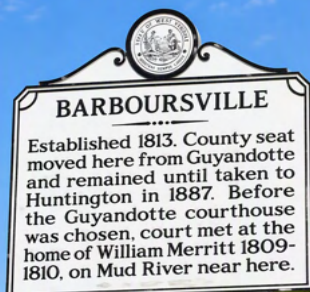


Technical Report For:



CSX UNDERPASS DRAINAGE STUDY

Central Avenue (County Route 31) and
CSX Underpass within the Village of Barboursville



Prepared by:

Michael Baker

INTERNATIONAL

+304-769-0821

400 Washington Street East, Charleston, WV 25301

www.mbakintl.com

September 1, 2026



400 Washington Street East | Charleston, WV 25301
Office: 304.769.0821 | Fax: 304.769.0822

Table of Contents

Project Description	1
Existing Conditions.....	2
Central Avenue Drainage	2
Topography	4
Land Use.....	4
Existing Inlets and Pipes	5
Drainage Analysis	6
Hydrology	6
Drainage Area	6
Time of Concentration	7
Runoff Coefficient (C).....	7
Curve Number (CN)	7
Design Discharge (Q).....	7
Hydraulics	8
Model of Existing Network.....	8
Existing Drainage System Deficiencies	8
Inlets	8
Pipes	9
Proposed Improvements	10
Inlets	10
Pipes	13
Potential Utility Conflicts.....	16
Temporary or Permanent Drainage Easements/Permits.....	17
Environmental	17
Cost Estimate	19

List of Figures

Figure 1: Study Area Map	1
Figure 2: Looking South at CSX Underpass.....	2
Figure 3: Central Avenue – Looking North Toward Main Street	3
Figure 4: Central Avenue – Looking South.....	3
Figure 5: Central Avenue – Looking South toward CSX Underpass	4
Figure 6: Drainage Area Map with Existing Pipes	6
Figure 7: Old Toll House Built in 1837	18

List of Tables

Table 1: Existing Drainage Inlets with Spread Exceeding Criteria.....	8
Table 2: Existing Drainage Pipes Insufficient based on Condition and/or Design Year Storm	9
Table 3: Proposed Drainage Inlets	11
Table 4: Proposed Drainage Pipes	13
Table 5: Potential Underground Utility Impacts	16
Table 6: Required Right-of-Way Easements/Permits	17
Table 7: Cost Estimate	20

Appendices

- Appendix A: CSX Underpass Drainage Study Plans
- Appendix B: Existing Drainage Schematics and Pipe Profiles
- Appendix C: Proposed Drainage Schematics and Pipe Profiles

Project Description

The purpose of the CSX Underpass Drainage Study (Study) is to address street flooding along Central Avenue (County Route 31) and at the CSX Underpass within the Village of Barboursville (Village), West Virginia. The existing drainage system located along Central Avenue, Slaughter Street (east of Central Avenue), and Musgrave Court, as well as the section of Main Street (County Route 60/5) from the Musgrave Court / Main Street intersection to its direct outfall location into Tanyard Branch at the headwall behind the Old Toll House log cabin at 731 Main Street will be evaluated with recommended improvements, as appropriate. See Figure 1 for Location Map of the Study.

The Village provided an inventory of its existing drainage system to facilitate the assessment of its adequacy in meeting the applicable design standards. Based on this analysis, improvements to the stormwater drainage system were recommended with a preference by the Village to utilize Slaughter Street and Musgrave Court to convey the drainage to Tanyard Branch behind the Old Toll House property.

The KYOVA Interstate Planning Commission is administering the Study in cooperation with the Village of Barboursville.

Study limits include drainage features located within private properties, CSX right-of-way, Village right-of-way, and West Virginia Division of Highways (WVDOH) right-of-way. These features are identified in the plan sheets in Appendix A.

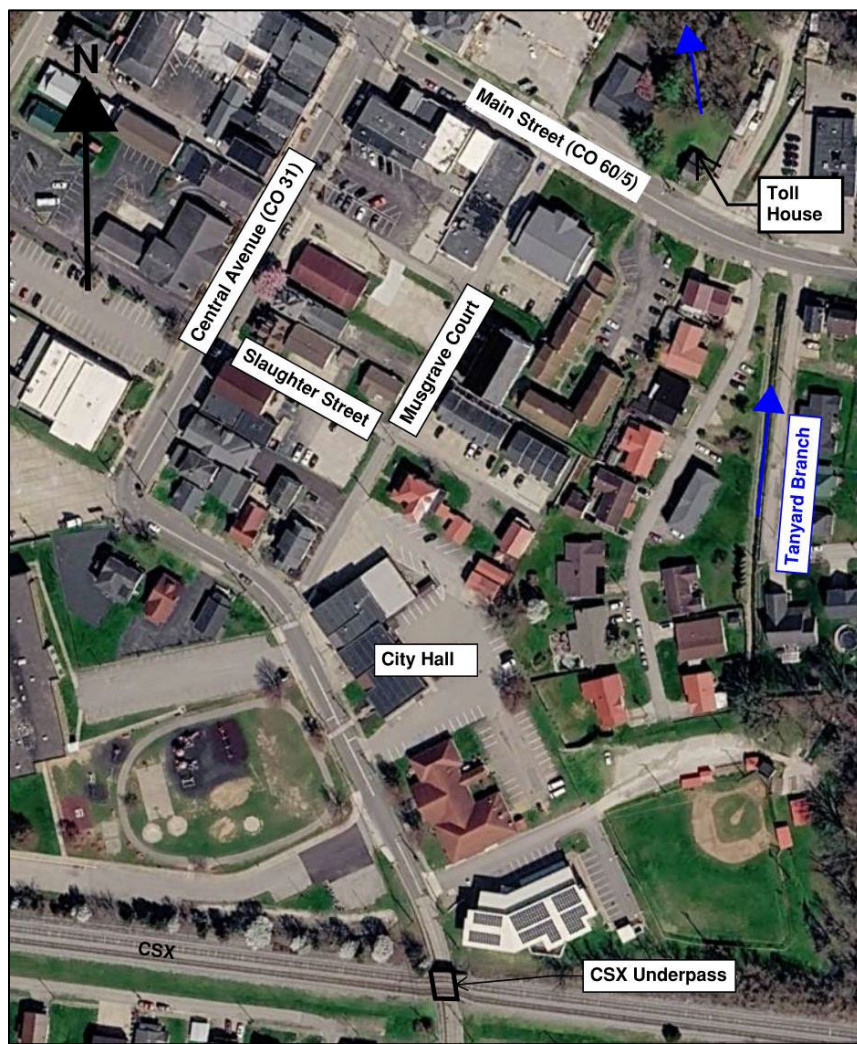


Figure 1: Study Area Map

The Central Avenue roadway has a relatively flat cross slope and longitudinal grade from its intersection with Main Street at the north end of the project to the Community Center location where the profile grade transitions into a sag vertical curve at the CSX Underpass that is susceptible to flooding. The profile grade then transitions to a drainage high point at the Central Avenue intersection with College Avenue. The Underpass typical section includes two lanes (one each direction) with a raised sidewalk along the southbound lane and a posted vertical clearance of 11'-5" (Figure 2). The minimum horizontal clearance is 19'-0" and the overpass structure has a span length of 32'. The posted speed limit along Central Avenue is 25 miles per hour.



Figure 2: Looking South at CSX Underpass

Existing Conditions

Central Avenue Drainage

Central Avenue is classified as a minor urban arterial with an AADT of 4,300. The limits along Central Avenue that contribute to flooding of the CSX Underpass extend from Main Street north of the Underpass to the intersection of Central Avenue with College Avenue on the south side of the Underpass over a total distance of 0.26 miles. Central Avenue has varying typical section widths. The existing roadway cross slopes and longitudinal grades are less than 2 percent and 1 percent, respectively. These relatively flat grades significantly reduce drainage efficiency and adversely affect the performance of the existing stormwater drainage system. This section of Central Avenue includes locations with on-street parking, shoulders, drainage swales, offset inlets, and curb inlets (See Figure 3, Figure 4 and Figure 5).



Figure 3: Central Avenue – Looking North Toward Main Street



Figure 4: Central Avenue – Looking South



Figure 5: Central Avenue – Looking South toward CSX Underpass

Topography

The 1-meter-resolution digital elevation models (DEMs) used in this Study were obtained from the WV Elevation and LiDAR Download Tool (<https://data.wvgis.wvu.edu/elevation/>). The DEMs for the entire Study area were mosaicked into a single raster in ArcMap version 10.8.2 for further processing. The terrain was derived from the resulting DEM.

The background mapping used in this Study was developed using available aerial imagery. The Village provided the drainage features, property lines, and underground utility locations. Overhead utility locations were not included in the mapping based on anticipated recommended improvements.

Land Use

Land use along Central Avenue is characterized primarily by a mix of urban and residential area within the Village. The development is generally concentrated close to the roadway with limited setbacks and includes retail businesses, offices, restaurants, a US Post Office, and an elementary school.

Impervious surfaces along the corridor consist primarily of roadway pavement, residential rooftops and driveways, parking areas associated with commercial properties, and sidewalks. Vegetated areas are limited and primarily consist of lawns, streetscape landscaping, and isolated trees. The lack of extensive pervious surfaces reduces infiltration opportunities and contributes to high stormwater runoff to the existing drainage features and the CSX Underpass.

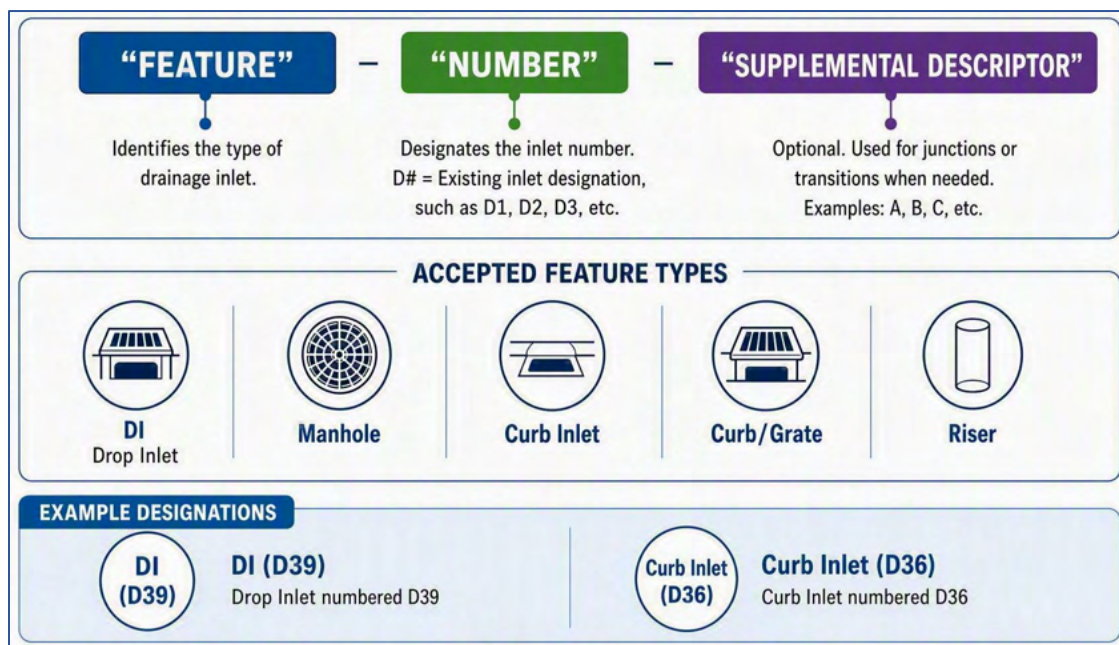
Land cover data for the Study area were obtained from the Multi-Resolution Land Characteristics (MRLC) Consortium (<https://www.mrlc.gov/>). As the National Land Cover Database (NLCD) classifies the project area primarily as urban and suburban, high-resolution Google aerial imagery was utilized to further refine and supplement the land cover classification.

The Village is a designated Municipal Separate Storm Sewer System (MS4), operating under the West Virginia National Pollutant Discharge Elimination System (NPDES) program. Based on the existing conditions and recommended improvements, additional impervious area is not anticipated and would not trigger MS4 requirements.

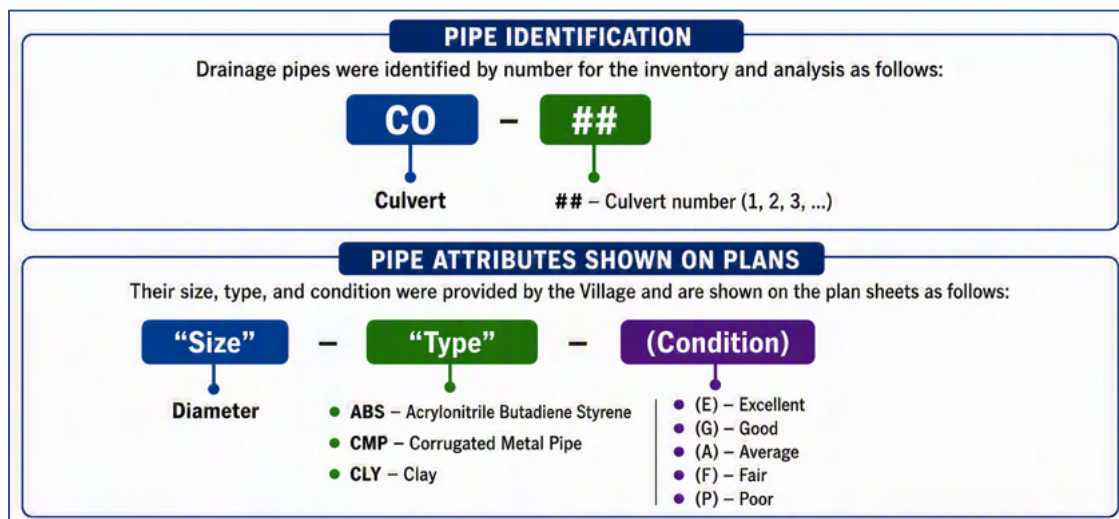
Existing Inlets and Pipes

The locations, types, sizes, and rim and invert elevations of existing inlets, were obtained from the Village. Each inlet location was verified through field observations and Google Earth Street View. Information on the existing pipe network, such as pipe material, condition, shape, size, length, and invert elevations was also provided by the Village. These datasets were received in shapefile format and subsequently converted to Computer-Aided Design and Drafting (CADD) format for further analysis and preparation of plan sheets. The existing drainage inlets and pipes were identified on the plan sheets included in Appendix A as follows:

Drainage Inlets



Drainage Pipes



Proposed drainage improvements at existing inlet and pipe locations will utilize the same identity number and follow the same naming convention as shown above. For proposed inlets and pipes at locations where none currently exist, the designation CB-## and CO-## is used, where ## is a new inlet or pipe number, respectively.

Drainage Analysis

Hydrology

Drainage Area

The DEM was processed in ArcGIS to delineate flow paths and drainage areas. To do so, the local depressions within the DEM were filled to eliminate sink that would otherwise prevent flow from occurring between cells. The flow direction for each cell was then computed using D8 Method, which assigns flow direction to its steepest downslope neighboring cell and establishes the drainage network topology. The resulting flow direction raster was used to generate the flow path, which serves as a basis for estimating travel time.

The drainage areas corresponding to spatial location of each inlet were delineated using the Pour Point Method in ArcGIS. The resulting drainage boundaries were exported to CADD and further refined to account for mainly building structures that alter the normal drainage pattern.

The drainage area and existing pipes (with flow direction shown by arrows) in this study area is shown in Figure 6.

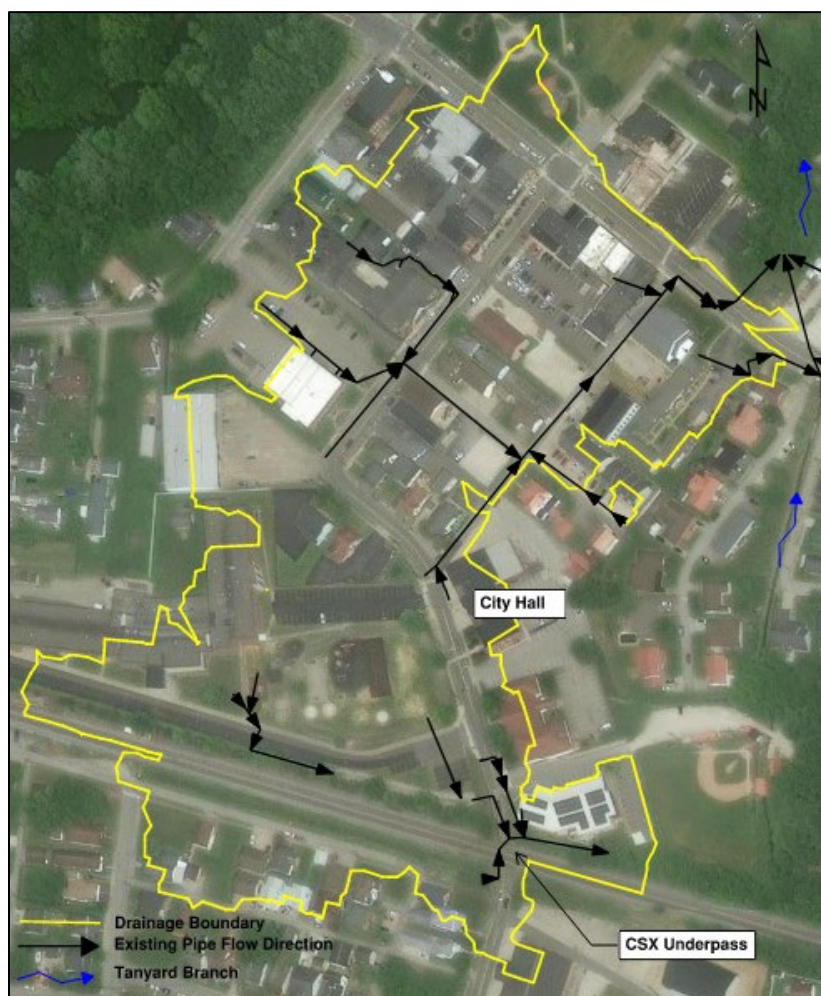


Figure 6: Drainage Area Map with Existing Pipes

Time of Concentration

The time of concentration (T_c) is defined as the travel time along the flow path from the hydraulically most distant point within a drainage area to the point of interest. The total T_c represents the combined travel time of sheet flow, shallow concentrated flow, and channel flow. For each drainage area, these flow segments were delineated.

Manning's roughness coefficients ("n") for sheet and channel flow, as well as the surface cover coefficient ("k") for shallow concentrated flow, were assigned based on surface characteristics in accordance with the current addendum to the WVDOH Drainage Manual, Table 4-5 and Table 4-6. The longitudinal slopes for each flow segment were determined using terrain data derived from the DEM. Travel times for sheet flow, shallow concentrated flow, and channel flow were calculated following the procedures outlined in the WVDOH Drainage Manual.

Runoff Coefficient (C)

The runoff coefficient (C) is a dimensionless parameter that represents the fraction of rainfall that becomes the surface runoff. The runoff coefficient for each land use/landcover category within the drainage area was selected in accordance with the WVDOH DM, Table 4-4. A weighted runoff coefficient was then calculated for each drainage area based on the proportional distribution of land use types.

Curve Number (CN)

The curve number (CN) is a dimensionless parameter to estimate runoff potential based on Natural Resources Conservation Services (NRCS, formerly SCS) Method. These numbers are determined from the combination of soil type and land cover data, in accordance with the WVDOH DM. The land cover information was obtained from NLCD and aerial imagery, while soil data were obtained from the NRCS (<https://websoilsurvey.nrcs.usda.gov/app/>). The review of soil mapping indicates that the soil in the Study area is predominantly classified as Hydrologic Soil Group (HSG) Type B.

Design Discharge (Q)

In accordance with the WVDOH DM, Table 4-2, a 10-year (10%) Return Period (Probability of Occurrence) was used for the analysis and design of drainage network. For each drainage area, the peak-discharge for 10-year storm event was estimated using three different methods outlined in WVDOH DM: a) Rational Method, b) TR-55 (SCS) Method, and c) United States Geological Survey (USGS) Method.

In Rational Method, rainfall intensity for 10-year storm was determined as a function of T_c from Intensity-Duration-Frequency (IDF) curve provided in WVDOH DM. The rainfall intensity, together with the contributing drainage area and runoff coefficient, was used to estimate design discharge.

For TR-55 method, 24-hour rainfall depth for the Study area was obtained from WVDOH DM. The CN values were used to estimate the runoff depth for the specified storm event. The unit peak discharge was determined as a function of T_c and ratio of initial interception (I_a) to Precipitation (P). These parameters were used to calculate the design discharge in accordance with equations from WVDOH DM.

In USGS Method, peak discharge was estimated using regional regression equation as a function of drainage area. This method is appropriate for rural areas with drainage area greater than 10 square miles but can be used for preliminary analysis or design if standard prediction error is added. In this Study, we added the standard prediction error for comparing the discharge with other methods.

The discharge values obtained from the Rational Method were used for the analysis and design of the drainage network. Results from the TR-55 and USGS methods were utilized for comparison purposes. The estimates from all three methods were found to be reasonably consistent, providing increased confidence in the calculated flows.

Hydraulics

Model of Existing Network

The hydraulic model of existing drainage network was developed using StormCAD, a Bentley Software Platform. The network consists of catchments, catch basins (inlets), storm water conduits, gutters, manholes, and detention channels. For each catchment, the contributing drainage area, runoff coefficient, and T_c were assigned, along with the corresponding inlet to which it drains. The IDF curve from WVDOH DM was incorporated for 10-year storm event.

The geometric properties of the drainage structures including length, size, and invert elevations, were added to the model. The Manning's "n" values were selected based on the material types. The conduit and inlet catalogs were developed to account for various sizes, materials, and inlet types within the existing drainage network. These catalogs also facilitate the evaluation and design of appropriate conduits and inlets required to convey the design discharge.

For each inlet, the longitudinal slope and cross slopes were derived from the terrain data. The gutter alignment was established to follow the direction of gravity flow. Standard method was used for estimating energy loss at each node. Manning's equation was used for Gravity Flow condition, while Darcy-Weisbach method was used for pipes under pressure flow.

The StormCAD model provides results including spread, captured flow at each inlet, bypass flow, conduit flow, hydraulic grade line (HGL), energy grade line (EGL), and other relevant hydraulic parameters.

The schematic drawings of the existing drainage network and the pipe profiles used for the analysis are shown in Appendix B.

Existing Drainage System Deficiencies

Inlets

Results from hydraulic analysis of existing drainage network indicate that the system is inadequate to convey runoff from a 10-year storm event. According to the WVDOH Drainage Manual, the allowable spread for a design speed less than 40 miles per hour is the shoulder width plus 3 feet into the traveled lane. See Typical Section plan sheet in Appendix A. The computed spread exceeds the allowable limit at multiple locations and several inlets experience overflow, localized flooding, including at the CSX Underpass.

The nine locations where the spread exceeds the allowable criteria are shown in Table 1 and are identified on the Existing Drainage plan sheets within the plan set in Appendix A.

Table 1: Existing Drainage Inlets with Spread Exceeding Criteria

Drainage Inlet	Pavement Width (ft.)	Lane Width (ft.)	Parking Lane Width (ft.)	Shoulder Width (ft.)	Gutter Shape	Allowable Spread (ft.)	Existing Spread (ft.)
D02	11.50	10.00	0.00	1.50	C	4.5	7.1
D05	14.50	10.00	0.00	3.50	V	13.0	13.8
D08	17.50	10.00	0.00	7.50	V	21.0	30.8
D12	17.50	10.00	6.00	1.50	V	8.4	9.7
D18	18.50	11.00	6.00	1.50	V	9.0	12.9
D34	12.00	10.00	0.00	2.00	C	5.0	5.6
D35	11.50	10.00	0.00	1.50	C	4.5	11.1
D36	10.50	10.00	0.00	0.50	C	5.0	5.6
D39	10.50	10.00	0.00	0.50	C	3.5	19.5

Pipes

The existing drainage pipes' conditions were assessed by the Village through pipe camera inspections and field observations and subsequently rated based on five conditions: Excellent (E), Good (G), Average (A), Fair (F), and Poor (P). Pipes rated in "Poor" condition were recommended for replacement regardless of their hydraulic capacity.

Drainage pipes determined insufficient to convey the 10-year design year storm as well as pipes with a "Poor" condition rating were identified. Forty-one existing drainage pipes are insufficient to convey the design year storm, with six of these pipes also rated in poor condition (CO-3, CO-4, CO-5, CO-6, CO-23, and CO-50). Each of the 41 conduits' location, hydraulics, and condition, and possible elimination were evaluated and their disposition shown in the Recommended Improvements Section. These deficient pipes are shown on the Existing Drainage plan sheets within the plan set in Appendix A.

Table 2: Existing Drainage Pipes Insufficient based on Condition and/or Design Year Storm

Conduits	Diameter (in.)	Max. Flow depth (ft)	Hydraulic Condition	Conduit Condition Rating
CO-1	6	7.1	Pressure flow	A
CO-2	12	3.4	Pressure flow	F
CO-3	18	9.9	Pressure flow	P
CO-4	18	36.2	Pressure flow	P
CO-4_DS	15	5.0	Pressure flow	G
CO-5	15	92.3	Pressure flow	P
CO-6	24	3.5	Pressure flow	P
CO-7	10	3.6	Pressure flow	A
CO-9	18	3.7	Pressure flow	G
CO-10	15	7.3	Pressure flow	A
CO-11	15	30.6	Pressure flow	G
CO-12	4	46.1	Pressure flow	A
CO-13	21	8.2	Pressure flow	A
CO-14	15	28.9	Pressure flow	G
CO-15_1	15	66.1	Pressure flow	A
CO-16	6	2.5	Pressure flow	G
CO-17	12	4.6	Pressure flow	G
CO-19	12	1.9	Pressure flow	G
CO-20	12	1.6	Pressure flow	G
CO-21_D	12	2.0	Pressure flow	G
CO-22	12	2.0	Pressure flow	G
CO-23	18	8.1	Pressure flow	P
CO-25	12	2.4	Pressure flow	A
CO-26_1	12	9.8	Pressure flow	G
CO-26_2	8	5.2	Pressure flow	G
CO-26_3	15	2.1	Pressure flow	G
CO-28	12	2.8	Pressure flow	A
CO-29	12	3.0	Pressure flow	A
CO-30	18	6.7	Pressure flow	E

Conduits	Diameter (in.)	Max. Flow depth (ft)	Hydraulic Condition	Conduit Condition Rating
CO-34	10	13.7	Pressure flow	A
CO-38	6	4.2	Pressure flow	G
CO-40_1	8	4.7	Pressure flow	G
CO-40_2	8	5.7	Pressure flow	G
CO-41	8	3.6	Pressure flow	-
CO-50	24	3.7	Pressure flow	P
CO-51	8	1.7	Pressure flow	E
CO-52	8	2.9	Pressure flow	E
CO-53	15	3.0	Pressure flow	E
CO-54	8	2.2	Pressure flow	-
CO-62	18	3.3	Pressure flow	G
CO-76	12	4.0	Pressure flow	E

Proposed Improvements

Hydraulic analysis indicates that significant improvements to the existing drainage system are necessary to convey the runoff from the design storm while satisfying the flow spread criteria and limiting pipe flow depths to 80 percent of the pipe diameter, in accordance with the requirements of the WVDOH Drainage Manual. The recommended design includes the addition of several new inlets and storm sewer pipes, as well as replacement of several existing inlets and undersized pipes that do not provide hydraulic capacity. The recommendations include cross-slope adjustment of the Central Avenue template to maintain a minimum roadway cross slope of 2 percent to improve the capture efficiency of inlets. Given their specific locations and hydraulic conditions, four pipe locations are recommended to remain in pressure flow and are denoted in Table 3.

The replacement of existing drainage pipes and the installation of pipes at new locations provide the benefit to other portions of stormwater drainage system without the need to replace additional existing pipes, some of which are on private property. Adjustments to inlet and pipe locations will be refined during the engineering design phase of the project once detailed topographic survey is complete and utility locations are better defined. The location of an existing inlet within a traveled way and its pipe connections is recommended to be evaluated for relocation to an adjacent curb line once a detailed survey is available to prevent vehicle tire tracking directly onto an inlet. An example location would be at the intersection of Musgrave Court and Central Avenue where the existing inlet is within the travel path of a vehicle wheel line.

Inlets

A total of 41 new inlets, including new installation locations and replacement or modification of existing inlets based spread criteria, pipe hydraulics criteria, pipe cover, and invert elevations, are proposed to be utilized in conjunction with the existing inlets to meet the design year spread criteria. The proposed inlet number (D1, D2, D3, etc.) and type for each of these locations is shown in Table 3.

The existing inlets were preserved where possible and their condition should be further evaluated during the design phase of the project to determine their ultimate disposition.

Table 3: Proposed Drainage Inlets

Inlet/ Catch Basin	Pavement Width (ft.)	Lane Width (ft.)	Parking Lane Width (ft.)	Shoulder Width (ft.)	Gutter Shape	Allowable Spread (ft.)	Proposed Condition (ft.)	Proposed Inlet / Catch Basin
Upper Section								
CB-49	17.85	11.00	5.00	1.85	V	7.6	6.5	Type B Inlet
CB-50	23.40	11.00	5.00	7.40	C	15.4	3.5	Type B Inlet
CB-44	22.55	10.00	6.00	6.55	V	15.6	7.9	Type B Inlet
CB-31	18.90	10.00	6.00	2.90	C	11.9	3.9	6' Type E Curb inlet
CB-35	15.90	10.00	0	2.95	V	10.5	8.8	Slot Inlet 25'
CB-65	15.90	10.00	0	2.95	V	11.5	11.3	Slot Inlet 15'
D13*	Parking lot						10.4	1.79'x1.79' grate
D14*	Parking lot						21.8	1.75'x1.75' grate
CB-45	19.80	10.00	0	4.90	C	7.9	6.7	Type F Inlet
CB-34	11.40	10.00	0	1.40	C	4.4	4.4	6' Type E Curb Inlet
CB-48	16.00	10.00	0	6.00	C	9.0	6.4	10' Type E Curb Inlet
CB-39	Parking lot	-	-	-	-	-	10.2	Type F Inlet
CB-57	Parking lot	-	-		-		4.9	Type B Inlet
CB-58	15.00	10.00		7.50	C	10.5	6.3	8' Type E Curb Inlet
D08	17.50	10.00	0.00	7.50	V	21.0	8.8	Type B Inlet
CB-46	24.00	10.00	6.00	8.00	V	17.0	8.7	Slot Inlet 5'
CB-59	24.00	10.00	6.00	8.00	V	17.0	11.8	Slot Inlet 5'
CB-63	16.70	12.00	0	2.35	V	10.3	10.2	Type B Inlet
D17	23.50	10.00	8.00	5.50	V	12.1	8.7	Type B Inlet
D11	15.50	10.00	0.00	5.50	V	16.4	8.9	Type B Inlet-Modified
D12	17.50	10.00	6.00	1.50	V	8.4	8.4	Type B Inlet-Modified
CB-60	Ditch	-	-	-	-	-	4.0	Type G Inlet
CB-51	Parking lot	-	-	-	-	-	6.4	Type F Inlet
D1*	10.00	10.00	0.00	4.20	V	13.0	10.8	2.17'x2.17' grate

Inlet/ Catch Basin	Pavement Width (ft.)	Lane Width (ft.)	Parking Lane Width (ft.)	Shoulder Width (ft.)	Gutter Shape	Allowable Spread (ft.)	Proposed Condition (ft.)	Proposed Inlet / Catch Basin
CB-61	16.70	12.00	0	2.35	V	7.7	7.6	Type B Inlet
CB-64	16.80	10.00	0	3.40	C	6.4	6.5	Type B Inlet
D6*	Parking lot						4.4	2'x2' grate
CB-67	22.60	11.00	8.00	3.60	C	14.6	2.2	Type F Inlet
CB-55	10.70	10.00		0.70	C	3.7	3.2	6' Type E Curb Inlet
CB-38	11.00	10.00	0	1.00	C	4.0	3.1	6' Type E Curb Inlet
CB-37	13.65	10.00	0	3.65	C	6.7	4.6	6' Type E Curb Inlet
CB-32	15.50	10.00	0	5.50	C	8.5	4.8	Type B Inlet
CB-33	15.50	10.00	0	5.50	C	8.5	7.2	Type F Inlet
D02	11.50	10.00	0.00	1.50	C	4.5	3.2	Type B Inlet
D03	13.20	10.00	0.00	3.20	V	11.6	9.0	Type B Inlet-Modified
D04	14.50	10.00	0.00	2.25	V	8.9	6.6	Type B Inlet-Modified
D05	17.00	10.00	0.00	3.50	V	13.0	9.9	Type B Inlet-Modified
CB-62	16.80	10.00	0	3.40	C	6.4	6.4	Type F Inlet
CB-36	15.50	10.00	0	2.75	C	5.8	4.6	Type F Inlet
D7*	16.00	11.00	0	5.00	C	8.0	3.6	2.15'x2.15' grate
D18*	18.50	11.00	6.00	1.50	V	9.0	5.5	2.25'x2.25' grate
D19*	21.00	11.00	8.00	2.00	V	9.1	6.5	2.17'x2.17' grate
D26*	19.50	11.00	8.00	0.50	C	11.5	6.5	2.83'x1.42' grate
Lower Section								
D27*	Turf ground	-	-	-	-	-	14.1	2.5'x2.5 grate
D28*	33.00	12.00	16.00	5.00	C	24.0	12.7	2.15' x 2.15' Combine inlet
D29	Turf ground	-	-	-	-	-	1.7	Type B Inlet
CB-54	11.75	10.00	0	1.75	C	4.8	2.2	Type F Inlet
D34	12.00	10.00	0	2.00	C	5.0	1.6	Type F Inlet
D35*	11.50	10.00	0	1.50	C	4.5	3.9	2.25' x 2.25' Combine inlet
D36*	10.50	10.00	0	0.50	C	5.0	4.0	1.25' x 0.25' Combine inlet
CB-66	11.50	10.00	0	1.5	C	4.5	3.2	Type F Inlet

Inlet/ Catch Basin	Pavement Width (ft.)	Lane Width (ft.)	Parking Lane Width (ft.)	Shoulder Width (ft.)	Gutter Shape	Allowable Spread (ft.)	Proposed Condition (ft.)	Proposed Inlet / Catch Basin
D37	Ditch							Type G Inlet
D38*	11.50	10.00	0	1.50	C	4.5	2.9	2'x2' grate
D39	10.50	10.00	0	0.50	C	3.5	3.5	Type F Inlet

* May be retained if adjustment of invert elevation of catch basin is feasible

CB-## Proposed New Inlets

D## Proposed replacement inlet at existing inlet location

Pipes

The recommended drainage improvements include 3,750' of pipe ranging in diameter from 12" to 36" and new installation locations and replacement of existing pipes as shown in Table 4. The size of the existing pipes, their proposed replacement, and the proposed size of new pipes also are shown in this table. High-density polyethylene (HDPE) pipe was utilized throughout the drainage network. The specific pipe material type should be further evaluated during the design phase of the project that considers flow lines, pipe cover, flow capacity, water quality, and velocity. A minimum velocity of 2 feet per second (ft/s) was utilized to provide for self-cleaning of the pipes. The minimum cover required per WVDOH's Design Directive (DD-) 502 was met for each designed pipe.

Table 4: Proposed Drainage Pipes

Conduits	Pipe Diameter (in.)		Max. Flow Depth (ft.)		Flow Regime	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
Upper Section						
CO-69	-	18	-	0.4	-	Gravity flow
CO-70	-	18	-	0.4	-	Gravity flow
CO-55(1)	-	18	-	0.4	-	Gravity flow
CO-55(2)	-	18	-	0.4	-	Gravity flow
CO-66	-	18	-	0.3	-	Gravity flow
CO-58	-	12	-	0.9	-	Gravity flow
CO-57	-	12	-	0.7	-	Gravity flow
CO-41	8	**	3.6	0.2	Pressure flow	Gravity flow
CO-38	6	12	4.2	0.5	Pressure flow	Gravity flow
CO-40(1)	8	15	4.7	0.8	Pressure flow	Gravity flow
CO-40(2)	8	15	5.7	1.0	Pressure flow	Gravity flow
CO-54	8	**	2.2	0.3	Pressure flow	Gravity flow
CO-67	-	12	-	0.4	-	Gravity flow
CO-51	8	**	1.7	0.3	Pressure flow	Gravity flow

Conduits	Pipe Diameter (in.)		Max. Flow Depth (ft.)		Flow Regime	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
CO-52	8	**	2.9	0.6	Pressure flow	Gravity flow
CO-53	15	**	3.0	0.5	Pressure flow	Gravity flow
CO-9	18	**	3.7	0.6	Pressure flow	Gravity flow
CO-84	-	15	-	1.1	-	Gravity flow
CO-68	-	18	-	0.6	-	Gravity flow
CO-94	-	12	-	0.5	-	Gravity flow
CO-82	-	12	-	0.3	-	Gravity flow
CO-83	-	15	-	1.1	-	Gravity flow
CO-7(1)	10	18	3.6	1.3	Pressure flow	Gravity flow
CO-7(2)		18		1.1		Gravity flow
CO-7(3)		24		1.8		Gravity flow
CO-56	-	18	-	0.8	-	Gravity flow
CO-6	24	18	3.5	1.1	Pressure flow	Gravity flow
CO-10	15	27	7.3	1.4	Pressure flow	Gravity flow
CO-11(1)	15	27	30.6	1.4	Pressure flow	Gravity flow
CO-11(2)		27		1.4		Gravity flow
CO-16	6	**	2.5	0.3	Pressure flow	Gravity flow
CO-17	12	**	4.6	0.4	Pressure flow	Gravity flow
CO-74	-	12	-	0.7	-	Gravity flow
CO-1	6	12	7.1	0.8	Pressure flow	Gravity flow
CO-89	-	12	-	0.5	-	Gravity flow
CO-92	-	12	-	0.5	-	Gravity flow
CO-99	-	12	-	0.5		Gravity flow
CO-100	-	18	-	0.5		Gravity flow
CO-78	-	12	-	0.3	-	Gravity flow
CO-79	-	18	-	0.7	-	Gravity flow
CO-95	-	18	-	0.8	-	Gravity flow
CO-80	-	18	-	1.3	-	Gravity flow

Conduits	Pipe Diameter (in.)		Max. Flow Depth (ft.)		Flow Regime	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
CO-103	-	18		1.4		Gravity flow
CO-2	12	18	3.4	1.1	Pressure flow	Gravity flow
CO-3	18	24	9.9	1.2	Pressure flow	Gravity flow
CO-4(1)	18	36	36.2	1.9	Pressure flow	Gravity flow
CO-4(2)	15	36	36.2	2.2	Pressure flow	Gravity flow
CO-5(1)	15	36	92.3	2.3	Pressure flow	Gravity flow
CO-5(2)		36		1.8		Gravity flow
CO-5(3)		36		1.8		Gravity flow
CO-13	21	36	8.1	1.8	Pressure flow	Gravity flow
CO-14	15	36	28.5	1.9	Pressure flow	Gravity flow
CO-15(1)	15	36	65.2	1.9	Pressure flow	Gravity flow
CO-31	10	**	0.3	0.3	Gravity flow	Gravity flow
CO-32	12	**	0.6	0.6	Gravity flow	Gravity flow
CO-33	12	**	1.0	0.7	Gravity flow	Gravity flow
CO-34	10	15	13.7	0.8	Pressure flow	Gravity flow
CO-93(1)	72	**	1.9	1.4	Gravity flow	Gravity flow
CO-93(2)	72	**	1.9	1.5	Gravity flow	Gravity flow
Lower Section						
CO-18	8	12	0.5	0.5	Gravity flow	Gravity flow
CO-19*	12	15	1.9	1.3	Pressure flow	Pressure flow
CO-20*	12	15	1.6	1.3	Pressure flow	Pressure flow
CO-77	-	12	-	0.3	-	Gravity flow
CO-24	12	**	0.7	0.7	Gravity flow	Gravity flow
CO-21(U)	12	15	1.0	1.0	Gravity flow	Gravity flow
CO-21(D)	12		2.0		Pressure flow	
CO-98	-	18	-	1.4	-	Gravity flow
CO-25	12	18	2.4	0.3	Pressure flow	Gravity flow
CO-26(1)	12	18	9.8	0.4	Pressure flow	Gravity flow
CO-26(2)	8	18	5.2	1.0	Pressure flow	Gravity flow
CO-26(3)	15		2.1		Pressure flow	
CO-76	12	**	4.0	0.0	Pressure flow	Gravity flow
CO-60	15	**	0.3	0.3	Gravity flow	Gravity flow
CO-61	18	**	0.7	0.3	Gravity flow	Gravity flow
CO-62	18	**	3.3	0.9	Pressure flow	Gravity flow

Conduits	Pipe Diameter (in.)		Max. Flow Depth (ft.)		Flow Regime	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
CO-27	12	12	1.0	1.0	Gravity flow	Gravity flow
CO-28	12	18	2.8	1.1	Pressure flow	Gravity flow
CO-29	12	18	3.0	1.2	Pressure flow	Gravity flow
CO-23*	18	18	8.1	1.8	Pressure flow	Pressure flow
CO-30*	18	18	6.7	1.5	Pressure flow	Pressure flow
CO-50	24	24	3.7	1.3	Pressure flow	Gravity flow

* Flow Regime is pressure flow, but no overflow is anticipated.

** Existing pipe is recommended to remain in the final layout. Pipe was insufficient in the existing condition but sufficient in the final layout due to changes in the downstream boundary conditions.

The type, size, and location of the proposed drainage structures are shown on the Proposed Drainage Improvements sheets within the plan set in Appendix A. The schematic drawings of the proposed drainage network and the pipe profiles including flow characteristics of the proposed drainage network are shown in Appendix C. Existing drainage pipes that are under pressure flow and not recommended for replacement are based on pipe specific conditions, location, backwater effect, hydraulic grade line below ground surface, re-routing of existing drainage, or a combination of these factors.

Existing soil and water testing was not performed and is not anticipated to be an issue based on the scope of the proposed improvements; however, it is recommended this be further evaluated during the design phase of the project.

For any locations where the existing pipe is proposed to be replaced, the pipe crowns are matched so that an increase in pipe size would lower the invert elevations of the connected downstream pipe.

Potential Utility Conflicts

Existing underground utilities include gas, sanitary sewer, and water lines and are shown on the plan sheets in Appendix A. The proposed drainage improvements include the replacement of existing inlets and pipes at the same location as well as the installation of inlets and pipes at new locations to meet the design year storm. The potential underground utility conflicts along each street are as shown in Table 5. The types and line locations of overhead utilities and poles were not shown for clarity and are not anticipated to be impacted based on the proposed drainage improvements. The extent of any potential utility impacts, whether underground or overhead, will be further determined during the project design phase through formal consultation with each utility company including service lines to each respective property.

Table 5: Potential Underground Utility Impacts

Street	Underground Utilities		
	Gas	Sanitary Sewer	Water
Main Street	x	x	x
Central Avenue	x	x	x
Slaughter Street	-	-	-
Musgrave Court	x	x	

Temporary or Permanent Drainage Easements/Permits

The proposed drainage system improvements are expected to require temporary construction easements (TCE), permanent drainage easements (PDE), a WVDOH Encroachment Permit (MM-109), and a CSX Railroad Agreement. Based on direction received from the Village, proposed drainage improvements associated with CSX Railroad right-of-way may be performed by the Village's resources and thus any such improvements should be incorporated into the project design phase. The proposed location of the drainage improvements and need for easements are based on study-level mapping and will be further refined during the design phase of the project.

Table 6: Required Right-of-Way Easements/Permits

Parcel	Drainage Feature	Easement Type
7-86	CB-39, CB-57, CO-94, CO-82	PDE
7-94	CO-40_1	TCE
7-104	CO-38, CO-40_1, CO-40_2	TCE
7-107	CB-45, CO-67	PDE
7-115	CB-60, CO-11_1, CO-11_2	PDE
7-116	CO-11_1	PDE
8-4	CO-15_1, D.R.G.	PDE
7-90	CB-51, D29, CO-74, CO-18, CO-19, CO-20	TCE, PDE
CSX	D39, CO-22, CO-23, CO-26, CO-29, CO-30, CO-50	TCE
WVDOH	Various features	MM-109

Environmental

The proposed improvements include the replacement of the existing drainage pipe that traverses the property where the historic Old Toll House (see Figure 7) is located. The Old Toll House was built in 1837 and was originally located on the bank of the Guyan River where tolls were collected on the James River – Kanawha Turnpike from those using the ferry. The structure was restored and relocated to its current site in 1950. A report on the historic property is anticipated for the proposed drainage improvements.

Based on the analysis of the existing drainage network and the proposed improvements, the outfall velocity into the Tanyard Branch channel is reduced from 26.6 feet per second (ft/s) to 18.4 ft/s. Although the outflow velocity is decreased the WVDOH Drainage Manual Chart 5-29 recommends a blanket of outlet protection a minimum of 15 feet long consisting of a 30" mat thickness with a minimum rock size of 12".



Figure 7: Old Toll House Built in 1837

Based on the proposed improvements, the following environmental considerations may be applicable:

- Historic report for the property for review by SHPO;
- Archeological report for review by SHPO;
- Information for Planning and Consultation (IPaC) evaluation for Rare, Threatened, and Endangered Species
- Coordination with WVDNR to obtain species information to complete IPaC
- Stream and Wetland determination Report
- US Army Corps of Engineers permit application
- NPDES permit application

Based on the proposed improvements being maintenance-based and not increasing the impervious area, MS4 requirements are not anticipated to be necessary.

Cost Estimate

The cost estimate for the proposed improvements is \$2,450,000 separated into three phases of work: Engineering, Right-of-Way, and Construction as follows:

Engineering (\$310,000) – the cost for the Engineering Phase is based on:

- topographic survey;
- utility (overhead and underground) verification and coordination;
- preparation of National Environmental Protection Agency documents, preparation of permits, consultation with resource agencies, assisting in NEPA review process, and obtaining NEPA decision (cost for this activity accounts for extensive environmental agency coordination and review and thus, may be reduced during final design, if determined a lesser effort is required by the resource agencies);
- preparation of construction contract documents (plans, specifications, and estimate);
- project advertisement for construction bids, bid evaluations, and bid recommendation; and
- RW-1 & RW-2 & RW-3 Plans including deed research, right-of-way questionnaires, and appraisals; the cost for this activity may reduce depending on field survey and final stormwater inlet and pipe locations.

Right-of-Way (\$70,000) – the Right-of-Way cost estimate is based on:

- property searches, right-of-way questionnaires;
- acquisition of Temporary Construction Easements;
- acquisition of Permanent Drainage Easements;
- CSX coordination (plan review, agreement execution);
- preparation of preliminary plans for utility companies' review to determine if their facilities are impacted or may remain in place;
- utility adjustments and relocation costs are not anticipated at this time; any costs for Village owned utilities are anticipated to be incurred by the Village; and
- MM-109 access permits are required to work on WVDOH right-of-way and costs for performance bond are not anticipated nor included in the cost estimate.

Construction (\$2,070,000) – the cost for the Construction Phase is based on:

- bid items of work in accordance with WVDOH Standard Specifications;
- plugging pipes are incidental to the respective closest inlet at each end;
- pipe installation will utilize traditional open cut methods with a trench box, i.e., no pipe bores are estimated;
- cost for the connections of existing pipes to proposed pipes without a junction box is included in the per-foot cost of the proposed pipe;
- costs for modifying existing inlets for proposed pipe connections are included in the per-foot cost of the proposed pipe;
- environmental mitigation costs associated with work on the Old Toll House property are not anticipated at this time and thus, not included;
- CSX flagger costs are included in the 636 Temporary Traffic Control cost; these costs will be further defined in the design phase of the project and separated accordingly;
- 10% contingency included based on level of study detail and inflation; and
- 15% of physical construction cost included for engineering and contingency (E&C) costs.

In general, costs were based on utilizing WVDOH average unit bid prices adjusted to reflect project specific features as stated above and are included in Table 7. The cost estimate identifies Item Numbers in accordance with WVDOH Standard Specifications for Roads and Bridges and should be considered a planning level estimate.

Table 7: Cost Estimate

Item Number	Alt.	Description	Units	Qty	Unit Price	Total
		ROADWAY				
204001-000		MOBILIZATION	LS	1	\$78,640.70	\$78,641
401003-001		MARSHALL ASPHALT P/L CRSE, SG	TN	67	\$200.00	\$13,400
402001-020		MARSHALL ASPHALT SKID PVT, SG, TY I	TN	244	\$250.00	\$61,000
408002-001		ASPHALT MATERIAL	GA	577	\$5.00	\$2,885
415005-001		STANDARD MILLING	SY	2,821	\$9.00	\$25,389
604050-010		12 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	663	\$135.00	\$89,505
604050-012		15 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	538	\$210.00	\$112,980
604050-016		18 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	1,230	\$250.00	\$307,500
604050-020		24 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	472	\$260.00	\$122,720
604050-021		27 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	243	\$265.00	\$64,395
604050-024		36 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	604	\$310.00	\$187,240
605001-001		TYPE A MANHOLE	EA	2	\$12,000.00	\$24,000
605004-001		TYPE B INLET	EA	12	\$7,000.00	\$84,000
605007-001		TYPE E INLET	EA	7	\$19,000.00	\$133,000
605008-001		TYPE F INLET	EA	11	\$10,500.00	\$115,500
605009-001		TYPE G INLET	EA	2	\$17,000.00	\$34,000
605014-001		MODIFIED INLET, TYPE B	EA	5	\$10,000.00	\$50,000
605041-010		12 INCH SLOT INLET	LF	40	\$500.00	\$20,000
605041-016		18 INCH SLOT INLET	LF	5	\$600.00	\$3,000
605041-020		24 INCH SLOT INLET	LF	5	\$700.00	\$3,500
633003-001		DUMPED ROCK GUTTER	CY	16	\$300.00	\$4,800
636 ITEMS		TEMPORARY TRAFFIC CONTROL (INCLUDES CSX FLAGGING)	LS	1	\$95,000.00	\$95,000
639001-001		CONSTRUCTION LAYOUT STAKE	LS	1	\$5,000.00	\$5,000
642 ITEMS		TEMPORARY EROSION AND SEDIMENT CONTROL	LS	1	\$10,000.00	\$10,000
663 ITEMS		PAVEMENT MARKINGS	LS	1	\$4,000.00	\$4,000

Item Number	Alt.	Description	Units	Qty	Unit Price	Total
		TOTAL ESTIMATED CONSTRUCTION COST				\$1,651,455
		CONSTRUCTION ADMINISTRATION AND INSPECTION (15%)				\$247,718
		DESIGN CONTINGENCY (10%)				\$165,146
		TOTAL CONSTRUCTION COST				\$2,064,319
		(ROUNDED UP TO \$10,000)				\$2,070,000
		TOTAL RIGHT-OF-WAY				\$70,000
		ENGINEERING				\$310,000
		TOTAL PROJECT COST				\$2,450,000

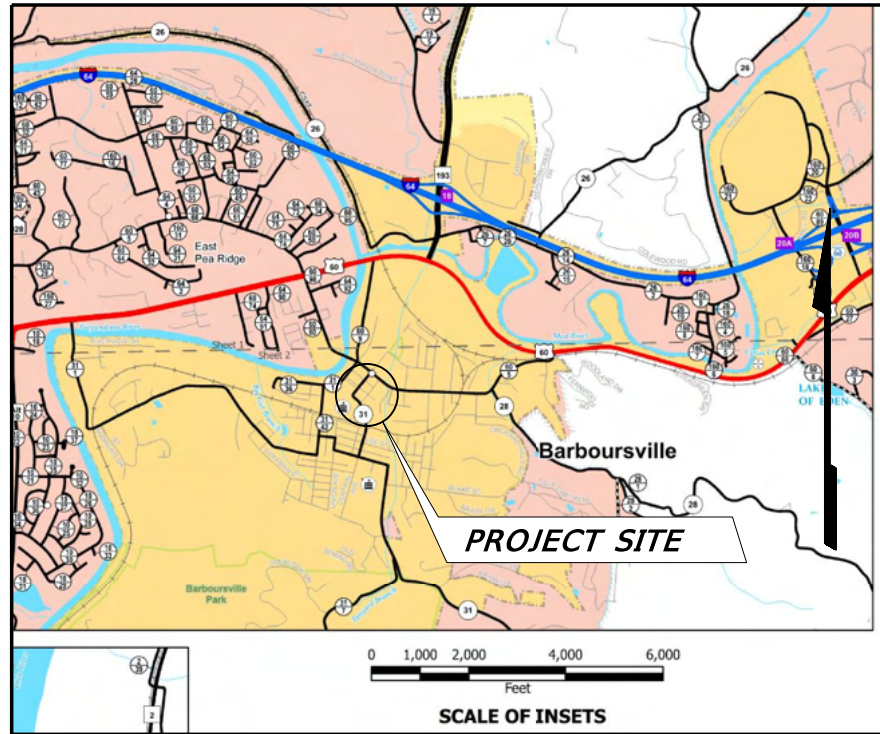


APPENDICES



Appendix A:

CSX Underpass Drainage Study Plans

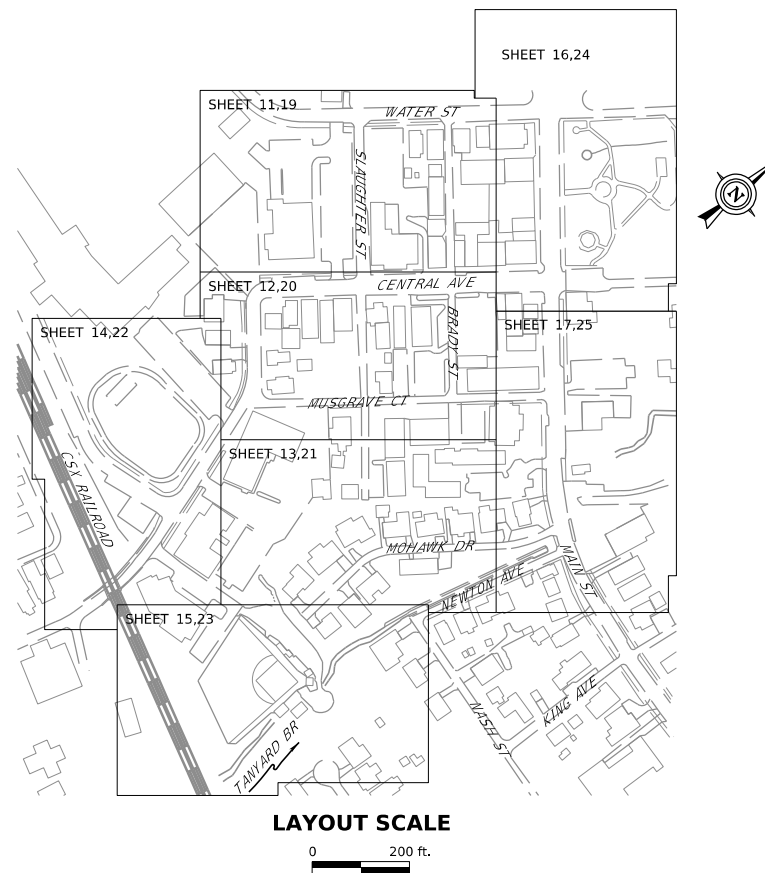


UTILITIES ENCOUNTERED

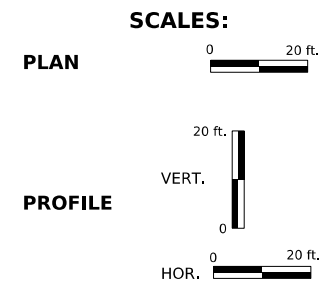
BARBOURSVILLE SANITARY BOARD (SEWER)
MOUNTAINEER GAS (GAS)
WV AMERICAN WATER COMPANY (WATER)
OVERHEAD UTILITIES NOT SHOWN

KYOVA
INTERSTATE PLANNING COMMISSION
VILLAGE
OF
BARBOURSVILLE

CENTRAL AVE
BARBOURSVILLE CORP DISTRICT
CABELL COUNTY
CSX UNDERPASS DRAINAGE STUDY

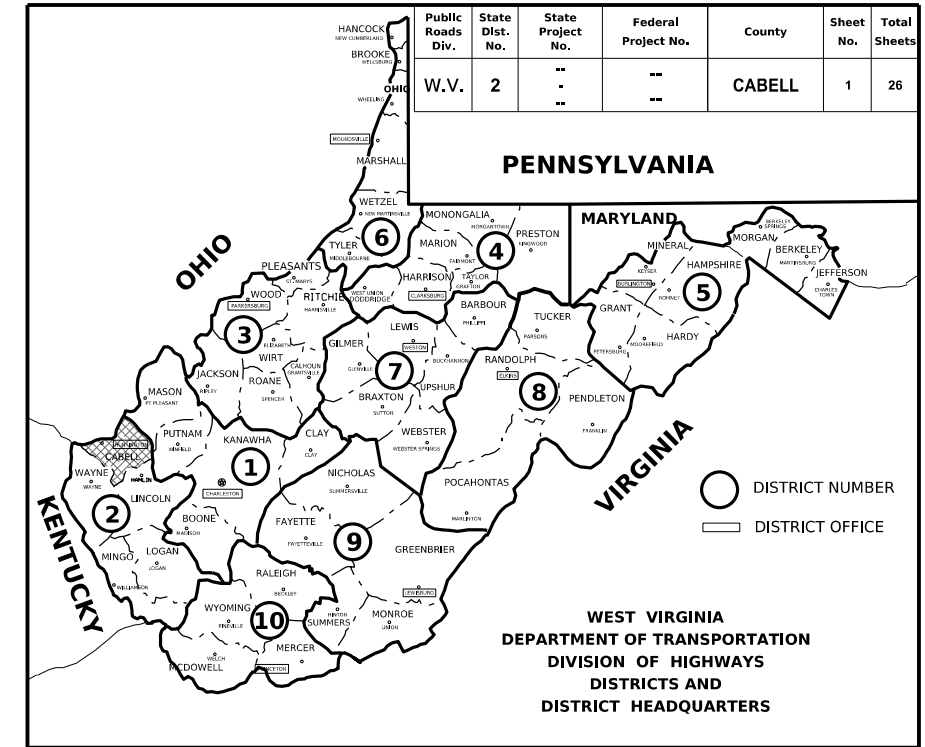


INDEX TO SHEETS

[illegible]

CONVENTIONAL SIGNS

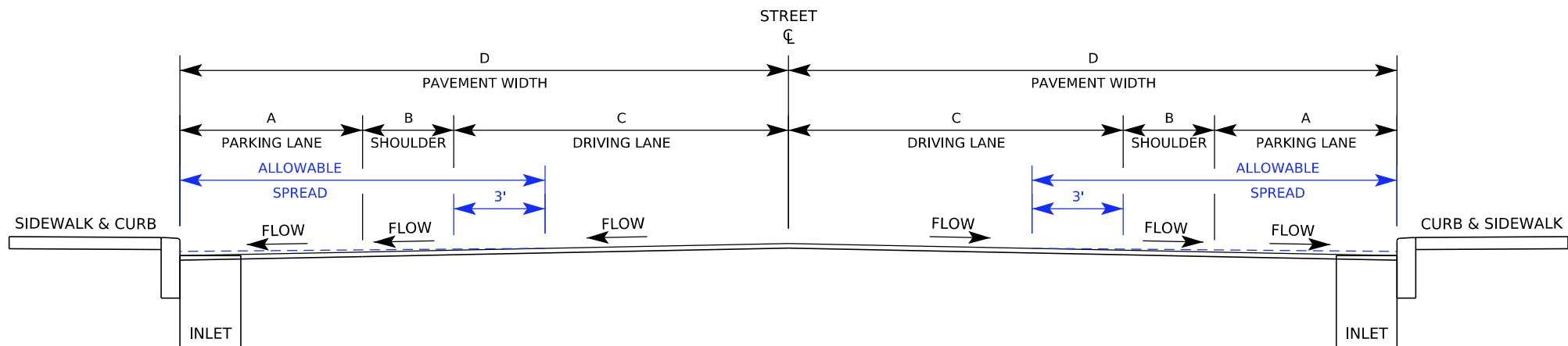
	STATE LINE
	COUNTY LINE
	CORPORATION LINE
	PROPOSED R/W & EASEMENT LINE
	EXISTING R/W LINE
	PROPERTY LINE
	EXISTING FENCE
	PROPOSED FENCE
	EDGE OF STREAM
	PROPOSED GUARD RAIL
	EXISTING GUARD RAIL
	RAILROAD
	GAS LINE
	WATER LINE
	TELEPHONE LINE
	ELECTRIC LINE
	EXISTING DRAINAGE PIPE
	TELEPHONE POLE
	POWER POLE
	COMBINED POWER AND TELEPHONE POLE
	TREE
	SHRUB
	RIGHT OF WAY MARKER



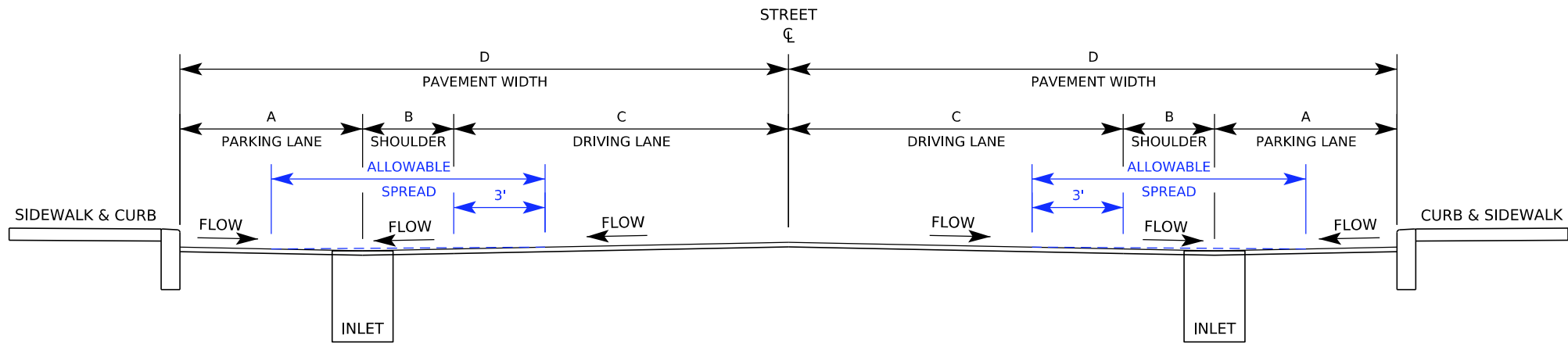
TYPE OF CONSTRUCTION

DESIGN STUDY
NOT FOR CONSTRUCTION

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY



Central Avenue - Existing Typical Section
(Normal Crown Curb Section)



Central Avenue - Existing Typical Section
(Normal Crown with Drainage Swale)

- Notes:
- 1. Central Avenue Typical Section varies in features over the project length.
 - 2. Typical Sections reflect presence of sidewalks, curbs, parking lanes, swales, and shoulders for illustrative purposes.
 - 3. Dimensions (A) and (B) represent parking lanes and shoulder widths, where present, respectively.

Michael Baker INTERNATIONAL							
		REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY	

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
TYPICAL SECTIONS
AND DETAILS

NOT TO SCALE

9/1/2026

1-SEP-2026 09:20 p:\r\nb-us-pw-bentley.commb-us-pw-03\Documents\Charleston.WV\01_Projects\CSX_Underpass_Drainage_Study\CADD\Drainage\rdy_CUD_tup_sh02.dgn 1-SEP-2026 09:20

- ①

ITEM 402001-020

MARSHALL ASPHALT SKID PVT, SG TY1, PER TN
- ②

ITEM 401003-001

MARSHALL ASPHALT P/L CRSE, SG, PER TN
- ③

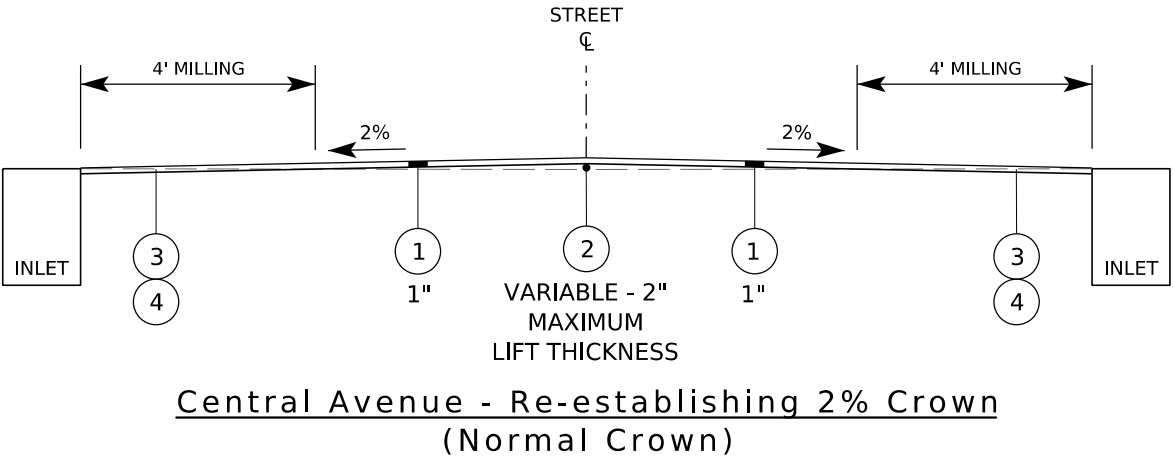
ITEM 408002-001

ASPHALT MATERIAL, PER GA
- ④

ITEM 415005-001

STANDARD MILLING, PER SY

LEGEND:



NOT TO SCALE

Michael Baker INTERNATIONAL					
	REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
TYPICAL SECTIONS
AND DETAILS

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	3	26

1-SEP-2026 09:20

1-SEP-2026 09:20 pwt:/mb-us-pw-bentley.commb-us-pw-03/Documents/Charleston,WV/01_Projects/CSX_Underpass_Drainage_Study/CADD/Drainage/dra-CUD_gns.shd01.dgn

GOVERNING SPECIFICATIONS

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, STANDARD SPECIFICATIONS ROADS AND BRIDGES, ADOPTED 2023, AS AMENDED BY THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, SUPPLEMENTAL SPECIFICATIONS, DATED JANUARY 2026, THE CONTRACT DOCUMENTS, AND THE CONTRACT PLANS ARE THE GOVERNING PROVISIONS APPLICABLE TO THIS PROJECT.

STANDARD DETAILS VOLUME I AND II

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, STANDARD DETAILS BOOK, VOLUME I, DATED MAY 2016 & VOLUME II, DATED JANUARY 2019 SHALL APPLY TO THIS PROJECT. STANDARD DETAILS CAN BE FOUND AT <http://www.transportation.wv.gov/highways/engineering/Pages/publications.aspx>

EXISTING DRAINAGE

ALL EXISTING DRAINAGE FEATURES, INCLUDING PIPES, PIPE SIZE, INLETS, MANHOLES AND OTHER CONNECTIONS ARE SOURCED THROUGH THE VILLAGE OF BARBOURSVILLE FROM GPS DATA.

EXISTING PIPE CONDITION

DURING THE DATA COLLECTION PROCESS IN LOCATING ALL EXISTING DRAINAGE STRUCTURES, THE VILLAGE OF BARBOURSVILLE PROVIDED A PIPE CONDITION ASSESSMENT. THE CONDITION IS SHOWN AT EACH PIPE LABEL AS "SIZE" "TYPE" (CONDITION), I.E., 8" ABS (A). THE FOLLOWING LEGEND IS THE ASSESSMENT CONDITION USED.

- (E) - EXCELLENT
- (G) - GOOD
- (A) - AVERAGE
- (F) - FAIR
- (P) - POOR

MAPPING

EXISTING FEATURES USED FOR BACKGROUND MAPPING PURPOSES WERE DRAWN FROM AERIAL PHOTOGRAPH AND ARE NOT SURVEY QUALITY.

THE CONTOURS WERE GENERATED FROM THE WV ELEVATION AND LIDAR DOWNLOAD TOOL (<https://data.wvgis.wvu.edu/elevation/>). THE DEM IS 1 - METER RESOLUTION.

EXISTING RIGHT OF WAY AND PROPERTY LINES

ALL EXISTING RIGHT OF WAY AND PROPERTY LINES ARE SOURCED THROUGH THE VILLAGE OF BARBOURSVILLE FROM TAX MAPS.

UNDERGROUND UTILITIES

ALL EXISTING UTILITIES ARE SOURCED THROUGH THE VILLAGE OF BARBOURSVILLE FROM GPS DATA.

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	--	--	CABELL	4	26

Item Number	ALT.	Description	Units	Quantity
ROADWAY				
204001-000		MOBILIZATION	LS	1
401003-001		MARSHALL ASPHALT P/L CRSE, SG	TN	67
402001-020		MARSHALL ASPHALT SKID PVT, SG, TY I	TN	244
408002-001		ASPHALT MATERIAL	GA	577
415005-001		STANDARD MILLING	SY	2,821
604050-010		12 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	663
604050-012		15 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	538
604050-016		18 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	1,230
604050-020		24 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	472
604050-021		27 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	243
604050-024		36 INCH HIGH DENSITY POLYETHYLENE PIPE, PROFILE WALL	LF	604
605001-001		TYPE A MANHOLE	EA	2
605004-001		TYPE B INLET	EA	12
605007-001		TYPE E INLET	EA	7
605008-001		TYPE F INLET	EA	11
605009-001		TYPE G INLET	EA	2
605014-001		MODIFIED INLET, TYPE B	EA	5
605041-010		12 INCH SLOT INLET	LF	40
605041-016		18 INCH SLOT INLET	LF	5
605041-020		24 INCH SLOT INLET	LF	5
633003-001		DUMPED ROCK GUTTER	CY	16
636 ITEMS		TEMPORARY TRAFFIC CONTROL (INCLUDES CSX FLAGGING)	LS	1
639001-001		CONSTRUCTION LAYOUT STAKE	LS	1
642 ITEMS		TEMPORARY EROSION AND SEDIMENT CONTROL	LS	1
663 ITEMS		PAVEMENT MARKINGS	LS	1

PLAN SHEET LEGEND

- Sto

EXISTING DRAINAGE PIPE THAT MEETS CURRENT WVDOH HYDRAULIC CRITERIA AND IS IN FAIR OR BETTER CONDITION
- EXISTING CATCH BASIN STRUCTURE AND IF LOCATED ALONG CURB AND GUTTER IT MEETS CURRENT WVDOH SPREAD CRITERIA
- Sto

EXISTING DRAINAGE PIPE THAT IS NOT HYDRAULIC FUNCTIONING TO CURRENT WVDOH DRAINAGE MANUAL STANDARDS AND/OR IS IN POOR CONDITION
- EXISTING INLET STRUCTURE ALONG CURB AND GUTTER THAT DOES NOT MEET CURRENT WVDOH REQUIREMENTS FOR SPREAD
- PROPOSED DRAINAGE PIPES
- Sto

BASED ON LOCATION, DEPTH OF COVER AND FLOW CHARACTERISTICS, PIPE IN PROPOSED DRAINAGE LAYOUT IS UNDER PRESSURE FLOW FOR THE DESIGN STORM, BUT NO OVERFLOW IS ANTICIPATED
- PROPOSED INLETS
- PROPOSED MANHOLE
- #

PARCEL NUMBER FOR OWNERSHIP INDEX
- P.D.E.

PERMANENT DRAINAGE EASEMENT
- T.C.E.

TEMPORARY CONSTRUCTION EASEMENT

Michael Baker INTERNATIONAL						
	REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY	
KYOVA INTERSTATE PLANNING COMMISSION VILLAGE OF BARBOURSVILLE GENERAL NOTES AND SUMMARY OF QUANTITIES						

9/1/2026

1-SEP-2026 09:20

pwt:/mb-us-pw-bentley.commb-us-pw-03/Documents/Charleston,WV/01_Projects/CSX_Underpass_Drainage_Study/CADD/Drainage/dra-CUD_gns.shd01.dgn

NOTES

UNLESS OTHERWISE SPECIFIED ON THE PLANS, TYPE B INLETS MAY BE CONSTRUCTED IN ANY OF THE SHAPES SHOWN WHEN THE OUTLET PIPE DIAMETERS IS 21" OR LESS AND THE ADJACENT PAVEMENT IS CONCRETE.
IF THE OUTLET PIPE DIAMETER IS 24" OR THE ADJACENT PAVEMENT IS HOT MIX ASPHALT, ONLY THE SQUARE STYLE WITH THE DEEP FRAME WILL BE USED. THE INSIDE OPENING OF THE INLET WILL BE ADJUSTED TO ACCOMMODATE THE 24" PIPE.

CONSTRUCTION MAY BE CAST-IN-PLACE, PRECAST IN ONE OR MULTIPLE SECTIONS, OR ANY COMBINATION OF CAST-IN-PLACE AND PRECAST.

OPTIONAL CONSTRUCTION JOINTS LABELED "CJ" MAY BE ROUGHENED CONCRETE, KEYED OR DOWELED AS PER THE TYPICAL DETAILS SHOWN HEREIN, OR AS APPROVED BY THE ENGINEER. NON SHRINK GROUT MEETING THE REQUIREMENTS OF SUBSECTION 715.5 OF THE SPECIFICATIONS MAY BE USED TO A DEPTH OF 1/2" FOR LEVELING BETWEEN PRECAST SECTIONS. THICKER DEPTHS WILL BE ALLOWED AS PER THE MANUFACTURER'S RECOMMENDATIONS.

THE FINAL INSTALLED TOP SURFACE OF INLET AND GRATE SHALL BE FLUSH WITH ADJACENT FINISHED SURFACES SUCH AS PAVEMENT, GUTTERS, CURBS, AND SIDEWALKS. TOP OF GRATE ELEVATION, IF SHOWN ON THE PLANS, IS FOR INFORMATION ONLY.

REBARS ARE TO BE INSTALLED AT THE QUARTER POINTS TO CONNECT CURB TO INLET. REBARS ARE NOT REQUIRED IF CURB IS POURED MONOLITHICALLY WITH THE INLET OR IF TYPE V OR VIMEDIAN IS SPECIFIED ON THE PLANS.

FOR DETAILS OF GRATES AND FRAMES, SEE INLET CASTING STANDARD SHEET DR6-X.

THE CONTRACTOR MAY, AT HIS OPTION, OMIT USE OF THE SHALLOW FRAME BY FORMING A LEDGE IN THE CONCRETE.

SPECIAL CARE SHALL BE EXERCISED IN FORMING THE 2" WIDE CONCRETE LEDGE TO PROVIDE A SMOOTH, EVEN SURFACE FOR SUPPORTING THE GRATE IF A FRAME IS NOT USED. NO PROJECTIONS SHALL EXIST ON THE GRATE AND THE GRATE SHALL SEAT ON THE LEDGE WITHOUT ROCKING.

FIBRE FORM SHALL BE REMOVED PRIOR TO COMPLETION OF THE PROJECT.

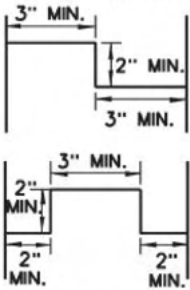
PC(MINIMUM PIPE COVER) SHALL BE 12" BELOW INLET TOP FOR PIPES PLACED UNDER SIDEWALK OR GRASSED AREA OR 24" BELOW INLET TOP FOR PIPES PLACED UNDER PAVEMENT OR SHOULDER.

CURB, IF SPECIFIED, MAY BE EITHER CONCRETE PLACED ON THE INLET BACKWALL AS DETAILED HEREIN OR AN APPROVED CURB BOX AS MANUFACTURED WITH THE GRATE AND FRAME. DIMENSIONS OF THE CURB BOX SHOULD REASONABLY CONFORM TO THE STANDARD CURB AS SPECIFIED ON THE PLANS. THE CURB WILL BE PAID FOR PER SECTION 610, IN EITHER CASE.

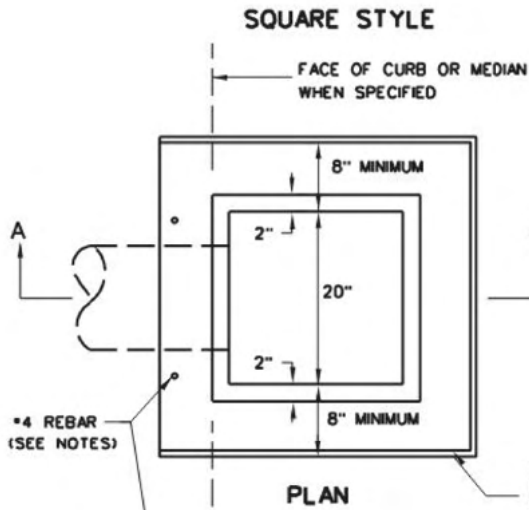
THIS INLET SHALL NOT BE PLACED IN A PEDESTRIAN CROSS WALK.

THE MINIMUM DISTANCE FROM THE TOP OF ANY PIPE OPENING TO ANY CONSTRUCTION JOINT ABOVE THE OPENING SHALL BE FOUR (4) INCHES.

THE NUMBER AND LOCATION OF PIPE OPENINGS SHALL BE AS SHOWN IN THE PLANS. THE CONTRACTOR AT NO ADDITIONAL COST, SHALL BE RESPONSIBLE FOR ANY TEMPORARY BRACING REQUIRED TO TRANSPORT PRECAST INLET SECTIONS DUE TO MULTIPLE OPENINGS.

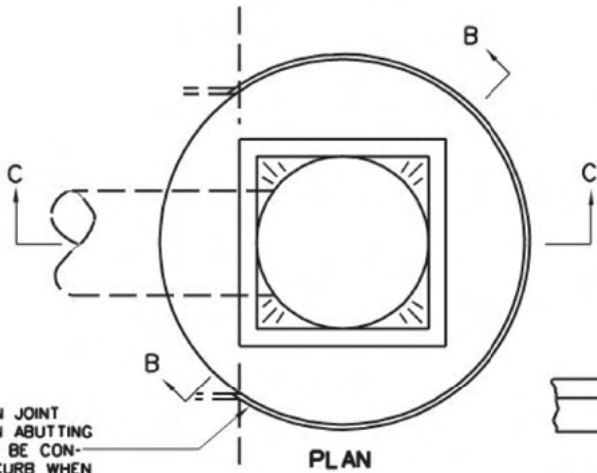


CONSTRUCTION JOINT DETAILS



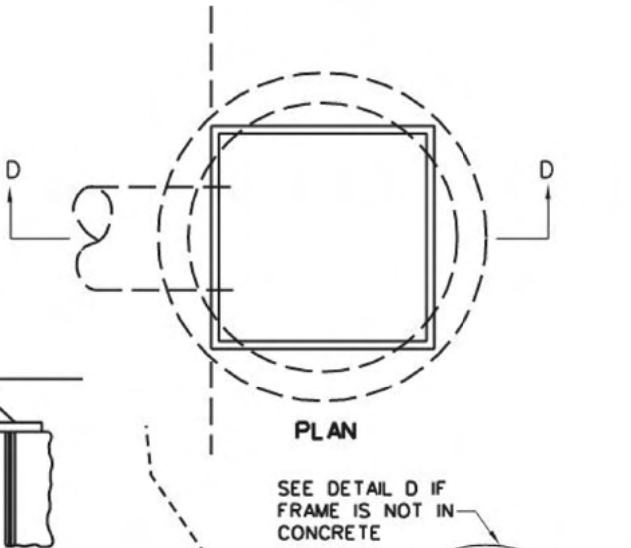
PLAN

CIRCULAR STYLE 1



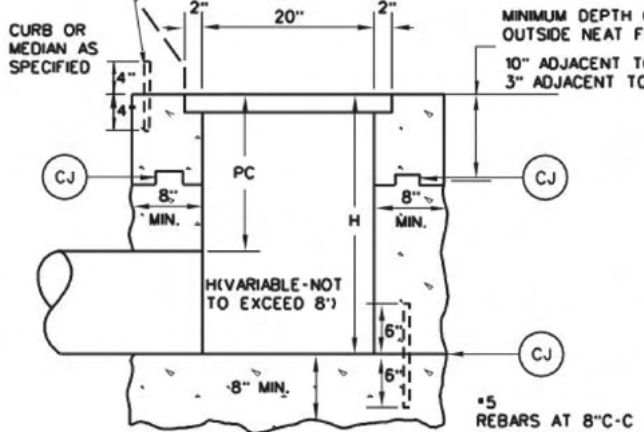
PLAN

CIRCULAR STYLE 2

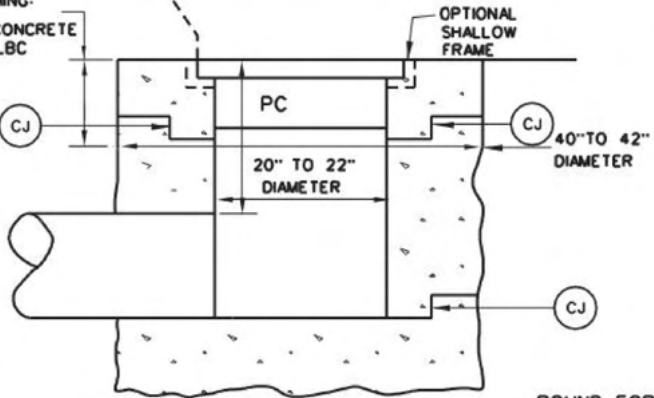


PLAN

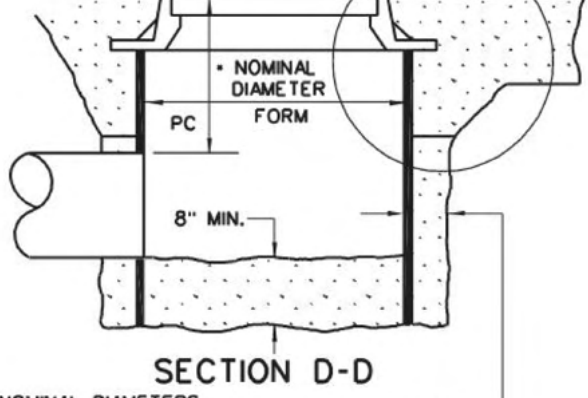
DETAIL D



SECTION A-A
WITHOUT SHALLOW FRAME

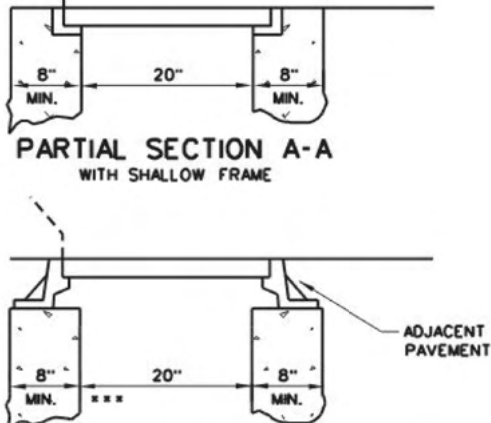


SECTION C-C

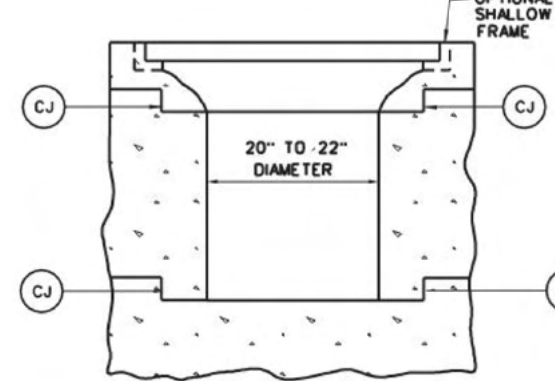


SECTION D-D

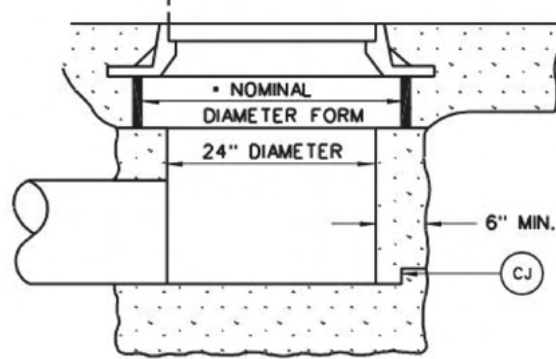
• ROUND FORM NOMINAL DIAMETERS:
CORRUGATED PIPE : 30"
FIBRE FORM : 28"
4" MIN. WITH PIPE FORM
6" MIN. WITH FIBRE FORM



PARTIAL SECTION A-A
WITH SHALLOW FRAME



SECTION B-B



SECTION D-D
OPTIONAL METHOD



PARTIAL SECTION A-A
WITH DEEP FRAME

*** OPENING WILL BE 24" FOR 24" DIAMETER OUTLET PIPE

Michael Baker

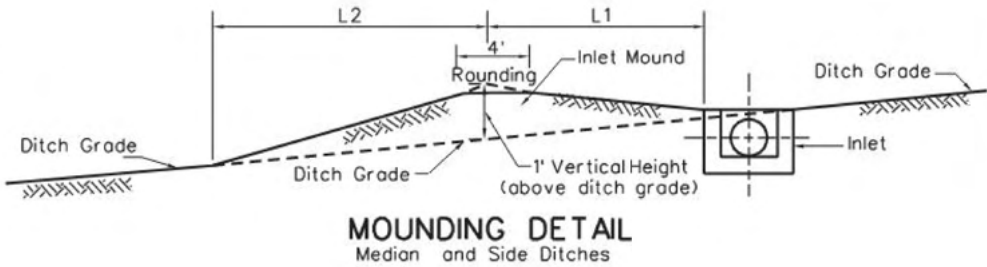
INTERNATIONAL

NOT TO SCALE

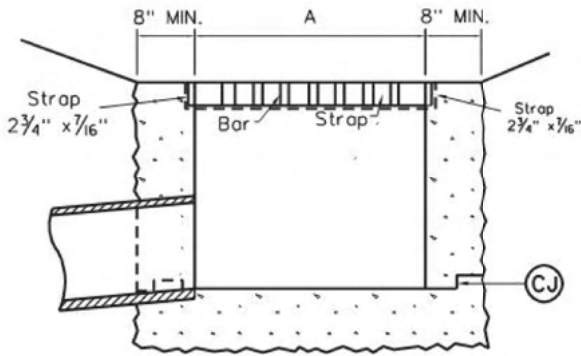
REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
SPECIAL DETAILS
TYPE B INLET

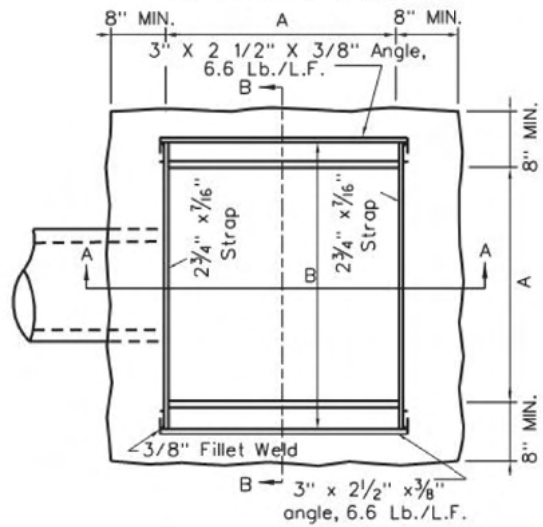
9/1/2026



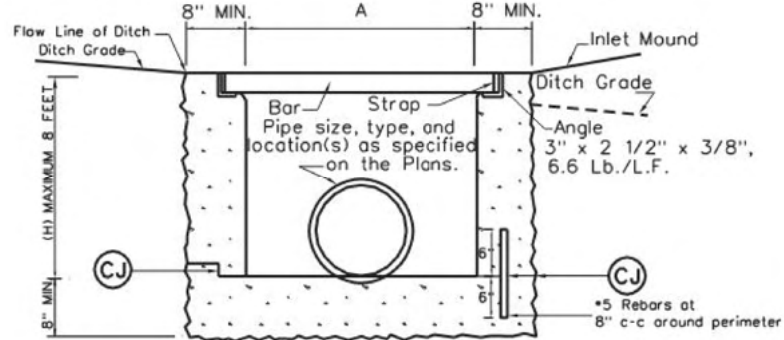
INLET MOUNDING TABLE			
DITCH GRADE (Z)		L1, HORIZONTAL LENGTH (FT.)	L2, HORIZONTAL LENGTH (FT.)
FROM	TO		
0	3	10	15
3	5	9	20
5	7.5	8	40
7.5	UP	SPECIAL DESIGN	SPECIAL DESIGN



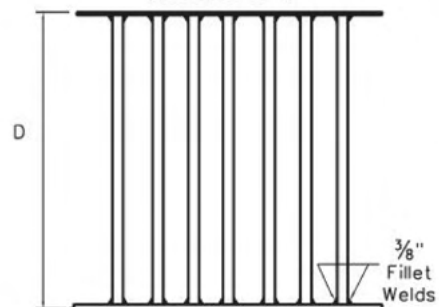
SECTION A-A
(Type 2 Grate Shown)



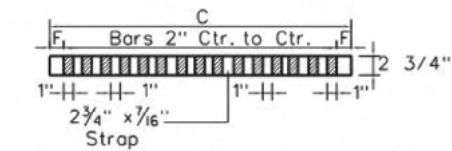
PLAN



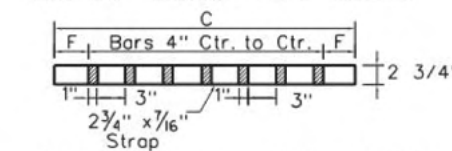
SECTION B-B



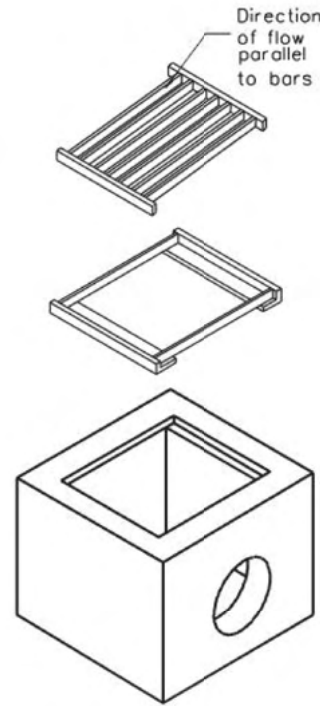
PLAN VIEW-TYPE 2 GRATE



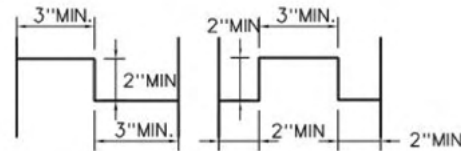
SECTION THROUGH TYPE 1 GRATE



SECTION THROUGH TYPE 2 GRATE



EXPLODED DETAIL



CONSTRUCTION JOINT DETAILS

NOTES

The final installed top surface of inlet and grate shall be flush with adjacent finished surfaces such as pavement, gutters, curbs, and sidewalks. Top of grate elevation, if shown on the plans, is for information only.

Construction may be cast-in place, precast in one or multiple sections, or any combination of cast-in-place and precast.

Type 2 Grate shall be used at all locations unless otherwise specified on the Plans. Type 1 Urban Grates shall be used only at specially designated locations as shown on the plans.

The Contractor, at his option, may omit use of the frame by forming a ledge in the concrete.

Special care shall be exercised in forming the 2" wide concrete ledge to provide a smooth, even surface for supporting the grates if the shallow frame is not used. No projections shall exist on the bearing surfaces of the ledge or the grates, and the grates shall seat on the ledge without rocking.

The Mounding Detail as shown is not required when an inlet is placed in a sag.

Optional construction joints labeled "CJ" may be roughened concrete, keyed or doweled as per the typical details shown herein or as approved by the Engineer. Non shrink grout meeting the requirements of subsection 715.5 of the specifications may be used to a depth of 1/2" for leveling between precast sections. Thicker depths will be allowed as per the manufacturer's recommendations.

This inlet is to be installed in roadside or median ditches only. It is not to be placed adjacent to pavement or in the gutter pan of combination curb and gutter.

The minimum distance from the top of any pipe opening to any construction joint above the opening shall be four (4) inches.

The number and location of pipe openings shall be as shown in the plans. The contractor at no additional cost, shall be responsible for any temporary bracing required to transport precast inlet sections due to multiple openings.

DIMENSIONS						TYPE 2 GRATE			FRAME		TYPE 1 GRATE		
Pipe Size	A	B	C	D	H(Min)	F	Bors	WT.	WT.	F	Bors	WT.	
18"	2'-8"	3'-2"	2'-7 3/4"	3'-1 3/4"	2'-0"	3 3/8"	7	223	62	1 3/8"	15	453	
21"	2'-8"	3'-2"	2'-7 3/4"	3'-1 3/4"	2'-3"	3 3/8"	7	223	62	1 3/8"	15	453	
24"	2'-8"	3'-2"	2'-7 3/4"	3'-1 3/4"	2'-6"	3 3/8"	7	223	62	1 3/8"	15	453	
27"	3'-0"	3'-6"	2'-11 3/4"	3'-5 3/4"	2'-9"	3 3/8"	8	279	69	1 3/8"	17	566	
30"	3'-6"	4'-0"	3'-5 3/4"	3'-11 3/4"	3'-0"	3 3/8"	9	357	80	1 3/8"	21	797	
33"	3'-9"	4'-3"	3'-8 3/4"	4'-2 3/4"	3'-3"	3 7/8"	10	419	85	1 7/8"	21	847	
36"	4'-0"	4'-6"	3'-11 3/4"	4'-5 3/4"	3'-6"	3 3/8"	11	486	90	1 3/8"	23	981	
42"	4'-6"	5'-0"	4'-5 3/4"	4'-11 3/4"	4'-0"	3 3/8"	12	587	101	1 3/8"	27	1277	
48"	5'-0"	5'-6"	4'-11 3/4"	5'-5 3/4"	4'-6"	3 3/8"	14	748	112	1 3/8"	29	1507	

Table Note: Grate and frame weights are for information only and will increase if larger straps and bars are used. The following substitutions in dimensions are acceptable for fabricating the grate and frame:
Strap Thickness: 1/2" Strap Depth: 3" Bar Depth: 3"

Michael Baker

INTERNATIONAL

NOT TO SCALE

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE

SPECIAL DETAILS
TYPE G INLET

9/1/2026

1-SEP-2026 09:21

p:\r\mb-us-pw-bentley\comb-us-pw-03\Documents\Charleston_WV\01-Projects\CSX Underpass Drainage Study\CADD\Drawings\dr-g-CUD.dtl-sh-04.dgn

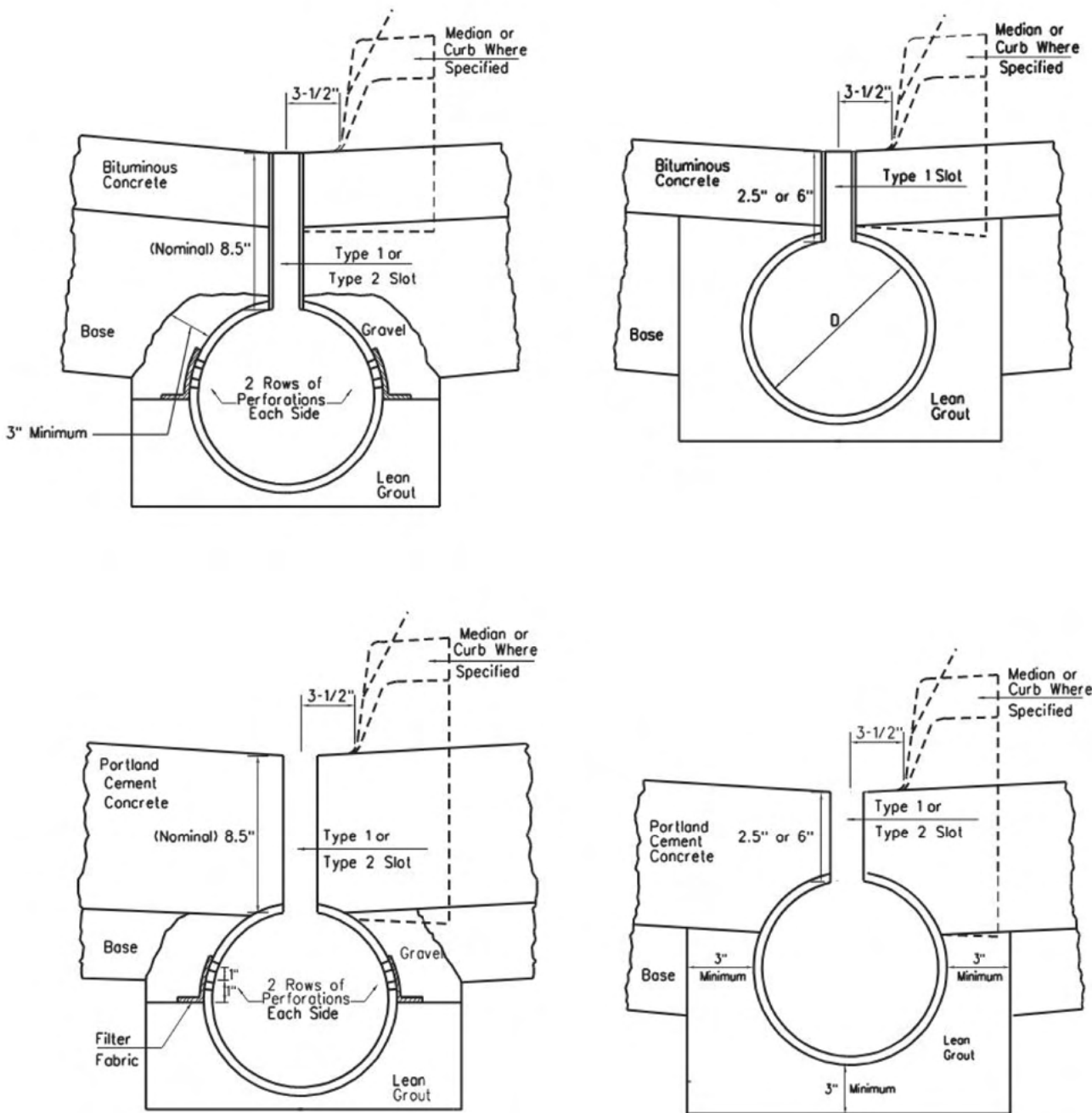
1-SEP-2026 09:21

p:\r\mb-us-pw-bentley\comb-us-pw-03\Documents\Charleston_WV\01-Projects\CSX Underpass Drainage Study\CADD\Drawings\dr-g-CUD.dtl-sh-04.dgn

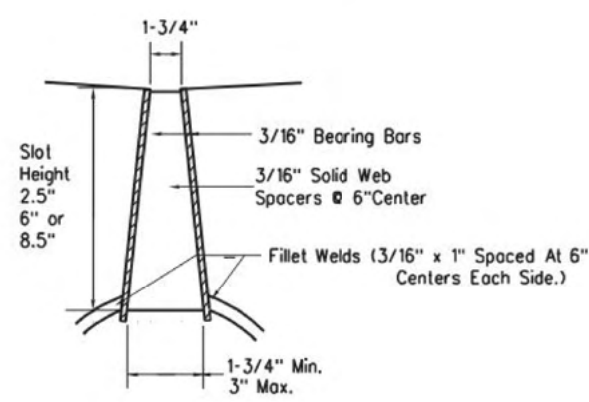
9/1/2026

1-SEP-2026 09:21
pw:/mb-us-pw-bentley.comb-us-pw-03/Documents/Charleston, WV/01_P-projects/CSX Underpass Drainage Study/CADD/Drawings/drawings/CUD.dtl.shd05.dgn

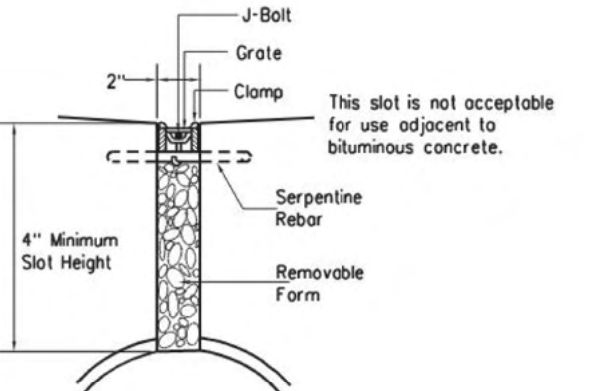
TYPICAL INSTALLATIONS



SLOT DETAILS



TYPE 1 SLOT



TYPE 2 SLOT

NOTES

The contractor may, at his option but subject to the limitations as noted on this sheet and elsewhere on the plans, install Type 1 or 2 Slots or approved equals.

When specified on the plans, Type 1 slots shall include expanded steel mesh heel guards tack welded to the spacer bars.

Gravel shall be omitted from the perforated slot inlet installation when free-draining base is specified and will be placed against the inlet.

When slot heights of 8.5" are specified, the Type 1 slots may be fabricated by stocking a 2.5" slot on top of a 6" slot. The assembly shall then be joined by minimum 3/16" x 1" fillet welds at 6" centers along each side of the horizontal joint. The resultant slot height may be slightly less than 8 1/2".

Slot inlet shall not be placed across a pedestrian cross walk.

SLOTS NOTES

TYPE 1 SLOT

BEARING BARS AND SPACERS: These elements are to be 3/16" structural steel suitably welded to form the open slot and hot-dip galvanized as per ASTM A-123. Spacer may be vertical or tilted at approximately 30° from vertical. If the slot inlet is placed on a grade and adjacent to a curb or median, the inlet is to be installed to position tilted spacers to tilt upgrade toward the incoming gutter flow.

TYPE 2 SLOT

GRATE AND CLAMP: These parts are to be hot-dip galvanized mild carbon steel conforming to ASTM A569. Grating, measuring 3/4" deep by 1-3/4" wide, shall extend the full length of each pipe section slot.

REBARS: The rebar shall be serpentine bent to cross the slotted opening on 6" centers and shall be coated with 7 mils of fusion-bonded epoxy powder.

J-BOLT: The J-bolt shall be 5/16 inch diameter, plated, ASTM A307 steel supplied with self-locking nuts.

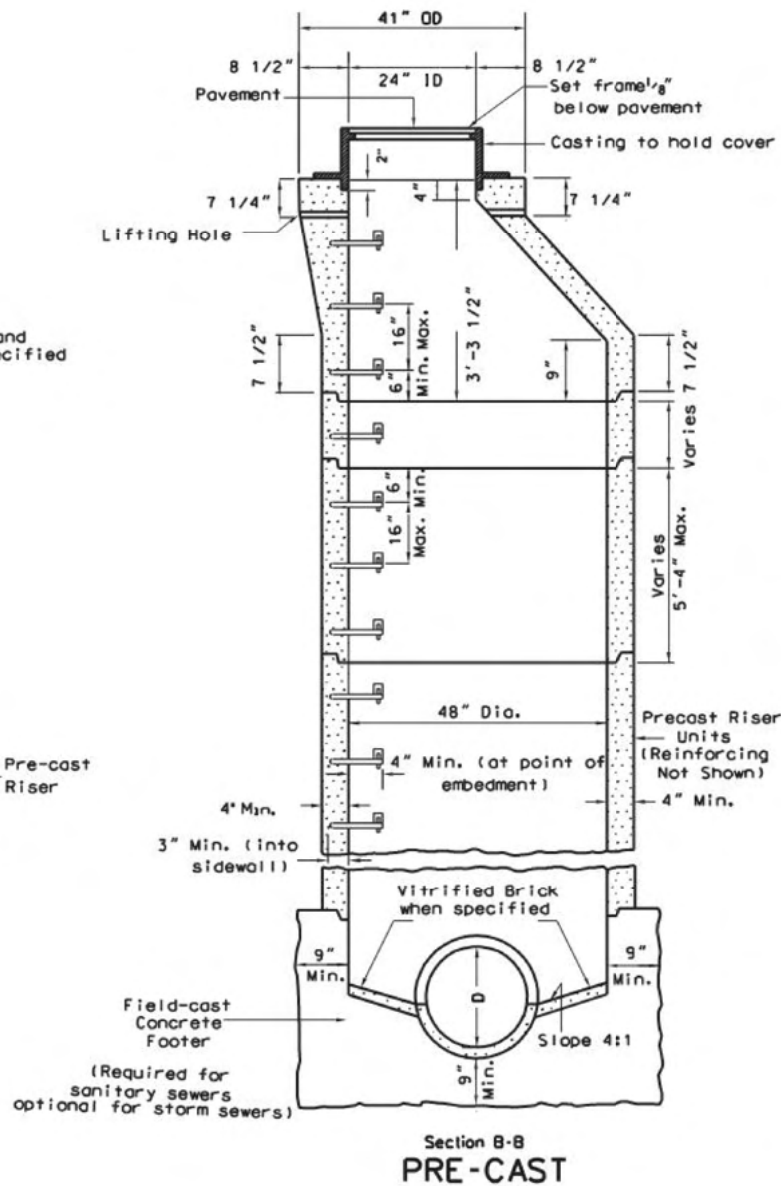
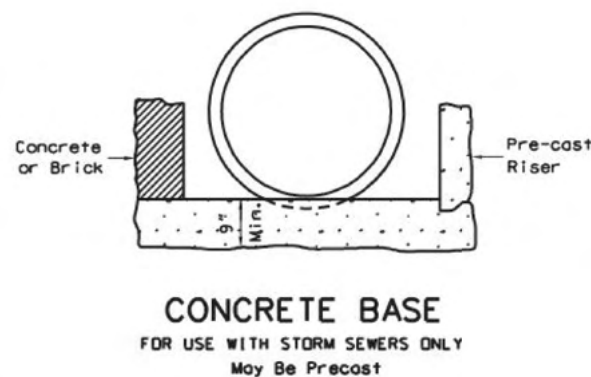
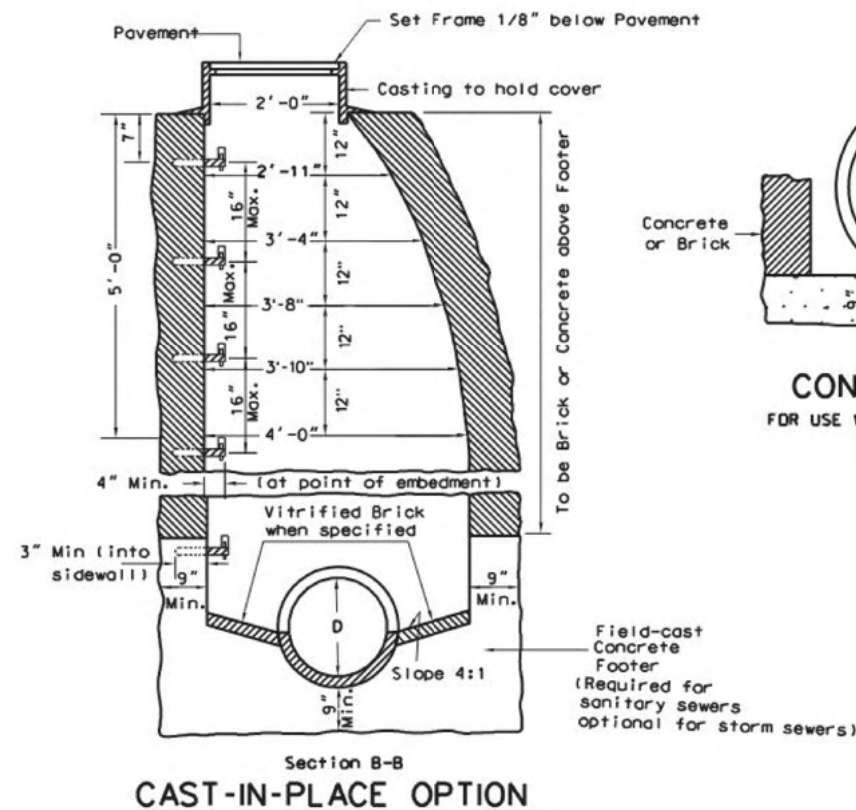
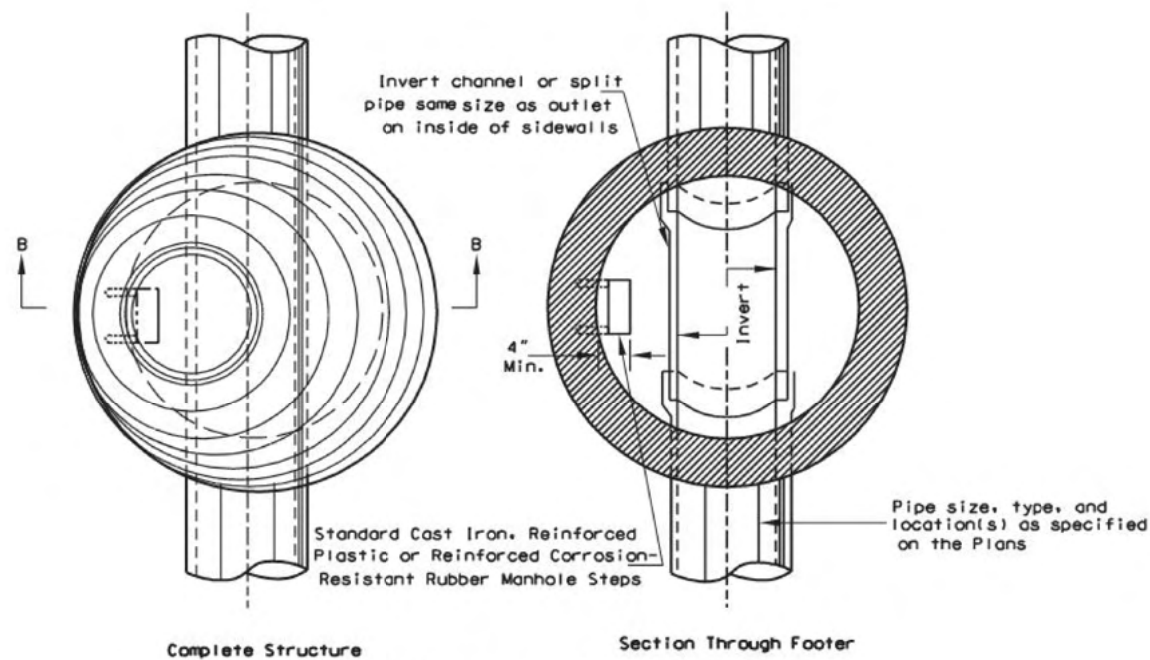
REMOVABLE FORMS: Forms are to be cellular foam with a wood or plastic cap.

SLOT HEIGHT: 4" minimum slot height acceptable where 2.5" slot height is specified.

NOT TO SCALE

Michael Baker							
INTERNATIONAL							
REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY			

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
SPECIAL DETAILS
SLOT INLET



NOTES

Type A Manholes, when specified on the Plans, may be constructed in either method (cast-in-place or pre-cast option) as shown herein.

Steps, frames, and covers shall be as shown on Standard Sheet DR7-X.

"Keyed" or "doweled" type construction joints, acceptable to the Engineer, may be used in the construction of concrete manholes.

If the cast-in-place manhole is over twelve feet (12') in depth, the sidewalls below that depth will be double thickness.

Pipe at elevations other than shown may be joined to the manhole by cutting a hole the size of the connecting pipe in the manhole, inserting the pipe the thickness of the manhole shell and closing all openings around the connecting pipe with joint mortar.

Drawing shows pipe entering and leaving manhole in a straight line. However, the pipes may enter or leave at an angle or place as called for or shown on the Plans.

Minimum height of bench wall above flowline of pipe is 25% of the diameter of the pipes.

The use of brick for manhole construction will not be allowed when a manhole is located in the roadway.

The following additional notes are applicable for pre-cast manholes:

Manhole steps shall be placed into plastic concrete wall during manufacture or mortared into holes after the concrete has set.

Sidewall sections may be used in any combination to produce a manhole of desired depth, except the tapered top section shall be retained as shown.

The tapered top section shall be manufactured and meet the same requirements as the manhole's sidewalls, but shall conform to the dimensions detailed herein.

Lifting holes in the tapered top section and the circumferential notches in the manhole cover are for handling purposes only.

The pre-cast sidewall units shall be set in joint mortar or sealed with O-ring gaskets.

Michael Baker

INTERNATIONAL

NOT TO SCALE

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE

SPECIAL DETAILS
TYPE A MANHOLE

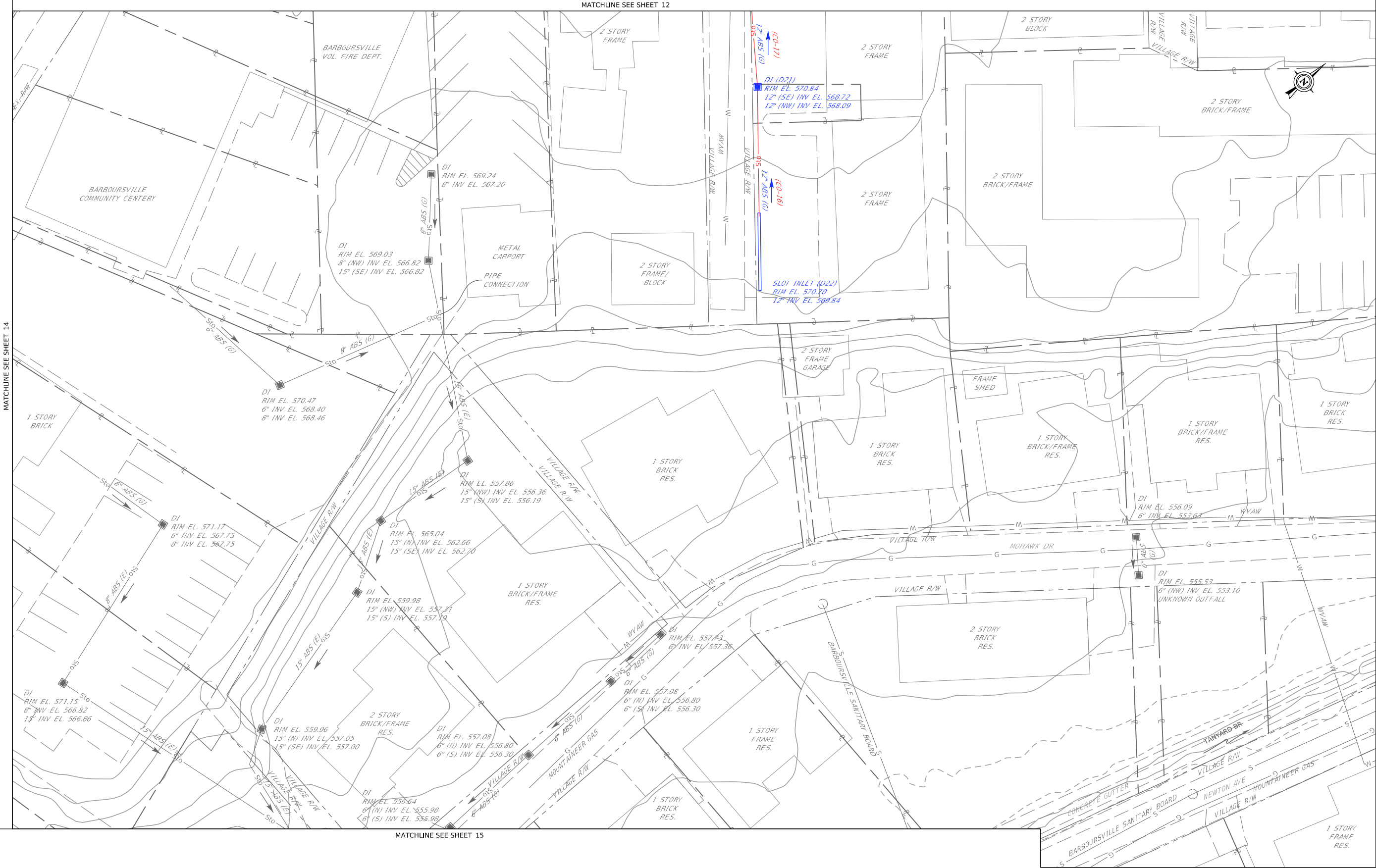
9/1/2026

1-SEP-2026 09:22

p:\r\mb-us-pw-bentley\comb-us-pr-03\Documents\Charleston, WV\01_Projects\CSX Underpass Drainage Study\CADD\Drawings\dra-CUD-pln-E03.dgn

1-SEP-2026 09:22

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	13	26



Michael Baker
INTERNATIONAL

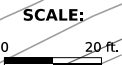
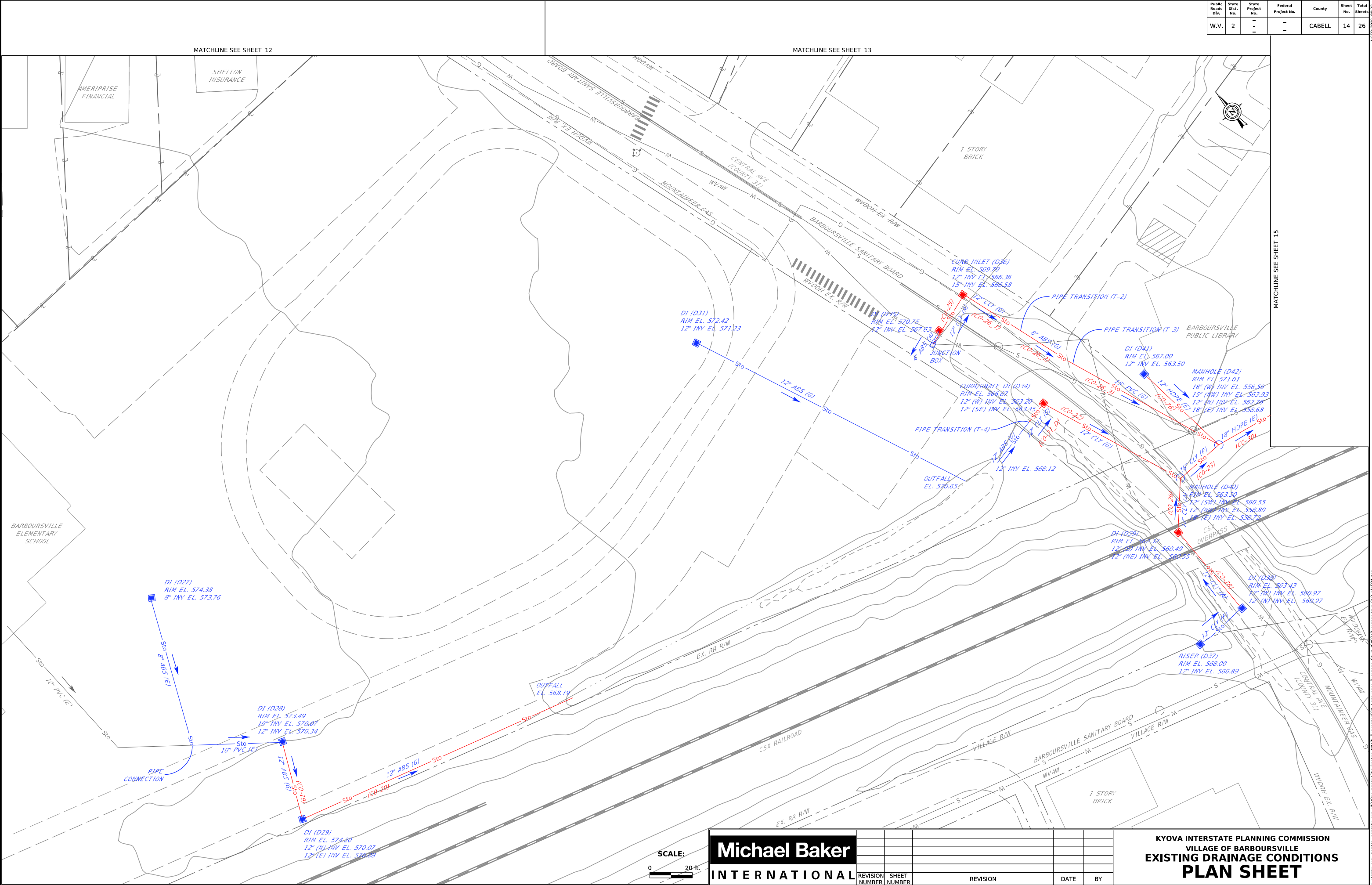
REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
EXISTING DRAINAGE CONDITIONS
PLAN SHEET

9/1/2026

1-SEP-2026 09:22 p:\r\mb-us-pw-bentley\comb-us-pr-03\Documents\Charleston, WV\01_P\Projects\CSX Underpass Drainage Study\CADD\Drawings\dra_cud_plnE04.dgn

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	14	26



Michael Baker
INTERNATIONAL

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
**EXISTING DRAINAGE CONDITIONS
PLAN SHEET**

9/1/2026

1-SEP-2026 09:22 p:\r\mb-us-pw-bentley\comb-us-pr-03\Documents\Charleston_WV\01_Projects\CSX_Underpass_Drainage_Study\CADD\Drainage\dra-CUD-pln-E06.dgn 1-SEP-2026 09:22



Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	16	26

SCALE:
0 20 ft.

Michael Baker
INTERNATIONAL

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
**EXISTING DRAINAGE CONDITIONS
PLAN SHEET**

9/1/2026

1-SEP-2026 09:22 p:\r\mb-us-pw-bentley\comb-us-pr-03\Documents\Charleston, WV\01_Projects\CSX Underpass Drainage Study\CADD\Drawings\dra-CUD-pln-E07.dgn

MATCHLINE SEE SHEET 16

MATCHLINE SEE SHEET 13

MATCHLINE SEE SHEET 12

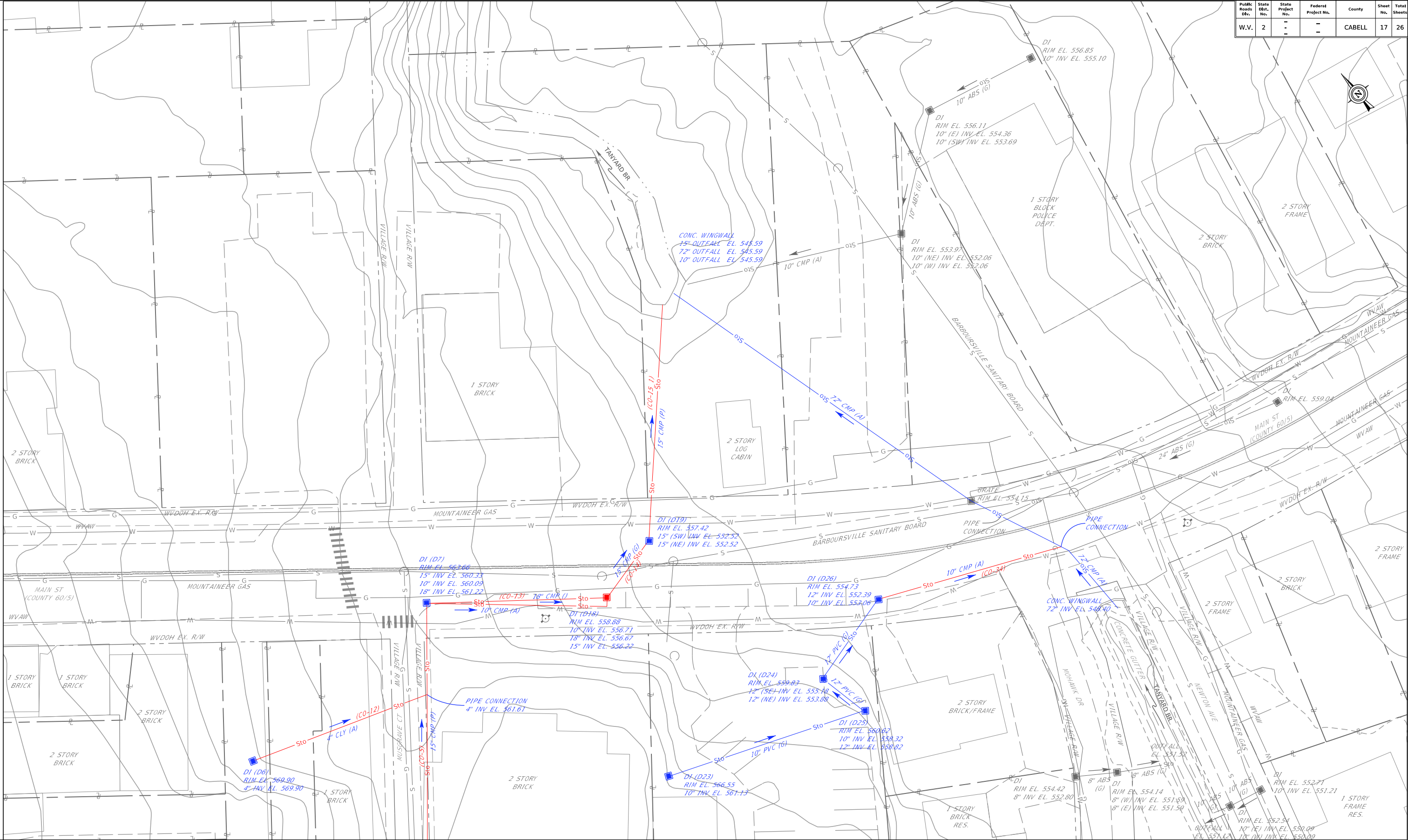
SCALE:
0 20 ft.

Michael Baker
INTERNATIONAL

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
EXISTING DRAINAGE CONDITIONS
PLAN SHEET

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	17	26



9/1/2026

1-SEP-2026 09:22 p:\r\nb-us-pw-bentley\comb-us-pw-03\Documents\Charleston_WV\01_P\Projects\CSX Underpass Drainage Study\CA00\Drainage\dra-CUD_qnt-shd01.dgn 1-SEP-2026 09:22

PROPOSED DRAINAGE TABLE																	
LOCATION		PIPES						MANHOLES	INLETS								REMARKS
START NODE	STOP NODE	604050-010 12 INCH HDPE PROFILE WALL LF	604050-012 15 INCH HDPE PROFILE WALL LF	604050-016 18 INCH HDPE PROFILE WALL LF	604050-020 24 INCH HDPE PROFILE WALL LF	604050-021 27 INCH HDPE PROFILE WALL LF	604050-024 36 INCH HDPE PROFILE WALL LF	605001-001 TYPE A MANHOLE EA	605004-001 TYPE B INLET EA	605007-001 TYPE E INLET EA	605008-001 TYPE F INLET EA	605009-001 TYPE G INLET EA	605014-001 MODIFIED INLET, TYPE B EA	605041-010 12 INCH SLOT INLET LF	605041-016 18 INCH SLOT INLET LF	605041-020 24 INCH SLOT INLET LF	
CB-49	CB-50			31.8					1								CO-69
CB-50	MH-14			30.9					1								CO-70
MH-14	CB-44			110.5				1									CO-55_1
CB-44	CB-63			74.0					1								CO-55_2
CB-31	CB-63			29.2						1							CO-66, 6" CURB INLET
CB-35	CB-65	40.0												25			CO-58
CB-65	CB-63	115.2												15			CO-57
D13	D14	53.4															CO-38, RETAIN D13
D14	D17		178.9														CO-40_1, CO-40_2, RETAIN D14
CB-45	D11	31.6									1						CO-67
CB-34	CB-58		24.6							1							CO-84, 6" CURB INLET
CB-48	D8			35.0						1							CO-68, 10' CURB INLET
CB-39	D8	42.7									1						CO-94
CB-57	CB-58	13.6							1								CO-82
CB-58	D8		39.0						1	1							CO-83, 8" CURB INLET
D8	CB-46			40.1													CO-7_1
CB-46	CB-59			59.2											5		CO-7_2
CB-59	D11				89.9											5	CO-7_3
CB-63	D17			79.2					1								CO-56
D17	D11			121.8					1								CO-6
D11	D12					23.4							1				CO-10
D12	CB-60					144.1							1				CO-11_1
CB-60	D4					75.2						1					CO-11_2
CB-51	D2	22.0									1						CO-74
D1	D3	39.0															CO-1, RETAIN D1
CB-61	MH-18	9.0							1								CO-89
CB-64	CB-62	32.9							1								CO-92
D6	CB-67	61.5															CO-99, RETAIN D6
CB-67	D7			78.9							1						CO-100
CB-55	CB-38	52.2								1							CO-78, 6" CURB INLET
CB-38	CB-37			22.3						1							CO-79, 6" CURB INLET
CB-37	CB-32			111.7						1							CO-95, 6" CURB INLET
CB-32	CB-33			21.0					1								CO-80
CB-33	D2			78.6							1						CO-103
D2	D3			25.1					1								CO-2
D3	D4				220.0								1				CO-3
D4	MH-18						123.9						1				CO-4_1
MH-18	D5						75.4	1									CO-4_2
D5	CB-62						58.4						1				CO-5_1
CB-62	CB-36						89.0				1						CO-5_2
CB-36	D7						41.5				1						CO-5_3
D7	D18						79.7										CO-13, RETAIN D7
D18	D19						31.4										CO-14, RETAIN D18
D19	D20						104.2										CO-15_1, RETAIN D19
D26			84.2														CO-34, RETAIN D26, CONNECT TO 72" CMP
D27	D28	113.5															CO-18, RETAIN D27
D28	D29		37.2														CO-19, RETAIN D28
D29	D30		138.8						1								CO-20, D30 OUTFALL TO DETENTION BASIN
CB-54	D34	9.9									1						CO-77
D32	D34		35.0														CO-21
D34	CB-66			20.6							1						CO-98
D35	D36			26.2													CO-25, RETAIN D35
D36	CB-66			59.0													CO-26_1, RETAIN D36
CB-66	D42			79.8							1						CO-26_2
D37	D38	26.4										1					CO-27
D38	D39			46.5													CO-28, RETAIN D38
D39	D40			24.8							1						CO-29
D40	D42			24.0													CO-23, RETAIN D40
MH-1	MH-9				162.3												CO-50, RETAIN MH-1
TOTAL		662.9	537.7	1230.2	472.2	242.7	603.5	2	12	7	11	2	5	40	5	5	

Michael Baker

INTERNATIONAL

REVISION NUMBER

SHEET NUMBER

REVISION

DATE

BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE

DRAINAGE LAYOUT INDEX

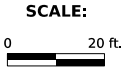
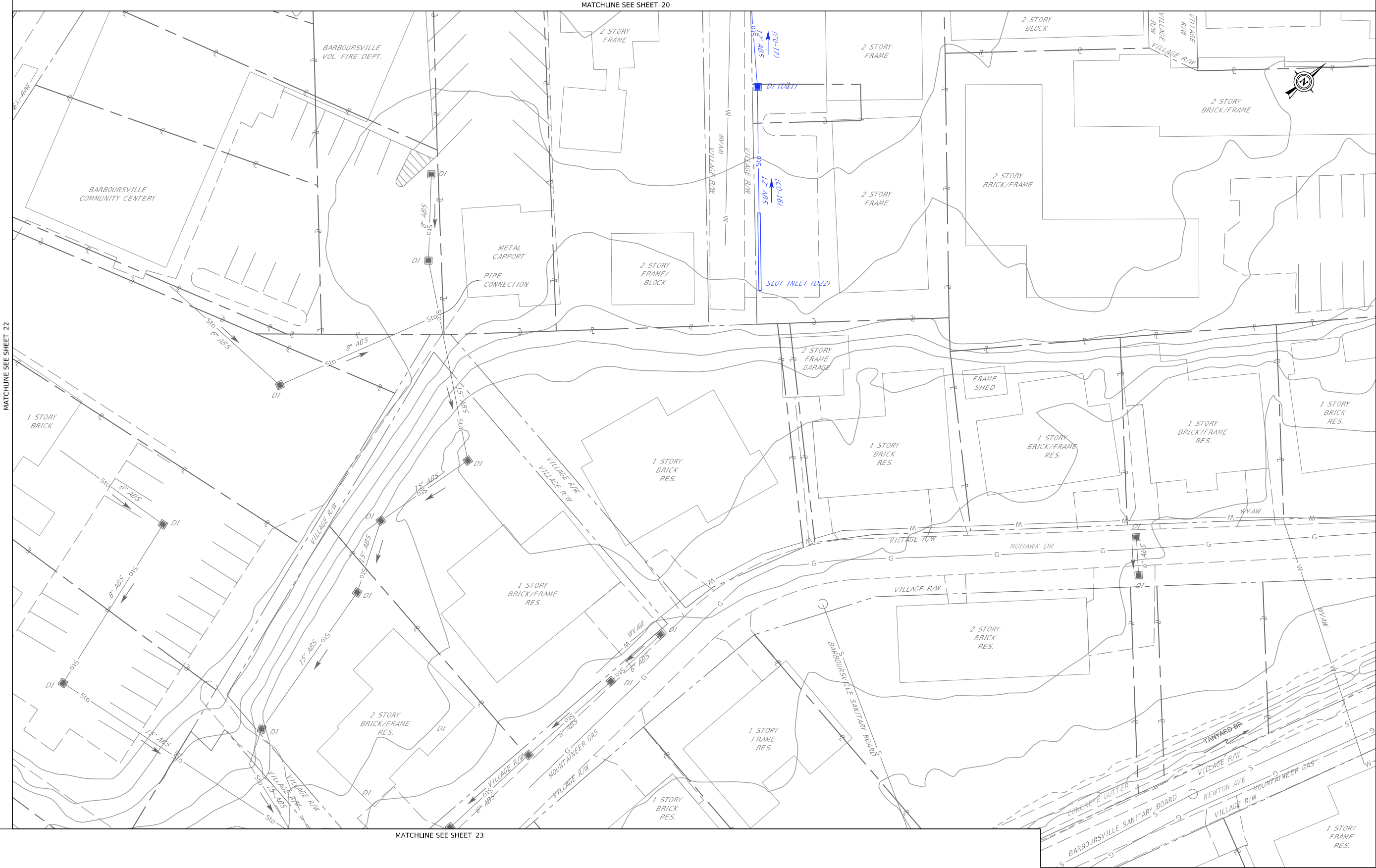
9/1/2026

1-SEP-2026 09:23

p:\r\mb-us-pw-bentley\comb-us-pr-03\Documents\Charleston, WV\01_Projects\CSX Underpass Drainage Study\CADD\Drainage\dra-CUD-pln-P03.dgn

1-SEP-2026 09:23

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	21	26



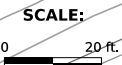
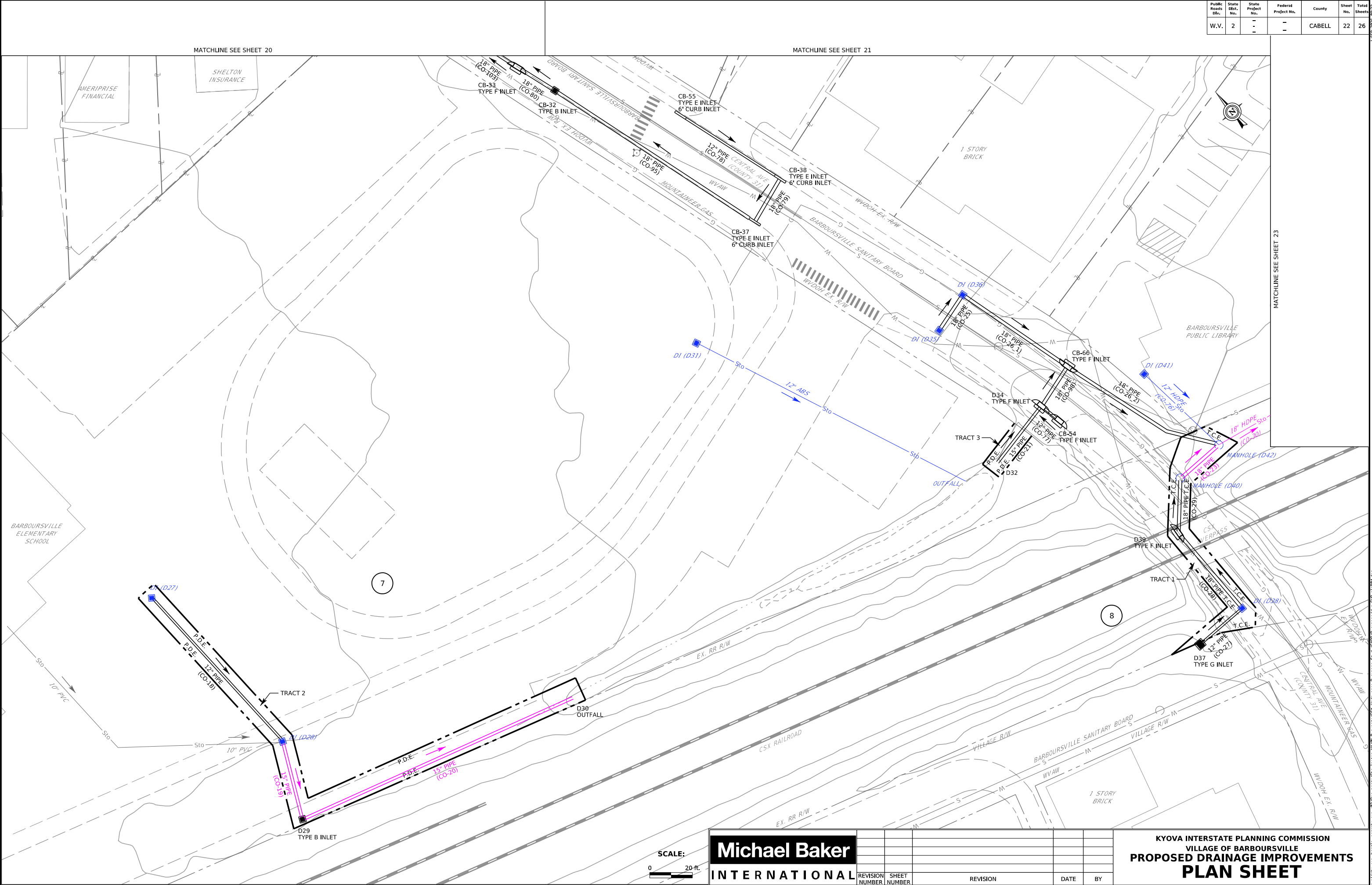
Michael Baker							
INTERNATIONAL							
REVISION NUMBER	SHEET NUMBER	REVISION			DATE	BY	

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
PROPOSED DRAINAGE IMPROVEMENTS
PLAN SHEET

9/1/2026

1-SEP-2026 09:23 pwt/mh-us-pw-bentley.comb-us-pw-03/Documents/Charleston,WV/01_P-projects/CSX Underpass Drainage Study/CA00/Drainage/dra-CUD.pln-P04.dgn

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	22	26



Michael Baker
INTERNATIONAL

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
**PROPOSED DRAINAGE IMPROVEMENTS
PLAN SHEET**

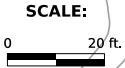
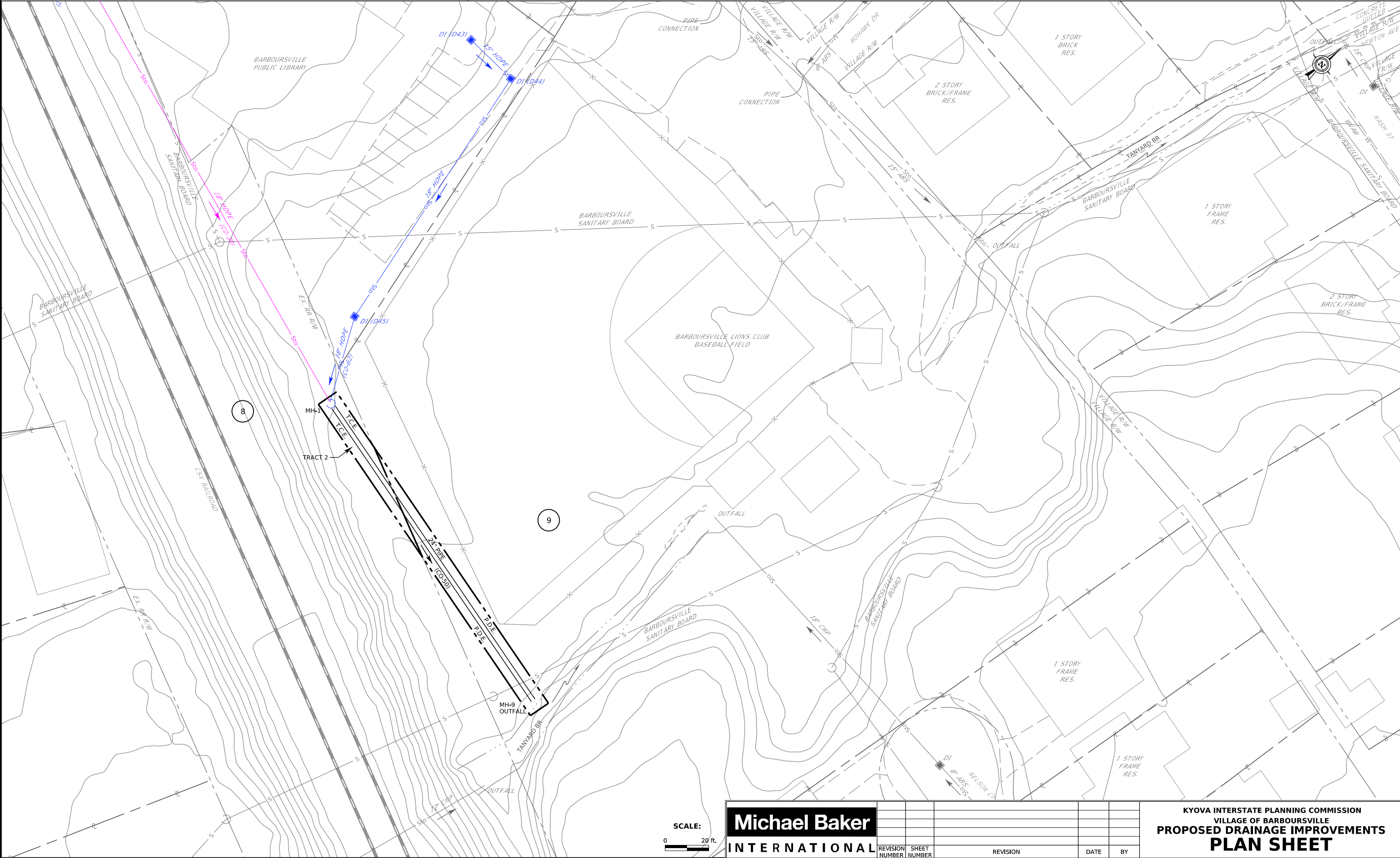
9/1/2026

1-SEP-2026 09:23 p:\7\mb-us-pw-bentley\comb-us-pr-03\Documents\Charleston, WV\01_P\Projects\CSX Underpass Drainage Study\CADD\Drawings\dra-CUD.plt-P05.dgn 1-SEP-2026 09:23

MATCHLINE SEE SHEET 22

MATCHLINE SEE SHEET 21

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	23	26



Michael Baker							
INTERNATIONAL							
REVISION NUMBER	SHEET NUMBER	REVISION			DATE	BY	

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
PROPOSED DRAINAGE IMPROVEMENTS
PLAN SHEET

9/1/2026

1-SEP-2026 09:24 p:\r\mb-us-pw-bentley\comb-us-pr-03\Documents\Charleston WV\01_Projects\CSX Underpass Drainage Study\CADD\Drawings\dra-CUD-pln-P06.dgn 1-SEP-2026 09:24



Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	24	26



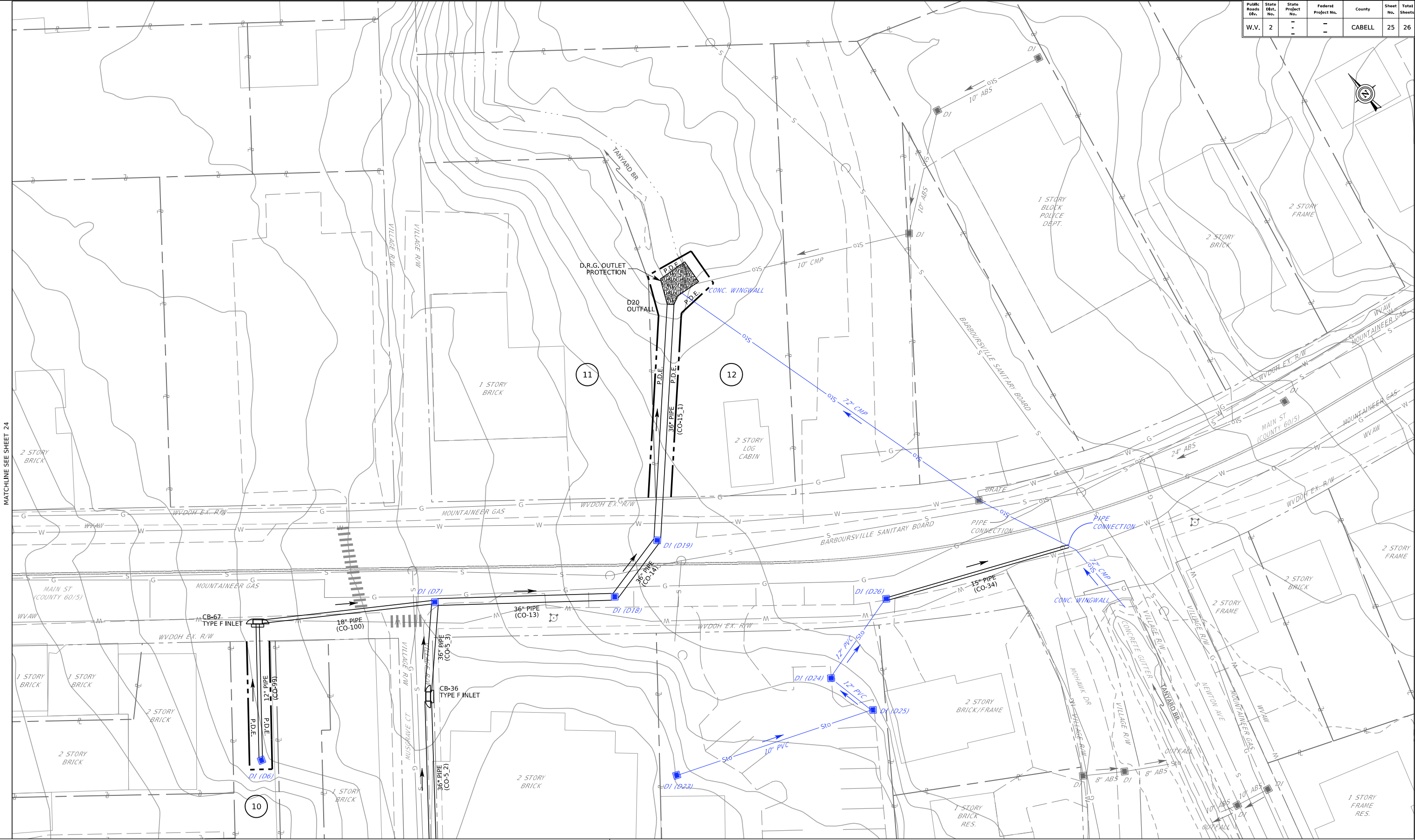
Michael Baker
INTERNATIONAL

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
PROPOSED DRAINAGE IMPROVEMENTS
PLAN SHEET

9/1/2026

1-SEP-2026 09:24 p:\r\mb-us-pw-bentley\comb-us-pr-03\Documents\Charleston, WV\01_Projects\CSX Underpass Drainage Study\CADD\Drainage\dra-CUD.plt\P07.dgn



Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	25	26

MATCHLINE SEE SHEET 20

MATCHLINE SEE SHEET 21



Michael Baker
INTERNATIONAL

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE
PROPOSED DRAINAGE IMPROVEMENTS
PLAN SHEET

Parcel No.	Plan Sheet No.	Titleholder	Recorded		Tract No.	AREA - Sq. Ft. (Unless noted otherwise)								Remarks	R/W Deed Record		
			Deed Book	Page No.		C/A	Non C/A	Easement		Remaining			Total Taken		Parcel Total	Deed Book	Page No.
								Type	Area	Left	Right	Total					
1	20,21	Tax Map 7 - Parcel 86			1			P.D.E.	169								
					2			P.D.E.	433								
2	20,21	Tax Map 7 - Parcel 107						P.D.E.	124								
3	20	Tax Map 7 - Parcel 104						T.C.E.	1,983								
4	20	Tax Map 7 - Parcel 94						T.C.E.	63								
5	21	Tax Map 7 - Parcel 116						P.D.E.	541								
6	21	Tax Map 7 - Parcel 115						P.D.E.	853								
7	22,23	Tax Map 7 - Parcel 90			1			P.D.E.	209								
					2			P.D.E.	2,853								
					3			P.D.E.	245								
8	23	CSX Transportation			1			T.C.E.	1,456								
					2			T.C.E.	577								
9	26	Tax Map 8 - Parcel 85						P.D.E.	1,146								
10	26	Tax Map 8 - Parcel 53						P.D.E.	568								
11	26	Tax Map 8 - Parcel 3						P.D.E.	58								
12	26	Tax Map 8 - Parcel 4						P.D.E.	1,250								

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County	Sheet No.	Total Sheets
W.V.	2	-	-	CABELL	26	26

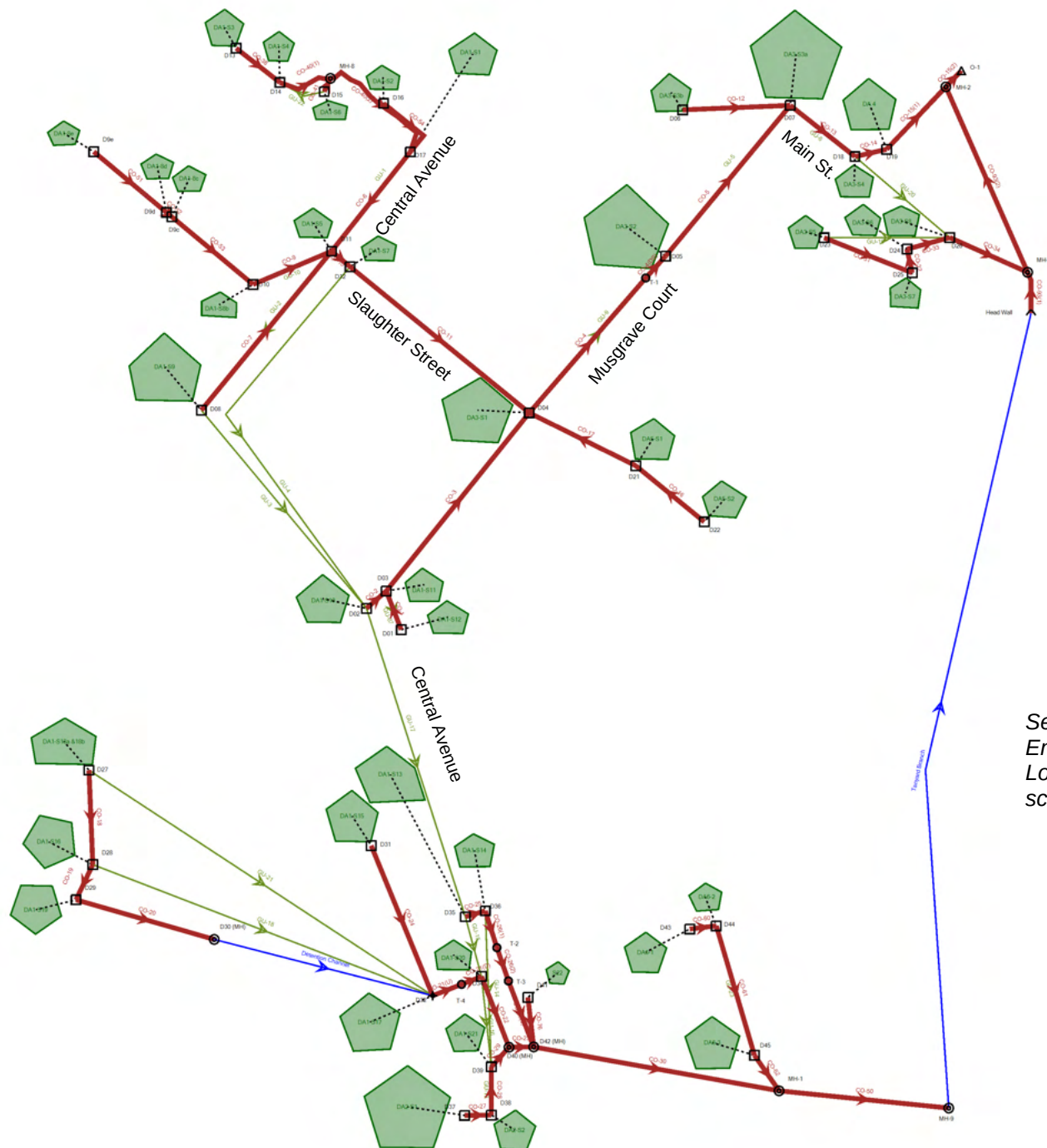
Michael Baker INTERNATIONAL					
	REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

KYOVA INTERSTATE PLANNING COMMISSION
VILLAGE OF BARBOURSVILLE

OWNERSHIP INDEX

Appendix B:

Existing Drainage Schematics and Pipe Profiles

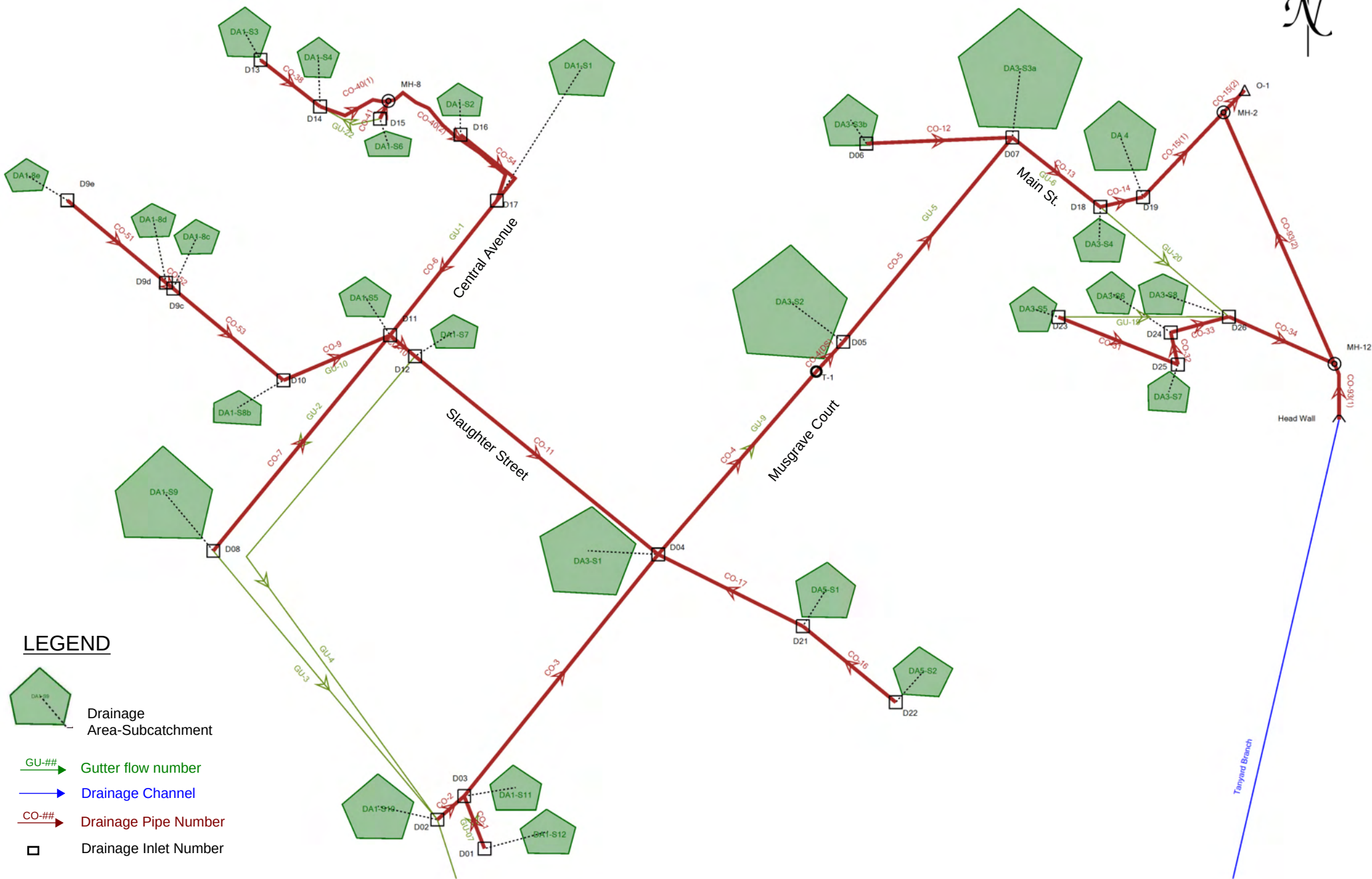


LEGEND

-  Drainage Area-Subcatchment
-  Gutter flow number
-  Drainage Channel
-  Drainage Pipe Number
-  Drainage Inlet Number

See Sheets 2 and 3 of 15 for Enlarged Image of Upper and Lower Drainage Network schematics, respectively.

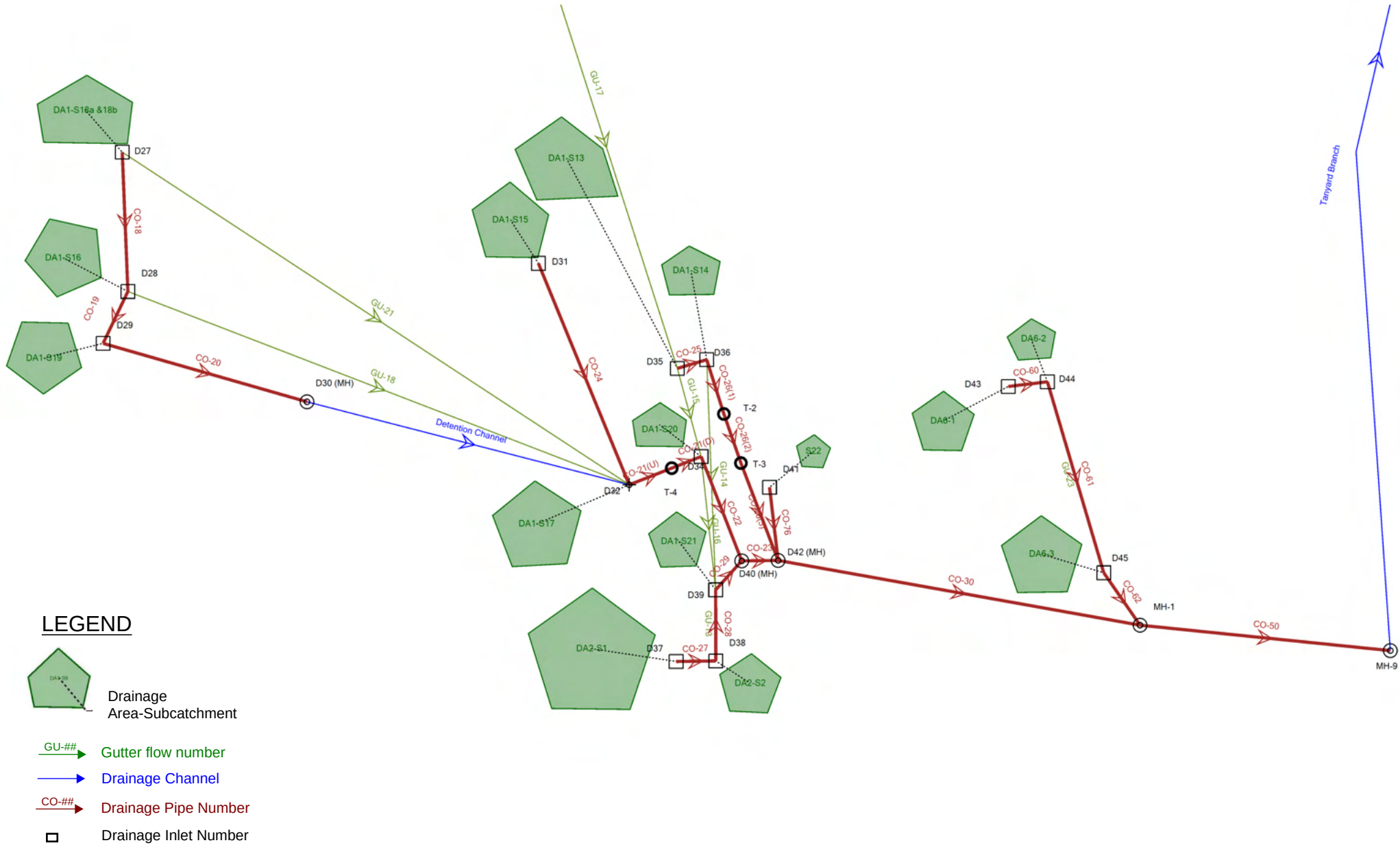
Figure. Schematic of Entire Existing Drainage Network in StormCAD Model



LEGEND

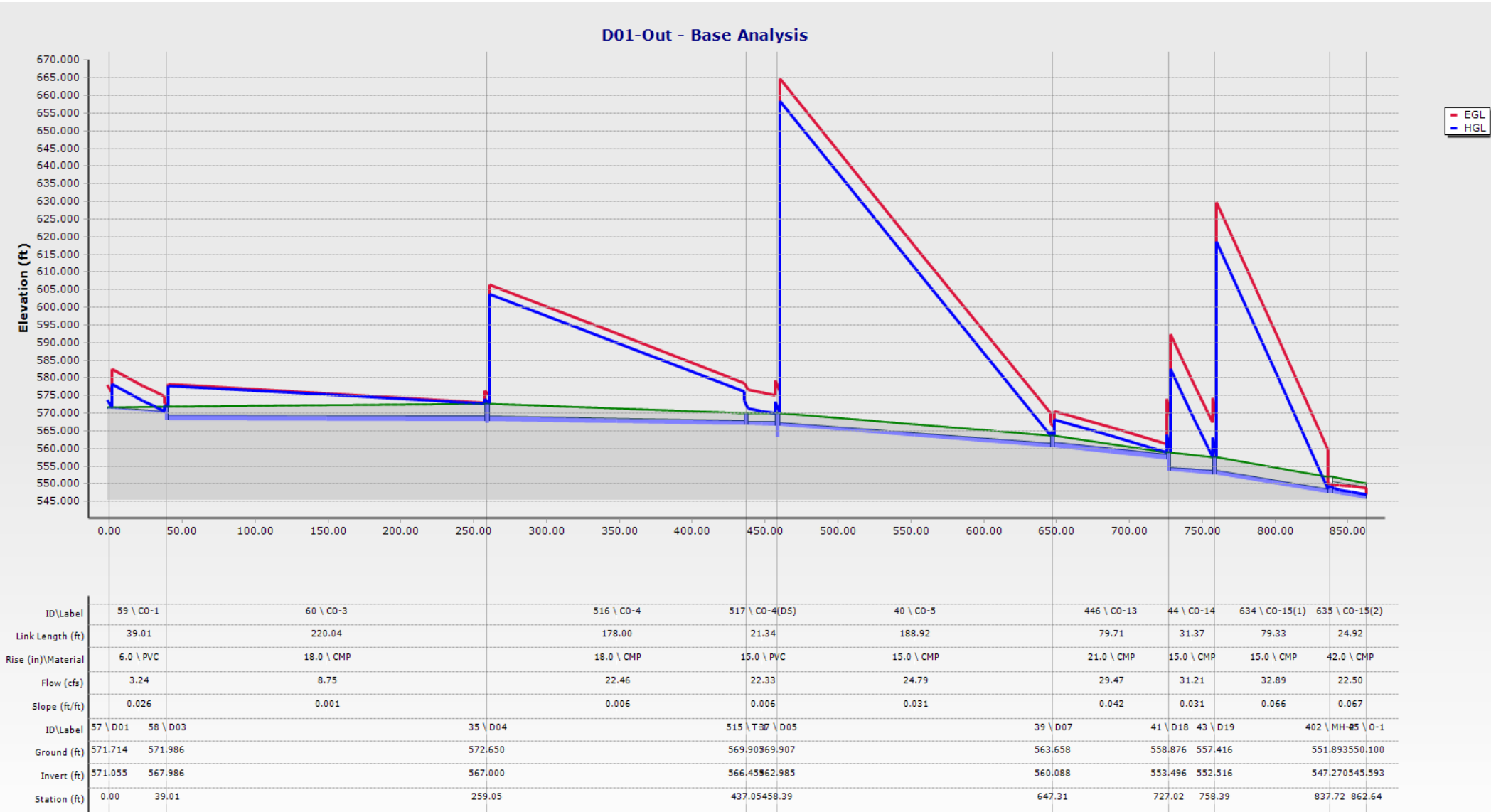
-  Drainage Area-Subcatchment
-  Gutter flow number
-  Drainage Channel
-  Drainage Pipe Number
-  Drainage Inlet Number

Schematic Diagram - Enlarged Upper Section of Existing Drainage Network

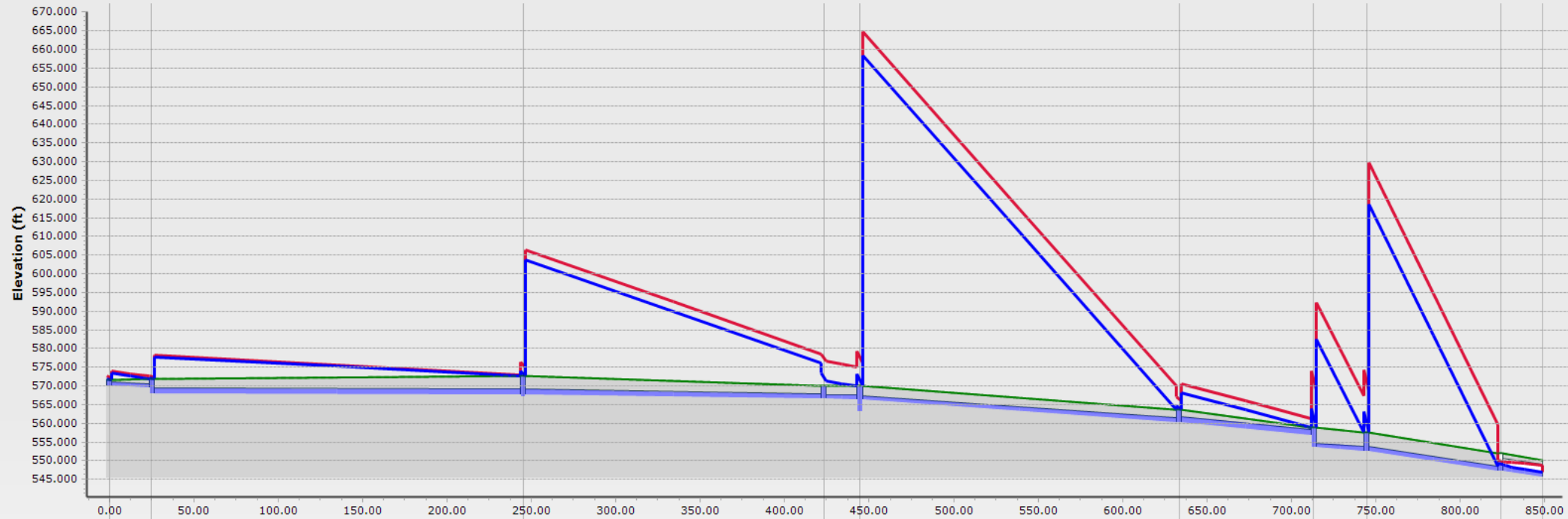


Schematic Diagram - Enlarged Lower Section of Existing Drainage Network

Existing Drainage Profiles

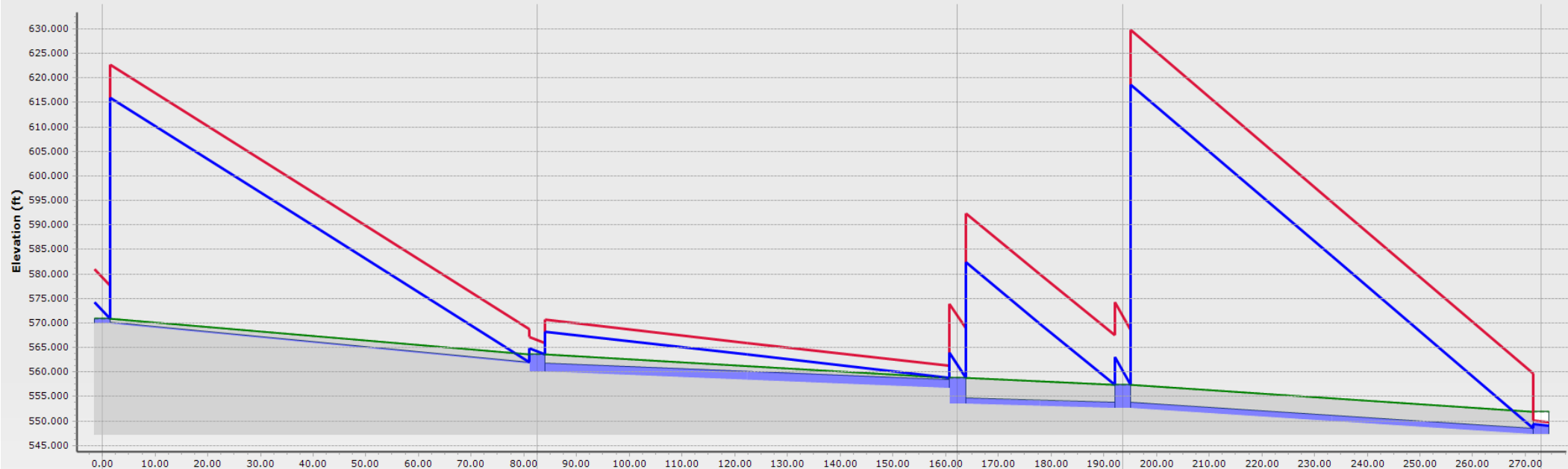


D02-Out - Base Analysis



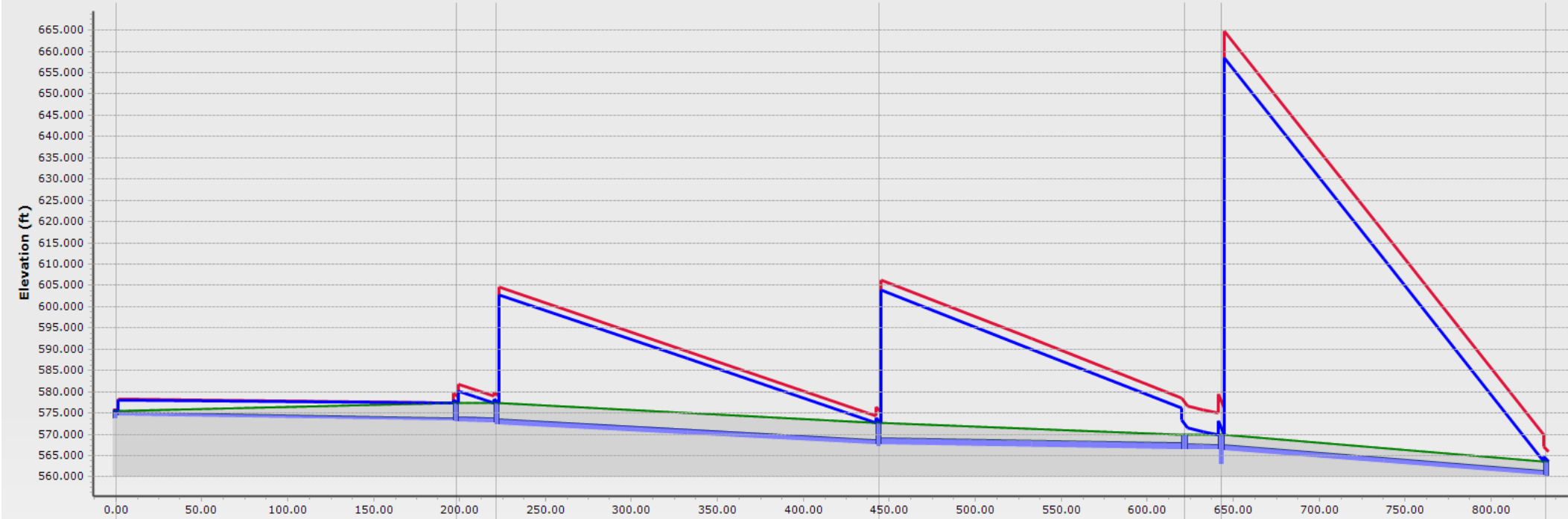
ID\Label	62 \ C0-2	60 \ C0-3	516 \ C0-4	517 \ C0-4(DS)	40 \ C0-5	446 \ C0-13	44 \ C0-14	634 \ C0-15(1)	635 \ C0-15(2)
Link Length (ft)	25.09	220.04	178.00	21.34	188.92	79.71	31.37	79.33	24.92
Rise (in)\Material	12.0 \ CMP	18.0 \ CMP	18.0 \ CMP	15.0 \ PVC	15.0 \ CMP	21.0 \ CMP	15.0 \ CMP	15.0 \ CMP	42.0 \ CMP
Flow (cfs)	4.74	8.75	22.46	22.33	24.79	29.47	31.21	32.89	22.50
Slope (ft/ft)	0.022	0.001	0.006	0.006	0.031	0.042	0.031	0.066	0.067
ID\Label	61 \ D0258 \ D03	35 \ D04	515 \ T-37 \ D05	39 \ D07	41 \ D18	43 \ D19	402 \ MH-25 \ O-1		
Ground (ft)	571.707 571.986	572.650	569.907 569.907	563.658	558.876	557.416	551.893 550.100		
Invert (ft)	570.081 567.986	567.000	566.458 562.985	560.088	553.496	552.516	547.270 545.593		
Station (ft)	0.00 25.09	245.13	423.13 444.47	633.39	713.10	744.47	823.80 848.72		

D06-Out - Base Analysis



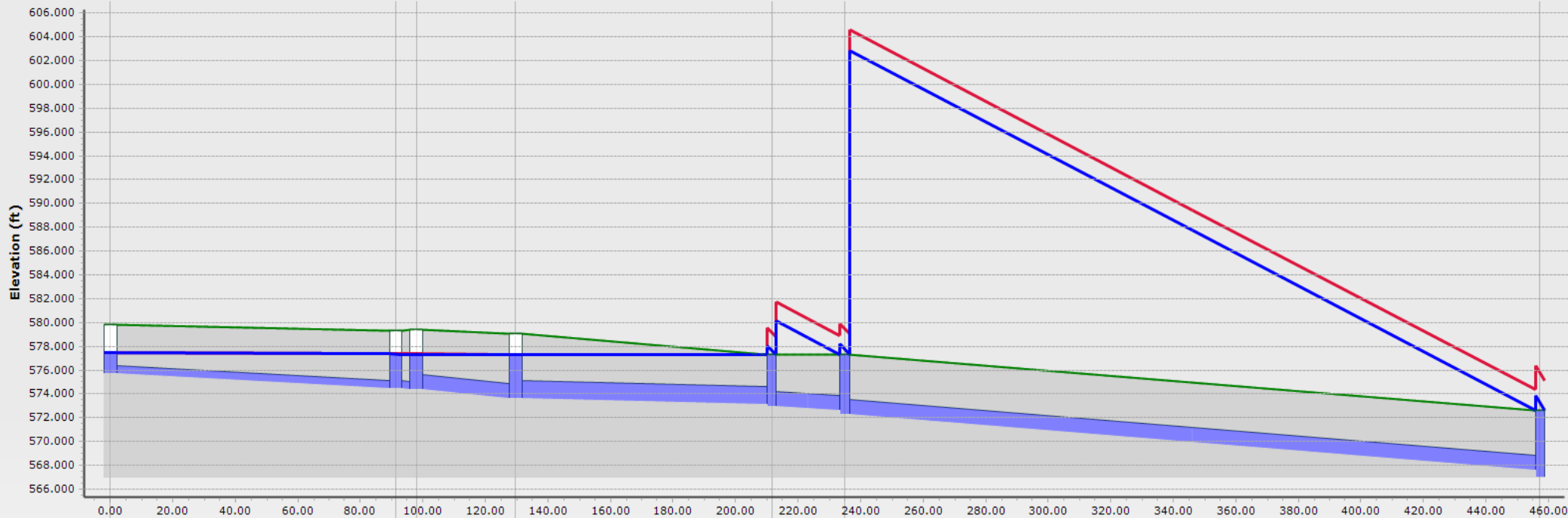
ID\Label	83 \ CO-12		446 \ CO-13		44 \ CO-14		634 \ CO-15(1)	
Link Length (ft)	82.56		79.71		31.37		79.33	
Rise (in)\Material	4.0 \ Vitrified Clay Pipe		21.0 \ CMP		15.0 \ CMP		15.0 \ CMP	
Flow (cfs)	1.82		29.47		31.21		32.89	
Slope (ft/ft)	0.100		0.042		0.031		0.066	
ID\Label	82 \ D06	39 \ D07	41 \ D18	43 \ D19	402 \ MH-2			
Ground (ft)	570.851	563.658	558.876	557.416	551.893			
Invert (ft)	569.897	560.088	553.496	552.516	547.270			
Station (ft)	0.00	82.56	162.27	193.64	272.97			

D08-D07 - Base Analysis



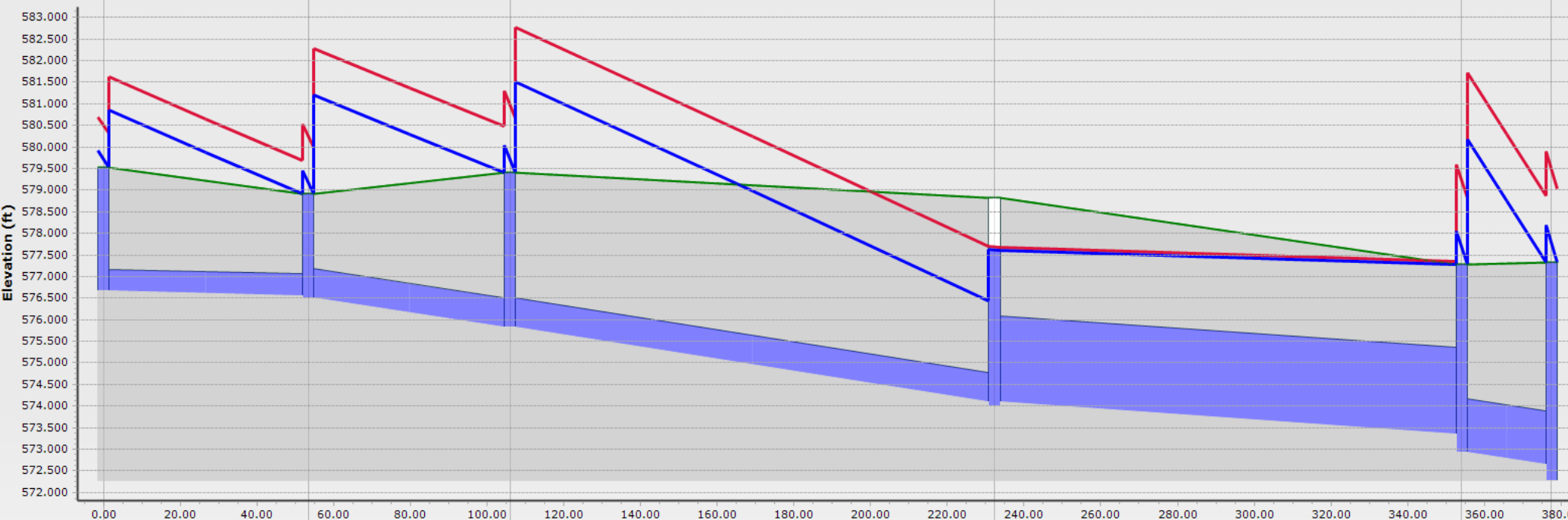
ID\Label	56 \ C0-7	97 \ C0-10	96 \ C0-11	516 \ C0-4	517 \ C0-4(D5)	40 \ C0-5
Link Length (ft)	198.01	23.37	222.33	178.00	21.34	188.92
Rise (in)\Material	10.0 \ PVC	15.0 \ CMP	15.0 \ CMP	18.0 \ CMP	15.0 \ PVC	15.0 \ CMP
Flow (cfs)	1.75	12.22	12.90	22.46	22.33	24.79
Slope (ft/ft)	0.007	0.012	0.021	0.006	0.006	0.031
ID\Label	55 \ D08	33 \ D1195 \ D12	35 \ D04	515 \ T-87 \ D05	39 \ D07	
Ground (ft)	575.490	577.283577.326	572.650	569.907569.907	563.658	
Invert (ft)	573.588	572.923572.276	567.000	566.459562.985	560.088	
Station (ft)	0.00	198.01 221.38	443.71	621.71 643.05	831.97	

D09-D04 - Base Analysis



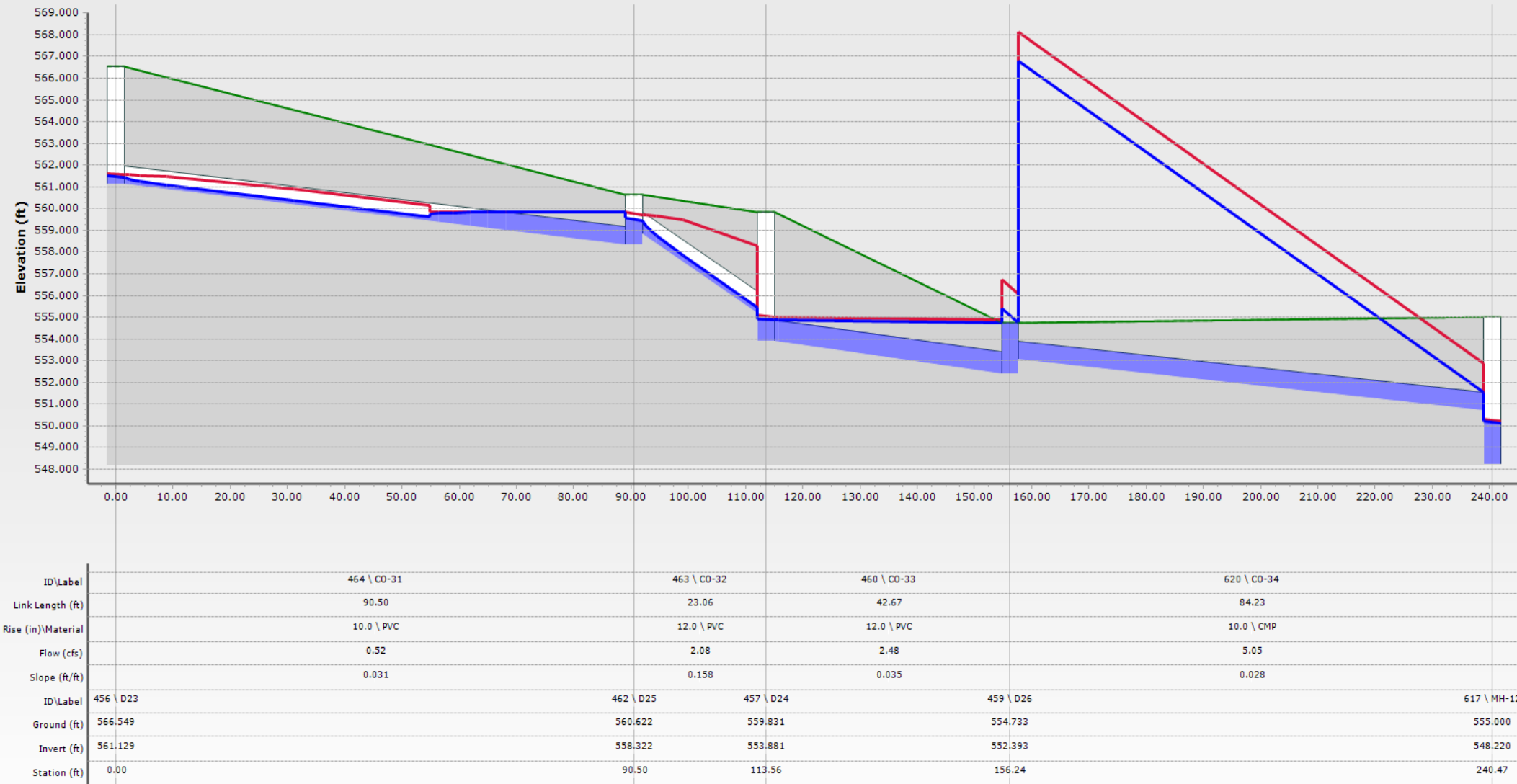
ID\Label	479 \ C0-51		481 \ C0-52 627 \ C0-53		54 \ C0-9		97 \ C0-10		96 \ C0-11		
Link Length (ft)	91.34		6.53 31.80		81.95		23.37		222.33		
Use (in)\Material	8.0 \ PVC		8.0 \ PVC 15.0 \ PVC		18.0 \ PVC		15.0 \ CMP		15.0 \ CMP		
Flow (cfs)	0.29		0.76 1.70		2.15		12.22		12.90		
Slope (ft/ft)	0.014		0.017 0.024		0.006		0.012		0.021		
ID\Label	477 \ D9e	478 \ D9c	52 \ D10	33 \ D11	95 \ D12	35 \ D04					
Ground (ft)	579.788	579.335	579.058	577.283	577.326	572.650					
Invert (ft)	575.738	574.838	573.588	572.923	572.276	567.000					
Station (ft)	0.00	91.34	129.67	211.62	234.99	457.32					

D13-D12 - Base Analysis

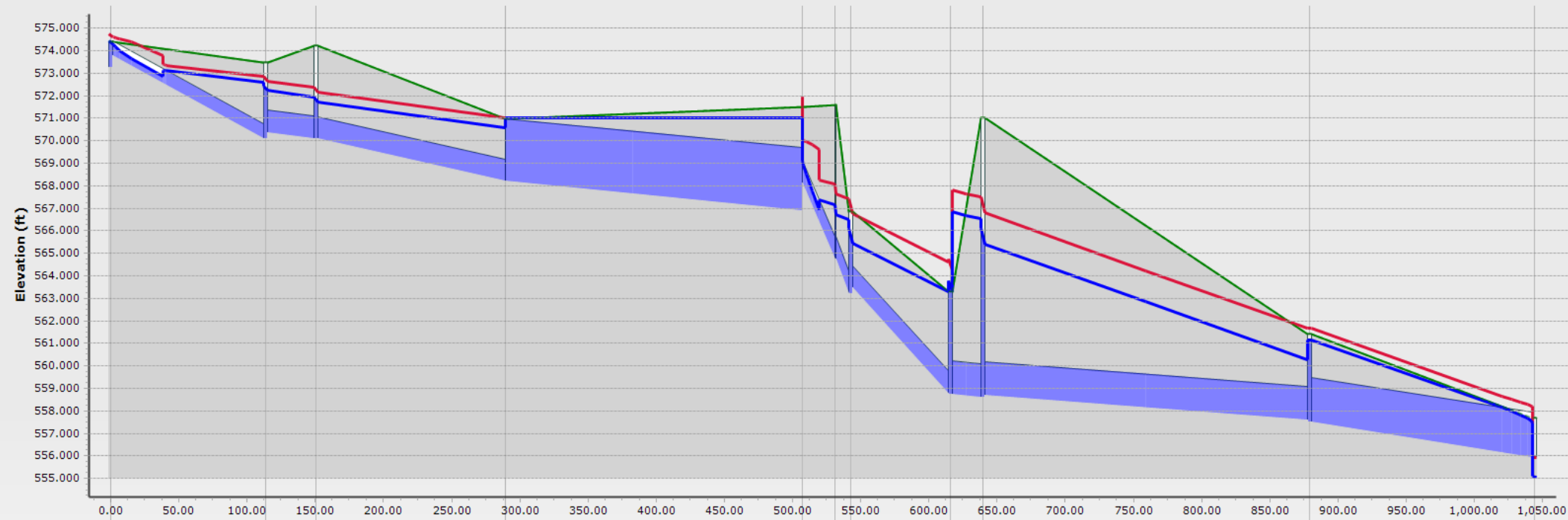


ID\Label	499 \ C0-38	511 \ C0-40(1)	512 \ C0-40(2)	34 \ C0-6	97 \ C0-10	
Link Length (ft)	53.39	52.60	126.31	121.83	23.37	
se (in)\Material	6.0 \ PVC	8.0 \ PVC	8.0 \ PVC	24.0 \ CMP	15.0 \ CMP	
Flow (cfs)	1.39	2.91	3.15	6.34	12.22	
Slope (ft/ft)	0.002	0.013	0.014	0.006	0.012	
ID\Label	497 \ D13	498 \ D14	510 \ MH-8	32 \ D17	33 \ D11	95 \ D12
Ground (ft)	579.530	578.910	579.400	578.828	577.283	577.326
Invert (ft)	576.670	576.510	575.833	574.000	572.923	572.276
Station (ft)	0.00	53.39	105.99	232.30	354.12	377.50

D23- Tanyard - Base Analysis

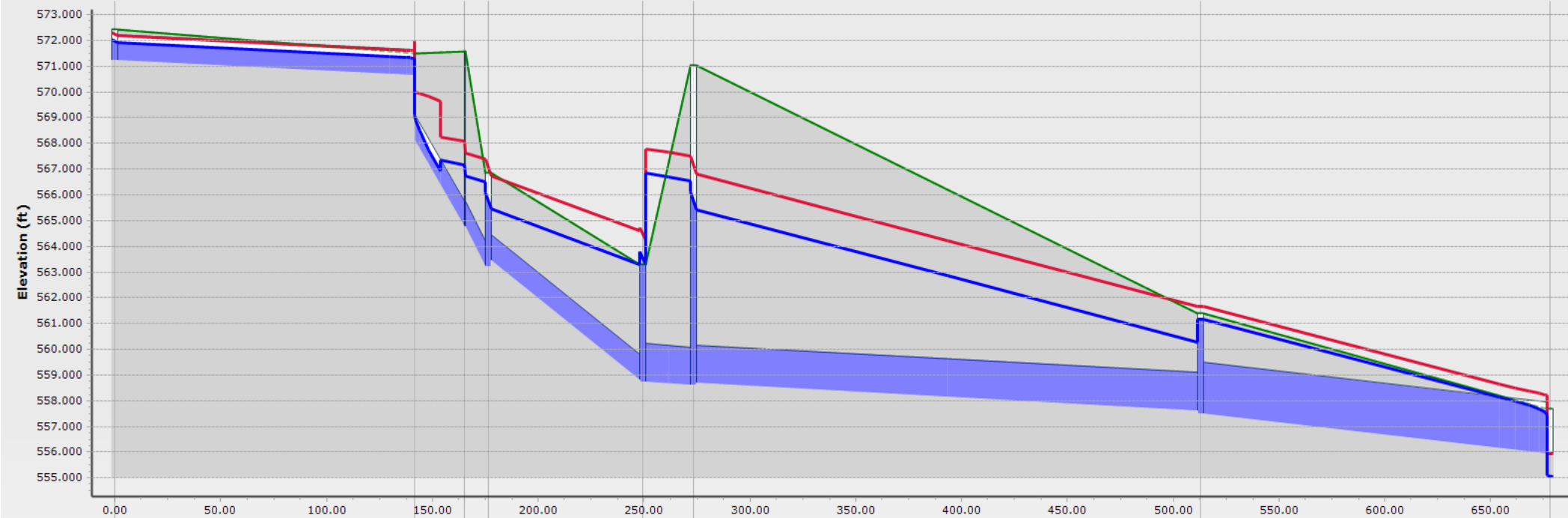


D27-Tanyard - Base Analysis



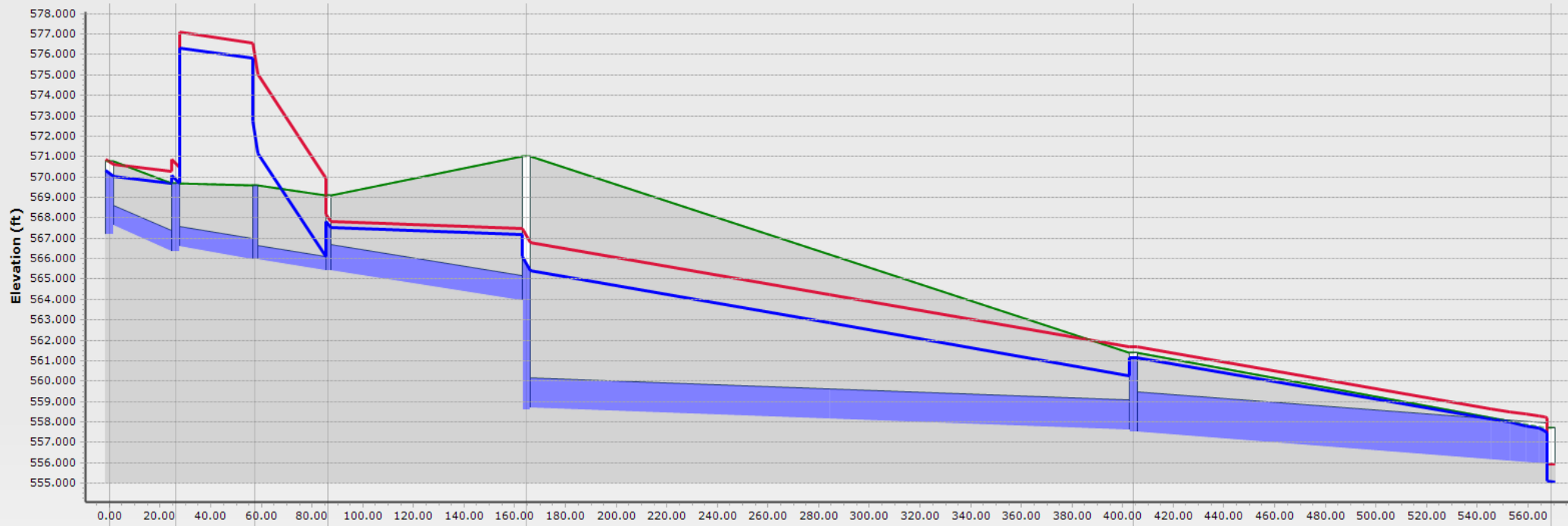
ID\Label	334 \ CO-18	336 \ CO-19	407 \ CO-20	408 \ Detention Channel	530 \ CO-21	531 \ CO-22	419 \ CO-23	415 \ CO-30	580 \ CO-50	
Link Length (ft)	113.50	37.20	138.80	217.99	23.90	1.06	73.06	24.00	239.50	165.10
Rise (in)\Material	8.0 \ PVC	12.0 \ PVC	12.0 \ PVC	33.6 \ Gravel riprap, 50 mm (2 in) D50	12.0 \ PVC	1.06 \ Clay Pipe	18.0 \ Purified Clay Pipe	18.0 \ Corrugated HDPE (Smooth Interior)	24.0 \ CMP	
Flow (cfs)	1.32	4.01	4.15	4.05	5.97	5.96	7.21	13.88	12.34	13.12
Slope (ft/ft)	0.032	0.007	0.014	0.006	0.140	0.141	0.064	0.005	0.004	0.009
ID\Label	332 \ D27	333 \ D28	335 \ D29	406 \ D30 (MH)	539 \ D32	537 \ D34	417 \ D40 (MH)	413 \ D42 (MH)	392 \ MH-1	579 \ MH-9
Ground (ft)	574.380	573.490	574.200	570.969	571.508	566.869	563.308	567.009	561.411	557.700
Invert (ft)	573.252	570.074	570.079	568.192	566.906	563.202	558.713	558.592	557.494	555.935
Station (ft)	0.00	113.50	150.70	289.50	507.48	531.38	604.44	615.50	879.00	1044.10

D31-Tanyard - Base Analysis



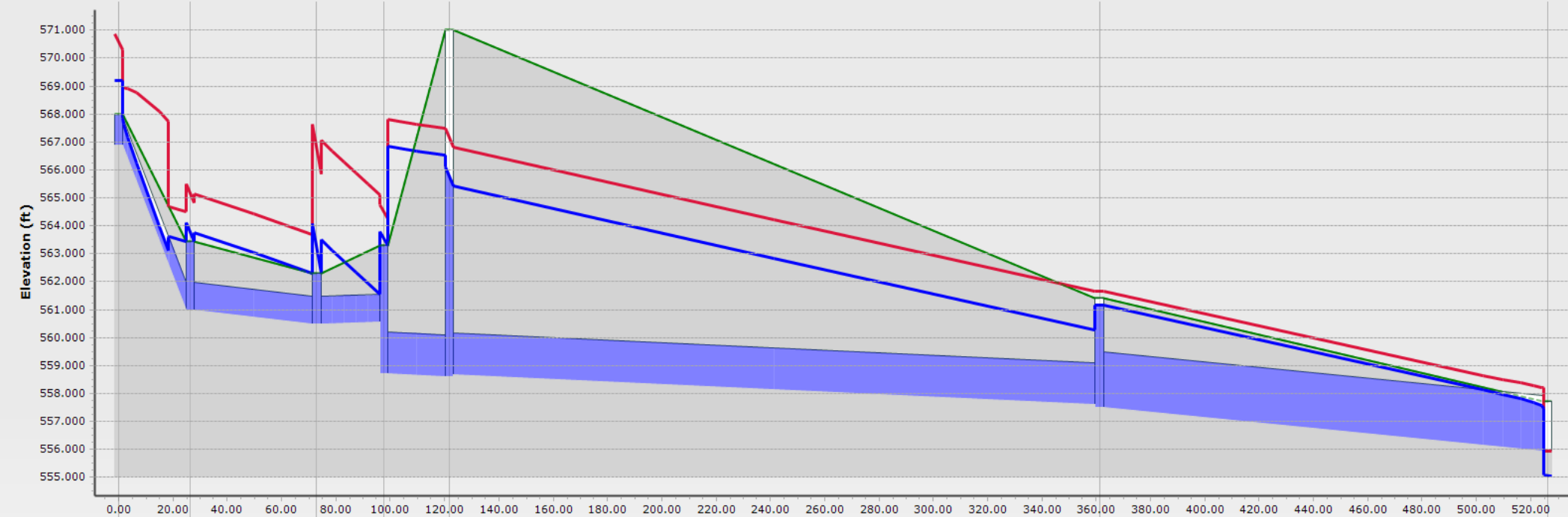
ID\Label	374 \ CO-24	530 \ CO-21	530 \ CO-21(D)	420 \ CO-22	419 \ CO-23	415 \ CO-30	580 \ CO-50
Link Length (ft)	141.42	23.90	11.06	73.06	24.00	239.50	165.10
Rise (in)\Material	12.0 \ PVC	12.0 \ Vitrified Clay Pipe	12.0 \ Vitrified Clay Pipe	12.0 \ Vitrified Clay Pipe	12.0 \ Vitrified Clay Pipe	18.0 \ Corrugated HDPE (Smooth Interior)	24.0 \ CMP
Flow (cfs)	2.33	5.97	5.96	7.21	13.88	12.34	13.12
Slope (ft/ft)	0.004	0.141	0.141	0.064	0.005	0.004	0.009
ID\Label	373 \ D31	359 \ D32	529 \ D34	417 \ D40 (MH)	418 \ D42 (MH)	392 \ MH-1	579 \ MH-9
Ground (ft)	572.420	571.500	571.566	563.300	571.009	561.411	557.700
Invert (ft)	571.230	566.900	563.202	558.717	558.592	557.494	555.935
Station (ft)	0.00	141.41	165.37	249.43	273.43	512.92	678.02

D35-Tanyard - Base Analysis



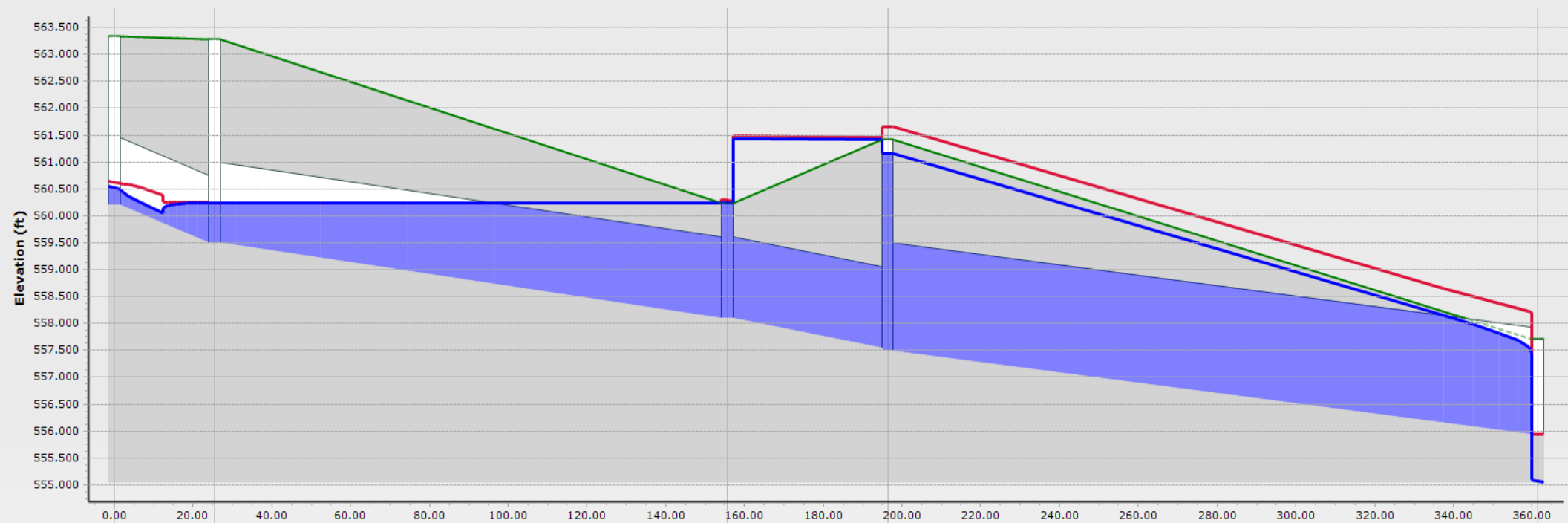
ID\Label	382 \ CO-25		519 \ CO-26(1)	521 \ CO-26(2)	522 \ CO-26(3)	415 \ CO-30	580 \ CO-50
Link Length (ft)	26.14		31.40	28.93	78.17	239.50	165.10
Rise (in)\Material	12.0 \ Vitrified Clay Pipe (Class 2)		12.0 \ Vitrified Clay Pipe (Class 2)	12.0 \ Vitrified Clay Pipe (Class 2)		18.0 \ Corrugated HDPE (Smooth Interior)	24.0 \ CMP
Flow (cfs)	4.75		5.51	5.49	5.49	12.34	13.12
Slope (ft/ft)	0.048		0.019	0.019	0.019	0.004	0.009
ID\Label	380 \ D35	381 \ D36	518 \ T-2	520 \ T-3	413 \ D42 (MH)	392 \ MH-1	579 \ MH-9
Ground (ft)	570.751	569.698	569.600	569.100	571.009	561.411	557.700
Invert (ft)	567.200	566.358	565.978	565.424	558.592	557.494	555.935
Station (ft)	0.00	26.14	57.54	86.48	164.64	404.14	569.24

D37-Tanyard - Base Analysis



ID\Label	387 \ CO-27	389 \ CO-28	418 \ CO-29	419 \ CO-23	415 \ CO-30	580 \ CO-50	
Link Length (ft)	26.41	46.50	24.78	24.00	239.50	165.10	
Rise (in)\Material	12.0 \ Vitrified Clay Pipe	12.0 \ Vitrified Clay Pipe	12.0 \ Vitrified Clay Pipe	12.0 \ Vitrified Clay Pipe	18.0 \ Corrugated HDPE (Smooth Interior)	24.0 \ CMP	
Flow (cfs)	6.56	7.42	11.86	13.88	12.34	13.12	
Slope (ft/ft)	0.224	0.010	-0.003	0.005	0.004	0.009	
ID\Label	385 \ D37	386 \ D38	388 \ D39	417 \ D40 (MH)	413 \ D42 (MH)	392 \ MH-1	579 \ MH-9
Ground (ft)	567.996	563.431	562.318	563.300	571.009	561.411	557.700
Invert (ft)	566.887	560.973	560.485	558.717	558.592	557.494	555.935
Station (ft)	0.00	26.41	72.91	97.69	121.69	361.19	526.29

D43-Tanyard - Base Analysis



ID\Label	584 \ C0-60		586 \ C0-61		587 \ C0-62		588 \ C0-50	
Link Length (ft)	25.44		130.18		40.72		165.10	
Rise (in)\Material	15.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		24.0 \ CMP	
Flow (cfs)	0.57		0.61		3.04		13.12	
Slope (ft/ft)	0.028		0.011		0.014		0.009	
ID\Label	582 \ D43	583 \ D44	585 \ D45		392 \ MH-1		579 \ MH-9	
Ground (ft)	563.336	563.286	560.234		561.411		557.700	
Invert (ft)	560.201	559.500	558.103		557.494		555.935	
Station (ft)	0.00	25.44	155.62		196.34		361.44	

Appendix C:

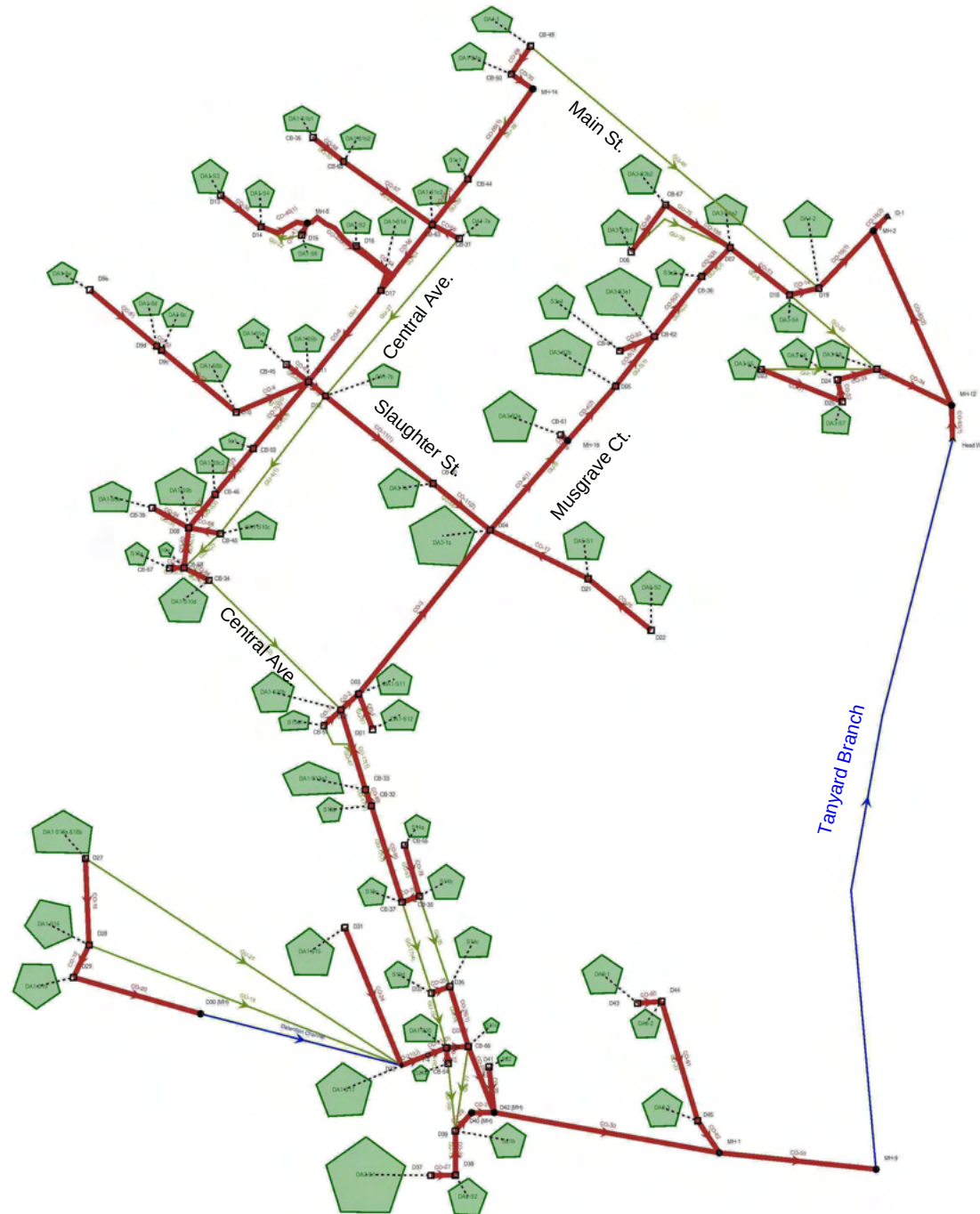
Proposed Drainage Schematics and Pipe Profiles

Scenario: Base Design



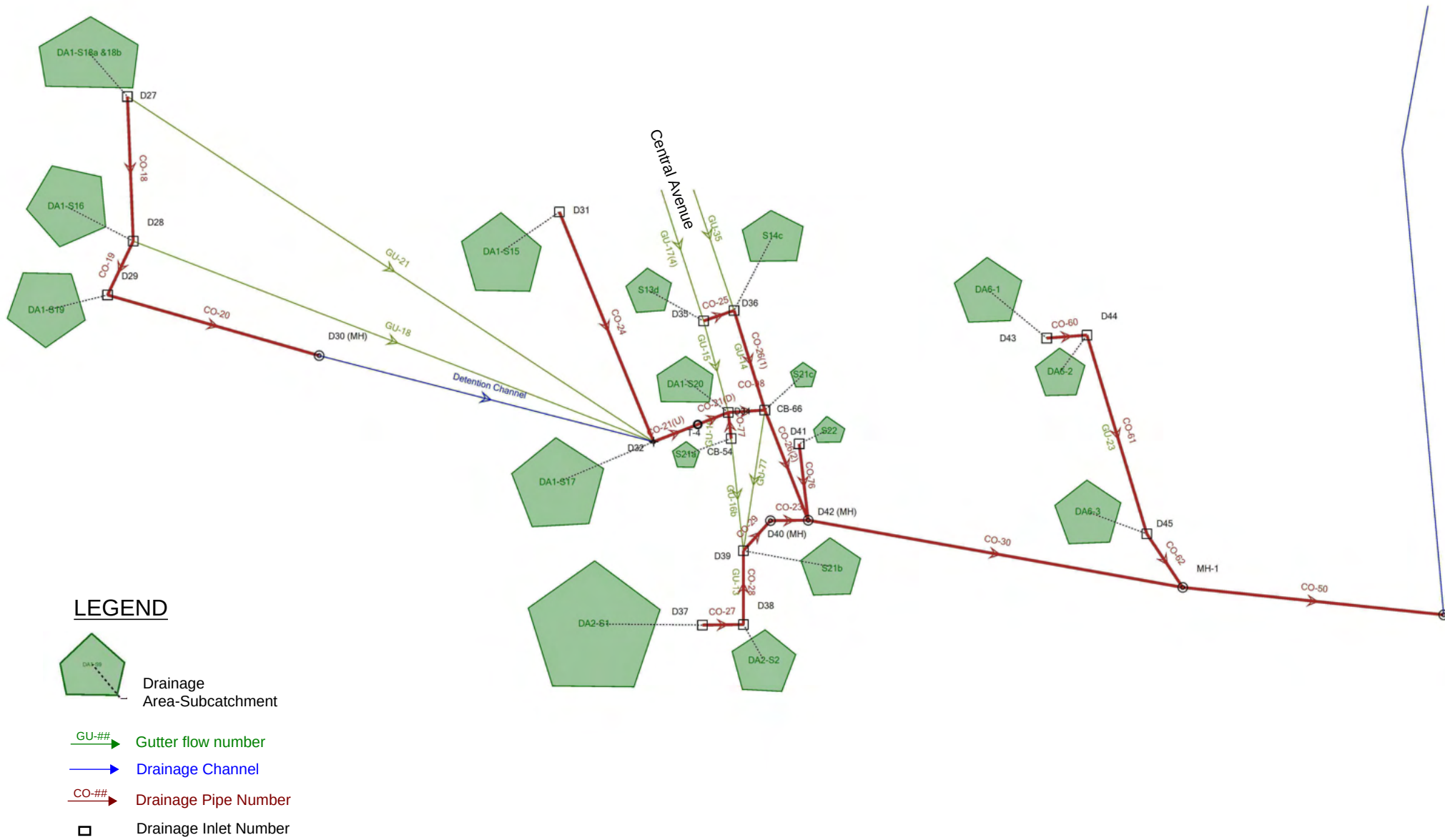
LEGEND

-  Drainage Area-Subcatchment
-  Gutter flow number
-  Drainage Channel
-  Drainage Pipe Number
-  Drainage Inlet Number



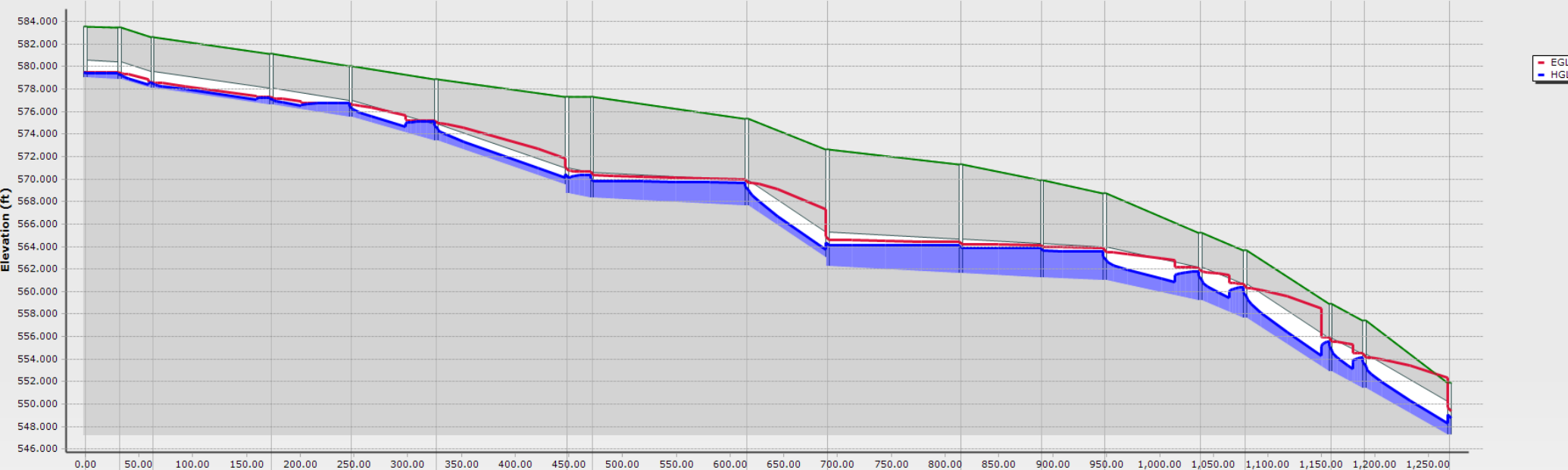


Schematic Diagram - Enlarged Upper Section of Proposed Drainage Network



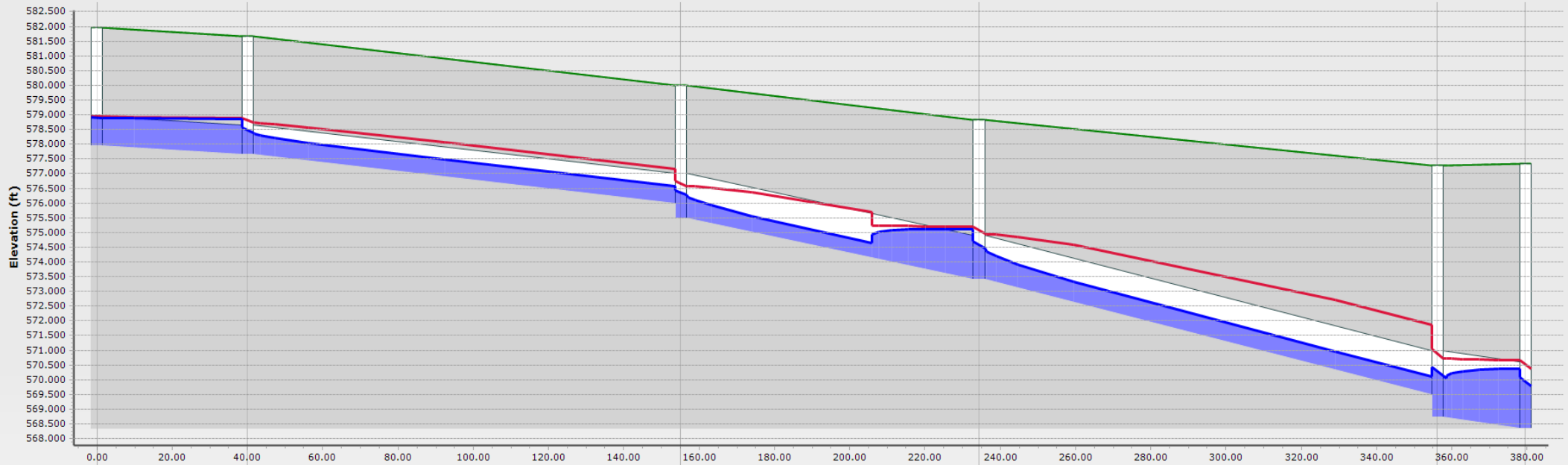
Schematic Diagram - Enlarged Lower Section of Proposed Drainage Network

CB-49 to Tanyard - Base Design- Conduits & Inlets



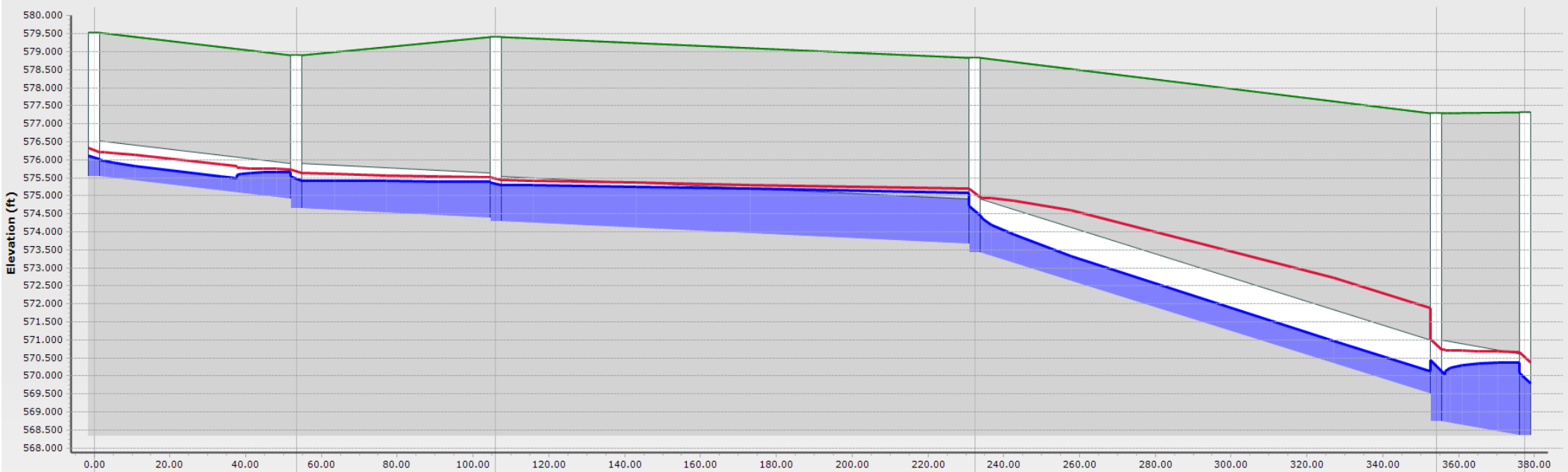
ID\Label	720 \ CO-69 \ CO-70			726 \ CO-55(1)		696 \ CO-55(2)		580 \ CO-56		34 \ CO-6		97 \ CO-10		791 \ CO-11(1)		792 \ CO-11(2)		800 \ CO-4(1)		808 \ CO-4(2)		810 \ CO-5(1)		811 \ CO-5(2)		630 \ CO-5(3)		446 \ CO-13		44 \ CO-14		403 \ CO-15(1)					
Link Length (ft)	31.80		30.85		110.50		74.00		79.20		121.83		23.37		144.10		75.20		123.88		75.40		58.40		89.00		41.50		79.71		31.37		79.33				
Rise (in 100 ft)	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00				
Flow (cfs)	0.52		1.01		1.01		1.29		4.14		7.40		16.01		16.39		16.59		26.06		26.71		27.82		30.17		30.93		32.98		33.22		34.20				
Slope (ft/ft)	0.005		0.026		0.013		0.015		0.026		0.032		0.017		0.005		0.061		0.005		0.005		0.005		0.020		0.037		0.060		0.047		0.052				
ID\Label	718 \ CB-49 \ CB-50 \ MH-14			694 \ CB-44		578 \ CB-63		32 \ D17		33 \ D15		790 \ CB-60		35 \ D04		799 \ MH-18		37 \ D05		809 \ CB-62		628 \ CB-36		39 \ D07		41 \ D18		402 \ MH-2									
Ground (ft)	583.540		583.500		582.577		581.112		580.000		578.828		577.287		577.326		575.360		572.650		571.260		569.907		568.700		565.189		563.658		558.876		557.416		551.893		
Invert (ft)	579.040		578.881		578.077		576.612		575.500		573.415		568.745		568.353		567.632		562.267		561.647		561.270		560.978		559.189		557.658		552.876		551.416		547.270		
Station (ft)	0.00		31.80		62.65		173.15		247.15		326.35		448.18		471.55		615.65		690.85		814.73		890.13		948.53		1037.53		1079.03		1158.74		1190.11		1269.44		

CB-35 to D12 - Base Design- Conduits & Inlets



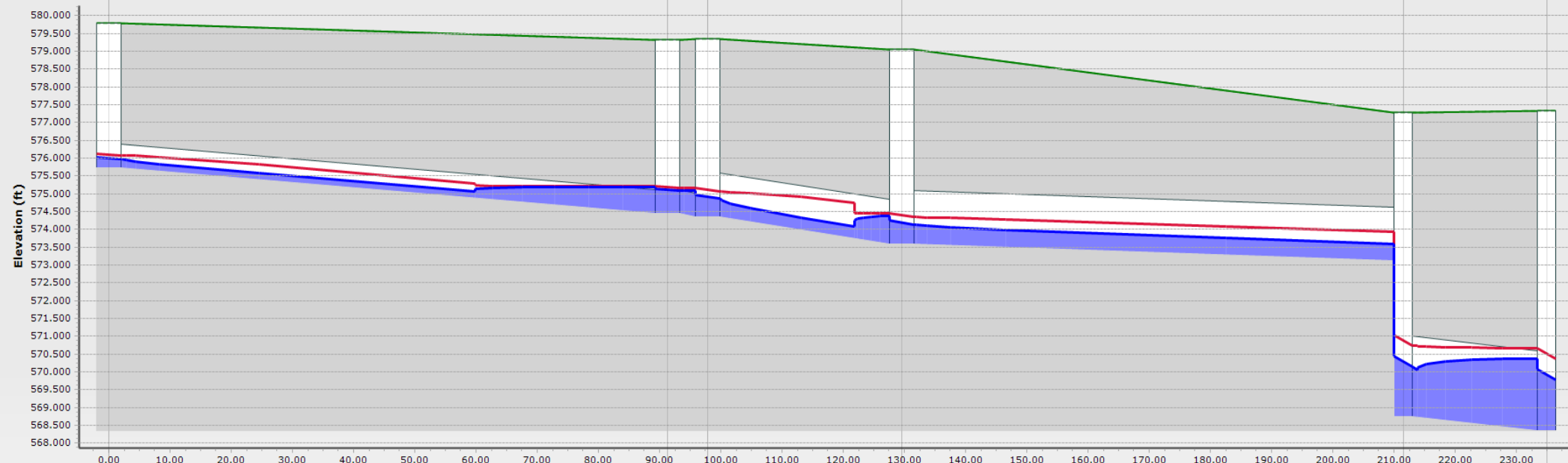
ID\Label	618 \ CO-58		582 \ CO-57		580 \ CO-56		34 \ CO-6		97 \ CO-10	
Link Length (ft)	40.00		115.15		79.20		121.83		23.37	
Rise (in)\Material	12.0 \ Corrugated HDPE (Smooth Interior)		12.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		27.0 \ Corrugated HDPE (Smooth Interior)	
Flow (cfs)	1.16		2.85		4.14		7.40		16.01	
Slope (ft/ft)	0.007		0.014		0.026		0.032		0.017	
ID\Label	617 \ CB-35	581 \ CB-65	578 \ CB-63		32 \ D17		33 \ D11		95 \ D12	
Ground (ft)	581.958	581.665	580.000		578.828		577.283		577.326	
Invert (ft)	577.958	577.665	575.500		573.415		568.747		568.353	
Station (ft)	0.00	40.00	155.15		234.35		356.18		379.55	

D13 to D12 - Base Design- Conduits & Inlets



ID\Label	499 \ C0-38		511 \ C0-40(1)		512 \ C0-40(2)		34 \ C0-6		97 \ C0-10	
Link Length (ft)	53.39		52.60		126.31		121.83		23.37	
se (in)\Material	12.0 \ Corrugated HDPE (Smooth Interior)		15.0 \ Corrugated HDPE (Smooth Interior)		15.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		27.0 \ Corrugated HDPE (Smooth Interior)	
Flow (cfs)	1.39		2.90		3.12		7.40		16.01	
Slope (ft/ft)	0.012		0.005		0.005		0.032		0.017	
ID\Label	497 \ D13	498 \ D14	510 \ MH-8		32 \ D17		33 \ D11		95 \ D12	
Ground (ft)	579.530	578.910	579.400		578.828		577.283		577.326	
Invert (ft)	575.530	574.660	574.297		573.415		568.747		568.353	
Station (ft)	0.00	53.39	105.99		232.30		354.12		377.50	

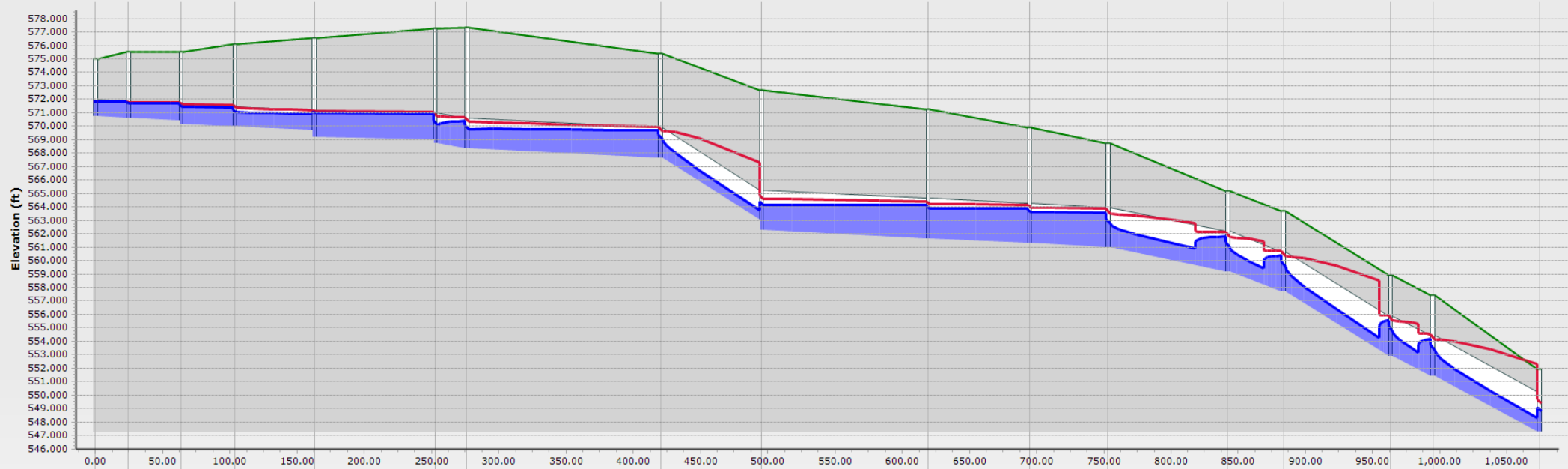
D9e to D12 - Base Design- Conduits & Inlets



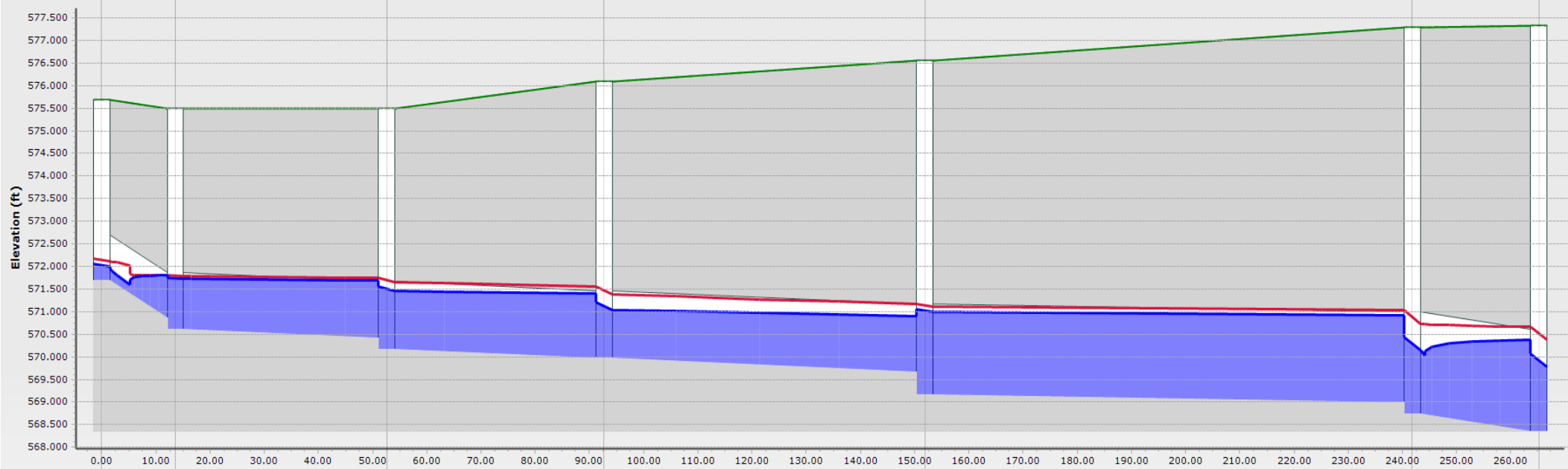
ID\Label	479 \ CO-51	481 \ CO-52	784 \ CO-53	54 \ CO-9	97 \ CO-10
Link Length (ft)	91.34	6.53	31.80	81.95	23.37
Rise (in)\Material	8.0 \ PVC	8.0 \ PVC	15.0 \ PVC	18.0 \ PVC	27.0 \ Corrugated HDPE (Smooth Interior)
Flow (cfs)	0.29	0.76	1.70	2.15	16.01
Slope (ft/ft)	0.014	0.017	0.024	0.006	0.017
ID\Label	477 \ D9e	478 \ D9d480 \ D9c	52 \ D10	33 \ D11	95 \ D12
Ground (ft)	579.788	579.333 579.355	579.058	577.283	577.326
Invert (ft)	575.738	574.453 574.345	573.588	568.747	568.353
Station (ft)	0.00	91.34 97.87	129.67	211.62	234.99

The existing drainage pipes except CO-10 were retained

CB-34 to Tanyard - Base Design- Conduits & Inlets

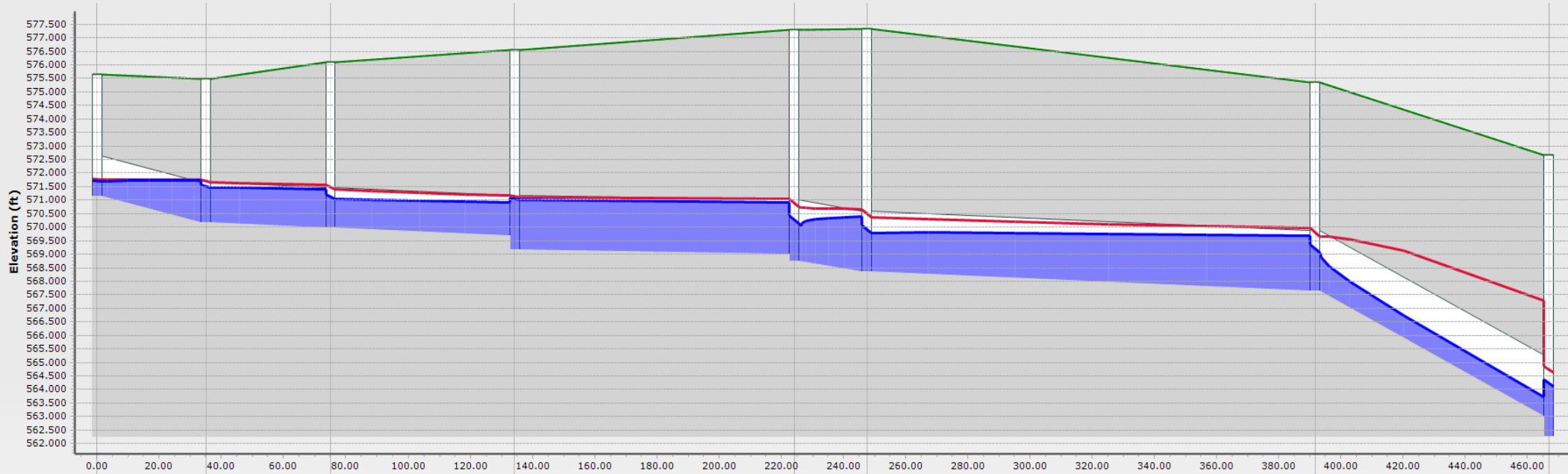


CB-57 to D12 - Base Design- Conduits & Inlets



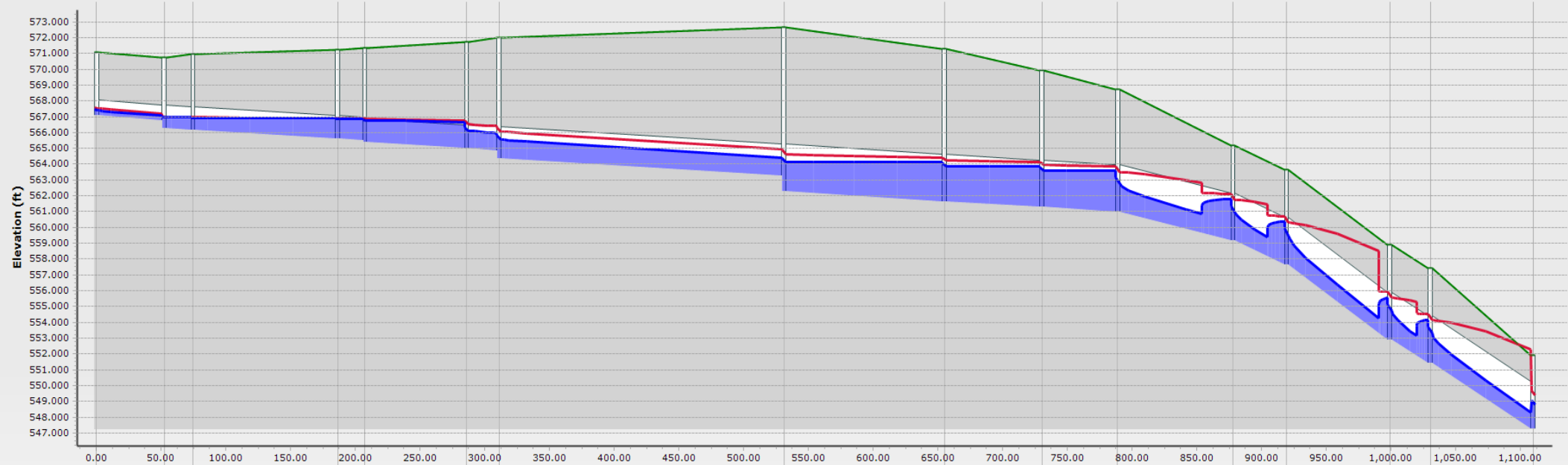
ID\Label	772 \ C0-82		771 \ C0-83		705 \ C0-7(1)		779 \ C0-7(2)		780 \ C0-7(3)		97 \ C0-10		
Link Length (ft)	13.60		39.00		40.10		59.20		89.90		23.37		
Rise (in)\Material	12.0 \ Corrugated HDPE (Smooth Interior)		15.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		24.0 \ Corrugated HDPE (Smooth Interior)		27.0 \ Corrugated HDPE (Smooth Interior)		
Flow (cfs)	0.55		2.22		5.62		6.42		8.03		16.01		
Slope (ft/ft)	0.061		0.005		0.005		0.005		0.002		0.017		
ID\Label	759 \ CB-57		769 \ CB-58		55 \ D08		704 \ CB-46		778 \ CB-59		33 \ D11		95 \ D12
Ground (ft)	575.690		575.487		575.490		576.085		576.550		577.283		577.326
Invert (ft)	571.690		570.611		570.166		569.965		569.169		568.747		568.353
Station (ft)	0.00		13.60		52.60		92.70		151.90		241.80		265.17

CB-48 to D04 - Base Design- Conduits & Inlets



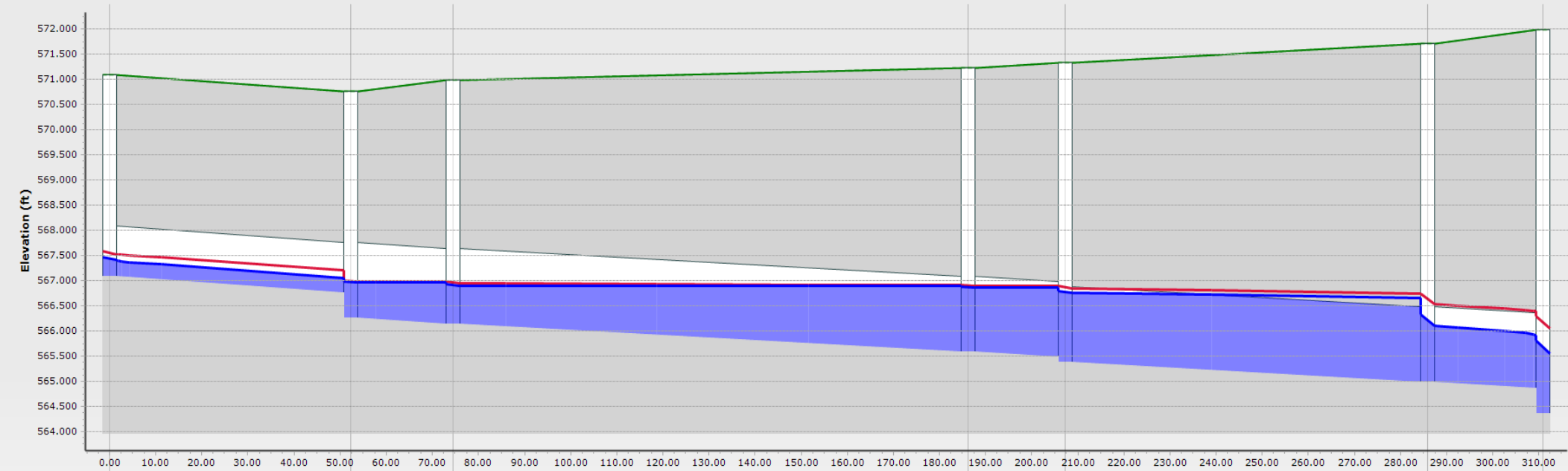
ID\Label	714 \ CO-68	705 \ CO-7(1)	779 \ CO-7(2)	780 \ CO-7(3)	97 \ CO-10	791 \ CO-11(1)	792 \ CO-11(2)	
Link Length (ft)	35.00	40.10	59.20	89.90	23.37	144.10	75.20	
Rise (in)\Material	0 \ Corrugated HDPE (Smooth Interior)	0 \ Corrugated HDPE (Smooth Interior)	0 \ Corrugated HDPE (Smooth Interior)	24.0 \ Corrugated HDPE (Smooth Interior)	27.0 \ Corrugated HDPE (Smooth Interior)	27.0 \ Corrugated HDPE (Smooth Interior)	27.0 \ Corrugated HDPE (Smooth Interior)	
Flow (cfs)	1.20	5.62	6.42	8.03	16.01	16.39	16.59	
Slope (ft/ft)	0.028	0.005	0.005	0.002	0.017	0.005	0.061	
ID\Label	13 \ CB-48	55 \ D08	704 \ CB-46	778 \ CB-59	33 \ D11	95 \ D12	790 \ CB-60	35 \ D04
Ground (ft)	575.629	575.490	576.085	576.550	577.283	577.326	575.360	572.650
Invert (ft)	571.129	570.166	569.965	569.169	568.747	568.353	567.632	562.267
Station (ft)	0.00	35.00	75.10	134.30	224.20	247.57	391.67	466.87

CB-55 to Tanyard - Base Design- Conduits & Inlets



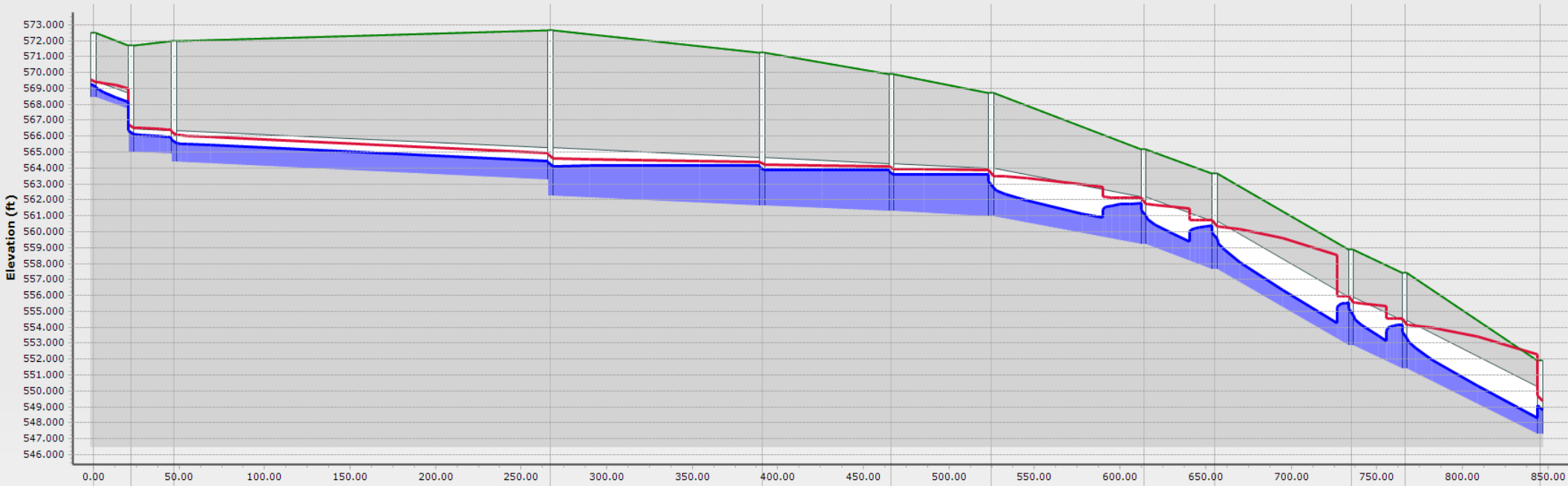
ID\Label	749 \ CO-78641 \ CO-79		888 \ CO-95	889 \ CO-80	890 \ CO-103	62 \ CO-2	60 \ CO-3		800 \ CO-4(1)		808 \ CO-4(2)	810 \ CO-5(1)	811 \ CO-5(2)	630 \ CO-5(3)	446 \ CO-13	44 \ CO-14	403 \ CO-15(1)		
Link Length (ft)	52.20	22.30	111.70	21.00	78.60	25.09	220.04		123.88		75.40	58.40	89.00	41.50	79.71	31.37	79.33		
Rise (in)\Material	36.0 \ Corrugated HDPE (Smooth Interior)																		
Flow (cfs)	0.61	1.04	1.62	2.23	4.11	7.41	11.06		26.06		26.71	27.82	30.17	30.93	32.98	33.22	34.20		
Slope (ft/ft)	0.006	0.005	0.005	0.005	0.005	0.005	0.005		0.005		0.005	0.005	0.020	0.037	0.060	0.047	0.052		
ID\Label	48 \ CB-55	640 \ CB-37	590 \ CB-33	61 \ D028 \ D03	35 \ D04		799 \ MH-18		37 \ D05	809 \ CB-62	628 \ CB-36	39 \ D07	41 \ D18	43 \ D19	402 \ MH-2				
Ground (ft)	571.089	570.76870.985	571.2371.324	571.707571.986	572.650		571.260		569.907	568.700	565.189	563.658	558.876	557.416	551.893				
Invert (ft)	567.089	566.26866.149	565.5965.386	564.992564.367	562.267		561.647		561.270	560.978	559.189	557.658	552.876	551.416	547.270				
Station (ft)	0.00	52.20 74.50	186.20207.20	285.80 310.89	530.93		654.81		730.21	788.61	877.61	919.11	998.82	1030.19	1109.51				

CB-55 to D03 - Base Design- Conduits & Inlets



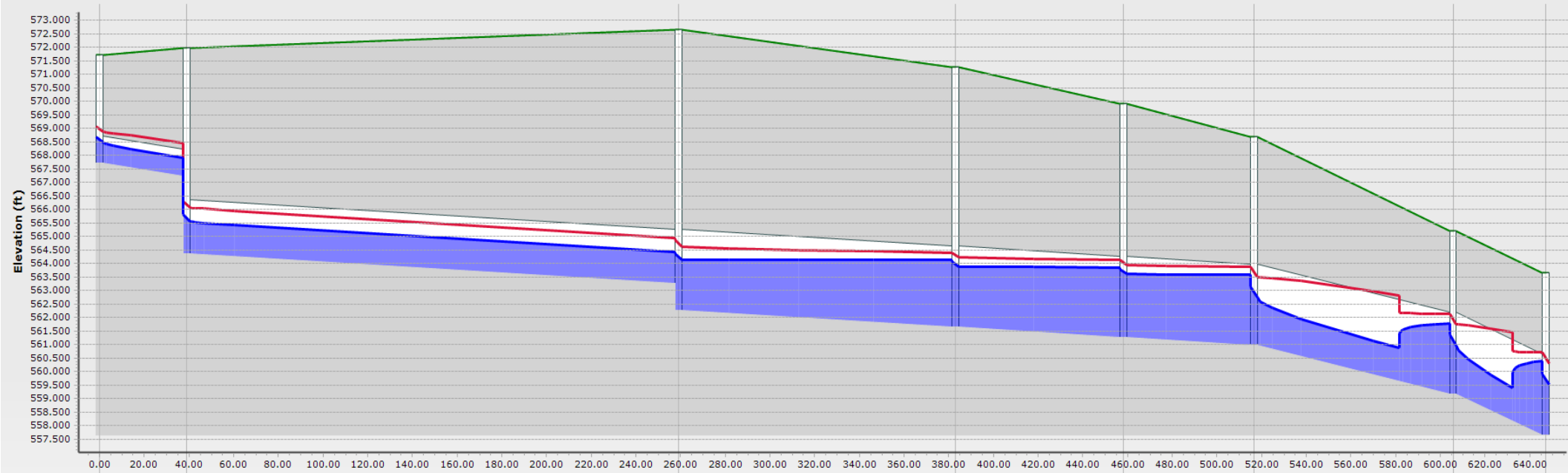
ID\Label	749 \ C0-78		641 \ C0-79		888 \ C0-95		889 \ C0-80		890 \ C0-103		62 \ C0-2		
Link Length (ft)	52.20		22.30		111.70		21.00		78.60		25.09		
Rise (in)\Material	12.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		
Flow (cfs)	0.61		1.04		1.62		2.23		4.11		7.41		
Slope (ft/ft)	0.006		0.005		0.005		0.005		0.005		0.005		
ID\Label	748 \ CB-55		640 \ CB-38		637 \ CB-37		590 \ CB-32		596 \ CB-33		61 \ D02		58 \ D03
Ground (ft)	571.089		570.760		570.985		571.231		571.324		571.707		571.986
Invert (ft)	567.089		566.260		566.149		565.590		565.386		564.992		564.367
Station (ft)	0.00		52.20		74.50		186.20		207.20		285.80		310.89

CB-51 to Tanyard - Base Design- Conduits & Inlets



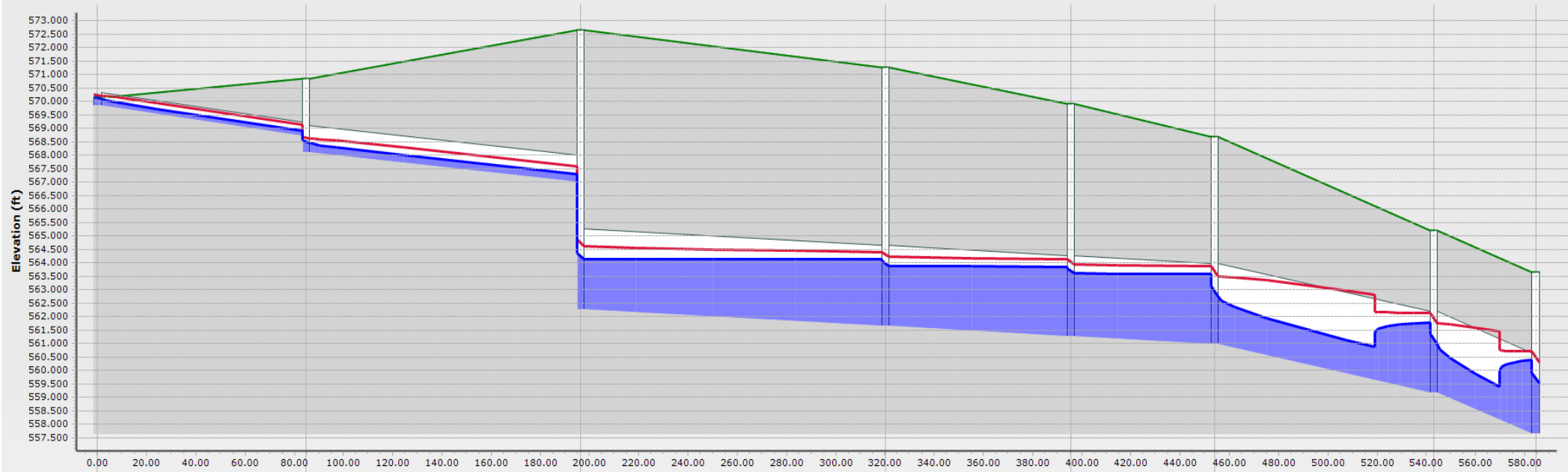
ID\Label	731 \ CO-7(1) 732 \ CO-2		60 \ CO-3	800 \ CO-4(1)		808 \ CO-4(2)	810 \ CO-5(1)	811 \ CO-5(2)	630 \ CO-5(3)	446 \ CO-13	44 \ CO-14	403 \ CO-15(1)
Link Length (ft)	22.00	25.09	220.04	123.88	75.40	58.40	89.00	41.50	79.71	31.37	79.33	
Size (in)\Material	36.0 \ Corrugated HDPE (Smooth Interior)		24.0 \ Corrugated HDPE (Smooth Interior)	36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)	36.0 \ Corrugated HDPE (Smooth Interior)	36.0 \ Corrugated HDPE (Smooth Interior)	36.0 \ Corrugated HDPE (Smooth Interior)	36.0 \ Corrugated HDPE (Smooth Interior)	36.0 \ Corrugated HDPE (Smooth Interior)	36.0 \ Corrugated HDPE (Smooth Interior)
Flow (cfs)	2.37	7.41	11.06	26.06	26.71	27.82	30.17	30.93	32.98	33.22	34.20	
Slope (ft/ft)	0.034	0.005	0.005	0.005	0.005	0.005	0.020	0.037	0.060	0.047	0.052	
ID\Label	30 \ CB-561 \ D02 58 \ D03		35 \ D04	799 \ MH-18	37 \ D05	809 \ CB-62	628 \ CB-36	39 \ D07	41 \ D18	43 \ D19	402 \ MH-2	
Ground (ft)	572.460	571.707	571.986	572.650	571.260	569.907	568.700	565.189	563.658	558.876	557.416	551.893
Invert (ft)	568.460	564.992	564.367	562.267	561.647	561.270	560.978	559.189	557.658	552.876	551.416	547.270
Station (ft)	0.00	22.00	47.09	267.13	391.01	466.41	524.81	613.81	655.31	735.02	766.39	845.71

D01 to D07 - Base Design- Conduits & Inlets



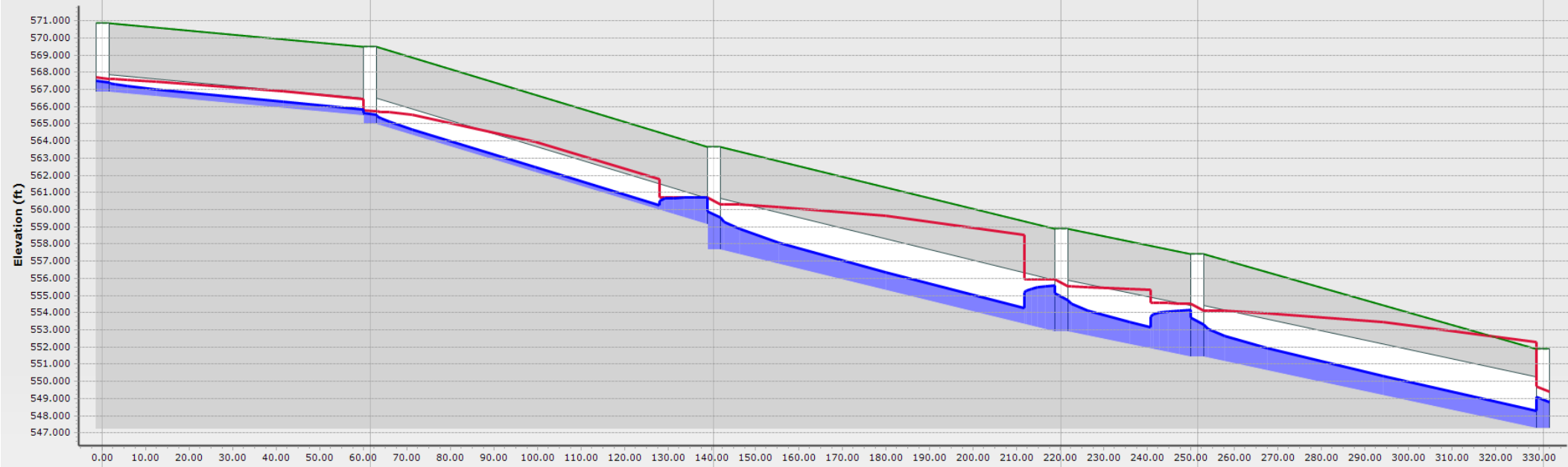
ID\Label	59 \ CO-1		60 \ CO-3		800 \ CO-4(1)		808 \ CO-4(2)		810 \ CO-5(1)		811 \ CO-5(2)		630 \ CO-5(3)		
Link Length (ft)	39.01		220.04		123.88		75.40		58.40		89.00		41.50		
Rise (in)\Material	22.0 \ Corrugated HDPE (Smooth Interior)		24.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		
Flow (cfs)	3.24		11.06		26.06		26.71		27.82		30.17		30.93		
Slope (ft/ft)	0.012		0.005		0.005		0.005		0.005		0.020		0.037		
ID\Label	57 \ D01		58 \ D03		35 \ D04		799 \ MH-18		37 \ D05		809 \ CB-62		628 \ CB-36		39 \ D07
Ground (ft)	571.714		571.986		572.650		571.260		569.907		568.700		565.189		563.658
Invert (ft)	567.710		564.367		562.267		561.647		561.270		560.978		559.189		557.658
Station (ft)	0.00		39.01		259.05		382.93		458.33		516.73		605.73		647.23

D22 to D07 - Base Design- Conduits & Inlets



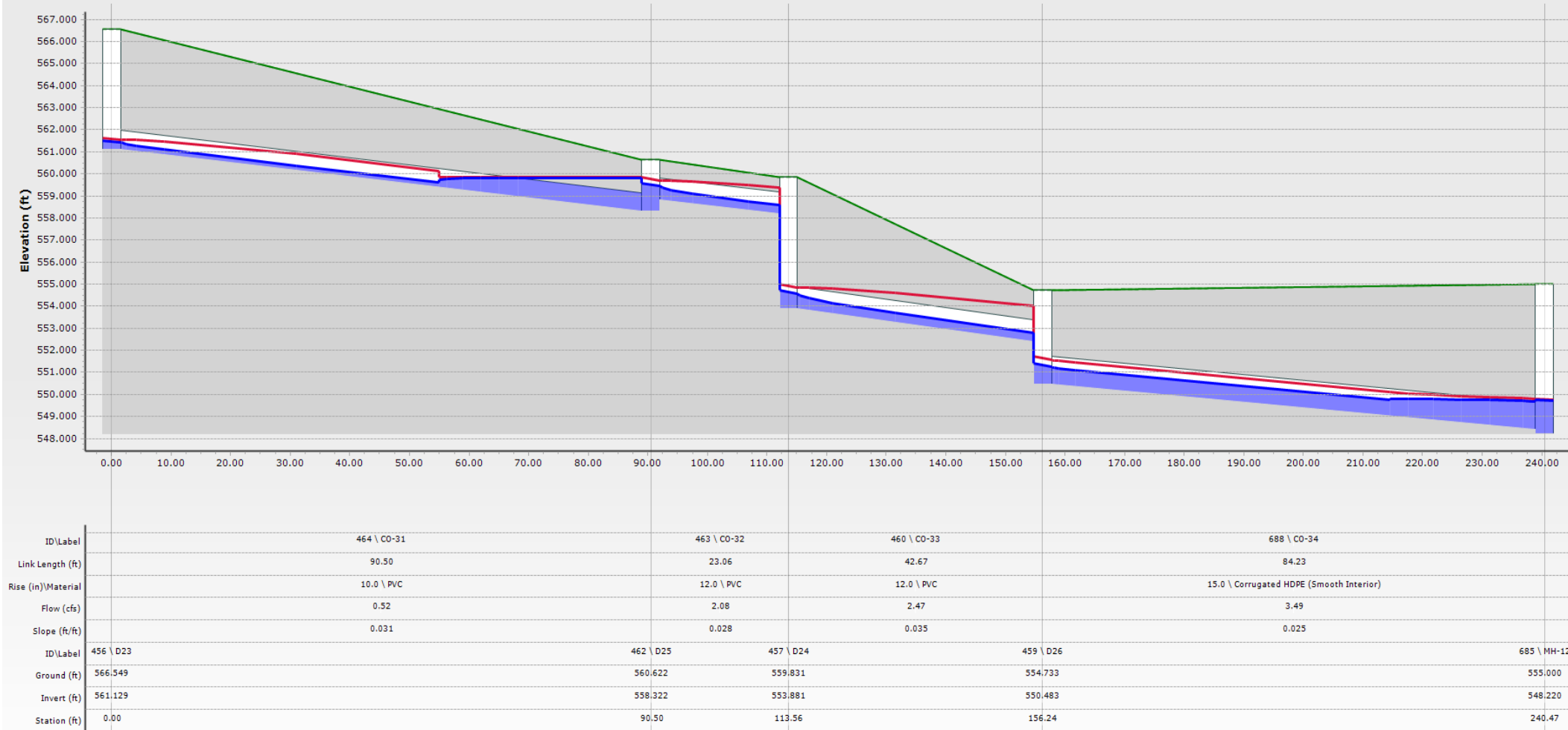
ID\Label	65 \ CO-16		66 \ CO-17		800 \ CO-4(1)		808 \ CO-4(2)		810 \ CO-5(1)		811 \ CO-5(2)		630 \ CO-5(3)	
Link Length (ft)	84.75		111.53		123.88		75.40		58.40		89.00		41.50	
Rise (in)\Material	6.0 \ PVC		12.0 \ PVC		36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)	
Flow (cfs)	0.27		0.83		26.06		26.71		27.82		30.17		30.93	
Slope (ft/ft)	0.013		0.010		0.005		0.005		0.005		0.020		0.037	
ID\Label	63 \ D22	64 \ D21	35 \ D04		799 \ MH-18		37 \ D05	809 \ CB-62		628 \ CB-36	39 \ D07			
Ground (ft)	570.120	570.840	572.650		571.260		569.907	568.700		565.189	563.658			
Invert (ft)	569.841	568.091	562.267		561.647		561.270	560.978		559.189	557.658			
Station (ft)	0.00	84.75	196.28		320.16		395.56	453.96		542.96	584.46			

D06 to Tanyard - Base Design- Conduits & Inlets



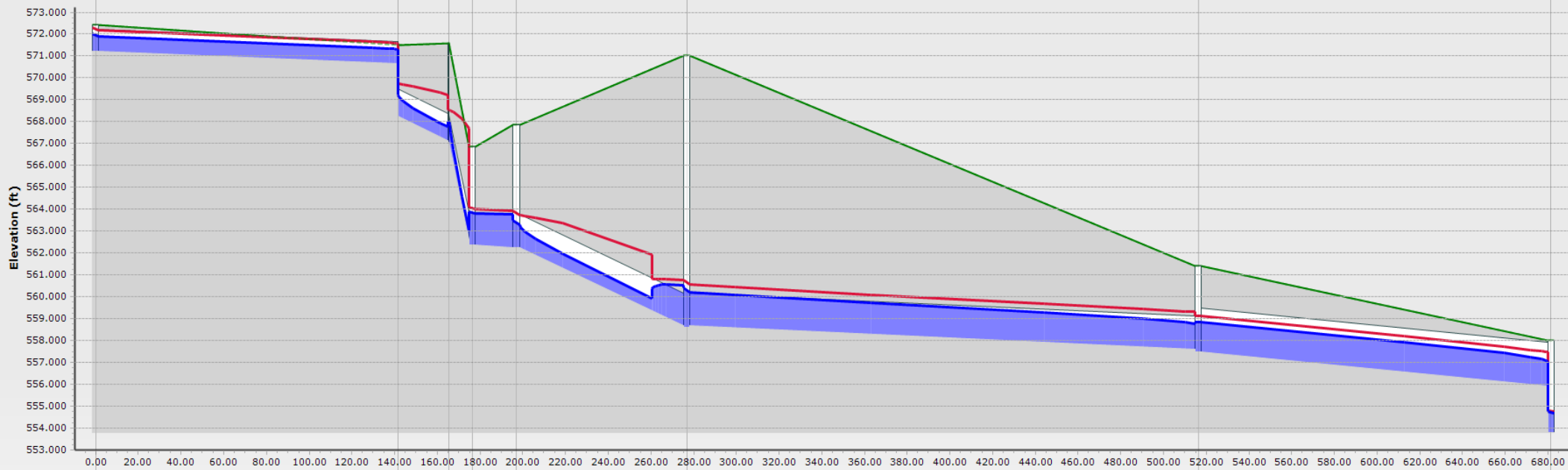
ID\Label	861 \ CO-99		860 \ CO-100		446 \ CO-13		44 \ CO-14		403 \ CO-15(1)		
Link Length (ft)	61.50		78.90		79.71		31.37		79.33		
Rise (in)\Material	12.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		36.0 \ Corrugated HDPE (Smooth Interior)		
Flow (cfs)	1.57		1.99		32.98		33.22		34.20		
Slope (ft/ft)	0.022		0.074		0.060		0.047		0.052		
ID\Label	82 \ D06		859 \ CB-67		39 \ D07		41 \ D18		43 \ D19		402 \ MH-2
Ground (ft)	570.851		569.480		563.658		558.876		557.416		551.893
Invert (ft)	566.851		564.980		557.658		552.876		551.416		547.270
Station (ft)	0.00		61.50		140.40		220.11		251.48		330.81

D23 to Tanyard - Base Design- Conduits & Inlets



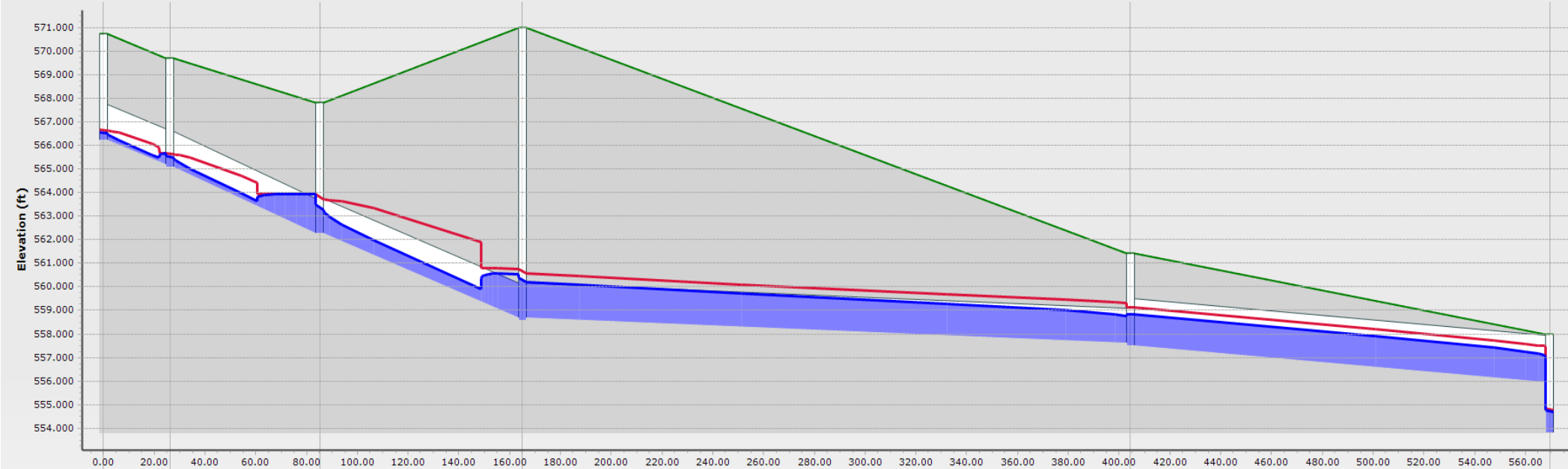
The pipes in this profile are retained from existing drainage network except CO-34.

D31-Tanyard - Base Design- Conduits & Inlets



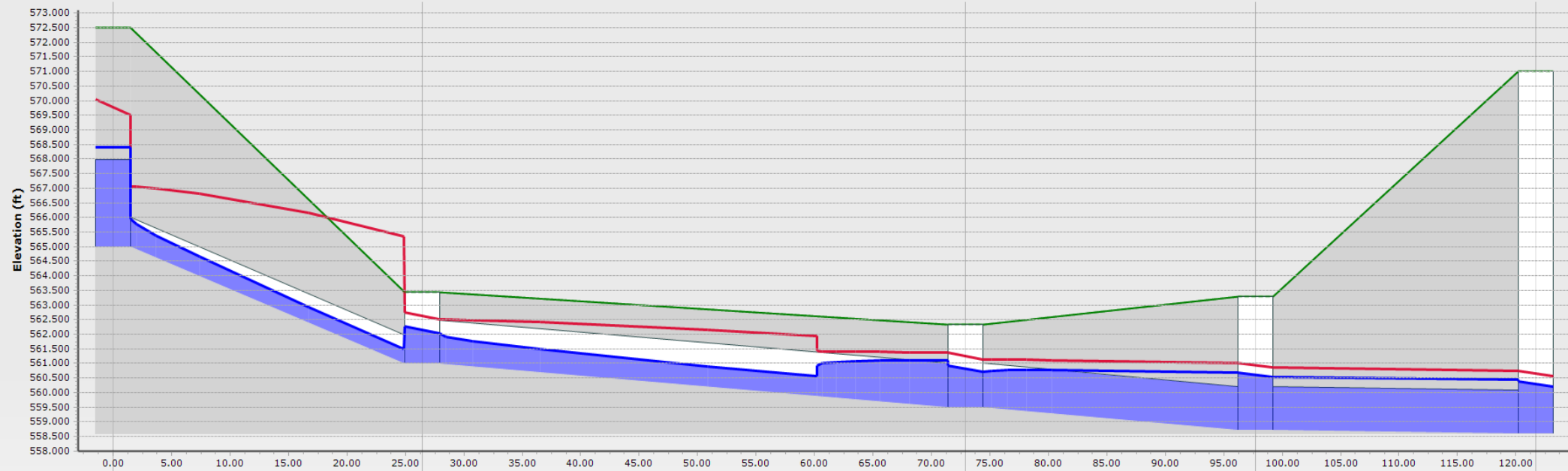
ID\Label	374 \ C0-24				530 \ C0-25(1) C0-2			
----------	-------------	--	--	--	---	--	--	--

D35 to Tanyard - Base Design- Conduits & Inlets



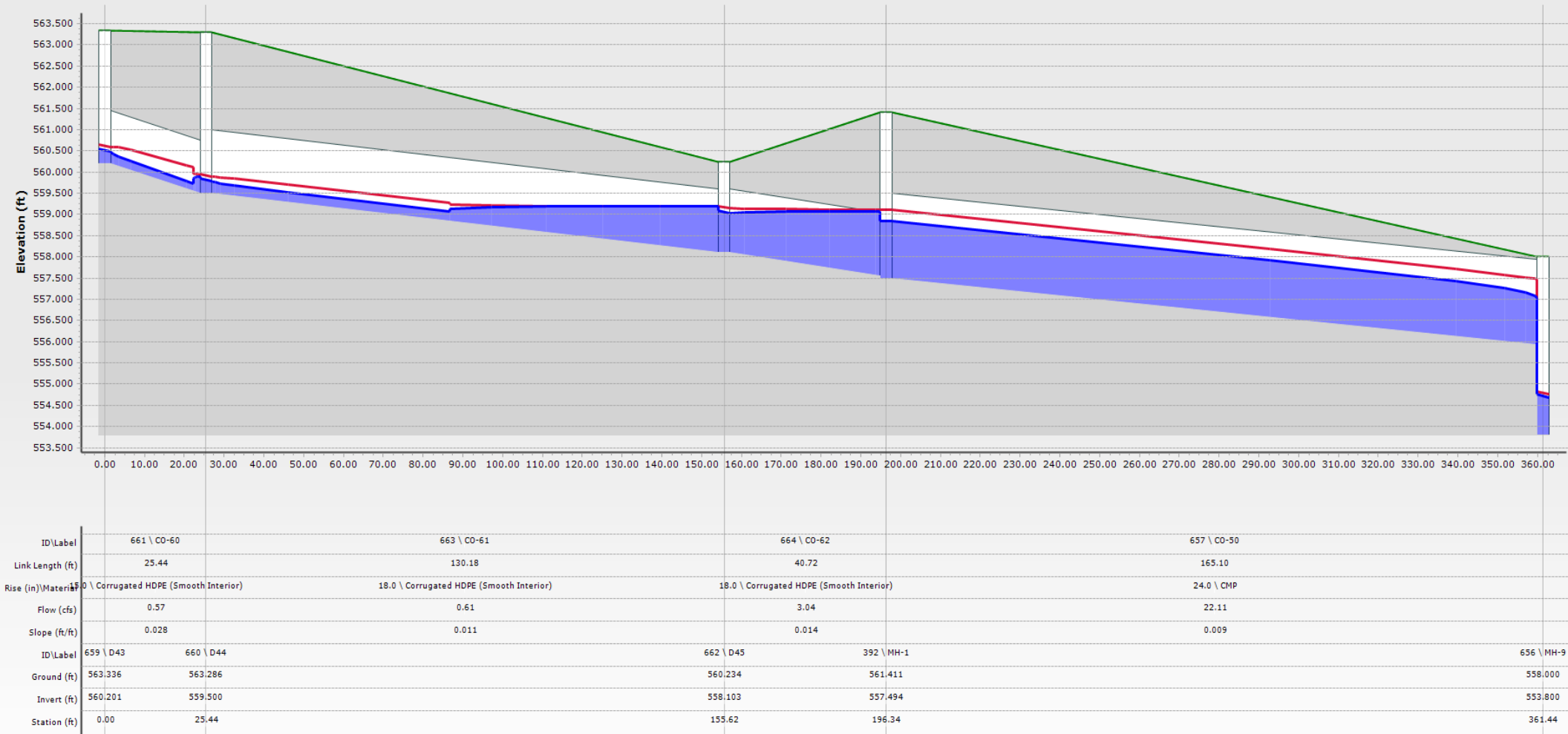
ID\Label	382 \ CO-25		848 \ CO-26(1)		847 \ CO-26(2)		415 \ CO-30		657 \ CO-50	
Link Length (ft)	26.14		59.00		79.80		239.50		165.10	
Rise (in)\Material	18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		24.0 \ CMP	
Flow (cfs)	0.58		1.09		13.69		20.25		22.11	
Slope (ft/ft)	0.040		0.048		0.045		0.004		0.009	
ID\Label	380 \ D35	381 \ D36	846 \ CB-66		413 \ D42 (MH)		392 \ MH-1		656 \ MH-9	
Ground (ft)	570.751	569.698	567.840		571.009		561.411		558.000	
Invert (ft)	566.251	565.098	562.266		558.392		557.494		553.800	
Station (ft)	0.00	26.14	85.14		164.94		404.44		569.54	

D37 to D42 - Base Design- Conduits & Inlets



ID\Label	387 \ CO-27		389 \ CO-28		418 \ CO-29		419 \ CO-23	
Link Length (ft)	26.41		46.50		24.78		24.00	
Rise (in)\Material	12.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Corrugated HDPE (Smooth Interior)		18.0 \ Vitrified Clay Pipe	
Flow (cfs)	6.56		7.42		8.17		8.16	
Slope (ft/ft)	0.152		0.032		0.032		0.005	
ID\Label	385 \ D37	386 \ D38		388 \ D39		417 \ D40 (MH)		413 \ D42 (MH)
Ground (ft)	572.500	563.431		562.318		563.300		571.009
Invert (ft)	564.996	560.973		559.500		558.717		558.592
Station (ft)	0.00	26.41		72.91		97.69		121.69

D43 to Tanyard - Base Design- Conduits & Inlets



This profile is retained from Existing Drainage Network