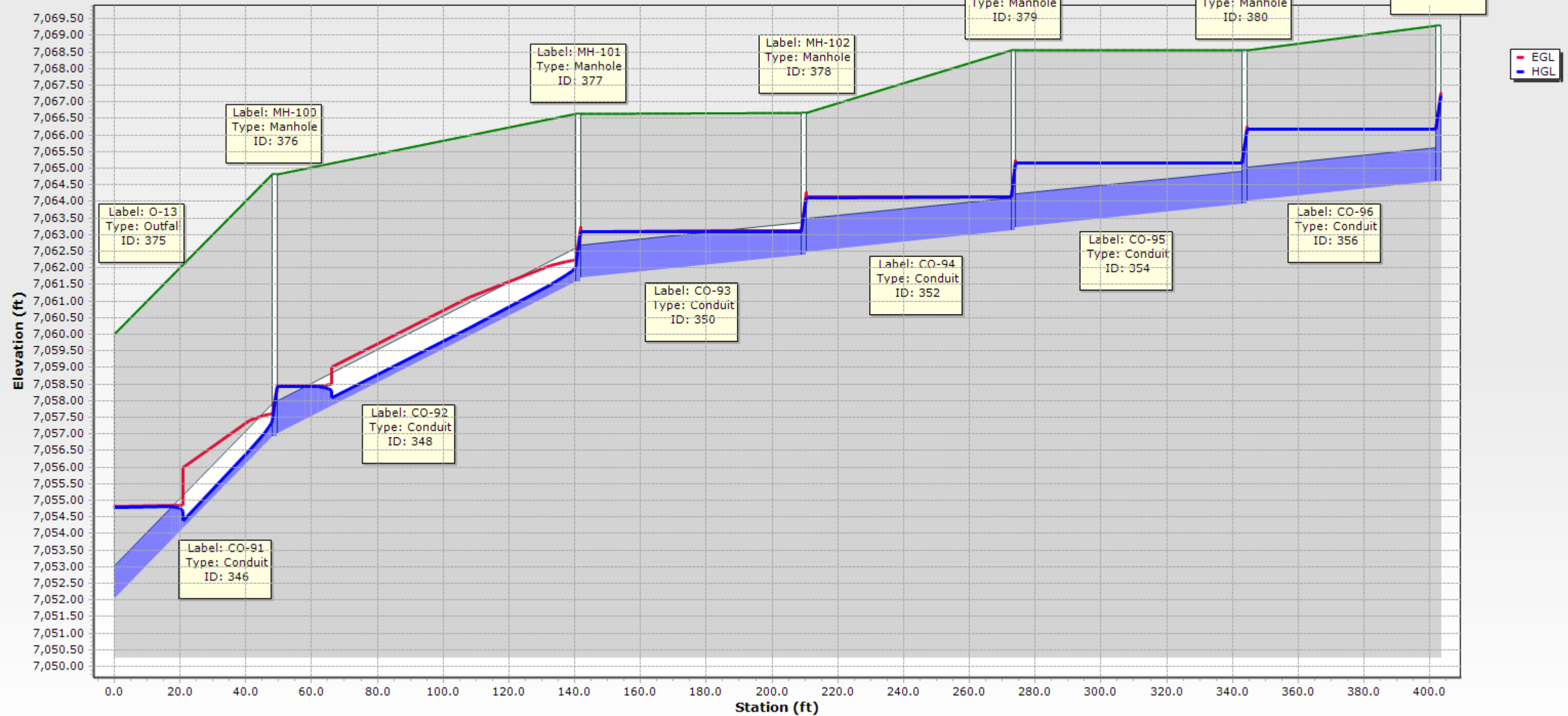
LOTS 13-18 INDEX MAP



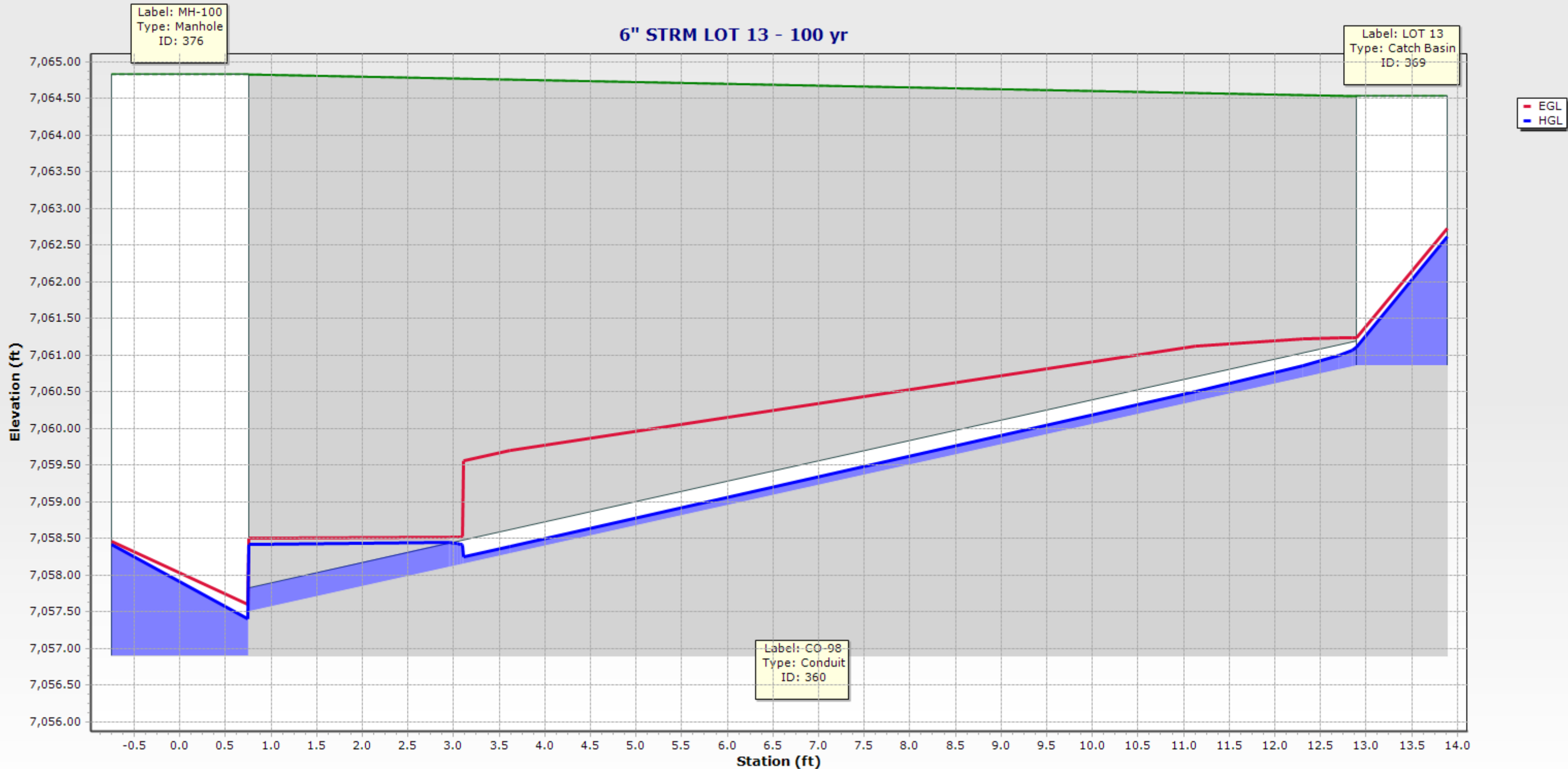
Conduit FlexTable: LOTS 13-18

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)
CO-91	346	MH-100	1.40	11.5	48.7	10.34	4.544	0.23	0.50	7,057.60	7,054.83	7,057.40	7,054.78	2.62	7,057.60
CO-92	348	MH-101	1.20	14.0	92.5	7.71	3.213	0.25	0.46	7,062.23	7,057.69	7,062.05	7,057.60	4.45	7,062.23
CO-93	350	MH-102	0.90	23.2	68.5	4.02	1.450	0.33	0.40	7,062.93	7,062.30	7,062.78	7,062.23	0.54	7,062.93
CO-94	352	MH-103	0.60	15.5	63.7	3.58	1.447	0.27	0.32	7,063.56	7,062.98	7,063.44	7,062.93	0.51	7,063.56
CO-95	354	MH-104	0.40	10.4	70.3	3.17	1.431	0.22	0.26	7,064.27	7,063.61	7,064.18	7,063.56	0.62	7,064.28
CO-96	356	MH-105	0.20	5.2	59.0	2.59	1.396	0.15	0.18	7,064.86	7,064.30	7,064.79	7,064.28	0.52	7,064.86
CO-97	358	LOT 18	0.20	12.4	17.3	5.60	3.407	0.12	0.22	7,066.74	7,065.82	7,066.65	7,065.33	1.33	7,066.78
CO-98	360	LOT 13	0.20	19.4	13.4	9.18	6.057	0.10	0.25	7,061.24	7,058.91	7,061.11	7,057.60	3.51	7,061.30
CO-99	362	LOT 14	0.30	22.9	11.4	5.41	2.775	0.16	0.28	7,063.11	7,062.78	7,063.00	7,062.36	0.64	7,063.17
CO-100	364	LOT 15	0.30	35.6	11.4	3.94	1.763	0.21	0.28	7,063.59	7,063.42	7,063.48	7,063.19	0.29	7,063.65
CO-101	366	LOT 16	0.20	9.3	11.4	6.86	4.501	0.10	0.22	7,065.46	7,064.55	7,065.37	7,063.82	1.55	7,065.50
CO-102	368	LOT 17	0.20	9.1	11.4	6.94	4.577	0.10	0.22	7,066.31	7,065.37	7,066.22	7,064.62	1.60	7,066.35
Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)										
9.18	1.020	0.20	7,060.00	7,052.03	7,056.90										
2.06	1.020	0.18	7,064.83	7,057.00	7,061.59										
1.75	1.020	0.15	7,066.63	7,061.69	7,062.38										
1.69	1.020	0.12	7,066.67	7,062.48	7,063.12										
1.26	1.020	0.09	7,068.56	7,063.22	7,063.92										
5.60	1.020	0.06	7,068.56	7,064.02	7,064.61										
2.35	1.500	0.13	7,069.29	7,065.21	7,066.43										
2.82	1.500	0.19	7,064.83	7,057.50	7,060.86										
2.69	1.500	0.17	7,066.63	7,062.19	7,062.72										
2.69	1.500	0.17	7,066.67	7,062.98	7,063.20										
2.35	1.500	0.13	7,068.56	7,063.72	7,065.15										
2.35	1.500	0.13	7,068.56	7,064.52	7,066.00										

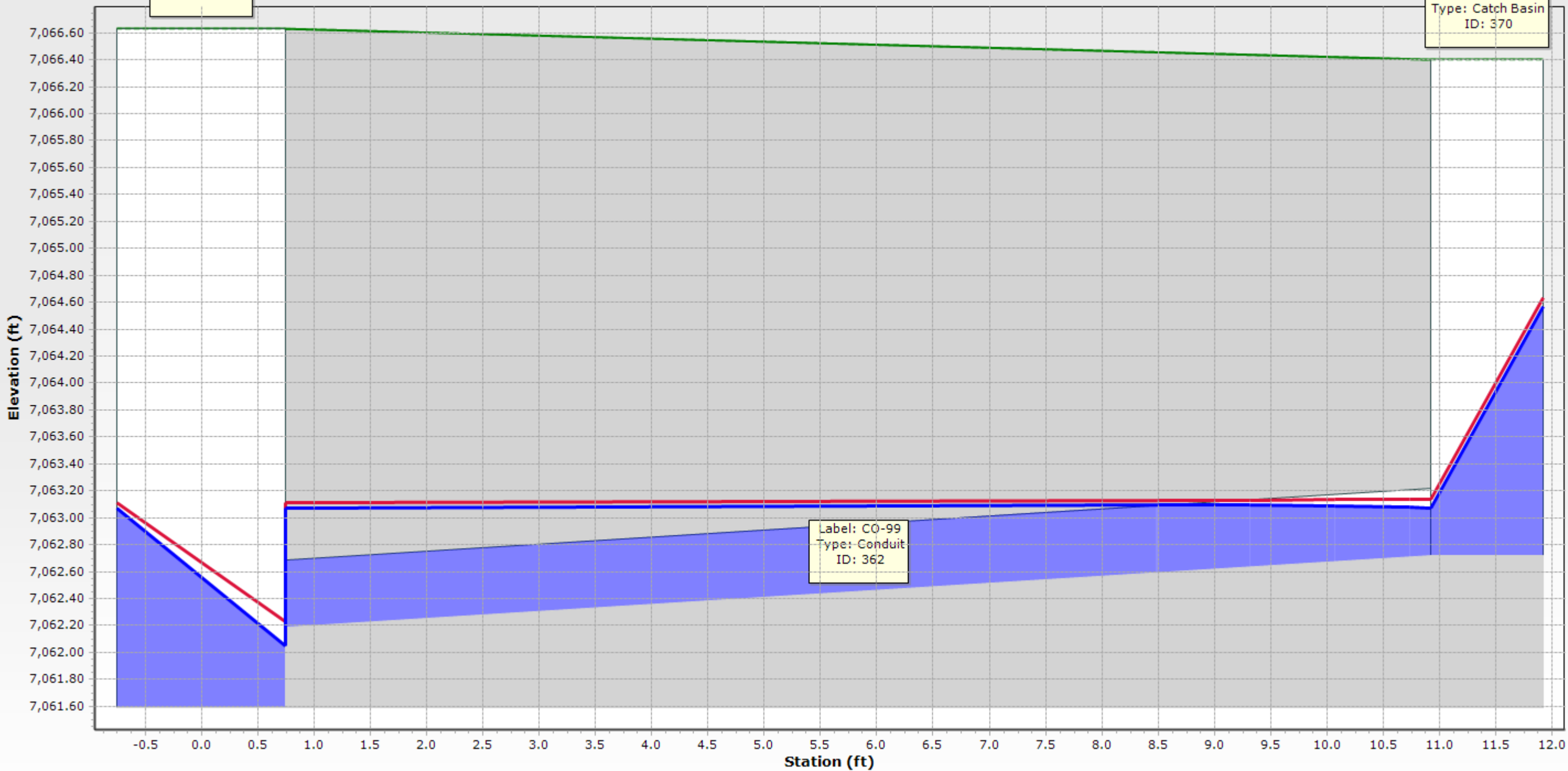
12" STRM LOTS 13-18 - 100 yr



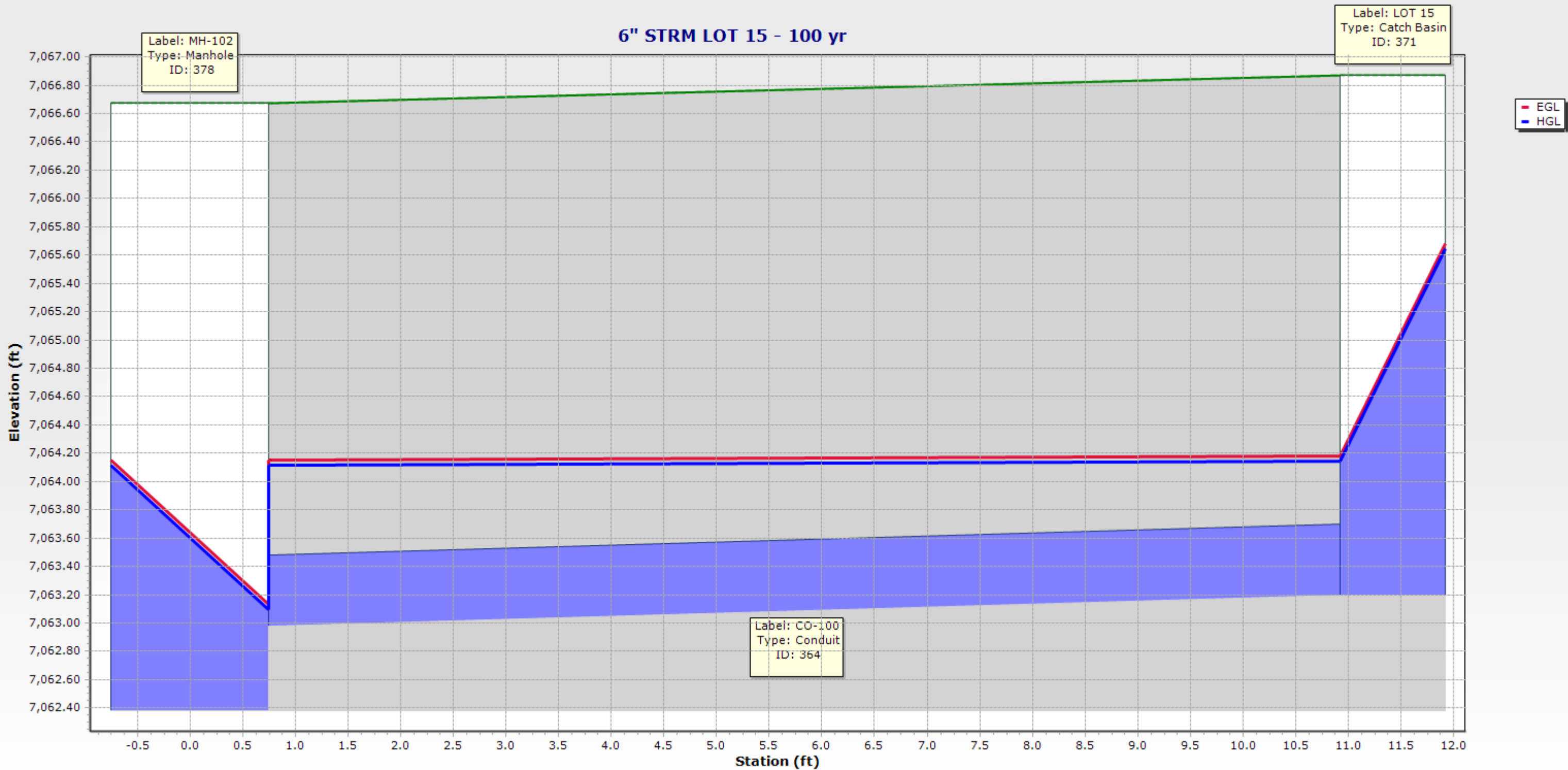
6" STRM LOT 13 - 100 yr



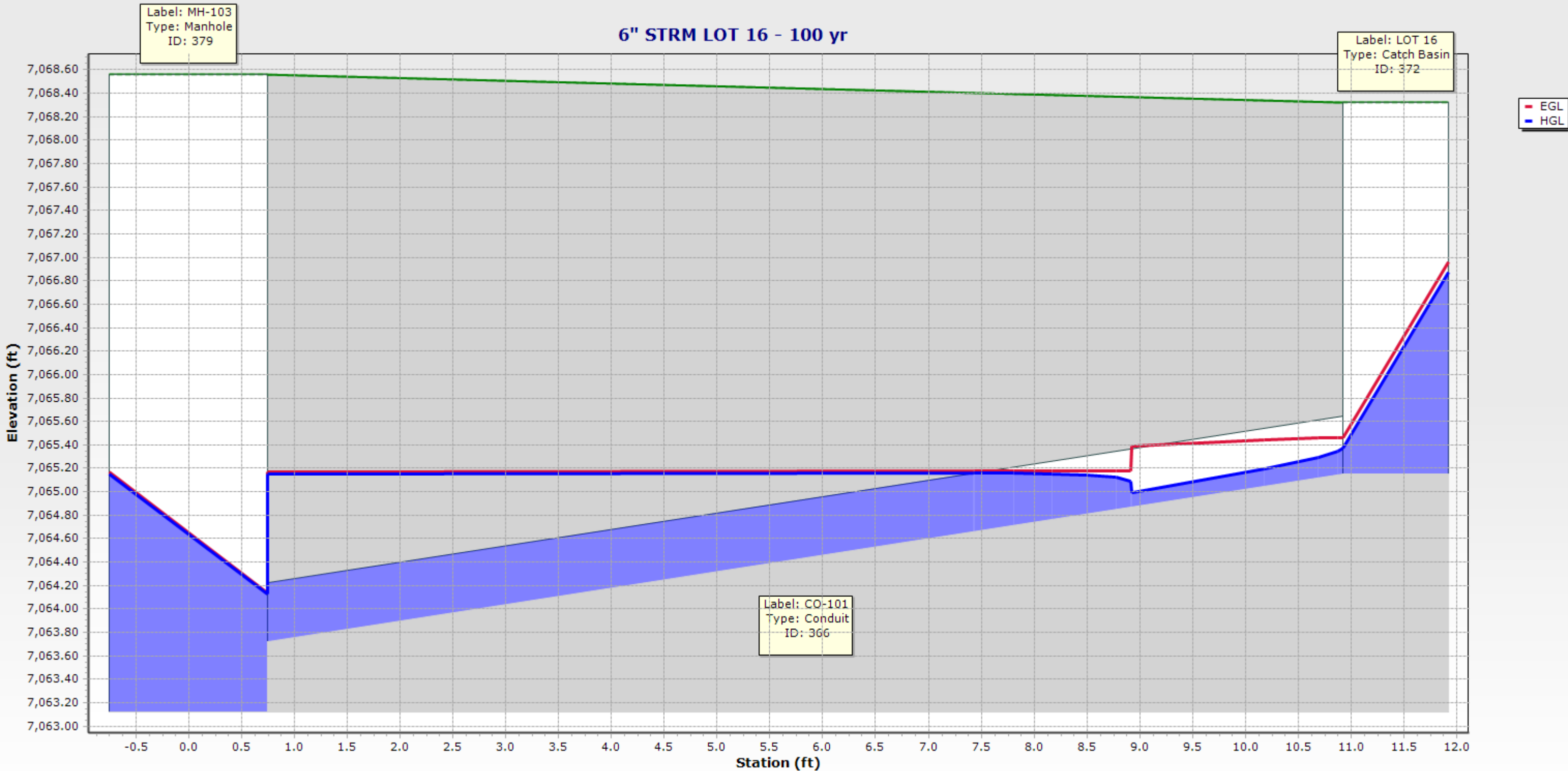
6" STRM LOT 14 - 100 yr



6" STRM LOT 15 - 100 yr



6" STRM LOT 16 - 100 yr



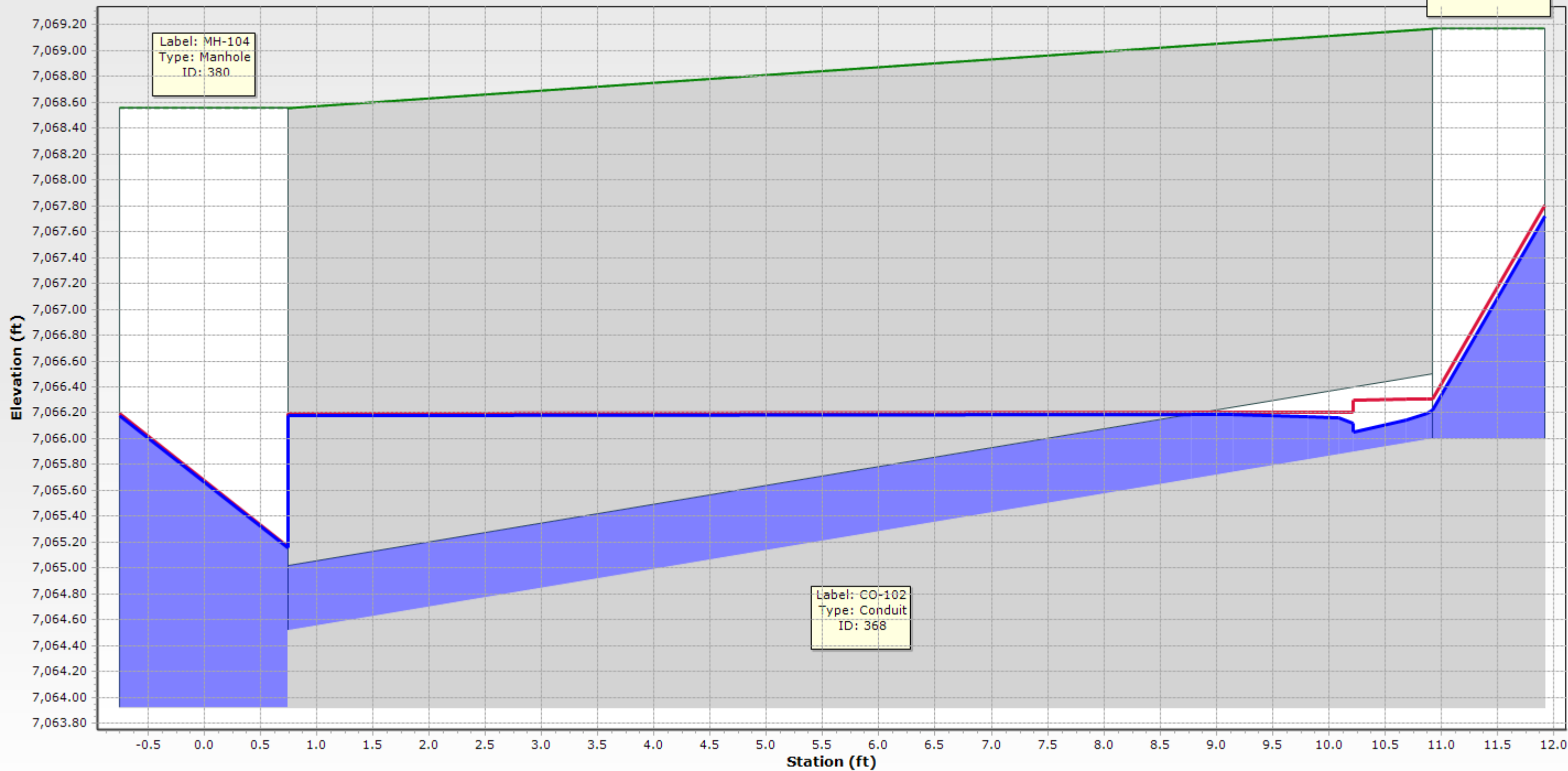
6" STRM LOT 17 - 100 yr

Label: LOT 17
Type: Catch Basin
ID: 373

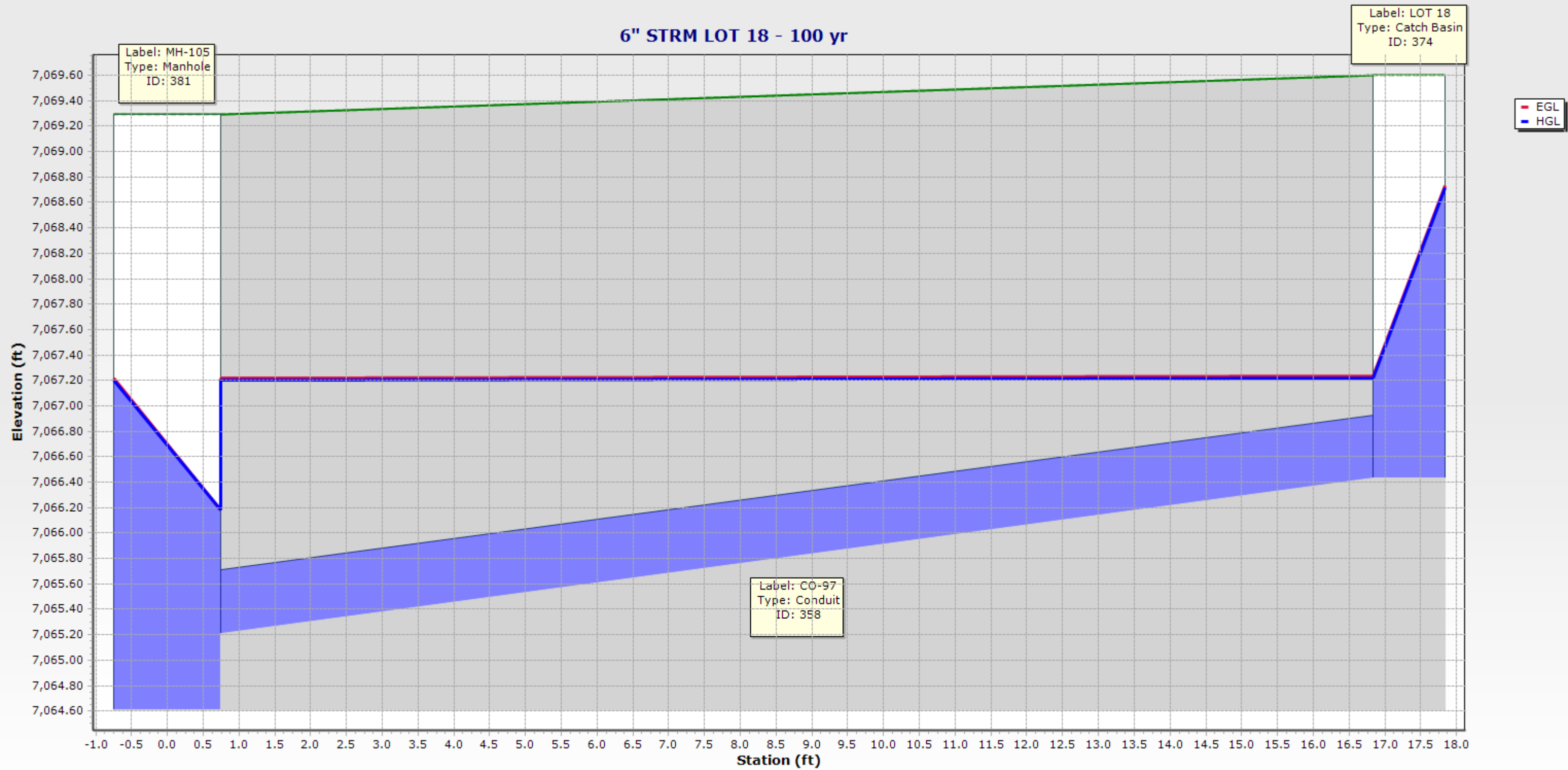
Label: MH-104
Type: Manhole
ID: 380

Label: CO-102
Type: Conduit
ID: 368

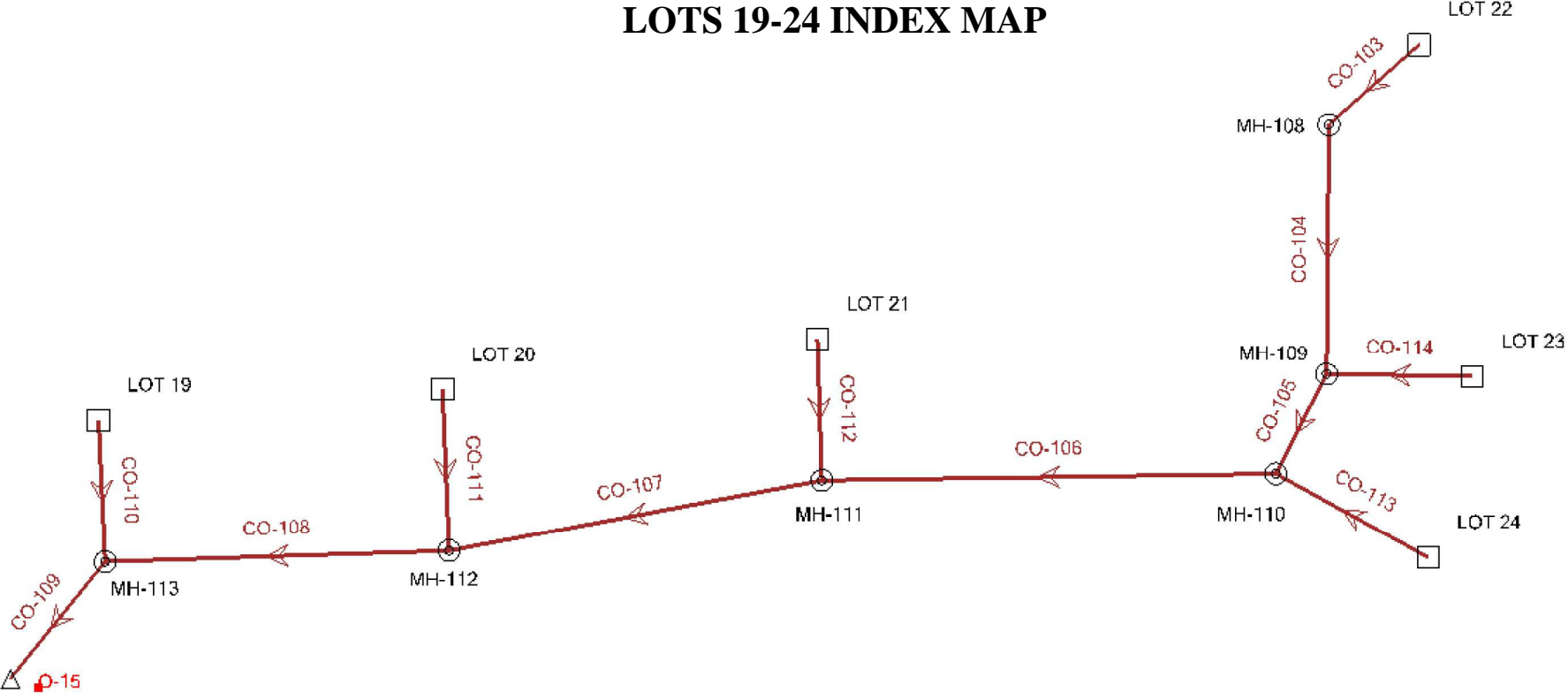
EGL
HGL



6" STRM LOT 18 - 100 yr



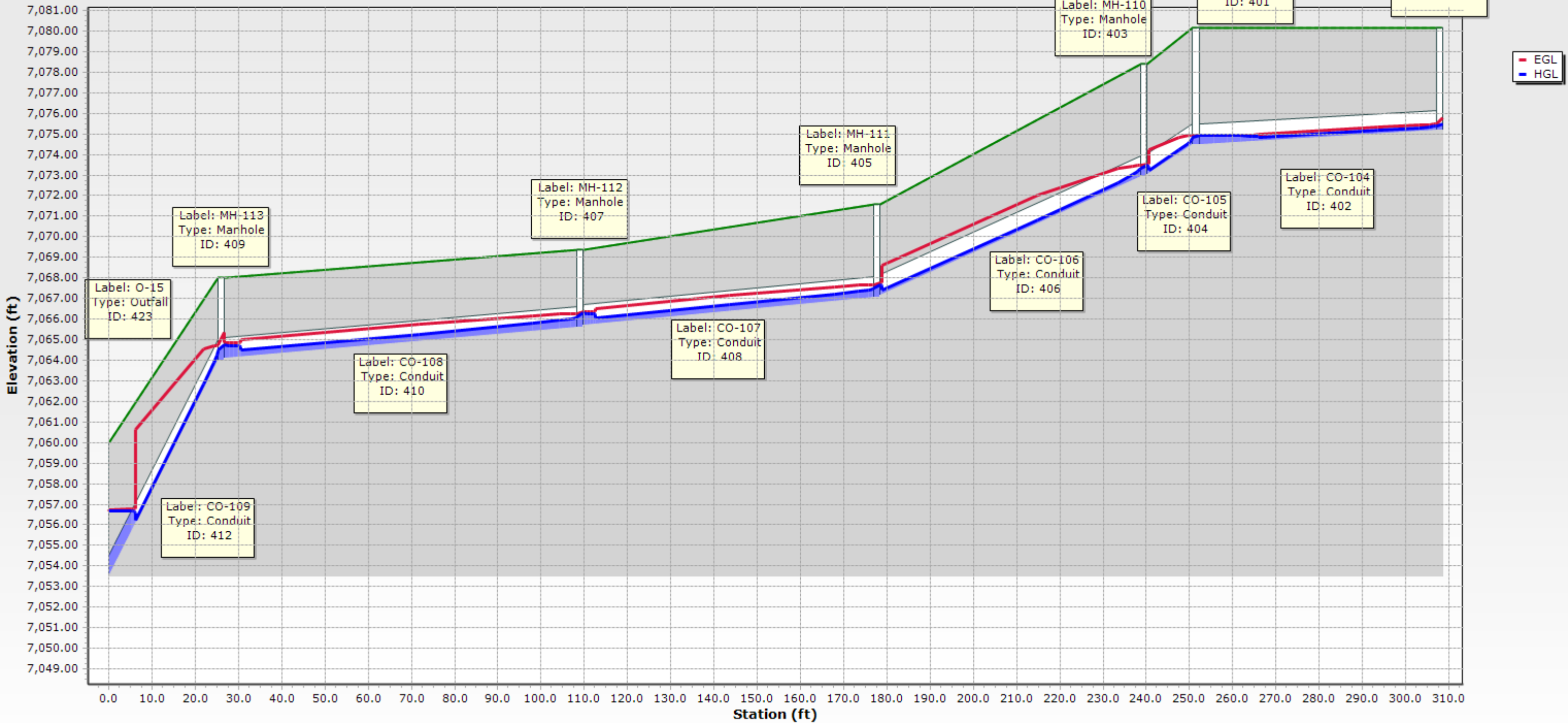
LOTS 19-24 INDEX MAP



Conduit FlexTable: LOTS 19-24

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)
CO-103	400	LOT 22	0.30	26.4	8.3	4.87	2.391	0.18	0.28	7,076.34	7,076.16	7,076.23	7,075.85	0.38	7,077.73
CO-104	402	MH-108	0.30	7.1	56.4	3.10	1.543	0.18	0.23	7,075.46	7,074.94	7,075.39	7,074.93	0.45	7,075.47
CO-105	404	MH-109	0.60	4.4	12.0	8.64	4.839	0.14	0.32	7,074.93	7,073.52	7,074.81	7,073.47	1.34	7,074.93
CO-106	406	MH-110	0.90	7.6	61.7	8.88	4.338	0.19	0.40	7,073.47	7,067.75	7,073.32	7,067.67	5.64	7,073.47
CO-107	408	MH-111	1.10	20.3	68.8	5.40	2.026	0.31	0.44	7,067.67	7,066.37	7,067.50	7,066.28	1.22	7,067.67
CO-108	410	MH-112	1.30	25.0	82.9	5.51	1.946	0.34	0.48	7,066.28	7,064.83	7,066.09	7,064.73	1.36	7,066.28
CO-109	412	MH-113	1.50	6.1	26.1	17.27	8.934	0.17	0.52	7,064.73	7,056.75	7,064.52	7,056.69	7.83	7,064.73
CO-110	414	LOT 19	0.20	1.4	11.3	6.41	4.758	0.08	0.18	7,066.60	7,065.32	7,066.53	7,064.68	1.85	7,066.63
CO-111	416	LOT 20	0.20	24.0	12.8	3.49	1.763	0.17	0.22	7,066.76	7,066.56	7,066.67	7,066.38	0.30	7,066.80
CO-112	418	LOT 21	0.20	24.0	12.7	3.49	1.768	0.17	0.22	7,068.21	7,068.02	7,068.12	7,067.83	0.30	7,068.25
CO-113	420	LOT 24	0.30	39.5	19.2	3.64	1.576	0.22	0.28	7,074.21	7,073.94	7,074.10	7,073.74	0.36	7,074.27
CO-114	422	LOT 23	0.30	11.2	4.6	8.98	5.603	0.11	0.28	7,076.36	7,076.07	7,076.25	7,075.22	1.03	7,076.42
Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)										
2.69	1.000	1.50	7,079.62	7,075.95	7,075.66										
4.53	1.020	0.08	7,080.13	7,075.16	7,074.49										
0.90	1.020	0.12	7,080.15	7,074.49	7,073.02										
1.75	1.020	0.15	7,078.40	7,072.92	7,067.16										
2.22	1.020	0.17	7,071.56	7,067.06	7,065.71										
2.36	1.020	0.19	7,069.39	7,065.61	7,064.10										
6.41	1.020	0.21	7,068.00	7,064.00	7,053.50										
2.02	1.500	0.10	7,069.52	7,066.35	7,064.60										
2.35	1.500	0.13	7,069.62	7,066.45	7,066.21										
2.35	1.500	0.13	7,071.57	7,067.90	7,067.66										
2.69	1.500	0.17	7,077.49	7,073.82	7,073.52										
2.69	1.500	0.17	7,079.64	7,075.97	7,075.09										

12" STRM LOTS19-24 - 100 yr



6" STRM LOT 19 - 100 yr

Label: LOT 19
Type: Catch Basin
ID: 424

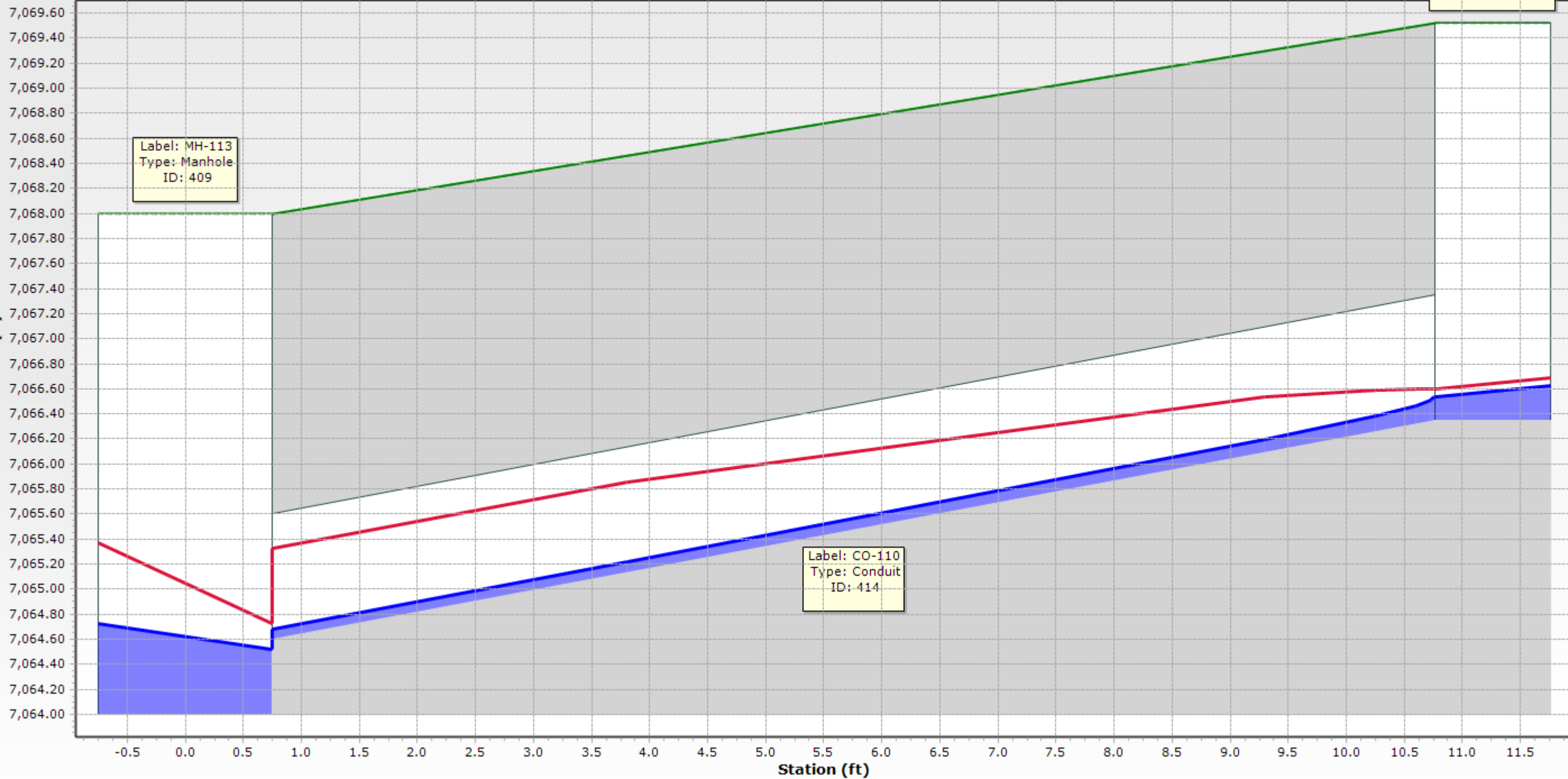
EGL
HGL

Label: MH-113
Type: Manhole
ID: 409

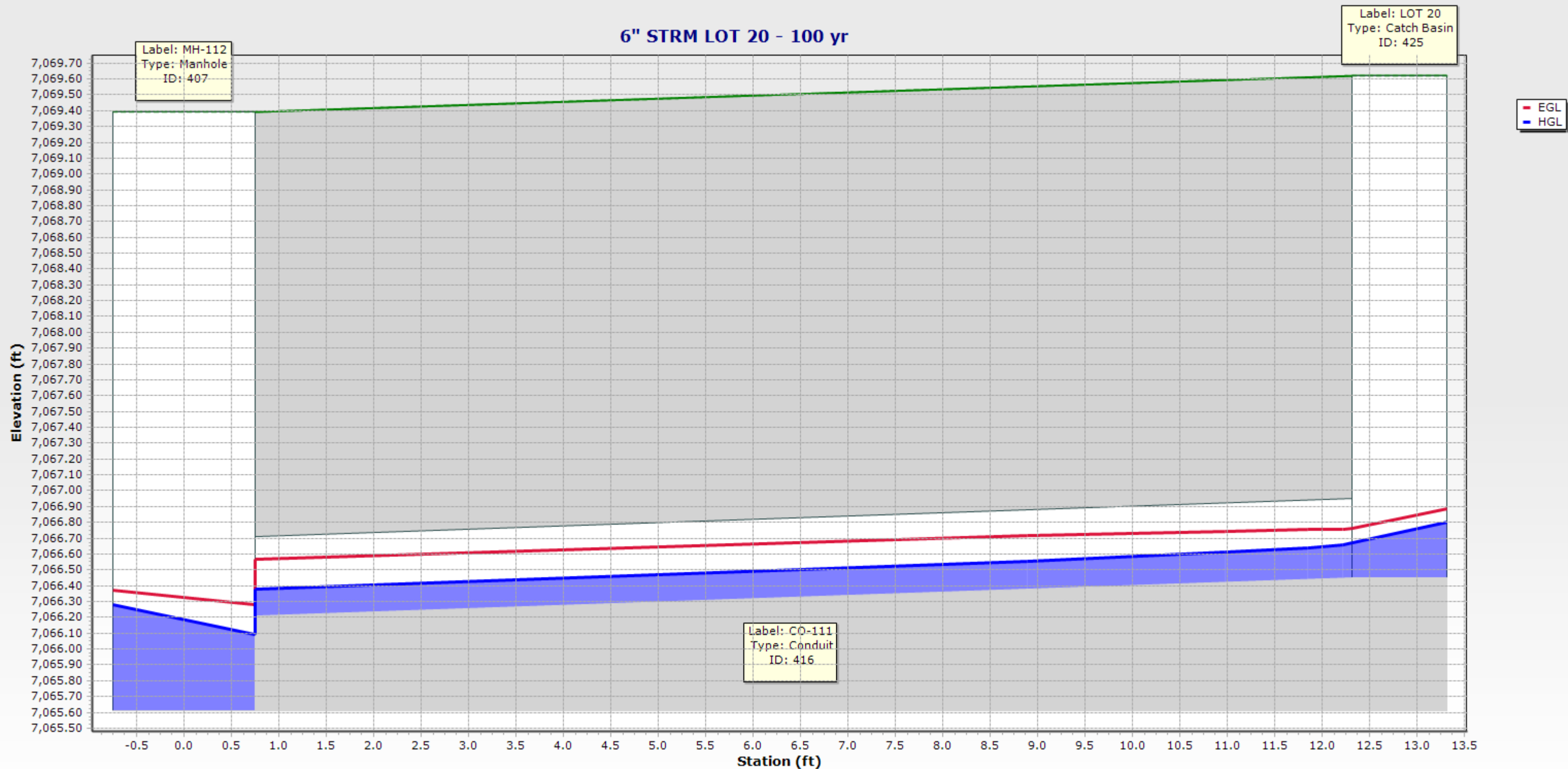
Label: CO-110
Type: Conduit
ID: 414

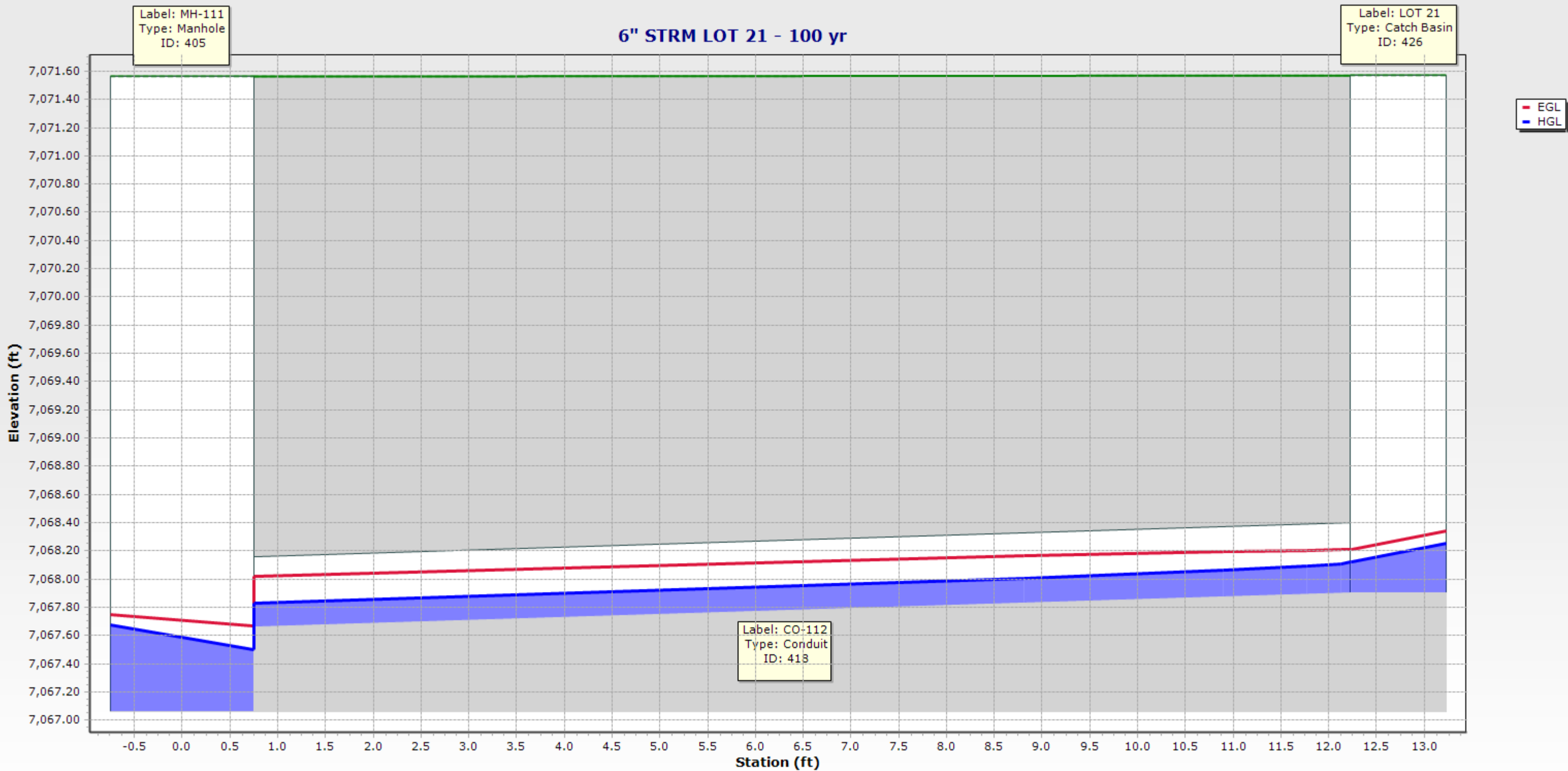
Elevation (ft)

Station (ft)

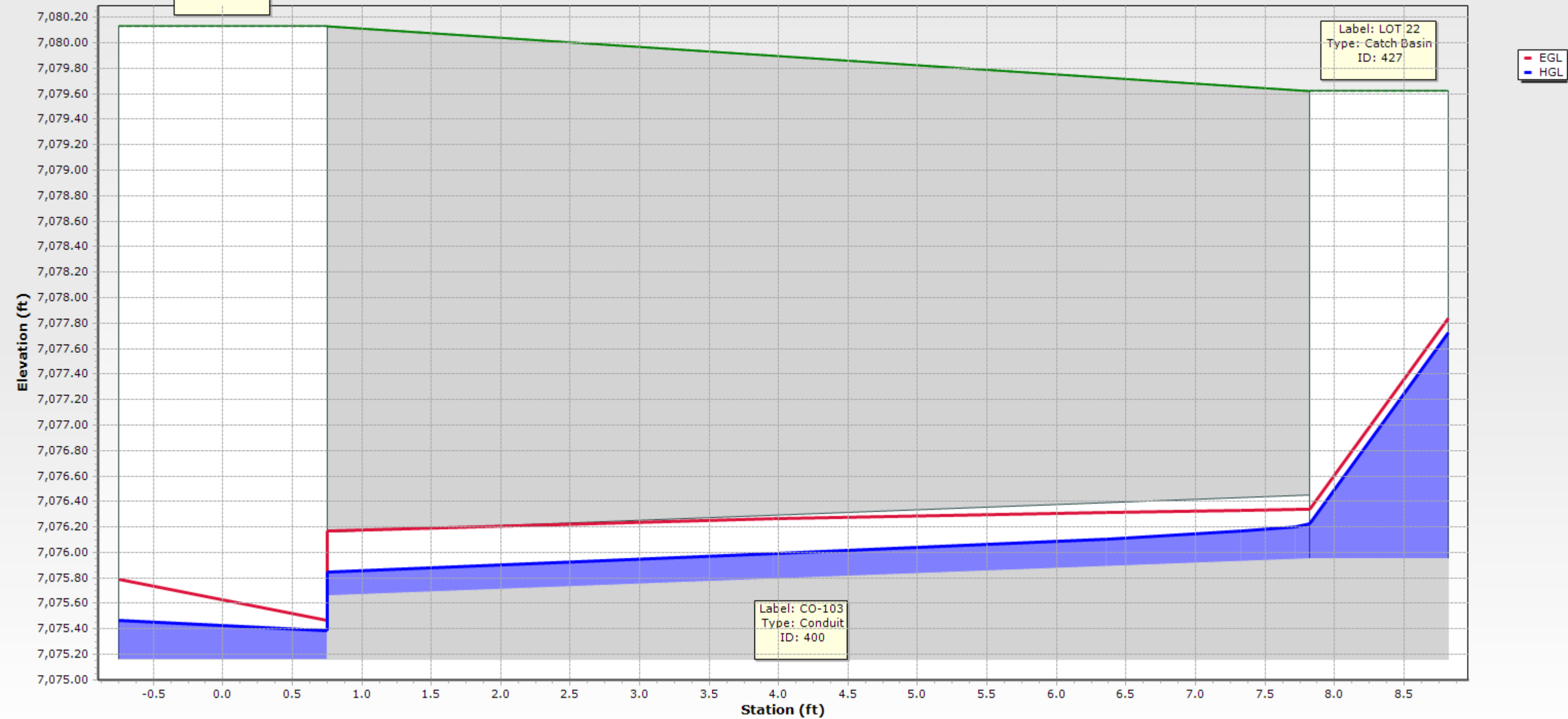


6" STRM LOT 20 - 100 yr





6" STRM LOT 22 - 100 yr



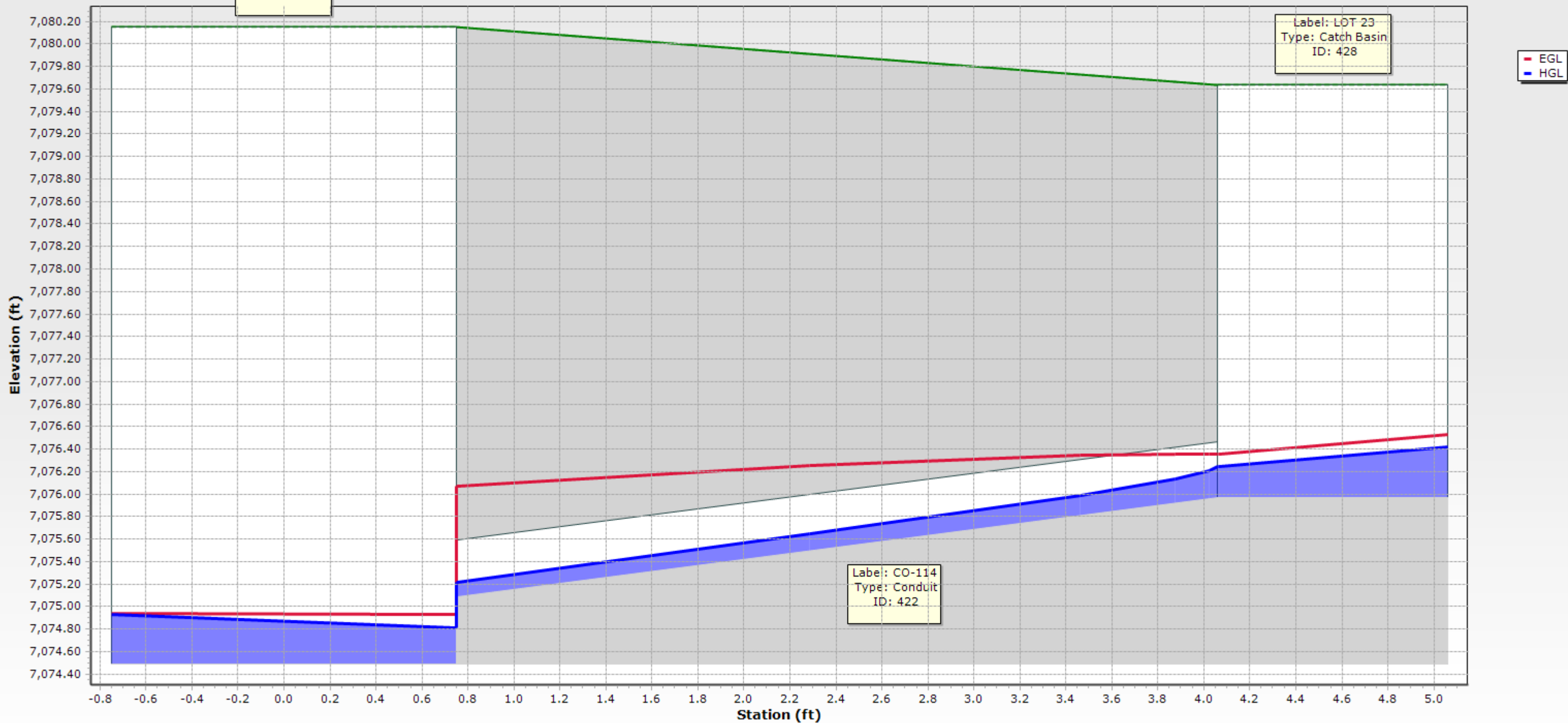
6" STRM LOT 23 - 100 yr

Label: MH-109
Type: Manhole
ID: 401

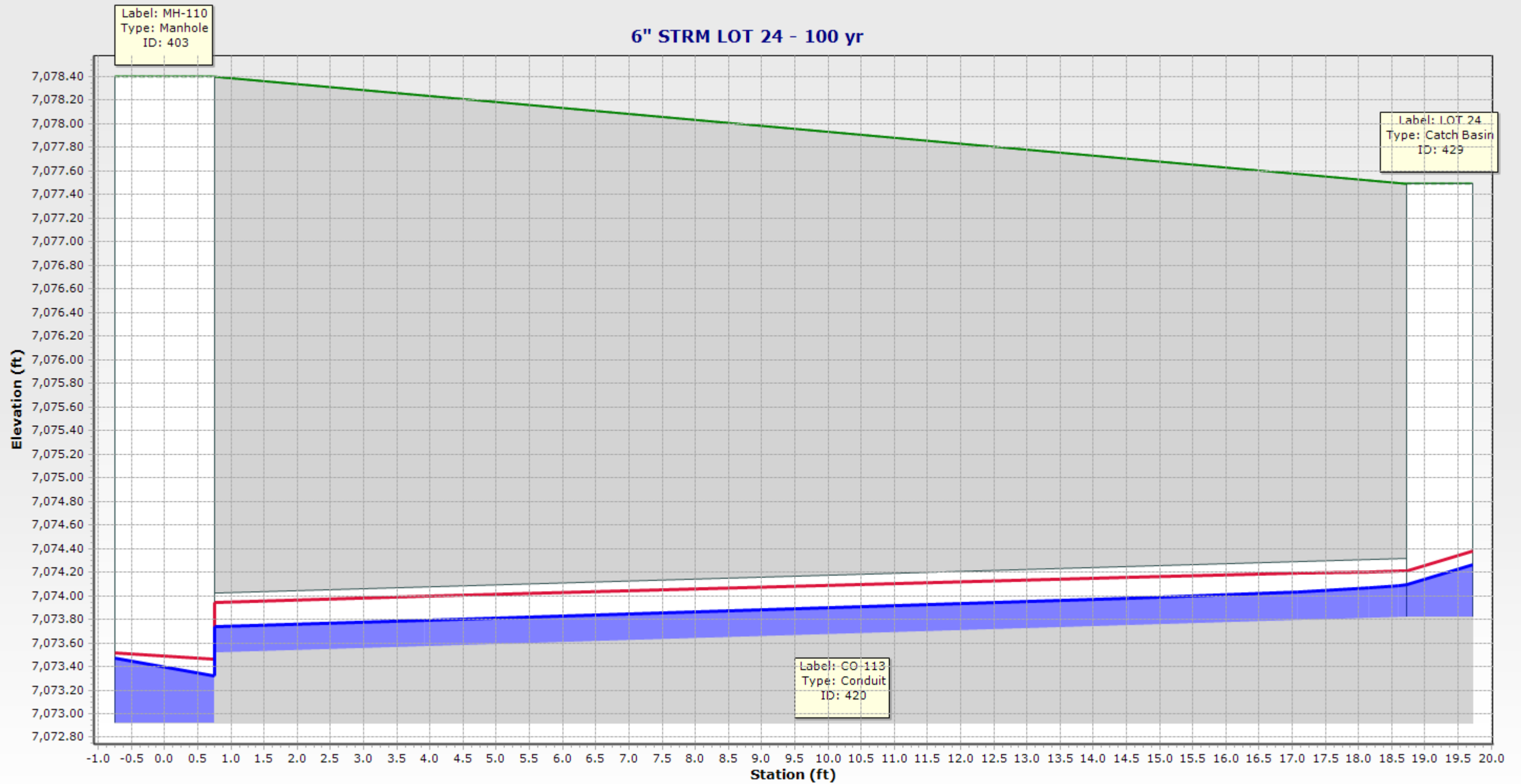
Label: LOT-23
Type: Catch Basin
ID: 428

EGL
HGL

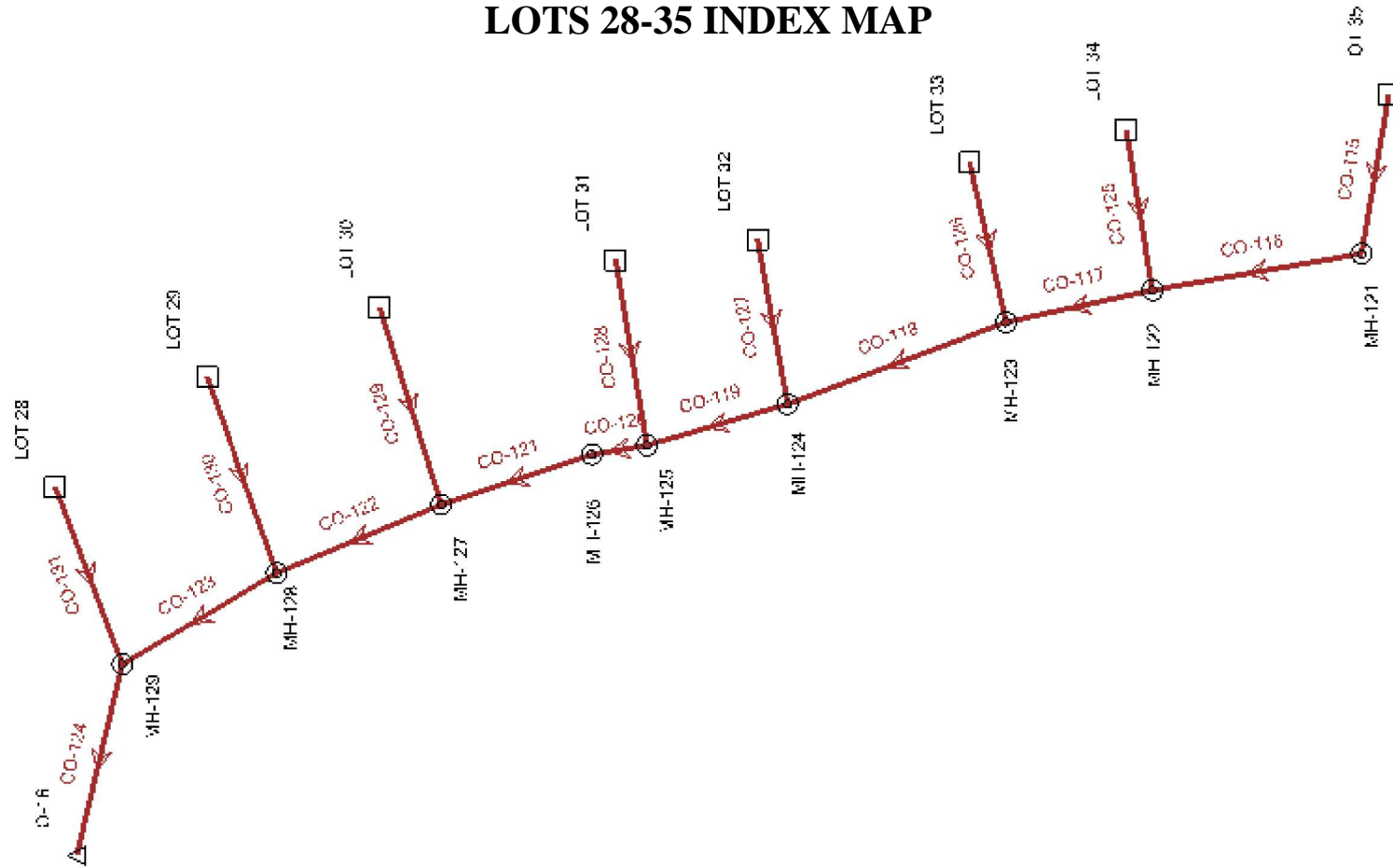
Label: CO-114
Type: Conduit
ID: 422



6" STRM LOT 24 - 100 yr



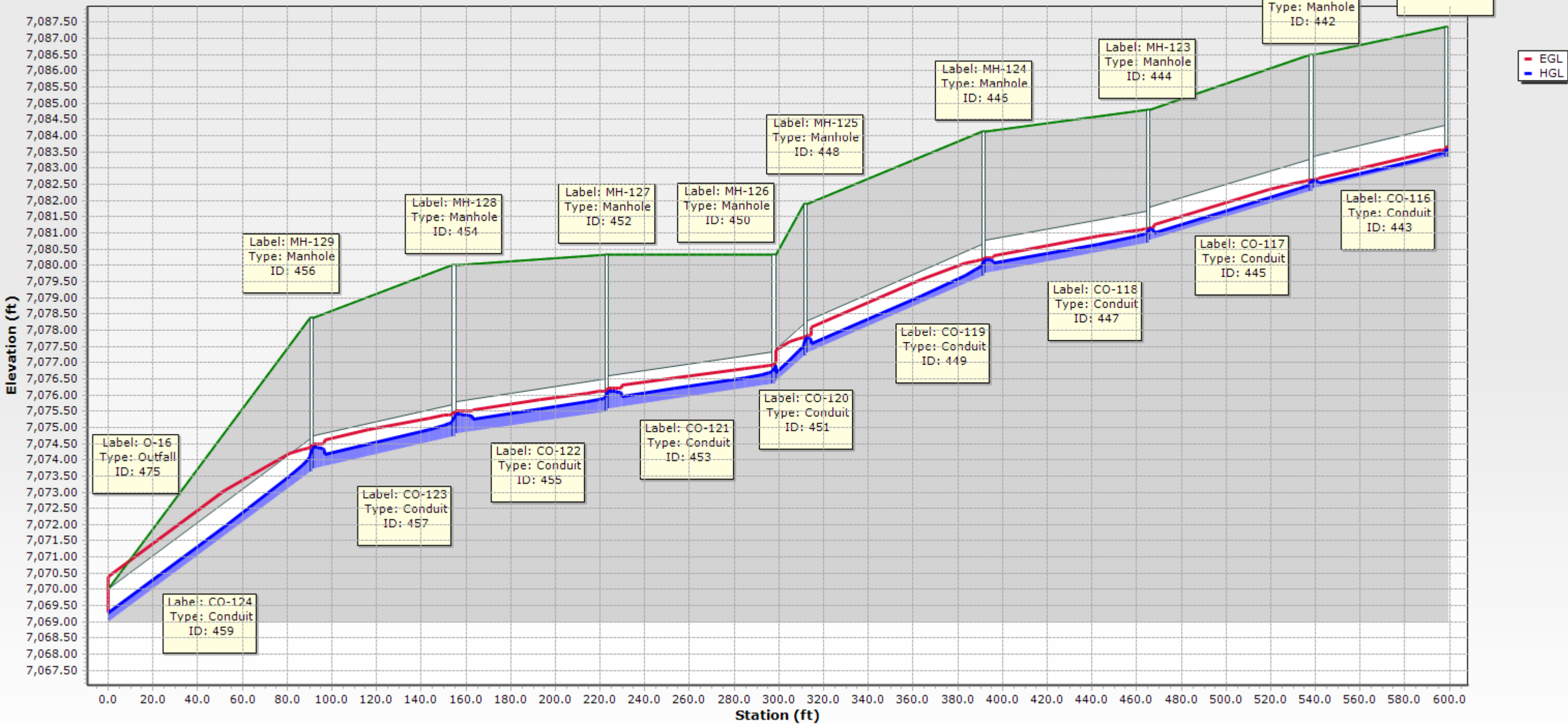
LOTS 28-35 INDEX MAP



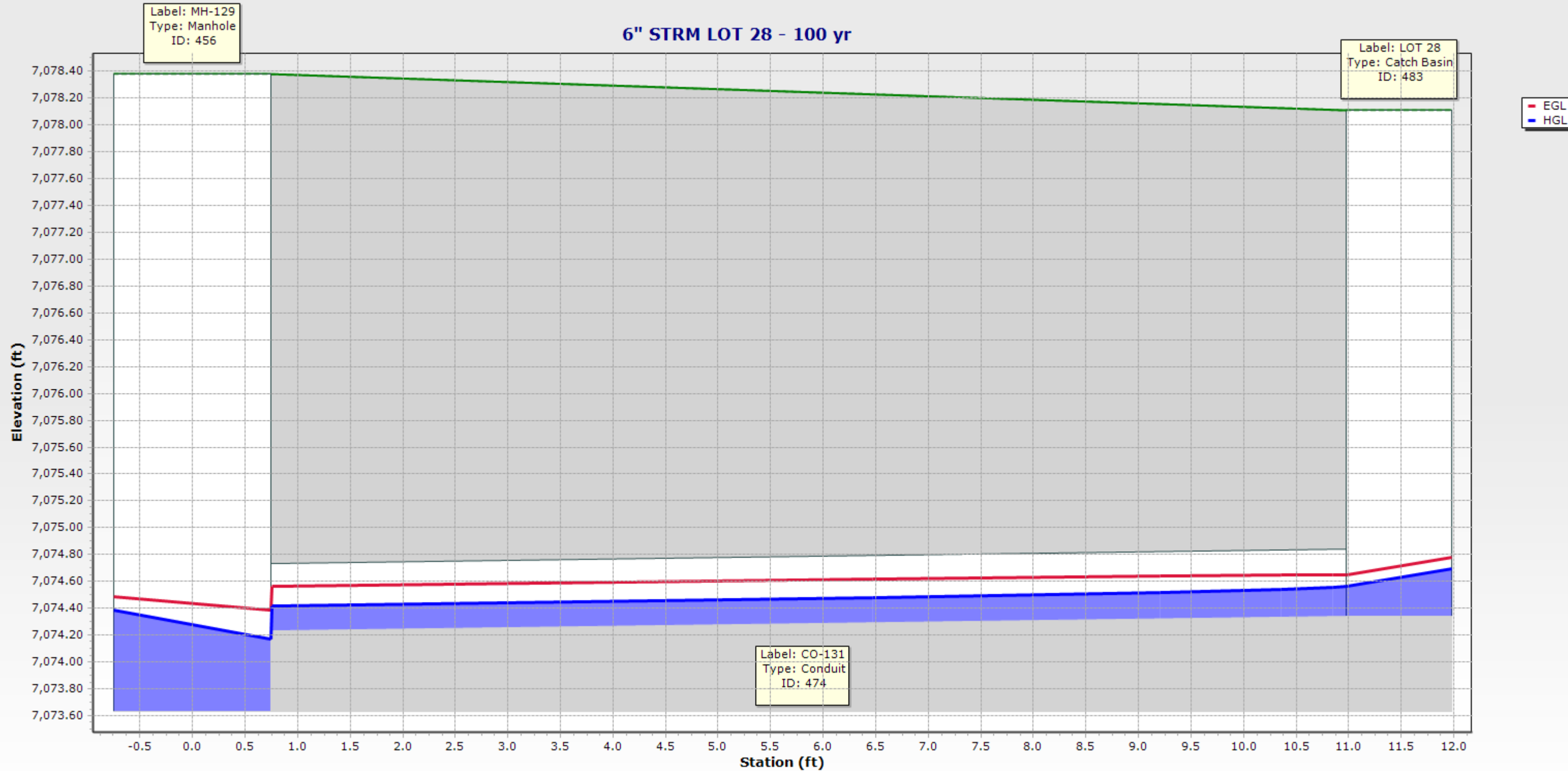
Conduit FlexTable: LOTS 28-35

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)
CO-115	441	LOT 35	0.20	32.9	24.9	2.78	1.278	0.20	0.22	7,084.48	7,084.24	7,084.39	7,084.12	0.28	7,084.52
CO-116	443	MH-121	0.20	4.1	60.4	3.05	1.741	0.14	0.18	7,083.57	7,082.64	7,083.50	7,082.62	0.89	7,083.57
CO-117	445	MH-122	0.40	7.3	73.1	4.07	2.015	0.18	0.26	7,082.61	7,081.17	7,082.52	7,081.12	1.40	7,082.62
CO-118	447	MH-123	0.60	13.9	73.5	3.87	1.614	0.25	0.32	7,081.12	7,080.23	7,081.00	7,080.18	0.83	7,081.12
CO-119	449	MH-124	0.80	12.0	79.5	5.72	2.483	0.23	0.37	7,080.17	7,077.84	7,080.03	7,077.77	2.26	7,080.18
CO-120	451	MH-125	1.00	11.2	14.2	7.51	3.319	0.23	0.42	7,077.77	7,077.02	7,077.61	7,076.91	0.70	7,077.77
CO-121	453	MH-126	1.00	21.5	74.7	4.71	1.738	0.32	0.42	7,076.91	7,076.21	7,076.75	7,076.12	0.63	7,076.91
CO-122	455	MH-127	1.20	31.2	68.5	4.33	1.430	0.38	0.46	7,076.12	7,075.49	7,075.94	7,075.40	0.54	7,076.12
CO-123	457	MH-128	1.40	29.4	63.6	5.28	1.776	0.37	0.50	7,075.40	7,074.49	7,075.20	7,074.39	0.81	7,075.40
CO-124	459	MH-129	1.60	18.4	91.1	8.44	3.258	0.29	0.54	7,074.38	7,070.40	7,074.17	7,069.29	4.88	7,074.39
CO-125	462	LOT 34	0.20	32.6	11.8	2.80	1.288	0.20	0.22	7,083.29	7,083.18	7,083.20	7,083.06	0.15	7,083.33
CO-126	464	LOT 33	0.20	32.4	10.7	2.81	1.297	0.20	0.22	7,081.70	7,081.60	7,081.61	7,081.48	0.14	7,081.74
CO-127	466	LOT 32	0.20	23.8	11.0	3.51	1.779	0.17	0.22	7,080.78	7,080.61	7,080.69	7,080.43	0.27	7,080.82
CO-128	468	LOT 31	0.20	14.2	11.4	5.08	2.976	0.13	0.22	7,078.71	7,078.31	7,078.62	7,077.92	0.71	7,078.75
CO-129	470	LOT 30	0.20	7.4	11.5	8.06	5.616	0.09	0.22	7,078.64	7,077.18	7,078.55	7,076.17	2.38	7,078.68
CO-130	472	LOT 29	0.20	9.7	11.4	6.66	4.328	0.11	0.22	7,076.93	7,076.09	7,076.84	7,075.41	1.44	7,076.97
CO-131	474	LOT 28	0.20	28.0	11.5	3.12	1.509	0.18	0.22	7,074.65	7,074.56	7,074.56	7,074.41	0.15	7,074.69
Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)										
2.35	1.500	0.13	7,087.44	7,084.17	7,083.92										
2.78	1.020	0.06	7,087.35	7,083.32	7,082.36										
1.26	1.020	0.09	7,086.48	7,082.26	7,080.78										
1.69	1.020	0.12	7,084.80	7,080.68	7,079.76										
1.95	1.020	0.14	7,084.14	7,079.66	7,077.29										
2.14	1.020	0.16	7,081.90	7,077.19	7,076.43										
2.67	1.020	0.16	7,080.33	7,076.33	7,075.58										
2.29	1.020	0.18	7,080.33	7,075.48	7,074.80										
2.43	1.020	0.20	7,080.00	7,074.70	7,073.73										
2.56	1.020	0.22	7,078.38	7,073.63	7,069.00										
2.35	1.500	0.13	7,086.25	7,082.98	7,082.86										
2.35	1.500	0.13	7,084.66	7,081.39	7,081.28										
2.35	1.500	0.13	7,083.74	7,080.47	7,080.26										
2.35	1.500	0.13	7,081.67	7,078.40	7,077.79										
2.35	1.500	0.13	7,081.60	7,078.33	7,076.08										
2.35	1.500	0.13	7,079.89	7,076.62	7,075.30										
2.35	1.500	0.13	7,078.11	7,074.34	7,074.23										

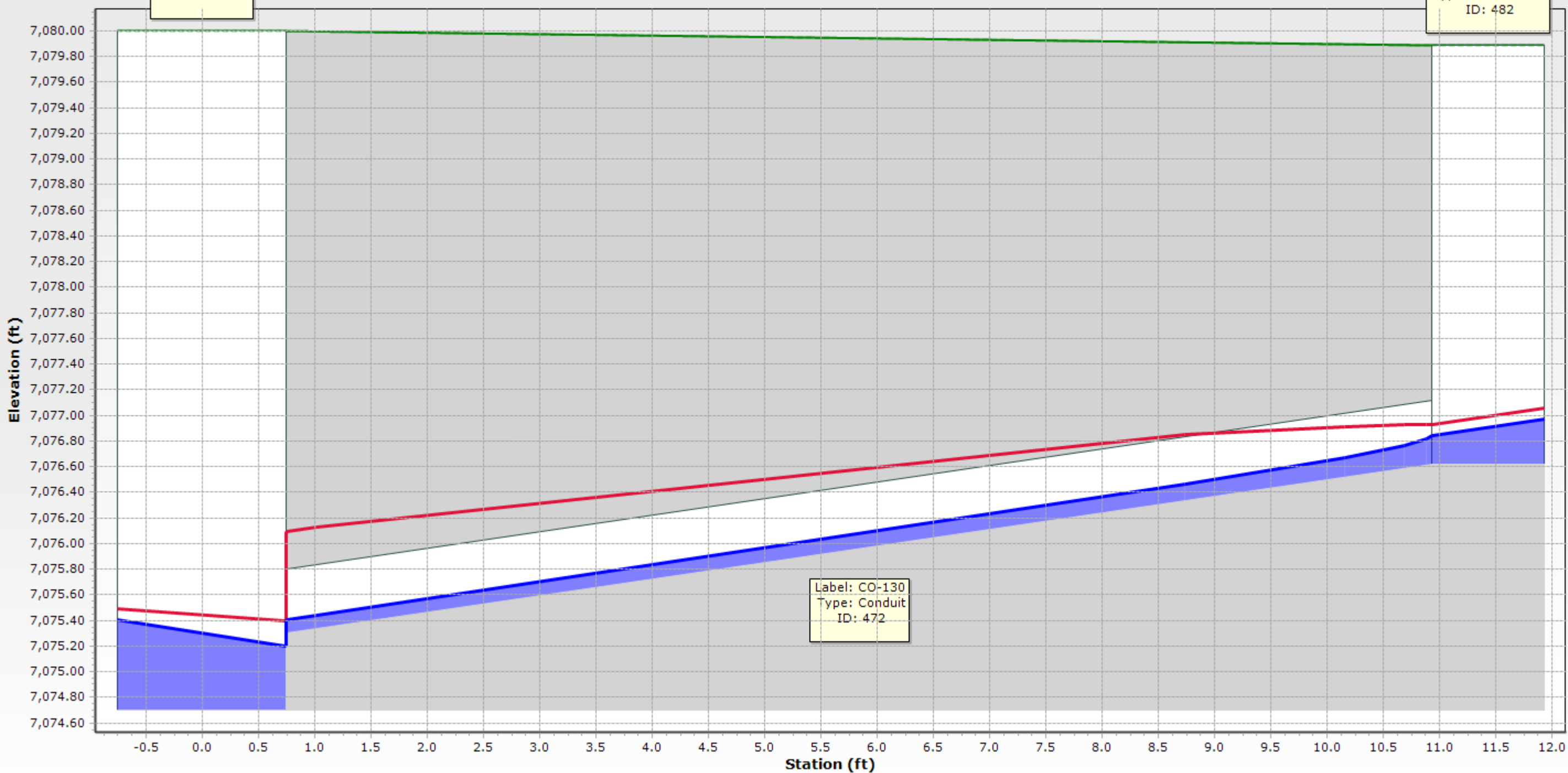
12" STRM LOTS 28-35 - 100 yr



6" STRM LOT 28 - 100 yr



6" STRM LOT 29 - 100 yr



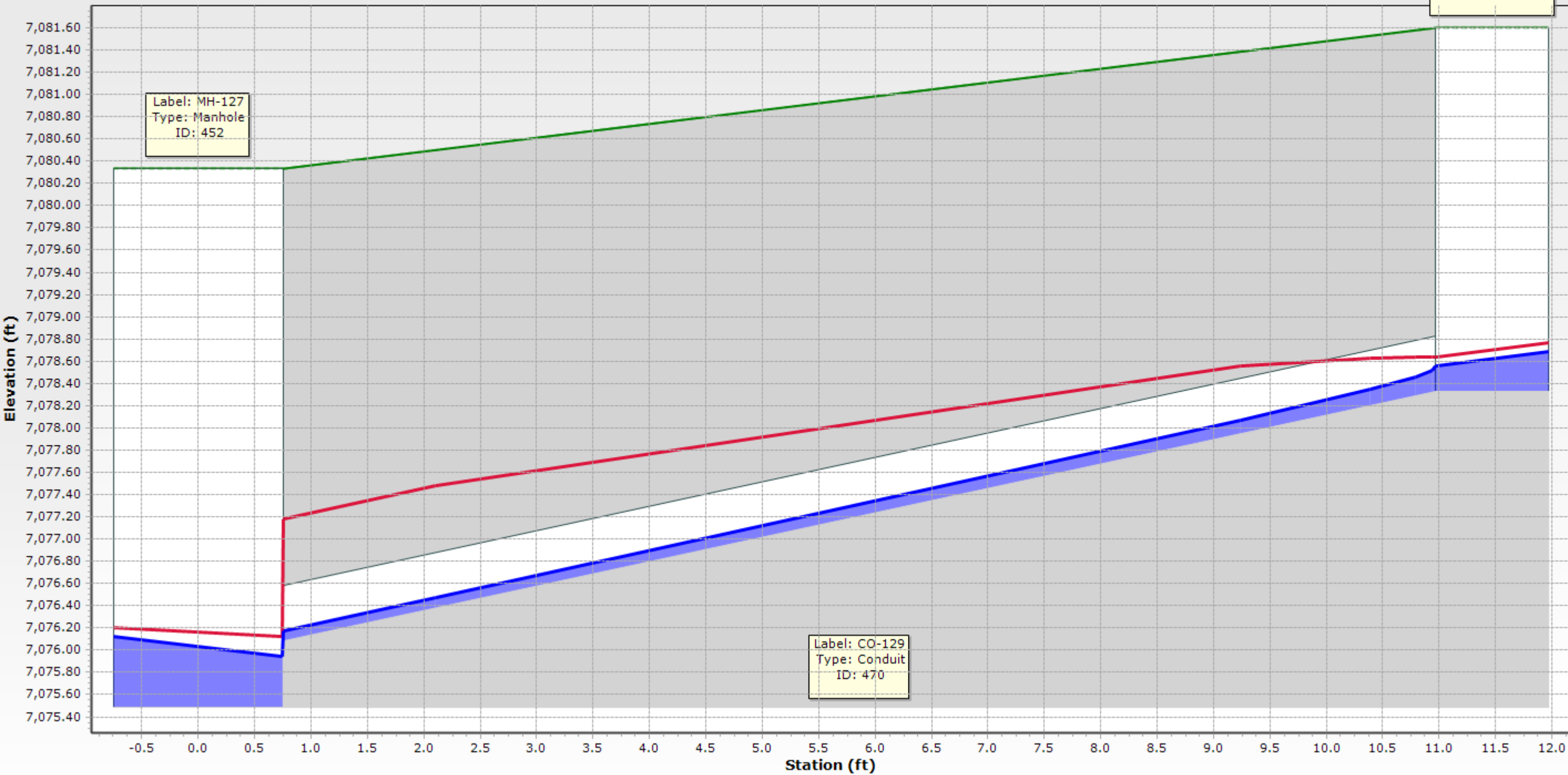
6" STRM LOT 30 - 100 yr

Label: LOT 30
Type: Catch Basin
ID: 481

EGL
HGL

Label: MH-127
Type: Manhole
ID: 452

Label: CO-129
Type: Conduit
ID: 470

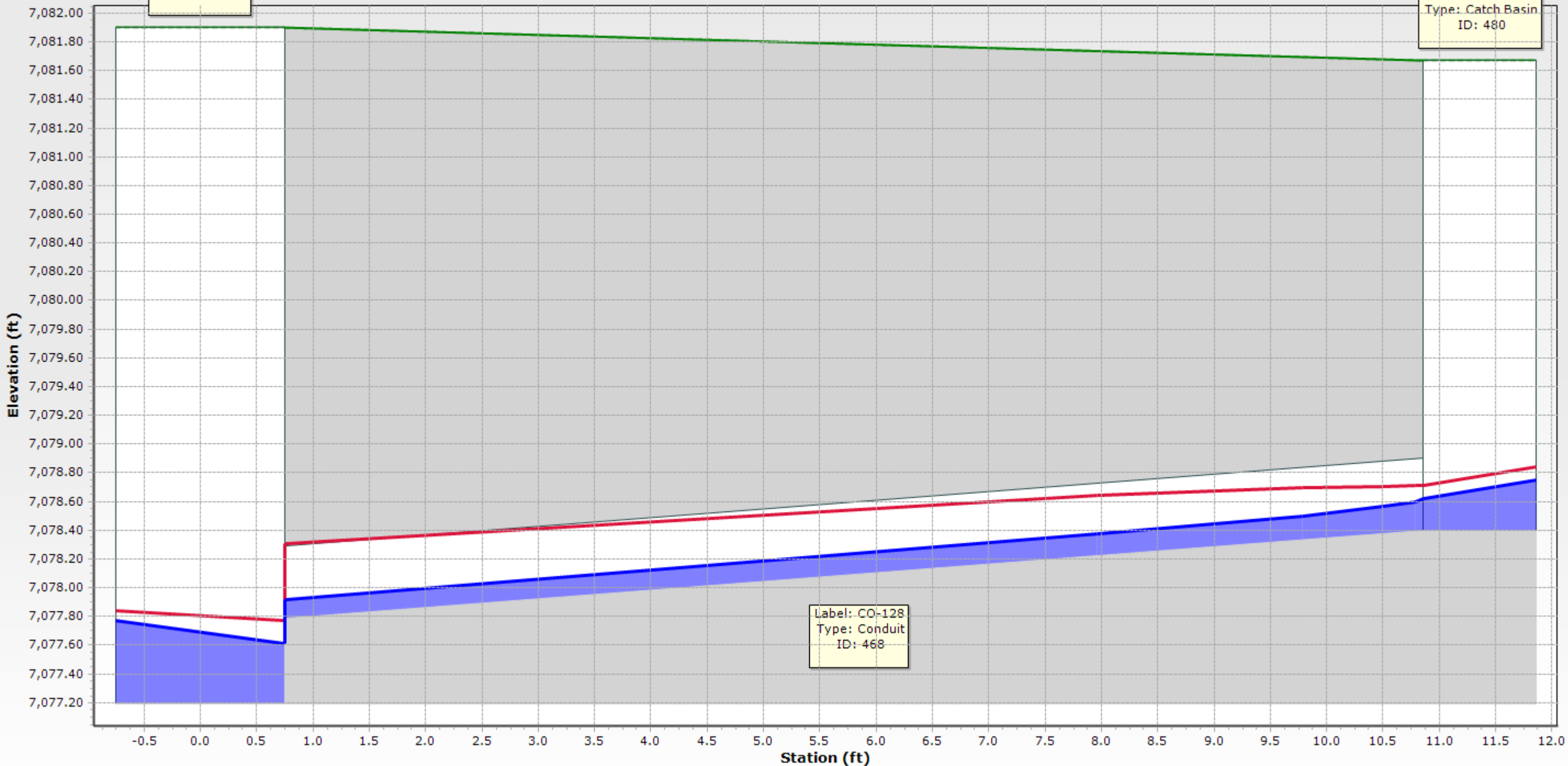


Label: MH-125
Type: Manhole
ID: 448

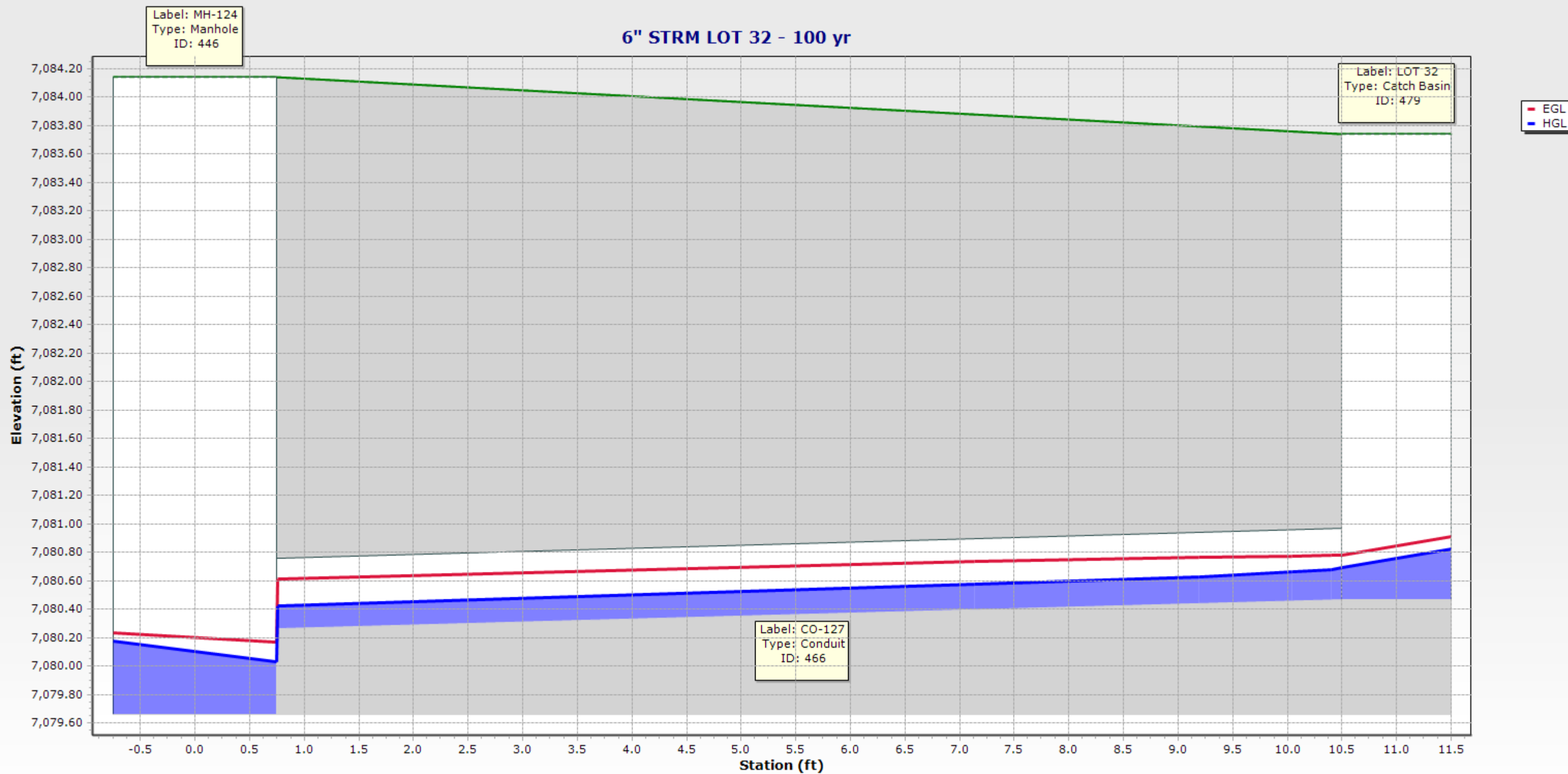
6" STRM LOT 31 - 100 yr

Label: LOT 31
Type: Catch Basin
ID: 480

EGL
HGL



Label: CO-128
Type: Conduit
ID: 468

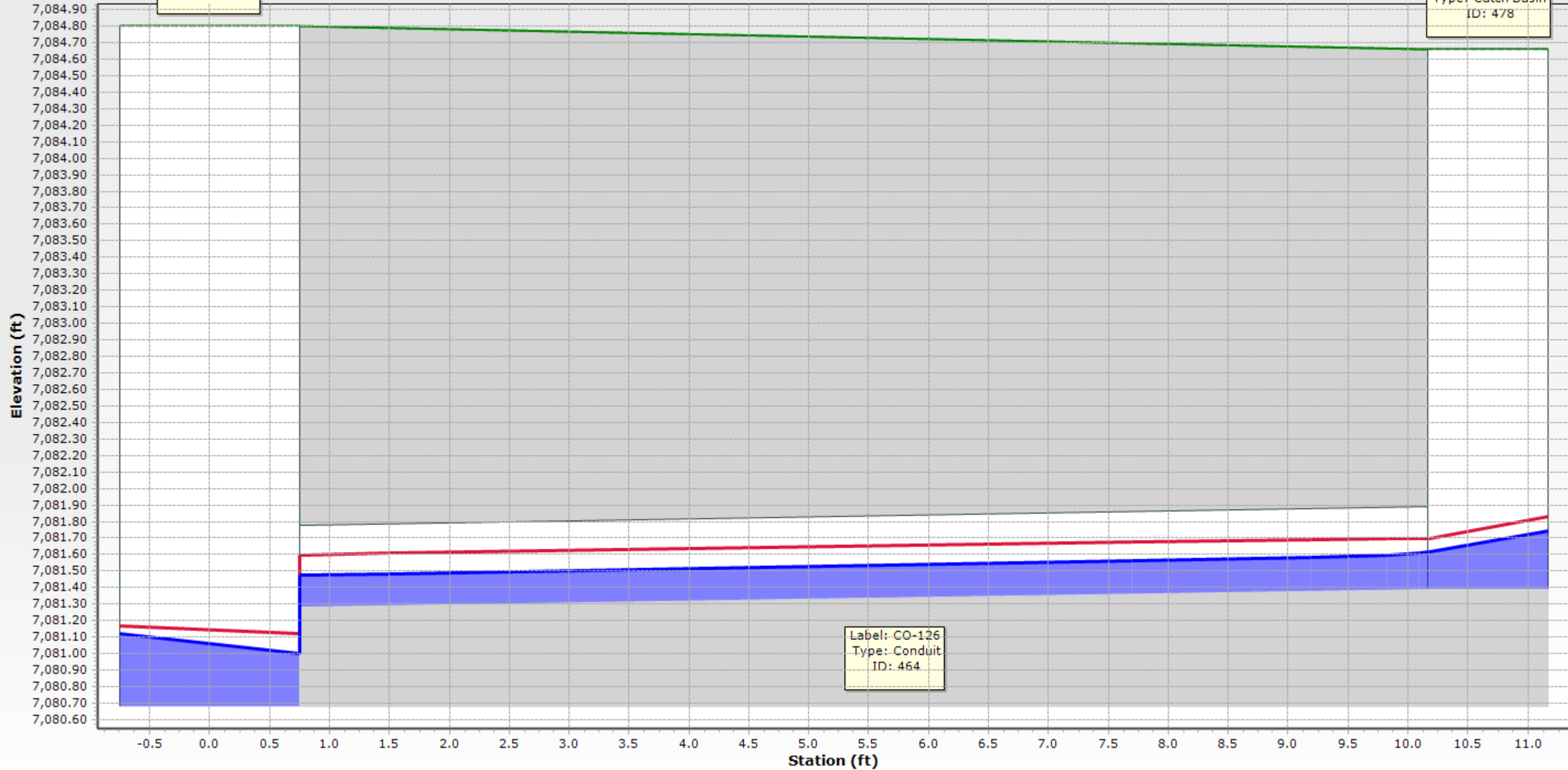


Label: MH-123
Type: Manhole
ID: 444

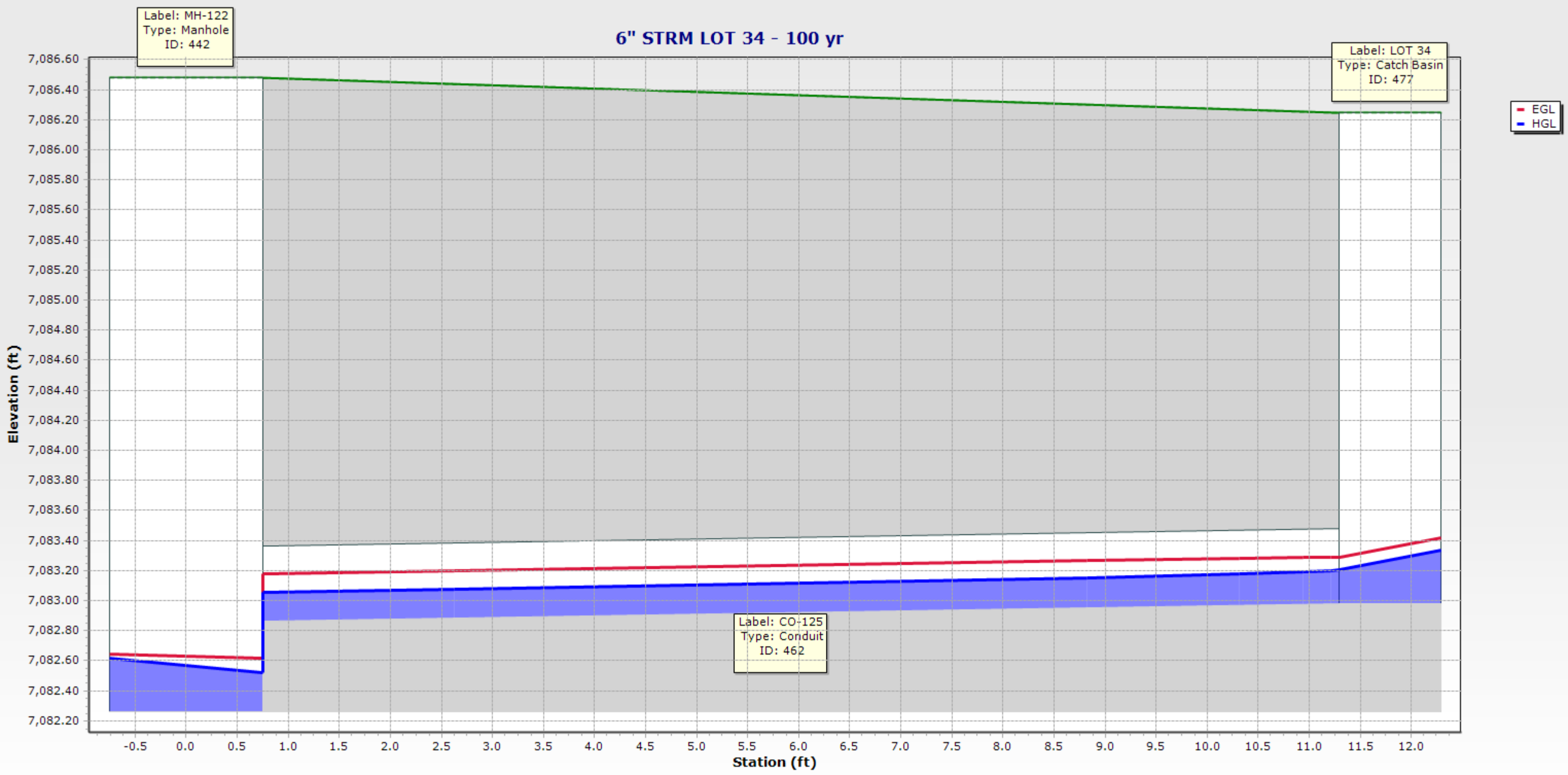
6" STRM LOT33 - 100 yr

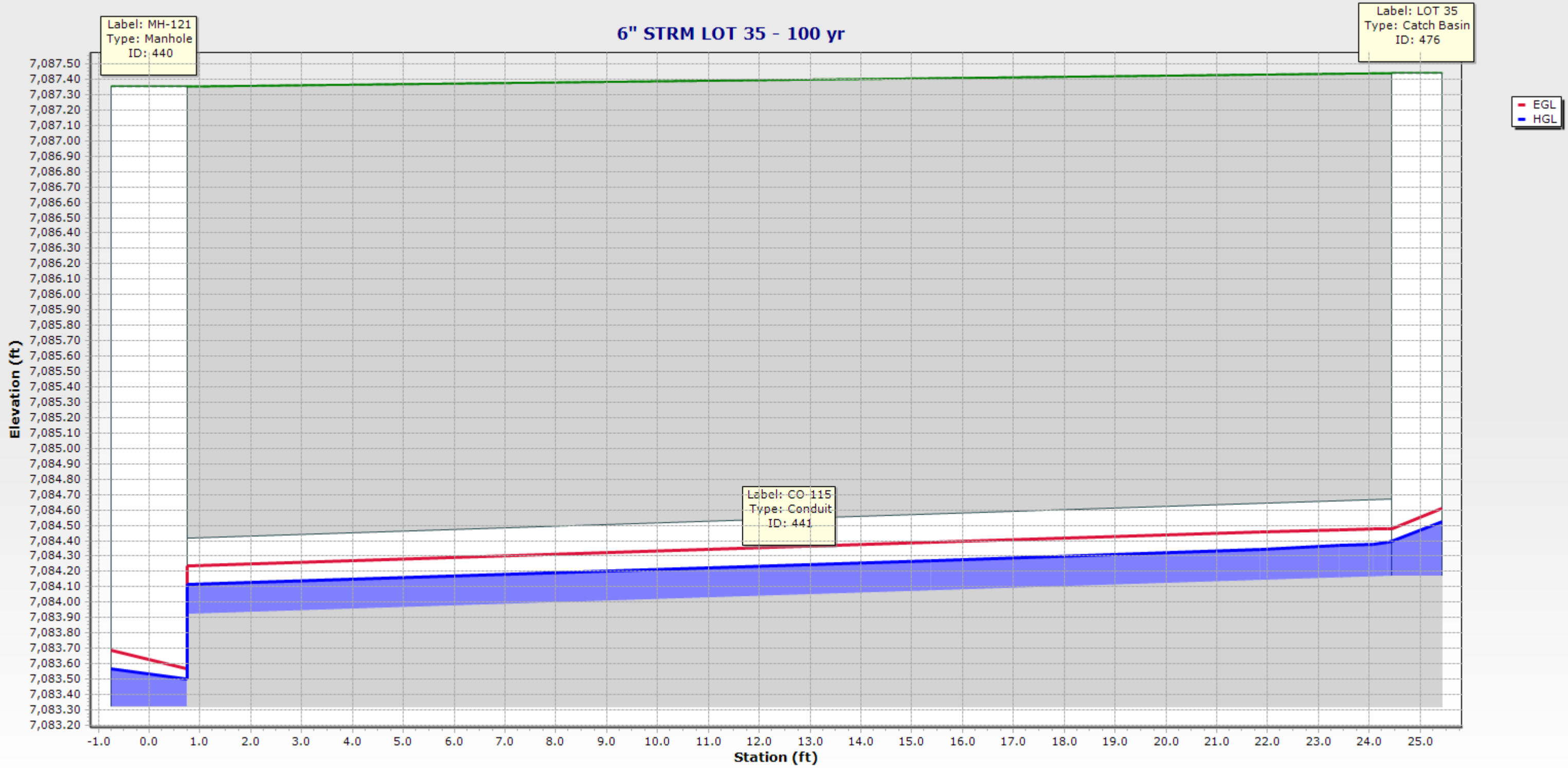
Label: LOT 33
Type: Catch Basin
ID: 478

EGL
HGL

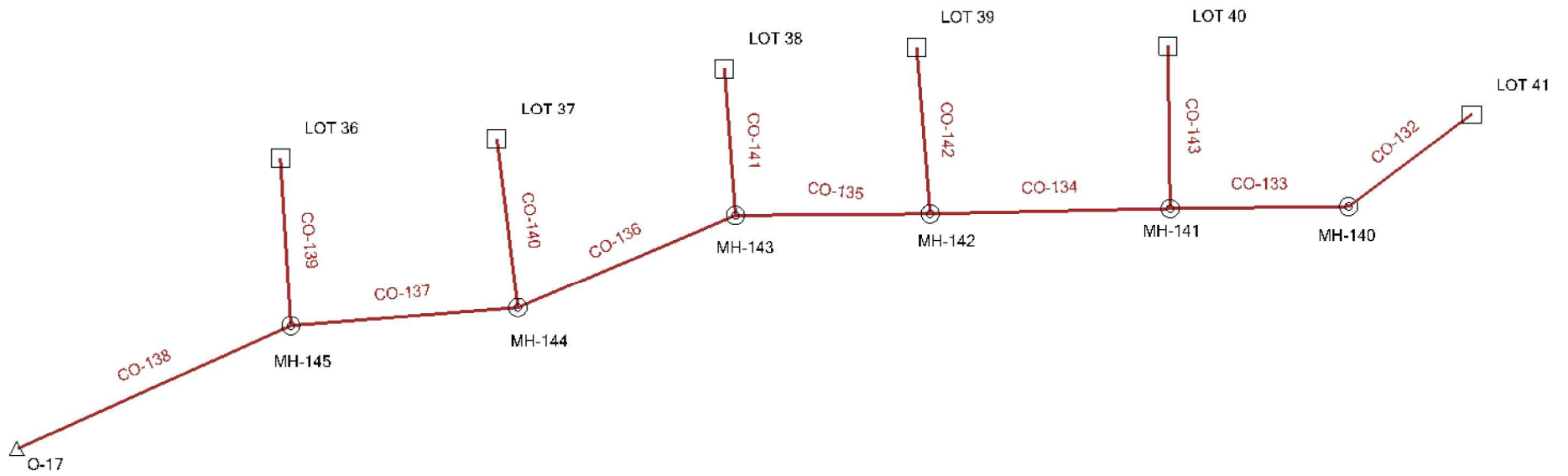


6" STRM LOT 34 - 100 yr





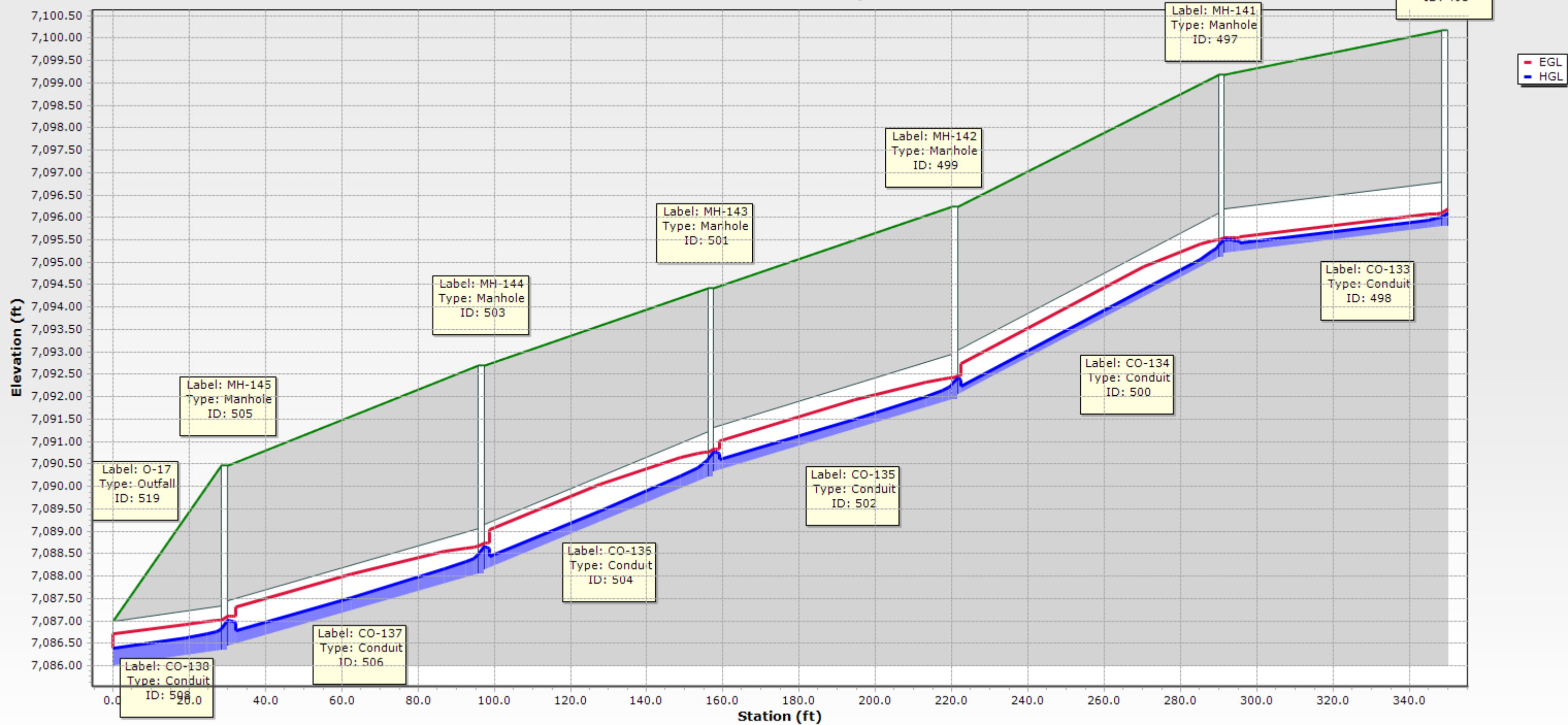
LOTS 36-41 INDEX MAP

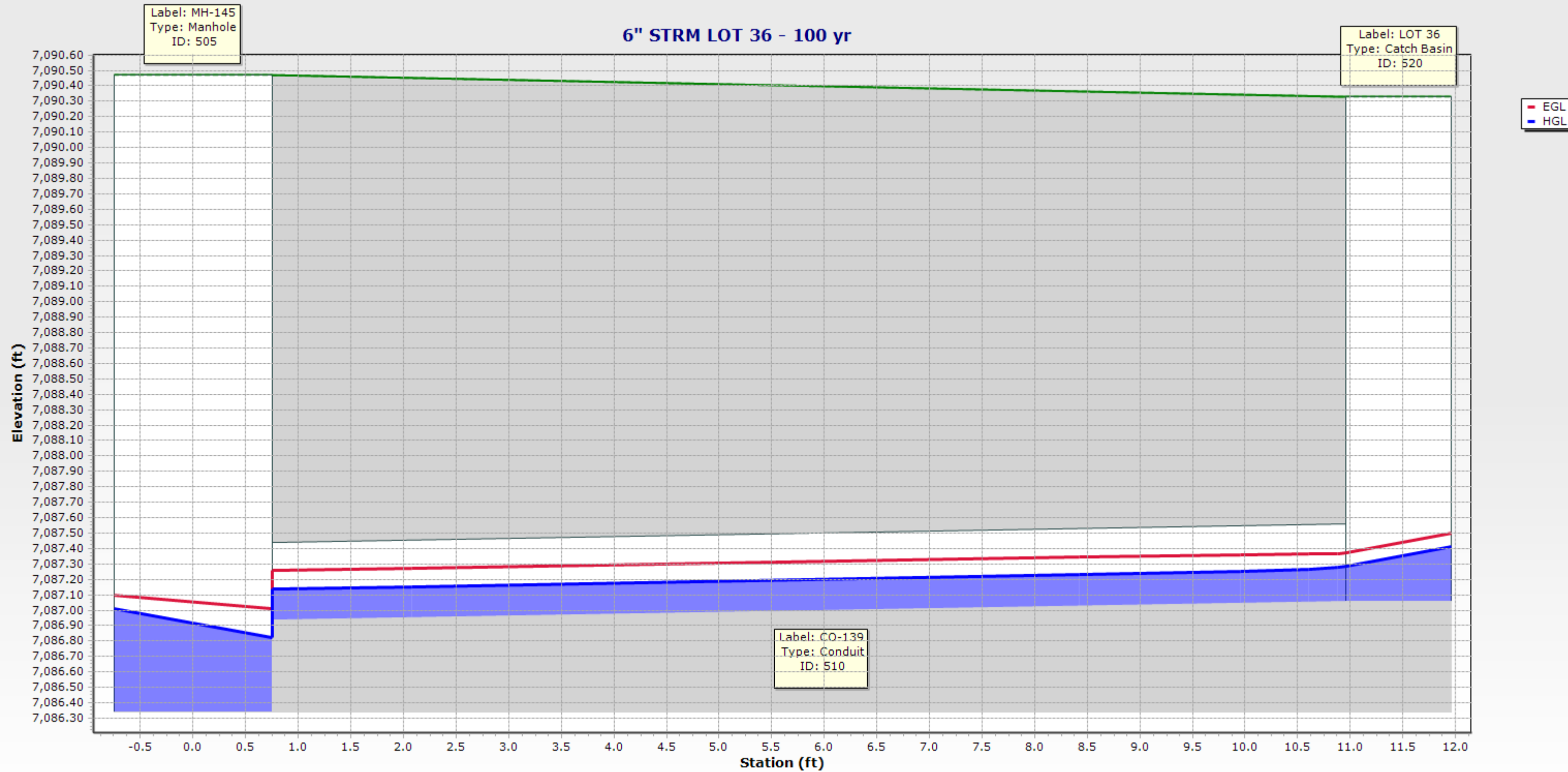


Conduit FlexTable: LOTS 36-41

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)
CO-132	496	LOT 41	0.30	27.0	21.2	4.80	2.340	0.18	0.28	7,096.89	7,096.18	7,096.78	7,096.10	0.68	7,096.95
CO-133	498	MH-140	0.30	7.7	58.6	2.93	1.425	0.19	0.23	7,096.09	7,095.54	7,096.02	7,095.50	0.51	7,096.10
CO-134	500	MH-141	0.50	6.2	69.9	5.71	2.947	0.17	0.29	7,095.50	7,092.47	7,095.39	7,092.42	2.97	7,095.50
CO-135	502	MH-142	0.70	11.4	64.0	5.19	2.285	0.23	0.35	7,092.42	7,090.83	7,092.29	7,090.77	1.52	7,092.42
CO-136	504	MH-143	0.90	12.6	60.2	6.22	2.666	0.24	0.40	7,090.77	7,088.74	7,090.62	7,088.66	1.95	7,090.77
CO-137	506	MH-144	1.10	18.5	67.5	5.79	2.233	0.29	0.44	7,088.66	7,087.10	7,088.49	7,087.01	1.48	7,088.66
CO-138	508	MH-145	1.30	31.2	29.2	4.69	1.550	0.38	0.48	7,087.01	7,086.72	7,086.82	7,086.39	0.44	7,087.01
CO-139	510	LOT 36	0.20	32.2	11.5	2.83	1.307	0.19	0.22	7,087.37	7,087.26	7,087.28	7,087.13	0.15	7,087.41
CO-140	512	LOT 37	0.20	14.1	11.2	5.10	2.996	0.13	0.22	7,089.07	7,088.68	7,088.98	7,088.66	0.32	7,089.11
CO-141	514	LOT 38	0.20	32.2	11.5	2.83	1.307	0.19	0.22	7,091.25	7,091.14	7,091.16	7,091.01	0.15	7,091.29
CO-142	516	LOT 39	0.20	33.6	11.5	2.74	1.249	0.20	0.22	7,092.96	7,092.86	7,092.87	7,092.74	0.13	7,092.89
CO-143	518	LOT 40	0.20	13.0	12.4	5.38	3.227	0.12	0.22	7,096.80	7,096.27	7,096.71	7,095.82	0.89	7,096.84
Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)										
2.69	1.500	0.17	7,100.17	7,096.50	7,095.79										
2.38	1.020	0.08	7,100.17	7,095.79	7,095.20										
1.51	1.020	0.11	7,099.19	7,095.10	7,092.04										
1.83	1.020	0.13	7,096.23	7,091.94	7,090.32										
2.05	1.020	0.15	7,094.42	7,090.22	7,088.15										
2.22	1.020	0.17	7,092.69	7,088.05	7,086.44										
2.36	1.020	0.19	7,090.47	7,086.34	7,086.00										
2.35	1.500	0.13	7,090.33	7,087.06	7,086.94										
2.35	1.500	0.13	7,091.83	7,088.76	7,088.15										
2.35	1.500	0.13	7,094.01	7,090.94	7,090.82										
2.35	0.200	0.02	7,095.72	7,092.65	7,092.54										
2.35	1.500	0.13	7,099.56	7,096.49	7,095.70										

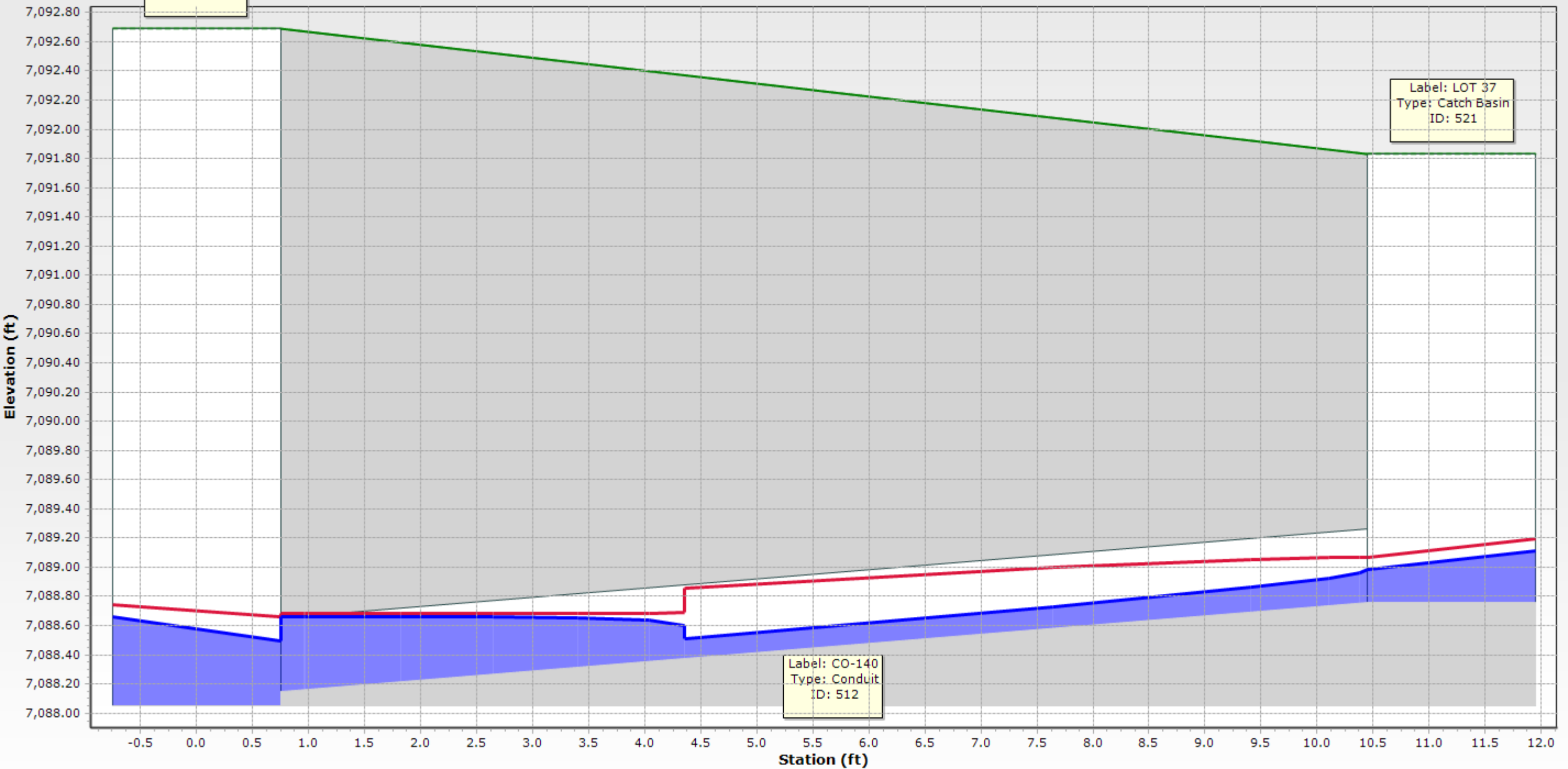
12" STRM LOTS 36-41 - 100 yr

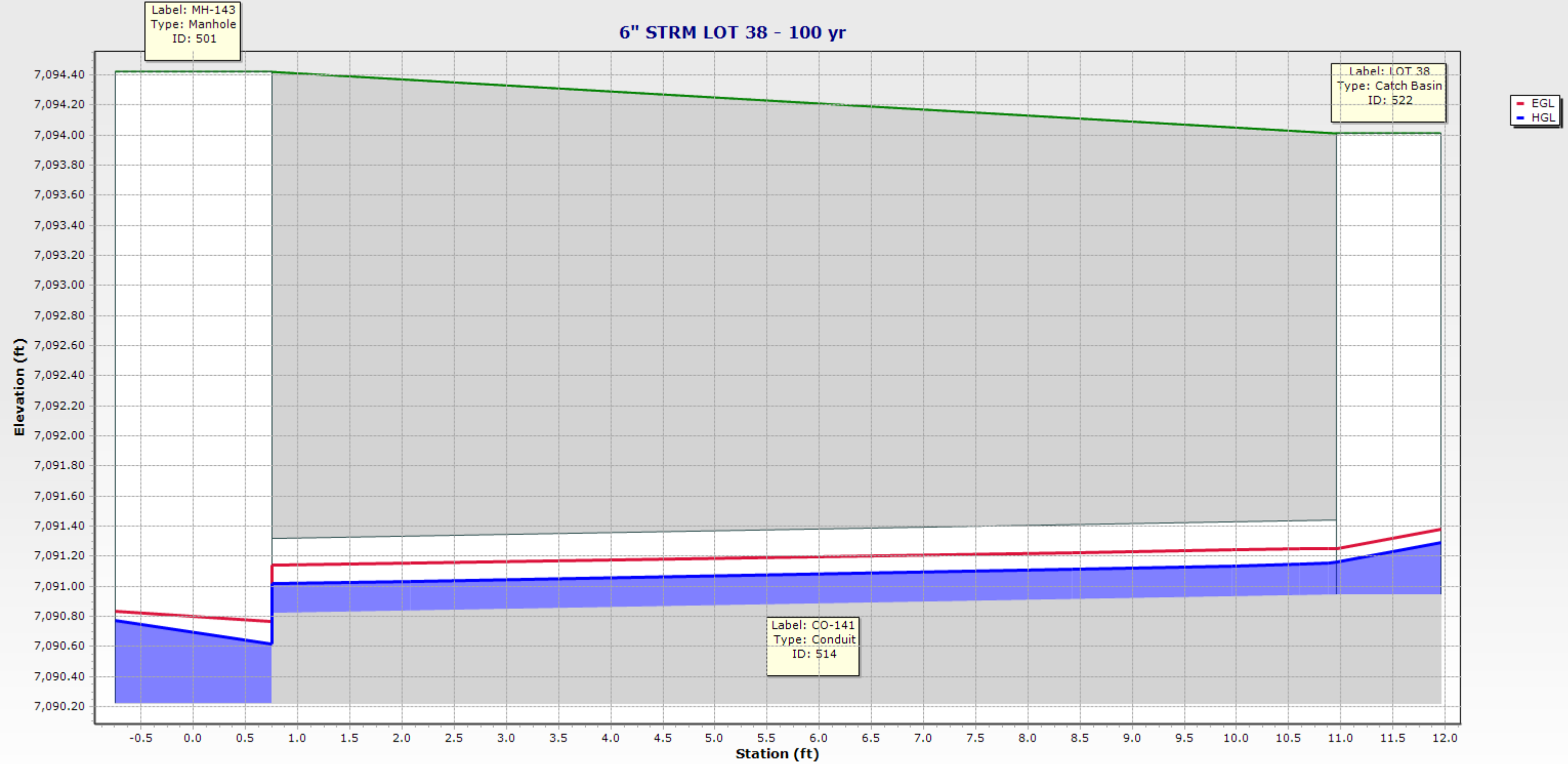




6" STRM LOT 37 - 100 yr

EGL
HGL





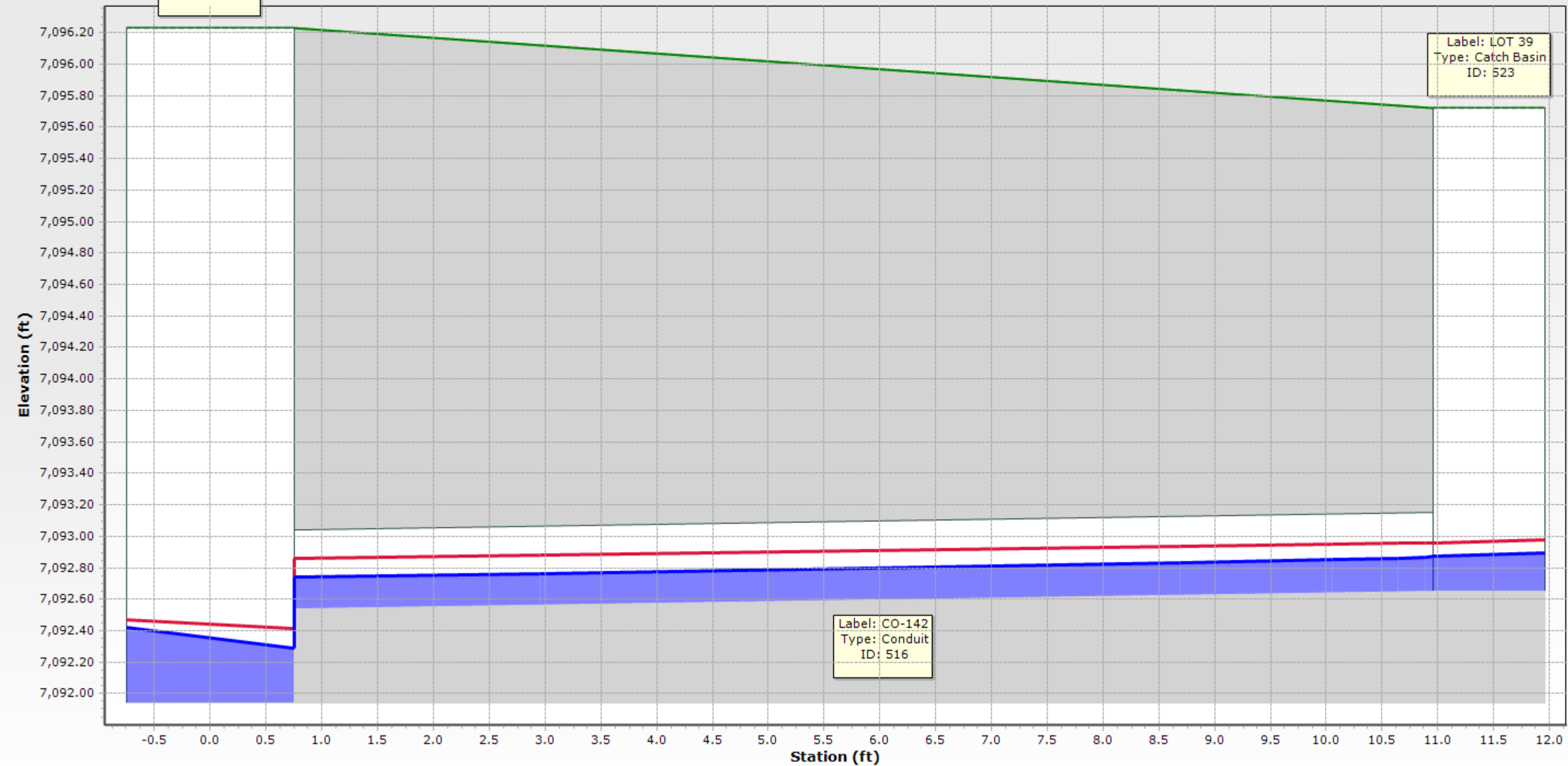
6" STRM LOT 39 - 100 yr

Label: MH-142
Type: Manhole
ID: 499

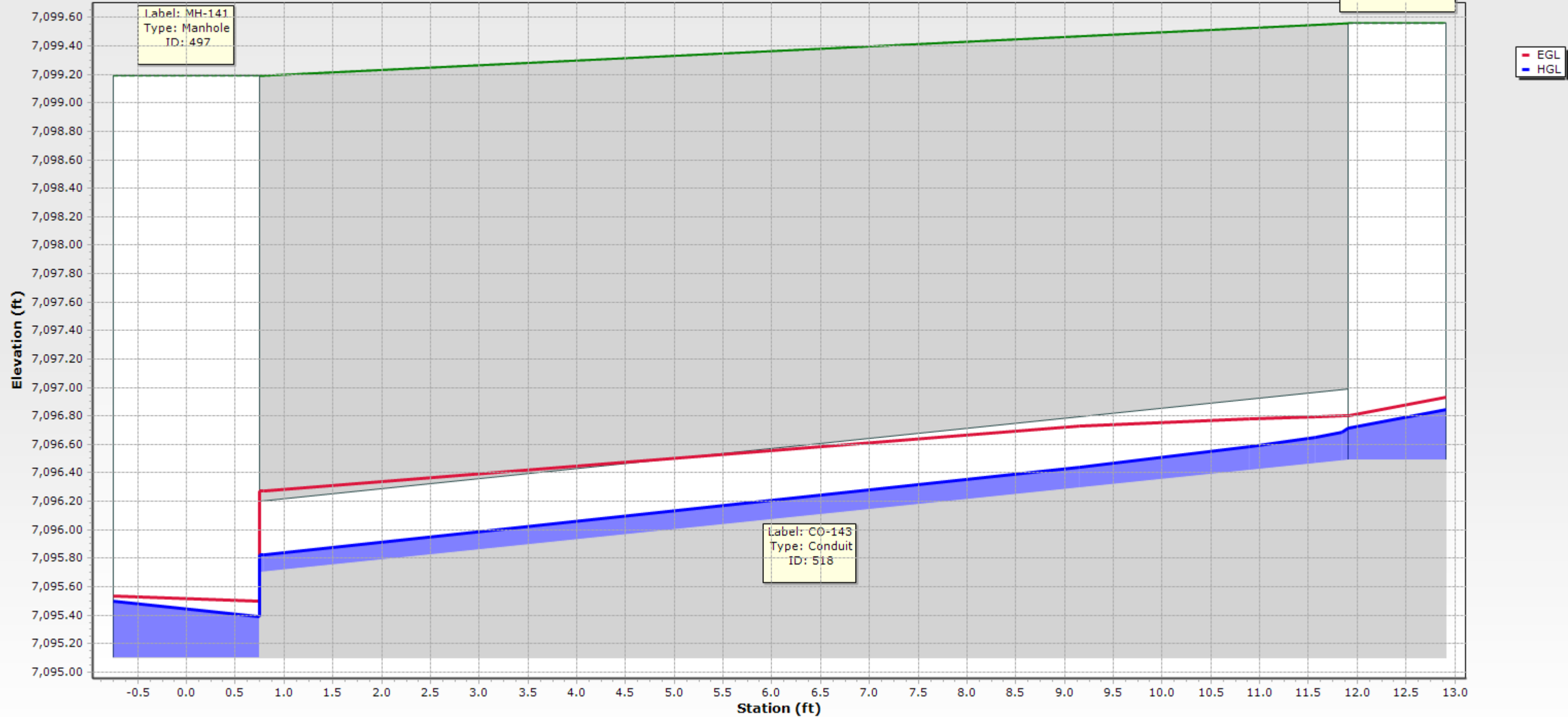
Label: LOT 39
Type: Catch Basin
ID: 523

Label: CO-142
Type: Conduit
ID: 516

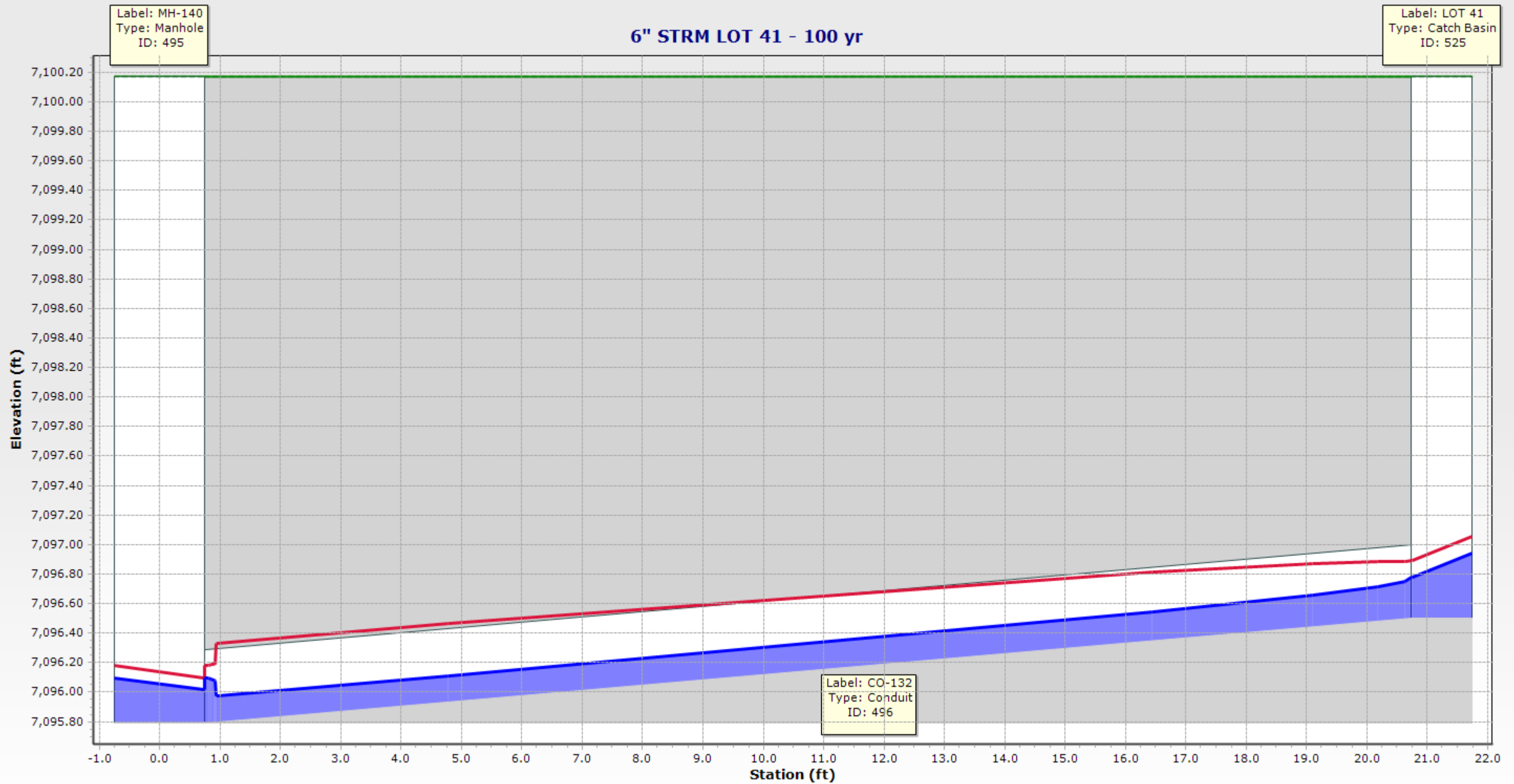
EGL
HGL



6" STRM LOT 40 - 100 yr

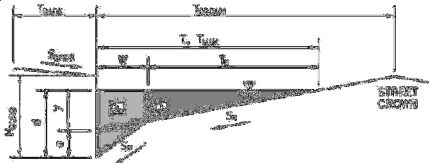


6" STRM LOT 41 - 100 yr



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

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

 Project: _____
 Inlet ID: _____ Enter Your Project Name Here
 Inlet DP 7
**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $T_{BACK} = 8.0$ ft $S_{BACK} = 0.020$ ft/ft $n_{BACK} = 0.020$ $H_{CURB} = 6.00$ inches $T_{CROWN} = 17.0$ ft $W = 2.00$ ft $S_X = 0.020$ ft/ft $S_W = 0.083$ ft/ft $S_O = 0.000$ ft/ft $n_{STREET} = 0.020$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.1	7.8	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

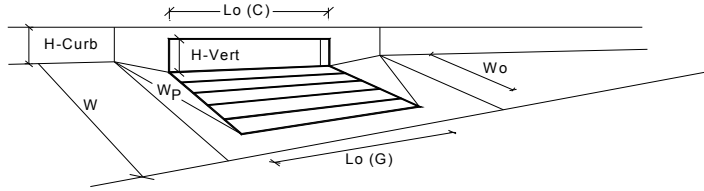
MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)

Type of Inlet CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Combination Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Grated Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

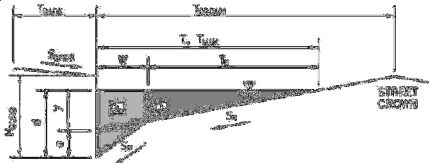
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{local} =	3.00	3.00	inches
No =	2	2	
Ponding Depth =	5.1	7.8	inches
	MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
$L_o (G)$ =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
$C_r (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o (C)$ =	5.00	5.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
$C_r (C)$ =	0.10	0.10	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
d_{Grate} =	N/A	N/A	ft
d_{Curb} =	0.26	0.48	ft
$RF_{Combination}$ =	0.48	0.74	
RF_{Curb} =	0.88	1.00	
RF_{Grate} =	N/A	N/A	
	MINOR	MAJOR	
Q_a =	6.7	18.7	cfs
$Q_{PEAK REQUIRED}$ =	5.7	13.8	cfs

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

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

Project: _____
 Inlet ID: _____
 Enter Your Project Name Here
 Inlet DP 8

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $T_{BACK} = 8.0$ ft $S_{BACK} = 0.020$ ft/ft $n_{BACK} = 0.020$ $H_{CURB} = 6.00$ inches $T_{CROWN} = 17.0$ ft $W = 2.00$ ft $S_X = 0.020$ ft/ft $S_W = 0.083$ ft/ft $S_O = 0.000$ ft/ft $n_{STREET} = 0.020$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

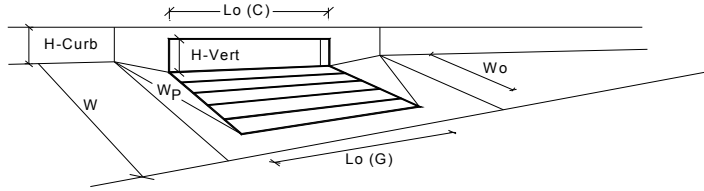
	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.1	7.8	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)

Type of Inlet CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Combination Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Grated Inlet Performance Reduction Factor for Long Inlets

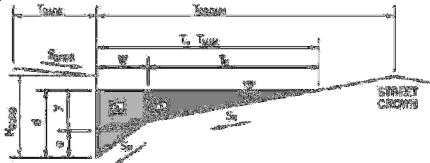
Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{local} =	3.00	3.00	inches
No =	2	2	
Ponding Depth =	5.1	7.8	inches
	MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
$L_o (G)$ =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
$C_r (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o (C)$ =	5.00	5.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
$C_r (C)$ =	0.10	0.10	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
d_{Grate} =	N/A	N/A	ft
d_{Curb} =	0.26	0.48	ft
$RF_{Combination}$ =	0.48	0.74	
RF_{Curb} =	0.88	1.00	
RF_{Grate} =	N/A	N/A	
	MINOR	MAJOR	
Q_a =	6.7	18.7	cfs
$Q_{PEAK REQUIRED}$ =	4.9	11.8	cfs

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

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

 Project: _____
 Inlet ID: _____ Enter Your Project Name Here
 Inlet DP 9
**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $T_{BACK} = 8.0$ ft $S_{BACK} = 0.020$ ft/ft $n_{BACK} = 0.020$ $H_{CURB} = 6.00$ inches $T_{CROWN} = 17.0$ ft $W = 2.00$ ft $S_X = 0.020$ ft/ft $S_W = 0.083$ ft/ft $S_O = 0.000$ ft/ft $n_{STREET} = 0.020$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.1	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

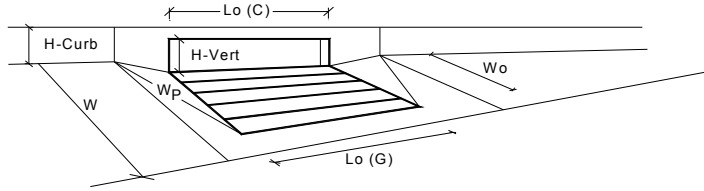
MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)

Type of Inlet CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Combination Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Grated Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

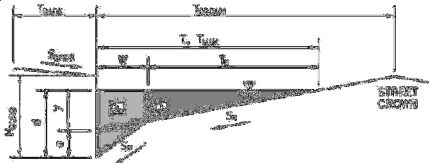
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{local} =	3.00	3.00	inches
No =	1	1	
Ponding Depth =	5.1	7.8	inches
	MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
$L_o (G)$ =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
$C_r (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o (C)$ =	5.00	5.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
$C_r (C)$ =	0.10	0.10	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
d_{Grate} =	N/A	N/A	ft
d_{Curb} =	0.26	0.48	ft
$RF_{Combination}$ =	0.65	1.00	
RF_{Curb} =	1.00	1.00	
RF_{Grate} =	N/A	N/A	
	MINOR	MAJOR	
Q_a =	3.7	9.0	cfs
$Q_{PEAK REQUIRED}$ =	2.2	5.4	cfs

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

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

Project: _____
 Inlet ID: _____ Enter Your Project Name Here
 Inlet DP 10

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 8.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 17.0$ ft

Gutter Width

 $W = 2.00$ ft

Street Transverse Slope

 $S_X = 0.020$ ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

 $S_W = 0.083$ ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

 $S_O = 0.022$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.020$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.1	7.8	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)



check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM Allowable Capacity is based on Depth Criterion**

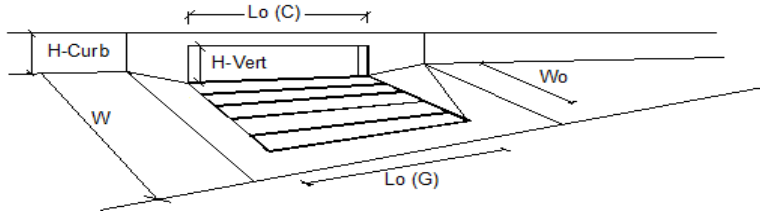
	Minor Storm	Major Storm	
$Q_{allow} =$	9.4	29.1	cfs

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_o =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_F-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_F-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity		MINOR		MAJOR	
Total Inlet Interception Capacity		Q =	9.1	12.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	0.3	2.9	cfs
Capture Percentage = Q_i/Q_c =		C% =	97	82	%

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

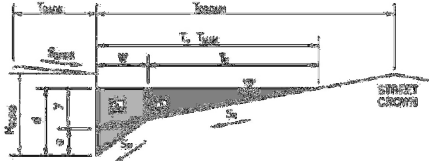
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Enter Your Project Name Here

Inlet ID:

Inlet DP 11

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

T_{BACK} = 8.0 ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

S_{BACK} = 0.020 ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

n_{BACK} = 0.020

Height of Curb at Gutter Flow Line

H_{CURB} = 6.00 inches

Distance from Curb Face to Street Crown

T_{CROWN} = 17.0 ft

Gutter Width

W = 2.00 ft

Street Transverse Slope

S_X = 0.020 ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

S_W = 0.083 ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

S_O = 0.022 ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

n_{STREET} = 0.020

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
T _{MAX}	17.0	17.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
d _{MAX}	5.1	7.8	inches

Allow Flow Depth at Street Crown (leave blank for no)

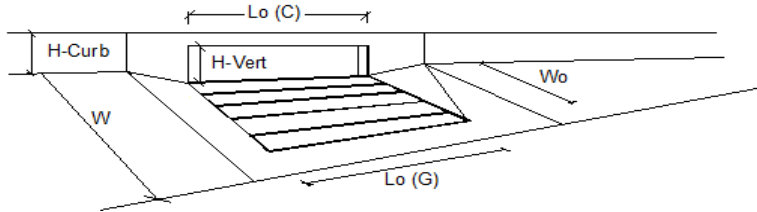
☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q _{allow}	9.4	29.1	cfs

MAJOR STORM Allowable Capacity is based on Depth Criterion**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'****Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

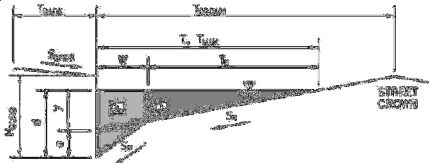


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	$a_{LOCAL} = 3.0$	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$No = 1$	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o = 15.00$	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	$W_o = N/A$	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Total Inlet Interception Capacity	$Q = 1.9$	12.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	2.9	cfs
Capture Percentage = $Q_i/Q_c =$	$C\% = 100$	82	%

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

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

Project: _____
 Inlet ID: _____ Enter Your Project Name Here
 Inlet DP 12

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 8.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 17.0$ ft

Gutter Width

 $W = 2.00$ ft

Street Transverse Slope

 $S_X = 0.020$ ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

 $S_W = 0.083$ ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

 $S_O = 0.000$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.020$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	5.1	7.8	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

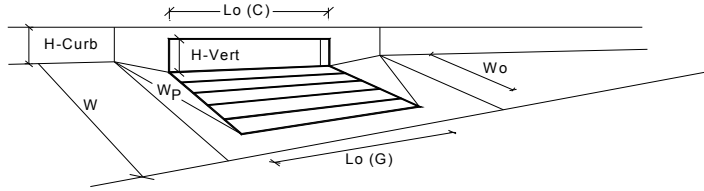
Check boxes are not applicable in SUMP conditions

**MINOR STORM Allowable Capacity is based on Depth Criterion****MAJOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)

Type of Inlet CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Combination Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Grated Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

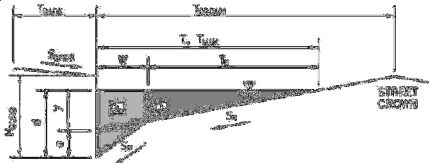
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a _{local} =	3.00	3.00	inches
No =	2	2	
Ponding Depth =	5.1	7.8	inches
	MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
L _o (G) =	N/A	N/A	feet
W _o =	N/A	N/A	feet
A _{ratio} =	N/A	N/A	
C _r (G) =	N/A	N/A	
C _w (G) =	N/A	N/A	
C _o (G) =	N/A	N/A	
	MINOR	MAJOR	
L _o (C) =	5.00	5.00	feet
H _{vert} =	6.00	6.00	inches
H _{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W _p =	2.00	2.00	feet
C _r (C) =	0.10	0.10	
C _w (C) =	3.60	3.60	
C _o (C) =	0.67	0.67	
	MINOR	MAJOR	
d _{Grate} =	N/A	N/A	ft
d _{Curb} =	0.26	0.48	ft
RF _{Combination} =	0.48	0.74	
RF _{Curb} =	0.88	1.00	
RF _{Grate} =	N/A	N/A	
	MINOR	MAJOR	
Q _a =	6.7	18.7	cfs
Q _{PEAK REQUIRED} =	6.2	17.2	cfs

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

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

Project: _____
 Inlet ID: _____ Enter Your Project Name Here
 Inlet DP 13

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

T_{BACK} = 8.0 ft
 S_{BACK} = 0.020 ft/ft
 n_{BACK} = 0.020

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

H_{CURB} = 6.00 inches
 T_{CROWN} = 17.0 ft
 W = 2.00 ft
 S_X = 0.020 ft/ft
 S_W = 0.083 ft/ft
 S_O = 0.000 ft/ft
 n_{STREET} = 0.020

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	17.0	17.0	ft
d_{MAX}	5.1	5.1	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

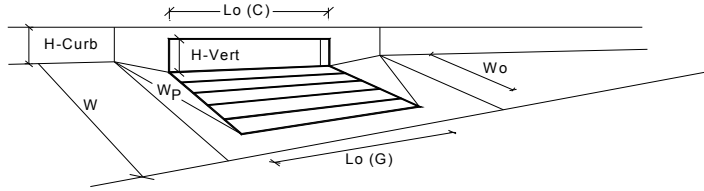
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

Q_{allow} =

Minor Storm	Major Storm	
SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)

Type of Inlet CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Combination Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Grated Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{local} =	3.00	3.00	inches
No =	1	1	
Ponding Depth =	5.1	7.8	inches
	MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
$L_o (G)$ =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
$C_r (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o (C)$ =	5.00	5.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
$C_r (C)$ =	0.10	0.10	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
d_{Grate} =	N/A	N/A	ft
d_{Curb} =	0.26	0.48	ft
$RF_{Combination}$ =	0.65	1.00	
RF_{Curb} =	1.00	1.00	
RF_{Grate} =	N/A	N/A	
	MINOR	MAJOR	
Q_a =	3.7	9.0	cfs
$Q_{PEAK REQUIRED}$ =	1.2	5.9	cfs

EDB AND SFB DETAILS

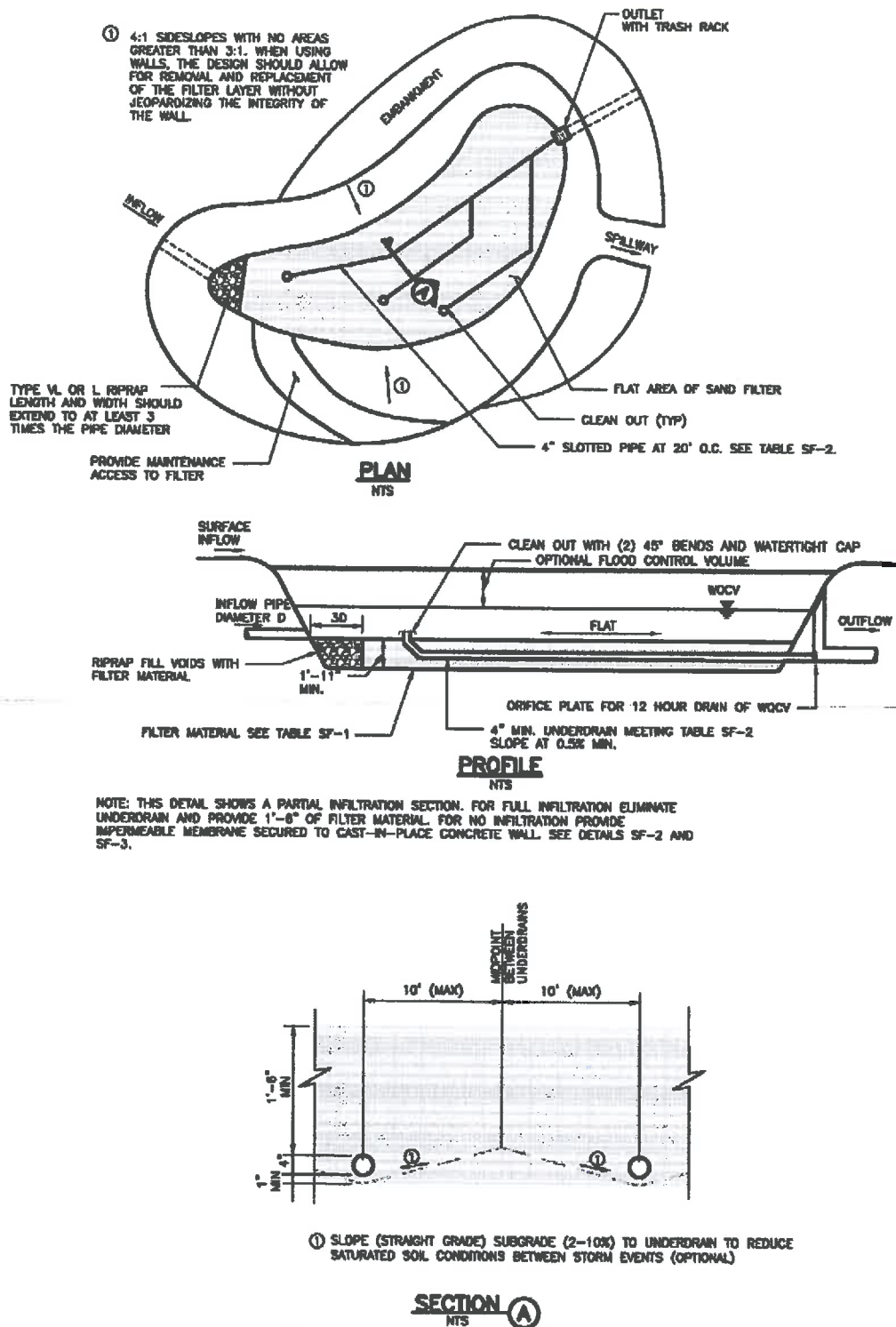


Figure SF-1. Sand Filter Plan and Sections

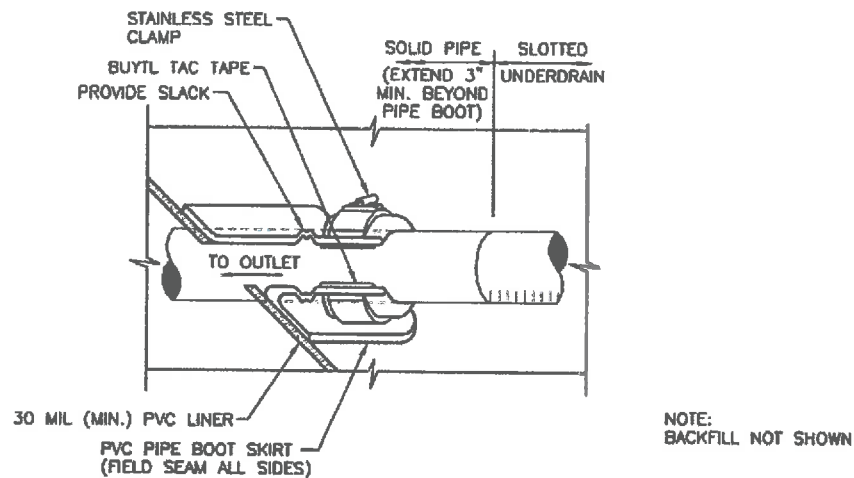


Figure SF-2. Geomembrane Liner/Underdrain Penetration Detail

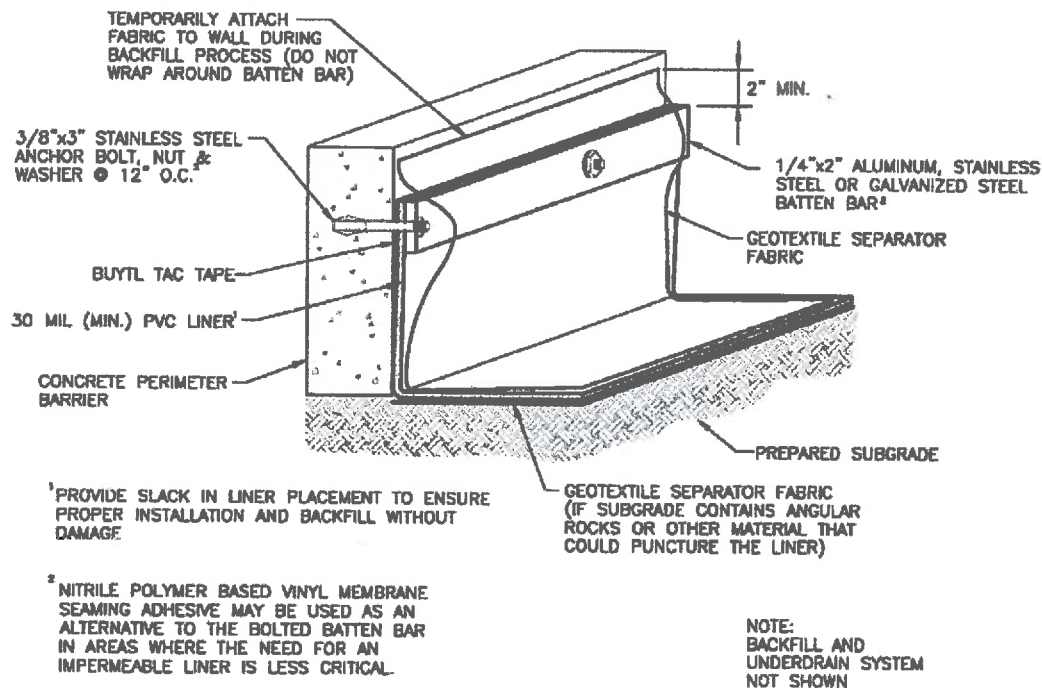


Figure SF-3. Geomembrane Liner/Concrete Connection Detail

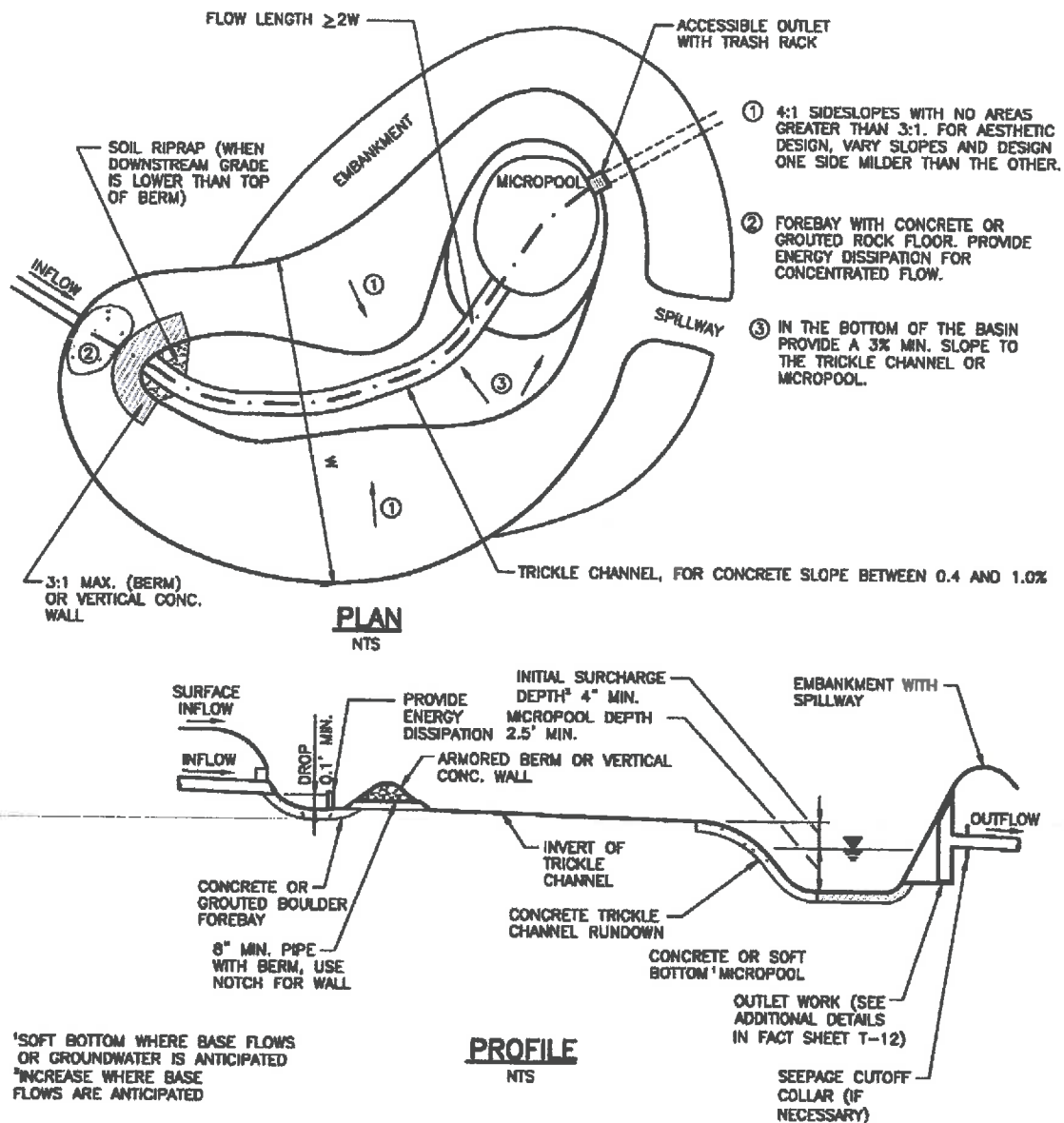
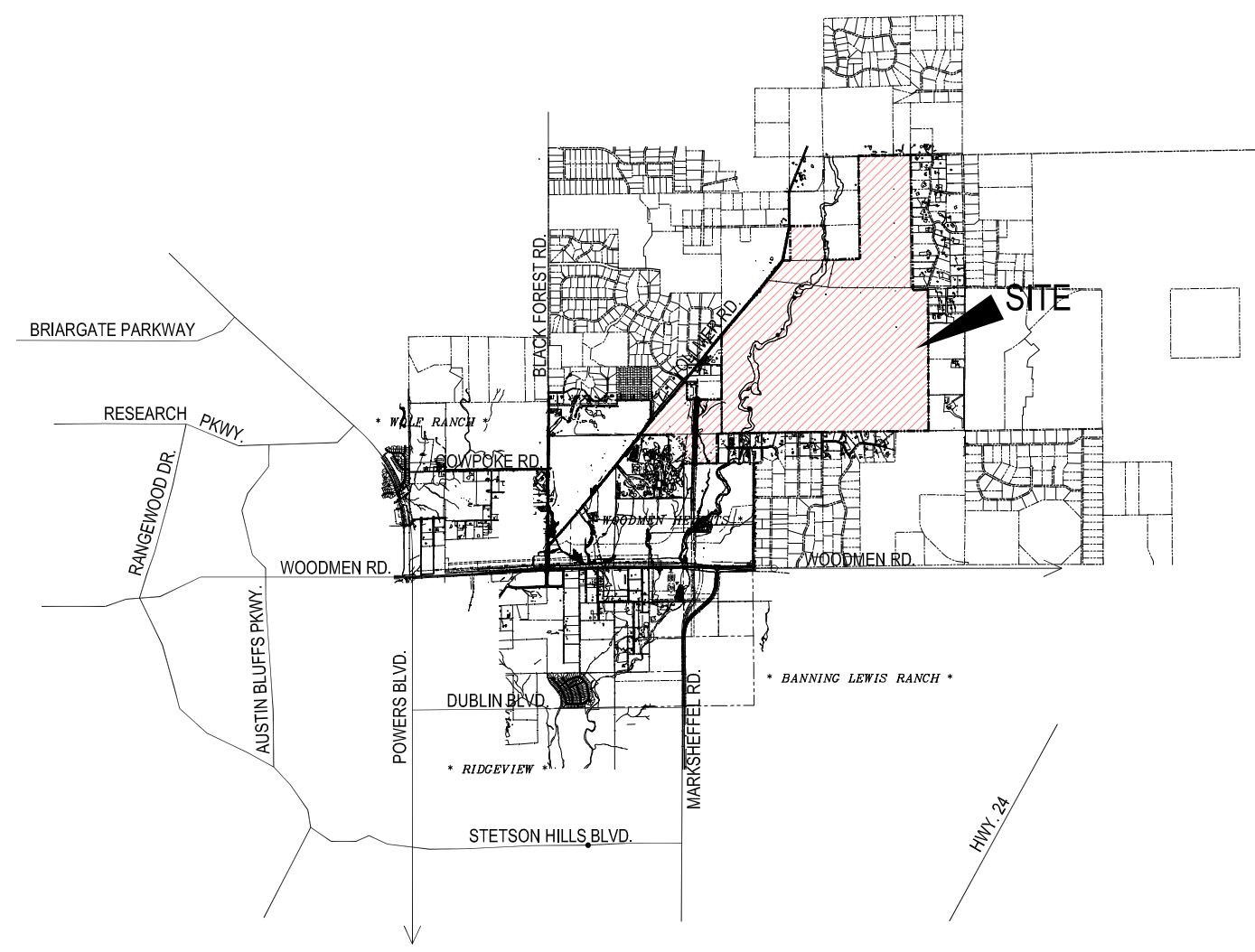


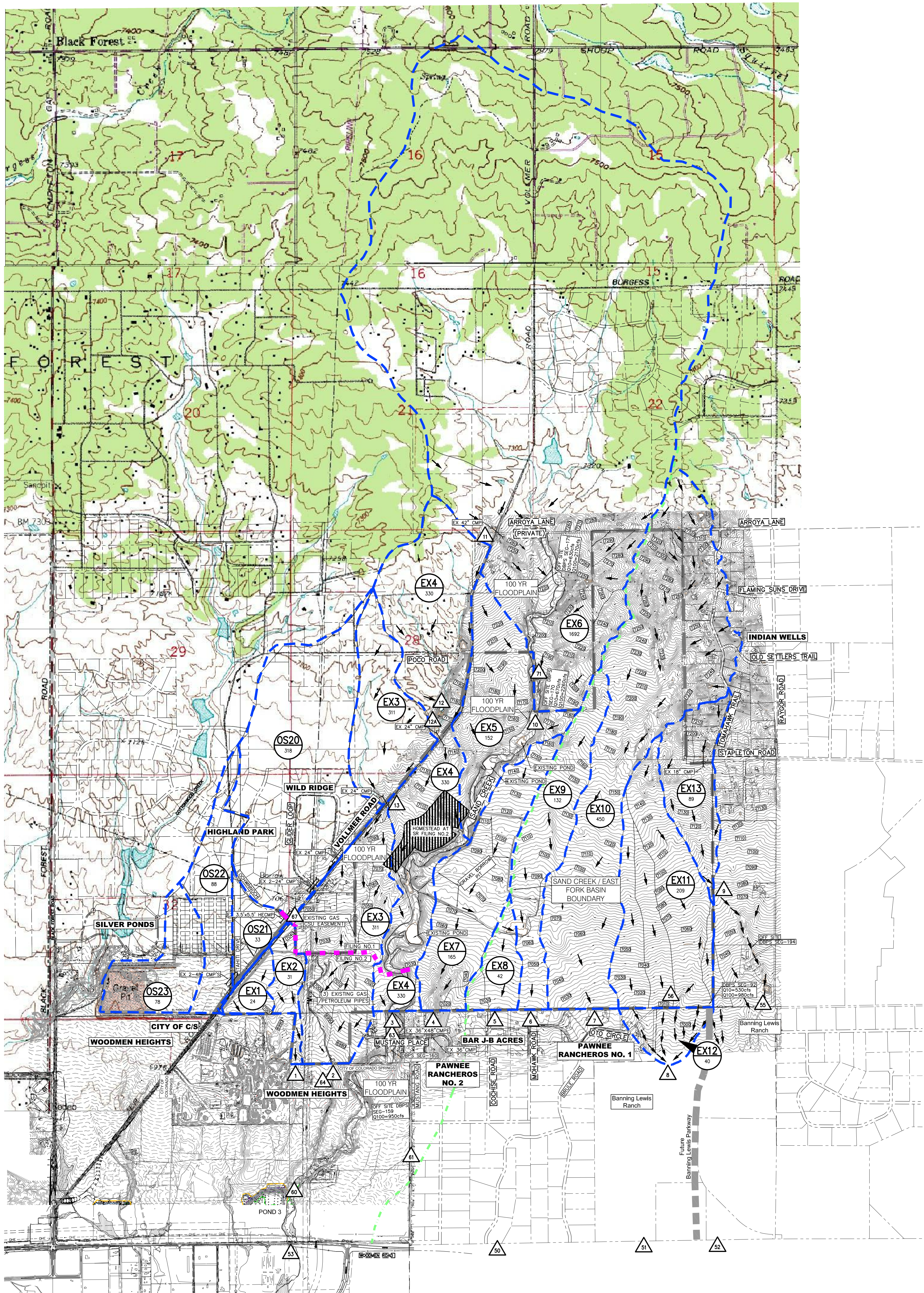
Figure EDB-3. Extended Detention Basin (EDB) Plan and Profile

Additional Details are provided in BMP Fact Sheet T-12. This includes outlet structure details including orifice plates and trash racks.

HISTORIC, EXISTING AND PROPOSED DRAINAGE MAPS



STERLING RANCH
N.T.S.



HISTORIC CONDITION

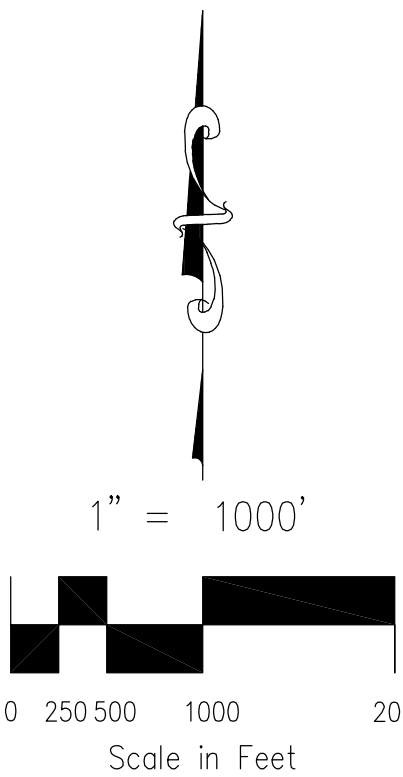
BASIN SUMMARY			
BASIN	AREA (ACRES)	Q _s (CFS)	Q ₁₀₀ (CFS)
EX-1	24	3	40
EX-2	31	3	45
EX-3	311	49	341
EX-4	330	71	352
EX-5	152	14	209
EX-6	1692	118	2168
EX-7	165	12	197
EX-8	42	4	64
EX-9	132	11	149
EX-10	450	48	474
EX-11	209	17	261
EX-12	40	5	65
EX-13	89	6	114
OS-20	318	61	310
OS-21	33	8	38
OS-22	88	18	91
OS-23	78	34	84

* NOTE: BASIN S OS-22 & OS-23 NOT PART OF THIS REPORT. FLOWS FOLLOW HISTORIC PATTERNS ON THE WEST SIDE OF VOLLMER ROAD.

HISTORIC CONDITION

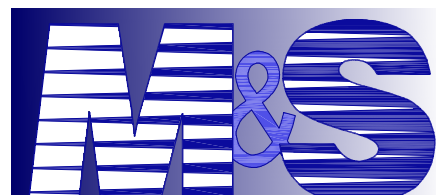
DESIGN POINTS					
DESIGN POINT	SQ. MI.	Q _s (CFS)	Q ₁₀₀ (CFS)	SQ. MI.	DBPS DP/D
1	0.09	5	84		
2	0.49	49	341	0.74	465 64
3	0.52	139	2610	4.33	2552 63
4	0.26	12	197		
5	0.07	4	64		
6	0.21	11	149		
7	0.70	48	474		
8	0.39	18	305		
9	0.14	6	114		
10	2.64	122	2245	3.27	2245 71
11	0.09	5	83		
12A	0.01	3	16		
12	0.27	10	200		
13	0.17	6	126		

* NOTE: SQ. MI. ARE NOT CONSTANT AT EACH DESIGN POINT DP-DBPS



LEGEND

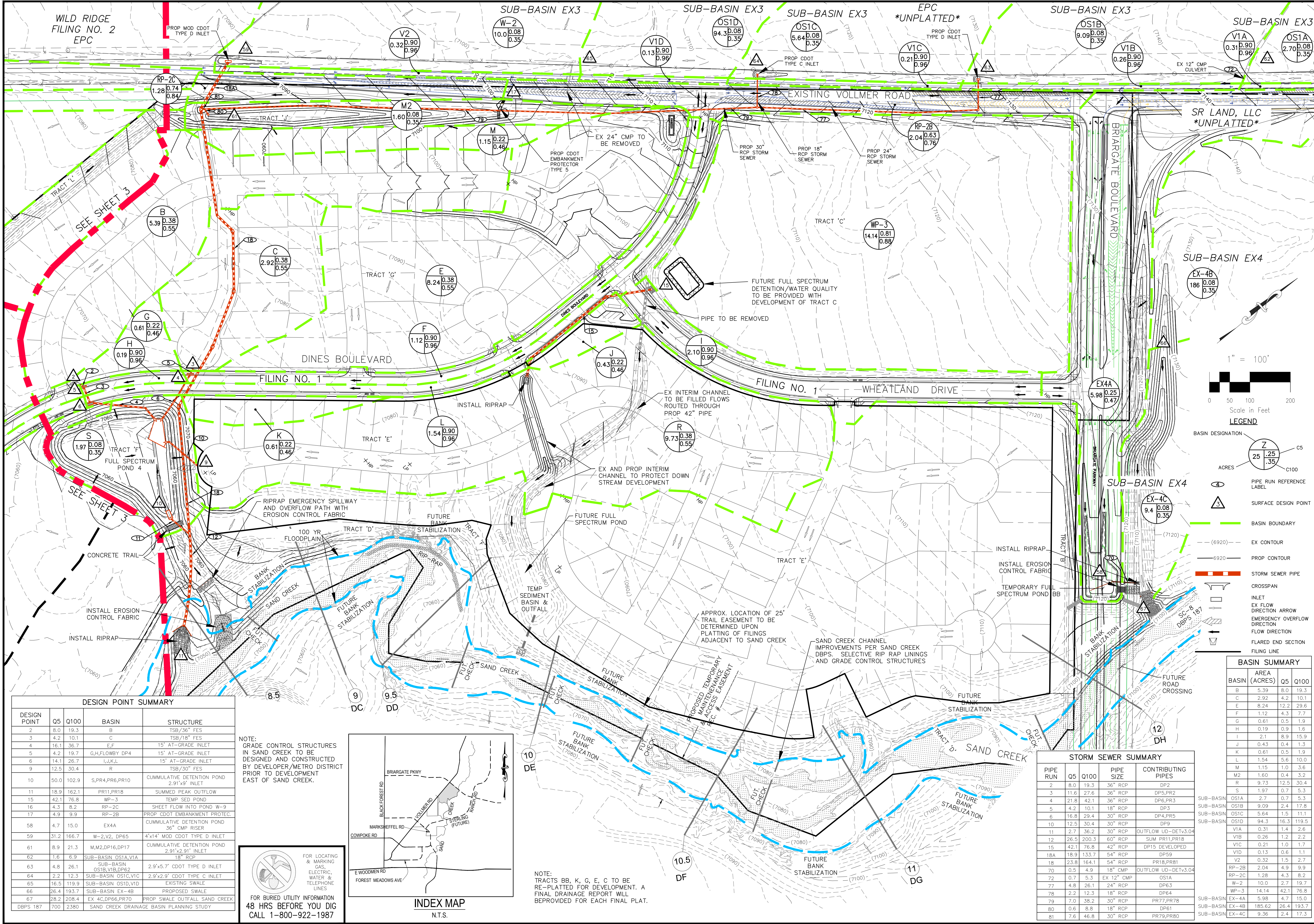
- EX1 312 EXISTING MDDP BASIN ACREAGE
- E1 EXISTING FLOW RELEASE POINT
- FLOW DIRECTION
- BASIN BOUNDARY
- FILING NO.1 & NO.2 DIVISION LINE
- PROPERTY BOUNDARY
- 6920 EXISTING CONTOUR
- CULVERT PIPE



STERLING RANCH

HISTORIC - DRAINAGE MAP

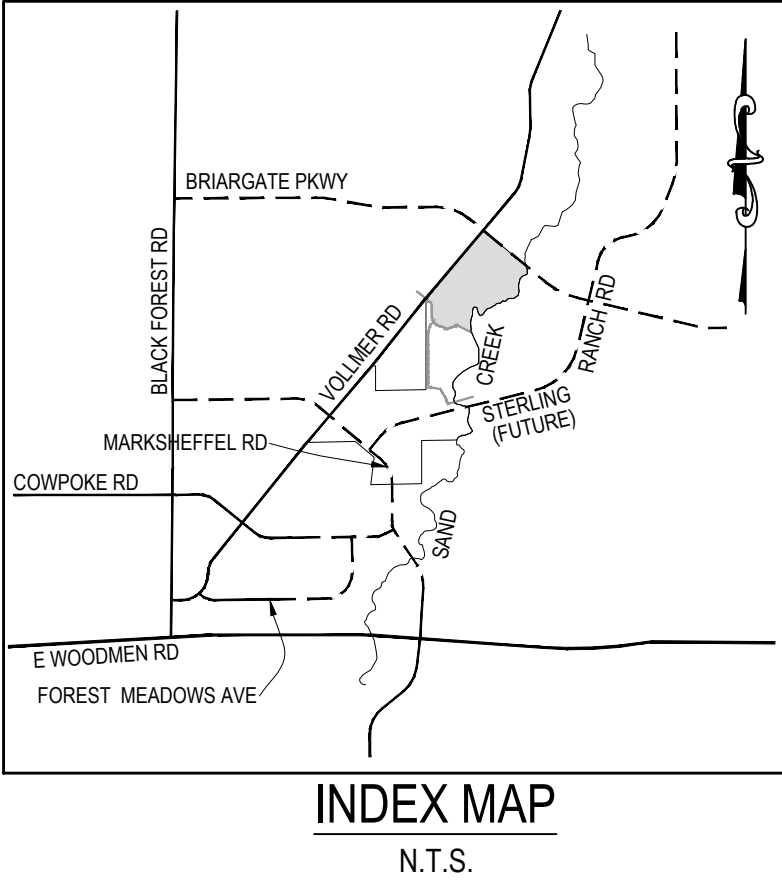
PROJECT NO. 09-002	FILE: 0:\dwg\Eng Exhibits\MDDP HISTORIC	DATE: 2/6/17
DESIGNED BY: VAS	SCALE	
DRAWN BY: VAS	HORIZ: 1"=1000'	
CHECKED BY: VAS	VERT: N/A	SHEET 1 OF 1



DESIGN POINT SUMMARY				
DESIGN POINT	Q5	Q100	BASIN	STRUCTURE
2	8.0	19.3	B	TSB/36" FES
3	4.2	10.1	C	TSB/18" FES
4	16.1	36.7	E,F	15' AT-GRADE INLET
5	4.2	19.7	G,H,FLOWBY DP4	15' AT-GRADE INLET
6	14.1	26.7	I,J,K,L	15' AT-GRADE INLET
9	12.5	30.4	R	TSB/30" FES
10	50.0	102.9	S,PR4,PR6,PR10	CUMULATIVE DETENTION POND 2.91'x9' INLET
11	18.9	162.1	PR11,PR18	SUMMED PEAK OUTFLOW
15	42.1	76.8	WP-3	TEMP SED POND
16	4.3	8.2	RP-2C	SHEET FLOW INTO POND W-9
17	4.9	9.9	RP-2B	PROP CDOT EMBANKMENT PROTEC.
58	4.7	15.0	EX4A	CUMULATIVE DETENTION POND 36" CMP RISER
59	31.2	166.7	W-2,V2, DP65	4'x14' MOD CDOT TYPE D INLET
61	8.9	21.3	M,M2,DP16,DP17	CUMULATIVE DETENTION POND 2.91'x2.91' INLET
62	1.6	6.9	SUB-BASIN OS1A,V1A	18" RCP
63	4.8	26.1	SUB-BASIN OS1B,V1B,DP62	2.9'x5.7' CDOT TYPE D INLET
64	2.2	12.3	SUB-BASIN OS1C,V1C	2.9'x2.9' CDOT TYPE C INLET
65	16.5	119.9	SUB-BASIN OS1D,V1D	EXISTING SWALE
66	26.4	193.7	SUB-BASIN EX-4B	PROPOSED SWALE
67	28.2	208.4	EX 4C,DP66,PR70	PROP SWALE OUTFALL SAND CREEK
DBPS 187	700	2380	SAND CREEK DRAINAGE BASIN PLANNING STUDY	

NOTE: GRADE CONTROL STRUCTURES IN SAND CREEK TO BE DESIGNED AND CONSTRUCTED BY DEVELOPER/METRO DISTRICT PRIOR TO DEVELOPMENT EAST OF SAND CREEK.

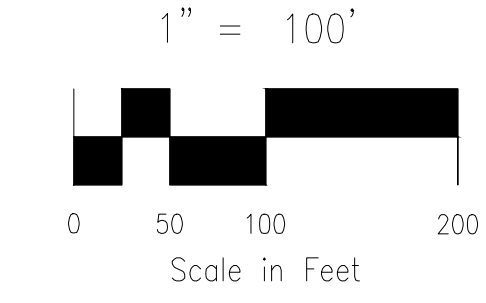
FOR BURIED UTILITY INFORMATION 48 HRS BEFORE YOU DIG CALL 1-800-922-1987



NOTE: TRACTS BB, K, G, E, C TO BE RE-PLATTED FOR DEVELOPMENT. A FINAL DRAINAGE REPORT WILL BE PROVIDED FOR EACH FINAL PLAT.

STORM SEWER SUMMARY			
PIPE RUN	Q5	Q100	CONTRIBUTING PIPES
2	8.0	19.3	36" RCP DP2
3	11.6	27.6	36" RCP DP5,PR2
4	21.8	42.1	36" RCP DP6,PR3
5	4.2	10.1	18" RCP DP3
6	16.8	29.4	30" RCP DP4,PR5
10	12.5	30.4	30" RCP DP9
11	2.7	36.2	30" RCP OUTFLOW UD-DET3.04
12	26.5	200.3	60" RCP SUM PR11,PR18
15	42.1	76.8	42" RCP DP15 DEVELOPED
18A	18.9	133.7	54" RCP DP59
18	23.8	164.1	54" RCP PR18,PR81
70	0.5	4.9	18" CMP OUTFLOW UD-DET3.04
72	0.7	5.3	EX 12" CMP OS1A
77	4.8	26.1	24" RCP DP63
78	2.2	12.3	18" RCP DP64
79	7.0	38.2	30" RCP PR77,PR78
80	0.6	8.8	18" RCP DP61
81	7.6	46.8	30" RCP PR79,PR80

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q5	Q100
B	5.39	8.0	19.3
C	2.92	4.2	10.1
E	8.24	12.2	29.6
F	1.12	4.3	7.7
G	0.61	0.5	1.9
H	0.19	0.9	1.6
I	2.1	8.9	15.9
J	0.43	0.4	1.3
K	0.61	0.5	1.9
L	1.54	5.6	10.0
M	1.15	1.0	3.6
M2	1.60	0.4	3.2
R	9.73	12.5	30.4
S	1.97	0.7	5.3
SUB-BASIN OS1A	2.7	0.7	5.3
SUB-BASIN OS1B	9.09	2.4	17.8
SUB-BASIN OS1C	5.64	1.5	11.1
SUB-BASIN OS1D	94.3	16.3	119.5
V1A	0.31	1.4	2.6
V1B	0.26	1.2	2.2
V1C	0.21	1.0	1.7
V1D	0.13	0.6	1.1
V2	0.32	1.5	2.7
W-2	10.0	4.9	9.9
RP-2C	1.28	4.3	8.2
W-2	10.0	2.7	19.7
WP-3	14.14	42.1	76.8
SUB-BASIN EX-4A	5.98	4.7	15.0
SUB-BASIN EX-4B	185.62	26.4	193.7
SUB-BASIN EX-4C	9.36	2.4	17.3



- LEGEND
- BASIN DESIGNATION
 - ACRES
 - PIPE RUN REFERENCE LABEL
 - SURFACE DESIGN POINT
 - BASIN BOUNDARY
 - EX CONTOUR
 - PROP CONTOUR
 - STORM SEWER PIPE
 - CROSSSPAN
 - INLET
 - EX FLOW DIRECTION ARROW
 - EMERGENCY OVERFLOW DIRECTION
 - FLOW DIRECTION
 - FLARED END SECTION
 - FILING LINE

STERLING RANCH FILING NO. 1

PROPOSED FINAL DRAINAGE MAP

PROJECT NO. 09-002

DESIGNED BY: ET

DRAWN BY: BB

CHECKED BY: GT

DATE: 1/2/2018

SHEET 4 OF 4

SHEET 4

20 BOULDER CREST DRIVE SUITE 110

COLORADO SPRINGS, CO 80903

PHONE: 719.555.5485

CIVIL CONSULTANTS, INC.

FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.

APPROVED BY: DATE: DESCRIPTION:

REVISIONS:

NO. DATE: BY: DESCRIPTION:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CAUTION

HOMESTEAD AT STERLING RANCH FILING NO. 2
COUNTY OF EL PASO, STATE OF COLORADO
PROPOSED DRAINAGE MAP

JANUARY 2020

LEGEND

- BASIN DESIGNATION
ACRES
PIPE RUN REFERENCE LABEL
SURFACE DESIGN POINT
BASIN BOUNDARY
EXISTING CONTOUR
PROP CONTOUR
HOMESTEAD FILING NOS. 2&3 BOUNDARY
PROPOSED STORM SEWER PIPE
EXISTING STORM SEWER PIPE
CROSSSPAN
INLET
EXISTING FLOW DIRECTION ARROW
PROPOSED FLOW DIRECTION ARROW
FLARED END SECTION
HIGH POINT
LOW POINT

NOTE:
FOR CONSTRUCTION DRAWINGS AND DETAILS; SEE SAND CREEK BANK STABILIZATION PLAN, & GRADING AND EROSION CONTROL PLAN FOR HOMESTEAD AT STERLING RANCH FILING NO. 2 BY M&S CIVIL CONSULTANTS, INC.

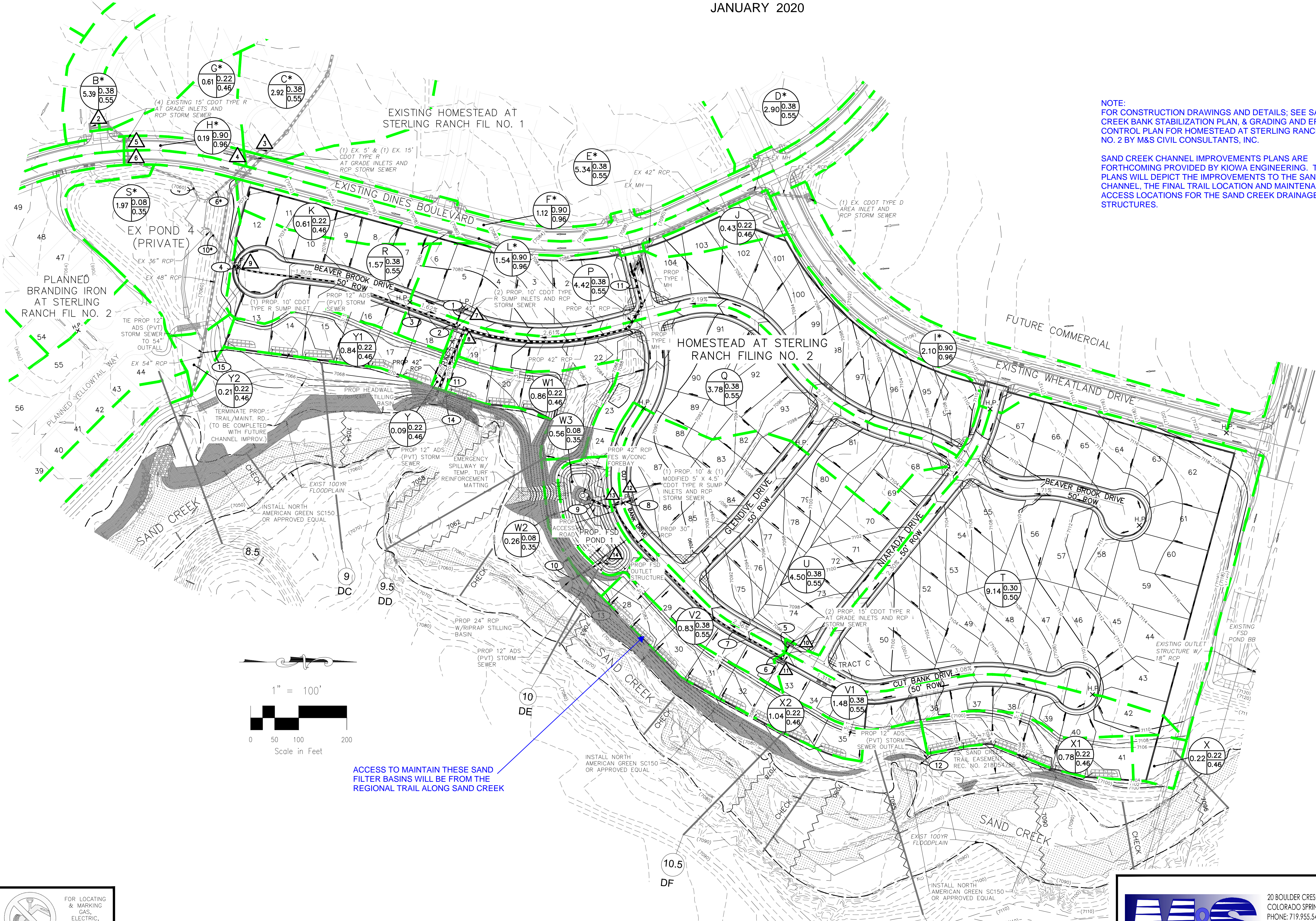
SAND CREEK CHANNEL IMPROVEMENTS PLANS ARE FORTHCOMING PROVIDED BY KIOWA ENGINEERING. THESE PLANS WILL DEPICT THE IMPROVEMENTS TO THE SAND CREEK CHANNEL, THE FINAL TRAIL LOCATION AND MAINTENANCE ACCESS LOCATIONS FOR THE SAND CREEK DRAINAGE STRUCTURES.

STORM SEWER SUMMARY					BASIN SUMMARY				
PIPE RUN	Q ₅	Q ₁₀₀	PIPE SIZE	CONTRIBUTING PIPES/DESIGN POINTS	BASIN	AREA (ACRES)	Q ₅	Q ₁₀₀	
1	5.7	13.8	18" RCP	DP7	ONSITE BASINS				
2	4.9	11.8	18" RCP	DP8	J	0.43	0.4	1.3	
3	10.6	25.7	24" RCP	PR1, PR2	K	0.61	0.5	1.9	
4	12.4	30.1	30" RCP	DP9, PR3	P	4.42	5.7	13.8	
5	9.1	12.7	18" RCP	DP10	Q	3.78	4.9	11.8	
6	1.9	12.7	18" RCP	DP11	R	1.57	2.2	5.4	
7	10.9	25.3	30" RCP	PR5, PR6	T	9.14	9.4	26.4	
8	6.2	17.2	24" RCP	DP12	U	4.50	6.4	15.6	
9	17.9	47.1	42" RCP	DP13, PR7, PR8	V1	1.48	2.1	5.0	
10	0.7	23.5	24" RCP	OUTLET STRUC.	V2	0.83	1.2	2.9	
11	42.1	76.8	42" RCP	CONTINUED FROM MDDP DP151	W1	0.56	0.2	1.7	
12	0.0	1.3	12" ADS	LOTS 36-41	W2	0.26	0.1	0.8	
13	0.0	1.6	12" ADS	LOTS 28-35	W3	0.56	0.2	1.7	
14	0.0	1.5	12" ADS	LOTS 19-24	X	0.22	0.2	0.8	
15	0.0	1.4	12" ADS	LOTS 13-18	X1	0.78	0.8	2.8	
4*	21.8	42.1	36" RCP	SEE MDDP*	X2	1.04	1.1	3.7	
6*	16.8	29.4	30" RCP	SEE MDDP*	Y	0.09	0.1	0.3	
10*	12.5	30.4	30" RCP	SEE MDDP*	Y1	0.84	0.8	3.0	
					Y2	0.21	0.2	0.7	

FULL SPECTRUM DETENTION INTERIM POND 1			
WO VOLUME	0.245 AC-FT		
EURV VOLUME	0.741 AC-FT		
100 YR STORAGE VOLUME	1.331 AC-FT		
100 YR WATER SURFACE EL	7083.91		
SPILLWAY CREST EL	7084.16		
TOP OF EMBANKMENT EL	7086.00		
SPILLWAY DESIGN FLOW DEPTH	0.84 FT		

DESIGN POINT SUMMARY			
DESIGN POINT	Q ₅	Q ₁₀₀	STRUCTURE
2*	8.0	19.3	(2) EX. 15" AT-GRADE INLETS
3*	4.2	10.1	C* EX. 6" SUMP INLET
4*	16.1	36.7	D*, E*, F* EX. 15" AT-GRADE INLET
5*	4.2	19.7	G*, H*, FLOWBY DP4* EX. 15" AT-GRADE INLET
6*	14.1	26.7	I*, J*, K*, L* EX. 15" AT-GRADE INLET
7	5.7	13.8	P PROP. 10" SUMP INLET
8	4.9	11.8	Q PROP. 10" SUMP INLET
9	2.2	5.4	R PROP. 5" SUMP INLET
10	9.4	15.6	T PROP. 15" AT-GRADE INLET
11	1.9	15.6	V1 PROP. 15" AT-GRADE INLET
12	6.2	17.2	U, FLOWBY DP10 PROP. 10" SUMP INLET
13	1.2	5.9	V2, FLOWBY DP11 PROP. 5" SUMP INLET
14	19.6	52.4	W3, PR9 CUMULATIVE DETENTION POND

* For detailed information on Design Points, Basins, Flowby, or Pipe Runs see Sterling Ranch Filing Nos. 1&2 MDDP prepared by M&S Civil Consultants, dated April 2017.
Refer to Homestead at Sterling Ranch Filing No. 2 Grading and Erosion Control Plan for additional interim channel stabilization improvements.
All elevations provided on map are referenced in NGVD29



ACCESS TO MAINTAIN THESE SAND FILTER BASINS WILL BE FROM THE REGIONAL TRAIL ALONG SAND CREEK

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

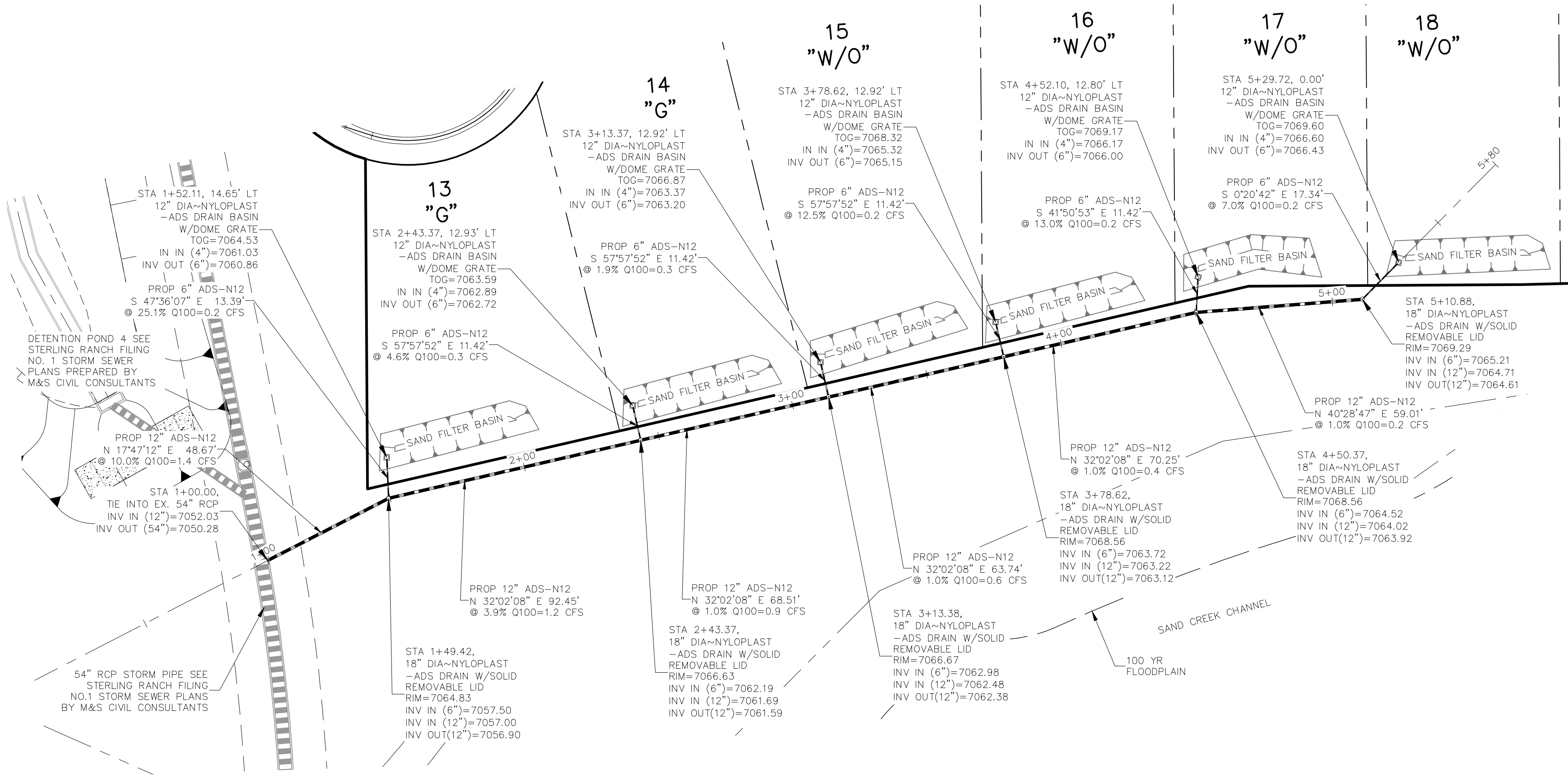


20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

HOMESTEAD AT STERLING RANCH FIL. NO. 2

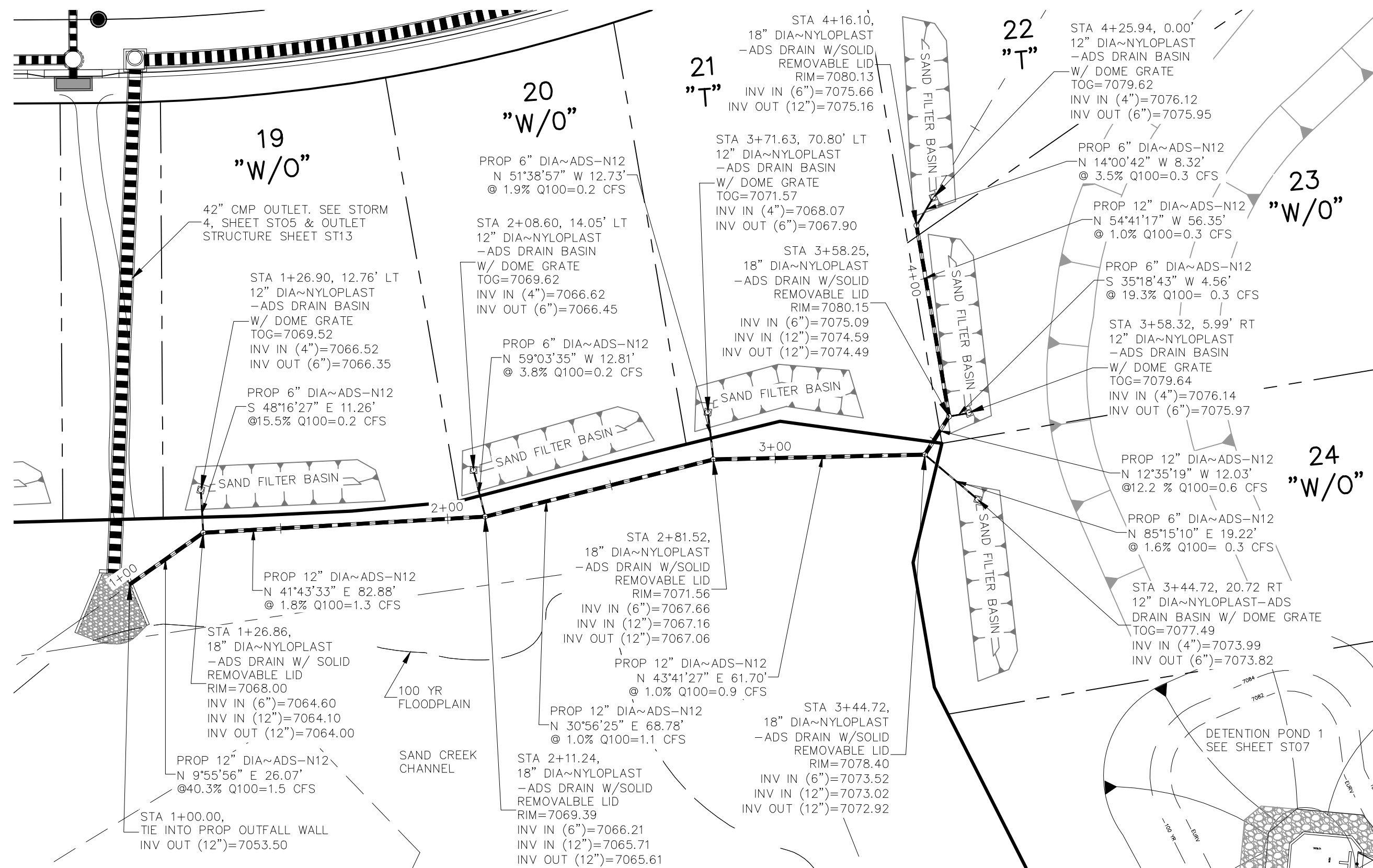
PROPOSED DRAINAGE MAP

PROJECT NO. 09-007	SCALE: HORIZONTAL: 1"=100' VERTICAL: N/A	DATE: 01/15/2020	
DESIGNED BY: CMN			
DRAWN BY: CMN			
CHECKED BY: VAS			
		SHEET 1 OF 1	PDM



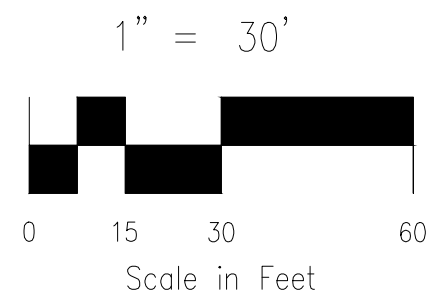
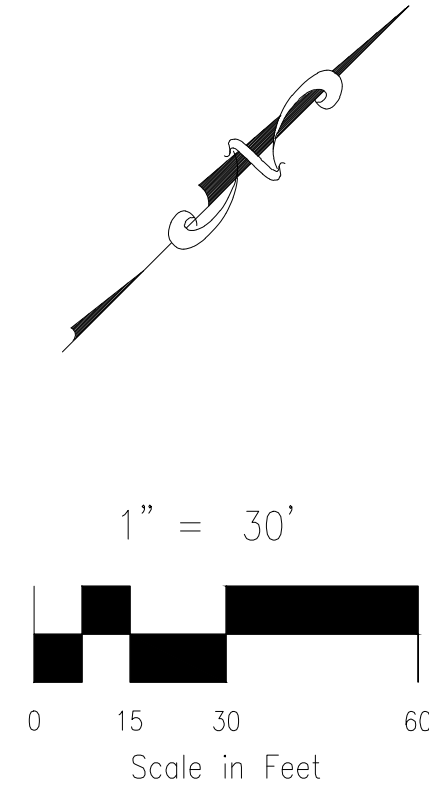
LOTS 13-18 STORM SEWER (PRIVATE)

SCALE 1"=30'



LOTS 19-24 STORM SEWER (PRIVATE)

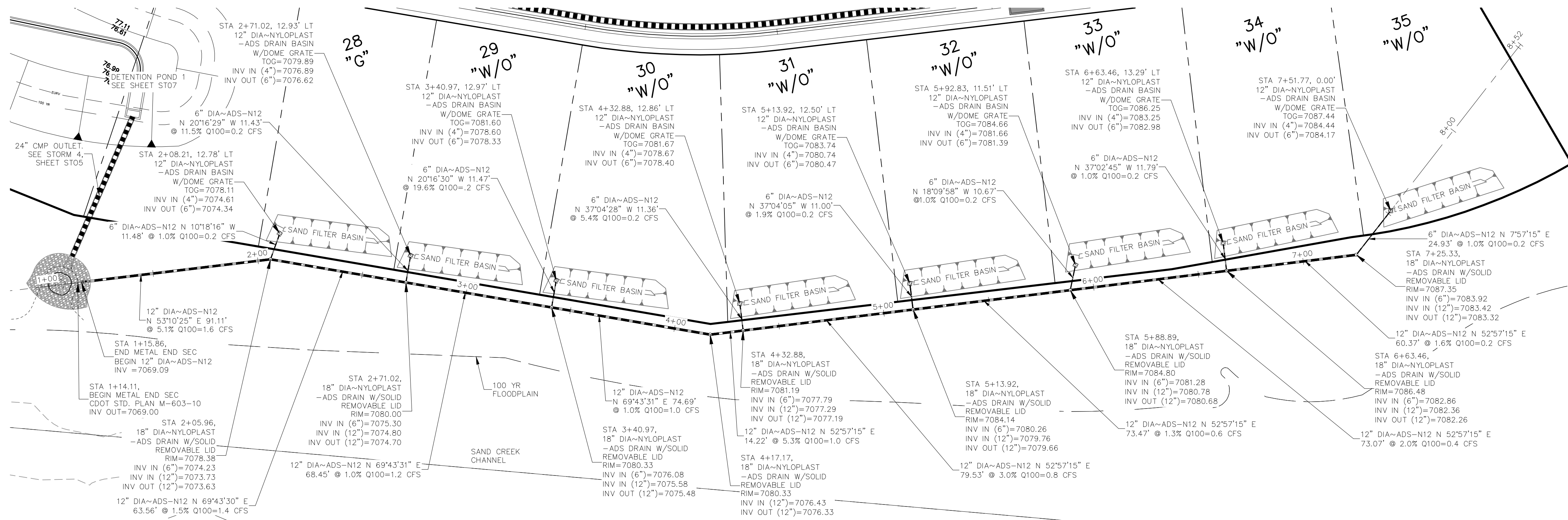
SCALE 1"=30'



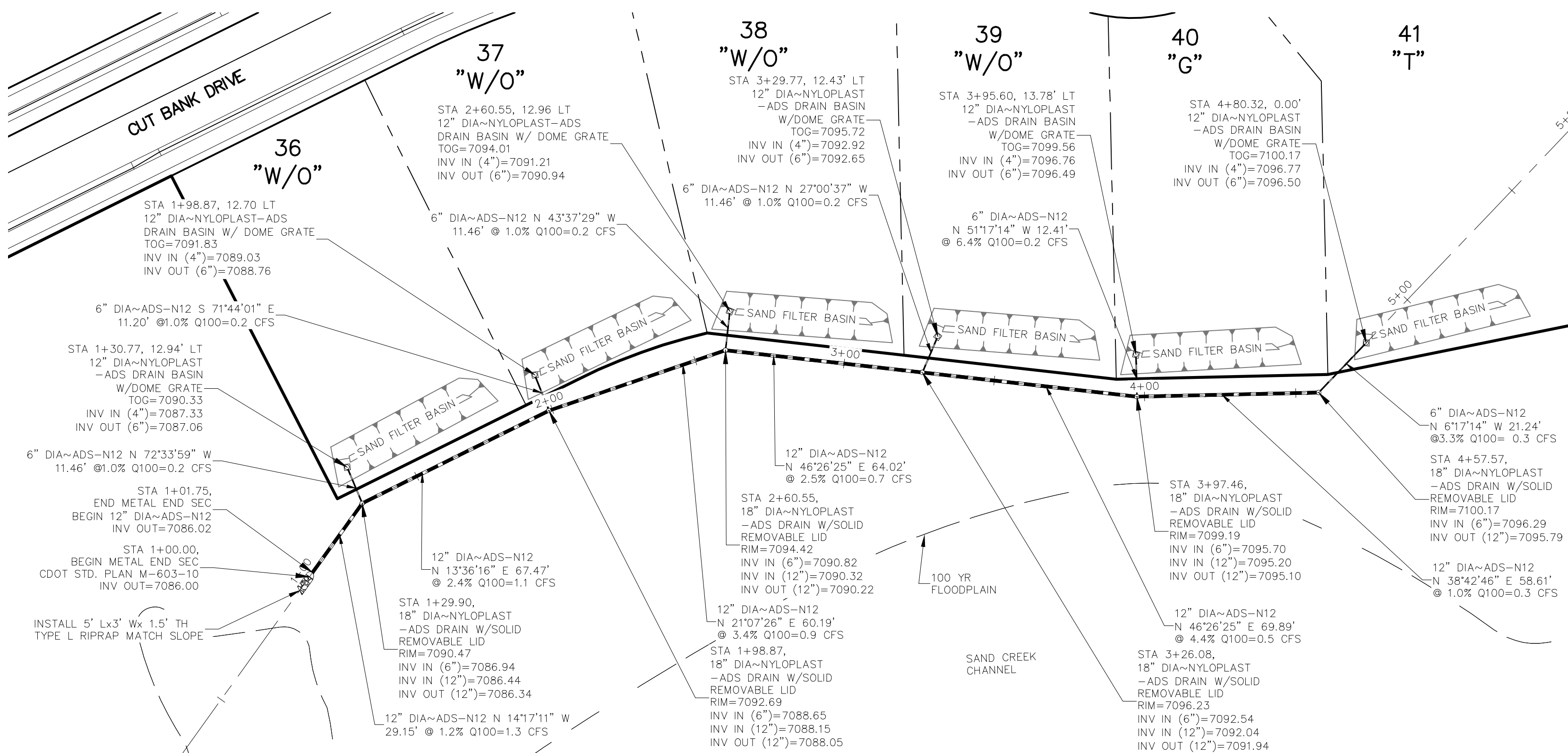
REVISIONS:			
NO.	DATE:	BY:	DESCRIPTION:
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.			
CAUTION			

FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.			
VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160			
102 E. PIKES PEAK AVE., 5TH FLOOR COLORADO SPRINGS, CO 80903 PHONE: 719.555.5485			
CIVIL CONSULTANTS, INC.			

HOMESTEAD AT STERLING RANCH FIL. NO. 2			
SAND FILTER PONDS LOTS 13-24			
PROJECT NO. 09-007	FILE: Yang\Const.Dwg\Street & Storm Plans\ST11.dwg	DATE: 11/19/2019	SHEET 11 OF 14 ST11
DESIGNED BY: CMM	SCALE: 1"=10'	VERT: N/A	
DRAWN BY: CMM	CHECKED BY: VAS		



LOTS 28-35 STORM SEWER (PRIVATE)
SCALE 1"=30'



LOTS 36-41 STORM SEWER (PRIVATE)
SCALE 1"=30'

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Colorado Springs, CO 80903
PHONE: 719.555.5485

CIVIL CONSULTANTS, INC.

HOMESTEAD AT STERLING RANCH FIL. NO. 2

SAND FILTER PONDS LOTS 28-41

PROJECT NO. 09-007

FILE: Yang\Const Dwg\Street & Storm Plans\ST12.dwg

DATE: 11/19/2019

DESIGNED BY: CMM

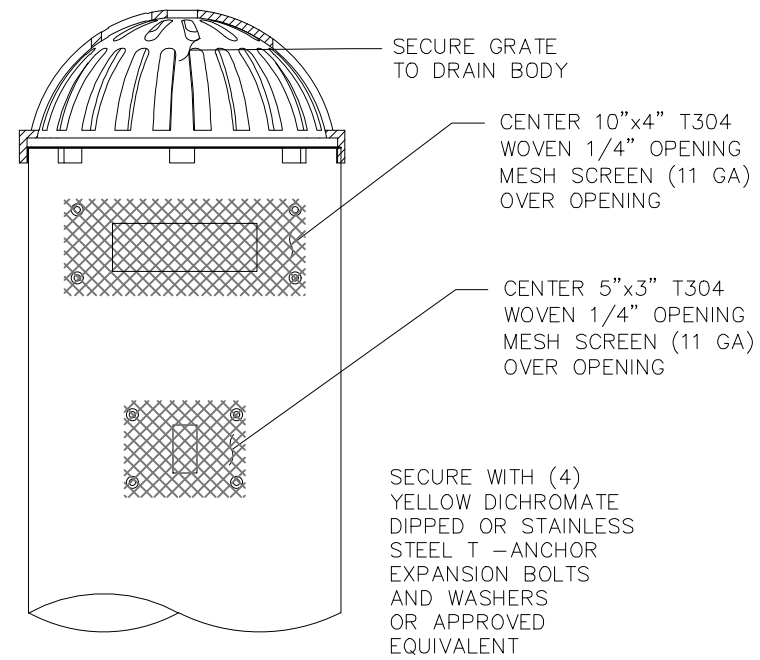
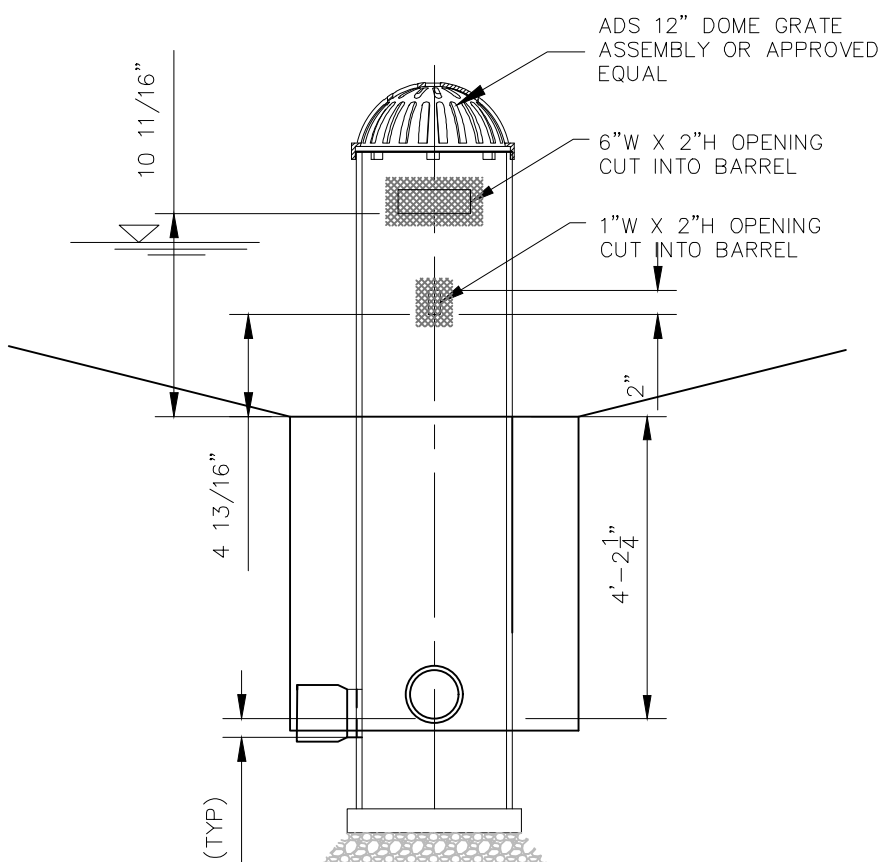
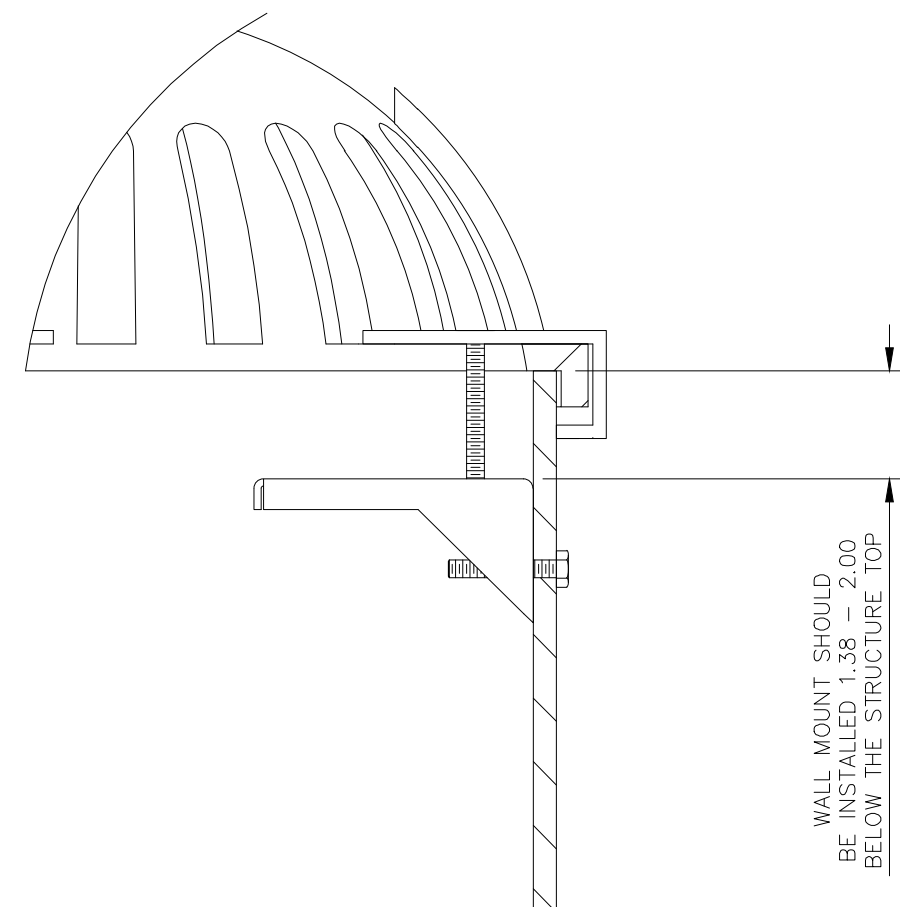
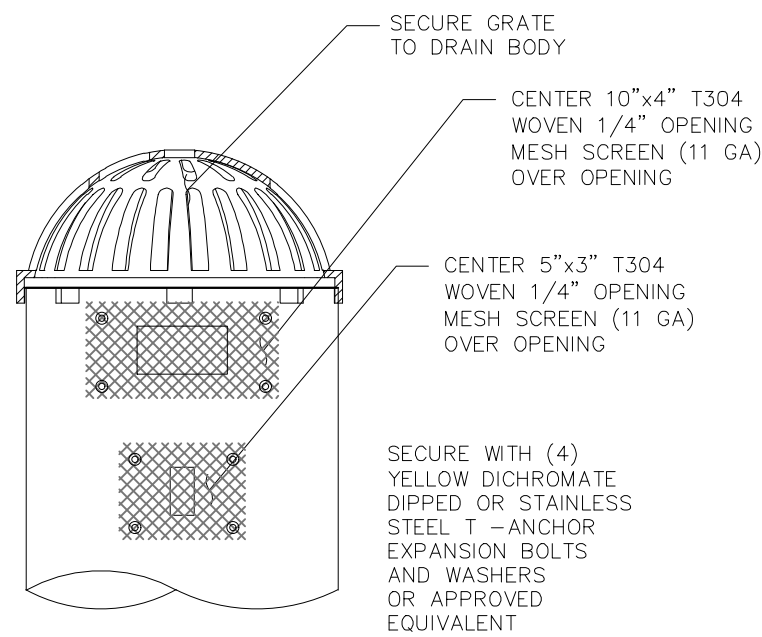
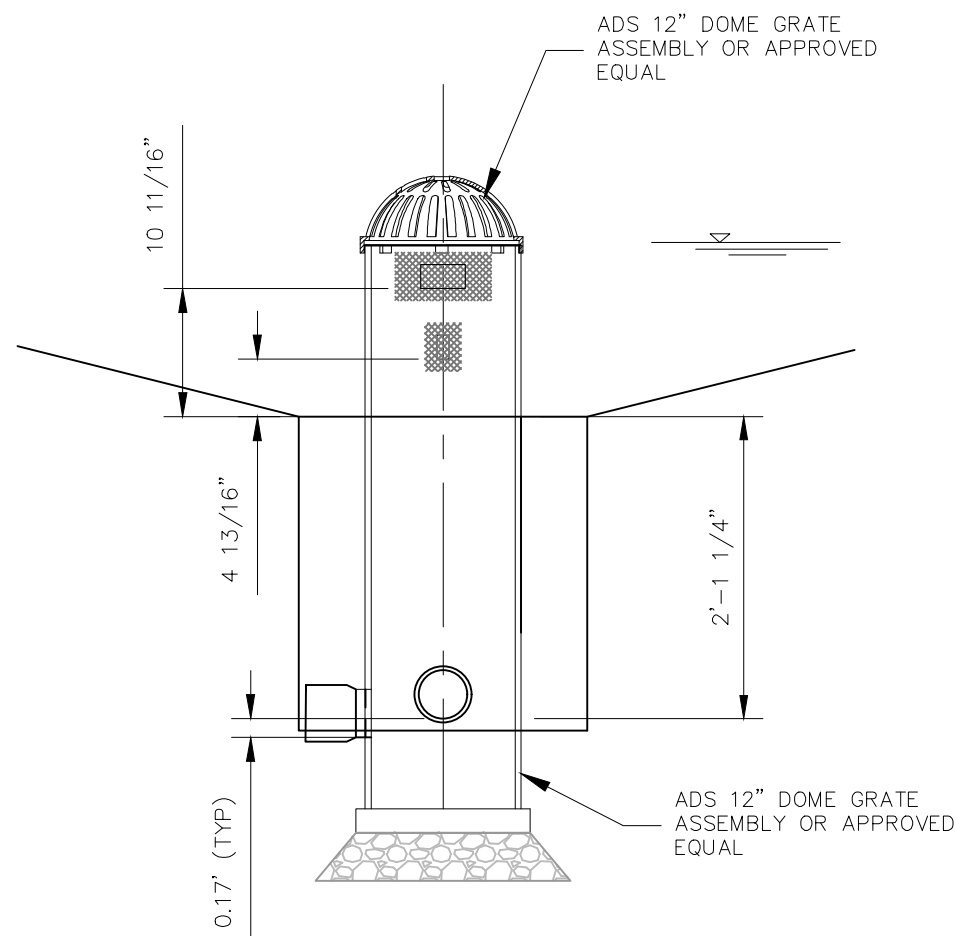
DRAWN BY: CMM

CHECKED BY: VAS

SCALE: 1"=10'

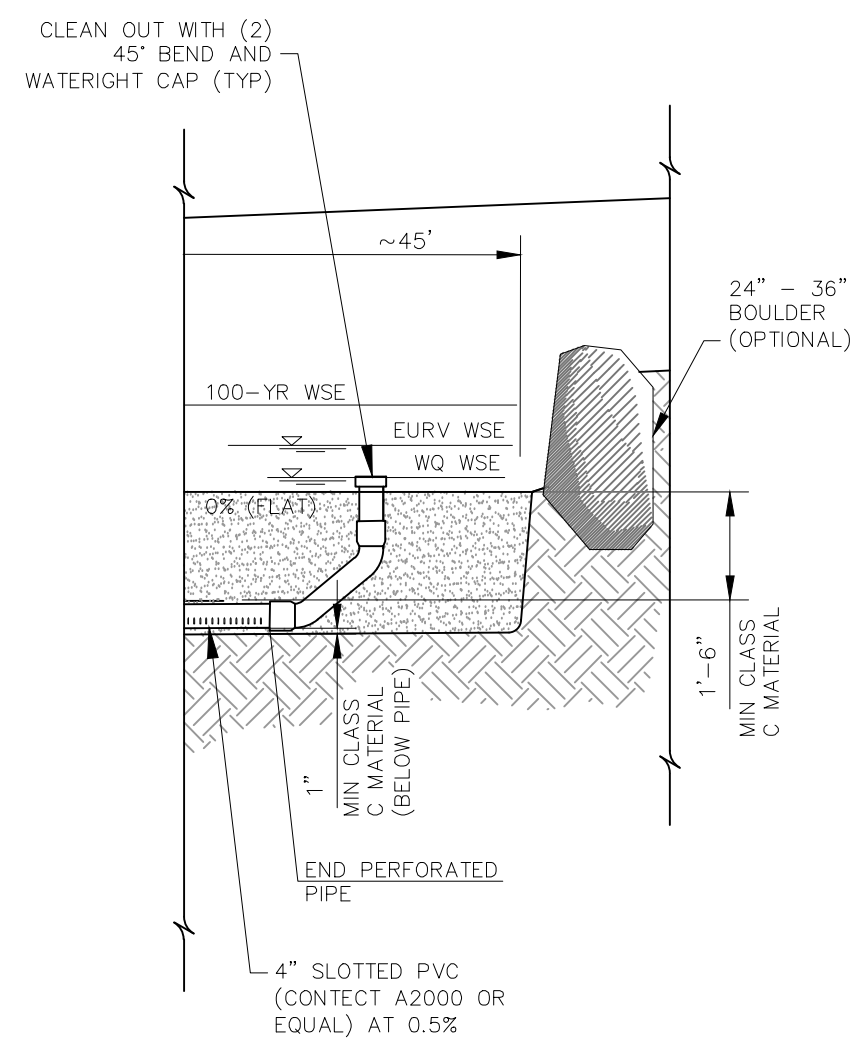
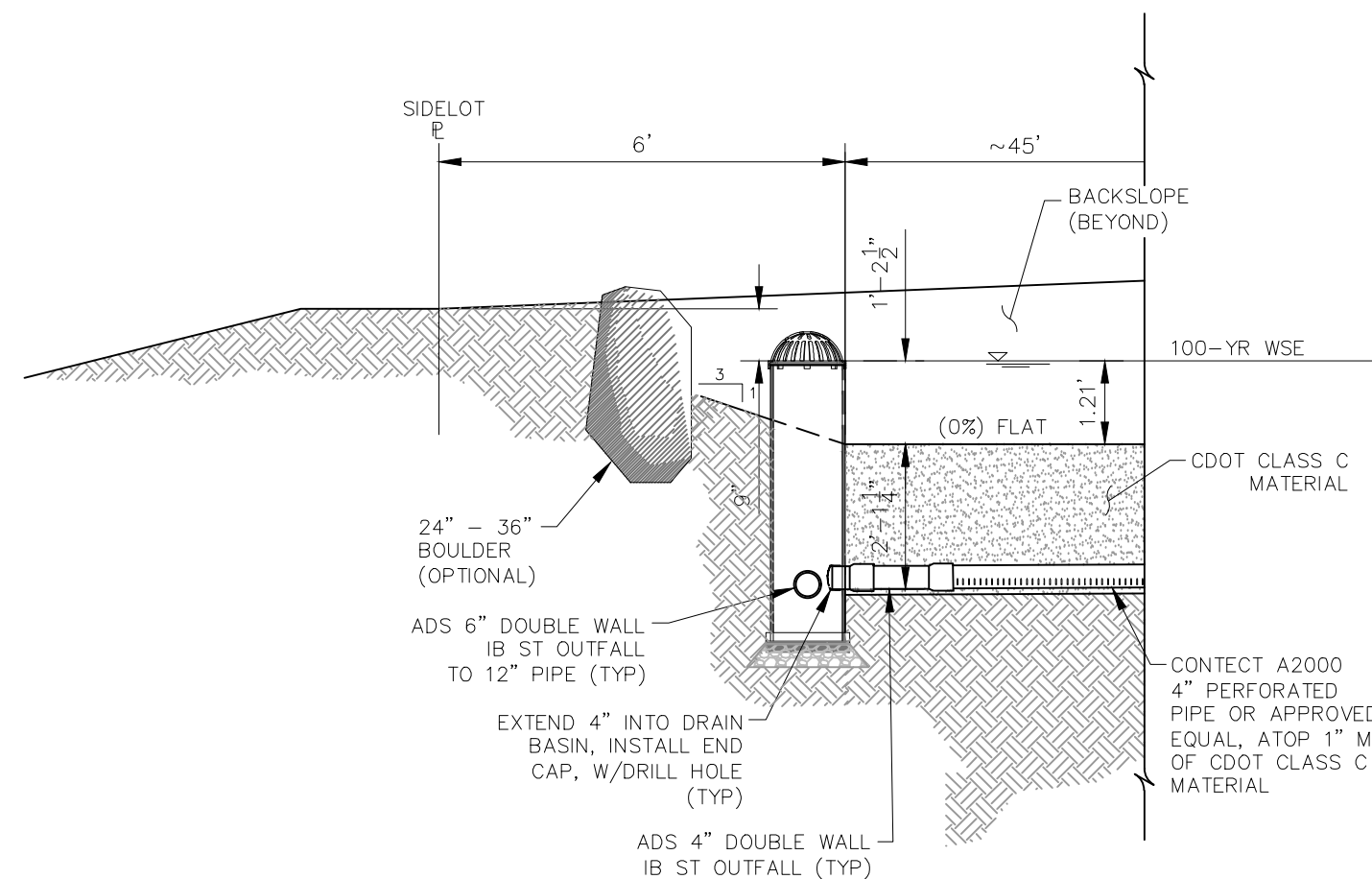
SHEET 12 OF 14

ST12

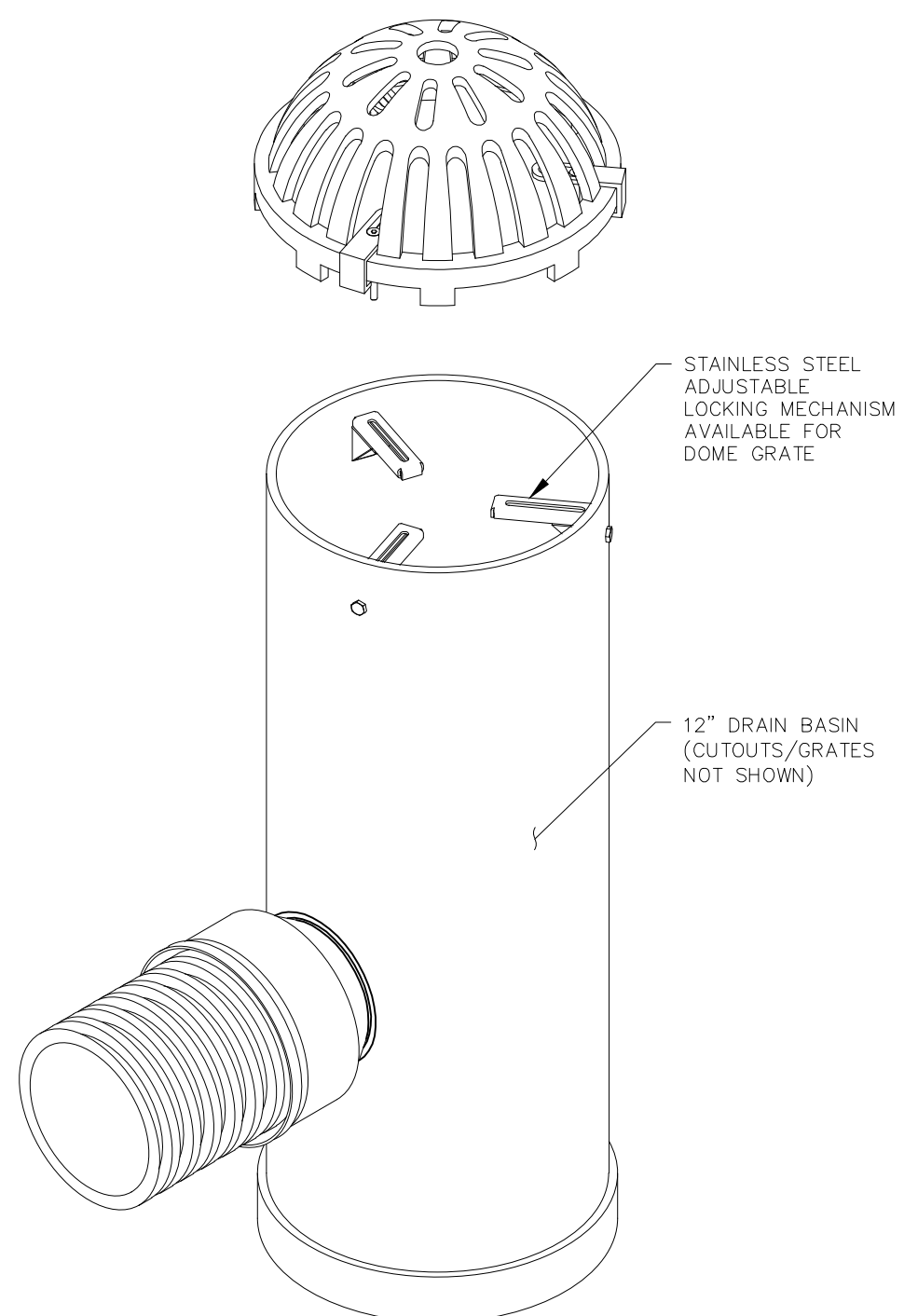


SCREEN DETAILS
NOT TO SCALE

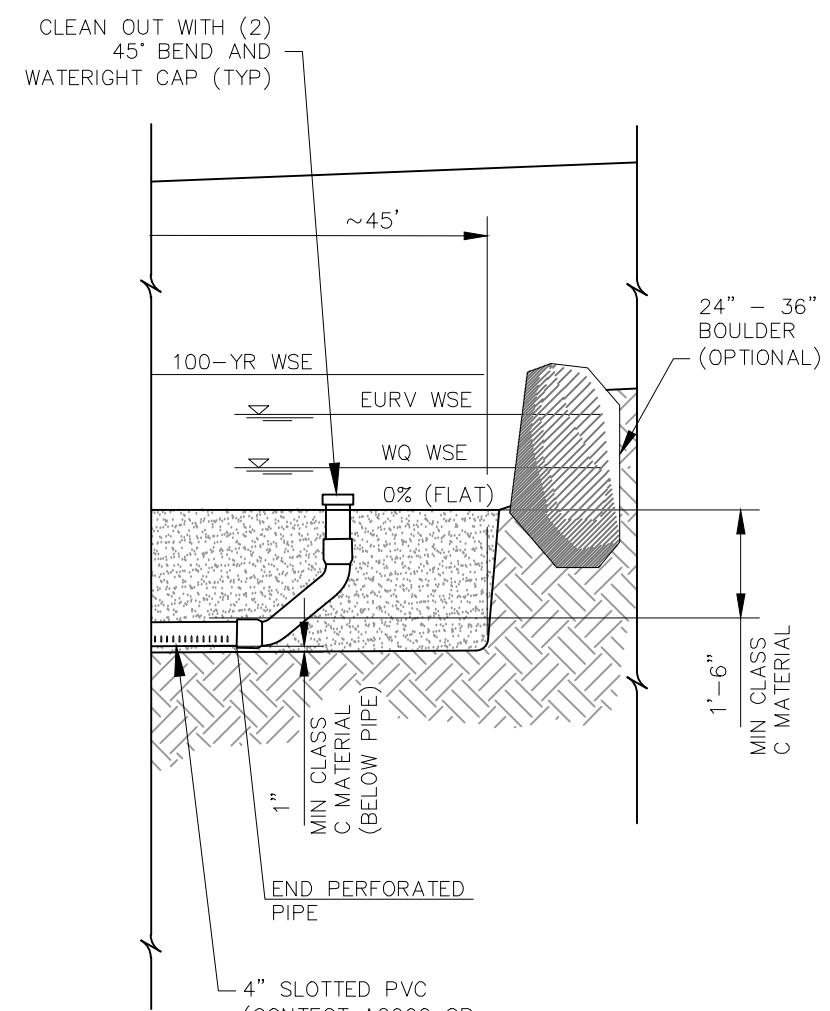
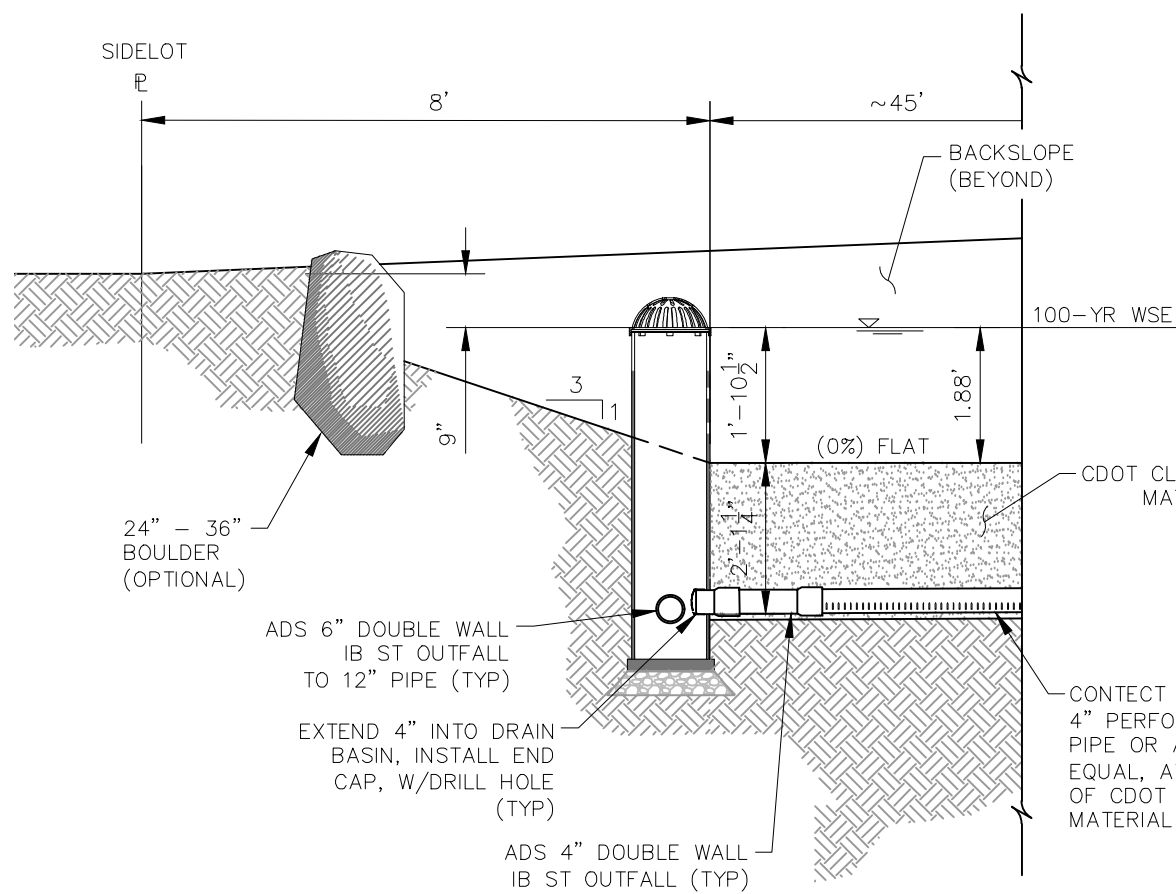
DRAIN BASIN OUTLET
FRONT DETAIL
NOT TO SCALE



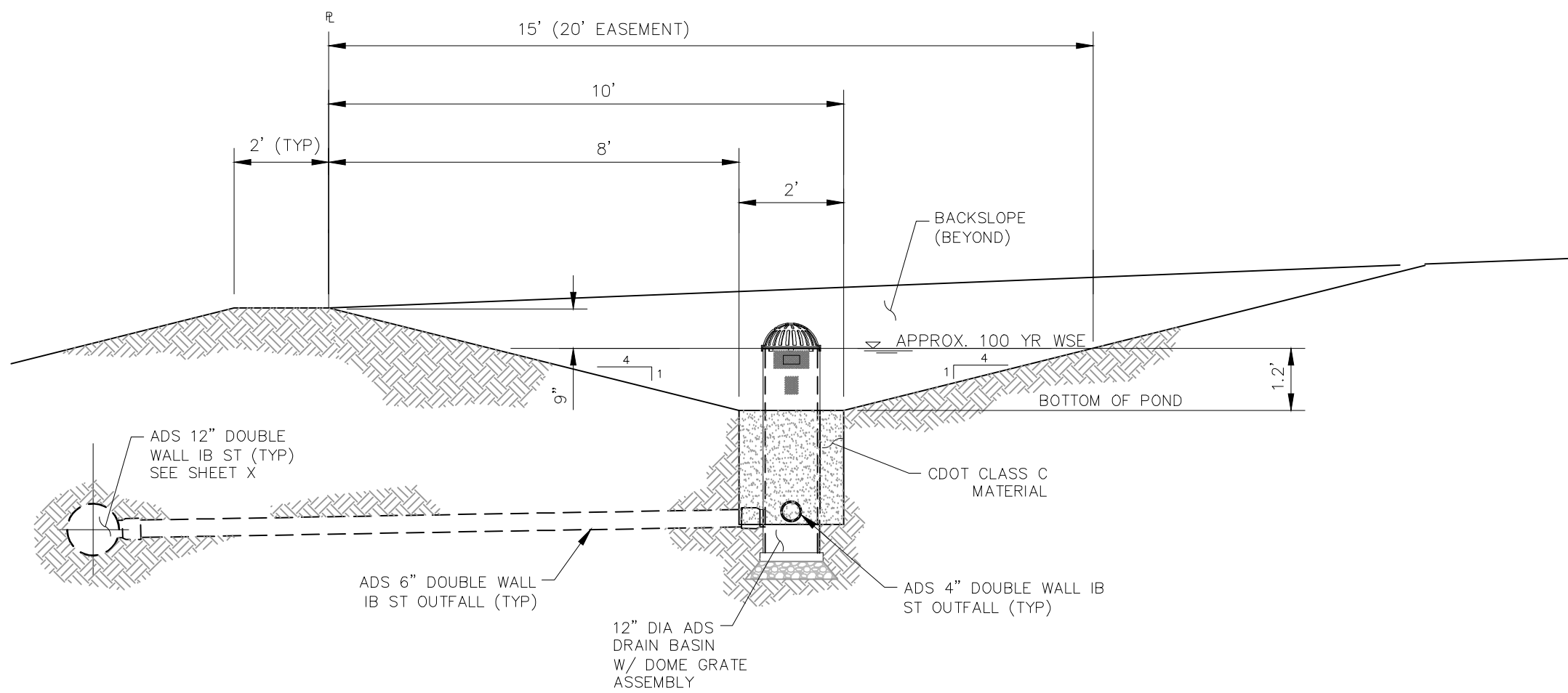
LONGITUDINAL CROSS SECTION DETAILS
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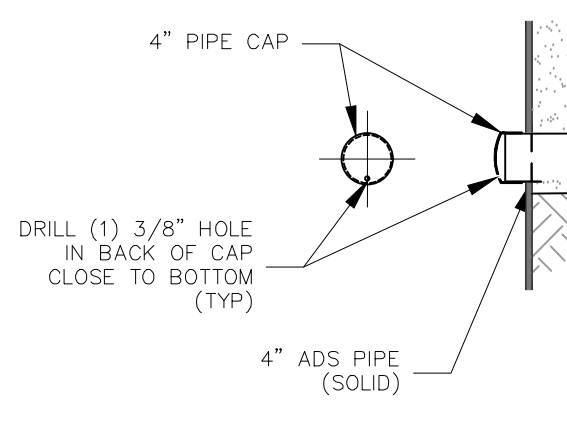
LOCKABLE DOME GRATE ASSEMBLY DETAILS
TYPICAL
NOT TO SCALE



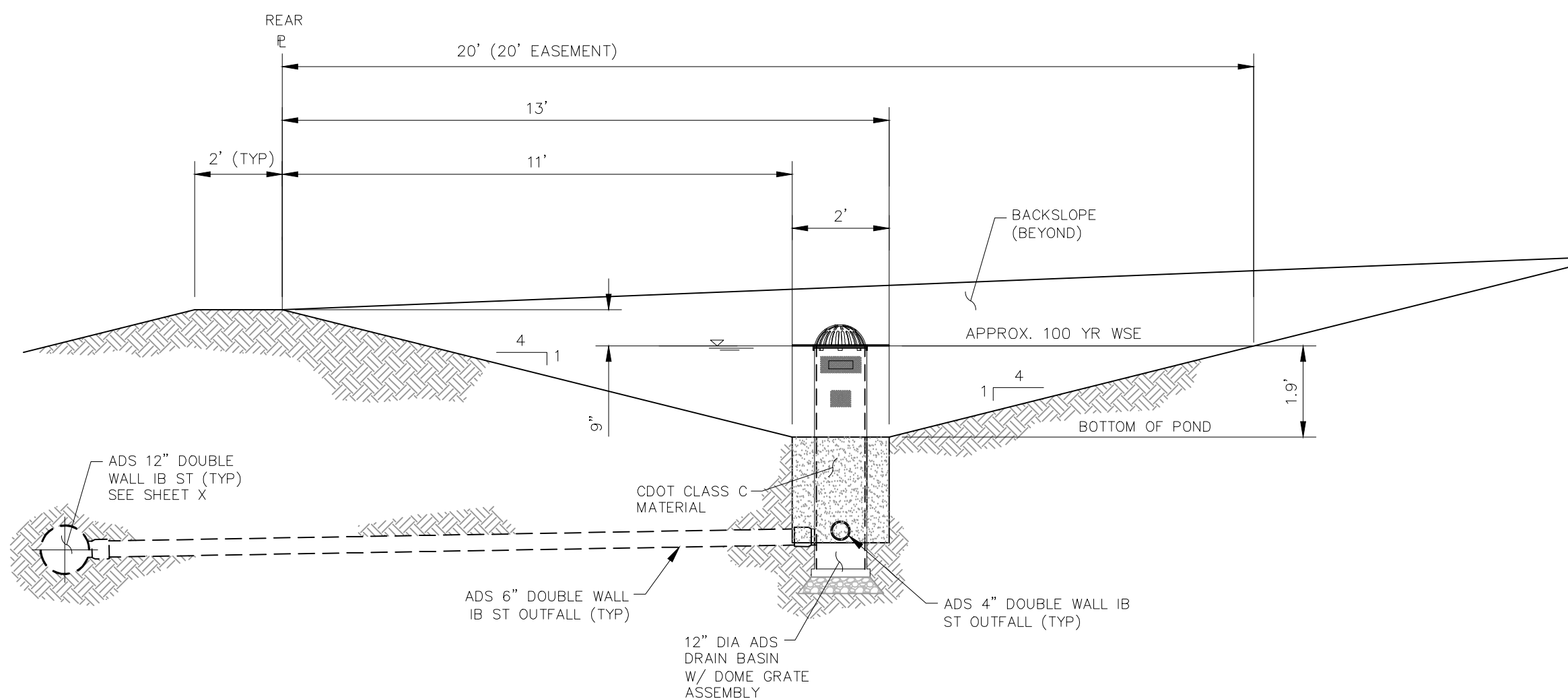
LONGITUDINAL CROSS SECTION DETAILS
NOT TO SCALE



TYPICAL SAND FILTER CROSS SECTION - LOTS 13, 16-20, & 28-40
NOT TO SCALE



UNDERDRAIN END CAP DETAIL
TYPICAL
NOT TO SCALE



TYPICAL SAND FILTER CROSS SECTION - LOTS 14, 15, 21-24 & 41
NOT TO SCALE

HOMESTEAD AT STERLING RANCH FIL. NO. 2

SAND FILTER DETAILS

PROJECT NO. 09-007

DESIGNED BY: CMM

DRAWN BY: CMM

CHECKED BY: VAS

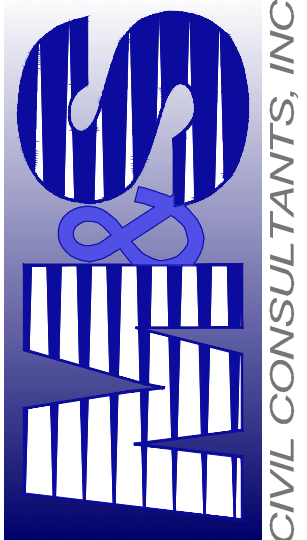
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DATE: 11/19/2019

SHEET 14 OF 14


ST14

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COLORADO SPRINGS, CO 80903
PHONE: 719.555.5485



CIVIL CONSULTANTS, INC.

FOR AND ON
BEHALF OF
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