Final Drainage Report
for
Compark Village South Multi-Family

Compark Village South, Filing No.1, Amendment 2
Parker, Colorado

P.N. CLCPKC3

Prepared For:
Century Communities
8390 E. Cresent Parkway, Suite 650
Greenwood Village, CO 80111

Prepared By:
Merrick & Company
5970 Greenwood Plaza Blvd
Greenwood Village, CO 80111
Contact: Kristofer K. Wiest, P.E.
303-353-3695

Date: 05/20/2022

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ENGINEER'S CERTIFICATE

This final drainage report amendment for the Compark Village South project was prepared by me or under my direct supervision in accordance with the provisions of the *Town of Parker Storm Drainage and Environmental Criteria Manual.* I understand that the Town of Parker and its designated town authority do not and will not assume liability for drainage facilities designed by others.

Prepared By:

_____

Kristofer K. Wiest, P.E.
State of Colorado No. 46080
For and on Behalf of Merrick & Company

I. GENERAL LOCATION AND DESCRIPTION

A. Scope

This project is part of the Compark Village South development. The following previously filed drainage reports apply to our site: “Final Drainage Report, Compark Village South, Filing No. 1” and “Final Drainage Report, Compark Village South, Filing No. 1 - Belford Ave Site Plan Amendment” , both prepared by Manhard Consulting, dated July 31, 2020 and June 18, 2021 respectively.
The intent of this report is to demonstrate the feasibility of the proposed storm drainage system planned to control the storm water associated with portions of the previously filed drainage reports. This report was prepared in accordance with the *Town of Parker Storm Drainage and Environmental Criteria Manual (Town Criteria) and the Mile High Flood District Criteria Manual*.

B. Location

Compark Village South (CVS) Filing No. 1, Amendment 2 lies in what was previously referred to as Tract G. All of Compark Village South Multi-Family (CVS-MF) is located in the South Half of Section 6, Township 6 South, Range 66 West of the Sixth Principle Meridian, Town of Parker, County of Douglas, State of Colorado, Tract 2. General project boundaries include Belford Avenue to the north, Happy Canyon Creek to the east, Grandview Estates to the south, and CVS Filing 1, Amendment 1 to the east. The project lies within the Future Multi-Family portion of the “Final Drainage Report, Compark Village South, Filing No. 1” and the future development portion (drainage basin F3 and POND) of the “Final Drainage Report, Compark Village South, Filing No. 1 - Belford Ave Site Plan Amendment”.

C. Description of Property

The site consists of approximately 16 acres and is currently being mass graded by others. Onsite soils consist of Newlin Gravelly Sandy Loam, Satanta Loam and Loamy alluvial land. These soils are classified as hydrologic group B. Refer to Appendix A of this report for excerpts of the SCS soil survey summary. For consistency in reporting between the various drainage reports, the storm pipes and inlets were sized assuming soil type C/D, which is conservative relative to soil type B.

D. Floodplain Information

The site is located within the Happy Canyon Creek major drainage basin which has a regulatory 100-year floodplain. Firm map 08035C0062H, Effective date: September 4, 2020 indicates that the site is located in Zone X which poses a minimal flood hazard.

II. DRAINAGE BASINS AND SUB-BASINS

A. Basin Description

The entirety of this project lies within the Happy Canyon Creek drainage basin, which has been studied by the Mile High Flood District (MHFD) (previously known as Urban Drainage Flood Control District (UDFCD)) under the following:

- UDFCD - Outfall System Planning - Happy Canyon Creek Watershed within Douglas County, prepared by Kiowa Consultants, June 1993. MHFD, in conjunction with sponsor partners Town of Parker and Douglas County, are planning on updating the Happy Canyon Creek OSP.
- Green Acres Tributary is a part of the Happy Canyon Creek watershed. There are several existing drainage studies covering the upstream area of the Green Acres Tributary development projects. See the Meridian Office Park, Filings 4 & 5 master drainage analysis for further detail.
- Happy Canyon Creek Major Drainageway Plan, prepared by Muller Engineering Company, March 2014.
- Amendment to Happy Canyon Creek Major Drainageway Plan, March 2014, prepared by Manhard Consulting, February 2016.

B. Sub-Basin Description

The site consists of two basins and 35 sub-basins. Basin A flows to existing detention pond A and Basin B flows to existing detention pond B. Runoff will be conveyed via overland and storm sewer to one of the two existing detention ponds located directly north and northeast of the site, as depicted in the drainage reports referenced above. These sub-basins have been determined based on land use, area, roadway slopes, storm sewer locations, and inlet capacities. The drainage basins from previous reports that are impacted by this project are described in detail below:

F3 - Belford Ave Drainage Report
Drainage Basin F3 in its existing state is composed of undeveloped land that drains directly into Happy Canyon Creek. The developed conditions of this 6.5 acre basin were assumed to be 75% impervious over the 6.5 acres and 61% over the entire 14.77 acres. This drainage basin flows into existing detention pond B located northeast of the site. This detention pond will be constructed by others. Please see Appendix A for the drainage map depicting this drainage area.

CVS-18, CVS-17, CVS-17A, CVS-23 - Compark Village South F1 Report
The drainage basins listed above are part of the 11.5 Ac of the CVS Filing No. 3 Multi-family**.** The listed basins are 75% impervious and will be conveyed to the existing detention pond described in the CVS F1 report (this is referred to on our drainage map as existing detention pond A). The proposed site will not exceed the 75% impervious percentages set by the CVS F1 drainage report and, as a result, will not exceed the required detention parameters set forth in this report. See Appendix A for the drainage map depicting this drainage area.

III. DRAINAGE CHANNELS

A. Happy Canyon Creek

Happy Canyon Creek is a major basin that is tributary to Cherry Creek. The portion of Happy Canyon Creek thalweg that extends through the proposed site is a natural sandy bottom channel. The thalweg has an existing natural meander bend located near the southeast corner of the site. No apparent head cutting exists within this channel reach. The active channel is a dry stream bed the experiences active flows during wet seasonal conditions.

As previously stated, the site is located within the Zone X floodplain adjacent to Happy Canyon Creek. It is anticipated that bank stabilization will be required along the outer edges of the existing meander bends by others. No major channel improvements are anticipated for Happy Canyon Creek with this project.

IV. DRAINAGE DESIGN CRITERIA

A. Regulations

This final drainage report is prepared in accordance with the *Town of Parker Storm Drainage Design (Addendum to the Urban Storm Drainage Criteria Manuals Volumes 1, 2, and 3)* and the *MHFD.*

The detention pond on site, Pond B, and proposed within the *Compark Village South F1 – Belford Ave Site Plan Amd.* completed by Manhard Consulting will require minor modifications to accommodate the proposed development. The design of these improvements has been documented within this report and associated construction documents. This design will be implemented into the *Compark Village South F1 – Belford Ave Site Plan Amd* plan set, to be constructed in lieu of their original design where applicable. Per the previously stated drainage reports, the detention pond to the north is sufficiently sized to accommodate the water quality and detention requirements for the CVS-MF site.

Based on the CVS F1 – Belford Avenue drainage report, it was assumed that 6.5 acres at 75% imperviousness would be draining to detention pond described in the report. This corresponds to the proposed basin B of the CVS-MF project documented herein. With the CVS-MF project, the B basin consists of 6.29 acres at 78% impervious that contribute flows to the existing detention pond B, the release rates from Pond B have been analyzed for both conditions and results are documented in the Drainage Facility Design below with associated calculations provided in Appendix D for reference. In conclusion the release rates have been determined to be equal and that no additional detention will need to be provided on site.

Based on the CVS-F1 Report, the proposed A basins consist of a portion of the 11.5 acres at 75% impervious. These basins will be detained by existing detention pond A. The A basin improvements proposed with this project are a total 5.28 acres at 62% impervious. Since

there is less area with a lower imperviousness, no additional onsite detention will be required for this project.

As previously stated, the site is located within the Zone X floodplain adjacent to Happy Canyon Creek. In accordance with the Town of Parker Municipal Code Section 13.10.220, the boundary of the floodplain shall mark the Happy Canyon Creek Stream Preservation boundary. No work is anticipated beyond this boundary.

B. Development Criteria Reference and Constraints

The site is situated within Basin F3 in the CVS F1-Belford Ave drainage report and the future Multi Family portion of the Compark Village South drainage report. According to the addendum, the fully developed percent imperviousness for the entire parcel was assumed to be 75% percent.

C. Hydrological Criteria

The minor storm design rainfall is the 5-year event, and the major storm design rainfall is the 100-year event. Runoff conveyance coefficients were calculated using the equations found in Table 6-4 of the *Urban Storm Drainage Criteria Manual.* Time of concentration calculations were based on land use as well as distance and slope of travel.

5-year and 100-year event storm flows are calculated using the Rational Method. Percent imperviousness values are from Town of Parker Strom Drainage and Environmental *Criteria* and are summarized below:

Description	Percent Impervious (%)
Parking lot: Paved	100
Roof Area	90
Lawns, Clayey Soil	2

Runoff coefficients are from Town of Parker *Criteria* using hydrologic Soil Group C.

Rainfall intensities (I) for the area are approximated by the equation:

$$I = \frac{28.5P_1}{(10+Tc)^{0.786}}$$

The 1-hour design point rainfall values (P_1) used are 1.39 for the 5-year rainfall and 2.60 for the 100-year rainfall per the Town of Parker Storm Drainage and Environmental Criteria Manual. T_c represents the time of concentration in minutes and consists of overland flow time plus travel time.

All hydrological calculations including a summary of the calculated minor and major rainfall event flows are provided in Appendix B. Basin maps are included in Appendix A.

D. Hydraulic Criteria

On-site storm sewer inlets were sized using the *Urban Storm Drainage Criteria Manual* UD-Inlet spreadsheet version 5.01 as well as Hydraflow Express Extension for AutoCAD Civil 3D. On-site final storm sewer pipes were sized using the Hydraflow software to determine hydraulic grade lines (HGL).

All proposed storm sewer is sized to carry the 5-year storm event without surcharging the sewer and the 100-year storm event with the hydraulic grade line a minimum of 1 foot below the proposed ground surface. Based on the Hydraflow results, the 100-year pipe flows are contained inside the pipe. 5-year HGLs are assumed to be contained within the pipe as well.

Inlets are sized to capture the 5-year storm event and inlets in a sump are designed for the 100-yr event. Calculations are included in Appendix C.

V. DRAINAGE FACILITY DESIGN

A. General Concept

The overall intent of the drainage design for the Site is to comply with the previous drainage reports and tie-in to the two existing detention ponds.

The proposed drainage design conveys developed runoff via sheet flow and gutter flow to inlets with sizing in appendix C. Developed runoff is then conveyed northeast via storm sewer to the existing storm sewer infrastructure.

Offsite public improvements for conveyance of minor and major flows are considered as part of Basin A-2 (see further explanation in the next section).

Based on the CVS-F1-Belford Avenue drainage report it was assumed that 6.5 acres at 75% imperviousness would be draining to the water quality and detention Pond B located south of Belford Avenue and east of the site. This corresponds to Basin B of CVS-MF with a total area of 6.29 acres at 78% imperviousness contributing to the Pond B. This is a decrease in total contributing area of 0.21 acres and an increase of imperviousness of 3.0%. Table 1 below describes the peak runoff value differences between what was originally proposed in the CVS-F1 report and the CVS-MF design. The associated design calculations for Table 1 have been provided within Appendix D for reference.

CVS-F1 vs. CVS-MF Peak Runoff to Happy Canyon Creek WQ & Detention Pond (cfs)				
	CVS-F1	CVS-MF	Difference	
5 YR	19.9	19.9	0.0	No Change
100 YR	24	23.5	-0.5	Decrease

Table 1

CVS-F1 vs. CVS-MF Happy Canyon Creek WQ & Detention Pond total release rates (cfs)				
	CVS-F1	CVS-MF	Difference	
5 YR	0.20	0.20	0.00	No Change
100 YR	12.70	12.79	0.09	Increase

Table 2

Compensatory storage volume is not required, the difference between the amount of runoff from the CVS-F1-Belford Ave Drainage Report drainage basin being conveyed to Happy Canyon Creek water quality and detention pond and that of the proposed site are approximately equal or are in an improved condition.

The CVS-F1-Belford Avenue water quality and detention pond has been modified to accommodate the proposed site and it's proposed storm sewer conveyance infrastructure. Calculations have been provided for reference in Appendix C.

Based on the CVS-F1 Report, the A basins consist of 11.5 Ac at 75% impervious. The A basin improvements proposed with this project are a total 5.28 acres at 62% impervious. Since there is less area with a lower imperviousness, no additional onsite detention will be required for this project.

Water quality will be provided by a forebay and a rip rap section at the outfall locations at each pond. Further coordination with Manhard will be needed for connection to the pond located northeast of the Site.

The water quality pond outlet structure has been modified to accommodate decrease in the overall watershed area and an increase in the imperviousness of that area. Pond supplemental plans have been submitted separate from this package; however, documentation of the change has been provided within this report. The revised calculations are provided in Appendix C. The 100-year peak storm event change to inflow to the pond is an increase of 1.9 cfs. The 100-year peak storm event change to outflow from the pond is an increase of 0.1 cfs. Changes to the outlet structure to maintain the original design include changing the restrictor plate orifice size from 1-5/16" diameter to 1-7/16" diameter and lowering the overflow weir grate by 0.04".

Developed Sub-Basins

Basin A-1 (1.37 acres) includes the park area, parking lot, and a portion of the area around building 10. It consists of parking lot coverage, hardscaping and landscaping area. Drainage will sheet flow east to a double Type 16 inlet (A3). Runoff coefficients calculated are C_5=0.27 and C_{100}=0.60; total developed flows are calculated as Q_5=1.8 cfs and Q_{100}=3.9 cfs.

Basin A-2 (1.43 acres) is situated in the southwest corner of the Site and includes a portion of the offsite drainage from the future single-family development (shown as OS-4, this area is included in this drainage basin). It consists of parking lot coverage, hardscaping, and landscaping area. Drainage will sheet flow east into a proposed 10' Type R inlet (A1) southwest of the building. Runoff coefficients calculated are C_5=0.58 and C_{100}=0.76; total developed flows are calculated as Q_5=3.9 cfs and Q_{100}=5.0 cfs.

Basin A-3 (0.20 acres) is located between building 7 and building 10. It consists of parking lot coverage, hardscaping and landscaping area. Drainage will sheet flow to a 5' Type R inlet (A2) and into the storm main. Runoff coefficients calculated are C_5=0.80 and C_{100}=0.87; total developed flows are calculated as Q_5=0.8 cfs and Q_{100}=0.8 cfs.

Basin B-4.1 & B4.2 (0.31 acres) is a building area associated with building 7. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=1.1 cfs and Q_{100}=1.2 cfs.

Basin A-5.1 & A5.2 (0.22 acres) is a building area associated with building 8. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=0.8 cfs and Q_{100}=0.8 cfs.

Basin A-6.1 & A6.2 (0.31 acres) is a building area associated with building 9. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=1.1 cfs and Q_{100}=1.2 cfs.

Basin A-7.1 & A7.2 (0.22 acres) is a building area associated with building 10. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=0.8 cfs and Q_{100}=0.9 cfs.

Basin B-1 (0.35 acres) is located interior to the site in between buildings 1, 6, 7, and 8. It consists of parking lot coverage, hardscaping and landscaping area. Drainage will sheet flow and channel flow northeast to a proposed 5' Type R inlet (B1). Runoff coefficients calculated are C_5=0.67 and C_{100}=0.80; total developed flows are calculated as Q_5=1.1 cfs and Q_{100}=1.3 cfs.

Basin B-2 (1.21 acres) is located interior to the site in between buildings 1, 2, 6, and the clubhouse. It consists of parking lot coverage, hardscaping and landscaping area. Drainage will sheet flow and channel flow southeast to a proposed 5' Type R inlet (B2). Runoff coefficients calculated are C_5=0.69 and C_{100}=0.80; total developed flows are calculated as Q_5=3.9 cfs and Q_{100}=4.5 cfs.

Basin B-3 (0.78 acres) is located interior to the site in between buildings 2, 3, 5, and the clubhouse. It consists of parking lot coverage, hardscaping and landscaping area. Drainage will sheet flow and channel flow southeast to a proposed 5' Type R inlet (B3). Runoff coefficients calculated are C_5=0.72 and C_{100}=0.83; total developed flows are calculated as Q_5=2.6 cfs and Q_{100}=3.0 cfs.

Basin B-4.1 & B4.2 (0.31 acres) is a building area associated with building 7. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=1.1 cfs and Q_{100}=1.2 cfs.

Basin B-5.1 (0.75 acres) is located interior to the site in between buildings 3, 4, and 5. It consists of parking lot coverage, hardscaping and landscaping area. Drainage will sheet flow and channel flow southeast to a proposed 5' Type R inlet (B4). Runoff coefficients calculated are C_5=0.71 and C_{100}=0.82; total developed flows are calculated as Q_5=2.5 cfs and Q_{100}=2.9 cfs.

Basin B-5 (0.13 acres) is located interior to the site in between building 4 and the entrance to Belford Ave. It consists of parking lot coverage, hardscaping and landscaping area. Drainage will sheet flow and channel flow northeast to a proposed type 16 combination inlet (B5). Runoff coefficients calculated are C_5=0.76 and C_{100}=0.85; total developed flows are calculated as Q_5=0.5 cfs and Q_{100}=0.5 cfs.

Basin B-6.1 & B6.2 (0.21 acres) is a building area associated with building 6. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=0.8 cfs and Q_{100}=0.9 cfs.

Basin B-7.1 & B7.2 (0.31 acres) is a building area associated with building 1. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=1.1 cfs and Q_{100}=1.2 cfs.

Basin B-8.1 & B8.2 (0.31 acres) is a building area associated with building 2. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=1.1 cfs and Q_{100}=1.2 cfs.

Basin B-9.1 & B9.2 (0.19 acres) is a building area associated with the clubhouse. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=0.7 cfs and Q_{100}=0.8 cfs.

Basin B-10.1 & B10.2 (0.22 acres) is a building area associated with the building 3. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=0.8 cfs and Q_{100}=0.8 cfs.

Basin B-11.1 & B11.2 (0.22 acres) is a building area associated with the building 5. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=0.8 cfs and Q_{100}=0.8 cfs.

Basin B-12.1 & B12.2 (0.31 acres) is a building area associated with the building 4. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=1.1 cfs and Q_{100}=1.2 cfs.

Basin B-13 (0.38 acres) is a landscape area surrounding the north end of buildings 1, 2, and 3. It consists of landscape area. Drainage will sheet flow to landscape drains and into

the storm main. Runoff coefficients calculated are C_5=0.09 and C_{100}=0.51; total developed flows are calculated as Q_5=0.2 cfs and Q_{100}=0.9 cfs.

Basin B-14 (0.39 acres) is a landscape, pool deck, and amenity area south of the club house. Drainage will sheet flow to landscape drains and into the storm main. Runoff coefficients calculated are C_5=0.76 and C_{100}=0.85; total developed flows are calculated as Q_5=1.4 cfs and Q_{100}=1.5 cfs.

Basin B-15 (0.05 acres) is a building area associated with the maintenance shed and bike shelter. It consists of roof area. Drainage will sheet flow to a roof drain collection system and into the storm main. Runoff coefficients calculated are C_5=0.77 and C_{100}=0.85; total developed flows are calculated as Q_5=0.2 cfs and Q_{100}=0.2 cfs.

Basin B-16 (0.05 acres) is a landscape area west of building 1. It consists of landscape area. Drainage will sheet flow to landscape drains and into the storm main. Runoff coefficients calculated are C_5=0.05 and C_{100}=0.49; total developed flows are calculated as Q_5=0.0 cfs and Q_{100}=0.1 cfs.

Basin B-17 (0.12 acres) is a landscape area west of building 7. It consists of landscape area. Drainage will sheet flow to landscape drains and into the storm main. Runoff coefficients calculated are C_5=0.14 and C_{100}=0.54; total developed flows are calculated as Q_5=0.1 cfs and Q_{100}=0.3 cfs.

Basin OS-1 (1.42 acres) is located along the east edge of the development and flows into Happy Canyon Creek. Drainage will sheet flow east into Happy Canyon Creek or into the detention pond. Runoff coefficients calculated are C_5=0.19 and C_{100}=0.56; total developed flows are calculated as Q_5=3.0 cfs and Q_{100}=4.6 cfs.

Basin OS-2 (0.15 acres) is located along the north entrance, west of building 7. Drainage will sheet flow north into Bunny Hop Lane. Runoff coefficients calculated are C_5=0.57 and C_{100}=0.75; total developed flows are calculated as Q_5=0.4 cfs and Q_{100}=0.5 cfs.

Basin OS-3 (0.43 acres) is located along the north side of the site near the entrance from Belfort Ave. Drainage will sheet flow north into the ROW. Runoff coefficients calculated are C_5=0.14 and C_{100}=0.54; total developed flows are calculated as Q_5=0.3 cfs and Q_{100}=1.1 cfs.

Basin OS-4 (1.42 acres) is located along the west side of the site in the future single family homes area. Drainage will sheet flow west onto our site and into drainage basin A-2 (This area was accounted for in A-2). Runoff coefficients calculated are C_5=0.44 and C_{100}=0.69; total developed flows are calculated as Q_5=3.0 cfs and Q_{100}=4.6 cfs.

Basin OS-5 (0.49 acres) is located along the west side of the site in the future single family homes area. Drainage will sheet flow west onto our site and into drainage basin OS-1. Runoff coefficients calculated are C_5=0.43 and C_{100}=0.68; total developed flows are calculated as Q_5=0.1 cfs and Q_{100}=1.1 cfs.

Basin OS-6 (0.67 acres) is located along the east edge of the development and flows into Happy Canyon Creek. Drainage will sheet flow east into Happy Canyon Creek or into the detention pond. Runoff coefficients calculated are C_5=0.08 and C_{100}=0.51; total developed flows are calculated as Q_5=2.6 cfs and Q_{100}=2.8 cfs.

Basin OS-7 (0.84 acres) is located along the west side of the site in the future single family homes area as well as the public right-of-way. Drainage will sheet flow west and south where it will be conveyed via curb and gutter a 5' Type R inlet located at design point 22. This inlet will replace the inlet [INL2-10A(Basin CVS-22)] that was originally proposed in the CVS No. 2 – Amendment No. 1 Final Road & Storm Drainage construction plans completed by Manhard. Runoff coefficients calculated are C_5=0.49 and C_{100}=0.71; total developed flows are calculated as Q_5=1.7 cfs and Q_{100}=2.7 cfs.

Basin OS-8 (0.15 acres) is located along the west side of the site in the future single family homes area and consists of public right-of-way. Drainage will sheet flow west where it will be conveyed via curb and gutter a 5' Type R inlet located at design point 23. This inlet will replace the inlet [INL2-10(Basin CVS-23)] that was originally proposed in the CVS No. 2 – Amendment No. 1 Final Road & Storm Drainage construction plans completed by Manhard. Runoff coefficients calculated are C_5=0.65 and C_{100}=0.79; total developed flows are calculated as Q_5=0.04 cfs and Q_{100}=0.4 cfs.

B. Specific Details

As mentioned previously in this report, the site will be divided into multiple drainage sub-basins. The onsite runoff will be routed through the site via gutters and sheet flow and intercepted by inlets in sump condition. Flows captured by the inlets will be routed via the storm sewer directly to the existing detention/water quality ponds. The detention ponds have been sized to accommodate the flows resulting from the areas shown on the drainage map.

Water Quality and Maintenance

Stormwater quality is provided by the existing detention ponds designed by Manhard and described within the previously stated drainage reports.

Temporary sediment and erosion control will be provided with silt fence, diversion ditches, and (2) temporary sediment basins. Inlet protection and rock socks will also be used to protect existing storm infrastructure and provide water quality measures during construction.

Appendices
Tables, figures, charts and drawings used for references and calculations can be found in the Appendices of this report.

- A provides a vicinity map, topographic map, soils maps, FEMA floodplain maps, and drainage basin maps;
- B provides the hydrologic calculations;
- C provides the hydraulic calculations;
- D provides stormwater quality baffle system details;
- E provides the excerpts from drainage studies referenced in this report.

VI. Environmental Protection Criteria

A. General

Site Drainage improvements are intended to minimize the impact to the environment. The previously installed improvements to the Happy Canyon Creek required permitting through FEMA. As part of this permitting process, requirements regarding potential impacts to wetland areas and to threatened and endangered species were identified and the proper permitting was obtained. Specifics can be found in the CLOMR for Happy Canyon Creek.

B. Construction BMP Plan

Construction BMPs shall be placed during construction to minimize soil erosion and the movement of sediment offsite. Construction BMPs shall be placed during the initial and interim phases of construction. The intent of the initial BMPs are to fulfill water quality objectives during the overlot and roadway rough grading phase of the project. Once the initial phase of earthmoving and rough grading is complete, interim BMP placement can be made. Interim BMPs are in place for fine grading, utility construction, and street construction. Construction plans will contain all appropriate Stormwater Management Details. In addition, a stormwater Management Plan will be prepared to meet the Town of Parker, State of Colorado, and EPA criteria.

VII. CONCLUSIONS

A. Compliance with the LSDC

The on-site drainage design complies with the Mile High Flood Control District's *Urban Storm Drainage Criteria Manual* and *Town of Parker Storm Drainage Design (Addendum to the Urban Storm Drainage Criteria Manuals Volumes 1, 2, and 3)*. The design is consistent with the drainage design proposed in the previously mentioned drainage reports

B. Drainage Concept

The drainage design will convey storm flows without causing damage. The site is not located within a FEMA designated floodplain.

REFERENCES

1. Town of Parker Storm Drainage and Environmental Criteria Manual (Addendum to Urban Storm Drainage Criteria Manuals Volumes 1, 2, and 3), Town of Parker – Stormwater, Town of Parker, Colorado, Revised February 2014.

2. Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed [July 24, 2021].

3. Mile High Flood Control District. Urban Storm Drainage Criteria Manual. Volume 1. Revised August 2018.

4. Mile High Flood Control District. Urban Storm Drainage Criteria Manual. Volume 2. Revised September 2017.

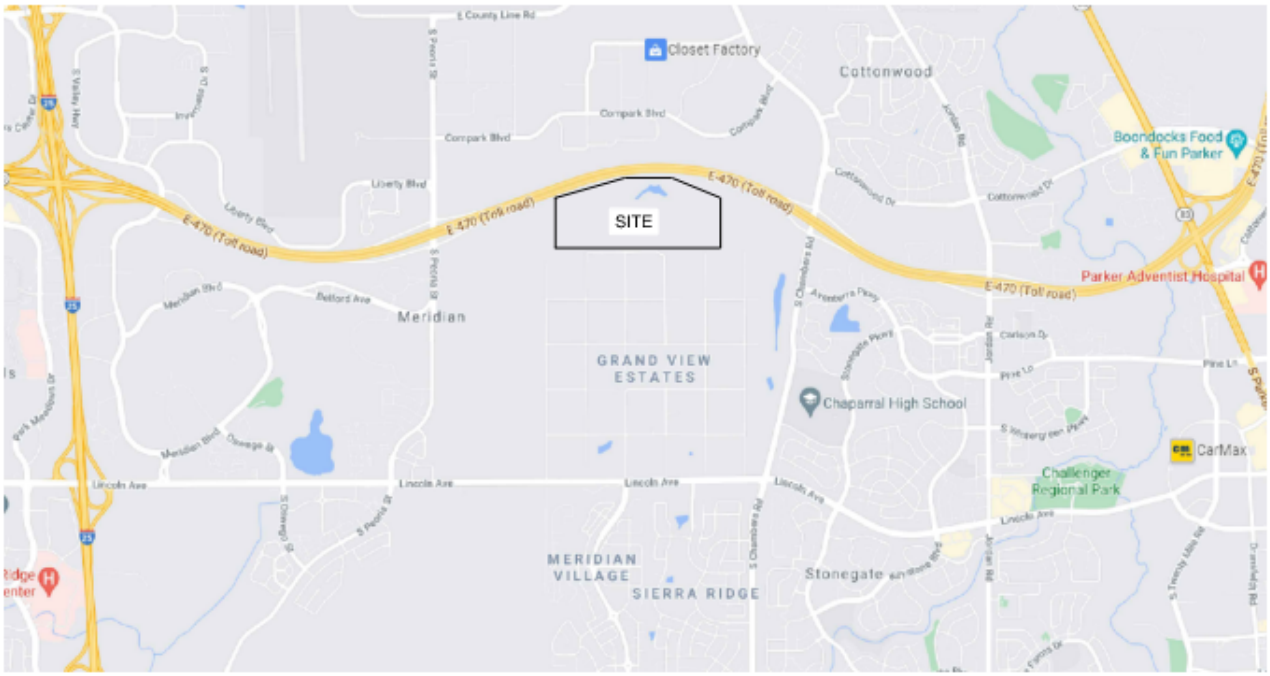
5. Urban Drainage and Flood Control District. Urban Storm Drainage Criteria Manual. Volume 3. Updated January 2021.

6. Manhard Consulting, LTD. Final Drainage Report Amendment Compark Village South, Filing No. 1. Prepared for 470 Compark, LLC. July 31, 2020.

7. Manhard Consulting, LTD. Final Drainage Report Compark Village South, Filing No. 1 - Belford Ave Site Plan Amendment. Prepared for Belford North Metropolitan District. June 18, 2021.

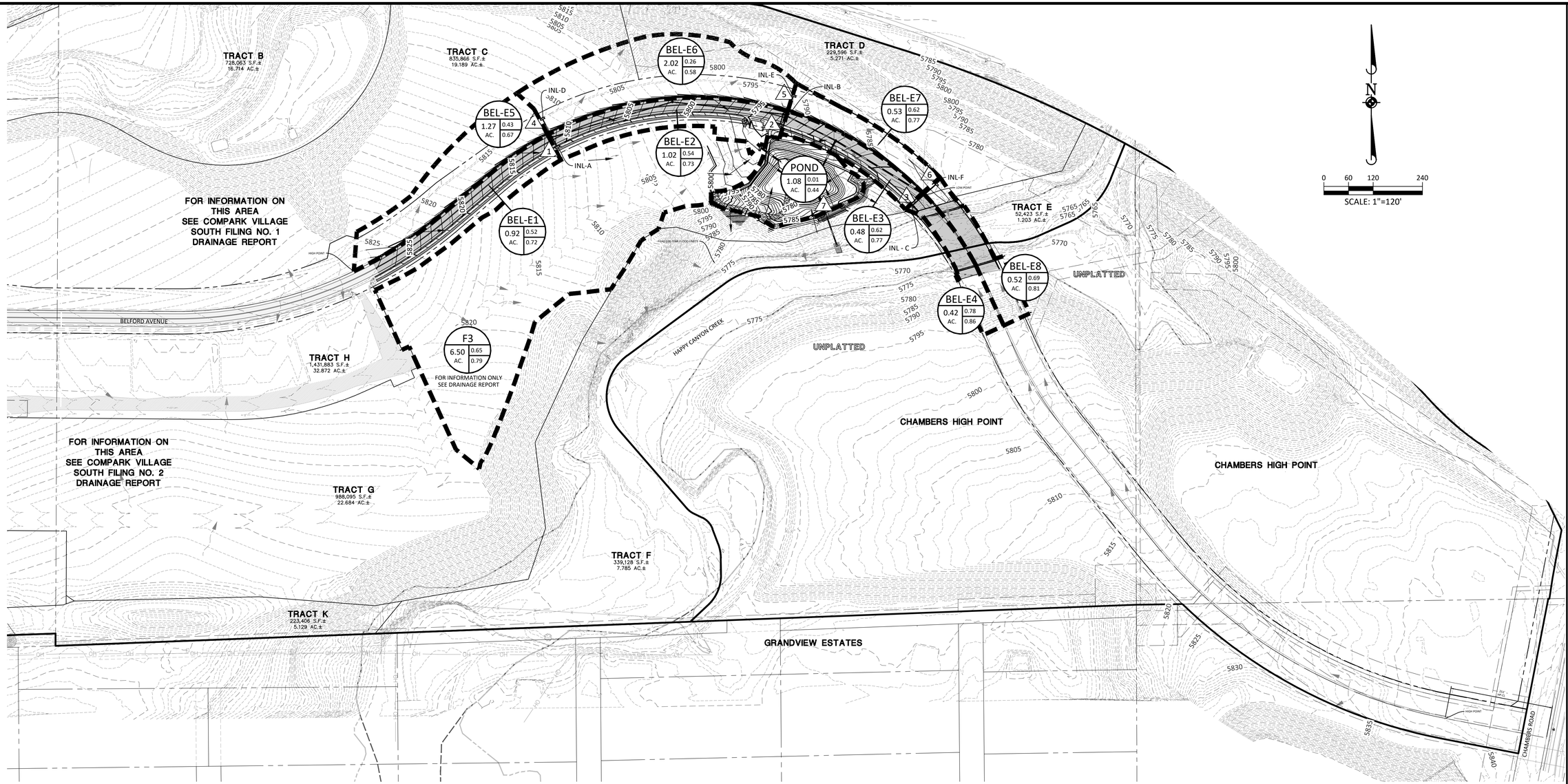
APPENDICES

Appendix A: Maps



Vicinity Map

(N.T.S.)



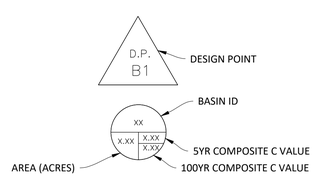
DRAINAGE SUMMARY TABLE

BASIN ID	5 YEAR COMPOSITE C	100 YEAR COMPOSITE C	5 YEAR RUNOFF (CFS)	100 YEAR RUNOFF (CFS)
BEL-E1	0.52	0.72	1.54	4.48
BEL-E2	0.54	0.73	1.76	5.03
BEL-E3	0.62	0.77	0.93	2.43
BEL-E4	0.78	0.86	1.15	2.68
BEL-E5	0.43	0.67	1.63	5.36
BEL-E6	0.26	0.58	1.23	5.71
BEL-E7	0.62	0.77	1.05	2.76
BEL-E8	0.69	0.81	1.19	2.94
F3 (Tract G)	0.65	0.79		
POND	0.01	0.44	0.04	3.55
		TOTAL	10.52	34.94

ROUTED FLOWS TABLE

RECEIVING BASIN	TRIBUTARY DESIGN POINTS	5 YEAR TOTAL FLOW (CFS)	100 YEAR TOTAL FLOW (CFS)
POND	1, 2, 3, 4, 5, 6	10.52	34.94

**ONLY BELFORD AVE RUNOFF SHOWN HERE, NO PROPOSED FLOW FROM TRACT G INCLUDED, TRACT G IS INCLUDED IN DETENTION BASIN SIZING



PREDOMINANT SOIL TYPE IS NRCS HYDROLOGICAL SOIL GROUP B

DRAWN BY | REVISIONS | DATE

Manhard CONSULTING LTD
8008 E. Arapahoe Court, Suite 110, Centennial, CO 80112 ph:303.708.0500 fx:303.708.0400 manhard.com
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COMPARK VILLAGE SOUTH - BELFORD AVENUE
PARKER, COLORADO
PROPOSED DRAINAGE MAP

PROJ. MGR.: GTI
PROJ. ASSOC.: ASD
DRAWN BY: JMP
DATE: 03/15/2021

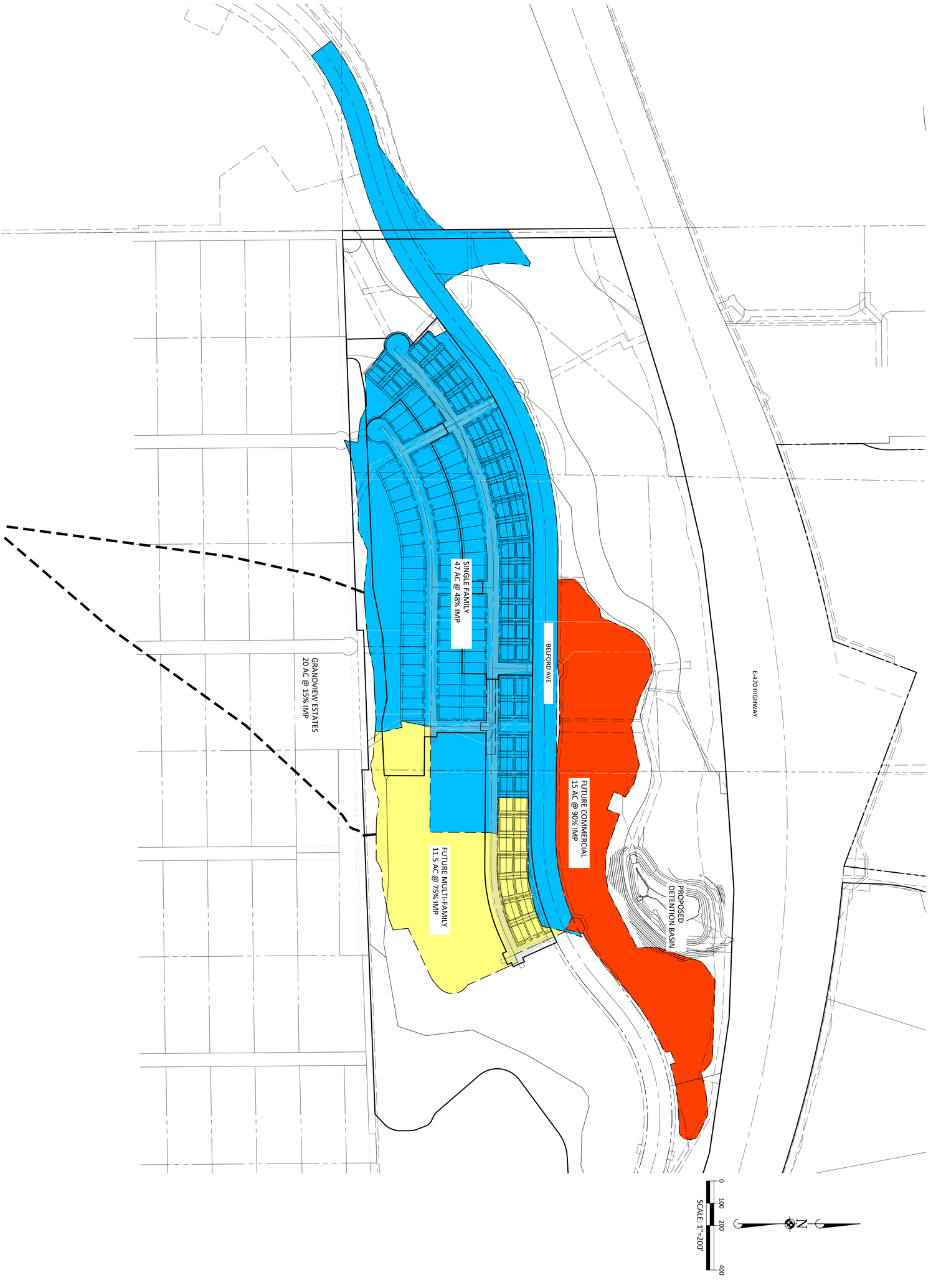
SHEET 1 OF 1

CLCPKC3

DRAINAGE MAP

Plotted: 3/18/2021 9:33 AM Dwg Name: P:\Clcpkc3\ComSouth09 - Belford Ave East\Documents\Engineering\Storm\Water Reports\Drainage Exhibits\Pre-Residential\Drainage Basins.dwg Updated By: ADrucker

Plotted: 5/6/2020 10:35 AM Dwg Name: P:\Clcpkc3\ComSouth12-Filing 1 No GAT\ComSouth03-Ultimate Belford Ave\Documents\Engineering\StormWater Reports\Drainage Exhibits\Drainage Areas to Det Basin.dwg, Updated By: ADrucker



SHEET 1 OF 1
CLCPKC3

DATE: 3-2-20
DRAWN BY: ASD
PROJ. MGR.: JE
PROJ. ANDOC.: GTI

COMPARK VILLAGE SOUTH FILING NO. 1

TOWN OF PARKER, CO

CONTRIBUTORY DRAINAGE AREAS TO DET BASIN EXHIBIT

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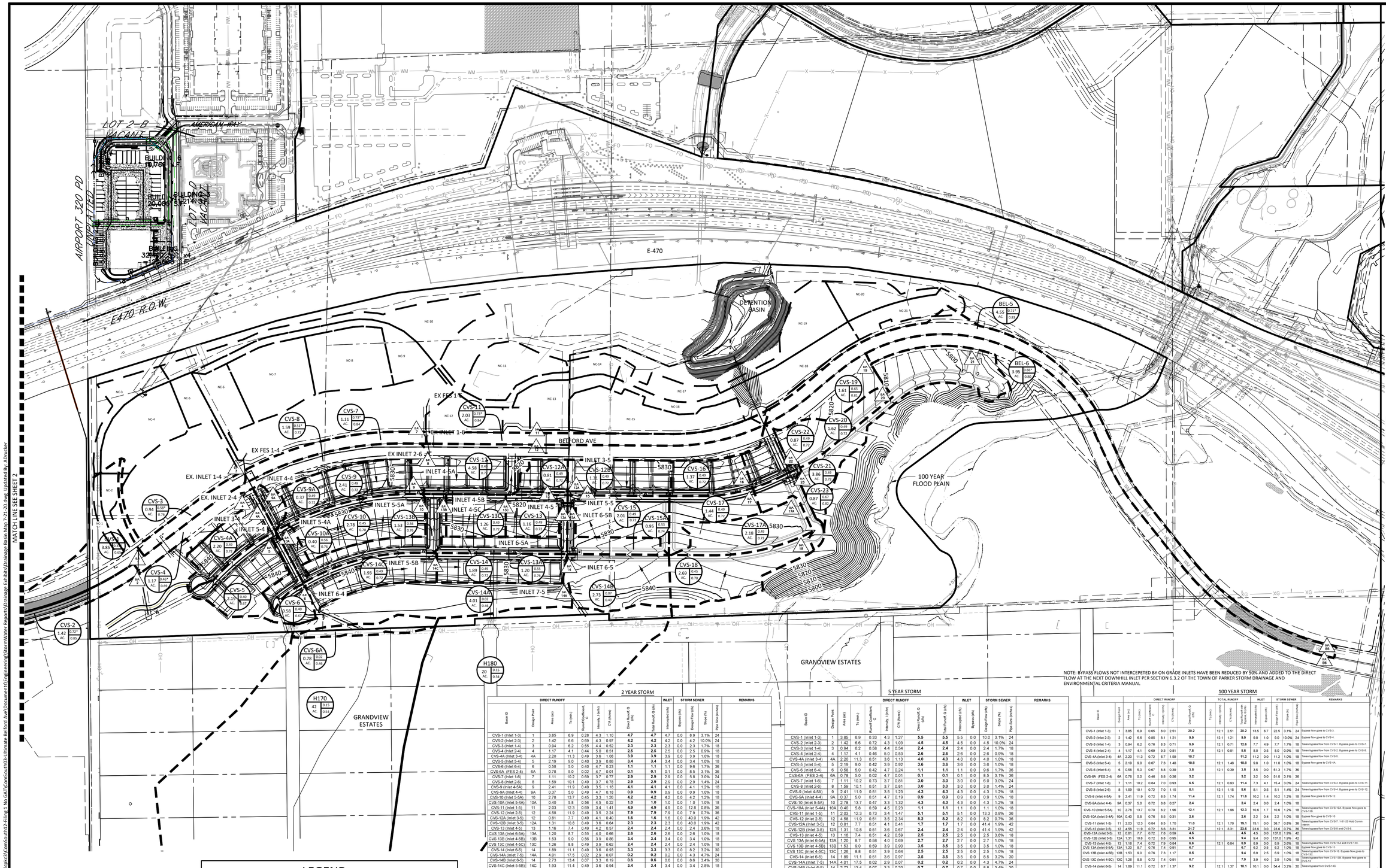

LEGEND

- SUB-BASIN #
- 2/5-YEAR RUNOFF COEFFICIENT (*DENOTES 5-YEAR RUNOFF)
- 100-YEAR RUNOFF COEFFICIENT
- AREA (ACRES)
- PROPOSED SUB-BASIN BOUNDARY

MATCH LINE SEE SHEET 2

2 YEAR STORM

DIRECT RUNOFF								INLET	STORM SEWER			REMARKS
Basin ID	Design Point	Area (ac)	T_c (min.)	Runoff Coefficient	Intensity, I (in/hr)	CrA (Acres)	Direct Runoff, Q (cfs)	Total Runoff, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.28	4.3	1.10	**4.7**	**4.7**	0.0	8.9	3.1%	24		
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.69	4.3	0.97	**4.2**	**4.2**	4.2	0.0	4.2	10.0%	24	
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.55	4.4	0.52	**2.3**	**2.3**	0.0	2.3	1.7%	18		
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.44	5.0	0.51	**2.5**	**2.5**	2.5	0.0	2.5	0.9%	18	
CVS-4A (Inlet 3-4)	4A	2.20	11.3	0.49	3.6	1.08	**3.9**	**3.9**	3.9	0.0	3.9	1.0%	18	
CVS-5 (Inlet 5-4)	5	2.19	9.0	0.40	3.9	0.88	**3.4**	**3.4**	3.4	0.0	3.4	1.0%	18	
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.40	4.7	0.23	**1.1**	**1.1**	1.1	0.0	9.6	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.02	4.7	0.01	**0.1**	**0.1**	0.1	0.0	8.5	3.1%	36	
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.69	3.7	0.77	**2.9**	**2.9**	2.9	0.0	5.8	3.0%	24	
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.49	3.7	0.78	**2.9**	**2.9**	2.9	0.0	2.9	1.4%	24	
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.49	3.5	1.18	**4.1**	**4.1**	4.1	0.0	4.1	1.2%	18	
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.49	4.7	0.18	**0.9**	**0.9**	0.9	0.0	0.9	1.0%	18	
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.45	3.3	1.26	**4.2**	**4.2**	4.2	0.0	4.2	1.2%	18	
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.56	4.5	0.22	**1.0**	**1.0**	1.0	0.0	1.0	1.0%	18	
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.69	3.4	1.41	**4.9**	**4.9**	4.9	0.0	12.8	0.8%	36	
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.49	3.5	2.24	**7.9**	**7.9**	7.9	0.0	7.9	0.7%	36	
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.49	4.1	0.40	**1.6**	**1.6**	1.6	0.0	40.0	1.9%	42	
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.49	3.6	0.64	**2.3**	**2.3**	2.3	0.0	40.0	1.9%	42	
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.49	4.2	0.57	**2.4**	**2.4**	2.4	0.0	2.4	3.6%	18	
CVS-13A (Inlet 6-5A)	13A	1.20	8.7	0.55	4.0	0.66	**2.6**	**2.6**	2.6	0.0	2.6	1.0%	18	
CVS-13B (Inlet 4-5B)	13B	1.53	9.0	0.56	3.9	0.86	**3.4**	**3.4**	3.4	0.0	3.4	1.0%	18	
CVS-13C (Inlet 4-5C)	13C	1.26	8.8	0.49	3.9	0.62	**2.4**	**2.4**	2.4	0.0	2.4	1.0%	18	
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.49	3.6	0.93	**3.3**	**3.3**	3.3	0.0	8.2	3.2%	30	
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.02	2.9	0.07	**0.2**	**0.2**	0.2	0.0	4.3	4.7%	24	
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.07	3.3	0.19	**0.6**	**0.6**	0.6	0.0	8.6	3.4%	30	
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.49	3.6	0.94	**3.4**	**3.4**	3.4	0.0	3.4	2.8%	18	
CVS-15 (Inlet 5-5)	15	2.05	13.4	0.49	3.3	1.00	**3.3**	**3.3**	3.3	0.0	3.3	1.0%	18	
CVS-15A (Inlet 6-5B)	15A	0.95	7.9	0.53	4.1	0.50	**2.0**	**2.0**	2.0	0.0	2.0	1.0%	18	
CVS-16 (Inlet 2-11A)	16	1.37	10.0	0.49	3.8	0.67	**2.5**	**2.5**	6.4	0.0	2.5	5.2%	18	
CVS-17 (Inlet 2-11)	17	1.44	8.4	0.49	4.0	0.70	**1.9**	**1.9**	6.8	0.0	1.9	5.2%	18	
CVS-17A	17A	2.18	13.6	0.49	3.3	1.07	**3.5**	**3.5**	-	-	-	-	-	
CVS-18	18	2.69	10.0	0.45	3.8	1.20	**4.5**	**4.5**	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.65	4.5	1.05	**4.7**	**4.7**	-	-	-	-	-	
CVS-20	20	1.80	10.4	0.49	3.7	0.88	**3.3**	**3.3**	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.51	3.1	1.98	**5.8**	**5.8**	-	-	-	-	-	
CVS-22 (Inlet 2-10A)	22	0.87	6.2	0.51	4.4	0.43	**1.9**	**1.9**	5.6	0.0	1.9	1.0%	18	
CVS-23 (Inlet 2-10)	23	0.87	5.5	0.67	4.6	0.58	**2.7**	**2.7**	7.1	0.0	2.7	1.0%	18	
BEL-1 (Inlet 2-1)	B1	3.73	12.8	0.30	3.4	1.13	**3.8**	**3.8**	3.8	0.0	5.9	3.3%	36	
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.69	4.2	0.95	**3.9**	**3.9**	3.9	0.0	8.4	0.9%	36	
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.19	3.2	1.26	**4.1**	**4.1**	4.1	0.0	6.6	3.2%	36	
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.69	4.1	1.21	**5.0**	**5.0**	5.0	0.0	11.6	2.9%	36	
BEL-5	B5	4.55	11.0	0.68	3.6	3.08	**11.1**	**11.1**	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.63	4.2	2.50	**10.5**	**10.5**	-	-	-	-	-	

5 YEAR STORM

DIRECT RUNOFF								INLET	STORM SEWER			REMARKS
Basin ID	Design Point	Area (ac)	T_c (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	CrA (Acres)	Direct Runoff, Q (cfs)	Total Runoff, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.33	4.3	1.27	**5.5**	**5.5**	0.0	10.0	3.1%	24		
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.72	4.3	1.03	**4.5**	**4.5**	4.5	0.0	10.0%	24		
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.58	4.4	0.54	**2.4**	**2.4**	0.0	2.4	1.7%	18		
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.46	5.0	0.53	**2.6**	**2.6**	2.6	0.0	0.9%	18		
CVS-4A (Inlet 3-4)	4A	2.20	11.3	0.51	3.6	1.13	**4.0**	**4.0**	4.0	0.0	1.0%	18		
CVS-5 (Inlet 5-4)	5	2.19	9.0	0.42	3.9	0.92	**3.6**	**3.6**	3.6	0.0	1.0%	18		
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.42	4.7	0.24	**1.1**	**1.1**	1.1	0.0	9.6	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.02	4.7	0.01	**0.1**	**0.1**	0.1	0.0	8.5	3.1%	36	
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.73	3.7	0.81	**3.0**	**3.0**	3.0	0.0	6.0	3.0%	24	
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.51	3.7	0.81	**3.0**	**3.0**	3.0	0.0	3.0	1.4%	24	
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.51	3.5	1.23	**4.3**	**4.3**	4.3	0.0	4.3	1.2%	18	
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.51	4.7	0.19	**0.9**	**0.9**	0.9	0.0	0.9	1.0%	18	
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.47	3.3	1.32	**4.3**	**4.3**	4.3	0.0	4.3	1.2%	18	
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.59	4.5	0.23	**1.1**	**1.1**	1.1	0.0	1.1	1.0%	18	
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.73	3.4	1.47	**5.1**	**5.1**	5.1	0.0	13.3	0.8%	36	
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.51	3.5	2.34	**8.2**	**8.2**	8.2	0.0	8.2	0.7%	36	
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.51	4.1	0.41	**1.7**	**1.7**	1.7	0.0	41.4	1.9%	42	
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.51	3.6	0.67	**2.4**	**2.4**	2.4	0.0	41.4	1.9%	42	
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.51	4.2	0.59	**2.5**	**2.5**	2.5	0.0	2.5	3.6%	18	
CVS-13A (Inlet 6-5A)	13A	1.20	8.7	0.58	4.0	0.69	**2.7**	**2.7**	2.7	0.0	2.7	1.0%	18	
CVS-13B (Inlet 4-5B)	13B	1.53	9.0	0.59	3.9	0.90	**3.5**	**3.5**	3.5	0.0	3.5	1.0%	18	
CVS-13C (Inlet 4-5C)	13C	1.26	8.8	0.51	3.9	0.64	**2.5**	**2.5**	2.5	0.0	2.5	1.0%	18	
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.51	3.6	0.97	**3.5**	**3.5**	3.5	0.0	8.5	3.2%	30	
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.02	2.9	0.07	**0.2**	**0.2**	0.2	0.0	4.3	4.7%	24	
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.07	3.3	0.19	**0.6**	**0.6**	0.6	0.0	8.8	3.4%	30	
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.49	3.6	0.94	**3.4**	**3.4**	3.4	0.0	3.4	2.8%	18	
CVS-15 (Inlet 5-5)	15	2.01	13.4	0.51	3.3	1.03	**3.4**	**3.4**	3.4	0.0	3.4	5.0%	18	
CVS-15A (Inlet 6-5B)	15A	0.95	7.9	0.55	4.1	0.52	**2.1**	**2.1**	2.1	0.0	2.1	1.0%	18	
CVS-16 (Inlet 2-11A)	16	1.37	10.0	0.51	3.8	0.70	**2.6**	**2.6**	6.4	0.0	2.6	5.2%	18	
CVS-17 (Inlet 2-11)	17	1.44	8.4	0.51	4.0	0.74	**3.0**	**3.0**	6.8	0.0	3.0	5.2%	18	
CVS-17A	17A	2.18	13.6	0.51	3.3	1.11	**3.7**	**3.7**	-	-	-	-	-	
CVS-18	18	2.69	10.0	0.47	3.8	1.25	**4.7**	**4.7**	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.68	4.5	1.09	**4.9**	**4.9**	-	-	-	-	-	
CVS-20	20	1.80	10.4	0.51	3.7	0.92	**3.4**	**3.4**	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.51	3.1	1.98	**6.1**	**6.1**	-	-	-	-	-	
CVS-22 (2-10A)	22	0.87	6.2	0.51	4.4	0.45	**2.0**	**2.0**	5.6	0.0	2.0	1.0%	18	
CVS-23 (Inlet 2-10)	23	0.87	5.5	0.70	4.6	0.61	**2.8**	**2.8**	7.1	0.0	2.8	1.0%	18	
BEL-1 (Inlet 2-1)	B1	3.73	12.8	0.32	3.4	1.18	**4.0**	**4.0**	4.0	0.0	6.1	3.3%	36	
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.72	4.2	0.99	**4.1**	**4.1**	4.1	0.0	8.8	0.9%	36	
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.20	3.2	1.32	**4.2**	**4.2**	4.2	0.0	6.9	3.2%	36	
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.72	4.1	1.27	**5.2**	**5.2**	5.2	0.0	12.1	2.9%	36	
BEL-5	B5	4.55	11.0	0.71	3.6	3.22	**11.6**	**11.6**	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.66	4.2	2.61	**10.9**	**10.9**	-	-	-	-	-	

100 YEAR STORM

DIRECT RUNOFF								TOTAL RUNOFF			INLET	STORM SEWER			REMARKS
Basin ID	Design Point	Area (ac)	T_c (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	CrA (Acres)	Direct Runoff, Q (cfs)	T_c (min.)	Intensity, I (in/hr)	CrA (Acres)	Total Runoff, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.65	8.0	2.51	**20.2**	12.1	2.51	**20.2**	13.5	6.7	22.5	3.1%	24	Bypass flow goes to CVS-3	
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.85	8.1	1.21	**9.9**	12.1	1.21	**9.9**	9.0	1.0	9.0	10.0%	24	Bypass flow goes to CVS-4	
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.76	8.3	0.71	**5.9**	12.1	0.71	**12.6**	7.7	4.9	7.7	1.7%	18	Takes bypass flow from CVS-1. Bypass goes to CVS-7	
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.69	9.3	0.81	**7.5**	12.1	0.81	**8.5**	8.0	0.0	8.0	0.9%	18	Takes bypass flow from CVS-2. Bypass goes to CVS-8.	
CVS-4A (Inlet 3-4)	4A	2.20	11.3	0.72	6.7	1.59	**10.7**			**11.2**	11.2	0.0	11.2	1.0%	18	Takes bypass flow from CVS-5	
CVS-5 (Inlet 5-4)	5	2.19	9.0	0.42	3.9	0.92	**3.6**	12.1	1.48	**10.8**	10.8	0.0	10.8	1.0%	18	Bypass flow goes to CVS-4A	
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.42	4.7	0.24	**1.1**	12.1	0.39	**3.6**	3.5	0.0	51.3	1.7%	36		
CVS-6A (FES 2-4)	6A	0.78	5.0	0.46	8.8	0.36	**3.2**			**3.2**	3.2	0.0	51.0	3.1%	36		
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.84	7.0	0.93	**6.5**	12.1	0.93	**11.4**	7.3	4.1	15.4	3.0%	24	Takes bypass flow from CVS-3. Bypass goes to CVS-11	
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.72	7.0	1.15	**8.1**	12.1	1.15	**8.6**	8.1	0.5	8.1	1.4%	24	Takes bypass flow from CVS-4. Bypass goes to CVS-12	
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.72	6.5	1.74	**11.4**	12.1	1.74	**11.6**	10.2	1.4	10.2	1.2%	18	Bypass flow goes to CVS-12	
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.72	8.8	0.27	**2.4**			**2.4**	2.4	0.0	2.4	1.0%	18		
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.70	6.2	1.96	**12.1**	12.1	1.96	**12.3**	10.6	1.7	10.6	1.2%	18	Takes bypass flow from CVS-10A. Bypass flow goes to CVS-10B	
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.76	8.5	0.31	**2.6**			**2.6**	2.2	0.4	2.2	1.0%	18	Bypass flow goes to CVS-10	
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.84	6.5	1.70	**11.0**	12.1	1.70	**15.1**	15.1	0.0	38.7	0.8%	36	Takes bypass flow from CVS-7. 1-31-20 Add Comm Interim	
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.72	6.6	3.31	**21.7**	12.1	3.31	**23.6**	23.6	0.0	23.6	0.7%	36	Takes bypass flow from CVS-8 and CVS-9	
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.72	7.8	0.59	**4.5**			**4.5**	4.5	0.0	137.0	1.9%	42		
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.72	7.2	0.95	**6.5**			**9.4**	9.4	0.0	137.0	1.9%	42		
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.72	7.9	0.84	**6.6**	12.1	0.84	**8.9**	8.9	0.0	8.9	3.6%	18	Takes bypass flow from CVS-13A and CVS 13C	
CVS 13A (Inlet 6-5A)	13A	1.20	8.7	0.78	7.4	0.91	**6.7**			**6.7**	6.2	0.5	6.2	1.0%	18	Takes bypass flow from CVS-13.	
CVS 13B (Inlet 4-5B)	13B	1.53	9.0	0.76	7.3	1.17	**8.5**			**9.4**	6.9	2.5	6.9	1.0%	18	Takes bypass flow from CVS-10. Bypass flow goes to CVS-13C	
CVS 13C (Inlet 4-5C)	13C	1.26	8.8	0.72	7.4	0.91	**6.7**			**7.9**	3.9	4.0	3.9	1.0%	18	Takes bypass flow from CVS 10B. Bypass flow goes to CVS-13	
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.72	6.7	1.37	**9.2**	12.1	1.37	**10.1**	10.1	0.0	54.4	3.2%	30	Takes bypass from CVS-14C	
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.46	6.5	1.86	**10.2**			**10.2**	10.2	0.0	34.8	4.7%	24		
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.49	6.2	1.35	**8.4**			**9.5**	9.5	0.0	54.4	3.4%	30		
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.72	6.7	1.40	**9.3**			**9.3**	7.5	1.8	7.5	2.8%	18	Takes bypass flow from CVS-14	
CVS-15 (Inlet 5-5)	15	2.01	13.4	0.72	6.2	1.45	**9.0**	12.1	1.45	**9.1**	9.1	0.0	9.1	5.0%	18	Takes bypass flow from CVS-15A	
CVS-15A (Inlet 6-5B)	15A	0.95	7.9	0.74	7.7	0.71	**5.4**			**5.4**	5.3	0.1	5.3	1.0%	18		
CVS-16 (Inlet 2-11A)	16	1.37	10.0	0.72	7.0	0.99	**7.0**			**7.0**	6.4	0.6	6.4	5.2%	18		
CVS-17 (Inlet 2-11)	17	1.44	8.4	0.72	7.7	1.04	**7.8**			**7.8**	6.8	1.0	6.8	5.2%	18		
CVS-17A	17A	2.18	13.6	0.72	6.2	1.58	**9.7**										
CVS-18	18	2.69	10.0	0.70	7.0	1.88	**15.2**	12.1	1.88	-	-	-	-	-	-		
CVS-19	19	1.61	6.0	0.81	8.4	1.31	**11.0**	12.1	1.31	-	-	-	-	-	-		
CVS-20	20	1.80	10.4	0.72	6.9	1.30	**9.0**	12.1	1.30	-	-	-	-	-	-		
CVS-21	21	3.88	16.1	0.72	5.7	2.81	**16.0**	12.1	2.81	-	-	-	-	-	-		
CVS-22 (2-10A)	22	0.87	6.2	0.72	8.3	0.63	**5.2**			**5.2**	5.6	0.2	5.6	1.0%	18	Takes bypass flow from CVS-16	
CVS-23 (Inlet 2-10)	23	0.87	5.5	0.82	8.6	0.71	**6.1**			**6.1**	7.1	0.5	6.1	1.0%	18	Takes bypass flow from CVS-17	
BEL-1 (Inlet 2-1)	B1	3.73	12.8	0.62	6.3	2.31	**14.7**			**14.7**	8.3	6.4	63.6	3.3%	36	Bypass flow goes to BEL-3	
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.83	7.8	1.15	**8.9**			**8.9**	6.5	2.4	69.5	0.9%	36	Bypass flow goes to BEL-4	
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.56	5.9	3.76	**22.3**			**29.0**	29.0	0.0	95.6	3.2%	36	Takes bypass from BEL-1	
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.84	7.7	1.46	**11.2**			**13.6**	13.6	0.0	110.8	2.9%	36	Takes bypass from BEL-2	
BEL-5	B5	4.55	11.0	0.83	6.8	3.76	**25.5**	12.1	3.76	-	-	-	-	-	-		
BEL-6	B6	3.95	7.4	0.80	7.9	3.17	**24.9**	12.1	3.17	-	-	-	-	-	-		

REVISIONS	DATE	DRAWN BY
REVISED TO ADD OFF-LINE DET BASIN	07/20/2020	ASD
REVISED PER TOWN COMMENTS	11/21/2016	RAK

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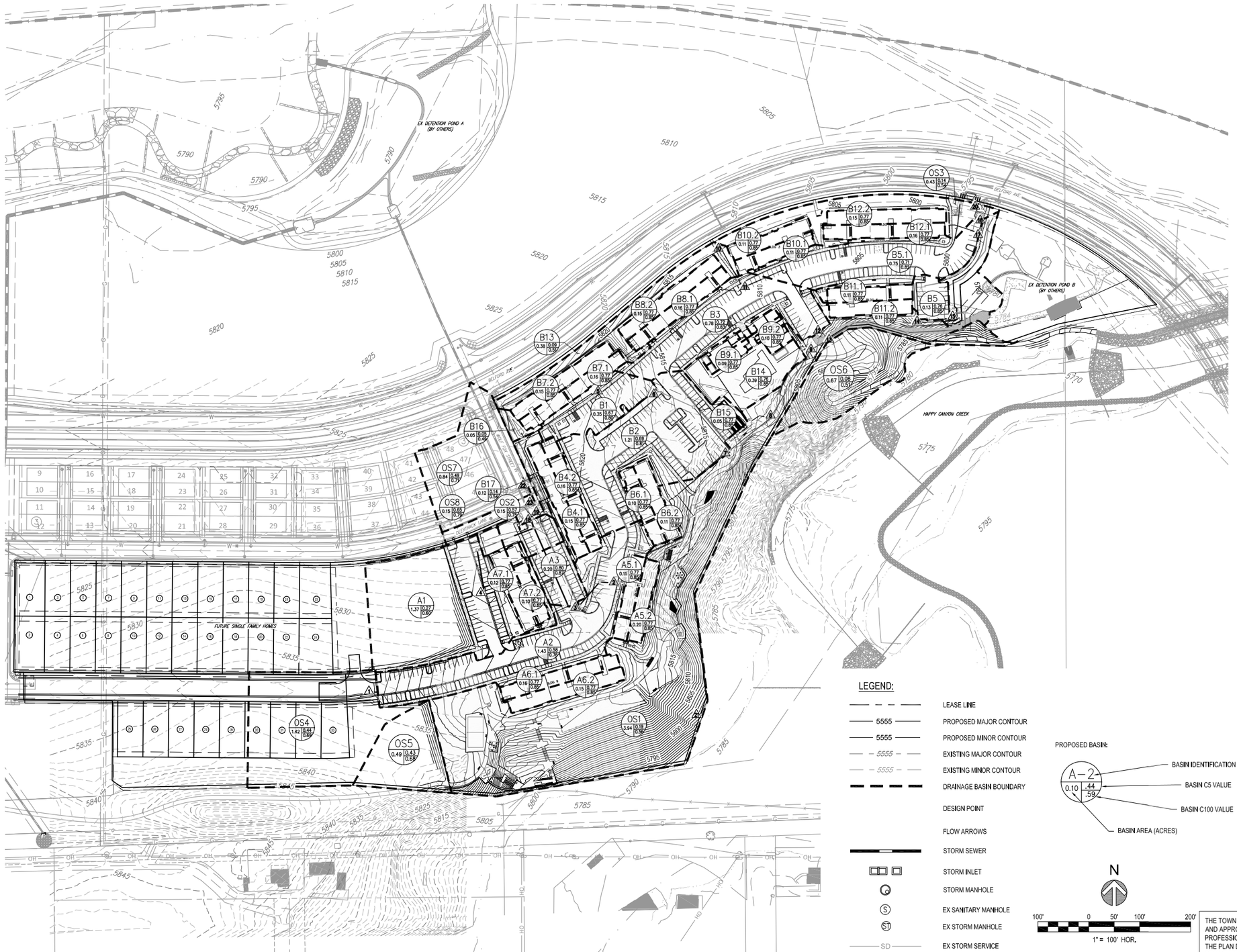
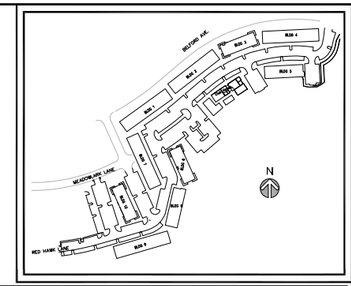
COMPARK VILLAGE SOUTH
TOWN OF PARKER, CO
PROPOSED DRAINAGE AREA MAP

PROJ. MGR.: RLB
PROJ. ASSOC.: ASD
DRAWN BY: RAK
DATE: 6-30-16

SHEET 1 OF 3
CLCPKC3

Plotted: 7/30/2020 4:05 PM By: Dug Nampi: P:\Cptac\3 Com\South\12 Filing 1 No GAT\Com\South\3-Ultimate Belford Ave\Documents\Engineering\Storm\Water Reports\Drainage Exhibits\Drainage Basin Map 7-21-20.dwg Updated By: Abucker





PROPOSED SUB-BASIN PEAK FLOWS

Design Point	Sub-Basins	Area (ac)	5-Yr Peak Flow (cfs)	100-Yr Peak Flow (cfs)
1	OS4	1.42	3.0	4.6
	A6.1	0.16	0.6	0.6
	A6.2	0.15	0.54	0.60
	A5.2	0.11	0.4	0.4
	A5.1	0.11	0.40	0.44
2	A2	1.43	3.9	5.0
2	Σ OS4+A2+A5.1-2+A6.1-2	3.37	8.81	11.71
	A7.2	0.10	0.4	0.4
3	A3	0.20	0.8	0.8
3	Σ A3+A7.2	3.68	9.94	12.92
	A1	1.4	1.8	3.9
	A7.1	0.12	0.4	0.4
4	Σ A1+A7.1	1.49	2.24	4.30
18	Σ A1-3+A5-7+OS4	8.54	20.99	28.93
	A4.1	0.15	0.53	0.58
	A4.2	0.16	0.6	0.6
	B4.1	0.15	0.5	0.6
	B4.2	0.16	0.6	0.6
	B7.1	0.16	0.56	0.61
	B16	0.05	0.01	0.11
	B17	0.12	0.09	0.31
5	Σ A4+B7	0.93	2.85	3.45
6	B1	0.35	1.09	1.30
6	Σ A4+B1+B7	1.28	3.95	4.75
	B6.1	0.10	0.38	0.41
	B6.2	0.11	0.41	0.45
7	B2	1.21	3.9	4.5
7	Σ A4+B1+B2+B7	2.40	7.54	8.95
	B9.1	0.09	0.34	0.37
	B14	0.39	1.4	1.5
	B15	0.05	0.19	0.21
8	Σ A4+B1+E2+B7+B9.1+B14+B15	2.94	9.45	11.07
	B9.2	0.10	0.4	0.4
9	Σ A4+B1+E2+B7.1+B9+B14+B15	3.04	9.82	11.47
	B7.2	0.15	0.54	0.60
	B8.2	0.15	0.54	0.59
	B13	0.38	0.17	0.92
	B10.2	0.11	0.39	0.43
10	Σ B7.2+B8.2+B10.2+B13	0.79	1.64	2.54
	B8.1	0.16	0.57	0.63
	B10.1	0.11	0.39	0.43
11	Σ B7.2+B8+B13	1.06	2.60	3.60
12	B3	0.78	2.6	3.0
12	Σ B3+B7.2+B8+B13	1.84	5.24	6.60
13	Σ A4+B1+B2+B3+B7+B9+B14+B15	4.88	15.06	18.07
	B11.1	0.11	0.4	0.4
	B11.2	0.11	0.4	0.4
14	Σ A4+B1+B2+B3+B7+B9+B11+B14+B15	5.10	15.86	18.94
15	B5	0.13	0.5	0.5
15	Σ A4+B1+B2+B3+B5+B7+B9+B11+B14+B1	5.23	16.32	19.46
16	B5.1	0.75	2.5	2.9
	B12.1	0.16	0.6	0.6
	B12.2	0.15	0.5	0.6
17	Σ B4+B12	1.06	3.61	4.08
19	OS2	0.15	0.41	0.5
20	OS3	0.43	0.30	1.1
	OS5	0.49	0.12	1.1
	OS1	1.42	3.00	4.6
	OS6	0.67	2.64	2.8
21	Σ OS1 + OS5	2.57	5.76	8.48
22	OS-7*	0.84	1.71	2.7
23	OS-8*	0.15	0.04	0.4
23	Σ OS-8 + DP19	0.30	0.45	0.89

LEGEND:

- LEASE LINE
- 5555 PROPOSED MAJOR CONTOUR
- 5555 PROPOSED MINOR CONTOUR
- 5555 EXISTING MAJOR CONTOUR
- 5555 EXISTING MINOR CONTOUR
- DRAINAGE BASIN BOUNDARY
- DESIGN POINT
- FLOW ARROWS
- STORM SEWER
- STORM INLET
- STORM MANHOLE
- EX SANITARY MANHOLE
- EX STORM MANHOLE
- SD EX STORM SERVICE
- EX STORM INLET

PROPOSED BASIN:

N

100' 0 50' 100' 200'

1" = 100' HOR.

THE TOWN OF PARKER REVIEW CONSTITUTES GENERAL COMPLIANCE WITH THE TOWN'S STANDARDS AND APPROVED VARIANCES, SUBJECT TO THESE PLANS BEING STAMPED, SIGNED, AND DATED BY THE PROFESSIONAL ENGINEER OF RECORD. REVIEW BY THE TOWN DOES NOT CONSTITUTE APPROVAL OF THE PLAN DESIGN OR ACCURACY AND CORRECTNESS OF ENGINEERING CALCULATIONS. ERRORS IN THE DESIGN OR CALCULATIONS REMAIN THE RESPONSIBILITY OF THE REGISTERED PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE ARE AFFIXED TO THIS DOCUMENT.

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CENTURY — LIVING —

REV	REVISION DESCRIPTION	DATE	CHK'D	CHK'D	APPR

TITLE
COMPARK VILLAGE SOUTH
PRIVATE IMPROVEMENT CONSTRUCTION PLANS
DRAINAGE MAP

PE STAMP

ISSUED FOR REVIEW

AS NOTED IN SCHEDULE OF ISSUED DOCUMENTS

JOB NUMBER 65120950
DATE 5/12/2022
SHEET 1 OF 1
1

National Flood Hazard Layer FIRMette

FEMA

104°49'30"W 39°33'23"N

104°48'53"W 39°32'55"N

Feet

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

1:6,000

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

Legend

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

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

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

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

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

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

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

N

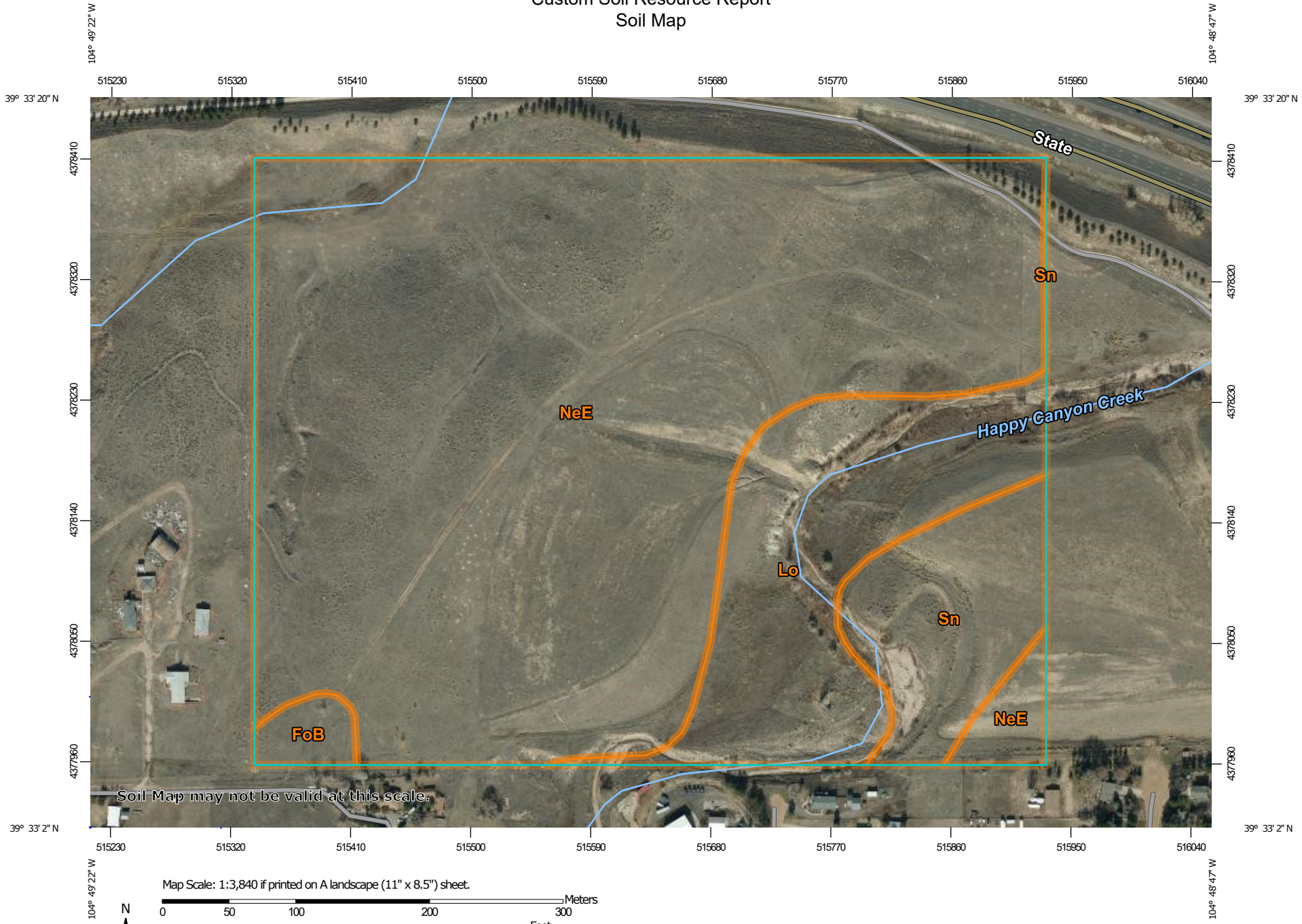
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/18/2021 at 4:19 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Custom Soil Resource Report
Soil Map



Map Scale: 1:3,840 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 13, Jun 5, 2020

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

Date(s) aerial images were photographed: Oct 3, 2018—Dec 4, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FoB	Fondis clay loam, 1 to 3 percent slopes	0.8	1.3%
Lo	Loamy alluvial land	10.6	15.9%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	49.9	74.8%
Sn	Satanta loam	5.4	8.0%
Totals for Area of Interest		**66.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Castle Rock Area, Colorado

FoB—Fondis clay loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: jqyn
Elevation: 5,500 to 6,800 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Fondis and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fondis

Setting

Landform: Buttes, hills, ridges, mesas
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits over sedimentary rock coarse-silty outwash derived from arkose

Typical profile

H1 - 0 to 7 inches: clay loam
H2 - 7 to 24 inches: clay
H3 - 24 to 60 inches: sandy clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Ecological site: R049XY208CO - Clayey Foothill DRAFT (1-2018) MLRA 49
Hydric soil rating: No

Minor Components

Kutch
Percent of map unit: 7 percent
Hydric soil rating: No

Buick
Percent of map unit: 6 percent
Hydric soil rating: No

Satanta
Percent of map unit: 6 percent
Hydric soil rating: No

Aquic haplustolls
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Lo—Loamy alluvial land

Map Unit Setting
National map unit symbol: jqzb
Elevation: 7,000 to 8,000 feet
Mean annual precipitation: 17 to 19 inches
Mean annual air temperature: 44 to 46 degrees F
Frost-free period: 115 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition
Loamy alluvial land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loamy Alluvial Land

Setting
Landform: Flood plains, swales
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile
H1 - 0 to 20 inches: sandy loam
H2 - 20 to 40 inches: stratified loamy sand to clay loam
H3 - 40 to 60 inches: sand and gravel

Properties and qualities
Slope: 1 to 5 percent
Drainage class: Well drained
Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: FrequentNone
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: R049XY036CO - Overflow
Hydric soil rating: No

Minor Components

Bresser
Percent of map unit: 7 percent
Hydric soil rating: No

Sampson
Percent of map unit: 7 percent
Hydric soil rating: No

Sandy alluvial land
Percent of map unit: 5 percent

Fluvaquentic haplustolls
Percent of map unit: 1 percent
Landform: Terraces
Hydric soil rating: Yes

NeE—Newlin gravelly sandy loam, 8 to 30 percent slopes

Map Unit Setting
National map unit symbol: jqzg
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 49 to 51 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition
Newlin and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Newlin

Setting
Landform: Terraces, mesas, plateaus

Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Unconformable sandy and gravelly and/or mixed source alluvium

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 17 inches: gravelly sandy clay loam
H3 - 17 to 22 inches: gravelly sandy loam
H4 - 22 to 60 inches: very gravelly sand

Properties and qualities

Slope: 8 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB215CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Bresser

Percent of map unit: 5 percent
Hydric soil rating: No

Satanta

Percent of map unit: 4 percent
Hydric soil rating: No

Stapleton

Percent of map unit: 4 percent
Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 2 percent
Landform: Swales
Hydric soil rating: Yes

Sn—Satanta loam

Map Unit Setting

National map unit symbol: jr05
Elevation: 5,400 to 6,200 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Satanta and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Satanta

Setting

Landform: Terraces, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed source eolian deposits

Typical profile

H1 - 0 to 9 inches: loam
H2 - 9 to 30 inches: clay loam
H3 - 30 to 60 inches: loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R049XC202CO - Loamy Foothill 14-19 P.Z.
Hydric soil rating: No

Minor Components

Fondis

Percent of map unit: 5 percent
Hydric soil rating: No

Sampson

Percent of map unit: 5 percent
Hydric soil rating: No

Englewood

Percent of map unit: 2 percent
Hydric soil rating: No

Buick

Percent of map unit: 2 percent
Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Appendix B: Hydrologic Computations

MERRICK & COMPANY

Developed Composite C-Factor and Impervious Analysis

Compark Village South

Calculated by: KB
Checked by: KW
Date: 7/27/2020

UDFCD - TABLE 6-4, SOIL GROUP C/D

Basin	Land Use	Area (acres)	I value	C5	C10	C100
A-1	PROPOSED LANDSCAPE	0.98	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.10	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.29	1.00	0.86	0.87	0.89
		1.37	**0.29**	**0.27**	**0.35**	**0.60**
A-2	PROPOSED LANDSCAPE	0.47	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.17	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.79	1.00	0.86	0.87	0.89
		1.43	**0.67**	**0.58**	**0.62**	**0.76**
A-3	PROPOSED LANDSCAPE	0.01	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.03	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.16	1.00	0.86	0.87	0.89
		0.20	**0.93**	**0.80**	**0.82**	**0.87**
B-4.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.15	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.15	**0.90**	**0.77**	**0.80**	**0.85**
B-4.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.16	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.16	**0.90**	**0.77**	**0.80**	**0.85**
A-5.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.11	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.11	**0.90**	**0.77**	**0.80**	**0.85**
A-5.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.11	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.11	**0.90**	**0.77**	**0.80**	**0.85**
A-6.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.16	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.16	**0.90**	**0.77**	**0.80**	**0.85**
A-6.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.15	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.15	**0.90**	**0.77**	**0.80**	**0.85**
A-7.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.12	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.12	**0.90**	**0.77**	**0.80**	**0.85**
A-7.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.10	0.90	0.77	0.80	0.85

MERRICK & COMPANY

Developed Composite C-Factor and Impervious Analysis

Compark Village South

Calculated by: KB
Checked by: KW
Date: 7/27/2020

		UDFCD - TABLE 6-4, SOIL GROUP C/D				
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.10	**0.90**	**0.77**	**0.80**	**0.85**
B-1	PROPOSED LANDSCAPE	0.08	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.04	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.23	1.00	0.86	0.87	0.89
		0.35	**0.77**	**0.67**	**0.70**	**0.80**
B-2	PROPOSED LANDSCAPE	0.24	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.09	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.87	1.00	0.86	0.87	0.89
		1.21	**0.80**	**0.69**	**0.72**	**0.81**
B-3	PROPOSED LANDSCAPE	0.12	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.11	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.55	1.00	0.86	0.87	0.89
		0.78	**0.84**	**0.72**	**0.75**	**0.83**
B-5.1	PROPOSED LANDSCAPE	0.12	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.10	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.53	1.00	0.86	0.87	0.89
		0.75	**0.83**	**0.71**	**0.74**	**0.82**
B-5	PROPOSED LANDSCAPE	0.01	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.11	1.00	0.86	0.87	0.89
		0.13	**0.89**	**0.76**	**0.79**	**0.85**
B-6.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.10	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.10	**0.90**	**0.77**	**0.80**	**0.85**
B-6.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.11	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.11	**0.90**	**0.77**	**0.80**	**0.85**
B-7.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.16	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.16	**0.90**	**0.77**	**0.80**	**0.85**
B-7.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.15	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.15	**0.90**	**0.77**	**0.80**	**0.85**
B-8.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.16	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.16	**0.90**	**0.77**	**0.80**	**0.85**
B-8.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49

MERRICK & COMPANY

Developed Composite C-Factor and Impervious Analysis

Compark Village South

Calculated by: KB
Checked by: KW
Date: 7/27/2020

			UDFCD - TABLE 6-4, SOIL GROUP C/D			
	PROPOSED BUILDING AND WALKS	0.15	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.15	**0.90**	**0.77**	**0.80**	**0.85**
B-9.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.09	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.09	**0.90**	**0.77**	**0.80**	**0.85**
B-9.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.10	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.10	**0.90**	**0.77**	**0.80**	**0.85**
B-10.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.11	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.11	**0.90**	**0.77**	**0.80**	**0.85**
B-10.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.11	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.11	**0.90**	**0.77**	**0.80**	**0.85**
B-11.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.11	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.11	**0.90**	**0.77**	**0.80**	**0.85**
B-11.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.11	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.11	**0.90**	**0.77**	**0.80**	**0.85**
B-12.1	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.16	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.16	**0.90**	**0.77**	**0.80**	**0.85**
B-12.2	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.15	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.15	**0.90**	**0.77**	**0.80**	**0.85**
B-13	PROPOSED LANDSCAPE	0.36	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.02	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.38	**0.07**	**0.09**	**0.18**	**0.51**
B-14	PROPOSED LANDSCAPE	0.01	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.38	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.39	**0.88**	**0.76**	**0.78**	**0.85**

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MERRICK & COMPANY

Developed Composite C-Factor and Impervious Analysis

Compark Village South

Calculated by: KB
Checked by: KW
Date: 7/27/2020

UDFCD - TABLE 6-4, SOIL GROUP C/D

B-15	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.05	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.05	**0.90**	**0.77**	**0.80**	**0.85**
B-16	PROPOSED LANDSCAPE	0.05	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.05	**0.02**	**0.05**	**0.15**	**0.49**
B-17	PROPOSED LANDSCAPE	0.11	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.02	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.12	**0.13**	**0.14**	**0.23**	**0.54**
OS-1	PROPOSED LANDSCAPE	3.20	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.74	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		3.94	**0.18**	**0.19**	**0.27**	**0.56**
OS-2	PROPOSED LANDSCAPE	0.05	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.02	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.08	1.00	0.86	0.87	0.89
		0.15	**0.65**	**0.57**	**0.61**	**0.75**
OS-3	PROPOSED LANDSCAPE	0.37	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.02	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.03	1.00	0.86	0.87	0.89
		0.43	**0.13**	**0.14**	**0.23**	**0.54**
OS-4	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.12	1.00	0.86	0.87	0.89
	SINGLE FAMILY LOT	1.31	0.45	0.40	0.47	0.67
		1.42	**0.49**	**0.44**	**0.50**	**0.69**
OS-5	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.03	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
	SINGLE FAMILY LOT	0.46	0.45	0.40	0.47	0.67
		0.49	**0.48**	**0.43**	**0.49**	**0.68**
OS-6	PROPOSED LANDSCAPE	0.64	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.03	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
	SINGLE FAMILY LOT	0.00	0.45	0.40	0.47	0.67
		0.67	**0.06**	**0.08**	**0.18**	**0.51**
OS-7*	CVS F2 Final Drainage Report - Basin CVS 22	0.84	0.55	0.49	0.54	0.71
		0.84	**0.55**	**0.49**	**0.54**	**0.71**
OS-8*	CVS F2 Final Drainage Report - Basin CVS 23	0.15	0.75	0.65	0.69	0.79
		0.15	**0.75**	**0.65**	**0.69**	**0.79**

MERRICK & COMPANY

Developed Composite C-Factor and Impervious Analysis

Compark Village South

Calculated by: KB
Checked by: KW
Date: 7/27/2020

		UDFCD - TABLE 6-4, SOIL GROUP C/D				
A Total	PROPOSED LANDSCAPE	1.46	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	1.05	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	1.24	1.00	0.86	0.87	0.89
		3.75	**0.59**	**0.52**	**0.57**	**0.73**
B Total	PROPOSED LANDSCAPE	1.09	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	2.89	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	2.30	1.00	0.86	0.87	0.89
		6.29	**0.78**	**0.68**	**0.71**	**0.81**
OS Total	PROPOSED LANDSCAPE	4.52	0.02	0.05	0.15	0.49
Excludes OS4+5+6+7	PROPOSED BUILDING AND WALKS	0.00	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.43	1.00	0.86	0.87	0.89
		4.94	**0.10**	**0.12**	**0.21**	**0.53**
TOTAL		**14.98**				
TOTAL	**INCLUDES OS4+5+6**	**17.55**				

***Basins OS-7 & OS-8 are based on the CVS F2 Final Drainage Report completed by Manhard Consulting July 2020, these basins have been modified to account for the vacation of the driveway east at the intersection of Deertrack Lane & Wolf Fox Street as well as the proposed development**

MERRICK & COMPANY

STANDARD FORM SF-2
TIME OF CONCENTRATION

5/20/2022

CALCULATED BY: *KB* PROJECT: Compark Village South JOB NO: 65119686
CHECKED BY: *KW* BASIN: LOCATION: Town of Parker, CO

SUB-BASIN DATA				INITIAL/OVERLAND TIME (Tc)			TRAVEL TIME Gutter (Tt)						Tc CHECK (Urbanized Basins)			FINAL Tc	CONVEYANCE REMARKS
DESIGNATION	AREA (acres)	IMPERVIOUS %	C_5	LENGTH (ft)	SLOPE (%)	Ti (min)	LENGTH (ft)	AVG. SLOPE ΔY	(%)	Conv. Type*	VEL (fps)	Tt (min)	COMP Tc (min)	TOTAL LENGTH (ft)	Tc=(26-17i)+L/(60*(14i+9)*sqrt(S)) (min)	(min)**	
A-1	1.37	29%	0.27	175	4.3	12.2	50	1.5	3.0	6	3.5	0.2	12.5	225	21.3	**12.5**	
A-2	1.43	67%	0.58	25	3.5	3.1	450	1.2	0.3	6	1.0	7.3	10.4	475	15.1	**10.4**	
A-3	0.20	93%	0.80	40	2.4	2.6	80	1.5	1.9	6	2.7	0.5	3.1	120	10.2	**5.0**	
B-4.1	0.15	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-4.2	0.16	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
A-5.1	0.11	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
A-5.2	0.11	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
A-6.1	0.16	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
A-6.2	0.15	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
A-7.1	0.12	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
A-7.2	0.10	90%	0.77	25	100.0	0.6	30	1.0	3.3	3	1.3	0.4	1.0	55	10.7	**5.0**	
B-1	0.35	77%	0.67	60	2.9	4.3	160	2.9	1.8	6	2.7	1.0	5.3	220	13.0	**5.3**	
B-2	1.21	80%	0.69	55	3.5	3.6	350	2.2	0.6	6	1.6	3.7	7.3	405	12.7	**7.3**	
B-3	0.78	84%	0.72	60	3.0	3.7	300	1.7	0.6	6	1.5	3.3	7.0	360	12.0	**7.0**	
B-5.1	0.75	83%	0.71	60	3.4	3.6	350	2.8	0.8	6	1.8	3.3	6.9	410	12.2	**6.9**	
B-5	0.13	89%	0.76	65	2.6	3.6	50	4.0	8.0	6	5.7	0.1	3.7	115	10.9	**5.0**	
B-6.1	0.10	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-6.2	0.11	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-7.1	0.16	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-7.2	0.15	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-8.1	0.16	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-8.2	0.15	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-9.1	0.09	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-9.2	0.10	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-10.1	0.11	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-10.2	0.11	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-11.1	0.11	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-11.2	0.11	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-12.1	0.16	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-12.2	0.15	90%	0.77	25	100.0	0.6	30	1.0	3.3	6	3.7	0.1	0.8	55	10.7	**5.0**	
B-13	0.38	7%	0.09	15	10.0	3.3	80	1.0	1.3	6	2.2	0.6	3.9	95	25.1	**5.0**	
B-14	0.39	88%	0.76	50	1.9	3.5	30	2.0	6.7	6	5.2	0.1	3.6	80	11.0	**5.0**	
B-15	0.05	90%	0.77	15	100.0	0.5	25	1.0	4.0	6	4.0	0.1	0.6	40	10.7	**5.0**	
B-16	0.05	2%	0.05	10	3.0	4.2	25	1.0	4.0	6	4.0	0.1	4.3	35	25.7	**5.0**	
B-17	0.12	13%	0.14	10	3.0	3.8	25	1.0	4.0	6	4.0	0.1	3.9	35	23.8	**5.0**	
OS-1	3.94	18%	0.19	185	18.0	8.6	50	25.0	50.0	6	14.1	0.1	8.7	235	22.9	**8.7**	
OS-2	0.15	65%	0.57	60	2.4	5.6	55	1.5	2.7	6	3.3	0.3	5.9	115	15.1	**5.9**	
OS-3	0.43	13%	0.14	25	16.0	3.5	10	16.0	160.0	6	25.3	0.0	3.5	35	23.8	**5.0**	
OS-4	1.42	49%	0.44	200	4.7	10.1	100	1.0	1.0	6	2.0	0.8	10.9	300	17.9	**10.9**	
OS-5	0.49	48%	0.43	100	4.7	7.3	25	1.0	4.0	3	1.4	0.3	7.6	125	18.0	**7.6**	
OS-6	0.67	6%	0.08	50	4.7	10.0	100	1.0	1.0	3	0.7	2.4	12.4	150	25.2	**12.4**	
OS-7*	0.84	55%	0.49	100	4.7	6.7	100	1.0	1.0	6	2.0	0.8	7.5	200	16.8	**7.5**	
OS-8*	0.15	75%	0.65	15	4.7	1.9	120	1.0	0.8	6	1.8	1.1	3.0	135	13.4	**5.0**	

* Note: Conveyance Coefficients - Type 1-Heavy Meadow, Type 2-Tillage/Field, Type 3-Short Pasture and lawns, Type 4-Nearly Bare Soil, Type 5-Grassed Waterway, Type 6-Paved areas and shallow paved swales. The maximum initial/overland length shall not exceed 300 feet.

** Based on Assumption that Building roofs will take 5 min to fully contribute to storm system

MERRICK & COMPANY

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

CALCULATED BY: KB
DATE: 5/20/2022
CHECKED BY: KW
JOB NO: 65110570
PROJECT: Compark Village South
DESIGN STORM: 5 Year

		DIRECT RUNOFF						TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME		
DESIGN POINT	AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	Tt (min)
	A-1	1.37	0.27	12.45	0.37	4.8	1.8												
	A-2	1.43	0.58	10.36	0.83	4.7	3.9												
	A-3	0.20	0.80	5.00	0.16	4.7	0.8												
	B-4.1	0.15	0.77	5.00	0.11	4.7	0.5												
	B-4.2	0.16	0.77	5.00	0.12	4.7	0.6												
	A-5.1	0.11	0.77	5.00	0.09	4.7	0.4												
	A-5.2	0.11	0.77	5.00	0.08	4.7	0.4												
	A-6.1	0.16	0.77	5.00	0.12	4.7	0.6												
	A-6.2	0.15	0.77	5.00	0.12	4.7	0.5												
	A-7.1	0.12	0.77	5.00	0.09	4.7	0.4												
	A-7.2	0.10	0.77	5.00	0.08	4.7	0.4												
	B-1	0.35	0.67	5.25	0.23	4.7	1.1												
	B-2	1.21	0.69	7.32	0.83	4.7	3.9												
	B-3	0.78	0.72	6.99	0.56	4.7	2.6												
	B-5.1	0.75	0.71	6.88	0.53	4.7	2.5												
	B-5	0.13	0.76	5.00	0.10	4.7	0.5												
	B-6.1	0.10	0.77	5.00	0.08	4.7	0.4												
	B-6.2	0.11	0.77	5.00	0.09	4.7	0.4												
	B-7.1	0.16	0.77	5.00	0.12	4.7	0.6												
	B-7.2	0.15	0.77	5.00	0.12	4.7	0.5												
	B-8.1	0.16	0.77	5.00	0.12	4.7	0.6												
	B-8.2	0.15	0.77	5.00	0.12	4.7	0.5												
	B-9.1	0.09	0.77	5.00	0.07	4.7	0.3												
	B-9.2	0.10	0.77	5.00	0.08	4.7	0.4												
	B-10.1	0.11	0.77	5.00	0.08	4.7	0.4												
	B-10.2	0.11	0.77	5.00	0.08	4.7	0.4												
	B-11.1	0.11	0.77	5.00	0.09	4.7	0.4												
	B-11.2	0.11	0.77	5.00	0.08	4.7	0.4												
	B-12.1	0.16	0.77	5.00	0.12	4.7	0.6												
	B-12.2	0.15	0.77	5.00	0.12	4.7	0.5												
	B-13	0.38	0.09	5.00	0.03	4.9	0.2												
	B-14	0.39	0.76	5.00	0.30	4.7	1.4												
	B-15	0.05	0.77	5.00	0.04	4.7	0.2												
	B-16	0.05	0.05	5.00	0.00	4.9	0.0												
	B-17	0.12	0.14	8.70	0.02	4.9	0.1												
	OS-1	3.94	0.19	5.00	0.73	4.9	3.6												
	OS-2	0.15	0.57	8.70	0.09	4.7	0.4												
	OS-3	0.43	0.14	5.86	0.06	4.9	0.3												
	OS-4	1.42	0.44	5.00	0.63	4.8	3.0												
	OS-5	0.49	0.05	7.59	0.03	4.9	0.1												
	OS-6	0.67	0.86	7.49	0.57	4.6	2.6												
	OS-7*	0.84	0.43	0.00	0.36	4.8	1.7												
	OS-8*	0.15	0.05	0.00	0.01	4.9	0.0												

5-YEAR RAINFALL = 1.39 IN/HR., 100-YEAR RAINFALL = 2.60 IN/HR.
*value known from Master Drainage Report

MERRICK & COMPANY

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

CALCULATED BY: KB
DATE: 5/20/2022
CHECKED BY: KW

JOB NO: 65110570
PROJECT: Compark Village South
DESIGN STORM: 100 Year

		DIRECT RUNOFF						TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME		
DESIGN POINT	AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	Tt (min)
	A-1	1.37	0.60	12.45	0.83	4.7	3.9												
	A-2	1.43	0.76	10.36	1.08	4.7	5.0												
	A-3	0.20	0.87	5.00	0.18	4.6	0.8												
	B-4.1	0.15	0.85	5.00	0.13	4.6	0.6												
	B-4.2	0.16	0.85	5.00	0.13	4.6	0.6												
	A-5.1	0.11	0.85	5.00	0.09	4.6	0.4												
	A-5.2	0.11	0.85	5.00	0.09	4.6	0.4												
	A-6.1	0.16	0.85	5.00	0.13	4.6	0.6												
	A-6.2	0.15	0.85	5.00	0.13	4.6	0.6												
	A-7.1	0.12	0.85	5.00	0.10	4.6	0.5												
	A-7.2	0.10	0.85	5.00	0.09	4.6	0.4												
	B-1	0.35	0.80	5.25	0.28	4.7	1.3												
	B-2	1.21	0.81	7.32	0.98	4.7	4.5												
	B-3	0.78	0.83	6.99	0.65	4.6	3.0												
	B-5.1	0.75	0.82	6.88	0.62	4.6	2.9												
	B-5	0.13	0.85	5.00	0.11	4.6	0.5												
	B-6.1	0.10	0.85	5.00	0.09	4.6	0.4												
	B-6.2	0.11	0.85	5.00	0.10	4.6	0.4												
	B-7.1	0.16	0.85	5.00	0.13	4.6	0.6												
	B-7.2	0.15	0.85	5.00	0.13	4.6	0.6												
	B-8.1	0.16	0.85	5.00	0.14	4.6	0.6												
	B-8.2	0.15	0.85	5.00	0.13	4.6	0.6												
	B-9.1	0.09	0.85	5.00	0.08	4.6	0.4												
	B-9.2	0.10	0.85	5.00	0.09	4.6	0.4												
	B-10.1	0.11	0.85	5.00	0.09	4.6	0.4												
	B-10.2	0.11	0.85	5.00	0.09	4.6	0.4												
	B-11.1	0.11	0.85	5.00	0.09	4.6	0.4												
	B-11.2	0.11	0.85	5.00	0.09	4.6	0.4												
	B-12.1	0.16	0.85	5.00	0.13	4.6	0.6												
	B-12.2	0.15	0.85	5.00	0.13	4.6	0.6												
	B-13	0.38	0.51	5.00	0.19	4.8	0.9												
	B-14	0.39	0.85	5.00	0.33	4.6	1.5												
	B-15	0.05	0.85	5.00	0.05	4.6	0.2												
	B-16	0.05	0.49	5.00	0.02	4.8	0.1												
	B-17	0.12	0.54	8.70	0.07	4.7	0.3												
	OS-1	3.94	0.56	5.00	2.20	4.7	10.4												
	OS-2	0.15	0.75	8.70	0.11	4.7	0.5												
	OS-3	0.43	0.54	5.86	0.23	4.7	1.1												
	OS-4	1.42	0.69	5.00	0.98	4.7	4.6												
	OS-5	0.49	0.49	7.59	0.24	4.8	1.1												
	OS-6	0.67	0.89	7.49	0.60	4.6	2.8												
	OS-7*	0.84	0.68	0.00	0.57	4.7	2.7												
	OS-8*	0.15	0.49	0.00	0.07	4.8	0.4												

5-YEAR RAINFALL = 1.39 IN/HR., 100-YEAR RAINFALL = 2.60 IN/HR.

*value known from Master Drainage Report

Appendix C: Hydraulic Computations

September 3, 2021

StormCAD Analysis Output

COMPARK - 5YR PEAK STORM

Scenario Summary

ID	363
Label	5YR
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	Base Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	Base Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	5YR
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Solver Calculation Options	Base Calculation Options

Gravity Hydraulics

Maximum Network Traversals	5	Structure Loss Mode	Hydraulic Grade
Flow Convergence Test	0.001	Include Conduit Flow Travel Time in Design	True
Flow Profile Method	Backwater Analysis	Save Detailed Headloss Data?	False
Number of Flow Profile Steps	5	Gravity Friction Method	Manning's
Hydraulic Grade Convergence Test	0.00 ft	Use Explicit Depth and Slope Equations?	False
Average Velocity Method	Actual Uniform Flow Velocity	Ignore Pipe Travel Time in Carrier Pipes?	False
Minimum Structure Headloss	0.00 ft	Correct for Partial Area Effects?	False
Governing Upstream Pipe Selection Method	Pipe with Maximum QV		

Inlets

Active Components for Combination Inlets on Grade	Grate and Curb	Neglect Gutter Cross Slope For Side Flow?	False
Active Components for Combination Inlets In Sag	Grate and Curb	Neglect Side Flow?	False

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter
P	30.000

COMPARK - 5YR PEAK STORM

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter
Q	45.000
R	60.000
S	80.000
T	110.000

Pressure Hydraulics			
Liquid Label	Water at 20C (68F)	Pressure Friction Method	Hazen-Williams

Rational Method			
Use Rational Method Frequency Factors	False	Carryover Modeling Method	As CA (Traditional)
Allow Runoff Coefficient to Exceed 1.0?	False		

Headloss (AASHTO)			
Expansion, Ke	0.350	Shaping Adjustment, Cs	0.500
Contraction, Kc	0.250	Non-Piped Flow Adjustment, Cn	1.300

Bend Angle vs. Bend Loss Curve

Bend Angle (degrees)	Bend Loss Coefficient, Kb
0.00	0.000
15.00	0.190
30.00	0.350
45.00	0.470
60.00	0.560
75.00	0.640
90.00	0.700

HEC-22 Energy Losses	
Consider Non-Piped Plunging Flow?	True

HEC-22 Energy Losses (Second Edition)			
Elevations Considered Equal Within	0.50 ft	Half Bench Submerged Factor	0.950
Flat Unsubmerged Factor	1.000	Full Bench Unsubmerged Factor	0.070
Flat Submerged Factor	1.000	Full Bench Submerged Factor	0.750
Depressed Unsubmerged Factor	1.000	Improved Bench Unsubmerged Factor	0.035
Depressed Submerged Factor	1.000	Improved Bench Submerged Factor	0.375

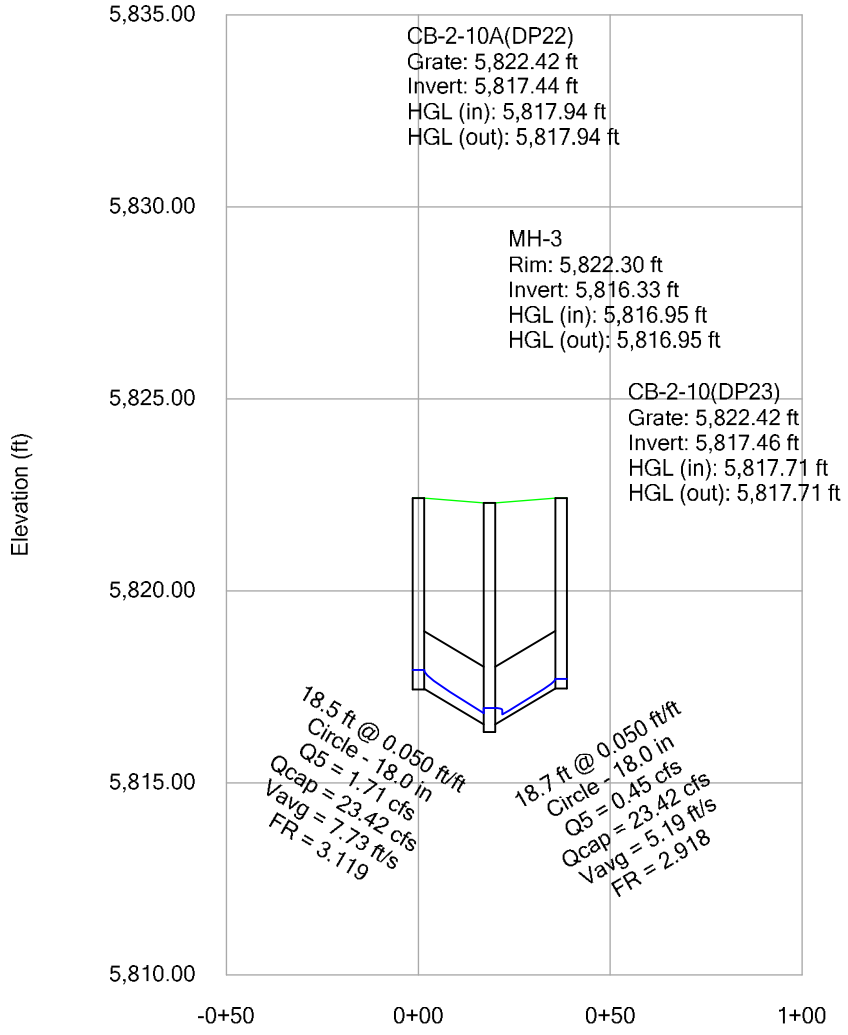
COMPARK - 5YR PEAK STORM

HEC-22 Energy Losses (Second Edition)	
Half Bench Unsubmerged Factor	0.150

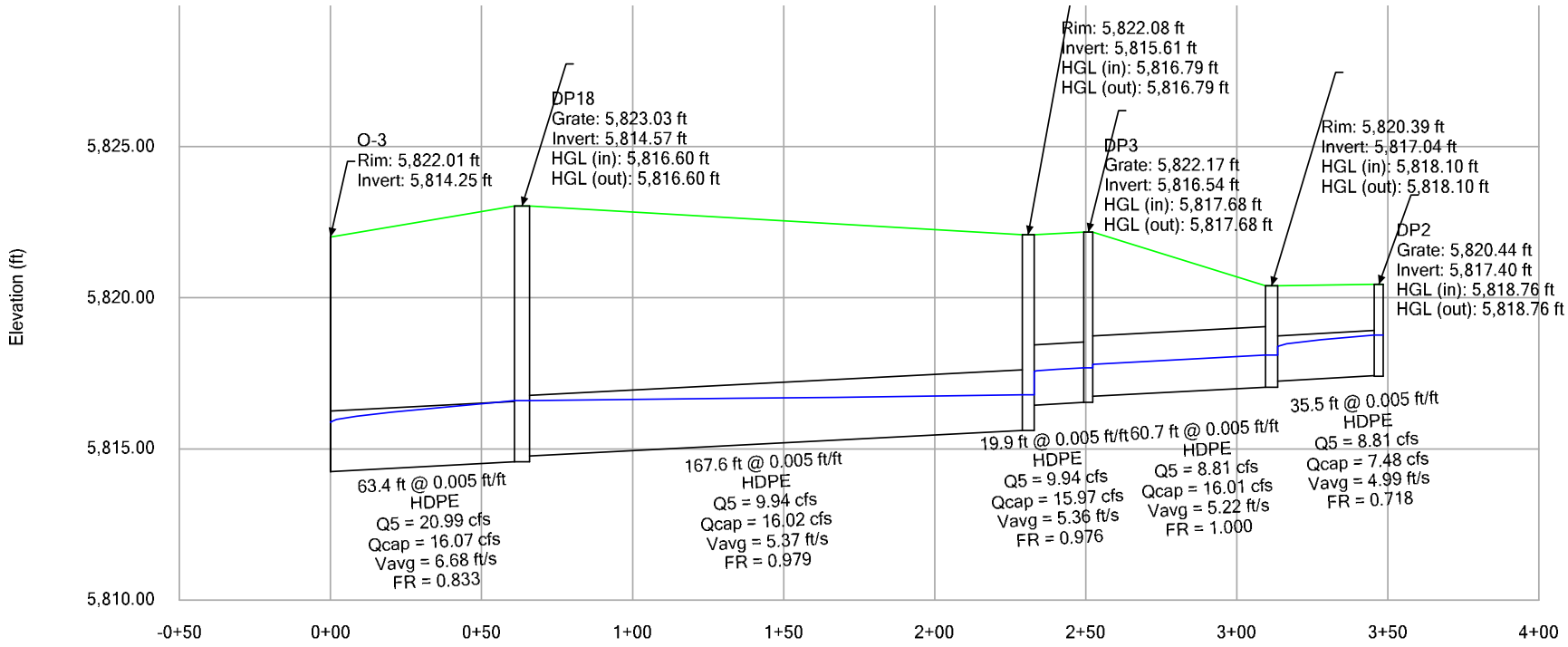
HEC-22 Energy Losses (Third Edition)			
Flat Submerged Coefficient	-0.050	Half Bench Unsubmerged Coefficient	-0.850
Flat Unsubmerged Coefficient	-0.050	Full Bench Submerged Coefficient	-0.250
Depressed Submerged Coefficient	0.000	Full Bench Unsubmerged Coefficient	-0.930
Depressed Unsubmerged Coefficient	0.000	Improved Submerged Coefficient	-0.600
Half Bench Submerged Coefficient	-0.050	Improved Unsubmerged Coefficient	-0.980

Modified Rational (United Kingdom)			
Apply Areal Reduction Factor?	False	Pipe Flow Includes Pipe Travel Time?	False
Runoff Routing Coefficient (Cr)	1.300		

COMPARK - 5YR PEAK STORM



COMPARK - 5YR PEAK STORM



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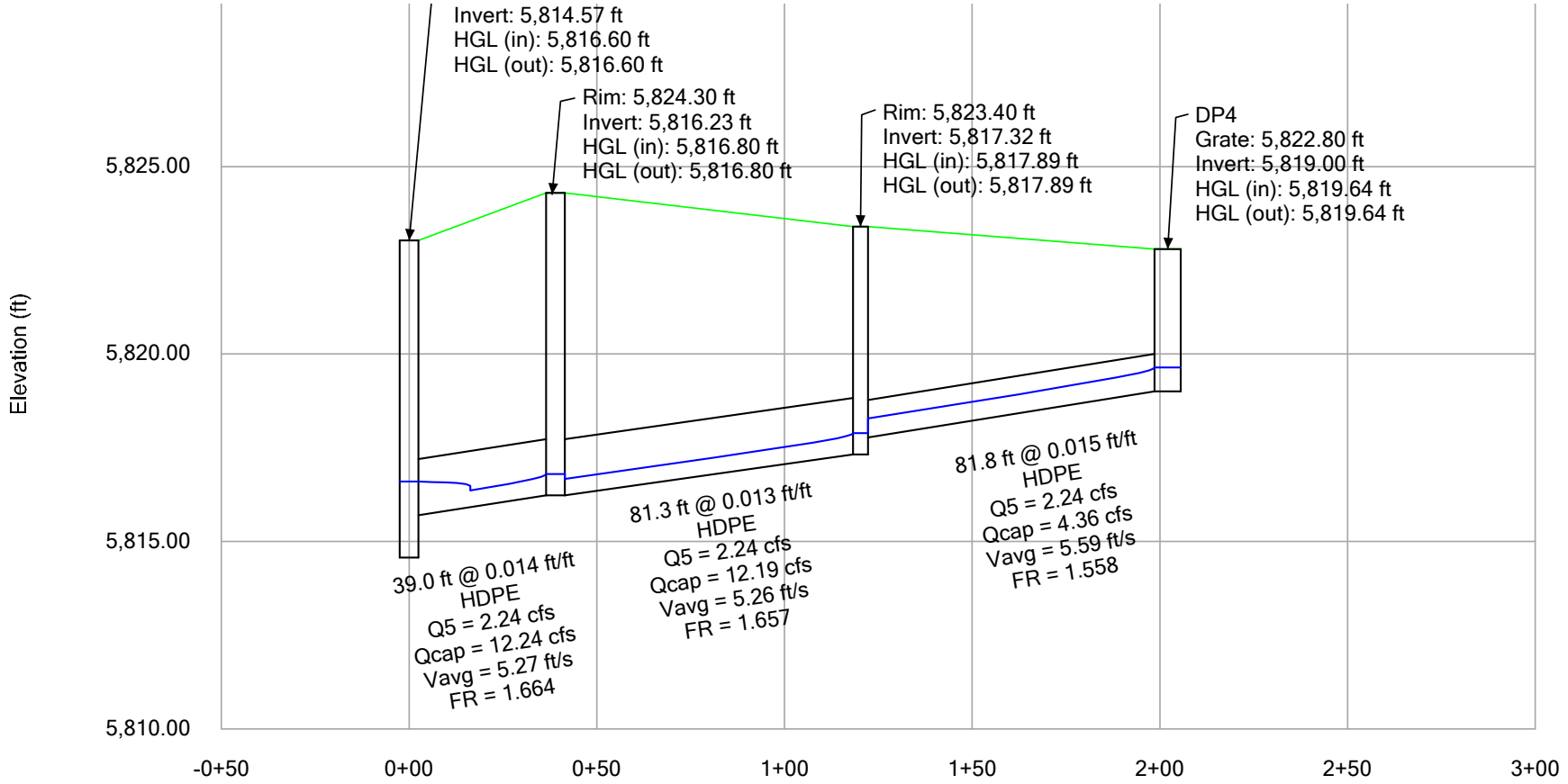
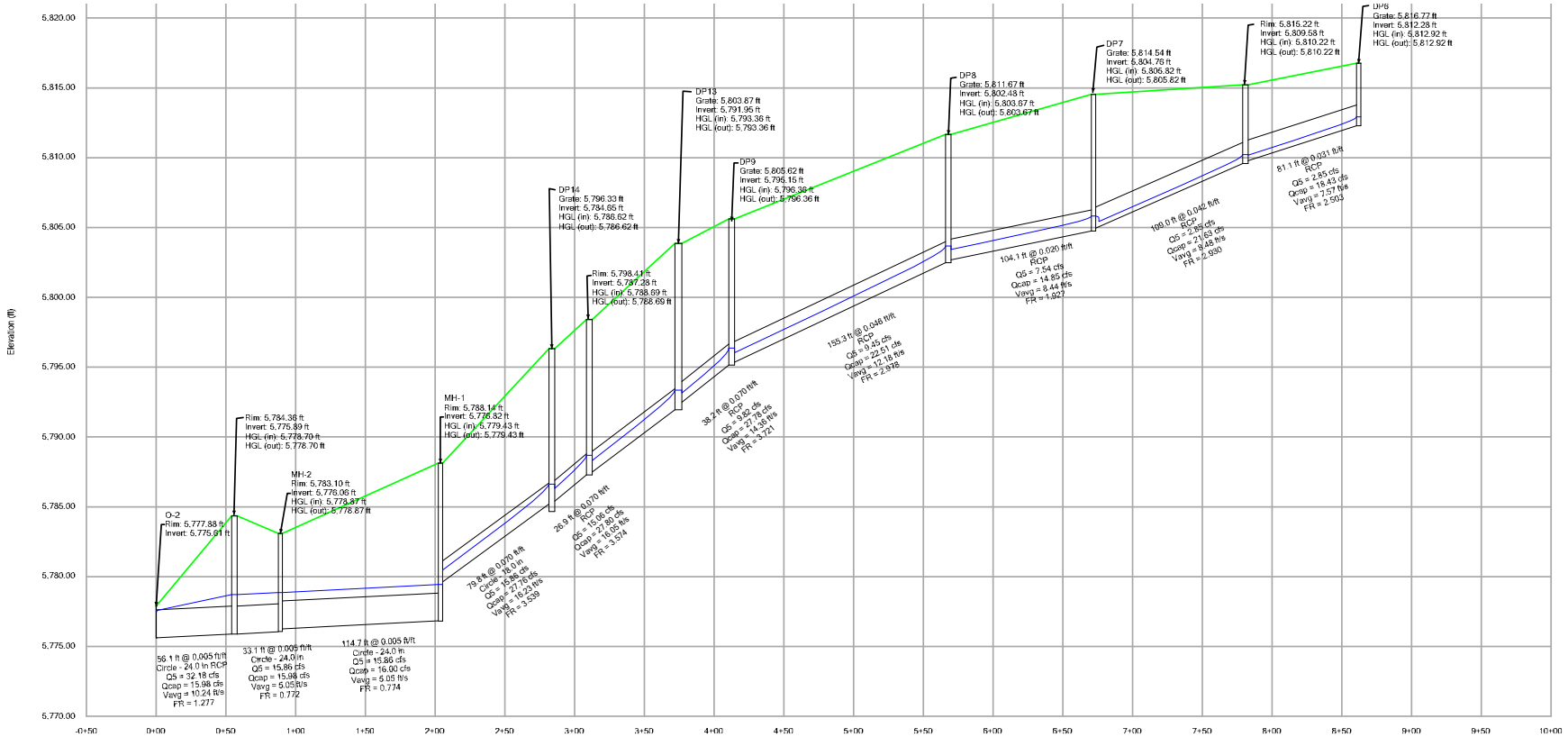
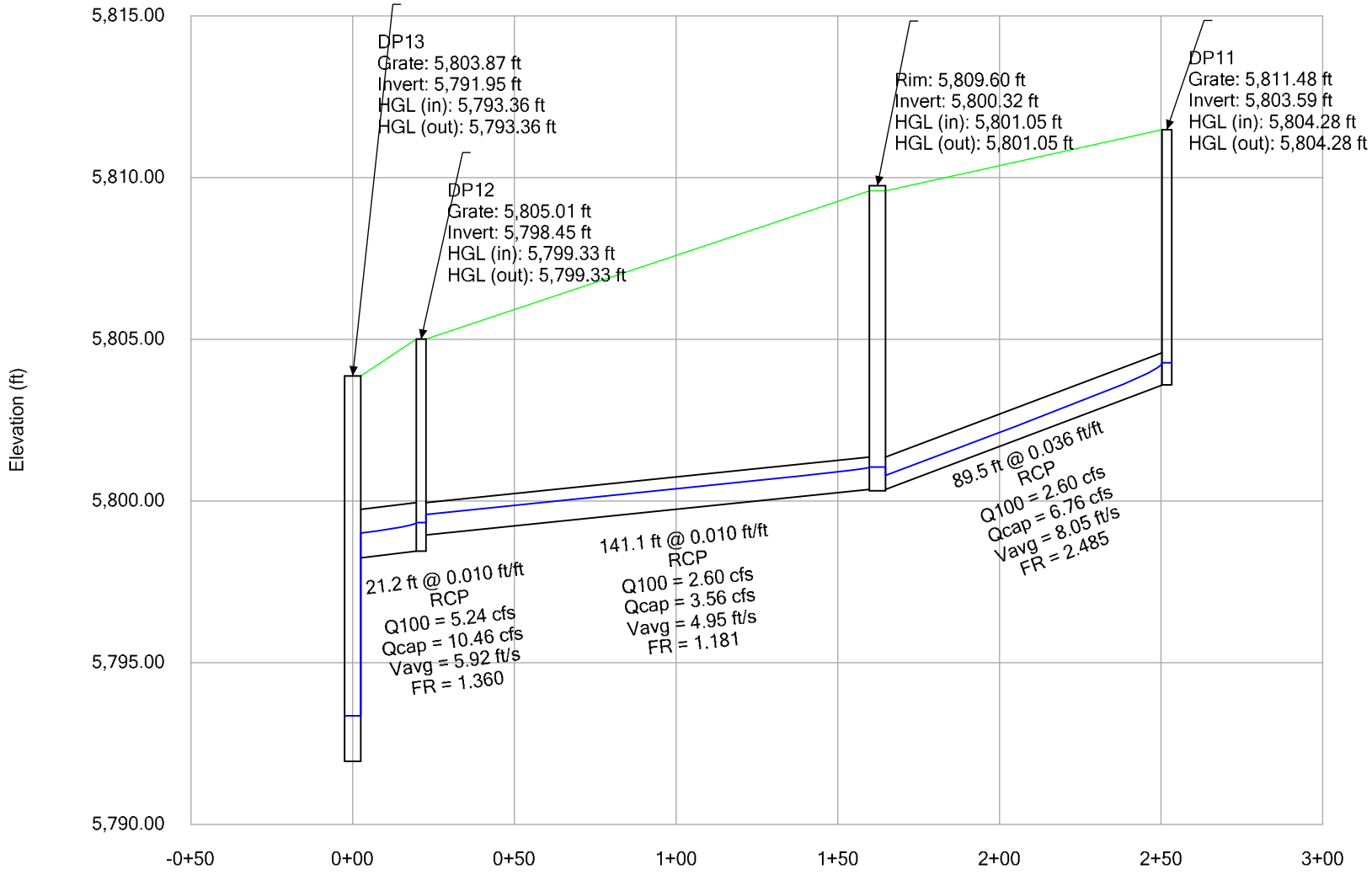
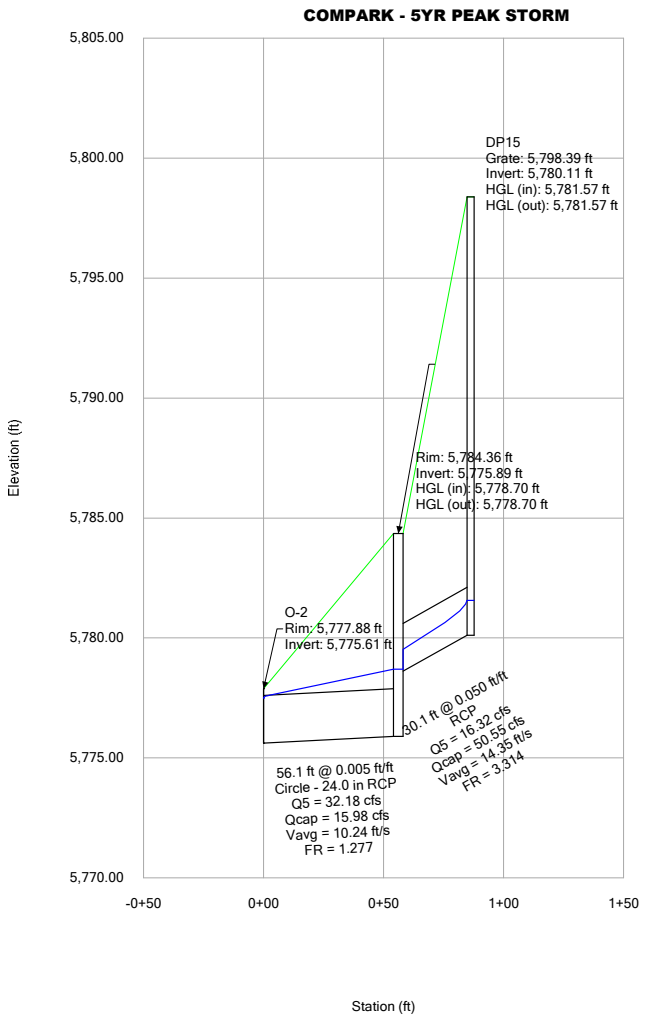


COMPARK - 5YR PEAK STORM

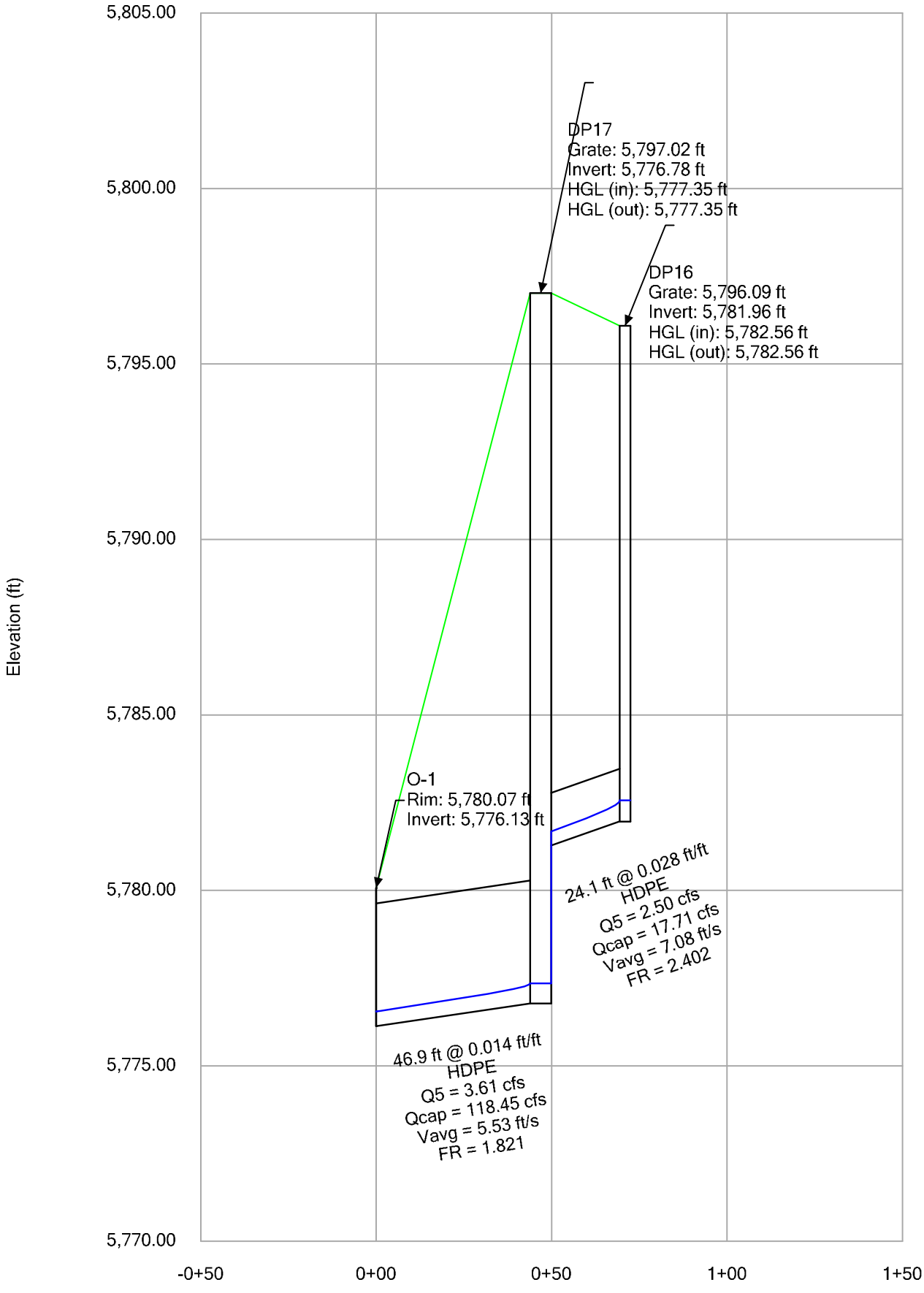


COMPARK - 5YR PEAK STORM




COMPARK - 5YR PEAK STORM
5,805.00
5,800.00
5,795.00
5,790.00
5,785.00
5,780.00
5,775.00
5,770.00
Elevation (ft)
-0+50
0+00
0+50
1+00
1+50
Station (ft)
DP15
Grate: 5,798.39 ft
Invert: 5,780.11 ft
HGL (in): 5,781.57 ft
HGL (out): 5,781.57 ft
Rim: 5,784.36 ft
Invert: 5,775.89 ft
HGL (in): 5,778.70 ft
HGL (out): 5,778.70 ft
O-2
Rim: 5,777.88 ft
Invert: 5,775.61 ft
30.1 ft @ 0.050 ft/ft
RCP
Q5 = 16.32 cfs
Qcap = 50.55 cfs
Vavg = 14.35 ft/s
FR = 3.314
56.1 ft @ 0.005 ft/ft
Circle - 24.0 in RCP
Q5 = 32.18 cfs
Qcap = 15.98 cfs
Vavg = 10.24 ft/s
FR = 1.277

COMPARK - 5YR PEAK STORM



COMPARK - 100YR PEAK STORM

Scenario Summary

ID	329
Label	100YR
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	100YR
Initial Settings	Base Initial Settings
Hydrology	Base Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	Base Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	100YR
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Solver Calculation Options	Base Calculation Options

Gravity Hydraulics

Maximum Network Traversals	5	Structure Loss Mode	Hydraulic Grade
Flow Convergence Test	0.001	Include Conduit Flow Travel Time in Design	True
Flow Profile Method	Backwater Analysis	Save Detailed Headloss Data?	False
Number of Flow Profile Steps	5	Gravity Friction Method	Manning's
Hydraulic Grade Convergence Test	0.00 ft	Use Explicit Depth and Slope Equations?	False
Average Velocity Method	Actual Uniform Flow Velocity	Ignore Pipe Travel Time in Carrier Pipes?	False
Minimum Structure Headloss	0.00 ft	Correct for Partial Area Effects?	False
Governing Upstream Pipe Selection Method	Pipe with Maximum QV		

Inlets

Active Components for Combination Inlets on Grade	Grate and Curb	Neglect Gutter Cross Slope For Side Flow?	False
Active Components for Combination Inlets In Sag	Grate and Curb	Neglect Side Flow?	False

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter
P	30.000

COMPARK - 100YR PEAK STORM

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter
Q	45.000
R	60.000
S	80.000
T	110.000

Pressure Hydraulics			
Liquid Label	Water at 20C (68F)	Pressure Friction Method	Hazen-Williams

Rational Method			
Use Rational Method Frequency Factors	False	Carryover Modeling Method	As CA (Traditional)
Allow Runoff Coefficient to Exceed 1.0?	False		

Headloss (AASHTO)			
Expansion, Ke	0.350	Shaping Adjustment, Cs	0.500
Contraction, Kc	0.250	Non-Piped Flow Adjustment, Cn	1.300

Bend Angle vs. Bend Loss Curve

Bend Angle (degrees)	Bend Loss Coefficient, Kb
0.00	0.000
15.00	0.190
30.00	0.350
45.00	0.470
60.00	0.560
75.00	0.640
90.00	0.700

HEC-22 Energy Losses	
Consider Non-Piped Plunging Flow?	True

HEC-22 Energy Losses (Second Edition)			
Elevations Considered Equal Within	0.50 ft	Half Bench Submerged Factor	0.950
Flat Unsubmerged Factor	1.000	Full Bench Unsubmerged Factor	0.070
Flat Submerged Factor	1.000	Full Bench Submerged Factor	0.750
Depressed Unsubmerged Factor	1.000	Improved Bench Unsubmerged Factor	0.035
Depressed Submerged Factor	1.000	Improved Bench Submerged Factor	0.375

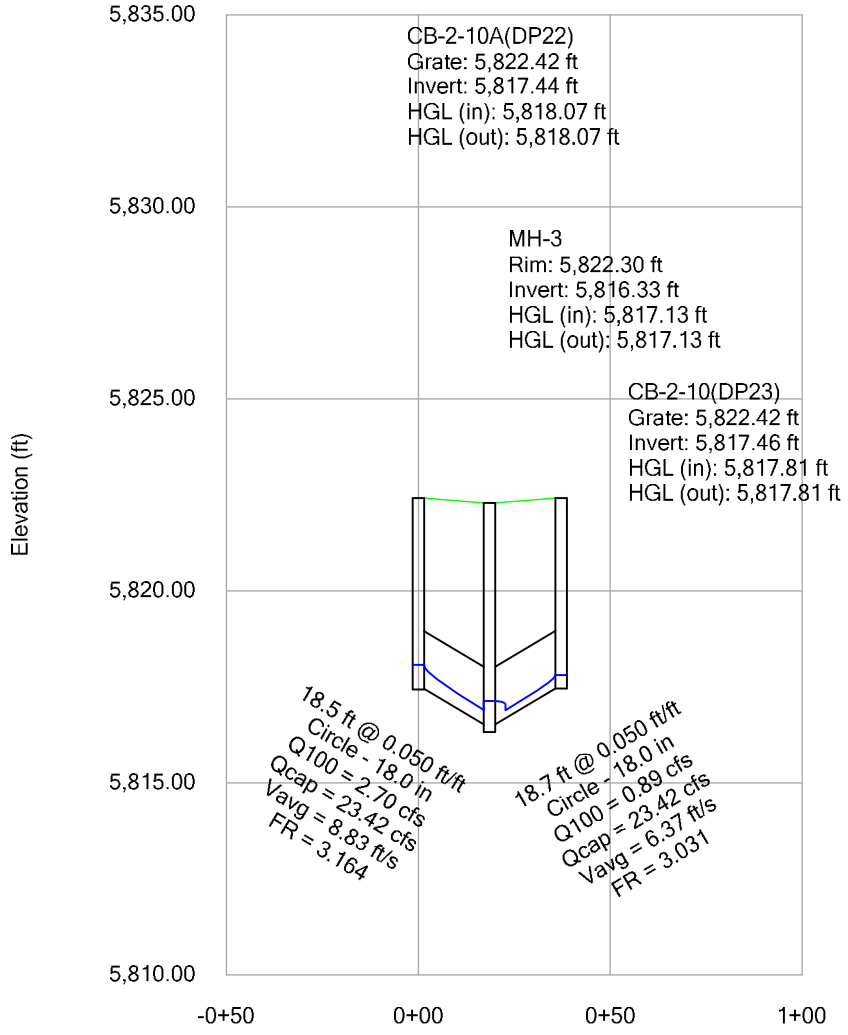
COMPARK - 100YR PEAK STORM

HEC-22 Energy Losses (Second Edition)	
Half Bench Unsubmerged Factor	0.150

HEC-22 Energy Losses (Third Edition)			
Flat Submerged Coefficient	-0.050	Half Bench Unsubmerged Coefficient	-0.850
Flat Unsubmerged Coefficient	-0.050	Full Bench Submerged Coefficient	-0.250
Depressed Submerged Coefficient	0.000	Full Bench Unsubmerged Coefficient	-0.930
Depressed Unsubmerged Coefficient	0.000	Improved Submerged Coefficient	-0.600
Half Bench Submerged Coefficient	-0.050	Improved Unsubmerged Coefficient	-0.980

Modified Rational (United Kingdom)			
Apply Areal Reduction Factor?	False	Pipe Flow Includes Pipe Travel Time?	False
Runoff Routing Coefficient (Cr)	1.300		

COMPARK - 100YR PEAK STORM



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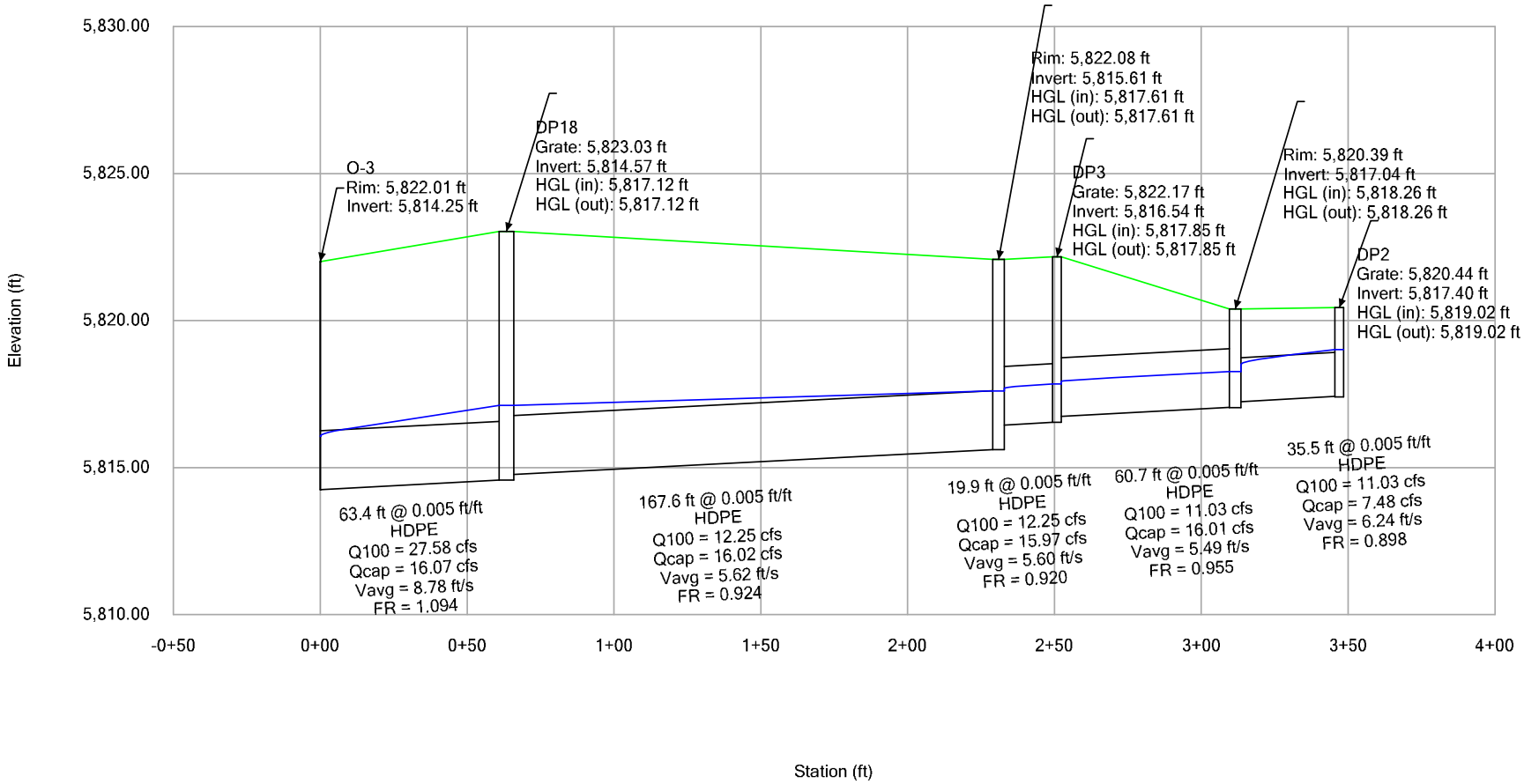
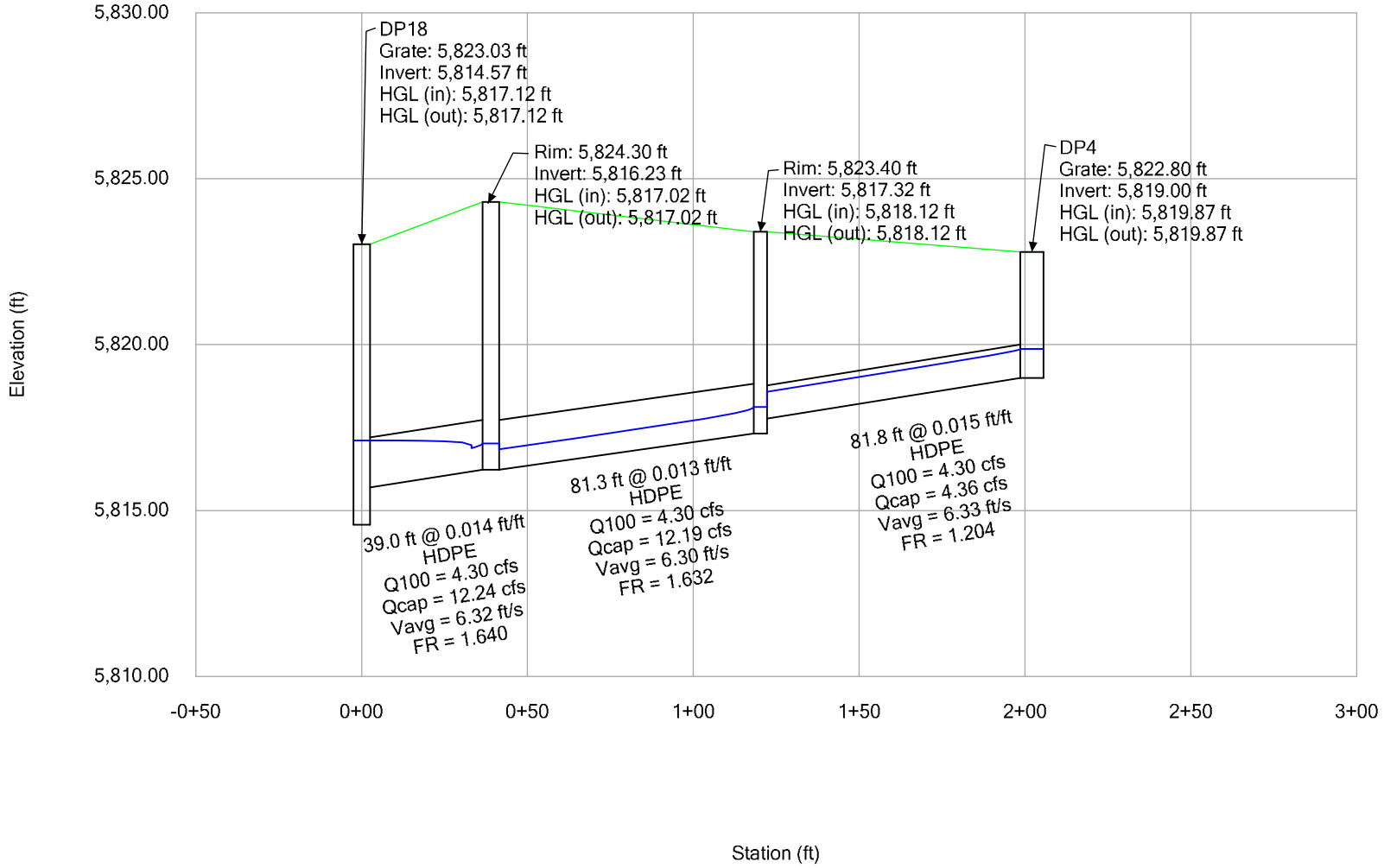


COMPARK - 100YR PEAK STORM



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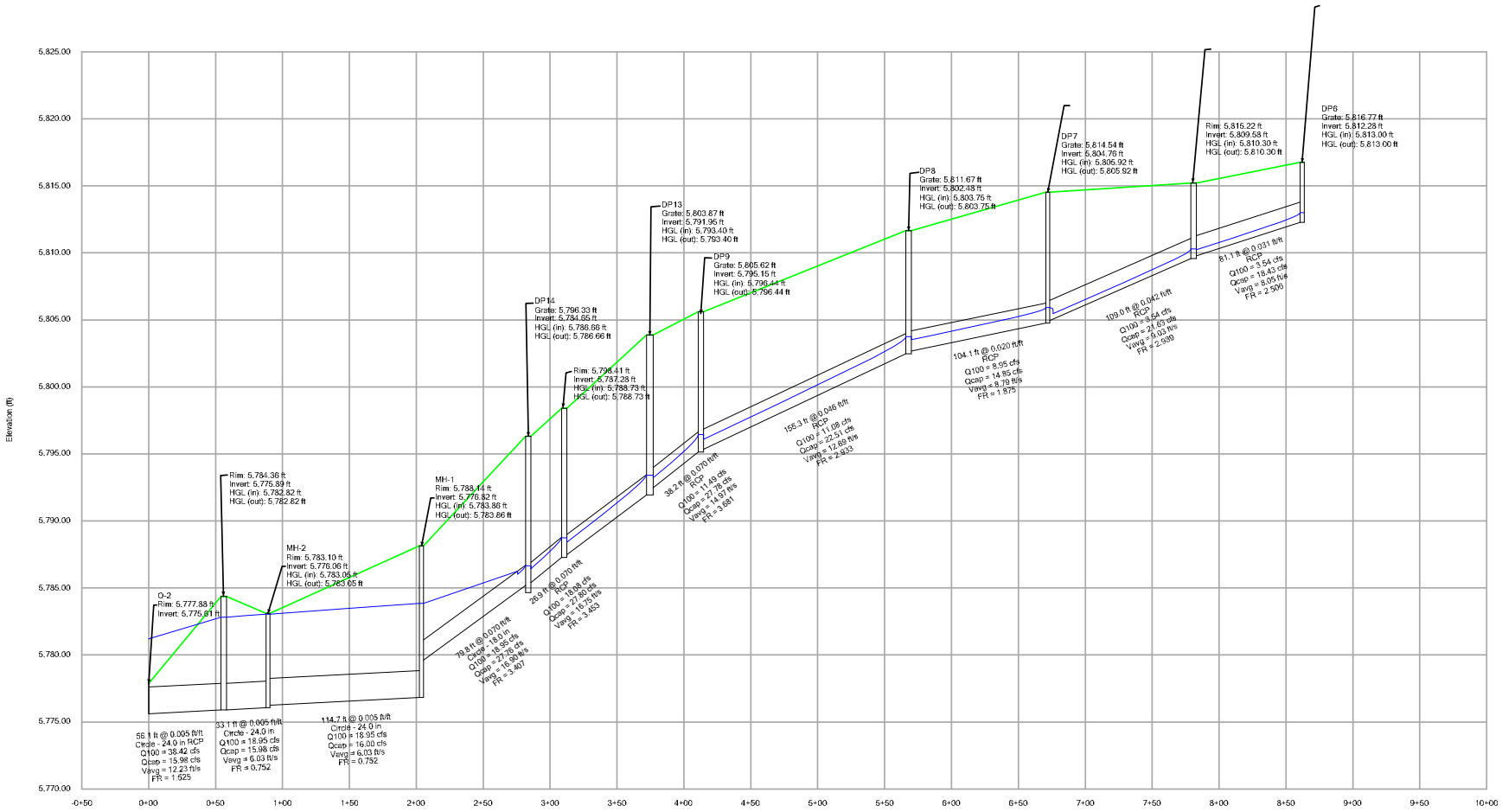

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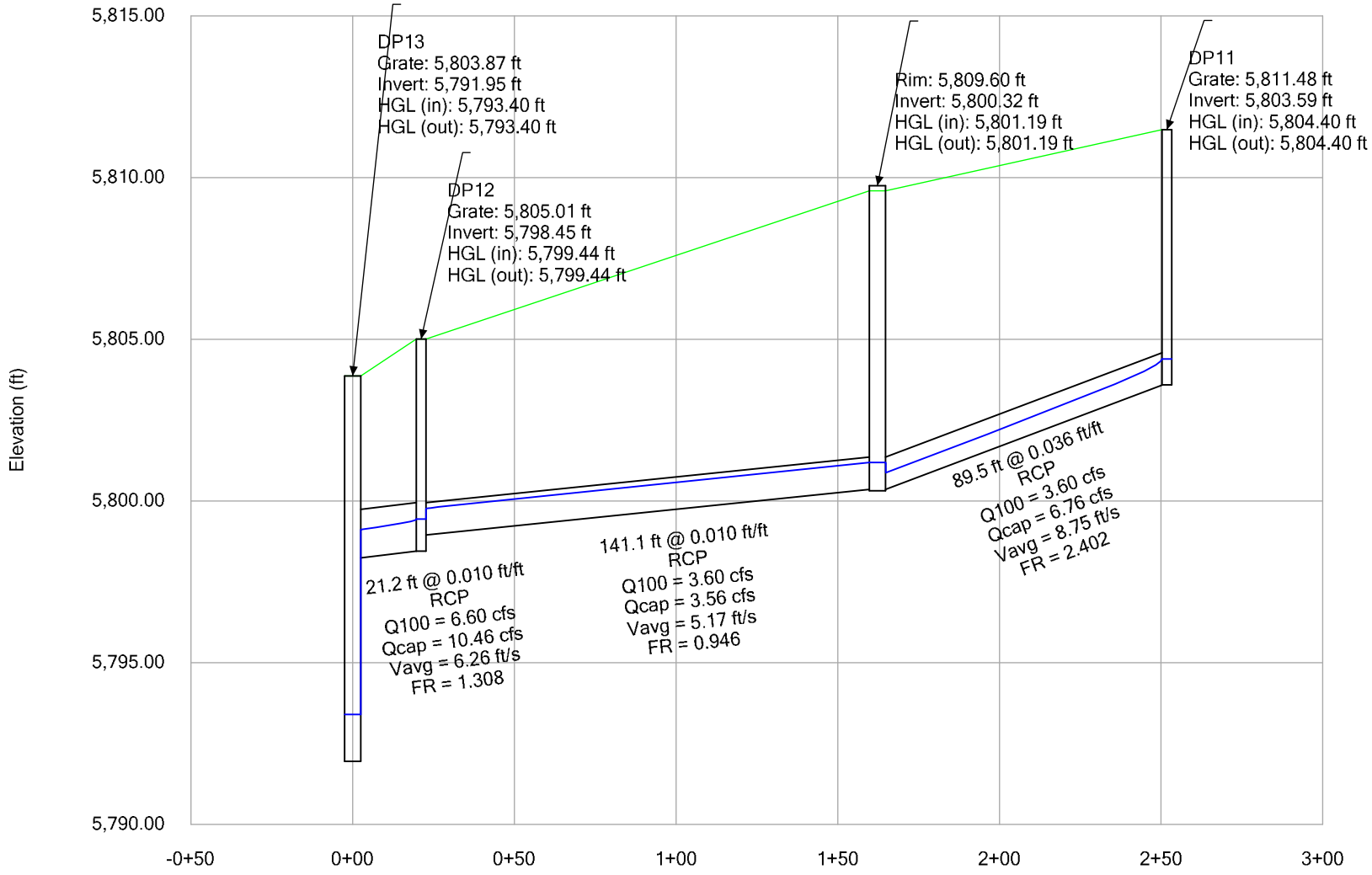

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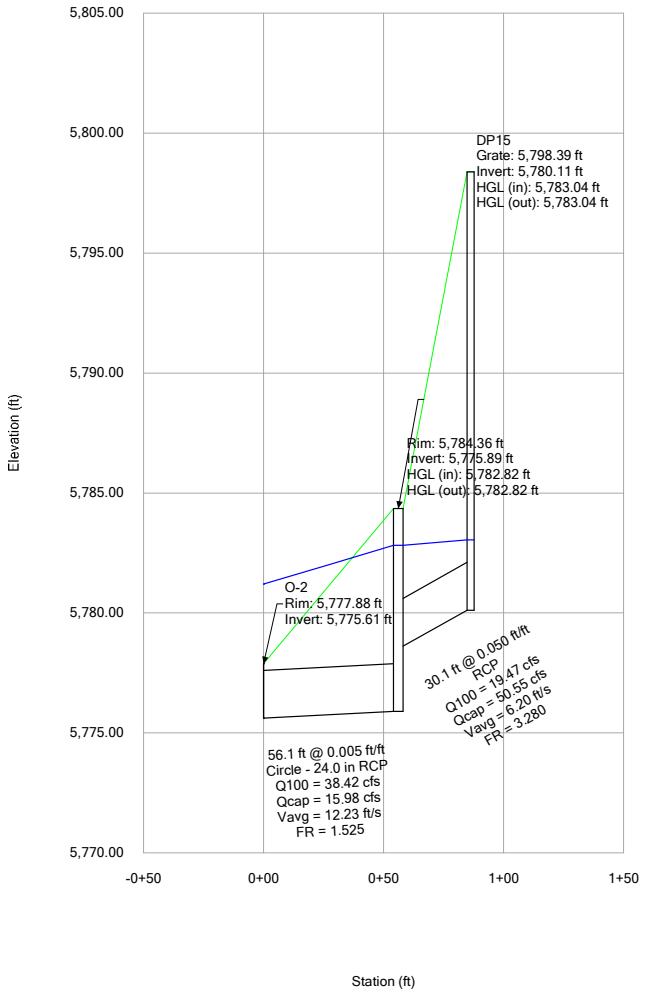
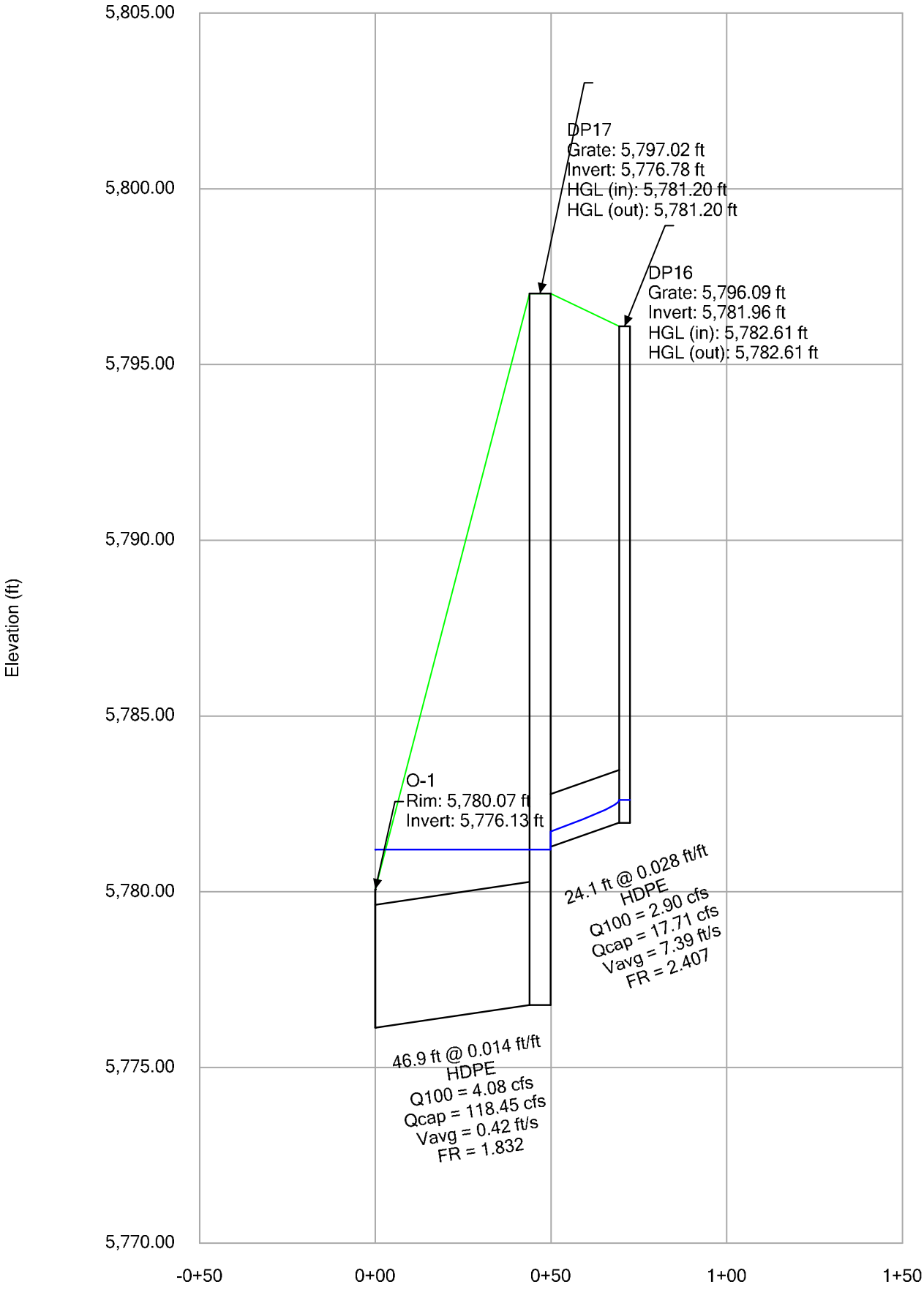


COMPARK - 100YR PEAK STORM



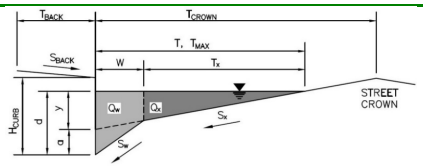
Inlet Sizing
UD-Inlet Calculations

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

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

Project:

Inlet ID: **DP2 - A-5**



Gutter Geometry:

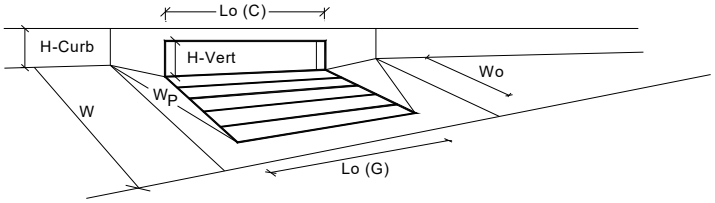
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	31.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	2.500	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	31.0	31.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



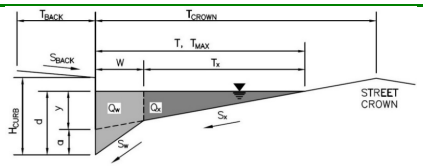
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.57	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	0.93	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.5**	**10.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	6.9	9.6	cfs

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

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

Project:

Inlet ID: **DP3 - A-3**



Gutter Geometry:

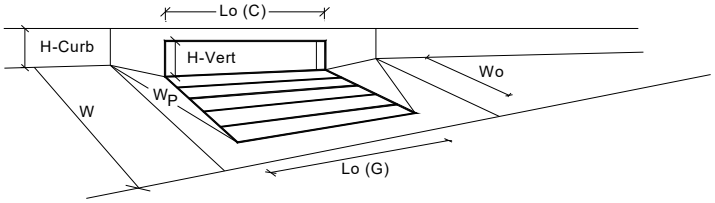
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	31.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	31.0	31.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



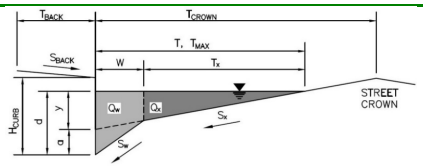
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.77	0.77	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.4**	**5.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.8	0.8	cfs

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

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

Project:

Inlet ID: **DP4 - A-1B**



Gutter Geometry:

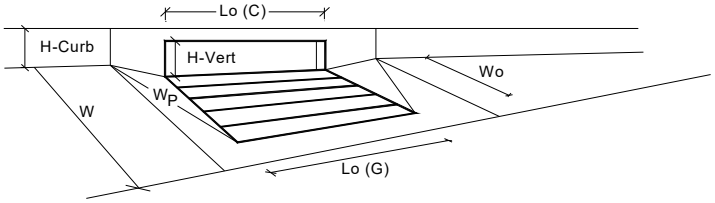
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	31.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	31.0	31.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.523	0.523	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.71	0.71	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.71	0.71	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.2**	**6.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.2	4.3	cfs

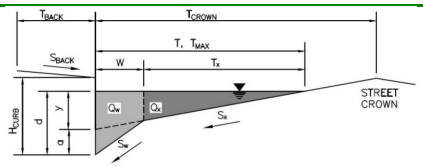
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project:

Inlet ID: **DP6 - B-1**



Gutter Geometry:

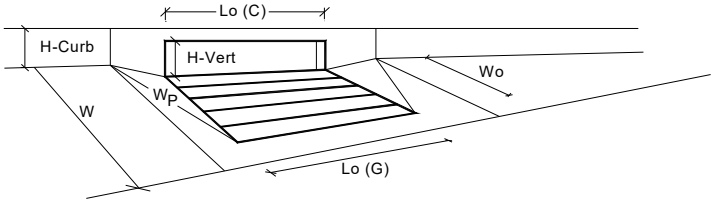
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.040	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	31.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.025	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	31.0	31.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



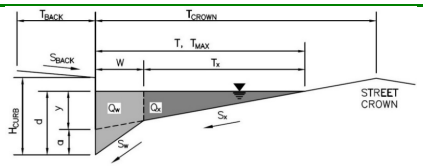
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.42	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.77	0.90	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.4**	**7.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.1	1.3	cfs

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

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

Project:

Inlet ID: **DP7 - B-2**



Gutter Geometry:

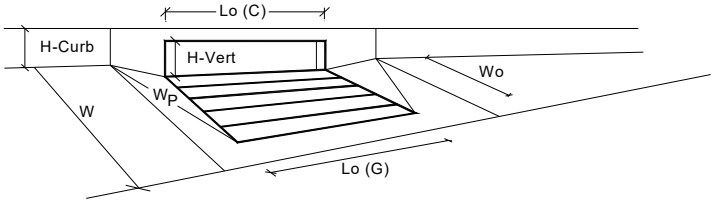
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.005	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	31.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.010	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	31.0	31.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.5	5.5	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.29	0.29	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.52	0.52	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.90	0.90	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.2**	**8.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.9	4.5	cfs

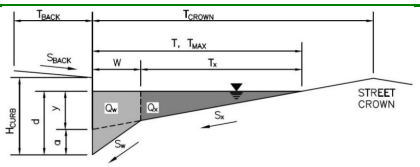
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project:

Inlet ID: **DP12 - B-3**



Gutter Geometry:

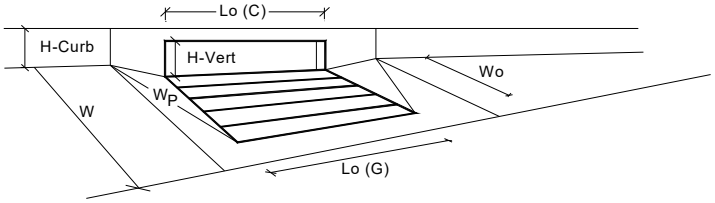
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.010	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.1	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.1	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.34	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.58	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	0.94	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.5**	**10.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.6	3.0	cfs

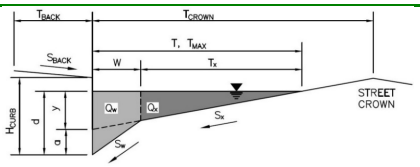
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project:

Inlet ID: **DP15 - B-4**



Gutter Geometry:

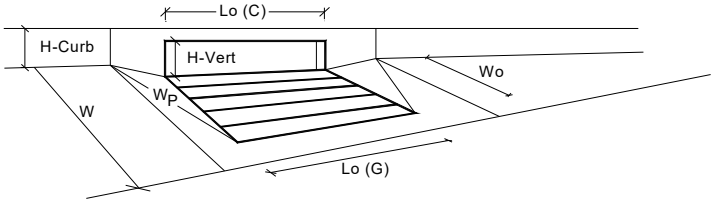
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.010	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



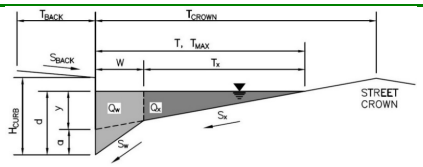
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT/Denver 13 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.523	0.523	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.71	0.71	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.71	0.71	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.3**	**5.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.5	0.5	cfs

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

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

Project:

Inlet ID: **DP16 - B-5**



Gutter Geometry:

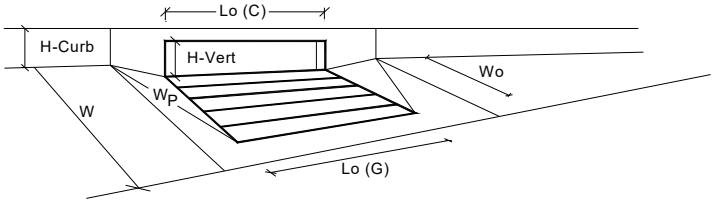
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.010	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.045	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

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

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



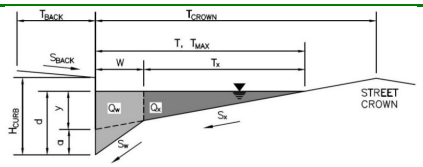
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT/Denver 13 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.523	0.523	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.94	0.94	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.94	0.94	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.6**	**3.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.5	2.9	cfs

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

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

Project:

Inlet ID: **DP22**



Gutter Geometry:

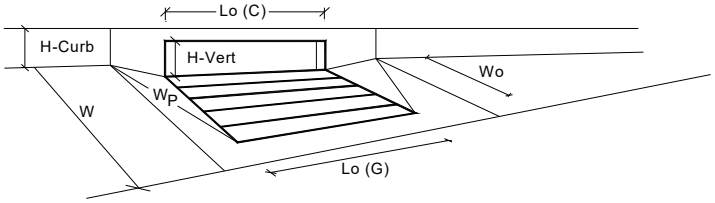
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.021	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



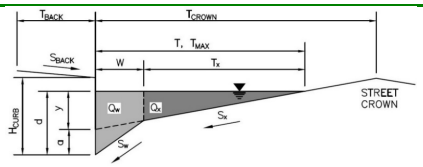
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	5.8	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.32	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.51	0.74	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.9**	**4.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.7	2.7	cfs

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

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

Project:

Inlet ID: **DP23**



Gutter Geometry:

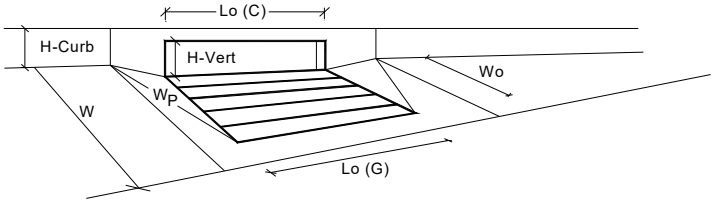
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.021	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	5.8	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.32	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.51	0.74	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.9**	**4.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.5	0.9	cfs

Appendix D: Stormwater Quality Information and Detention Details

MERRICK & COMPANY

Developed Composite C-Factor and Impervious Analysis

Compark Village South

Calculated by: KB
Checked by: KW
Date: 5/12/2022

UDFCD - TABLE 6-4, SOIL GROUP C/D

Basin	Land Use	Area (acres)	I value	C5	C10	C100
F3	Manhard Basin F3	6.50	0.75	0.65	0.69	0.79
		6.50	**0.75**	**0.65**	**0.69**	**0.79**

MERRICK & COMPANY

STANDARD FORM SF-2
TIME OF CONCENTRATION

5/12/2022

CALCULATED BY: *KB* PROJECT: Compark Village South JOB NO: 65119686
CHECKED BY: *KW* BASIN: LOCATION: Town of Parker, CO

SUB-BASIN DATA				INITIAL/OVERLAND TIME (Tc)			TRAVEL TIME Gutter (Tt)						Tc CHECK (Urbanized Basins)			FINAL Tc	CONVEYANCE REMARKS
DESIGNATION	AREA (acres)	IMPERVIOUS %	C_5	LENGTH (ft)	SLOPE (%)	Ti (min)	LENGTH (ft)	AVG. SLOPE ΔY	(%)	Conv. Type*	VEL (fps)	Tt (min)	COMP Tc (min)	TOTAL LENGTH (ft)	Tc=(26-17i)+L/(60*(14i+9)*sqrt(S)) (min)	(min)**	
F3	6.50	75%	0.65	150	3.0	6.9	800	25.5	3.2	6	3.6	3.7	10.7	950	13.4	**10.7**	

Q:\DEN\Projects\0950-00 Compark South\DESIGN\Drainage\Hydrology\Rational\[0950_Rational Calculations Drainage_Manhard F3.xls]tc1

* Note: Conveyance Coefficients - Type 1-Heavy Meadow, Type 2-Tillage/Field, Type 3-Short Pasture and lawns, Type 4-Nearly Bare Soil, Type 5-Grassed Waterway, Type 6-Paved areas and shallow paved swales. The maximum initial/overland length shall not exceed 300 feet.

** Based on Assumption that Building roofs will take 5 min to fully contribute to storm system

MERRICK & COMPANY

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

CALCULATED BY: KB
DATE: 5/12/2022
CHECKED BY: KW

JOB NO: 65110570
PROJECT: Compark Village South
DESIGN STORM: 5 Year

		DIRECT RUNOFF						TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME		
DESIGN POINT	AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	Tt (min)
	F3	6.50	0.65	10.66	4.23	4.7	19.9												

5-YEAR RAINFALL = 1.39 IN/HR., 100-YEAR RAINFALL = 2.60 IN/HR.

MERRICK & COMPANY

*value known from Master Drainage Report

MERRICK & COMPANY

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

CALCULATED BY: KB
DATE: 5/12/2022
CHECKED BY: KW
JOB NO: 65110570
PROJECT: Compark Village South
DESIGN STORM: 100 Year

DESIGN POINT	AREA DESIG.	DIRECT RUNOFF						TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME		
		AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	Tt (min)
	F3	6.50	0.79	10.66	5.14	4.7	24.0												

5-YEAR RAINFALL = 1.39 IN/HR., 100-YEAR RAINFALL = 2.60 IN/HR.

MERRICK & COMPANY

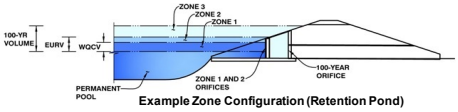
*value known from Master Drainage Report

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Compark - Revised Pond B (Merrick Addition)

Basin ID: Modified Outlet



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	14.60	acres
Watershed Length =	1,585	ft
Watershed Length to Centroid =	793	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	67.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Parker - Town Hall	

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

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.319	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	1.071	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 0.82 in.) =	0.610	acre-feet	inches
5-yr Runoff Volume (P1 = 1.1 in.) =	0.865	acre-feet	inches
10-yr Runoff Volume (P1 = 1.34 in.) =	1.129	acre-feet	inches
25-yr Runoff Volume (P1 = 1.69 in.) =	1.594	acre-feet	inches
50-yr Runoff Volume (P1 = 1.98 in.) =	1.950	acre-feet	inches
100-yr Runoff Volume (P1 = 2.29 in.) =	2.372	acre-feet	inches
500-yr Runoff Volume (P1 = 3.08 in.) =	3.373	acre-feet	inches
Approximate 2-yr Detention Volume =	0.575	acre-feet	
Approximate 5-yr Detention Volume =	0.817	acre-feet	
Approximate 10-yr Detention Volume =	1.083	acre-feet	
Approximate 25-yr Detention Volume =	1.286	acre-feet	
Approximate 50-yr Detention Volume =	1.393	acre-feet	
Approximate 100-yr Detention Volume =	1.550	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.319	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.752	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.479	acre-feet
Total Detention Basin Volume =	1.550	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

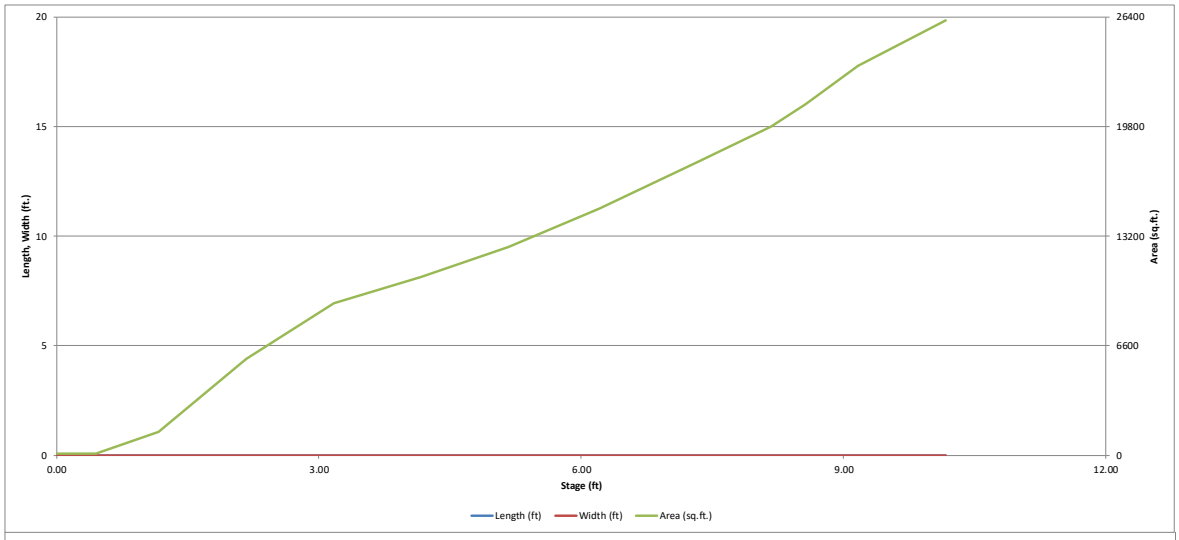
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

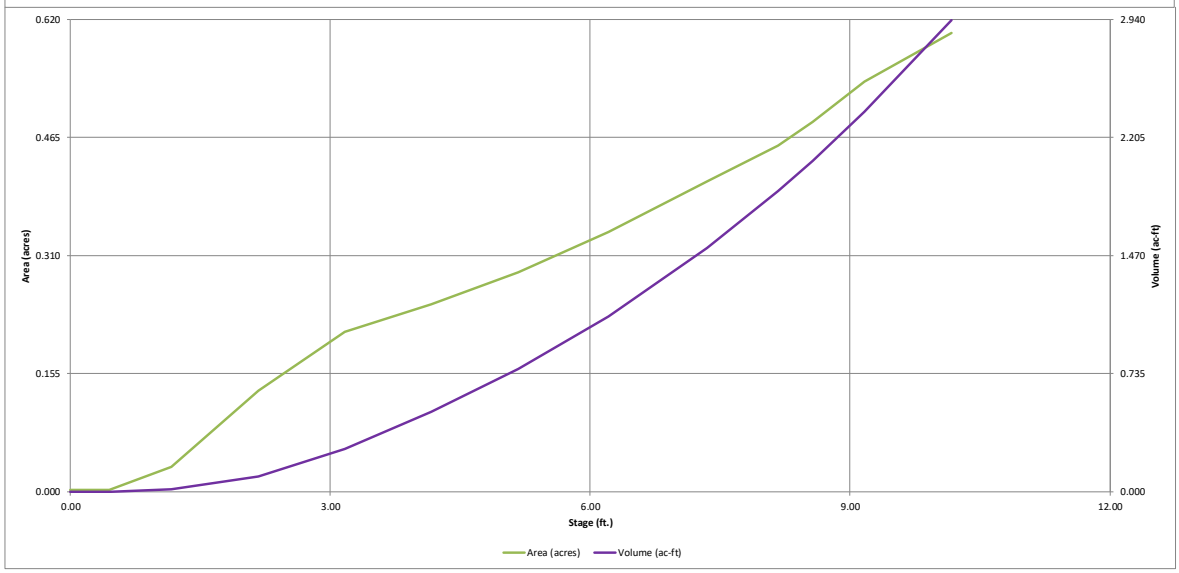
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	120	0.003		
5774.28	--	0.45	--	--	--	120	0.003	54	0.001
5775	--	1.17	--	--	--	1,411	0.032	605	0.014
5776	--	2.17	--	--	--	5,779	0.133	4,200	0.096
5777	--	3.17	--	--	--	9,148	0.210	11,664	0.268
5778	--	4.17	--	--	--	10,729	0.246	21,602	0.496
5779	--	5.17	--	--	--	12,557	0.288	33,245	0.763
5780.04 - EURV	--	6.21	--	--	--	14,858	0.341	47,501	1.090
5781.20 - 100 Yr	--	7.35	--	--	--	17,724	0.407	66,073	1.517
5782	--	8.17	--	--	--	19,802	0.455	81,458	1.870
5782.4 - Spillway	--	8.57	--	--	--	21,132	0.485	89,645	2.058
5783	--	9.17	--	--	--	23,450	0.538	103,020	2.365
5784 - Top Berm	--	10.17	--	--	--	26,238	0.602	127,864	2.935

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



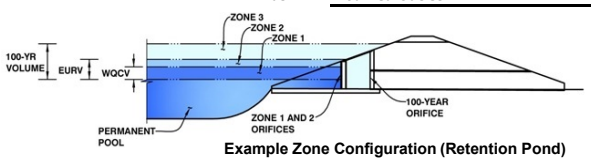


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Compark - Revised Pond B (Merrick Addition)

Basin ID: Modified Outlet



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.41	0.319	Orifice Plate
Zone 2 (EURV)	6.16	0.752	Orifice Plate
Zone 3 (100-year)	7.44	0.479	Weir&Pipe (Restrict)
Total (all zones)		1.550	

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

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

Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft^2

Underdrain Orifice Centroid = feet

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

Invert of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 6.16 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = 32.00 inches

Orifice Plate: Orifice Area per Row = 1.70 sq. inches (diameter = 1-7/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row = 1.181E-02 ft^2

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.70	5.40					
Orifice Area (sq. inches)	1.70	1.70	1.70					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.25	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.67	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.92	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.25	N/A	feet
Overflow Weir Slope Length =	2.92	N/A	feet
Grate Open Area / 100-yr Orifice Area =	11.43	N/A	
Overflow Grate Open Area w/o Debris =	11.52	N/A	ft^2
Overflow Grate Open Area w/ Debris =	11.52	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.13	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	10.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.01	N/A	ft^2
Outlet Orifice Centroid =	0.48	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.68	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 8.57 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 23.00 feet

Spillway End Slopes = 10.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 0.58 feet

Stage at Top of Freeboard = 10.15 feet

Basin Area at Top of Freeboard = 0.60 acres

Basin Volume at Top of Freeboard = 2.92 acre-ft

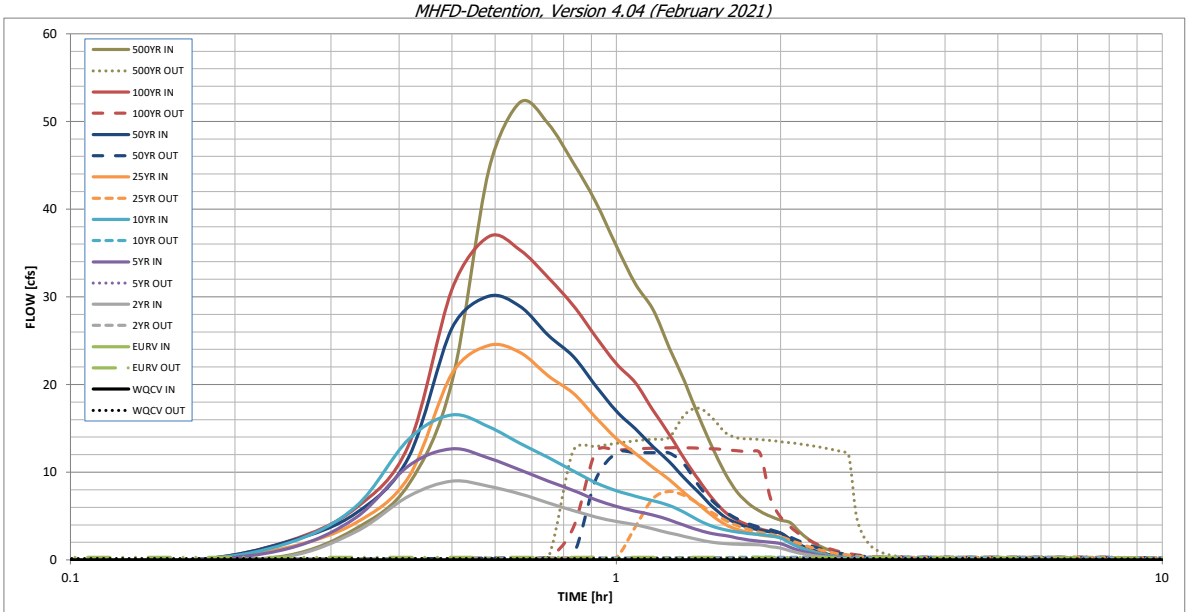
Routed Hydrograph Results

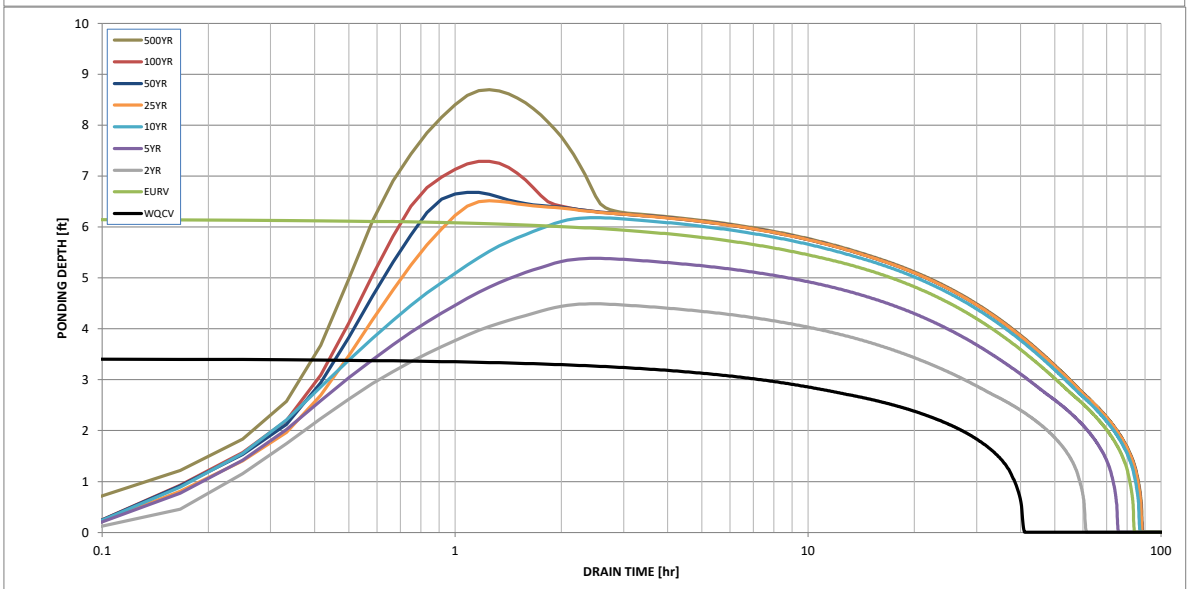
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

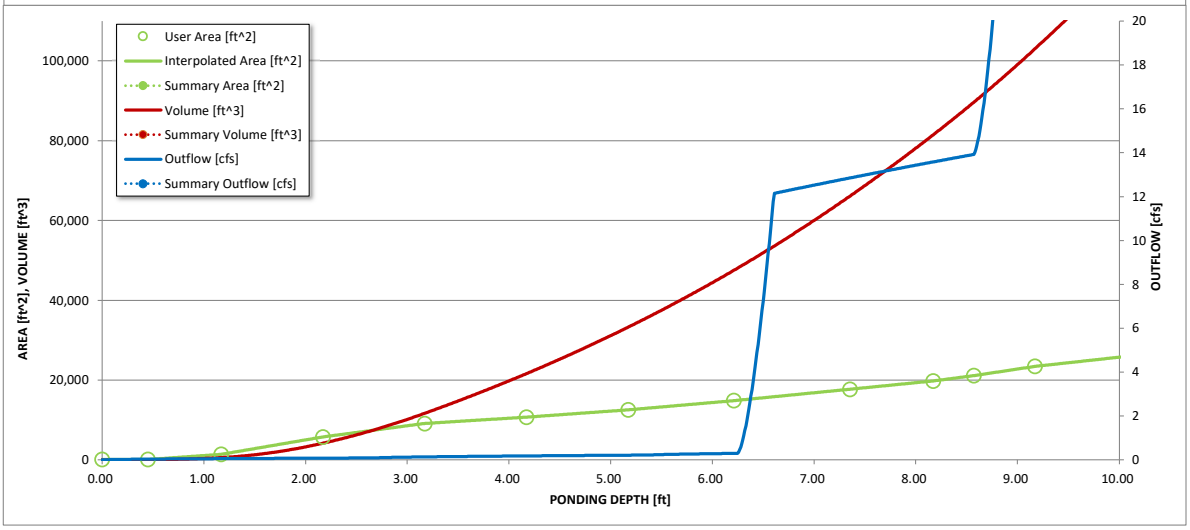
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.82	1.10	1.34	1.69	1.98	2.29	3.08
CUHP Runoff Volume (acre-ft) =	0.319	1.071	0.610	0.865	1.129	1.594	1.950	2.372	3.373
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.610	0.865	1.129	1.594	1.950	2.372	3.373
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	1.9	6.8	9.8	13.7	21.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.13	0.47	0.67	0.94	1.50
Peak Inflow Q (cfs) =	N/A	N/A	9.0	12.7	16.5	24.5	30.1	36.9	52.2
Peak Outflow Q (cfs) =	0.2	0.3	0.2	0.2	0.3	7.8	12.2	12.8	17.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.2	0.2	1.1	1.2	0.9	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.6	1.0	1.1	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	77	57	70	80	79	77	75	71
Time to Drain 99% of Inflow Volume (hours) =	**40**	81	60	73	84	85	84	83	82
Maximum Ponding Depth (ft) =	3.41	6.16	4.49	5.38	6.18	6.51	6.68	7.29	8.70
Area at Maximum Ponding Depth (acres) =	0.22	0.34	0.26	0.30	0.34	0.36	0.37	0.40	0.50
Maximum Volume Stored (acre-ft) =	0.319	1.073	0.574	0.825	1.077	1.195	1.253	1.488	2.117

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51
	0:15:00	0.00	0.00	0.40	1.28	1.89	1.44	2.07	2.14	3.59
	0:20:00	0.00	0.00	3.21	4.82	6.09	4.25	5.32	5.93	8.63
	0:25:00	0.00	0.00	7.28	10.73	13.77	9.46	11.73	13.10	20.27
	0:30:00	0.00	0.00	8.99	12.66	16.54	21.24	26.40	30.83	44.42
	0:35:00	0.00	0.00	8.40	11.62	15.17	24.46	30.07	36.87	52.18
	0:40:00	0.00	0.00	7.53	10.24	13.27	23.64	28.89	35.34	49.74
	0:45:00	0.00	0.00	6.51	9.00	11.68	21.00	25.63	32.20	45.29
	0:50:00	0.00	0.00	5.63	7.94	10.14	19.00	23.20	29.02	40.82
	0:55:00	0.00	0.00	4.89	6.86	8.81	16.25	19.87	25.47	35.81
	1:00:00	0.00	0.00	4.37	6.10	7.90	13.84	16.96	22.36	31.50
	1:05:00	0.00	0.00	4.01	5.57	7.28	12.17	14.95	20.23	28.57
	1:10:00	0.00	0.00	3.53	5.12	6.74	10.55	12.94	17.09	24.20
	1:15:00	0.00	0.00	3.09	4.56	6.20	9.15	11.19	14.33	20.35
	1:20:00	0.00	0.00	2.67	3.93	5.41	7.64	9.32	11.51	16.31
	1:25:00	0.00	0.00	2.30	3.39	4.51	6.31	7.68	9.08	12.82
	1:30:00	0.00	0.00	2.01	2.99	3.82	5.02	6.08	7.01	9.86
	1:35:00	0.00	0.00	1.86	2.79	3.42	4.04	4.86	5.45	7.69
	1:40:00	0.00	0.00	1.79	2.50	3.18	3.46	4.15	4.53	6.39
	1:45:00	0.00	0.00	1.74	2.28	3.01	3.10	3.70	3.94	5.55
	1:50:00	0.00	0.00	1.72	2.12	2.89	2.86	3.40	3.53	4.96
	1:55:00	0.00	0.00	1.52	2.00	2.74	2.70	3.19	3.24	4.55
	2:00:00	0.00	0.00	1.34	1.86	2.50	2.59	3.05	3.03	4.25
	2:05:00	0.00	0.00	1.03	1.43	1.92	1.99	2.34	2.28	3.19
	2:10:00	0.00	0.00	0.78	1.07	1.43	1.48	1.73	1.67	2.34
	2:15:00	0.00	0.00	0.59	0.80	1.06	1.10	1.29	1.25	1.73
	2:20:00	0.00	0.00	0.44	0.59	0.78	0.82	0.96	0.93	1.29
	2:25:00	0.00	0.00	0.32	0.43	0.57	0.60	0.70	0.68	0.95
	2:30:00	0.00	0.00	0.23	0.30	0.41	0.43	0.50	0.49	0.68
	2:35:00	0.00	0.00	0.16	0.22	0.30	0.31	0.36	0.36	0.50
	2:40:00	0.00	0.00	0.11	0.15	0.20	0.22	0.26	0.25	0.35
	2:45:00	0.00	0.00	0.07	0.10	0.13	0.14	0.17	0.16	0.23
	2:50:00	0.00	0.00	0.04	0.06	0.07	0.08	0.10	0.09	0.13
	2:55:00	0.00	0.00	0.02	0.03	0.03	0.04	0.05	0.04	0.06
	3:00:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

Appendix E: Excerpts from Referenced Drainage Studies

Final Drainage Report Amendment

Compark Village South, Filing No. 1
Parker, Colorado

P.N. CLCPKC3

Prepared for:
470 Compark, LLC
1001 Bannock Street, Suite 240
Denver, CO 80204

Prepared by:
Manhard Consulting
7600 E Orchard Road, Suite 150N
Greenwood Village, Colorado 80111
Contact: Rick Moore, P.E.
303-708-0500

Initially Submitted September 30, 2019
Revised March 2, 2020
Revised May 5, 2020
Revised July 31, 2020

I. GENERAL LOCATION AND DESCRIPTION

A. Scope

This is an amendment to the "Final Drainage Report, Compark Village South, Filing No. 1", prepared by Manhard Consulting, dated November 20, 2015, last revised October 21, 2016. The original scope of this project included realignment of the Green Acres Tributary and construction of an on-line regional detention pond. Since preparation of the previous design, it has been determined by a consultant for Mile High Flood Control District that the on-line regional detention basin is not required for this area. The realignment and improvements to the Green Acres Tributary will now be designed and permitted by RESPEC, the MHFD's consultant.

This amendment is to design an off-line detention basin to control the runoff and provide water quality treatment for the proposed stormwater runoff from Compark Village South Filing No. 1 Belford Avenue improvements and the Compark Village South Filing No. 2 residential subdivision, as well as, a portion of the Compark Village South Filing No. 3 project. Drainage criteria utilized for the design are in accordance with the *Town of Parker Storm Drainage and Environmental Criteria Manual and Urban Drainage and Flood Control District*.

II. DRAINAGE BASINS AND SUB-BASINS

A. Basin Description

The basins and sub-basins utilized to size the proposed detention basin were taken from the "Final Drainage Report, Compark Village South Filing No. 1", prepared by Manhard Consulting, dated November 20, 2015, last revised October 21, 2016. The areas include Belford Avenue from a high point at station 35+15 to the next high point at station 77+41, the 47 acres that comprise the CVS F2 project 11.5 acres of future multi-family development in CVS F3, the 15 acres of future commercial land between the Green Acres Tributary and Belford Avenue and 20 acres of off-site Grand View Estates property that currently drains through this property (H180).

In the original design, there were three direct discharges to the Green Acres Tributary and one discharge to the regional detention pond. The direct

discharge into the proposed arch culvert crossing of Belford Avenue will remain unchanged with this amendment. The other direct discharges into the Green Acres Tributary will remain, but baffle walls will be added to the structures upstream of the GAT to direct the 2 year storm runoff to a drainage pipe that will convey the runoff to the proposed off-line detention basin for water quality treatment. The elevations of the tops of the baffle walls were set at the 2 yr design storm HGL taken from the StormCAD model. The model includes rating tables in the diversion manholes to reflect the proposed diversion of the 2 yr storm flows from the pipes to the GAT. Flows greater than the 2 year storm will overtop the baffle walls and directly discharge to the Green Acres Tributary. The previous discharge to the regional detention pond will be upsized from a 42" RCP to a 60" RCP to convey the runoff from the original design plus the flows from a 2 year storm from the upstream drainage basins that previously discharged directly to the GAT. The drainage system has been revised to route the runoff from STMH 11-12 across the future commercial tract, along Green Acres Tributary and into the proposed off-line detention basin. Although runoff from portions of Belford Avenue and CVS F2 will be directly discharged to the GAT, storage and water quality treatment for these areas will be provided in the proposed detention basin. That is, compensatory storage and treatment will be provided in the proposed detention basin.

Sizing of the proposed Forebay A includes 40 acres of Grandview Estates in addition to the 93.5 acres utilized to size the detention basin. This property drains into the CVS system and was included in the calculations for the 2 year runoff being directed to the detention basin. Flows greater than the 2 year design storm will pass over the baffle wall in the diversion manhole and will discharge directly to the Green Acres Tributary, therefore, this area was not included in the sizing of the proposed detention basin.

III. DRAINAGE DESIGN CRITERIA

A. Regulations

The regulations, guidelines, and drainage design criteria to be used are those contained within the *Town of Parker Storm Drainage Design and Environmental Criteria* and the *Urban Storm Drainage Criteria Manual*. The general drainage concept is to construct a full spectrum extended detention

basin to provide detention and water quality treatment for the proposed stormwater runoff from a portion of Belford Avenue, the entire Compark Village South Filing No. 2 subdivision, a portion of the Compark Village South Filing No. 3 tract and the portion of the commercial tract between the Green Acres Tributary and Belford Avenue.

B. Hydrologic Criteria

The stormwater system associated with Belford Avenue (major collector) was designed for a 5 yr minor storm and the 100 yr major storm. Detailed design information for the system can be found in "Final Drainage Report, Compark Village South, Filing No. 1", prepared by Manhard Consulting, dated November 20, 2015, last revised October 21, 2016. The UDFCD UD Detention worksheet was utilized to design the proposed extended detention basin, the proposed outlet structure, emergency overflow weir, as well as, to calculate the direct runoff from the Grand View Estates property that currently drains across this property.

The UD Detention workbook was completed for the portions of Belford Avenue, all of Compark Village South Filing No. 2, an 11.5 acre portion of Compark Village South Filing No. 3 and 15 acres of commercial area north of Belford Avenue to calculate the allowable release rates for the proposed development without the Grand View Estates area. Then the workbook was utilized to calculate the runoff from the Grand View Estates drainage basin. The 100-year runoff from Grand View Estates will be "passed through" the detention basin, i.e. the allowable 90% of the 100-year discharge from the CVS F2 basin, 42.7 cfs, was increased to include the runoff of 26.8 cfs as calculated by the UD Worksheet for the 20 acre drainage basin.

Drainage Areas to Proposed Detention Basin (See Appendix A):

- 15 ac Commercial (South of Green Acres Trib) @ 90% Impervious (assumed)
- 47 ac CVS Filing No. 2 Residential @ 48% Impervious (calculated)
- 11.5 ac CVS Filing No. 3 Multi-Family @ 75% Impervious (assumed)
- 20 ac Grandview Estates (H180) @ 15% Impervious

Total DA=93.5 ac @ 51% Impervious

Use UD Detention to Calculate Allowable Release of Developed Areas (No Grandview Estates)

Total DA=73.5 ac @ 61% Impervious
From Spreadsheet 100 yr Predeveloped = 65.3 cfs

90% Predeveloped = 58.8 cfs
Direct Discharge to GAT - 26 cfs (Calculated using UD Detention)
32.8 cfs

Allowable 100 yr Release from Detention Basin:

32.8 cfs (Developed runoff) + 26.8 cfs (H180 Undetained Grand View runoff) = **59.6 cfs**

Summary of Predeveloped vs. Postdeveloped Discharges to Green Acres Tributary:

Design Storm Event	Predeveloped Flows to GAT (cfs) H170 + H180 (Grand View Estates)	Predeveloped Flows to GAT (cfs) CVS	Total Predeveloped Flow to GAT (cfs)	Developed Detained Flows (cfs)	Bypass Flows to GAT (cfs)	Total Postdeveloped Flow to GAT (cfs)
2 year	6.2	0.5	6.7	0.9	0.0	0.9
5 year	11.6	1.8	13.4	1.1	12.1	13.2
10 year	21.8	9.7	31.5	7.4	23.1	30.5
25 year	48.9	32.9	81.8	43.5	49.5	93.0
50 year	67.8	46.9	114.7	53.4	68.1	121.5
100 year	92.2	65.3	157.5	57.3	92.0	149.3
500 year	144.9	104.1	249.0	187.8	144.3	332.1

*See Appendix C for supporting runoff calculations

C. Variance from Criteria

No variance is required.

IV. CONCLUSION

This final drainage report amendment complies with all major standards of the Town of Parker and the Urban Drainage Flood Control District. This overall plan for the site's drainage design is effective and economical for controlling damage due to excess storm runoff and minimizing erosive discharges.

Final Drainage Report

Compark Village South, Filing No. 1 – Belford Ave Site Plan Amendment Parker, Colorado

P.N. CLCPKC3

Prepared for:
Belford North Metropolitan District
8390 East Crescent Parkway
Greenwood Village, CO 80111

Prepared By:

7600 E Orchard Road, Suite 150-N
Greenwood Village, Colorado 80111
Contact: Gary Iwata, P.E.
303-708-0500

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I. GENERAL LOCATION AND DESCRIPTION

A. Scope

This project is part of the Compark Village South development. The purpose of this report is to demonstrate the feasibility of the proposed storm drainage system planned to control the stormwater associated with a portion of Belford Avenue and a future development. Drainage criteria are in accordance with the *Town of Parker Storm Drainage and Environmental Criteria Manual* (*Town Criteria*) *and Urban Drainage and Flood Control District Criteria Manual* (*Urban Drainage Criteria*).

B. Location

Compark Village South Filing No, 3 – Belford Ave East lies within the south half of Section 6, Township 6 South, Range 66 West of the Sixth Principal Meridian, Town of Parker, Colorado. General project area boundaries include Highway E-470 to the north, the future Compark Village South Filing No. 3 residential development to the south, Compark Village South Filing No. 1 to the north, and Happy Canyon Creek to the east (see vicinity map in Appendix A). The project lies within drainage basin F as described in the Compark Village South Filing No. 1 drainage report (see map in Appendix D). The project includes a 1,585-foot continuation of a major collector road, Belford Avenue, running east-west connecting South Peoria Street to South Chambers Road.

C. Description of Property

The Compark Village South Filing No. 3 – Belford Ave Development Site consists of approximately 5.5 acres, and is mostly vacant with ground cover consisting of native grasses and shrubs. Onsite soils consist of Newlin gravelly sandy loam, Satanta loam and Loamy alluvial land in the area of the proposed bridge crossing. These soils are classified as hydrologic group B. Refer to Appendix A of this report for excerpts of the SCS soil survey summary.

D. Floodplain Information

Compark Village South Filing No. 3 – Belford Ave is located within the Happy Canyon Creek major drainage basin which has a regulatory 100-year floodplain. Firm Map No 08035C0062G, Effective date: March 16, 2016 reflects a Zone AE and Zone X floodplain across the eastern edge of the site. Refer to Appendix A for FIRMETTE copies of the FIRM Map. A

Floodplain Development Permit from the Town of Parker will be required for any construction within the documented floodplains on the property.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

The entirety of this project lies within the Happy Canyon Creek drainage basin, which has been studied by the Urban Drainage and Flood Control District under the following studies:

- UDFCD – Outfall System Planning – Happy Canyon Creek Watershed within Douglas County, prepared by Kiowa Consultants, June 1993. Urban Drainage in conjunction with sponsor partners Town of Parker and Douglas County are planning on updating the Happy Canyon Creek OSP.

- Green Acres Tributary is a part of the Happy Canyon Creek watershed. The upstream area of the Green Acres Tributary contains several existing and proposed development projects that contain features for which drainage studies have been prepared. All current upstream drainage features are part of the Meridian Office Park, Filings 4 & 5 (reference 5) master drainage analysis.

- Happy Canyon Creek Major Drainageway Plan, prepared by Muller Engineering Company, March 2014.

- Amendment to Happy Canyon Creek Major Drainageway Plan, March 2014, prepared by Manhard Consulting, February 2016.

The project area has further been described in the Compark Village Filing No. 1 Drainage Report as Basin F, comprised of 45 total acres. See Appendix D for the drainage map of this area.

B. Sub-Basin Description

The proposed site will be divided into several drainage sub-basins. These sub-basins have been determined based on land use, area, roadway slopes, storm sewer locations and inlet capacities. The developed site will generally follow the existing drainage patterns and runoff will be conveyed via overland flow and storm sewer to a proposed detention basin located directly south of the east side of the site.

BEL-E1

Drainage basin BEL-E1 is composed of landscaped area, sidewalk, and the south half of a portion of Belford Avenue. Storm water will flow northeast toward Design Point 1 where it will be collected by Inlet A. This is an on grade 10' Type R inlet with the capacity to handle the runoff from a 5 year storm event. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek. In the 100 year storm event, 0.08 cfs excess runoff will bypass Inlet A and Inlet B and flow into sub basin BEL-E3 where it will be intercepted by Inlet C at Design Point 3.

BEL-E2

Drainage basin BEL-E2 is composed of landscaped area, sidewalk, and the south half of a portion of Belford Avenue. Storm water will flow east toward Design Point 2 where it will be collected by Inlet B. This is an on grade 10' Type R inlet with the capacity to handle the runoff from a 5 year storm event. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek. In the 100 year storm event, 0.21 cfs excess runoff will bypass Inlet B and flow into sub basin BEL-E3 where it will be intercepted by Inlet C at Design Point 3.

BEL-E3

Drainage basin BEL-E3 is composed of landscaped area, sidewalk, and a continuation of the south half of Belford Avenue. Storm water will flow from the northwest and southeast towards Design Point 3 where it will be collected by Inlet C. This is a 10' Type R inlet in sump with the capacity to handle the runoff from a 100 year storm event plus the bypass from basins BEL-E1 and BEL-E2. Inlet C is in a 500-foot sag vertical curve. Street capacity for this inlet has been analyzed at 100-feet from the low point, showing adequate street capacity and conformance to section 6.3.2 of the Town Criteria. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek.

BEL-E4

Drainage basin BEL-E4 is composed of landscaped area, sidewalk, and a continuation of the south half of Belford Avenue, as well as, the south half of the proposed bridge over Happy Canyon Creek. This drainage basin also includes approximately 150' of Belford Avenue located within the proposed Chambers Highpoint project. Storm water will flow from the southeast towards Design Point 3 where it will be collected by Inlet C. This is a 10' Type R inlet in sump with the capacity to handle the runoff from a 100 year storm event for BEL-E3 and BEL-E4 plus the bypass from basins BEL-E1 and BEL-E2. This inlet will also collect 0.1 cfs from Chambers Highpoint in the 5 yr storm and 3.0 cfs in the 100 yr storm. Inlet C is in a 500-foot sag vertical curve. Street capacity for this inlet has been analyzed at 100-feet from the low point, showing adequate street capacity and conformance to section 6.3.2 of the Town Criteria. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek.

BEL-E5

Drainage basin BEL-E5 is composed of future landscaped area, sidewalk, and the north half of a portion of Belford Avenue. Storm water will flow northeast toward Design Point 4 where it will be collected by Inlet D. This is an on grade 10' Type R inlet with the capacity to handle the runoff from a 5 year storm event. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek. In the 100 year storm event, 0.36 cfs excess runoff will bypass Inlet D and flow into sub basin BEL-E6 where it will be intercepted by Inlet E at Design Point 5.

BEL-E6

Drainage basin BEL-E6 is composed of future landscaped area, sidewalk, and the north half of a portion of Belford Avenue. Storm water will flow east toward Design Point 5 where it will be collected by Inlet E. This is an on grade 10' Type R inlet with the capacity to handle the runoff from a 5 year storm event. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek. In the 100 year storm event, 0.67 cfs excess runoff will bypass Inlet E and flow

into sub basin BEL-E7 where it will be intercepted by Inlet F at Design Point 6.

BEL-E7

Drainage basin BEL-E7 is composed of future landscaped area, sidewalk, and the north half of a portion of Belford Avenue Storm water will flow from the northwest towards Design Point 6 where it will be collected by Inlet F. This is a 10' Type R inlet in sump with the capacity to handle the runoff from a 100 year storm event plus the bypass from basin BEL-E5 and BEL-E6. Inlet F is in a 500-foot sag vertical curve. Street capacity for this inlet has been analyzed at 100-feet from the low point, showing adequate street capacity and conformance to section 6.3.2 of the Town Criteria. From there, storm water will be conveyed to the proposed detention/water quality pond just southeast of Belford Avenue via storm sewer. This pond discharges directly to Happy Canyon Creek.

BEL-E8

Drainage basin BEL-E8 is composed of landscaped area, sidewalk, and a continuation of the north half of Belford Avenue, as well as, the north half of the proposed bridge over Happy Canyon Creek. This drainage basin also includes approximately 150' of Belford Avenue located within the proposed Chambers Highpoint project. Storm water will flow from the southeast towards Design Point 6 where it will be collected by Inlet F. This is a 10' Type R inlet in sump with the capacity to handle the runoff from a 100 year storm event for BEL-E3 and BEL-E4. Inlet F is in a 500-foot sag vertical curve. Street capacity for this inlet has been analyzed at 100-feet from the low point, showing adequate street capacity and conformance to section 6.3.2 of the Town Criteria. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek.

POND

The drainage for the portion of Belford Avenue being constructed, as well as, future construction of Belford Avenue, and a future residential development, will all drain to the proposed detention basin. The pond is comprised of landscape area with drainage features such as a trickle channel, forebays, and an outlet structure. The detention basin has been designed with the 7.2 acres of Belford Avenue drainage, 1.08 acres from the pond area itself, and 6.5 acres of drainage from the development that will

follow in the future, indicated by basin F3. The detention basin has been designed for the areas described and shown on the attached drainage map in appendix D. Any areas outside of the basins shown have not been included in the detention basin volume calculation. The detention basin discharges directly to Happy Canyon Creek.

F3

Drainage basin F3 in its existing state is composed of undeveloped land and drains directly to Happy Canyon Creek. In developed conditions, it was assumed that the drainage basin would be 6.5 acres, making the total drainage area to the pond 14.77 acres. The imperviousness of the F3 subbasin was assumed to be 75%. The imperviousness of the basin was assumed to be 61% over the entire 14.77 acres. In developed conditions, there will be a need for an inlet to capture the runoff from basin F3. Since walls are being constructed inside the detention basin, an inlet will be installed with pipe to the detention basin that will be used in the future development of the basin. The drainage for the development of this basin will be addressed by a separate drainage report.

The Compark Village Filing No. 1 Drainage Report identifies the area as Basin F, which totals 45 acres. The detention basin has been designed to accommodate the 14.77 acres tributary to the detention basin, leaving the remaining 30+/- acres draining to Happy Canyon Creek as it had in the existing condition.

III. DRAINAGE CHANNELS

A. Happy Canyon Creek

Happy Canyon Creek is a major basin that is tributary to Cherry Creek. The portion of Happy Canyon Creek thalweg that extends through the proposed site is a natural sandy bottom channel. The thalweg has an existing natural meander bend located near the southwest corner of the site. No apparent head cutting exists within this channel reach. The active channel is a dry stream bed that experiences active flows during wet seasonal conditions.

As discussed earlier, a Zone AE and Zone X floodplain exist along Happy Canyon Creek. It is anticipated that bank stabilization will be required along the outer edges of the existing meander bends. No major channel improvements are contemplated for Happy Canyon Creek, except the construction of a roadway bridge crossing needed for Belford Avenue and installation of grade control structures. This bridge structure will span the

existing floodplain. Floodplain mitigation is anticipated through the thalweg. Felsburg Holt & Ullevig (FHU) has been contracted to perform the proposed bridge design and floodplain mitigation. All proposed improvements to Happy Canyon Creek are addressed in the "Conditional Letter of Map Revision (CLOMR) for Happy Canyon Creek at Belford Avenue" found in Appendix E.

A CLOMR has been obtained from FEMA to construct the proposed bridge crossing and proposed improvements to Happy Canyon Creek. The CLOMR was issued November 20, 2019 and the Case No. is 19-08-0690R.(See Appendix E)

Verification has been obtained from the USACOE that the proposed Happy Canyon improvements are authorized by Nationwide Permit (NWP) 29, Residential Developments.(See Appendix E for verification letter)

A floodplain development permit will be required from the Town of Parker for the proposed bridge and channel improvements.

UDFCD and the Town of Parker have sponsored an update to the existing Happy Canyon Creek Outfall Systems Plan (OSP) and the 2014 Happy Canyon Creek Major Drainageway Plan (MDP). Any recommendations to channel upgrades to this reach of Happy Canyon Creek need to meet the recommendations of the OSP and 2014 MDP. Channel design and the Happy Canyon Creek bridge design must be reviewed and approved by UDFCD prior to the approval of associated drawings.

Note: All channel improvement design and construction shall meet the minimum requirements of the UDFCD maintenance eligibility program.

IV. DRAINAGE DESIGN CRITERIA

A. Regulations

The regulations, guidelines, and drainage design criteria to be used are those contained within the *Town of Parker Storm Drainage Design and Environmental Criteria* and the *Urban Storm Drainage Criteria Manual*. The general drainage concept is to construct a full spectrum detention basin to provide detention and water quality before releasing runoff from Belford Avenue and future residential development into Happy Canyon Creek.

The Town's Stream Preservation Standards will be met by providing a natural, undisturbed buffer between the proposed improvements and the Happy Canyon Creek, providing a maintenance road for the length of Happy Canyon Creek within this project and constructing grade control structures within Happy Canyon Creek to minimize erosion of the channel and thereby provide a more stable channel to minimize water pollution, enhance vegetation communities and thereby provide wildlife habitats.

B. Hydrologic Criteria

The Town of Parker *Storm Drainage and Environmental Criteria Manual* and the Urban Drainage and Flood Control District (UDFCD) *Urban Storm Drainage Criteria Manual* were used for the storm drainage system design.

The following criteria was utilized in developing the proposed drainage system:

- The proposed drainage system is designed to match, as best as possible, the historic drainage patterns occurring at the site.
- The proposed drainage system attempts to limit the diversion of storm runoff from one basin to another (basin transfer).
- Runoff generated from drainage sub-basins is conveyed via the proposed storm sewer system into the proposed detention and water quality pond.

Design Rainfall: UDFCD rainfall data is used to determine peak runoff values. The 5-year and 100-year frequency storms are used as the minor and major design storms respectively.

Runoff Calculation: Peak storm runoff is determined using the rational formula,

Q = CIA (CFS)
C = Runoff coefficient based on surface impermeability
I = Rainfall intensity in inches per hour
A = Drainage basin area in acres

UDFCD Imperviousness Values (Table 6-3) and Runoff Coefficients (Table 6-5) were used to develop basin runoff coefficients. These tables can be found in Appendix B. The runoff coefficients are weighted for each applicable sub-basin to more accurately reflect the runoff characteristics of the site.

Time of Concentration is determined using the criteria in Sections 3.4.1 and 3.4.2 of the UDFCD Criteria Manual. These calculations are included in Appendix B.

Rainfall intensities are determined using the Town of Parker's *Storm Drainage and Environmental Criteria Manual* Point Rainfall data and Intensity-Duration curves. The rainfall intensities utilized were:

ONE HOUR RAINFALL DEPTH TABLE

PROJECT NAME: Compark Village South - Belford Avenue East
PROJECT NO: CLCPKC3
LOCATION: Town of Parker, Colorado

*Calculations on this sheet come from UDFCD: Urban Storm Drainage Criteria Manual (V.1) (2017)

2 year		5 year		10 year		100 year	
Time (min.)	Intensity P_1 (in/hr)	Time (min.)	Intensity P_1 (in/hr)	Time (min.)	Intensity P_1 (in/hr)	Time (min.)	Intensity P_1 (in/hr)
60	0.83	60	1.09	60	1.33	60	2.31

C. Hydraulic Criteria

The following *Town Criteria* were utilized in determining allowable street flow.

Minor Storm (5-yr) from Table 2.4

- Collector Street – No curb overtopping. Flow Spread must leave at least a 10 foot width free of water. (5-feet on each side of crown for roads without median. 10-feet on each side of median for roads with a median.)

Major Storm (100-yr) from table 2.5

- Local and Collector Streets – The depth of water at the gutter flowline shall not exceed 12 inches. A minimum of 18-inches must be provided from the water surface elevation to the lowest floor elevation or window well opening elevation for structures that are adjacent to the roadway (this includes residential dwellings, public, commercial and industrial buildings).

For the major and minor storm events, allowable capacity was determined using UD-Inlet version 4.06 by UDFCD.

The following *Town Criteria* were utilized in determining proposed drainage system pipe sizes:

Minor Storm (5-yr)

- the hydraulic grade line must be located below the crown of the pipe

Major Storm (100-yr)

- the hydraulic grade must be located 12-inches below finished grade as a maximum condition.

For the major and minor storm events, HGL's were calculated utilizing Bentley StormCAD modelling software.

V. DRAINAGE FACILITY DESIGN

A. General Concept

Stormwater runoff from the proposed improvements will generally follow existing drainage patterns from northwest to southeast on the site. Overland flow and a proposed storm sewer system will route the runoff to the proposed detention and water quality basin. This detention basin will release restricted flows directly into Happy Canyon Creek.

B. Specific Details

As mentioned previously in this report, the site will be divided into several drainage sub-basins. The onsite runoff will be routed through the site via the proposed roadways and gutters where it will be intercepted by a number of on-grade inlets and inlets located in roadway sumps. This runoff will be routed, via storm sewer, directly to the proposed detention/water quality basin. The detention basin has been sized to accommodate the flows resulting from the areas shown on the drainage map. Any area outside of the basins depicted on the drainage map and described in this report have not been considered as tributary to the proposed detention basin.

The proposed full spectrum detention/water quality basin has been sized to intercept surface runoff from a portion of Belford Avenue, as shown on the drainage map, and a developed residential area, referred to as F3 in the sub-basin descriptions, for a total of approximately 14.77 acres (Full Buildout). The detention basin will release attenuated flows into the existing natural drainageway of Happy Canyon Creek via an outlet structure. The outlet structure has been designed to release controlled WQCV, EURV, and 100-year volume flows, allowing for sediment and trash removal and decreasing adverse downstream impacts. The detention basin will restrict 100 year flows from the developed project to 90% of the historic flows of the project area. Required detention volumes were calculated using the MHFD-Detention

spreadsheet v4.04 as described in the Town of Parker Storm Drainage and Environmental Criteria Manual. Basin tables and charts used in the rational method analysis, along with calculation sheets, are provided in Appendix B.

C. Variance from Criteria

No variances will be required for this project.

VI. ENVIRONMENTAL PROTECTION CRITERIA

A. General

Site drainage improvements are intended to minimize the impact to the environment. The proposed improvements to the Happy Canyon Creek required permitting through FEMA. As part of this permitting process, requirements regarding potential impacts to wetland areas and to threatened and endangered species were identified and the proper permitting was obtained. Specifics are included in the "Conditional Letter of Map Revision (CLOMR) for Happy Canyon Creek at Belford Avenue", page 14. (See Appendix E).

B. Construction BMP Plan

Construction BMPs shall be placed during the appropriate construction phases to minimize soil erosion and the movement of sediment offsite. Construction BMPs shall be placed in two phases (Phase A and Phase B). The intent of the Phase A BMPs are to fulfill water quality objectives during the overlot and roadway rough grading phase of the project. Once Phase A rough grading and earthmoving is completed, Phase B BMP placement will commence. Phase B includes fine grading, utility construction, and street construction. Construction Plans will contain all appropriate Stormwater Management Details. In addition, a Stormwater Management Plan will be prepared to meet the town of Parker, State of Colorado, and Environmental Protection Agency criteria.

VII. CONCLUSION

This drainage report is intended to comply with all major standards of the Town of Parker and the Urban Drainage Flood Control District. This overall plan for the site's drainage design is effective and economical for controlling damage due to excess storm runoff and minimizing erosive discharges. This plan is intended to

integrate into the future basin planning efforts by UDFCD, Douglas County and the Town of Parker when the Happy Canyon Creek Outfall System Planning study is updated.