PCD-ENGINEERING REVIEW COMMENTS
IN BLUE BOXES WITH BLUE TEXT

Engineering Review
12/30/2020 12:02:01 PM
dsdrice
JeffRice@elpasoco.com
(719) 520-7877
EPC Planning & Community
Development Department

See comment letter also.

# FINAL DRAINAGE REPORT
# FOR
# URBAN COLLECTION AT PALMER VILLAGE

**Prepared For:**

**MDC Holdings – Richmond American Homes**
**4350 South Monaco Street**
**Denver, CO 80237**
**720-977-3827**

PCD Filing No.:
SF-20-028

**October 29, 2020**
**Project No. 25149.01**

**Prepared By:**
**JR Engineering, LLC**
**5475 Tech Center Drive, Suite 235**
**Colorado Springs, CO 80919**
**719-593-2593**

**ENGINEER'S STATEMENT:**

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

_____

Glenn D. Ellis, Colorado P.E. 38861
For and On Behalf of JR Engineering, LLC

**DEVELOPER'S STATEMENT:**

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

Business Name: MDC Holdings – Richmond American Homes

By: _____

Title: _____

Address: 4350 South Monaco Street
Denver, CO 80237

**El Paso County:**

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

_____ _____

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

Conditions:

# Table of Contents



## APPENDIX

# PURPOSE

This document is the Final Drainage Report for Urban Collection at Palmer Village. The purpose of this report is to identify on-site and off-site drainage patterns, storm sewer, culvert and inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities.

# GENERAL SITE DESCRIPTION

## GENERAL LOCATION

Urban Collection at Palmer Village is a proposed development within the Urban Collection at Palmer Village subdivision with a total area of 23.1 acres. The site is located in the northeast quarter of Section 5, Township 14 South, Range 65 West of the Sixth Principal Meridian in the County of El Paso, State of Colorado. The site is located immediately south of Constitution Avenue on the west and east side of Hannah Ridge Drive, extending to the east to Marksheffel Road. The site is bounded by Constitution Avenue to the north, Marksheffel Road to the east, Jessica Heights Filing No. 1 to the south, and the Cherokee Park Townhomes to the west. Refer to the vicinity map in Appendix A.

## DESCRIPTION OF PROPERTY

A 100-unit residential development is proposed on lots 1 through 100 and Tracts A through L within the subdivision (hereby referred to as the "site") per the corresponding approved Final Plat. The area of the site totals 10.83 acres. The two tracts (M and N) along Constitution Avenue, east to Marksheffel Road will not be developed at this time. They are referenced in this report only in the context of being included in the plat of the proposed development. Any development of these two tracts shall require separate drainage analysis and drainage reports. The site is currently undeveloped other than a sanitary sewer easement that follows the eastern border of the site on the east side of Hannah Ridge Drive. The proposed development site is comprised of variable sloping grasslands that generally slope east at approximately 3% on the east side of Hannah Ridge Drive. On the west side of Hannah Ridge Drive the land slopes at about 1% to the east, draining into the curb and gutter in Hannah Ridge Drive.

Soil characteristics are comprised of Blakeland loamy sand. NRCS rates this soil designation as Hydrologic Group A. Group A soils exhibit a high infiltration rate when thoroughly wet and consist chiefly of deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a high rate of water transmission. Refer to the soil survey mapping in Appendix A.

There are no major drainageways on the proposed development site, although a tributary to the East Fork Sand Creek is immediately to the east of the site, within the undeveloped tracts.

There are no known irrigation facilities located on the project site. A 12" PVC sanitary sewer runs along the eastern side of the site within an easement.

### FLOODPLAIN STATEMENT

Based on the FEMA Firm Map Number 08041C0752G, revised December 7, 2018, the entire development is located within Zone X, or areas area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The FEMA map containing the site has been presented in Appendix A.

## EXISTING DRAINAGE CONDITIONS

### MAJOR BASIN DESCRIPTIONS

The site lies within the Sand Creek Drainage Basin based on the "Sand Creek Drainage Basin Planning Study" completed by Kiowa Engineering Corporation in January 1993. The Sand Creek Drainage Basin covers approximately 54 square miles and is divided into five major sub-basins: Sand Creek Mainstem, East Fork Sand Creek, Central Tributary to East Fork, West Fork, and East Fork Subtributary. The site is within the East Fork Sand Creek sub-basin, as shown in Appendix E. The Sand Creek Basin discharges into Fountain Creek approximately 1.5 miles upstream of Academy Boulevard Bridge over Fountain Creek.

As development occurred within the basin, the site was analyzed with the "Jessica Heights Filing No. 1 Final Drainage Report" completed by M.V.E. Inc. in April 2005. The portion of the site west of Hannah Ridge Drive was identified as Basin C1 and the portion of the site east of Hannah Ridge Drive was identified as Basin A2. Basin C1 contributes existing flows of $Q_5$ = 2.8 cfs and $Q_{100}$ = 6.8 cfs. Basin A2 contributes existing flows of $Q_5$ = 3.2 cfs and $Q_{100}$ = 7.6 cfs. Runoff from both basins flows east. Basin C1 is captured in Hannah Ridge Drive curb and gutter and is conveyed to Constitution Avenue, while Basin A2 sheet flows off site to the adjacent parcel to the east.

Most recently, the site was analyzed within the "Hannah Ridge at Feathergrass Master Drainage Development Plan" completed by M.V.E. Inc in November 2007. The site was identified as Basin OSA14 with existing flows of $Q_5$=14 and $Q_{100}$=27 cfs flowing easterly to Tributary to Sand Creek – East Fork Reach No. 6.

As previously stated, there are no known irrigation facilities within the site that would impact drainage. An existing 12" PVC sanitary sewer runs along the eastern boundary of the site and is contained within a dedicated easement.

## EXISTING SUB-BASIN DRAINAGE

The site is bisected by Hannah Ridge Drive, dividing the site into east and west parcels. The east side drains directly into a tributary to the East Fork Sand Creek (Tributary to Sand Creek – East Fork Reach No. 6). Runoff from the west site sheet flows across the site and is collected in Hannah Ridge Drive curb and gutter and is conveyed either north to Constitution Avenue or south to the Jessica Heights Subdivision. The west site is comprised of existing Basins EX3 and EX4. The east site is comprised of Basin EX6. Basins EX1 and EX2 are offsite basins that sheet flow onto Basins EX3 and EX4, respectively. Basin EX5 flows offsite to Constitution Avenue. The basins shown in the "Jessica Heights Filing No. 1 Final Drainage Report" created by M.V.E., Inc. in April, 2005 correspond to the existing basins in this report in the following manner: OSA = EX1, OSB = EX2, C1 = EX3 and EX4, A4 = EX5, A2 = EX6.

Existing Basin EX1 is approximately 0.15 acres and is consistent with the Jessica Heights Filing No. 1 Final Drainage Report Basin OSA. Flow from this basin sheet flows onto the site to Basin EX3 at Design Point (DP) 1 ($Q_5$=0.04 cfs, $Q_{100}$ =0.4 cfs), eventually reaching DP3, a local depression.

Existing Basin EX2 is approximately 0.46 acres and is consistent with the Jessica Heights Filing No. 1 Final Drainage Report Basin OSB. Flow from this basin ($Q_5$=0.2 cfs, $Q_{100}$ =1.2 cfs) sheet flows onto the site to Basin EX4 at DP2, eventually reaching Hannah Ridge Drive at DP4.

Existing Basin EX3 is approximately 4.27 acres and consists of prairie grasses. Flow from this basin ($Q_5$ =1.2 cfs, $Q_{100}$ =9.0 cfs) sheet flows to the local depression at DP3. According to the available contour data, once the local depression has filled, the overtopping flow travels to the northeast. The flow then is conveyed to the curb and gutter along the south side of Constitution Avenue, where it is conveyed to an existing Type R inlet approximately 670 feet east of Hannah Ridge Drive. The flow that enters the existing inlet is routed into the existing double 10' x 6' concrete box culvert that conveys the tributary to the East Fork Sand Creek under Constitution Avenue.

Existing Basin EX4 is approximately 1.62 acres and consists of prairie grasses and a portion of Hannah Ridge Drive. Flow from this basin ($Q_5$=1.1 cfs, $Q_{100}$ =4.0 cfs) sheet flows to the curb and gutter in Hannah Ridge Drive at DP4. The flow then is conveyed south via the Jessica Heights Subdivision storm sewer system, eventually discharging into a tributary to the East Fork Sand Creek.

Existing Basin EX5 is approximately 0.37 acres and consists of a portion of Hannah Ridge Drive and prairie grasses. Flow from this basin ($Q_5$=1.4 cfs, $Q_{100}$ =2.7 cfs) flows north along the Hannah Ridge Drive curb and gutter until it reaches the curb and gutter on the south side of Constitution Avenue at DP5. From there, the flow follows the same path as the flow that overtops the local depression in Basin EX3.

Existing Basin EX6 is approximately 5.25 acres and consists of prairie grasses. Flow from this basin ($Q_5$=1.5 cfs, $Q_{100}$ =11.1 cfs) sheet flows to the eastern property line at DP6 and enters a tributary to the East Fork Sand Creek.

As stated previously, the undeveloped tracts east of the site have not been analyzed in their existing conditions as part of this report. Future development of these tracts will require a separate drainage report.

# PROPOSED DRAINAGE CONDITIONS

## PROPOSED SUB-BASIN DRAINAGE

The site was broken into two major proposed basins: Basin A (west parcel) and Basin B (east parcel). The proposed basin (and sub-basin) delineation is shown on the drainage basin map and is described as follows:

Basin EX1 is approximately 0.15 acres and is consistent with the Jessica Heights Filing No. 1 Final Drainage Report Basin OSA. Flow from this basin sheet flows onto the site to Basin A1 at Design Point (DP) EX1 ($Q_5$=0.04 cfs, $Q_{100}$ =0.4 cfs). The flow is combined with runoff from Basin A1 at DP1.

Basin A1 consists of approximately 0.78 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=2.6 cfs and $Q_{100}$=5.0 cfs) will be collected and conveyed in the centerline of Vanhoutte View to DP1. At DP1 ($Q_5$=2.3 cfs and $Q_{100}$=4.8 cfs), flow combines with runoff from Basin EX1 and enters EPC Type A curb and gutter. The curb and gutter conveys the flow east to a sump Double Denver Type 16 Combination Inlet (Double Type 16 inlet) at DP3, where it combines with Basin A2 flow.

Basin A2 consists of approximately 0.22 acres and includes walks, drives, and landscape areas. Flow from this basin ($Q_5$=0.6 cfs and $Q_{100}$=1.3 cfs) will be collected and conveyed in EPC Type A curb and gutter on the north side of Wayfaring Tree Heights to a sump Double Type 16 inlet at DP3, where it combines with the flow from DP1.

Total flows at DP3 are $Q_5$=3.0 cfs and $Q_{100}$=6.1 cfs. The sump Double Type 16 inlet captures all flow in the 5-year and 100-year events. DP3 flow combine with DP4 flow at DP4.1. In the event that the inlet becomes clogged, the flow will follow the curb flowline to the east to the on-grade Double Type 16 inlet at DP5.

Basin A3 consists of approximately 0.11 acres and includes walks, drives, and landscape areas. Flow from this basin ($Q_5$=0.3 cfs and $Q_{100}$=0.7 cfs) will be collected and conveyed in EPC Type A curb

and gutter on the south side of Wayfaring Tree Heights to an on-grade Double Type 16 inlet at DP4, where it combines with Basin A4 flow.

Basin A4 consists of approximately 0.62 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=2.0 cfs and $Q_{100}$=4.0 cfs) will be collected and conveyed in the centerline of Vanhoutte View to DP2. At DP2, flow enters EPC Type A curb and gutter and is conveyed east to an on-grade Double Type 16 inlet at DP4, where it combines with Basin A3 flow.

Total flows at DP4 are $Q_5$=2.4 cfs and $Q_{100}$=5.7 cfs. The on-grade Double Type 16 inlet captures 1.9 cfs in the 5-year and 3.4 cfs in the 100-year event. DP4 flow-by of $Q_5$=0.5 cfs and $Q_{100}$=2.3 cfs continues east via curb and gutter to DP6 where it combines with Basin A7 flow. DP4 captured flow is piped in 18" RCP to DP4.1, where it combines with flow from DP3.

Total flows at DP4.1 are $Q_5$=4.8 cfs and $Q_{100}$=9.3 cfs. The flow is conveyed via 18" and 24" RCP to DP5.1, where it combines with flow from DP5.

Basin A5 consists of approximately 0.83 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=1.9 cfs and $Q_{100}$=4.2 cfs) will be collected and conveyed in the centerline of Serviceberry Grove and the EPC Type A curb and gutter on the north side of Wayfaring Tree Heights to an on-grade Double Type 16 inlet at DP5. The on-grade Double Type 16 inlet captures 1.6 cfs in the 5-year and 2.7 cfs in the 100-year event. DP5 flow-by of $Q_5$=0.3 cfs and $Q_{100}$=1.5 cfs continues east via curb and gutter to DP8 where it combines with Basin A6 and DP7 flow. DP5 captured flow combines with DP4.1 flow at DP5.1.

Total flows at DP5.1 are $Q_5$=6.6 cfs and $Q_{100}$=13.4 cfs. The flow is conveyed via 30" RCP to DP8.1, where it combines with flow from DP8.

Basin A6 consists of approximately 0.18 acres and includes walks, drives, and landscape areas. Flow from this basin ($Q_5$=0.6 cfs and $Q_{100}$=1.1 cfs) will be collected and conveyed in EPC Type A curb and gutter in Wayfaring Tree Heights to a sump Triple Type 16 inlet at DP8, where it combines with flow from DP7 and DP5 flow-by.

Basin A7 consists of approximately 0.46 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=1.3 cfs and $Q_{100}$=2.7 cfs) will be collected and conveyed in the centerline of Serviceberry Grove to DP6. At DP6, flow enters EPC Type A curb and gutter and combines with DP4 flow-by. The combined flow is conveyed to a sump Triple Type 16 inlet at DP9, where it combines with Basin A9 flow.

Total flows at DP6 are $Q_5$=1.8 cfs and $Q_{100}$=4.8 cfs. The flow is conveyed east via curb and gutter to DP9, where it combines with flow from Basin A9 and DP8 flow-by.

Basin A8 consists of approximately 0.74 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=1.5 cfs and $Q_{100}$=3.5 cfs) will be collected and conveyed in the centerline of Fountain Grass Grove to DP7. At DP7, flow enters EPC Type A curb and gutter and is conveyed west to a sump Triple Type 16 inlet at DP8 where it combines with DP5 flow-by and Basin A6 flow.

Total flows at DP8 are $Q_5$=2.3 cfs and $Q_{100}$=5.9 cfs. The sump Triple Type 16 inlet captures all flows in the 5-year and 4.3 cfs in the 100-year event. DP8 flow-by of $Q_{100}$=1.6 cfs overtops the centerline crown of the road south to DP9 where it combines with Basin A9 and DP6 flow. DP8 captured flow combines with DP5.1 flow at DP8.1.

Total flows at DP8.1 are $Q_5$=8.7 cfs and $Q_{100}$=14.9 cfs. All flow at DP8.1 is conveyed via 30" RCP to DP9.1, where it combines with flow from DP9.

Basin A9 consists of approximately 0.57 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=1.8 cfs and $Q_{100}$=3.5 cfs) will be collected and conveyed in EPC Type A curb and gutter on the west side of Fountain Grass Grove to a sump Triple Type 16 inlet at DP9, where it combines with flow from DP6 and DP8 flow-by.

The total combined flow at DP9 from DP6, DP8 flow-by, and Basin A9 is $Q_5$=3.4 cfs and $Q_{100}$=9.2 cfs. All flow at DP9 is captured and combines with flow from DP8.1 at DP9.1. If the sump inlet at DP9 were to become clogged, flow would overtop the curb to the south and discharge directly into Pond A.

Total flows at DP9.1 are $Q_5$=11.8 cfs and $Q_{100}$=23.8 cfs. All flow at DP9.1 is conveyed via 30" RCP to Pond A at DP10, where it combines with flow from Basin A10.

Basin A10 consists of approximately 0.78 acres of sidewalk, landscaped areas, and contains Full Spectrum Water Quality and Detention Pond A. Flow from this basin ($Q_5$=0.4 cfs and $Q_{100}$=2.1 cfs) is captured in a grass-lined swale that discharges directly into Pond A where it combines with flow from DP9.1. A detailed discussion of Full-Spectrum Water Quality and Detention Pond A is presented in the Water Quality section later in this report.

Total flows at DP10 are $Q_5$=12.1 cfs and $Q_{100}$=25.6 cfs. All flow at DP10 is routed through the Pond A outlet structure and proposed RCP (various sizes) before discharging into the existing double 10'x6' concrete box culvert that conveys a tributary to the East Fork Sand Creek.

Basin A11 consists of approximately 0.17 acres and includes walks, drives, and landscape areas. Due to topographical constraints, Basin A10 ($Q_5$=0.3 cfs and $Q_{100}$=0.7 cfs) flow drains overland to the existing curb and gutter on the south side of Constitution Avenue, which conveys it east to an existing Type R inlet at DP11.

Basin A12 consists of approximately 0.14 acres and includes landscaped area and sidewalk. Due to topographical constraints, Basin A11 ($Q_5$=0.2 cfs and $Q_{100}$=0.6 cfs) flow drains overland to the existing curb and gutter on the south side of Constitution Avenue, which conveys it east to the existing Hannah Ridge Drive cross pan at DP12.

Basin B1 consists of approximately 0.59 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=1.4 cfs and $Q_{100}$=3.1 cfs) will be collected and conveyed in the centerline of Fountain Grass Grove to DP15. At DP15, flow enters EPC Type A curb and gutter and is conveyed east to an on-grade Double Type 16 inlet at DP17, where it combines with Basin B2 flow.

Basin B2 consists of approximately 0.08 acres and includes walks and drives. Flow from this basin ($Q_5$=0.4 cfs and $Q_{100}$=0.6 cfs) will be collected and conveyed in EPC Type A curb and gutter in Blue Avena View to an on-grade Double Type 16 inlet at DP17, where it combines with flow from DP15.

Total flows at DP17 are $Q_5$=1.7 cfs and $Q_{100}$=3.5 cfs. The on-grade Double Type 16 inlet captures 1.4 cfs in the 5-year event and 2.3 cfs in the 100-year event. DP17 flow-by of $Q_5$=0.3 cfs and $Q_{100}$=1.2 cfs continues east in curb and gutter to an on-grade Single Type 16 inlet at DP19 where it combines with Basin B5 flow. DP17 captured flows are piped in 18” RCP to DP18.1, where it combines with flow from DP18.

Basin B3 consists of approximately 0.11 acres and includes walks, drives, and landscape areas. Flow from this basin ($Q_5$=0.5 cfs and $Q_{100}$=0.9 cfs) will be collected and conveyed in EPC Type A curb and gutter in Blue Avena View to a on-grade Double Type 16 inlet at DP18, where it combines with flow from DP16.

Basin B4 consists of approximately 0.76 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=2.5 cfs and $Q_{100}$=4.9 cfs) will be collected and conveyed in the centerline of Fountain Grass Grove to DP16. At DP16, flow enters EPC Type A curb and gutter and is conveyed east to a sump Double Type 16 inlet at DP18, where it combines with Basin B3 flow.

Total flows at DP18 from DP16 and Basin B3 are $Q_5$=2.8 cfs and $Q_{100}$=5.4 cfs. The sump Double Type 16 inlet captures all flow in the 5-year and 100-year events. DP18 flow combines with DP17 flow at DP18.1. In the event that the inlet at DP18 becomes clogged, flow will follow the flowline east to the sump Double Type 16 inlet at DP23.

Total flows at DP18.1 are $Q_5$=4.2 cfs and $Q_{100}$=7.8 cfs. The flow is conveyed via 18” RCP to DP23.1, where it combines with flow from DP23.

Basin B5 consists of approximately 0.65 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=1.5 cfs and $Q_{100}$=3.3 cfs) will be collected and conveyed in the centerline

of Purple Fountain Point to an on-grade Single Type 16 inlet at DP19, where it combines with DP17 flow-by.

Total flows at DP19 from Basin B5 and DP17 flow-by are $Q_5$=1.8 cfs and $Q_{100}$=4.6 cfs. The on-grade Single Type 16 inlet captures 1.2 cfs in the 5-year and 2.1 cfs in the 100-year event. DP19 flow-by of $Q_5$=0.6 cfs and $Q_{100}$=2.5 cfs continues east via curb and gutter to a sump Triple Type 16 inlet at DP24 where it combines with Basin B6 flow. DP19 captured flow is conveyed via 18" RCP to DP24.1, where it combines with DP24 flow.

Basin B6 consists of approximately 0.08 acres and includes walks, drives and landscape areas. Flow from this basin ($Q_5$=0.3 cfs and $Q_{100}$=0.6 cfs) will be collected and conveyed in EPC Type A curb and gutter in Blue Avena View to a sump Triple Type 16 inlet at DP24, where it combines with DP19 flow-by.

Total flows at DP24 from DP19 flow-by and Basin B6 are $Q_5$=0.8 cfs and $Q_{100}$=3.0 cfs. All flow at DP24 is captured by a sump Triple Type 16 inlet and combines with flow from DP19 and DP23.1 at DP24.1. In the event that the inlet at DP24 becomes clogged, flow will overtop the curb to the north and enter Pond B.

Basin B7 consists of approximately 0.13 acres and includes walks, drives, and landscape areas. Flow from this basin ($Q_5$=0.5 cfs and $Q_{100}$=1.0 cfs) will be collected and conveyed in EPC Type A curb and gutter in Blue Avena View to a sump Double Type 16 inlet at DP23, where it combines with flow from DP20 and DP22 flow-by.

Basin B8 consists of approximately 0.72 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=2.2 cfs and $Q_{100}$=4.4 cfs) will be collected and conveyed in the centerline of Purple Fountain Point to DP20. The flow is conveyed east to a sump Double Type 16 inlet at DP23, where it combines with Basin B7 flow and DP22 flow-by.

Basin B9 consists of approximately 0.31 acres of landscaped areas and sidewalk. Flow from this basin ($Q_5$=0.1 cfs and $Q_{100}$=0.9 cfs) is conveyed in a grass-lined swale to a sump Type C Inlet at DP21. All Basin B9 flow is captured at DP21 and is piped via 18" RCP to DP22.1, where it combines with flows from DP22. In the event that the inlet at DP21 becomes clogged, the flow will overtop the one-foot depression and continue to flow east to DP30 via a grass-lined swale.

Basin B10 consists of approximately 0.53 acres and includes walks, drives, roofs and landscape areas. Flow from this basin ($Q_5$=1.4 cfs and $Q_{100}$=3.0 cfs) will be collected and conveyed in EPC Type A curb and gutter on the west side of Foerster Grass View to a sump Double Type 16 inlet at DP22. All captured flow at DP22 ($Q_5$=1.4 cfs and $Q_{100}$=2.6 cfs) is piped via 18" RCP to DP22.1, where it combines with flow from DP21. DP22 flow-by ($Q_{100}$=0.4 cfs) will follow the curb flowline

north to the sump Double Type 16 inlet at DP23. In the event that the inlet at DP22 becomes clogged, the flow would follow the curb flowline north to the sump Double Type 16 inlet at DP23.

The total combined flow at DP23 from Basin B7, DP20, and DP22 flow-by is $Q_5$=2.6 cfs and $Q_{100}$=5.4 cfs. All flow at DP23 is captured and combines with flow from DP18.1 at DP23.1. In the event the inlet at DP23 becomes clogged, the flow will overtop the road crown to the north and enter the sump Triple Type 16 inlet at DP24.

Total flows at DP22.1 are $Q_5$=1.5 cfs and $Q_{100}$=3.5 cfs. The flow is conveyed via 18" RCP to DP23.1, where it combines with flow from DP23.

Total flows at DP23.1 from DP18.1, DP22.1, and DP23 are $Q_5$=8.1 cfs and $Q_{100}$=16.3 cfs. The flow is conveyed via 24" RCP to DP24.1, where it combines with flow from DP19 and DP24.

Total flows at DP24.1 are $Q_5$=10.0 cfs and $Q_{100}$=21.1 cfs. The flow is conveyed via 30" RCP to Pond B at DP25, where it combines with flow from Basin B11.

Basin B11 consists of approximately 0.53 acres of walks and landscaped areas and contains Full-Spectrum Water Quality and Detention Pond B. Flow from this basin ($Q_5$=0.3 cfs and $Q_{100}$=1.7 cfs) sheet flows directly into Pond B where it combines with flow from DP24.1 at DP25. A detailed discussion of Full-Spectrum Water Quality and Detention Pond B is presented in the Water Quality section later in this report.

Total flows at DP25 are $Q_5$=10.2 cfs and $Q_{100}$=22.6 cfs. All flow at DP25 is routed through the Pond B outlet structure and proposed RCP (various sizes) before discharging into the existing double 10'x6' concrete box culvert that conveys a tributary to the East Fork Sand Creek.

Basin B12 consists of approximately 0.07 acres of landscaped areas and sidewalk. Due to topographical constraints, flow from this basin ($Q_5$=0.1 cfs and $Q_{100}$=0.3 cfs) will discharge directly into Constitution Avenue curb and gutter at DP26, which conveys the flow east to an existing Type R inlet about 670 feet east of Hannah Ridge Drive.

Basin B13 consists of approximately 0.21 acres of landscaped areas and sidewalk. Due to topographical constraints, flow from this basin ($Q_5$=0.3 cfs and $Q_{100}$=0.9 cfs) will discharge directly into Constitution Avenue curb and gutter at DP27, and will follow the same flow path as Basin B12.

Basin B14 consists of approximately 0.19 acres of landscaped areas and contains approximately 1,870 square feet of asphalt roadway. Flow from this basin ($Q_5$=0.3 cfs and $Q_{100}$=0.9 cfs) follows historic drainage patterns and sheet flows offsite at DP28, along the eastern site boundary, eventually flowing directly into the Tributary to Sand Creek – East Fork Reach No. 6.

Basin B15 consists of approximately 0.18 acres of walks and landscaped areas. Flow from this basin ($Q_5$=0.2 cfs and $Q_{100}$=0.6 cfs) follows historic drainage patterns and sheet flows easterly offsite at DP29 to Tributary to Sand Creek – East Fork Reach No. 6.

Basin B16 consists of approximately 0.12 acres of landscaped areas and will remain undeveloped. Flow from this basin ($Q_5$=0.1 cfs and $Q_{100}$=0.3 cfs) is conveyed in a grass-lined swale onsite before discharging to the east property line at DP30. From here, the flow follows historic drainage patterns to the Tributary to Sand Creek – East Fork Reach No. 6.

# DRAINAGE DESIGN CRITERIA

## DEVELOPMENT CRITERIA REFERENCE

Storm drainage analysis and design criteria for this project were taken from the "*City of Colorado Springs/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual*" Volumes 1 to 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "*Colorado Springs Drainage Criteria Manual*" (CSDCM), dated May 2014, as adopted by El Paso County.

## HYDROLOGIC CRITERIA

All hydrologic data was obtained from the "*El Paso Drainage Criteria Manual*" Volumes 1 and 2, and the "*Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual*" Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5-year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the CSDCM. One hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the CSDCM. Time of concentrations were developed using equations from CSDCM. All runoff calculations and applicable charts and graphs are included in the Appendices.

**Table 2 - 1-hr Point Rainfall Data**

| Storm | Rainfall (in.) |
|---|---|
| 5-year | 1.50 |
| 100-year | 2.52 |

## HYDRAULIC CRITERIA

The Rational Method and USDCM's SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site, and the UDFCD UD-Detention v3.07 spreadsheet was utilized for evaluating proposed detention and water quality pond. Sump and on-grade inlets were sized using UDFCD UD-Inlet v2.07. Manning's equation was used to size the proposed pipes in this report and StormCAD was used to model the proposed storm sewer system and to analyze the

proposed HGL calculations for the Construction Drawings. See Appendix C for the HGL calculations.

# DRAINAGE FACILITY DESIGN

## FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

Step 1 – Reducing Runoff Volumes: The Urban Collection at Palmer Village development project consists of 50 duplex structures with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Roof drains from the structures will discharge to lawn areas, where feasible, to allow for infiltration and runoff volume reduction.

Step 2 – Stabilize Drainageways: The site lies within the Sand Creek Drainage Basin. Basin and bridge fees will be paid at time of platting. These funds will be used on future projects within the basin to stabilize drainageways. The site does not discharge directly into the open drainageway of Sand Creek, therefore no downstream stabilization will be accomplished with this project.

Step 3 – Treat the WQCV: Water Quality treatment for this site is provided in two proposed full-spectrum water quality detention ponds: Pond A and Pond B. The runoff from this site will be collected within inlets and conveyed to the proposed ponds via storm sewer. Upon entrance to the ponds, flows will be captured in a forebay designed to promote settlement of suspended solids. A trickle channel is also incorporated into the ponds to minimize the amount of standing water. The outlet structure has been designed to detain the water quality capture volume (WQCV) for 40 hours, and the extended urban runoff volume (EURV) for 72 hours. All flows released from the ponds will be reduced to less than historic rates.

Revise Step 4. This should be n/a since this is not an industrial or commercial site.

Step 4 – Consider Need for Industrial and Commercial BMPs: BMPs will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. Site specific temporary source control BMPs that will be implemented include, but are not limited to, silt fencing placed around downstream areas of disturbance, construction vehicle tracking pads at the entrances, designated concrete truck washout basin, designated vehicle fueling areas, covered storage areas, spill containment and control, etc. The permanent erosion control BMPs include asphalt drives and parking, storm inlets and storm pipe, two full-spectrum water quality and detention ponds, and permanent vegetation.

**Step 4: Consider Need for Industrial and Commercial BMPs**

If a new development or significant redevelopment activity is planned for an industrial or commercial site, the need for specialized BMPs must be considered. Two approaches are described in the New Development BMP Factsheets:

- Covering of Storage/Handling Areas
- Spill Containment and Control

Other Specialized BMPs may also be required

## WATER QUALITY

The site is split by Hannah Ridge Drive, therefore, a full-spectrum water quality and detention pond is provided on both sides. Basins EX1, EX2, and A1-A10, located west of Hannah Ridge Drive, will discharge to Pond A. Basins B1-B11, located east of Hannah Ridge Drive, will discharge to Pond B. Both ponds have been designed per Section 13.3.2.1 of Resolution 15-042 of the El Paso County Drainage Criteria Manual.

Full-Spectrum Water Quality and Detention Pond A is designed for a total contributing acreage of 5.91 acres at 50.2% impervious from Basins EX1, EX2, and A1-A10. The total WQCV is 0.102 ac-ft, the excess urban runoff volume (EURV) is 0.241 ac-ft, and the total required detention volume is 0.544 ac-ft. The WQCV is released over 43 hours, the EURV is released over 72 hours, and the 100-year volume is released over 79 hours. The 100-year discharge of 2.4 cfs is equal to 90% of predevelopment rates. An emergency inlet is provided that conveys the full undetained, peak 100-year flow of 26.5 cfs with a 1.0' freeboard.

Pond A's outlet structure outfalls into a 30" RCP that flows along the site's southern property line before discharging into the existing double 10'x6' RCBC located in the adjacent parcel, east of the eastern parcel. A drainage easement is provided for both the onsite and offsite portions of this pond outfall. The ultimate discharge of the double 10'x6' RCBC is the "Tributary to Sand Creek – East Fork Reach No. 6". A drainage map including Pond A and its outfall has been presented in Appendix F. Due to the fact that there are no upstream regional detention facilities, an "emergency conditions" scenario was not analyzed for Pond A.

Pond B is designed for a total contributing acreage of 4.49 acres at 54.1% impervious from Basins B1-B11. The total WQCV is 0.081 ac-ft, the excess urban runoff volume (EURV) is 0.205 ac-ft and the total required detention volume is 0.446 ac-ft. The WQCV is released over 43 hours, the EURV is released over 72 hours and the 100-year volume is released over 77 hours. The 100-year discharge of 1.5 cfs is equal to 70% of predevelopment rates. A riprap spillway is provided that conveys the full undetained, peak 100-year flow of 22.7 cfs with a 1.0' freeboard. The spillway has a crest length of 20' and a total depth of 1.50'. Additionally, emergency overflow inlets are included to capture emergency flows.

The pond outfalls into a 30" RCP that flows east and south, connecting to the Pond A outfall. A drainage easement will be provided for both the onsite and offsite portions of this pond outfall. The ultimate discharge of the double 10' x 6' RCBC is the" Tributary to Sand Creek – East Fork Reach No. 6". A drainage map including Pond B and it's outfall has been presented in Appendix F. Due to the fact that there are no upstream regional detention facilities, an "emergency conditions" scenario was not analyzed for Pond B.

### EROSION CONTROL PLAN

The Erosion Control Plan and Cost Estimate have been submitted for review in conjunction with the grading and erosion control plan and construction assurances will be posted prior to issuance of a building permit.

### OPERATION & MAINTENANCE

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. The property owner shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Access is provided from onsite facilities and easements for proposed infrastructure located offsite. We respectfully request that the Operation & Maintenance Manual be submitted in conjunction with the construction documents, prior to obtaining a grading permit.

### DRAINAGE AND BRIDGE FEES

The site lies within the Sand Creek Drainage Basin. Anticipated drainage and bridge fees are presented below, based on Resolution No. 19-441, and will be paid at time of platting. Fees could change, and are dependent on the timing of the plat.

| 2020 DRAINAGE AND BRIDGE FEES - URBAN COLLECTION AT PALMER VILLAGE | | | | |
|---|---|---|---|---|
| Impervious Acres | Drainage Fee (Per Imp. Acre) | Bridge Fee (Per Imp. Acre) | Urban Collection at Palmer Village Drainage Fee | Urban Collection at Palmer Village Bridge Fee |
| 5.67 | $19,698 | $8,057 | $111,688 | $45,683 |

## SUMMARY

The proposed Urban Collection at Palmer Village development drainage improvements, including storm sewer and two full-spectrum water quality and detention ponds were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development will not adversely affect the offsite drainageways or surrounding development. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site.

# REFERENCES

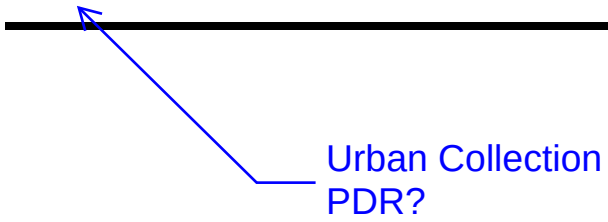
1. City of Colorado Springs Drainage Criteria Manual (Volumes I & II), City of Colorado Springs, Colorado, Updated May, 2014.

2. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.

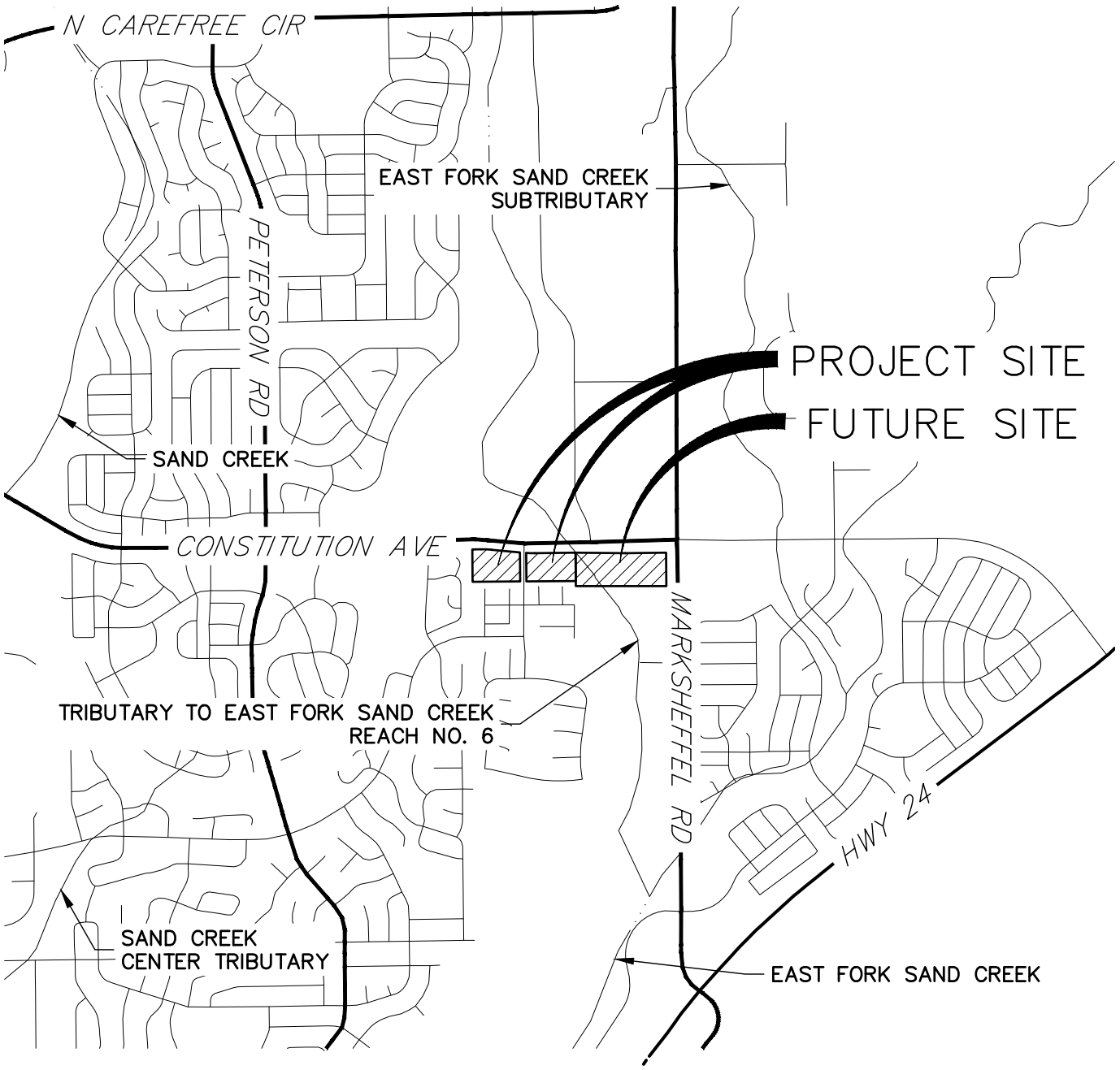
3. Sand Creek Drainage Basin Planning Study, prepared Kiowa Engineering Corporation, January, 1993.

4. Jessica Heights Filing No. 1 Final Drainage Report, prepared by M.V.E., Inc, April, 2005.

5. Hannah Ridge at Feathergrass Master Drainage Development Plan, prepared by M.V.E., Inc., November 15, 2007.



# Appendix A
# Vicinity Map, Soil Descriptions, FEMA Floodplain Map




N

2000 1000 0 2000

ORIGINAL SCALE: 1" = 2000'

APPENDIX A: VICINITY MAP
URBAN COLLECTION AT
PALMER VILLAGE
JOB NO. 25149.01
06/01/2020
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

## NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

**Base Map** information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

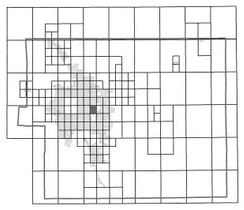
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

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

**El Paso County Vertical Datum Offset Table**

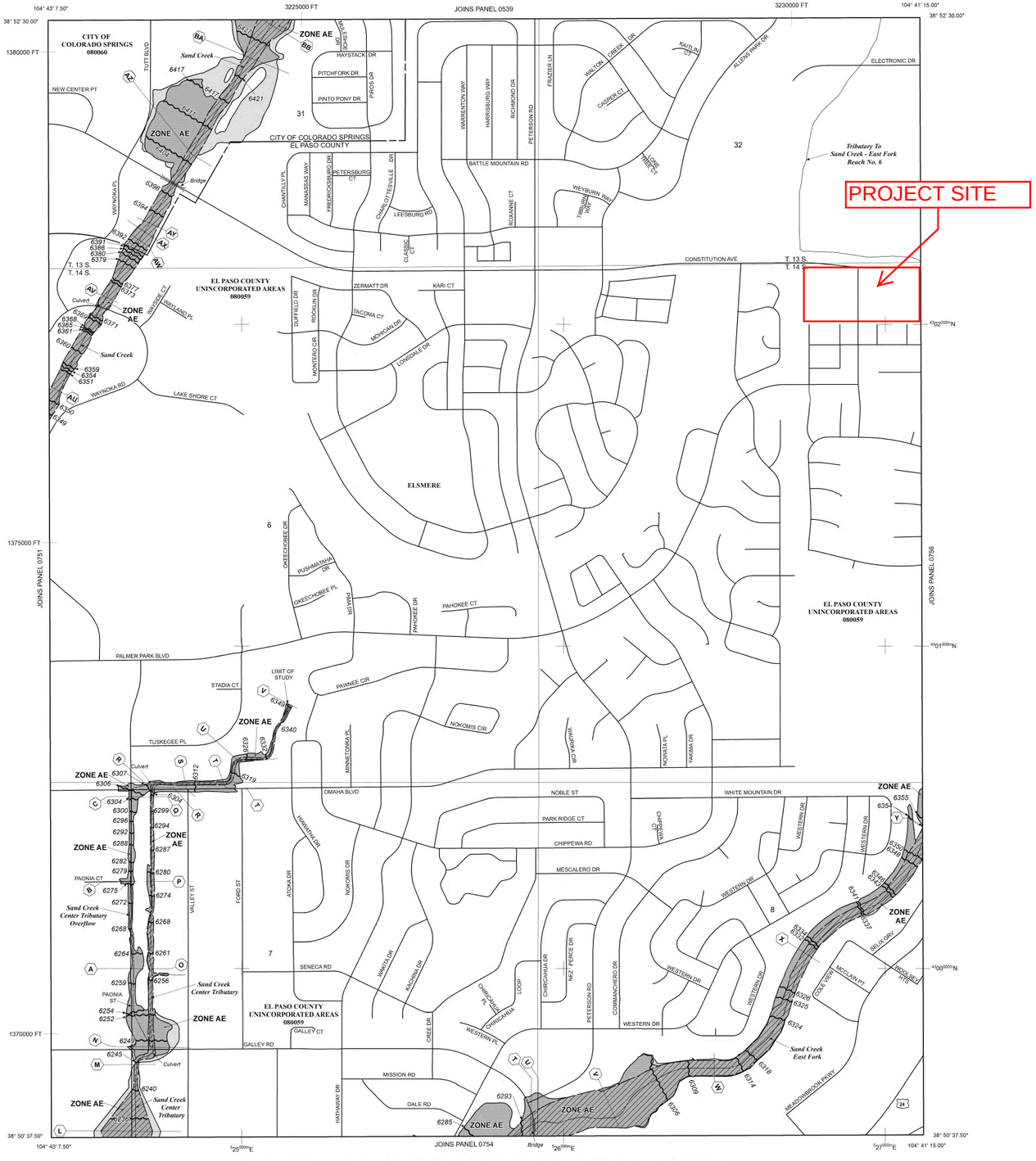
| Flooding Source | Vertical Datum Offset (ft) |
|---|---|
| REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION | |

**Panel Location Map**



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.




NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST, AND TOWNSHIP 14 SOUTH, RANGE 65 WEST.

## LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

**ZONE A** No Base Flood Elevations determined.
**ZONE AE** Base Flood Elevations determined.
**ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
**ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
**ZONE AR** Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
**ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
**ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
**ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
**ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A — Cross section line
- 23 — 23 — Transect line
- 97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
**MARCH 17, 1997**

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
**DECEMBER 7, 2018** - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

**PANEL 0752G**

NATIONAL FLOOD INSURANCE PROGRAM

# FIRM

## FLOOD INSURANCE RATE MAP

## EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

**PANEL 752 OF 1300**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| COLORADO SPRINGS, CITY OF | 080060 | 0752 | G |
| EL PASO COUNTY | 080059 | 0752 | G |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**08041C0752G**

**MAP REVISED**
**DECEMBER 7, 2018**

Federal Emergency Management Agency

## NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

**Base Map** information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

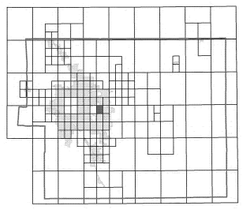
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

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

**El Paso County Vertical Datum Offset Table**

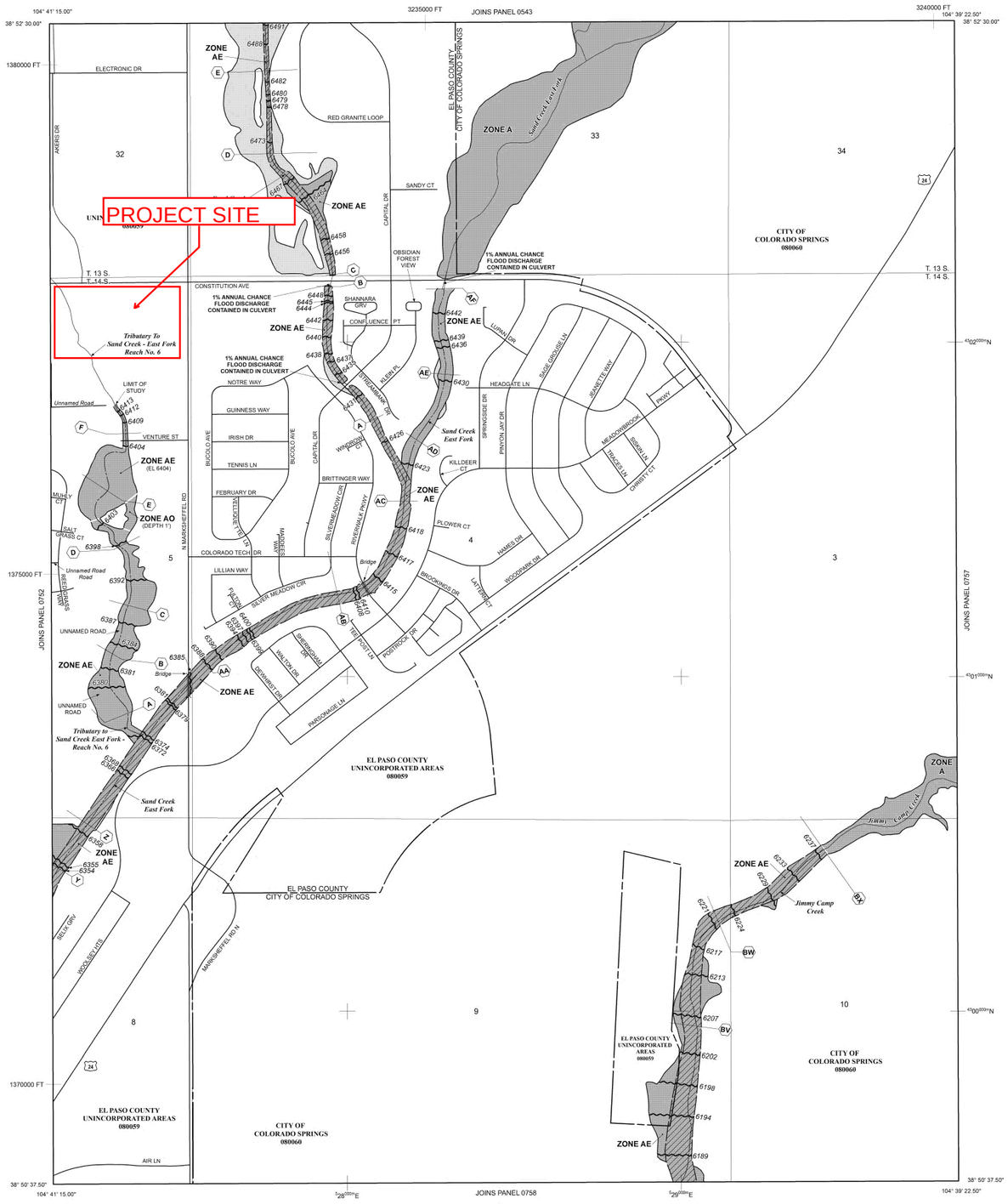
| Flooding Source | Vertical Datum Offset (ft) |
|---|---|
| REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION | |

**Panel Location Map**



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.




**NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST, AND TOWNSHIP 14 SOUTH, RANGE 65 WEST.**

## LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| **ZONE A** | No Base Flood Elevations determined. |
| **ZONE AE** | Base Flood Elevations determined. |
| **ZONE AH** | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| **ZONE AO** | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| **ZONE AR** | Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| **ZONE A99** | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| **ZONE V** | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| **ZONE VE** | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

| | |
|---|---|
| **ZONE X** | Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. |

OTHER AREAS

| | |
|---|---|
| **ZONE X** | Areas determined to be outside the 0.2% annual chance floodplain. |
| **ZONE D** | Areas in which flood hazards are undetermined, but possible. |

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A — Cross section line
- 23 — 23 — Transect line
- 97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- DX5510 X — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
**MARCH 17, 1997**

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
**DECEMBER 7, 2018** - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

**MAP SCALE 1" = 500'**

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

**PANEL 0756G**

NATIONAL FLOOD INSURANCE PROGRAM

# FIRM

## FLOOD INSURANCE RATE MAP

## EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

**PANEL 756 OF 1300**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

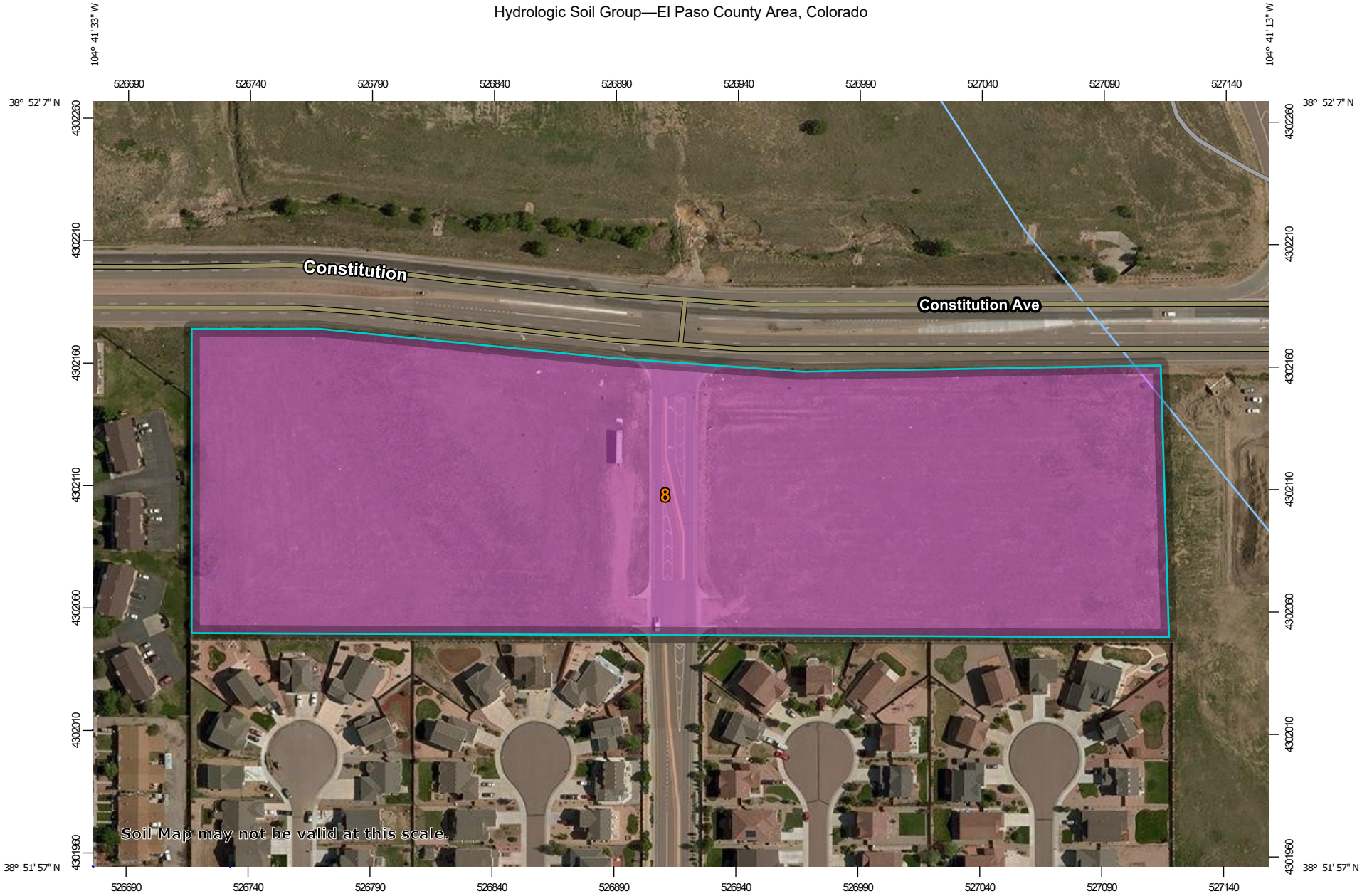
| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| COLORADO SPRINGS, CITY OF | 080060 | 0756 | G |
| EL PASO COUNTY | 080059 | 0756 | G |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**08041C0756G**

**MAP REVISED**
**DECEMBER 7, 2018**

**Federal Emergency Management Agency**




Map Scale: 1:2,200 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

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

## MAP LEGEND

**Area of Interest (AOI)**

- Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Lines**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Points**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Water Features**

- Streams and Canals

**Transportation**

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

**Background**

- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Apr 15, 2011—Jun 17, 2014

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

# Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 8 | Blakeland loamy sand, 1 to 9 percent slopes | A | 11.3 | 100.0% |
| **Totals for Area of Interest** | | | **11.3** | **100.0%** |

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

# Appendix B
# Hydrologic Calculations

# PALMER VILLAGE - EXISTING DRAINAGE SUMMARY

## EXISTING BASIN SUMMARY TABLE

| Tributary Sub-basin | Area (acres) | Percent Impervious | $C_5$ | $C_{100}$ | $t_c$ (min) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| EX1 | 0.15 | 2% | 0.08 | 0.35 | 7.9 | 0.04 | 0.4 |
| EX2 | 0.46 | 2% | 0.08 | 0.35 | 8.1 | 0.2 | 1.2 |
| EX3 | 4.27 | 2% | 0.08 | 0.35 | 14.2 | 1.2 | 9.0 |
| EX4 | 1.62 | 19% | 0.22 | 0.45 | 17.9 | 1.1 | 4.0 |
| EX5 | 0.37 | 82% | 0.75 | 0.85 | 5.0 | 1.4 | 2.7 |
| EX6 | 5.25 | 2% | 0.08 | 0.35 | 14.4 | 1.5 | 11.1 |

## EXISTING DESIGN POINT SUMMARY TABLE

| DP | $Q_5$ | $Q_{100}$ |
|---|---|---|
| 1 | 0.04 | 0.4 |
| 2 | 0.2 | 1.2 |
| 3 | 1.3 | 9.3 |
| 4 | 1.3 | 4.9 |
| 5 | 1.4 | 2.7 |
| 6 | 1.5 | 11.1 |

# % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT C

| | | |
|---|---|---|
| Subdivision: | PALMER VILLAGE | PALMER VILLAGE |
| Location: | Colorado Springs | 2000-5149.01 |
| | | RPD |
| | | NQJ |
| | | 1/30/20 |

| Basin ID | Total Area (ac) | PAVED STREETS | | | UNDEVELOPED MEADOW | | | Basins Total Weighted % Imp. |
|---|---|---|---|---|---|---|---|---|
| | | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | |
| EX1 | 0.15 | 100% | 0.00 | 0.0% | 2% | 0.15 | 2.0% | 2.0% |
| EX2 | 0.46 | 100% | 0.00 | 0.0% | 2% | 0.46 | 2.0% | 2.0% |
| EX3 | 4.27 | 100% | 0.00 | 0.0% | 2% | 4.27 | 2.0% | 2.0% |
| EX4 | 1.62 | 100% | 0.27 | 17.0% | 2% | 1.35 | 1.7% | 18.6% |
| EX5 | 0.37 | 100% | 0.30 | 81.8% | 2% | 0.07 | 0.4% | 82.1% |
| EX6 | 5.25 | 100% | 0.00 | 0.0% | 2% | 5.25 | 2.0% | 2.0% |
| TOTAL | 12.12 | | | | | | | 6.7% |

**Table 6-6. Runoff Coefficients for Rational Method**
(Source: UDFCD 2001)

| Land Use or Surface Characteristics | Percent Impervious | Runoff Coefficients | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2-year | | 5-year | | 10-year | | 25-year | | 50-year | | 100-year | |
| | | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D |
| Business | | | | | | | | | | | | | |
| Commercial Areas | 95 | 0.79 | 0.80 | 0.81 | 0.82 | 0.83 | 0.84 | 0.85 | 0.87 | 0.87 | 0.88 | 0.88 | 0.89 |
| Neighborhood Areas | 70 | 0.45 | 0.49 | 0.49 | 0.53 | 0.53 | 0.57 | 0.58 | 0.62 | 0.60 | 0.65 | 0.62 | 0.68 |
| Residential | | | | | | | | | | | | | |
| 1/8 Acre or less | 65 | 0.41 | 0.45 | 0.45 | 0.49 | 0.49 | 0.54 | 0.54 | 0.59 | 0.57 | 0.62 | 0.59 | 0.65 |
| 1/4 Acre | 40 | 0.23 | 0.28 | 0.30 | 0.35 | 0.36 | 0.42 | 0.42 | 0.50 | 0.46 | 0.54 | 0.50 | 0.58 |
| 1/3 Acre | 30 | 0.18 | 0.22 | 0.25 | 0.30 | 0.32 | 0.38 | 0.39 | 0.47 | 0.43 | 0.52 | 0.47 | 0.57 |
| 1/2 Acre | 25 | 0.15 | 0.20 | 0.22 | 0.28 | 0.30 | 0.36 | 0.37 | 0.46 | 0.41 | 0.51 | 0.46 | 0.56 |
| 1 Acre | 20 | 0.12 | 0.17 | 0.20 | 0.26 | 0.27 | 0.34 | 0.35 | 0.44 | 0.40 | 0.50 | 0.44 | 0.55 |
| Industrial | | | | | | | | | | | | | |
| Light Areas | 80 | 0.57 | 0.60 | 0.59 | 0.63 | 0.63 | 0.66 | 0.66 | 0.70 | 0.68 | 0.72 | 0.70 | 0.74 |
| Heavy Areas | 90 | 0.71 | 0.73 | 0.73 | 0.75 | 0.75 | 0.77 | 0.78 | 0.80 | 0.80 | 0.82 | 0.81 | 0.83 |
| Parks and Cemeteries | 7 | 0.05 | 0.09 | 0.12 | 0.19 | 0.20 | 0.29 | 0.30 | 0.40 | 0.34 | 0.46 | 0.39 | 0.52 |
| Playgrounds | 13 | 0.07 | 0.13 | 0.16 | 0.23 | 0.24 | 0.31 | 0.32 | 0.42 | 0.37 | 0.48 | 0.41 | 0.54 |
| Railroad Yard Areas | 40 | 0.23 | 0.28 | 0.30 | 0.35 | 0.36 | 0.42 | 0.42 | 0.50 | 0.46 | 0.54 | 0.50 | 0.58 |
| Undeveloped Areas | | | | | | | | | | | | | |
| Historic Flow Analysis--Greenbelts, Agriculture | 2 | 0.03 | 0.05 | 0.09 | 0.16 | 0.17 | 0.26 | 0.26 | 0.38 | 0.31 | 0.45 | 0.36 | 0.51 |
| Pasture/Meadow | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |
| Forest | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |
| Exposed Rock | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Offsite Flow Analysis (when landuse is undefined) | 45 | 0.26 | 0.31 | 0.32 | 0.37 | 0.38 | 0.44 | 0.44 | 0.51 | 0.48 | 0.55 | 0.51 | 0.59 |
| Streets | | | | | | | | | | | | | |
| Paved | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Gravel | 80 | 0.57 | 0.60 | 0.59 | 0.63 | 0.63 | 0.66 | 0.66 | 0.70 | 0.68 | 0.72 | 0.70 | 0.74 |
| Drive and Walks | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Roofs | 90 | 0.71 | 0.73 | 0.73 | 0.75 | 0.75 | 0.77 | 0.78 | 0.80 | 0.80 | 0.82 | 0.81 | 0.83 |
| Lawns | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |

# COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2000-5149.01
Calculated By: RPD
Checked By: NQJ
Date: 1/30/20

| Basin ID | Total Area (ac) | Basins Total Weighted % Imp. | Hydrologic Soil Group | | | Land Use | | Minor Coefficients | | Major Coefficients | | Basins Total Weighted $C_5$ | Basins Total Weighted $C_{100}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Area A (ac) | Area B (ac) | Area C/D (ac) | Area Paved Streets (ac) | Area Undeveloped Meadow (ac) | $C_{5,A,PAVED\ STREETS}$ | $C_{5,A,UNDEVELOPED\ MEADOW}$ | $C_{100,A,PAVED\ STREETS}$ | $C_{100,A,UNDEVELOPED\ MEADOW}$ | | |
| EX1 | 0.15 | 2.0% | 0.15 | 0.00 | 0.00 | 0.00 | 0.15 | 0.90 | 0.08 | 0.96 | 0.35 | 0.08 | 0.35 |
| EX2 | 0.46 | 2.0% | 0.46 | 0.00 | 0.00 | 0.00 | 0.46 | 0.90 | 0.08 | 0.96 | 0.35 | 0.08 | 0.35 |
| EX3 | 4.27 | 2.0% | 4.27 | 0.00 | 0.00 | 0.00 | 4.27 | 0.90 | 0.08 | 0.96 | 0.35 | 0.08 | 0.35 |
| EX4 | 1.62 | 18.6% | 1.62 | 0.00 | 0.00 | 0.27 | 1.35 | 0.90 | 0.08 | 0.96 | 0.35 | 0.22 | 0.45 |
| EX5 | 0.37 | 82.1% | 0.37 | 0.00 | 0.00 | 0.30 | 0.07 | 0.90 | 0.08 | 0.96 | 0.35 | 0.75 | 0.85 |
| EX6 | 5.25 | 2.0% | 5.25 | 0.00 | 0.00 | 0.00 | 5.25 | 0.90 | 0.08 | 0.96 | 0.35 | 0.08 | 0.35 |
| TOTAL | 12.12 | 6.7% | 12.12 | 0.00 | 0.00 | 5% | 95% | --- | --- | --- | --- | 0.12 | 0.38 |

**Table 6-6. Runoff Coefficients for Rational Method**
(Source: UDFCD 2001)

| Land Use or Surface Characteristics | Percent Impervious | Runoff Coefficients | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2-year | | 5-year | | 10-year | | 25-year | | 50-year | | 100-year | |
| | | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D |
| Business | | | | | | | | | | | | | |
| Commercial Areas | 95 | 0.79 | 0.80 | 0.81 | 0.82 | 0.83 | 0.84 | 0.85 | 0.87 | 0.87 | 0.88 | 0.88 | 0.89 |
| Neighborhood Areas | 70 | 0.45 | 0.49 | 0.49 | 0.53 | 0.53 | 0.57 | 0.58 | 0.62 | 0.60 | 0.65 | 0.62 | 0.68 |
| Residential | | | | | | | | | | | | | |
| 1/8 Acre or less | 65 | 0.41 | 0.45 | 0.45 | 0.49 | 0.49 | 0.54 | 0.54 | 0.59 | 0.57 | 0.62 | 0.59 | 0.65 |
| 1/4 Acre | 40 | 0.23 | 0.28 | 0.30 | 0.35 | 0.36 | 0.42 | 0.42 | 0.50 | 0.46 | 0.54 | 0.50 | 0.58 |
| 1/3 Acre | 30 | 0.18 | 0.22 | 0.25 | 0.30 | 0.32 | 0.38 | 0.39 | 0.47 | 0.43 | 0.52 | 0.47 | 0.57 |
| 1/2 Acre | 25 | 0.15 | 0.20 | 0.22 | 0.28 | 0.30 | 0.36 | 0.37 | 0.46 | 0.41 | 0.51 | 0.46 | 0.56 |
| 1 Acre | 20 | 0.12 | 0.17 | 0.20 | 0.26 | 0.27 | 0.34 | 0.35 | 0.44 | 0.40 | 0.50 | 0.44 | 0.55 |
| Industrial | | | | | | | | | | | | | |
| Light Areas | 80 | 0.57 | 0.60 | 0.59 | 0.63 | 0.63 | 0.66 | 0.66 | 0.70 | 0.68 | 0.72 | 0.70 | 0.74 |
| Heavy Areas | 90 | 0.71 | 0.73 | 0.73 | 0.75 | 0.75 | 0.77 | 0.78 | 0.80 | 0.80 | 0.82 | 0.81 | 0.83 |
| Parks and Cemeteries | 7 | 0.05 | 0.09 | 0.12 | 0.19 | 0.20 | 0.29 | 0.30 | 0.40 | 0.34 | 0.46 | 0.39 | 0.52 |
| Playgrounds | 13 | 0.07 | 0.13 | 0.16 | 0.23 | 0.24 | 0.31 | 0.32 | 0.42 | 0.37 | 0.48 | 0.41 | 0.54 |
| Railroad Yard Areas | 40 | 0.23 | 0.28 | 0.30 | 0.35 | 0.36 | 0.42 | 0.42 | 0.50 | 0.46 | 0.54 | 0.50 | 0.58 |
| Undeveloped Areas | | | | | | | | | | | | | |
| Historic Flow Analysis--Greenbelts, Agriculture | 2 | 0.03 | 0.05 | 0.09 | 0.16 | 0.17 | 0.26 | 0.26 | 0.38 | 0.31 | 0.45 | 0.36 | 0.51 |
| Pasture/Meadow | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |
| Forest | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |
| Exposed Rock | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Offsite Flow Analysis (when landuse is undefined) | 45 | 0.26 | 0.31 | 0.32 | 0.37 | 0.38 | 0.44 | 0.44 | 0.51 | 0.48 | 0.55 | 0.51 | 0.59 |
| Streets | | | | | | | | | | | | | |
| Paved | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Gravel | 80 | 0.57 | 0.60 | 0.59 | 0.63 | 0.63 | 0.66 | 0.66 | 0.70 | 0.68 | 0.72 | 0.70 | 0.74 |
| Drive and Walks | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Roofs | 90 | 0.71 | 0.73 | 0.73 | 0.75 | 0.75 | 0.77 | 0.78 | 0.80 | 0.80 | 0.82 | 0.81 | 0.83 |
| Lawns | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |

# STANDARD FORM SF-2
# TIME OF CONCENTRATION

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2000-5149.01
Calculated By: RPD
Checked By: NQJ
Date: 1/30/20

| SUB-BASIN DATA | | | | | | INITIAL/OVERLAND ($T_i$) | | | TRAVEL TIME ($T_t$) | | | | | *tc* CHECK (URBANIZED BASINS) | | | FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASIN ID | D.A. (ac) | Hydrologic Soils Group | Impervious (%) | $C_5$ | $C_{100}$ | $L$ (ft) | $S_o$ (%) | $t_i$ (min) | $L_t$ (ft) | $S_t$ (%) | $K$ | VEL. (ft/s) | $t_t$ (min) | COMP. $t_c$ (min) | TOTAL LENGTH (ft) | Urbanized $t_c$ (min) | $t_c$ (min) |
| EX1 | 0.15 | A | 2% | 0.08 | 0.35 | 50 | 5.0% | 7.7 | 26 | 5.0% | 10.0 | 2.2 | 0.2 | 7.9 | 76.0 | 25.9 | 7.9 |
| EX2 | 0.46 | A | 2% | 0.08 | 0.35 | 50 | 5.0% | 7.7 | 56 | 5.0% | 10.0 | 2.2 | 0.4 | 8.1 | 106.0 | 26.1 | 8.1 |
| EX3 | 4.27 | A | 2% | 0.08 | 0.35 | 50 | 7.8% | 6.6 | 471 | 1.1% | 10.0 | 1.0 | 7.6 | 14.2 | 521.0 | 33.9 | 14.2 |
| EX4 | 1.62 | A | 19% | 0.22 | 0.45 | 50 | 7.8% | 5.7 | 643 | 0.8% | 10.0 | 0.9 | 12.2 | 17.9 | 693.0 | 33.3 | 17.9 |
| EX5 | 0.37 | A | 82% | 0.75 | 0.85 | 0 | N/A | N/A | 189 | 0.5% | 20.0 | 1.4 | 2.3 | 2.3 | 189.0 | 14.3 | 5.0 |
| EX6 | 5.25 | A | 2% | 0.08 | 0.35 | 50 | 3.0% | 9.1 | 550 | 3.0% | 10.0 | 1.7 | 5.3 | 14.4 | 600.0 | 31.4 | 14.4 |

NOTES:

$$t_c = t_i + t_t$$ Equation 6-2

Where:

$t_c$ = computed time of concentration (minutes)

$t_i$ = overland (initial) flow time (minutes)

$t_t$ = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

$t_t$ = channelized flow time (travel time, min)
$L_t$ = waterway length (ft)
$S_o$ = waterway slope (ft/ft)
$V_t$ = travel time velocity (ft/sec) = $K\sqrt{S_o}$
$K$ = NRCS conveyance factor (see Table 6-2).

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

$t_i$ = overland (initial) flow time (minutes)
$C_5$ = runoff coefficient for 5-year frequency (from Table 6-4)
$L_i$ = length of overland flow (ft)
$S_o$ = average slope along the overland flow path (ft/ft).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$ Equation 6-5

Where:

$t_c$ = minimum time of concentration for first design point when less than $t_c$ from Equation 6-1.
$L_t$ = length of channelized flow path (ft)
$i$ = imperviousness (expressed as a decimal)
$S_t$ = slope of the channelized flow path (ft/ft).

**Table 6-2. NRCS Conveyance factors, K**

| Type of Land Surface | Conveyance Factor, K |
|---|---|
| Heavy meadow | 2.5 |
| Tillage/field | 5 |
| Short pasture and lawns | 7 |
| Nearly bare ground | 10 |
| Grassed waterway | 15 |
| Paved areas and shallow paved swales | 20 |

Use a minimum $t_c$ value of 5 minutes for urbanized areas and a minimum $t_c$ value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

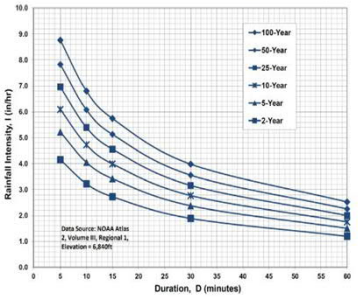
Subdivision: PALMER VILLAGE
Location: Colorado Springs
Design Storm: 5-Year

Project Name: PALMER VILLAGE
Project No.: 2000-5149.
Calculated By: RPD
Checked By: NQJ
Date: 1/30/20

| STREET | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | OVERLAND | | | PIPE | | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (Ac) | Runoff Coeff. | $t_c$ (min) | C*A (Ac) | I (in/hr) | Q (cfs) | tc (min) | C*A (ac) | I (in/hr) | Q (cfs) | $Q_{overland}$ (cfs) | C*A (ac) | Slope (%) | $Q_{pipe}$ (cfs) | C*A (ac) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | $t_t$ (min) | |
| | 1 | EX1 | 0.15 | 0.08 | 7.9 | 0.01 | 4.49 | 0.04 | | | | | 0.04 | 0.01 | 1.90 | | | | | 468 | 1.4 | 5.7 | BASIN EX1 FLOW AT DP1, OVERLAND FLOW TO DP3 |
| | 2 | EX2 | 0.46 | 0.08 | 8.1 | 0.04 | 4.45 | 0.2 | | | | | 0.2 | 0.04 | 1.61 | | | | | 626 | 1.3 | 8.2 | BASIN EX2 FLOW AT DP2, OVERLAND FLOW TO DP4 |
| | | EX3 | 4.27 | 0.08 | 14.2 | 0.34 | 3.60 | 1.2 | | | | | | | | | | | | | | | BASIN EX3 FLOW AT DP3 (LOCAL DEPRESSION) |
| | 3 | | | | | | | | 14.2 | 0.35 | 3.60 | 1.3 | | | | | | | | | | | COMBINED DP1 AND EX3 FLOW AT DP3 (LOCAL DEPRESSION) |
| | | EX4 | 1.62 | 0.22 | 17.9 | 0.35 | 3.26 | 1.1 | | | | | | | | | | | | | | | BASIN EX4 FLOW AT DP4, FLOWS SOUTH ALONG C&G |
| | 4 | | | | | | | | 17.9 | 0.39 | 3.26 | 1.3 | | | | | | | | | | | COMBINED DP2 AND EX4 FLOW AT DP4 |
| | 5 | EX5 | 0.37 | 0.75 | 5.0 | 0.28 | 5.17 | 1.4 | | | | | | | | | | | | | | | BASIN EX5 FLOW AT DP5, FLOWS EAST ALONG C&G |
| | 6 | EX6 | 5.25 | 0.08 | 14.4 | 0.42 | 3.59 | 1.5 | | | | | | | | | | | | | | | BASIN EX6 FLOW AT DP6 |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency




IDF Equations

$I_{100} = -2.52 \ln(aD) + 12.735$

$I_{50} = -2.25 \ln(aD) + 11.375$

$I_{25} = -2.00 \ln(aD) + 10.111$

$I_{10} = -1.75 \ln(aD) + 8.847$

$I_5 = -1.50 \ln(aD) + 7.583$

$I_2 = -1.19 \ln(aD) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: PALMER VILLAGE
Location: Colorado Springs
Design Storm: 100-Year

Project Name: PALMER VILLAGE
Project No.: 2000-5149.
Calculated By: RPD
Checked By: NQJ
Date: 1/30/20

| Description | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | OVERLAND | | | PIPE | | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (ac) | Runoff Coeff. | $t_c$ (min) | C*A (ac) | I (in/hr) | Q (cfs) | tc (min) | C*A (ac) | I (in/hr) | Q (cfs) | $Q_{overland}$ (cfs) | C*A (ac) | Slope (%) | $Q_{pipe}$ (cfs) | C*A (ac) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | $t_t$ (min) | |
| | 1 | EX1 | 0.15 | 0.35 | 7.9 | 0.05 | 7.54 | 0.4 | | | | | 0.4 | 0.05 | 1.90 | | | | | 468 | 1.4 | 5.7 | BASIN EX1 FLOW AT DP1, OVERLAND FLOW TO DP3 |
| | 2 | EX2 | 0.46 | 0.35 | 8.1 | 0.16 | 7.47 | 1.2 | | | | | 1.2 | 0.16 | 1.61 | | | | | 626 | 1.3 | 8.2 | BASIN EX2 FLOW AT DP2, OVERLAND FLOW TO DP4 |
| | | EX3 | 4.27 | 0.35 | 14.2 | 1.49 | 6.04 | 9.0 | | | | | | | | | | | | | | | BASIN EX3 FLOW AT DP3 (LOCAL DEPRESSION) |
| | 3 | | | | | | | | 14.2 | 1.54 | 6.04 | 9.3 | | | | | | | | | | | COMBINED DP1 AND EX3 FLOW AT DP3 (LOCAL DEPRESSION) |
| | | EX4 | 1.62 | 0.45 | 17.9 | 0.73 | 5.47 | 4.0 | | | | | | | | | | | | | | | BASIN EX4 FLOW AT DP4, FLOWS SOUTH ALONG C&G |
| | 4 | | | | | | | | 17.9 | 0.89 | 5.47 | 4.9 | | | | | | | | | | | COMBINED DP2 AND EX4 FLOW AT DP4 |
| | 5 | EX5 | 0.37 | 0.85 | 5.0 | 0.31 | 8.68 | 2.7 | | | | | | | | | | | | | | | BASIN EX5 FLOW AT DP5, FLOWS EAST ALONG C&G |
| | 6 | EX6 | 5.25 | 0.35 | 14.4 | 1.84 | 6.02 | 11.1 | | | | | | | | | | | | | | | BASIN EX6 FLOW AT DP6 |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

PALRMER VILLAGE - PROPOSED DRAINAGE
SUMMARY

| BASIN 'A' SUMMARY TABLE | | | | | | | |
|---|---|---|---|---|---|---|---|
| Tributary | Area | Percent | | | $t_c$ | $Q_5$ | $Q_{100}$ |
| Sub-basin | (acres) | Impervious | $C_5$ | $C_{100}$ | (min) | (cfs) | (cfs) |
| EX1 | 0.15 | 0% | 0.08 | 0.35 | 7.9 | 0.0 | 0.2 |
| EX2 | 0.46 | 0% | 0.08 | 0.35 | 8.1 | 0.2 | 0.7 |
| A1 | 0.78 | 74% | 0.65 | 0.77 | 5.5 | 2.6 | 5.0 |
| A2 | 0.22 | 67% | 0.63 | 0.76 | 7.8 | 0.6 | 1.3 |
| A3 | 0.11 | 63% | 0.60 | 0.74 | 6.2 | 0.3 | 0.7 |
| A4 | 0.62 | 75% | 0.65 | 0.76 | 5.2 | 2.0 | 4.0 |
| A5 | 0.83 | 54% | 0.50 | 0.65 | 7.0 | 1.9 | 4.2 |
| A6 | 0.18 | 84% | 0.74 | 0.84 | 7.9 | 0.6 | 1.1 |
| A7 | 0.46 | 67% | 0.60 | 0.73 | 5.8 | 1.3 | 2.7 |
| A8 | 0.74 | 47% | 0.44 | 0.61 | 7.8 | 1.5 | 3.5 |
| A9 | 0.57 | 72% | 0.66 | 0.77 | 6.9 | 1.8 | 3.5 |
| A10 | 0.78 | 5% | 0.12 | 0.38 | 9.4 | 0.4 | 2.1 |
| A11 | 0.17 | 43% | 0.44 | 0.61 | 9.5 | 0.3 | 0.7 |
| A12 | 0.14 | 36% | 0.37 | 0.57 | 8.0 | 0.2 | 0.6 |

| DESIGN POINT SUMMARY TABLE | | |
|---|---|---|
| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
| EX1 | 0.04 | 0.2 |
| EX2 | 0.2 | 0.7 |
| 1 | 2.3 | 4.8 |
| 2 | 2.0 | 4.7 |
| 3 | 3.0 | 6.1 |
| 4 | 2.4 | 5.7 |
| 4.1 | 4.8 | 9.3 |
| 5 | 1.9 | 4.2 |
| 5.1 | 6.6 | 13.4 |
| 6 | 1.8 | 4.8 |
| 7 | 1.5 | 3.5 |
| 8 | 2.3 | 5.9 |
| 8.1 | 8.7 | 14.9 |
| 9 | 3.4 | 9.2 |
| 9.1 | 11.8 | 23.8 |
| 10 | 12.1 | 25.6 |
| 11 | 0.3 | 0.7 |
| 12 | 0.2 | 0.6 |

| BASIN 'B' SUMMARY TABLE | | | | | | | |
|---|---|---|---|---|---|---|---|
| Tributary | Area | Percent | | | $t_c$ | $Q_5$ | $Q_{100}$ |
| Sub-basin | (acres) | Impervious | $C_5$ | $C_{100}$ | (min) | (cfs) | (cfs) |
| B1 | 0.59 | 54% | 0.49 | 0.64 | 6.4 | 1.4 | 3.1 |
| B2 | 0.08 | 100% | 0.90 | 0.96 | 5.0 | 0.4 | 0.6 |
| B3 | 0.12 | 87% | 0.79 | 0.88 | 5.0 | 0.5 | 0.9 |
| B4 | 0.76 | 75% | 0.66 | 0.77 | 5.9 | 2.5 | 4.9 |
| B5 | 0.65 | 52% | 0.48 | 0.64 | 6.3 | 1.5 | 3.3 |
| B6 | 0.08 | 85% | 0.78 | 0.87 | 5.0 | 0.3 | 0.6 |
| B7 | 0.13 | 84% | 0.77 | 0.86 | 5.0 | 0.5 | 1.0 |
| B8 | 0.72 | 68% | 0.60 | 0.72 | 5.5 | 2.2 | 4.4 |
| B9 | 0.31 | 2% | 0.10 | 0.36 | 5.6 | 0.1 | 0.9 |
| B10 | 0.53 | 63% | 0.57 | 0.71 | 6.5 | 1.4 | 3.0 |
| B11 | 0.53 | 3% | 0.10 | 0.37 | 5.6 | 0.3 | 1.7 |
| B12 | 0.07 | 30% | 0.33 | 0.54 | 5.0 | 0.1 | 0.3 |
| B13 | 0.21 | 33% | 0.35 | 0.55 | 7.3 | 0.3 | 0.9 |
| B14 | 0.19 | 27% | 0.30 | 0.52 | 5.2 | 0.3 | 0.9 |
| B15 | 0.18 | 10% | 0.17 | 0.41 | 5.0 | 0.2 | 0.6 |
| B16 | 0.12 | 0% | 0.08 | 0.35 | 5.0 | 0.1 | 0.3 |

| DESIGN POINT SUMMARY TABLE | | |
|---|---|---|
| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
| 15 | 1.4 | 3.1 |
| 16 | 2.5 | 4.9 |
| 17 | 1.7 | 3.5 |
| 18 | 2.8 | 5.4 |
| 18.1 | 4.2 | 7.8 |
| 19 | 1.8 | 4.6 |
| 20 | 2.2 | 4.4 |
| 21 | 0.1 | 0.9 |
| 22 | 1.4 | 3.0 |
| 22.1 | 1.5 | 3.5 |
| 23 | 2.6 | 5.4 |
| 23.1 | 8.1 | 16.3 |
| 24 | 0.8 | 3.0 |
| 24.1 | 10.0 | 21.1 |
| 25 | 10.2 | 22.6 |
| 26 | 0.3 | 1.7 |
| 27 | 0.1 | 0.3 |
| 28 | 0.3 | 0.9 |
| 29 | 0.3 | 0.9 |
| 30 | 0.1 | 0.3 |

| 2020 DRAINAGE AND BRIDGE FEES - PALMER VILLAGE | | | | |
|---|---|---|---|---|
| Impervious Acres (ac) | Drainage Fee (Per Imp. Acre) | Bridge Fee (Per Imp. Acre) | Feathergrass Drainage Fee | Feathergrass Bridge Fee |
| 5.67 | $19,698 | $8,057 | $111,688 | $45,683 |

# COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 10/29/20

| Basin ID | Total Area (ac) | Drives/Walks | | | Roofs | | | Lawns | | | Basins Total Weighted % Imp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | |
| EX1 | 0.15 | 100% | 0.00 | 0.0% | 90% | 0.00 | 0.0% | 0% | 0.15 | 0.0% | 0.0% |
| EX2 | 0.46 | 100% | 0.00 | 0.0% | 90% | 0.00 | 0.0% | 0% | 0.46 | 0.0% | 0.0% |
| A1 | 0.78 | 100% | 0.28 | 35.8% | 90% | 0.33 | 38.6% | 0% | 0.17 | 0.0% | 74.4% |
| A2 | 0.22 | 100% | 0.15 | 67.3% | 90% | 0.00 | 0.0% | 0% | 0.07 | 0.0% | 67.3% |
| A3 | 0.11 | 100% | 0.07 | 63.3% | 90% | 0.00 | 0.0% | 0% | 0.04 | 0.0% | 63.3% |
| A4 | 0.62 | 100% | 0.16 | 26.6% | 90% | 0.33 | 48.3% | 0% | 0.12 | 0.0% | 74.8% |
| A5 | 0.83 | 100% | 0.20 | 24.4% | 90% | 0.28 | 30.1% | 0% | 0.35 | 0.0% | 54.5% |
| A6 | 0.18 | 100% | 0.11 | 59.4% | 90% | 0.05 | 24.5% | 0% | 0.02 | 0.0% | 83.9% |
| A7 | 0.46 | 100% | 0.16 | 34.5% | 90% | 0.17 | 32.7% | 0% | 0.13 | 0.0% | 67.1% |
| A8 | 0.74 | 100% | 0.15 | 20.4% | 90% | 0.22 | 26.8% | 0% | 0.37 | 0.0% | 47.2% |
| A9 | 0.57 | 100% | 0.32 | 54.9% | 90% | 0.11 | 17.4% | 0% | 0.15 | 0.0% | 72.3% |
| A10 | 0.78 | 100% | 0.04 | 5.2% | 90% | 0.00 | 0.0% | 0% | 0.74 | 0.0% | 5.2% |
| A11 | 0.17 | 100% | 0.07 | 43.4% | 90% | 0.00 | 0.0% | 0% | 0.09 | 0.0% | 43.4% |
| A12 | 0.14 | 100% | 0.05 | 35.7% | 90% | 0.00 | 0.0% | 0% | 0.09 | 0.0% | 35.7% |
| | | | | | | | | | | | |
| B1 | 0.59 | 100% | 0.12 | 19.9% | 90% | 0.22 | 33.7% | 0% | 0.25 | 0.0% | 53.6% |
| B2 | 0.08 | 100% | 0.08 | 100.0% | 90% | 0.00 | 0.0% | 0% | 0.00 | 0.0% | 100.0% |
| B3 | 0.12 | 100% | 0.10 | 87.0% | 90% | 0.00 | 0.0% | 0% | 0.02 | 0.0% | 87.0% |
| B4 | 0.76 | 100% | 0.27 | 35.8% | 90% | 0.33 | 39.2% | 0% | 0.16 | 0.0% | 75.0% |
| B5 | 0.65 | 100% | 0.14 | 21.2% | 90% | 0.22 | 30.8% | 0% | 0.29 | 0.0% | 51.9% |
| B6 | 0.08 | 100% | 0.07 | 85.5% | 90% | 0.00 | 0.0% | 0% | 0.01 | 0.0% | 85.5% |
| B7 | 0.13 | 100% | 0.11 | 84.0% | 90% | 0.00 | 0.0% | 0% | 0.02 | 0.0% | 84.0% |
| B8 | 0.72 | 100% | 0.19 | 26.4% | 90% | 0.33 | 41.6% | 0% | 0.20 | 0.0% | 68.0% |
| B9 | 0.31 | 100% | 0.01 | 2.2% | 90% | 0.00 | 0.0% | 0% | 0.30 | 0.0% | 2.2% |
| B10 | 0.53 | 100% | 0.19 | 35.3% | 90% | 0.17 | 28.1% | 0% | 0.18 | 0.0% | 63.4% |
| B11 | 0.53 | 100% | 0.02 | 2.9% | 90% | 0.00 | 0.0% | 0% | 0.52 | 0.0% | 2.9% |
| B12 | 0.07 | 100% | 0.02 | 30.4% | 90% | 0.00 | 0.0% | 0% | 0.05 | 0.0% | 30.4% |
| B13 | 0.21 | 100% | 0.07 | 33.3% | 90% | 0.00 | 0.0% | 0% | 0.14 | 0.0% | 33.3% |
| B14 | 0.19 | 100% | 0.05 | 27.1% | 90% | 0.00 | 0.0% | 0% | 0.14 | 0.0% | 27.1% |
| B15 | 0.18 | 100% | 0.02 | 10.5% | 90% | 0.00 | 0.0% | 0% | 0.16 | 0.0% | 10.5% |
| B16 | 0.12 | 100% | 0.00 | 0.0% | 90% | 0.00 | 0.0% | 0% | 0.12 | 0.0% | 0.0% |
| | | | | | | | | | | | |
| SITE TOTAL | 11.47 | | | | | | | | | SITE | 49.6% |
| WEST POND | 5.91 | | | | | | | | | WEST POND | 50.4% |
| EAST POND | 4.49 | | | | | | | | | EAST POND | 54.1% |

# COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 10/29/20

| Basin ID | Total Area (ac) | Basins Total Weighted % Imp. | Hydrologic Soil Group | | | Land Use | | | Minor Coefficients | | | Major Coefficients | | | Basins Total Weighted $C_5$ | Basins Total Weighted $C_{100}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Area A (ac) | Area B (ac) | Area C/D (ac) | Area Walks & Drives (ac) | Area Roofs (ac) | Area Lawns (ac) | $C_{5,A,WALKS\ \&\ DRIVES}$ | $C_{5,A,ROOFS}$ | $C_{5,A,LAWNS}$ | $C_{100,A,WALKS\ \&\ DRIVES}$ | $C_{100,A,ROOFS}$ | $C_{100,A,LAWNS}$ | | |
| EX1 | 0.15 | 0% | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.08 | 0.35 |
| EX2 | 0.46 | 0% | 0.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.46 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.08 | 0.35 |
| A1 | 0.78 | 74% | 0.78 | 0.00 | 0.00 | 0.28 | 0.33 | 0.17 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.65 | 0.77 |
| A2 | 0.22 | 67% | 0.22 | 0.00 | 0.00 | 0.15 | 0.00 | 0.07 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.63 | 0.76 |
| A3 | 0.11 | 63% | 0.11 | 0.00 | 0.00 | 0.07 | 0.00 | 0.04 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.60 | 0.74 |
| A4 | 0.62 | 75% | 0.62 | 0.00 | 0.00 | 0.16 | 0.33 | 0.12 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.65 | 0.76 |
| A5 | 0.83 | 54% | 0.83 | 0.00 | 0.00 | 0.20 | 0.28 | 0.35 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.50 | 0.65 |
| A6 | 0.18 | 84% | 0.18 | 0.00 | 0.00 | 0.11 | 0.05 | 0.02 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.74 | 0.84 |
| A7 | 0.46 | 67% | 0.46 | 0.00 | 0.00 | 0.16 | 0.17 | 0.13 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.60 | 0.73 |
| A8 | 0.74 | 47% | 0.74 | 0.00 | 0.00 | 0.15 | 0.22 | 0.37 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.44 | 0.61 |
| A9 | 0.57 | 72% | 0.57 | 0.00 | 0.00 | 0.32 | 0.11 | 0.15 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.66 | 0.77 |
| A10 | 0.78 | 5% | 0.78 | 0.00 | 0.00 | 0.04 | 0.00 | 0.74 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.12 | 0.38 |
| A11 | 0.17 | 43% | 0.17 | 0.00 | 0.00 | 0.07 | 0.00 | 0.09 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.44 | 0.61 |
| A12 | 0.14 | 36% | 0.14 | 0.00 | 0.00 | 0.05 | 0.00 | 0.09 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.37 | 0.57 |
| | | | | | | | | | | | | | | | | |
| B1 | 0.59 | 54% | 0.59 | 0.00 | 0.00 | 0.12 | 0.22 | 0.25 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.49 | 0.64 |
| B2 | 0.08 | 100% | 0.08 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.90 | 0.96 |
| B3 | 0.12 | 87% | 0.12 | 0.00 | 0.00 | 0.10 | 0.00 | 0.02 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.79 | 0.88 |
| B4 | 0.76 | 75% | 0.76 | 0.00 | 0.00 | 0.27 | 0.33 | 0.16 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.66 | 0.77 |
| B5 | 0.65 | 52% | 0.65 | 0.00 | 0.00 | 0.14 | 0.22 | 0.29 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.48 | 0.64 |
| B6 | 0.08 | 85% | 0.08 | 0.00 | 0.00 | 0.07 | 0.00 | 0.01 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.78 | 0.87 |
| B7 | 0.13 | 84% | 0.13 | 0.00 | 0.00 | 0.11 | 0.00 | 0.02 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.77 | 0.86 |
| B8 | 0.72 | 68% | 0.72 | 0.00 | 0.00 | 0.19 | 0.33 | 0.20 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.60 | 0.72 |
| B9 | 0.31 | 2% | 0.31 | 0.00 | 0.00 | 0.01 | 0.00 | 0.30 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.10 | 0.36 |
| B10 | 0.53 | 63% | 0.53 | 0.00 | 0.00 | 0.19 | 0.17 | 0.18 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.57 | 0.71 |
| B11 | 0.53 | 3% | 0.53 | 0.00 | 0.00 | 0.02 | 0.00 | 0.52 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.10 | 0.37 |
| B12 | 0.07 | 30% | 0.07 | 0.00 | 0.00 | 0.02 | 0.00 | 0.05 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.33 | 0.54 |
| B13 | 0.21 | 33% | 0.21 | 0.00 | 0.00 | 0.07 | 0.00 | 0.14 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.35 | 0.55 |
| B14 | 0.19 | 27% | 0.19 | 0.00 | 0.00 | 0.05 | 0.00 | 0.14 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.30 | 0.52 |
| B15 | 0.18 | 10% | 0.18 | 0.00 | 0.00 | 0.02 | 0.00 | 0.16 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.17 | 0.41 |
| B16 | 0.12 | 0% | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.08 | 0.35 |
| | | | | | | | | | | | | | | | | |
| TOTAL | 11.47 | 49.6% | 11.47 | 0.00 | 0.00 | 3.20 | 2.76 | 5.50 | --- | --- | --- | --- | --- | --- | 0.47 | 0.63 |

# STANDARD FORM SF-2
## TIME OF CONCENTRATION

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 10/29/20

| SUB-BASIN DATA | | | | | | INITIAL/OVERLAND ($T_i$) | | | TRAVEL TIME ($T_t$) | | | | | *tc* CHECK (URBANIZED BASINS) | | | FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASIN ID | D.A. (ac) | Hydrologic Soils Group | Impervious (%) | $C_5$ | $C_{100}$ | $L$ (ft) | $S_o$ (%) | $t_i$ (min) | $L_t$ (ft) | $S_t$ (%) | $K$ | VEL. (ft/s) | $t_t$ (min) | COMP. $t_c$ (min) | TOTAL LENGTH (ft) | Urbanized $t_c$ (min) | $t_c$ (min) |
| EX1 | 0.15 | A | 0% | 0.08 | 0.35 | 50 | 5.0% | 7.7 | 26 | 5.0% | 10.0 | 2.2 | 0.2 | 7.9 | 76.0 | 26.2 | 7.9 |
| EX2 | 0.46 | A | 0% | 0.08 | 0.35 | 50 | 5.0% | 7.7 | 56 | 5.0% | 10.0 | 2.2 | 0.4 | 8.1 | 106.0 | 26.5 | 8.1 |
| A1 | 0.78 | A | 74% | 0.65 | 0.77 | 87 | 5.0% | 4.4 | 155 | 1.4% | 20.0 | 2.4 | 1.1 | 5.5 | 242.0 | 14.5 | 5.5 |
| A2 | 0.22 | A | 67% | 0.63 | 0.76 | 87 | 2.0% | 6.3 | 180 | 1.0% | 20.0 | 2.0 | 1.5 | 7.8 | 267.0 | 16.2 | 7.8 |
| A3 | 0.11 | A | 63% | 0.60 | 0.74 | 87 | 6.0% | 4.7 | 180 | 1.0% | 20.0 | 2.0 | 1.5 | 6.2 | 267.0 | 16.9 | 6.2 |
| A4 | 0.62 | A | 75% | 0.65 | 0.76 | 87 | 6.0% | 4.2 | 150 | 1.6% | 20.0 | 2.5 | 1.0 | 5.2 | 237.0 | 14.3 | 5.2 |
| A5 | 0.83 | A | 54% | 0.50 | 0.65 | 87 | 5.0% | 6.0 | 150 | 1.6% | 20.0 | 2.5 | 1.0 | 7.0 | 237.0 | 17.9 | 7.0 |
| A6 | 0.18 | A | 84% | 0.74 | 0.84 | 99 | 1.0% | 6.4 | 178 | 1.0% | 20.0 | 2.0 | 1.5 | 7.9 | 277.0 | 13.2 | 7.9 |
| A7 | 0.46 | A | 67% | 0.60 | 0.73 | 87 | 5.5% | 4.8 | 153 | 1.6% | 20.0 | 2.5 | 1.0 | 5.8 | 240.0 | 15.7 | 5.8 |
| A8 | 0.74 | A | 47% | 0.44 | 0.61 | 90 | 4.5% | 6.9 | 115 | 1.1% | 20.0 | 2.1 | 0.9 | 7.8 | 205.0 | 19.1 | 7.8 |
| A9 | 0.57 | A | 72% | 0.66 | 0.77 | 87 | 3.0% | 5.2 | 200 | 1.0% | 20.0 | 2.0 | 1.7 | 6.9 | 287.0 | 15.5 | 6.9 |
| A10 | 0.78 | A | 5% | 0.12 | 0.38 | 50 | 15.0% | 5.1 | 325 | 0.7% | 15.0 | 1.3 | 4.3 | 9.4 | 375.0 | 31.8 | 9.4 |
| A11 | 0.17 | A | 43% | 0.44 | 0.61 | 90 | 2.0% | 9.0 | 55 | 1.0% | 20.0 | 2.0 | 0.5 | 9.5 | 145.0 | 19.2 | 9.5 |
| A12 | 0.14 | A | 36% | 0.37 | 0.57 | 20 | 2.0% | 4.7 | 280 | 0.5% | 20.0 | 1.4 | 3.3 | 8.0 | 300.0 | 24.6 | 8.0 |
| | | | | | | | | | | | | | | | | | |
| B1 | 0.59 | A | 54% | 0.49 | 0.64 | 97 | 8.0% | 5.5 | 105 | 1.0% | 20.0 | 2.0 | 0.9 | 6.4 | 202.0 | 17.9 | 6.4 |
| B2 | 0.08 | A | 100% | 0.90 | 0.96 | 12 | 2.0% | 1.0 | 182 | 2.3% | 20.0 | 3.1 | 1.0 | 2.0 | 194.0 | 9.9 | 5.0 |
| B3 | 0.12 | A | 87% | 0.79 | 0.88 | 12 | 2.0% | 1.5 | 190 | 2.3% | 20.0 | 3.0 | 1.0 | 2.6 | 202.0 | 12.2 | 5.0 |
| B4 | 0.76 | A | 75% | 0.66 | 0.77 | 120 | 6.0% | 4.9 | 183 | 2.0% | 20.0 | 2.8 | 1.1 | 5.9 | 303.0 | 14.4 | 5.9 |
| B5 | 0.65 | A | 52% | 0.48 | 0.64 | 97 | 8.0% | 5.6 | 103 | 1.6% | 20.0 | 2.5 | 0.7 | 6.3 | 200.0 | 18.0 | 6.3 |
| B6 | 0.08 | A | 85% | 0.78 | 0.87 | 12 | 2.0% | 1.6 | 160 | 2.5% | 20.0 | 3.2 | 0.8 | 2.4 | 172.0 | 12.3 | 5.0 |
| B7 | 0.13 | A | 84% | 0.77 | 0.86 | 12 | 2.0% | 1.6 | 170 | 2.5% | 20.0 | 3.2 | 0.9 | 2.5 | 182.0 | 12.6 | 5.0 |
| B8 | 0.72 | A | 68% | 0.60 | 0.72 | 97 | 9.0% | 4.3 | 145 | 1.0% | 20.0 | 2.0 | 1.2 | 5.5 | 242.0 | 15.7 | 5.5 |
| B9 | 0.31 | A | 2% | 0.10 | 0.36 | 15 | 10.0% | 3.3 | 365 | 3.0% | 15.0 | 2.6 | 2.3 | 5.6 | 380.0 | 29.4 | 5.6 |
| B10 | 0.53 | A | 63% | 0.57 | 0.71 | 87 | 5.0% | 5.2 | 155 | 1.0% | 20.0 | 2.0 | 1.3 | 6.5 | 242.0 | 16.7 | 6.5 |
| B11 | 0.53 | A | 3% | 0.10 | 0.37 | 15 | 2.0% | 5.5 | 40 | 33.0% | 15.0 | 8.6 | 0.1 | 5.6 | 55.0 | 25.6 | 5.6 |
| B12 | 0.07 | A | 30% | 0.33 | 0.54 | 20 | 2.0% | 4.9 | 19 | 2.5% | 20.0 | 3.2 | 0.1 | 5.0 | 39.0 | 21.0 | 5.0 |
| B13 | 0.21 | A | 33% | 0.35 | 0.55 | 20 | 2.0% | 4.8 | 450 | 2.2% | 20.0 | 3.0 | 2.5 | 7.3 | 470.0 | 24.0 | 7.3 |
| B14 | 0.19 | A | 27% | 0.30 | 0.52 | 20 | 2.0% | 5.1 | 20 | 2.0% | 20.0 | 2.8 | 0.1 | 5.2 | 40.0 | 21.6 | 5.2 |
| B15 | 0.18 | A | 10% | 0.17 | 0.41 | 20 | 25.0% | 2.6 | 35 | 25.0% | 15.0 | 7.5 | 0.1 | 2.7 | 55.0 | 24.3 | 5.0 |
| B16 | 0.12 | A | 0% | 0.08 | 0.35 | 15 | 10.0% | 3.3 | 150 | 1.5% | 15.0 | 1.9 | 1.3 | 4.7 | 165.0 | 28.2 | 5.0 |
| | | | | | | | | | | | | | | | | | |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

bdivision: PALMER VILLAGE
Location: Colorado Springs
gn Storm: 5-Year

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 10/29/20

| STREET | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | | PIPE | | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (Ac) | Runoff Coeff. | $t_c$ (min) | C*A (Ac) | I (in/hr) | Q (cfs) | tc (min) | C*A (ac) | I (in/hr) | Q (cfs) | $Q_{street}$ (cfs) | C*A (ac) | Slope (%) | $Q_{pipe}$ (cfs) | C*A (ac) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | $t_t$ (min) | |
| | EX1 | EX1 | 0.15 | 0.08 | 7.9 | 0.01 | 4.49 | 0.0 | | | | | | | | | | | | | | | OFFSITE BASIN EX1 FLOW @ DPEX1, FLOW INTO BASIN A1 (ROUTED IN SF2) |
| | EX2 | EX2 | 0.46 | 0.08 | 8.1 | 0.04 | 4.45 | 0.2 | | | | | | | | | | | | | | | BASIN EX2 FLOW @ DPEX2, FLOW INTO BASIN A2 (ROUTED IN SF2) |
| | 1 | A1 | 0.78 | 0.65 | 5.5 | 0.51 | 5.02 | 2.6 | 7.9 | 0.52 | 4.49 | 2.3 | 2.3 | 0.52 | 1.13 | | | | | 170 | 2.1 | 1.3 | BASIN A1 & DPEX1 FLOW @ DP1, C&G FLOW TO DP3 |
| | | A2 | 0.22 | 0.63 | 7.8 | 0.14 | 4.51 | 0.6 | | | | | | | | | | | | | | | BASIN A2 FLOW @ DP3 (ROUTED IN SF2) |
| | | A3 | 0.11 | 0.60 | 6.2 | 0.07 | 4.85 | 0.3 | | | | | | | | | | | | | | | BASIN A3 FLOW @ DP4 (ROUTED IN SF2) |
| | 2 | A4 | 0.62 | 0.65 | 5.2 | 0.40 | 5.10 | 2.0 | 8.1 | 0.44 | 4.45 | 2.0 | 2.0 | 0.44 | 1.13 | | | | | 170 | 2.1 | 1.3 | BASIN A4 & DPEX2 FLOW @ DP2, C&G TO DP4 |
| | 3 | | | | | | | | 7.8 | 0.66 | 4.51 | 3.0 | | | | 3.0 | 0.66 | 1.0 | 18 | 5 | 5.1 | 0.0 | DP1 & BASIN A2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP4.1 |
| | 4 | | | | | | | | 6.6 | 0.51 | 4.76 | 2.4 | 0.5 | 0.11 | 1.13 | 1.9 | 0.40 | 1.0 | 18 | 60<br>31 | 2.1<br>4.4 | 0.5<br>0.1 | DP4 FLOW-BY, C&G FLOW TO DP6<br>BASIN A3 & DP2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP4.1 |
| | 4.1 | | | | | | | | 7.8 | 1.06 | 4.50 | 4.8 | | | | 4.8 | 4.50 | 0.8 | 24 | 110 | 5.2 | 0.4 | COMBINED DP3&DP4 CAPTURED FLOW, PIPE FLOW TO DP5.1 |
| | 5 | A5 | 0.83 | 0.50 | 7.0 | 0.41 | 4.67 | 1.9 | 7.0 | 0.41 | 4.67 | 1.9 | 0.3 | 0.07 | 0.66 | 1.6 | 0.34 | 0.8 | 24 | 115<br>5 | 1.6<br>3.9 | 1.2<br>0.0 | DP5 FLOW-BY, C&G FLOW TO DP8<br>BASIN A5 FLOW @ DP5, CAPTURED IN DBL DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO 5.1 |
| | 5.1 | | | | | | | | 7.8 | 1.47 | 4.50 | 6.6 | | | | 6.6 | 1.47 | 0.8 | 30 | 50 | 5.7 | 0.1 | DP4.1 & DP5 FLOW @ DP5.1, PIPE FLOW TO DP8.1 |
| | | A6 | 0.18 | 0.74 | 7.9 | 0.14 | 4.49 | 0.6 | | | | | | | | | | | | | | | BASIN A6 FLOW @ DP8 (ROUTED IN SF2) |
| | 6 | A7 | 0.46 | 0.60 | 5.8 | 0.27 | 4.94 | 1.3 | 7.0 | 0.38 | 4.66 | 1.8 | 1.8 | 0.38 | 1.13 | | | | | 130 | 2.1 | 1.0 | BASIN A7 FLOW & DP4 FLOW-BY @ DP6, C&G FLOW TO DP9 |
| | 7 | A8 | 0.74 | 0.44 | 7.8 | 0.33 | 4.51 | 1.5 | 7.8 | 0.33 | 4.50 | 1.5 | 1.5 | 0.33 | 1.00 | | | | | 100 | 2.0 | 0.8 | BASIN A8 FLOW @ DP7, C&G FLOW TO DP8 |
| | 8 | | | | | | | | 8.6 | 0.54 | 4.35 | 2.3 | | | | 2.3 | 0.54 | 0.5 | 30 | 5 | 3.6 | 0.0 | BASIN A6, DP5 & DP7 FLOW @ DP8, CAPTURED BY TRP DENVER TYPE 16 COMBO INLET (SUMP), PIPE FLOW TO DP8.1 |
| | 8.1 | | | | | | | | 8.6 | 2.01 | 4.35 | 8.7 | | | | 8.7 | 2.01 | 0.5 | 30 | 50 | 2.0 | 0.4 | DP5.1 & DP8 FLOW @ DP8.1, PIPE FLOW TO DP9.1 |
| | 9 | A9 | 0.57 | 0.66 | 6.9 | 0.38 | 4.69 | 1.8 | 8.1 | 0.76 | 4.45 | 3.4 | | | | 3.4 | 0.76 | 1.3 | 30 | 5 | 5.5 | 0.0 | DP6, DP8 FLOW-BY & BASIN A9 FLOW @ DP9, CAPTURED BY TRP. DENVER TYPE 16 COMBO INLET (SUMP), PIPE FLOW TO DP9.1 |
| | 9.1 | | | | | | | | 9.1 | 2.77 | 4.28 | 11.8 | | | | 11.8 | 2.77 | 1.3 | 30 | 18 | 7.9 | 0.0 | DP8.1 & DP9 FLOW @ DP9.1, PIPE FLOW TO DP10 (POND A) |
| | 10 | A10 | 0.78 | 0.12 | 9.4 | 0.09 | 4.22 | 0.4 | 9.4 | 2.86 | 4.22 | 12.1 | | | | | | | | | | | BASIN A1-10 FLOW @ DP10, TOTAL FLOW ENTERING POND A |
| | 11 | A11 | 0.17 | 0.44 | 9.5 | 0.07 | 4.20 | 0.3 | | | | | | | | | | | | | | | BASIN A11 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE @ DP11 |
| | 12 | A12 | 0.14 | 0.37 | 8.0 | 0.05 | 4.47 | 0.2 | | | | | | | | | | | | | | | BASIN A12 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE @ DP12 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

bdivision: PALMER VILLAGE
Location: Colorado Springs
gn Storm: 5-Year

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 10/29/20

| STREET | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | | PIPE | | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (Ac) | Runoff Coeff. | $t_c$ (min) | C*A (Ac) | I (in/hr) | Q (cfs) | tc (min) | C*A (ac) | I (in/hr) | Q (cfs) | $Q_{street}$ (cfs) | C*A (ac) | Slope (%) | $Q_{pipe}$ (cfs) | C*A (ac) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | $t_t$ (min) | |
| | | | | | | | | | | | | | 1.4 | 0.29 | 2.85 | | | | | 160 | 3.4 | 0.8 | BASIN B1 FLOW @ DP15, C&G FLOW TO DP17 |
| | 15 | B1 | 0.59 | 0.49 | 6.4 | 0.29 | 4.81 | 1.4 | 6.4 | 0.29 | 4.81 | 1.4 | | | | | | | | | | | |
| | | | | | | | | | | | | | 0.3 | 0.06 | 2.85 | | | | | 70 | 3.4 | 0.3 | DP17 FLOW-BY, C&G FLOW TO DP19 |
| | 17 | B2 | 0.08 | 0.90 | 5.0 | 0.07 | 5.17 | 0.4 | 7.2 | 0.36 | 4.63 | 1.7 | | | | 1.4 | 0.30 | 1.0 | 18 | 32 | 4.1 | 0.1 | BASIN B2 AND DP15 FLOW @ DP17, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP18.1 |
| | | B3 | 0.12 | 0.79 | 5.0 | 0.09 | 5.17 | 0.5 | | | | | | | | | | | | | | | BASIN B3 FLOW @ DP18 (ROUTED IN SF2) |
| | | | | | | | | | | | | | 2.5 | 0.50 | 2.85 | | | | | 185 | 3.4 | 0.9 | BASIN B4 FLOW @ DP16, C&G FLOW TO DP18 |
| | 16 | B4 | 0.76 | 0.66 | 5.9 | 0.50 | 4.91 | 2.5 | 5.9 | 0.50 | 4.91 | 2.5 | | | | | | | | | | | |
| | 18 | | | | | | | | 6.8 | 0.59 | 4.70 | 2.8 | | | | 2.8 | 0.59 | 1.4 | 18 | 5 | 5.5 | 0.0 | BASIN B3 & DP16 FLOW @ DP18, CAPTURED BY DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP18.1 |
| | 18.1 | | | | | | | | 6.9 | 0.89 | 4.69 | 4.2 | | | | 4.2 | 0.89 | 1.4 | 18 | 165 | 6.2 | 0.4 | DP17 & DP18 CAPTURED FLOW, PIPE FLOW TO DP22.1 |
| | | | | | | | | | | | | | 0.6 | 0.12 | 2.85 | | | | | 92 | 3.4 | 0.5 | DP19 FLOW-BY, C&G FLOW TO DP24 |
| | 19 | B5 | 0.65 | 0.48 | 6.3 | 0.31 | 4.83 | 1.5 | 6.3 | 0.37 | 4.83 | 1.8 | | | | 1.2 | 0.25 | 0.9 | 18 | 92 | 3.7 | 0.4 | BASIN B5 & DP17 FLOW-BY @ DP19, CAPTURED IN SINGLE DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP24.1 |
| | | B6 | 0.08 | 0.78 | 5.0 | 0.06 | 5.17 | 0.3 | | | | | | | | | | | | | | | BASIN B6 FLOW AT DP24 (ROUTED IN SF2) |
| | | B7 | 0.13 | 0.77 | 5.0 | 0.10 | 5.17 | 0.5 | | | | | | | | | | | | | | | BASIN B7 FLOW AT DP23 (ROUTED IN SF2) |
| | | | | | | | | | | | | | 2.2 | 0.43 | 2.85 | | | | | 125 | 3.4 | 0.6 | BASIN B8 FLOW @ DP20, C&G FLOW TO DP23 |
| | 20 | B8 | 0.72 | 0.60 | 5.5 | 0.43 | 5.02 | 2.2 | 5.5 | 0.43 | 5.02 | 2.2 | | | | | | | | | | | |
| | 21 | B9 | 0.31 | 0.10 | 5.6 | 0.03 | 4.99 | 0.1 | 5.6 | 0.03 | 4.99 | 0.1 | | | | 0.1 | 0.03 | 0.5 | 18 | 147 | 1.6 | 1.5 | BASIN B9 FLOW @ DP21, CAPTURED IN TYPE C INLET (SUMP), PIPED TO DP22.1 |
| | 22 | B10 | 0.53 | 0.57 | 6.5 | 0.30 | 4.77 | 1.4 | 6.5 | 0.30 | 4.77 | 1.4 | | | | 1.4 | 0.30 | 1.0 | 18 | 20 | 4.1 | 0.1 | BASIN B10 FLOW @ DP22, CAPTURED BY DBL DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP22.1 |
| | 22.1 | | | | | | | | 7.1 | 0.33 | 4.64 | 1.5 | | | | 1.5 | 0.33 | 0.5 | 18 | 25 | 3.2 | 0.1 | COMBINED DP21 & DP22 CAPTURED FLOW, PIPE TO DP23.1 |
| | 23 | | | | | | | | 6.2 | 0.53 | 4.86 | 2.6 | | | | 2.6 | 0.53 | 0.5 | 18 | 5 | 3.8 | 0.0 | BASIN B7 & DP20 FLOW @ DP23, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP23.1 |
| | 23.1 | | | | | | | | 7.3 | 1.75 | 4.60 | 8.1 | | | | 8.1 | 1.75 | 0.5 | 24 | 32 | 5.1 | 0.1 | DP23 CAPTURED FLOW & DP22.1 FLOW, PIPE TO DP24.1 |
| | 24 | | | | | | | | 6.7 | 0.18 | 4.72 | 0.8 | | | | 0.8 | 0.18 | 0.5 | 24 | 5 | 2.6 | 0.0 | BASIN B6 & DP19 FLOW-BY @ DP24, CAPTURED IN TRIPLE DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP24.1 |
| | 24.1 | | | | | | | | 7.4 | 2.18 | 4.58 | 10.0 | | | | 10.0 | 2.18 | 0.5 | 30 | 47 | 5.3 | 0.1 | COMBINED DP23.1 & DP24 FLOW, PIPE TO DP25 |
| | 25 | B11 | 0.53 | 0.10 | 5.6 | 0.06 | 4.99 | 0.3 | 7.6 | 2.24 | 4.55 | 10.2 | | | | | | | | | | | DP24.1 AND BASIN B11 FLOW, TOTAL FLOW @ DP25 (POND B) |
| | 26 | B12 | 0.07 | 0.33 | 5.0 | 0.02 | 5.15 | 0.1 | | | | | | | | | | | | | | | BASIN B12 FLOW, FOLLOWS EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE @ DP26 |
| | 27 | B13 | 0.21 | 0.35 | 7.3 | 0.07 | 4.60 | 0.3 | | | | | | | | | | | | | | | BASIN B13 FLOW, FOLLOWS EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE @ DP27 |
| | 28 | B14 | 0.19 | 0.30 | 5.2 | 0.06 | 5.10 | 0.3 | | | | | | | | | | | | | | | BASIN B14 FLOW, FOLLOWS EX PATTERNS & FLOWS EAST OFF SITE @ DP28 |
| | 29 | B15 | 0.18 | 0.17 | 5.0 | 0.03 | 5.17 | 0.2 | | | | | | | | | | | | | | | BASIN B15 FLOW, FOLLOWS EX PATTERNS & FLOWS EAST OFF SITE @ DP29 |
| | 30 | B16 | 0.12 | 0.08 | 5.0 | 0.01 | 5.17 | 0.1 | | | | | | | | | | | | | | | BASIN B16 FLOW, SWALE CONVEYS FLOW OFFSITE EAST (FOLLLOWS HISTORIC PATTERNS) @ DP30 |

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

sion: PALMER VILLAGE
tion: Colorado Springs
orm: 100-Year

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 10/29/20

| TREE | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | | PIPE | | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (ac) | Runoff Coeff. | $t_c$ (min) | C*A (ac) | I (in/hr) | Q (cfs) | tc (min) | C*A (ac) | I (in/hr) | Q (cfs) | $Q_{street}$ (cfs) | C*A (ac) | Slope (%) | $Q_{pipe}$ (cfs) | C*A (ac) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | $t_t$ (min) | |
| | EX1 | EX1 | 0.15 | 0.35 | 7.9 | 0.05 | 4.49 | 0.2 | | | | | | | | | | | | | | | OFFSITE BASIN EX1 FLOW @ DPEX1, FLOW INTO BASIN A1 (ROUTED IN SF2) |
| | EX2 | EX2 | 0.46 | 0.35 | 8.1 | 0.16 | 4.45 | 0.7 | | | | | | | | | | | | | | | BASIN EX2 FLOW @ DPEX2, FLOW INTO BASIN A2 (ROUTED IN SF2) |
| | 1 | A1 | 0.78 | 0.77 | 5.5 | 0.59 | 8.43 | 5.0 | 7.9 | 0.64 | 7.54 | 4.8 | 4.8 | 0.64 | 1.13 | | | | | 170 | 2.1 | 1.3 | BASIN A1 & DPEX1 FLOW @ DP1, C&G FLOW TO DP3 |
| | | A2 | 0.22 | 0.76 | 7.8 | 0.17 | 7.57 | 1.3 | | | | | | | | | | | | | | | BASIN A2 FLOW @ DP3 (ROUTED IN SF2) |
| | | A3 | 0.11 | 0.74 | 6.2 | 0.08 | 8.15 | 0.7 | | | | | | | | | | | | | | | BASIN A3 FLOW @ DP4 (ROUTED IN SF2) |
| | 2 | A4 | 0.62 | 0.76 | 5.2 | 0.47 | 8.56 | 4.0 | 8.1 | 0.63 | 7.47 | 4.7 | 4.7 | 0.63 | 1.13 | | | | | 170 | 2.1 | 1.3 | BASIN A4 & DPEX2 FLOW @ DP2, C&G TO DP4 |
| | 3 | | | | | | | | 7.8 | 0.81 | 7.57 | 6.1 | | | | 6.1 | 0.81 | 1.0 | 18 | 5 | 6.1 | 0.0 | 0<br>DP1 & BASIN A2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP4.1 |
| | 4 | | | | | | | | 6.6 | 0.71 | 7.99 | 5.7 | 2.3 | 0.28 | 1.13 | 3.4 | 0.43 | 1.0 | 18 | 60<br>31 | 2.1<br>5.3 | 0.5<br>0.1 | DP4 FLOW-BY, C&G FLOW TO DP6<br>BASIN A3 & DP2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP4.1 |
| | 4.1 | | | | | | | | 7.8 | 1.24 | 7.56 | 9.3 | | | | 9.3 | 7.56 | 0.8 | 24 | 110 | 6.2 | 0.3 | COMBINED DP3&DP4 CAPTURED FLOW, PIPE FLOW TO DP5.1 |
| | 5 | A5 | 0.83 | 0.65 | 7.0 | 0.54 | 7.84 | 4.2 | 7.0 | 0.54 | 7.84 | 4.2 | 1.5 | 0.20 | 0.66 | 2.7 | 0.34 | 0.8 | 24 | 115<br>5 | 1.6<br>4.4 | 1.2<br>0.0 | DP5 FLOW-BY, C&G FLOW TO DP8<br>BASIN A5 FLOW @ DP5, CAPTURED IN DBL DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO 5.1 |
| | 5.1 | | | | | | | | 7.8 | 1.78 | 7.56 | 13.4 | | | | 13.4 | 1.78 | 0.8 | 30 | 50 | 6.9 | 0.1 | DP4.1 & DP5 FLOW @ DP5.1, PIPE FLOW TO DP8.1 |
| | | A6 | 0.18 | 0.84 | 7.9 | 0.15 | 7.53 | 1.1 | | | | | | | | | | | | | | | BASIN A6 FLOW @ DP8 (ROUTED IN SF2) |
| | 6 | A7 | 0.46 | 0.73 | 5.8 | 0.33 | 8.29 | 2.7 | 7.0 | 0.61 | 7.82 | 4.8 | 4.8 | 0.61 | 1.13 | | | | | 130 | 2.1 | 1.0 | BASIN A7 FLOW & DP4 FLOW-BY @ DP6, C&G FLOW TO DP9 |
| | 7 | A8 | 0.74 | 0.61 | 7.8 | 0.46 | 7.56 | 3.5 | 7.8 | 0.46 | 7.56 | 3.5 | 3.5 | 0.46 | 1.00 | | | | | 100 | 2.0 | 0.8 | BASIN A8 FLOW @ DP7, C&G FLOW TO DP8 |
| | 8 | | | | | | | | 8.6 | 0.81 | 7.31 | 5.9 | 1.6 | 0.22 | 2.00 | 4.3 | 0.59 | 0.5 | 30 | 60<br>5 | 2.8<br>4.2 | 0.4<br>0.0 | DP8 FLOW-BY, OVERTOPS CROWN TO DP9<br>BASIN A6, DP5 & DP7 FLOW @ DP8, CAPTURED BY TRP DENVER TYPE 16 COMBO INLET (SUMP), PIPE FLOW TO DP8.1 |
| | 8.1 | | | | | | | | 8.6 | 2.04 | 7.30 | 14.9 | | | | 14.9 | 2.04 | 0.5 | 30 | 50 | 2.0 | 0.4 | DP5.1 & DP8 FLOW @ DP8.1, PIPE FLOW TO DP9.1 |
| | 9 | A9 | 0.57 | 0.77 | 6.9 | 0.44 | 7.88 | 3.5 | 9.0 | 1.27 | 7.21 | 9.2 | | | | 9.2 | 1.27 | 1.3 | 30 | 5 | 7.4 | 0.0 | DP6, DP8 FLOW-BY & BASIN A9 FLOW @ DP9, CAPTURED BY TRP. DENVER TYPE 16 COMBO INLET (SUMP), PIPE FLOW TO DP9.1 |
| | 9.1 | | | | | | | | 9.1 | 3.31 | 7.18 | 23.8 | | | | 23.8 | 3.31 | 1.3 | 30 | 18 | 9.5 | 0.0 | DP8.1 & DP9 FLOW @ DP9.1, PIPE FLOW TO DP10 (POND A) |
| | 10 | A10 | 0.78 | 0.38 | 9.4 | 0.30 | 7.08 | 2.1 | 9.4 | 3.61 | 7.08 | 25.6 | | | | | | | | | | | BASIN A1-10 FLOW @ DP10, TOTAL FLOW ENTERING POND A |
| | 11 | A11 | 0.17 | 0.61 | 9.5 | 0.10 | 7.06 | 0.7 | | | | | | | | | | | | | | | BASIN A11 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE @ DP11 |
| | 12 | A12 | 0.14 | 0.57 | 8.0 | 0.08 | 7.50 | 0.6 | | | | | | | | | | | | | | | BASIN A12 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE @ DP12 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

sion: PALMER VILLAGE
tion: Colorado Springs
orm: 100-Year

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 10/29/20

| TREE | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | | PIPE | | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (ac) | Runoff Coeff. | $t_c$ (min) | C*A (ac) | I (in/hr) | Q (cfs) | tc (min) | C*A (ac) | I (in/hr) | Q (cfs) | $Q_{street}$ (cfs) | C*A (ac) | Slope (%) | $Q_{pipe}$ (cfs) | C*A (ac) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | $t_t$ (min) | |
| | 15 | B1 | 0.59 | 0.64 | 6.4 | 0.38 | 8.07 | 3.1 | 6.4 | 0.38 | 8.07 | 3.1 | 3.1 | 0.38 | 2.85 | | | | | 160 | 3.4 | 0.8 | BASIN B1 FLOW @ DP15, C&G FLOW TO DP17 |
| | 17 | B2 | 0.08 | 0.96 | 5.0 | 0.07 | 8.68 | 0.6 | 7.2 | 0.45 | 7.78 | 3.5 | 1.2 | 0.15 | 2.85 | 2.3 | 0.30 | 1.0 | 18 | 70<br>32 | 3.4<br>4.7 | 0.3<br>0.1 | DP17 FLOW-BY, C&G FLOW TO DP19<br>BASIN B2 AND DP15 FLOW @ DP17, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP18.1 |
| | | B3 | 0.12 | 0.88 | 5.0 | 0.10 | 8.68 | 0.9 | | | | | | | | | | | | | | | BASIN B3 FLOW @ DP18 (ROUTED IN SF2) |
| | 16 | B4 | 0.76 | 0.77 | 5.9 | 0.59 | 8.25 | 4.9 | 5.9 | 0.59 | 8.25 | 4.9 | 4.9 | 0.59 | 2.85 | | | | | 185 | 3.4 | 0.9 | BASIN B4 FLOW @ DP16, C&G FLOW TO DP18 |
| | 18 | | | | | | | | 6.8 | 0.69 | 7.89 | 5.4 | | | | 5.4 | 0.69 | 1.4 | 18 | 5 | 6.7 | 0.0 | 0<br>BASIN B3 & DP16 FLOW @ DP18, CAPTURED BY DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP18.1 |
| | 18.1 | | | | | | | | 6.9 | 0.99 | 7.88 | 7.8 | | | | 7.8 | 0.99 | 1.4 | 18 | 165 | 7.3 | 0.4 | DP17 & DP18 CAPTURED FLOW, PIPE FLOW TO DP22.1 |
| | 19 | B5 | 0.65 | 0.64 | 6.3 | 0.41 | 8.11 | 3.3 | 6.3 | 0.56 | 8.11 | 4.6 | 2.5 | 0.31 | 2.85 | 2.1 | 0.26 | 0.9 | 18 | 92<br>92 | 3.4<br>4.3 | 0.5<br>0.4 | DP19 FLOW-BY, C&G FLOW TO DP24<br>BASIN B5 & DP17 FLOW-BY @ DP19, CAPTURED IN SINGLE DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP24.1 |
| | | B6 | 0.08 | 0.87 | 5.0 | 0.07 | 8.68 | 0.6 | | | | | | | | | | | | | | | BASIN B6 FLOW AT DP24 (ROUTED IN SF2) |
| | | B7 | 0.13 | 0.86 | 5.0 | 0.11 | 8.68 | 1.0 | | | | | | | | | | | | | | | BASIN B7 FLOW AT DP23 (ROUTED IN SF2) |
| | 20 | B8 | 0.72 | 0.72 | 5.5 | 0.52 | 8.42 | 4.4 | 5.5 | 0.52 | 8.42 | 4.4 | 4.4 | 0.52 | 2.85 | | | | | 125 | 3.4 | 0.6 | BASIN B8 FLOW @ DP20, C&G FLOW TO DP23 |
| | 21 | B9 | 0.31 | 0.36 | 5.6 | 0.11 | 8.39 | 0.9 | 5.6 | 0.11 | 8.39 | 0.9 | | | | 0.9 | 0.11 | 0.5 | 18 | 147 | 2.8 | 0.9 | BASIN B9 FLOW @ DP21, CAPTURED IN TYPE C INLET (SUMP), PIPED TO DP22.1 |
| | 22 | B10 | 0.53 | 0.71 | 6.5 | 0.38 | 8.01 | 3.0 | 6.5 | 0.38 | 8.01 | 3.0 | 0.4 | 0.06 | 1.00 | 2.6 | 0.32 | 1.0 | 18 | 65<br>20 | 2.0<br>4.9 | 0.5<br>0.1 | DP22 FLOW-BY, C&G FLOW TO DP23<br>BASIN B10 FLOW @ DP22, CAPTURED BY DBL DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP22.1 |
| | 22.1 | | | | | | | | 6.6 | 0.43 | 7.99 | 3.5 | | | | 3.5 | 0.43 | 0.5 | 18 | 25 | 4.1 | 0.1 | COMBINED DP21 & DP22 CAPTURED FLOW, PIPE TO DP23.1 |
| | 23 | | | | | | | | 7.1 | 0.69 | 7.81 | 5.4 | | | | 5.4 | 0.69 | 0.5 | 18 | 5 | 4.5 | 0.0 | BASIN B7, DP20 FLOW & DP22 FLOW-BY@ DP23, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP23.1 |
| | 23.1 | | | | | | | | 7.2 | 2.11 | 7.75 | 16.3 | | | | 16.3 | 2.11 | 0.5 | 24 | 32 | 5.8 | 0.1 | DP23 CAPTURED FLOW & DP22.1 FLOW, PIPE TO DP24.1 |
| | 24 | | | | | | | | 6.7 | 0.38 | 7.93 | 3.0 | | | | 3.0 | 0.38 | 0.5 | 24 | 5 | 3.8 | 0.0 | BASIN B6 & DP19 FLOW-BY @ DP24, CAPTURED IN TRIPLE DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP24.1 |
| | 24.1 | | | | | | | | 7.3 | 2.74 | 7.72 | 21.1 | | | | 21.1 | 2.74 | 0.5 | 30 | 47 | 6.4 | 0.1 | COMBINED DP23.1 & DP24 FLOW, PIPE TO DP25 |
| | 25 | B11 | 0.53 | 0.37 | 5.6 | 0.20 | 8.39 | 1.7 | 7.5 | 2.94 | 7.67 | 22.6 | | | | | | | | | | | DP24.1 AND BASIN B11 FLOW, TOTAL FLOW @ DP25 (POND B) |
| | 26 | B12 | 0.07 | 0.54 | 5.0 | 0.04 | 8.65 | 0.3 | | | | | | | | | | | | | | | BASIN B12 FLOW, FOLLOWS EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE @ DP26 |
| | 27 | B13 | 0.21 | 0.55 | 7.3 | 0.12 | 7.72 | 0.9 | | | | | | | | | | | | | | | BASIN B13 FLOW, FOLLOWS EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE @ DP27 |
| | 28 | B14 | 0.19 | 0.52 | 5.2 | 0.10 | 8.56 | 0.9 | | | | | | | | | | | | | | | BASIN B14 FLOW, FOLLOWS EX PATTERNS & FLOWS EAST OFF SITE @ DP28 |
| | 29 | B15 | 0.18 | 0.41 | 5.0 | 0.07 | 8.68 | 0.6 | | | | | | | | | | | | | | | BASIN B15 FLOW, FOLLOWS EX PATTERNS & FLOWS EAST OFF SITE @ DP29 |
| | 30 | B16 | 0.12 | 0.35 | 5.0 | 0.04 | 8.68 | 0.3 | | | | | | | | | | | | | | | BASIN B16 FLOW, SWALE CONVEYS FLOW OFFSITE EAST (FOLLLOWS HISTORIC PATTERNS) @ DP30 |

Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

# Appendix C
# Hydraulic Calculations

# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Nov 11 2019

## Alley Street Capacity - 1% CL - Allowable Spread - Edge of Pavement

**User-defined**

| | |
|---|---|
| Invert Elev (ft) | = 0.36 |
| Slope (%) | = 1.00 |
| N-Value | = 0.016 |

**Calculations**

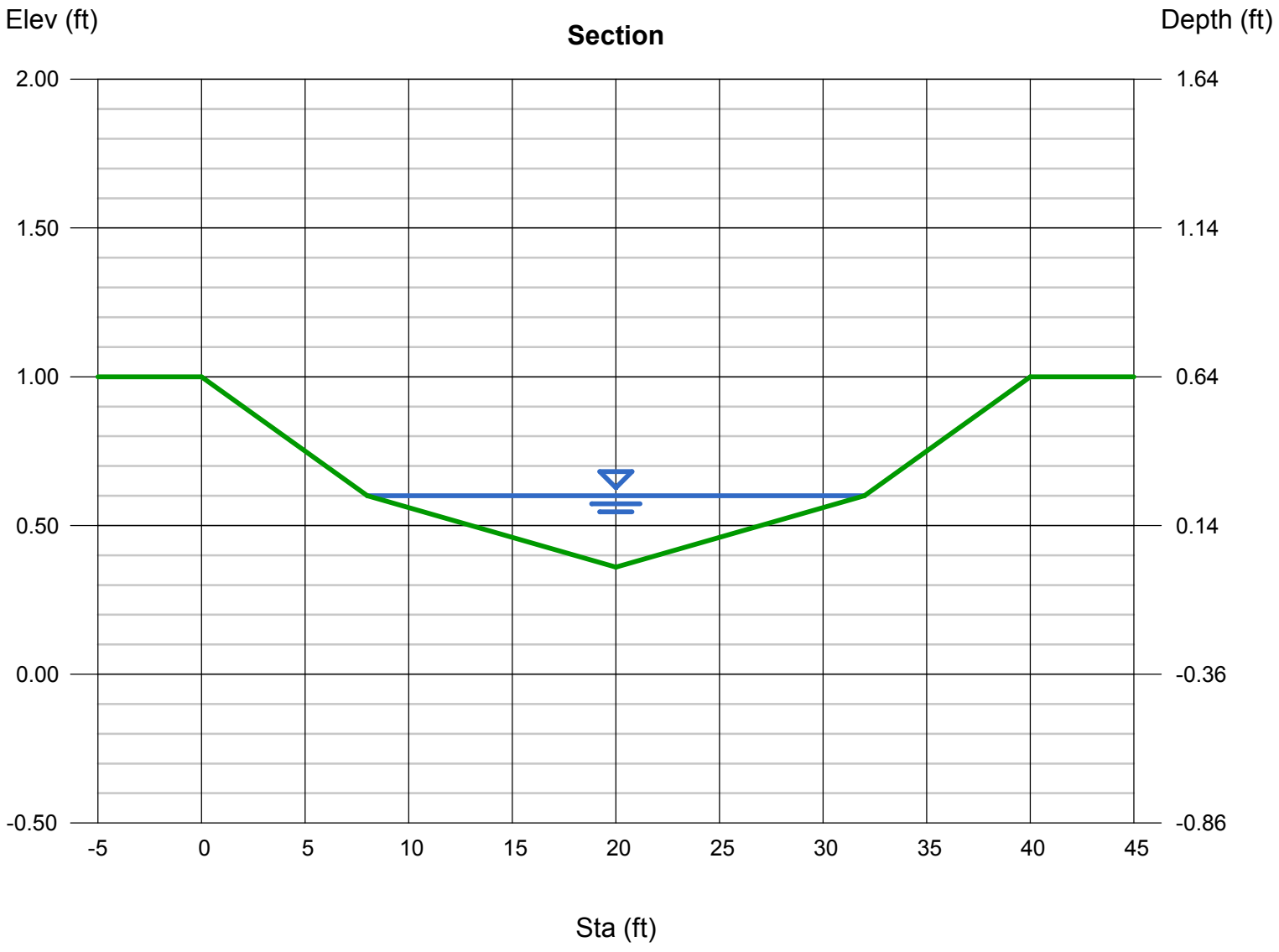
| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 6.00 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.24 |
| Q (cfs) | = 6.000 |
| Area (sqft) | = 2.88 |
| Velocity (ft/s) | = 2.08 |
| Wetted Perim (ft) | = 24.00 |
| Crit Depth, Yc (ft) | = 0.25 |
| Top Width (ft) | = 24.00 |
| EGL (ft) | = 0.31 |

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

( 0.00, 1.00)-(8.00, 0.60, 0.016)-(20.00, 0.36, 0.016)-(32.00, 0.60, 0.016)-(40.00, 1.00, 0.016)



# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Nov 11 2019

## Alley Street Capacity - 1.55% CL - Allowable Spread - Edge of Pavement

**User-defined**

| | |
|---|---|
| Invert Elev (ft) | = 0.36 |
| Slope (%) | = 1.55 |
| N-Value | = 0.016 |

**Calculations**

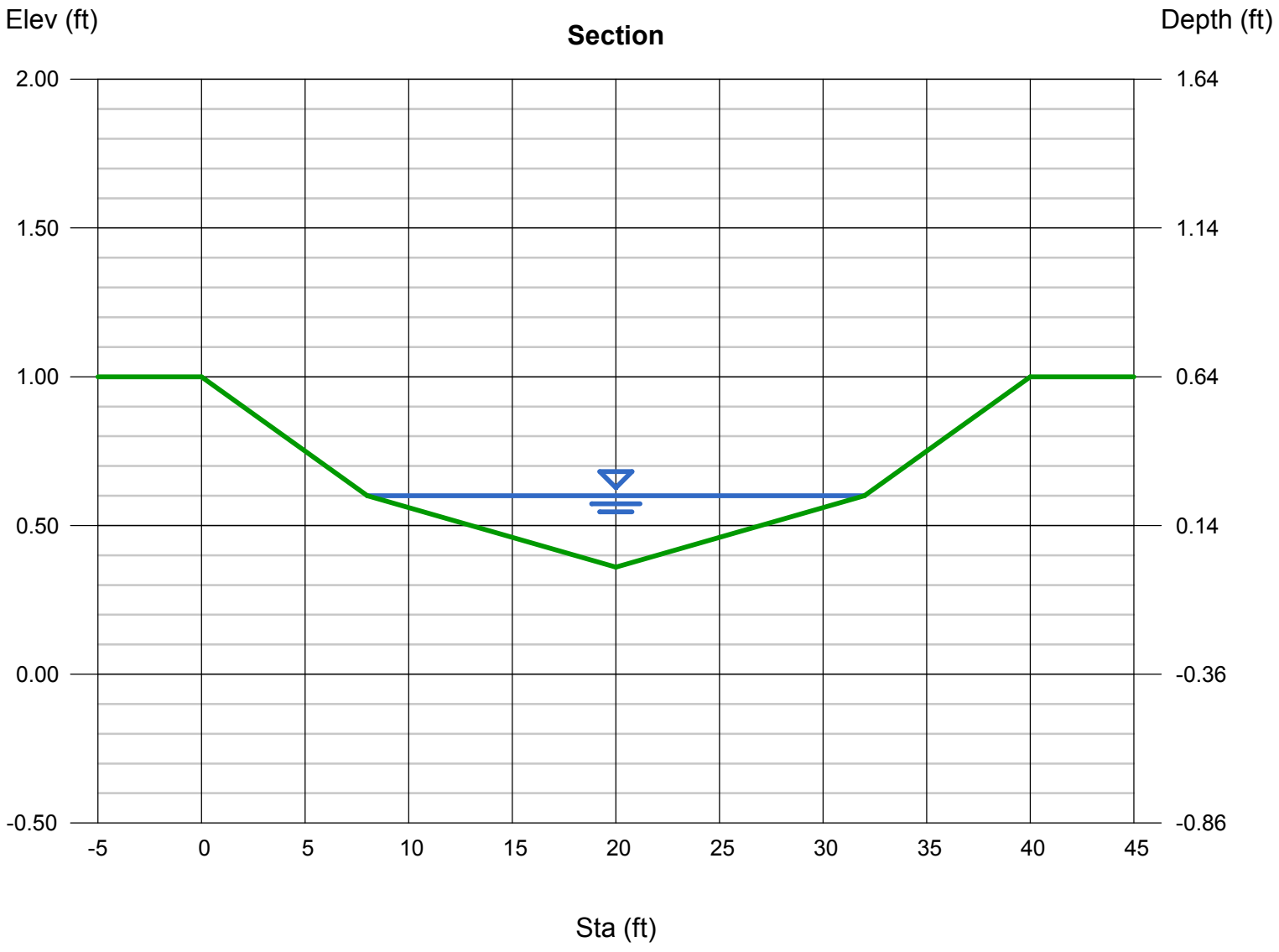
| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 8.00 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.24 |
| Q (cfs) | = 8.000 |
| Area (sqft) | = 2.88 |
| Velocity (ft/s) | = 2.78 |
| Wetted Perim (ft) | = 24.00 |
| Crit Depth, Yc (ft) | = 0.28 |
| Top Width (ft) | = 24.00 |
| EGL (ft) | = 0.36 |

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

( 0.00, 1.00)-(8.00, 0.60, 0.016)-(20.00, 0.36, 0.016)-(32.00, 0.60, 0.016)-(40.00, 1.00, 0.016)



Version 4.05 Released March 2017

# INLET MANAGEMENT

Worksheet Protected

| INLET NAME | DP3 | DP4 | STREET CAPACITY @ DP4 | DP8 | DP9 | DP24 |
|---|---|---|---|---|---|---|
| Site Type (Urban or Rural) | URBAN | URBAN | URBAN | URBAN | URBAN | URBAN |
| Inlet Application (Street or Area) | STREET | STREET | STREET | STREET | STREET | STREET |
| Hydraulic Condition | In Sump | On Grade | On Grade | In Sump | In Sump | In Sump |
| Inlet Type | Denver No. 16 Combination | Denver No. 16 Combination | | Denver No. 16 Combination | Denver No. 16 Combination | Denver No. 16 Combination |

**USER-DEFINED INPUT**

**User-Defined Design Flows**

| | | | | | | |
|---|---|---|---|---|---|---|
| Minor $Q_{Known}$ (cfs) | 3.0 | 2.4 | 2.4 | 2.3 | 3.4 | 0.8 |
| Major $Q_{Known}$ (cfs) | 6.1 | 5.7 | 5.7 | 5.9 | 9.2 | 3.0 |

**Bypass (Carry-Over) Flow from Upstream**

| | | | | | | |
|---|---|---|---|---|---|---|
| Receive Bypass Flow from: | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Major Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Watershed Characteristics**

| | | | | | | |
|---|---|---|---|---|---|---|
| Subcatchment Area (acres) | | | | | | |
| Percent Impervious | | | | | | |
| NRCS Soil Type | | | | | | |

**Watershed Profile**

| | | | | | | |
|---|---|---|---|---|---|---|
| Overland Slope (ft/ft) | | | | | | |
| Overland Length (ft) | | | | | | |
| Channel Slope (ft/ft) | | | | | | |
| Channel Length (ft) | | | | | | |

**Minor Storm Rainfall Input**

| | | | | | | |
|---|---|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | | | |

**Major Storm Rainfall Input**

| | | | | | | |
|---|---|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | | | |

**CALCULATED OUTPUT**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Minor Total Design Peak Flow, Q (cfs)** | **3.0** | **2.4** | **2.4** | **2.3** | **3.4** | **0.8** |
| **Major Total Design Peak Flow, Q (cfs)** | **6.1** | **5.7** | **5.7** | **5.9** | **9.2** | **3.0** |
| Minor Flow Bypassed Downstream, $Q_b$ (cfs) | N/A | 0.5 | | N/A | N/A | N/A |
| Major Flow Bypassed Downstream, $Q_b$ (cfs) | N/A | 2.3 | | N/A | N/A | N/A |

**Minor Storm (Calculated) Analysis of Flow Time**

| | | | | | | |
|---|---|---|---|---|---|---|
| C | N/A | N/A | N/A | N/A | N/A | N/A |
| $C_5$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Overland Flow Velocity, Vi | N/A | N/A | N/A | N/A | N/A | N/A |
| Channel Flow Velocity, Vt | N/A | N/A | N/A | N/A | N/A | N/A |
| Overland Flow Time, Ti | N/A | N/A | N/A | N/A | N/A | N/A |
| Channel Travel Time, Tt | N/A | N/A | N/A | N/A | N/A | N/A |
| Calculated Time of Concentration, $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Regional $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Recommended $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| $T_c$ selected by User | N/A | N/A | N/A | N/A | N/A | N/A |
| Design Rainfall Intensity, I | N/A | N/A | N/A | N/A | N/A | N/A |
| Calculated Local Peak Flow, $Q_p$ | N/A | N/A | N/A | N/A | N/A | N/A |

**Major Storm (Calculated) Analysis of Flow Time**

| | | | | | | |
|---|---|---|---|---|---|---|
| C | N/A | N/A | N/A | N/A | N/A | N/A |
| $C_5$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Overland Flow Velocity, Vi | N/A | N/A | N/A | N/A | N/A | N/A |
| Channel Flow Velocity, Vt | N/A | N/A | N/A | N/A | N/A | N/A |
| Overland Flow Time, Ti | N/A | N/A | N/A | N/A | N/A | N/A |
| Channel Travel Time, Tt | N/A | N/A | N/A | N/A | N/A | N/A |
| Calculated Time of Concentration, $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Regional $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Recommended $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| $T_c$ selected by User | N/A | N/A | N/A | N/A | N/A | N/A |
| Design Rainfall Intensity, I | N/A | N/A | N/A | N/A | N/A | N/A |
| Calculated Local Peak Flow, $Q_p$ | N/A | N/A | N/A | N/A | N/A | N/A |

Version 4.05 Released March 2017

# INLET MANAGEMENT

Worksheet Protected

| INLET NAME | DP23 | DP17 | DP18 | DP22 | DP19 | DP21 |
|---|---|---|---|---|---|---|
| Site Type (Urban or Rural) | URBAN | URBAN | URBAN | URBAN | URBAN | RURAL |
| Inlet Application (Street or Area) | STREET | STREET | STREET | STREET | STREET | AREA |
| Hydraulic Condition | In Sump | On Grade | In Sump | In Sump | On Grade | Swale |
| Inlet Type | Denver No. 16 Combination | Denver No. 16 Combination | Denver No. 16 Combination | Denver No. 16 Combination | Denver No. 16 Combination | CDOT Type C |

## USER-DEFINED INPUT

**User-Defined Design Flows**

| | | | | | | |
|---|---|---|---|---|---|---|
| Minor $Q_{Known}$ (cfs) | 2.6 | 1.7 | 2.8 | 1.4 | 1.8 | 0.1 |
| Major $Q_{Known}$ (cfs) | 5.4 | 3.5 | 5.4 | 3.0 | 4.6 | 0.9 |

**Bypass (Carry-Over) Flow from Upstream**

| | | | | | | |
|---|---|---|---|---|---|---|
| Receive Bypass Flow from: | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Major Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Watershed Characteristics**

| | | | | | | |
|---|---|---|---|---|---|---|
| Subcatchment Area (acres) | | | | | | |
| Percent Impervious | | | | | | |
| NRCS Soil Type | | | | | | |

**Watershed Profile**

| | | | | | | |
|---|---|---|---|---|---|---|
| Overland Slope (ft/ft) | | | | | | |
| Overland Length (ft) | | | | | | |
| Channel Slope (ft/ft) | | | | | | |
| Channel Length (ft) | | | | | | |

**Minor Storm Rainfall Input**

| | | | | | | |
|---|---|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | | | |

**Major Storm Rainfall Input**

| | | | | | | |
|---|---|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | | | |

## CALCULATED OUTPUT

| | | | | | | |
|---|---|---|---|---|---|---|
| **Minor Total Design Peak Flow, Q (cfs)** | **2.6** | **1.7** | **2.8** | **1.4** | **1.8** | **0.1** |
| **Major Total Design Peak Flow, Q (cfs)** | **5.4** | **3.5** | **5.4** | **3.0** | **4.6** | **0.9** |
| Minor Flow Bypassed Downstream, $Q_b$ (cfs) | N/A | 0.3 | N/A | N/A | 0.6 | 0.0 |
| Major Flow Bypassed Downstream, $Q_b$ (cfs) | N/A | 1.2 | N/A | N/A | 2.5 | 0.0 |

**Minor Storm (Calculated) Analysis of Flow T**

| | | | | | | |
|---|---|---|---|---|---|---|
| C | N/A | N/A | N/A | N/A | N/A | N/A |
| $C_5$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Overland Flow Velocity, Vi | N/A | N/A | N/A | N/A | N/A | N/A |
| Channel Flow Velocity, Vt | N/A | N/A | N/A | N/A | N/A | N/A |
| Overland Flow Time, Ti | N/A | N/A | N/A | N/A | N/A | N/A |
| Channel Travel Time, Tt | N/A | N/A | N/A | N/A | N/A | N/A |
| Calculated Time of Concentration, $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Regional $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Recommended $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| $T_c$ selected by User | N/A | N/A | N/A | N/A | N/A | N/A |
| Design Rainfall Intensity, I | N/A | N/A | N/A | N/A | N/A | N/A |
| Calculated Local Peak Flow, $Q_p$ | N/A | N/A | N/A | N/A | N/A | N/A |

**Major Storm (Calculated) Analysis of Flow T**

| | | | | | | |
|---|---|---|---|---|---|---|
| C | N/A | N/A | N/A | N/A | N/A | N/A |
| $C_5$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Overland Flow Velocity, Vi | N/A | N/A | N/A | N/A | N/A | N/A |
| Channel Flow Velocity, Vt | N/A | N/A | N/A | N/A | N/A | N/A |
| Overland Flow Time, Ti | N/A | N/A | N/A | N/A | N/A | N/A |
| Channel Travel Time, Tt | N/A | N/A | N/A | N/A | N/A | N/A |
| Calculated Time of Concentration, $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Regional $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| Recommended $T_c$ | N/A | N/A | N/A | N/A | N/A | N/A |
| $T_c$ selected by User | N/A | N/A | N/A | N/A | N/A | N/A |
| Design Rainfall Intensity, I | N/A | N/A | N/A | N/A | N/A | N/A |
| Calculated Local Peak Flow, $Q_p$ | N/A | N/A | N/A | N/A | N/A | N/A |

Version 4.05 Released March 2017

# INLET MANAGEMENT

Worksheet Protected

| INLET NAME | DP5 |
|---|---|
| Site Type (Urban or Rural) | URBAN |
| Inlet Application (Street or Area) | STREET |
| Hydraulic Condition | On Grade |
| Inlet Type | Denver No. 16 Combination |

**USER-DEFINED INPUT**

**User-Defined Design Flows**

| | |
|---|---|
| Minor $Q_{Known}$ (cfs) | 1.9 |
| Major $Q_{Known}$ (cfs) | 4.2 |

**Bypass (Carry-Over) Flow from Upstream**

| | |
|---|---|
| Receive Bypass Flow from: | No Bypass Flow Received |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.0 |
| Major Bypass Flow Received, $Q_b$ (cfs) | 0.0 |

**Watershed Characteristics**

| | |
|---|---|
| Subcatchment Area (acres) | |
| Percent Impervious | |
| NRCS Soil Type | |

**Watershed Profile**

| | |
|---|---|
| Overland Slope (ft/ft) | |
| Overland Length (ft) | |
| Channel Slope (ft/ft) | |
| Channel Length (ft) | |

**Minor Storm Rainfall Input**

| | |
|---|---|
| Design Storm Return Period, $T_r$ (years) | |
| One-Hour Precipitation, $P_1$ (inches) | |

**Major Storm Rainfall Input**

| | |
|---|---|
| Design Storm Return Period, $T_r$ (years) | |
| One-Hour Precipitation, $P_1$ (inches) | |

**CALCULATED OUTPUT**

| | |
|---|---|
| **Minor Total Design Peak Flow, Q (cfs)** | **1.9** |
| **Major Total Design Peak Flow, Q (cfs)** | **4.2** |
| Minor Flow Bypassed Downstream, $Q_b$ (cfs) | 0.3 |
| Major Flow Bypassed Downstream, $Q_b$ (cfs) | 1.5 |

**Minor Storm (Calculated) Analysis of Flow T**

| | |
|---|---|
| C | N/A |
| $C_s$ | N/A |
| Overland Flow Velocity, Vi | N/A |
| Channel Flow Velocity, Vt | N/A |
| Overland Flow Time, Ti | N/A |
| Channel Travel Time, Tt | N/A |
| Calculated Time of Concentration, $T_c$ | N/A |
| Regional $T_c$ | N/A |
| Recommended $T_c$ | N/A |
| $T_c$ selected by User | N/A |
| Design Rainfall Intensity, I | N/A |
| Calculated Local Peak Flow, $Q_p$ | N/A |

**Major Storm (Calculated) Analysis of Flow T**

| | |
|---|---|
| C | N/A |
| $C_s$ | N/A |
| Overland Flow Velocity, Vi | N/A |
| Channel Flow Velocity, Vt | N/A |
| Overland Flow Time, Ti | N/A |
| Channel Travel Time, Tt | N/A |
| Calculated Time of Concentration, $T_c$ | N/A |
| Regional $T_c$ | N/A |
| Recommended $T_c$ | N/A |
| $T_c$ selected by User | N/A |
| Design Rainfall Intensity, I | N/A |
| Calculated Local Peak Flow, $Q_p$ | N/A |

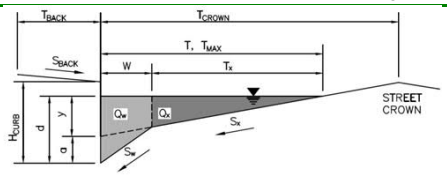
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP3




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

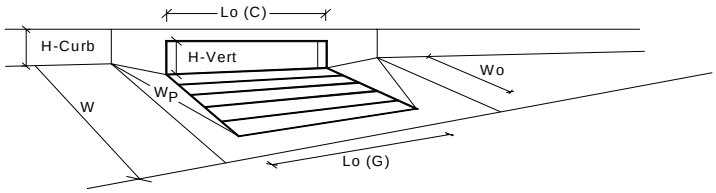
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.018 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 21.0 | 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) | $n_{STREET}$ = | 0.014 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 21.0 | 21.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | 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

**Version 4.05 Released March 2017**




| **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 | 6.6 | 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 | 0.569 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.33 | 0.38 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.71 | 0.77 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.71 | 0.77 | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **6.2** | **7.9** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 3.0 | 6.1 | cfs |

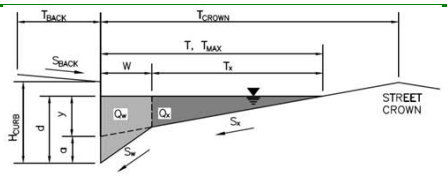
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP4




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

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.018 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | 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 | $S_O$ = | 0.011 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.014 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.4 | 6.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☐ | check = yes |

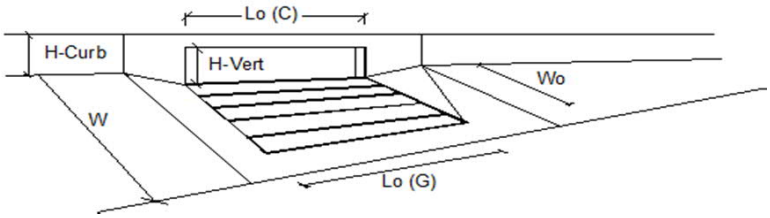
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Spread Criterion** | **$Q_{allow}$ =** | **5.6** | **5.6** | **cfs** |

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

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

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 2.0 | 2.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 3.00 | 3.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | 1.73 | 1.73 | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | 0.50 | 0.50 | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **1.9** | **3.4** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.5** | **2.3** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **80** | **60** | **%** |

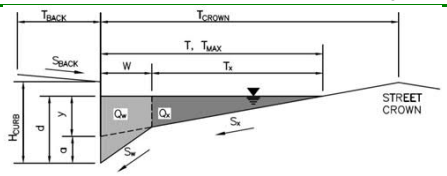
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP5




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

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 7.5 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.018 | |
| 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 | $S_X$ = | 0.013 | 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 | $S_O$ = | 0.007 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.014 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 21.0 | 21.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☐ | check = yes |

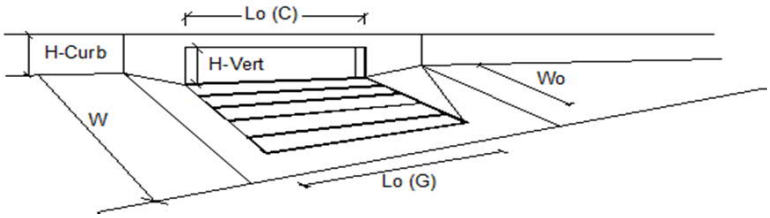
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Spread Criterion** | **$Q_{allow}$ =** | **8.5** | **8.5** | **cfs** |

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

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

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 2.0 | 2.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 3.00 | 3.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | 1.73 | 1.73 | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | 0.50 | 0.50 | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **1.6** | **2.7** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.3** | **1.5** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **83** | **64** | **%** |

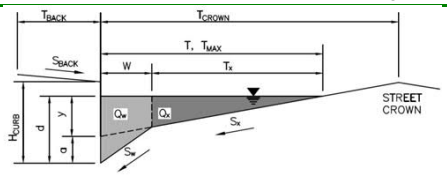
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP8




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

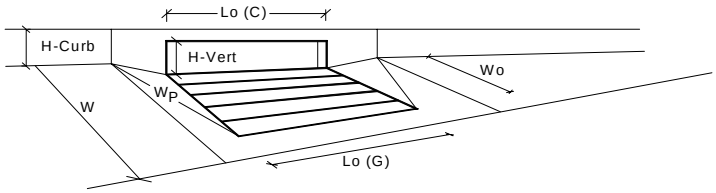
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.018 | |
| 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 | $S_X$ = | 0.009 | 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) | $n_{STREET}$ = | 0.014 | |

| | | 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 | 8.0 | 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

**Version 4.05 Released March 2017**




| **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 = | 3 | 3 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.9 | 4.9 | 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 | $d_{Grate}$ = | 0.432 | 0.432 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.24 | 0.24 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.46 | 0.46 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.90 | 0.90 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.46 | 0.46 | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **4.3** | **4.3** | **cfs** |
| **WARNING: Inlet Capacity less than Q Peak for Major Storm** | $Q_{PEAK\ REQUIRED}$ = | 2.3 | 5.9 | cfs |

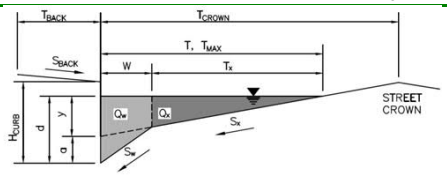
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP9




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

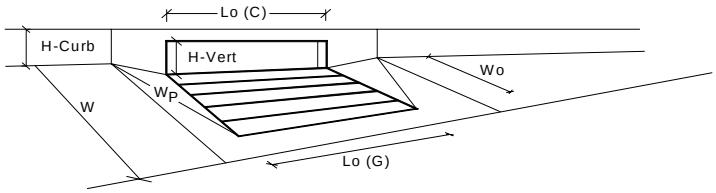
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.018 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 21.0 | 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) | $n_{STREET}$ = | 0.014 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 21.0 | 21.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | 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

**Version 4.05 Released March 2017**




| **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 = | 3 | 3 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 6.0 | 6.6 | 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 | 0.569 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.33 | 0.38 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.57 | 0.62 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.97 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.57 | 0.62 | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **7.6** | **9.6** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 3.4 | 9.2 | cfs |

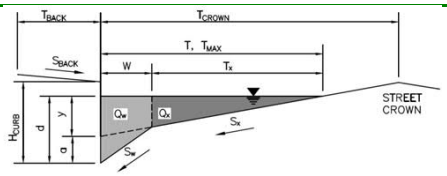
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP17




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

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | 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) | $n_{BACK}$ = | 0.018 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | 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 | $S_O$ = | 0.029 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.014 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☐ | check = yes |

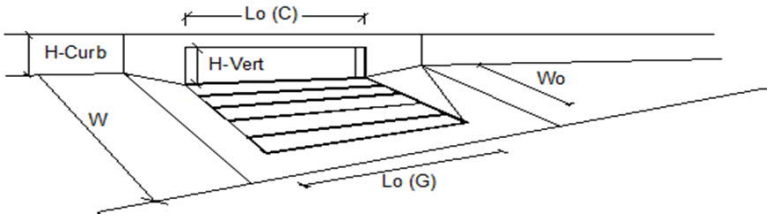
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Spread Criterion** | **$Q_{allow}$ =** | **9.1** | **9.1** | **cfs** |

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

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

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 2.0 | 2.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 3.00 | 3.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | 1.73 | 1.73 | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | 0.50 | 0.50 | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity** | **Q =** | **1.4** | **2.3** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.3** | **1.2** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **82** | **65** | **%** |

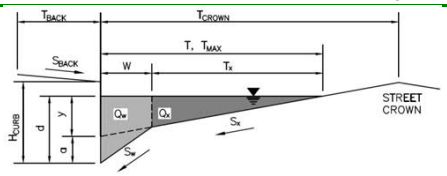
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP18




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

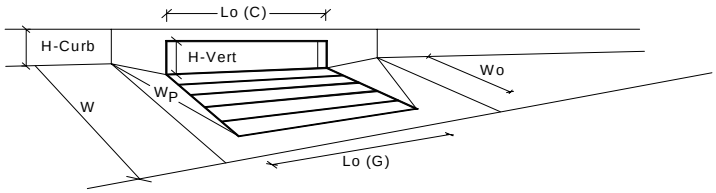
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.018 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 21.0 | 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) | $n_{STREET}$ = | 0.014 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 21.0 | 21.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | 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

**Version 4.05 Released March 2017**




| **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 | 6.6 | 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 | 0.569 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.33 | 0.38 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.71 | 0.77 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.71 | 0.77 | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **6.2** | **7.9** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 2.8 | 5.4 | cfs |

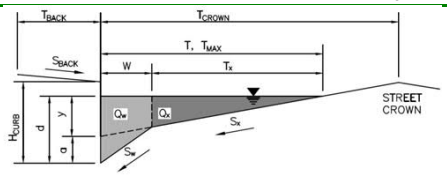
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP19




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

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | 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) | $n_{BACK}$ = | 0.018 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | 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 | $S_O$ = | 0.025 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.014 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☐ | check = yes |

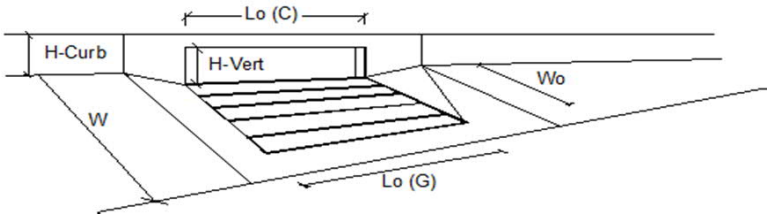
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Spread Criterion** | **$Q_{allow}$ =** | **8.5** | **8.5** | **cfs** |

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

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

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**



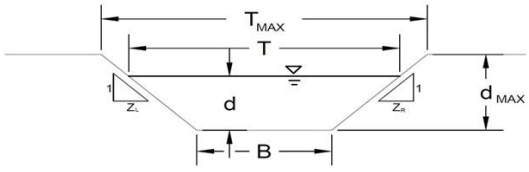

| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 2.0 | 2.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 3.00 | 3.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | 1.73 | 1.73 | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | 0.50 | 0.50 | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity** | **Q =** | **1.2** | **2.1** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.6** | **2.5** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **69** | **46** | **%** |

Version 4.05 Released March 2017

# AREA INLET IN A SWALE

**PALMER VILLAGE**

**DP21**




This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

**Analysis of Trapezoidal Grass-Lined Channel Using SCS Method**

| | | | |
|---|---|---|---|
| NRCS Vegetal Retardance (A, B, C, D, or E) | A, B, C, D or E | C | |
| Manning's n (Leave cell D16 blank to manually enter an n value) | n = | see details below | |
| Channel Invert Slope | $S_O$ = | 0.0300 | ft/ft |
| Bottom Width | B = | 1.00 | ft |
| Left Side Slope | Z1 = | 4.00 | ft/ft |
| Right Side Slope | Z2 = | 3.00 | ft/ft |

Check one of the following soil types:

| Soil Type: | Max. Velocity ($V_{MAX}$) | Max Froude No. ($F_{MAX}$) |
|---|---|---|
| Non-Cohesive | 5.0 fps | 0.60 |
| Cohesive | 7.0 fps | 0.80 |
| Paved | N/A | N/A |

Choose One:
- ○ Non-Cohesive
- ◉ Cohesive
- ○ Paved

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Top Width of Channel for Minor & Major Storm | $T_{MAX}$ = | 6.00 | 6.00 | feet |
| Max. Allowable Water Depth in Channel for Minor & Major Storm | $d_{MAX}$ = | 1.00 | 1.00 | feet |

**Allowable Channel Capacity Based On Channel Geometry**

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Top Width Criterion** | $Q_{allow}$ = | 1.8 | 1.8 | cfs |
| **MAJOR STORM Allowable Capacity is based on Top Width Criterion** | $d_{allow}$ = | 0.71 | 0.71 | ft |

**Water Depth in Channel Based On Design Peak Flow**

| | | | | |
|---|---|---|---|---|
| **Design Peak Flow** | $Q_o$ = | 0.1 | 0.9 | cfs |
| **Water Depth** | d = | 0.27 | 0.67 | feet |

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

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

Version 4.05 Released March 2017

# AREA INLET IN A SWALE

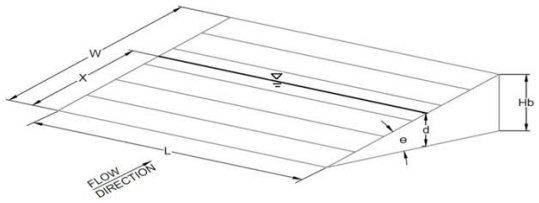
**PALMER VILLAGE**

**DP21**

**Inlet Design Information (Input)**

Type of Inlet: CDOT Type C

Inlet Type = CDOT Type C




| | | | |
|---|---|---|---|
| Angle of Inclined Grade (must be <= 30 degrees) | θ = | 0.00 | degrees |
| Width of Grade | W = | 3.00 | feet |
| Length of Grade | L = | 3.00 | feet |
| Open Area Ratio | $A_{RATIO}$ = | 0.70 | |
| Height of Inclined Grade | $H_B$ = | 0.00 | feet |
| Clogging Factor | $C_f$ = | 0.50 | |
| Grate Discharge Coefficient | $C_d$ = | 0.96 | |
| Orifice Coefficient | $C_o$ = | 0.64 | |
| Weir Coefficient | $C_w$ = | 2.05 | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| Water Depth at Inlet (for depressed inlets, 1 foot is added for depression) | d = | 0.27 | 0.67 | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **2.6** | **10.0** | **cfs** |
| | **Bypassed Flow, $Q_b$ =** | **0.0** | **0.0** | **cfs** |
| | **Capture Percentage = $Q_a/Q_o$ = C%** | **100** | **100** | **%** |

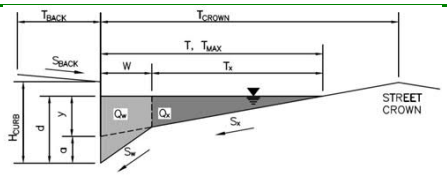
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP22




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

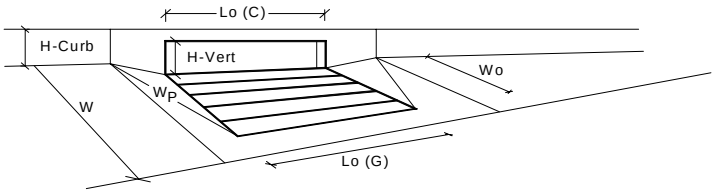
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.018 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | 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) | $n_{STREET}$ = | 0.014 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | 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

**Version 4.05 Released March 2017**




| **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 = | 4.4 | 4.4 | 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 | $d_{Grate}$ = | 0.389 | 0.389 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.20 | 0.20 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.52 | 0.52 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.52 | 0.52 | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **2.6** | **2.6** | **cfs** |
| **WARNING: Inlet Capacity less than Q Peak for Major Storm** | $Q_{PEAK\ REQUIRED}$ = | 1.4 | 3.0 | cfs |

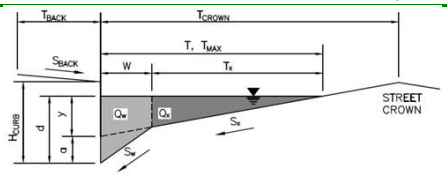
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP23




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

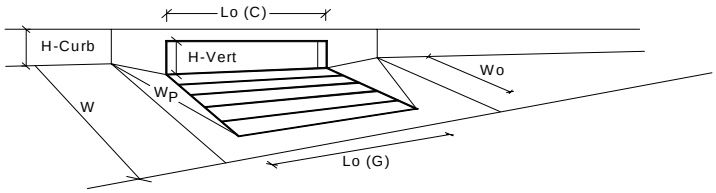
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.018 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 21.0 | 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) | $n_{STREET}$ = | 0.014 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 21.0 | 21.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | 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

**Version 4.05 Released March 2017**




| **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 | 6.6 | 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 | 0.569 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.33 | 0.38 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.71 | 0.77 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.71 | 0.77 | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **6.2** | **7.9** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 2.6 | 5.4 | cfs |

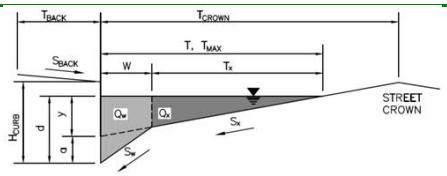
Version 4.05 Released March 2017

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

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

**Project:** PALMER VILLAGE

**Inlet ID:** DP24




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

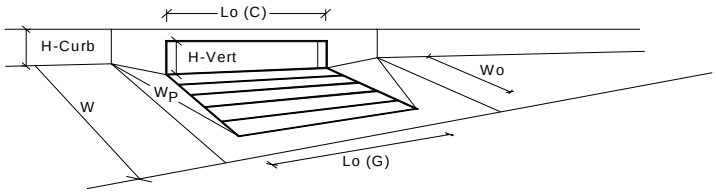
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.018 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | 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) | $n_{STREET}$ = | 0.014 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | 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

**Version 4.05 Released March 2017**




| **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 = | 3 | 3 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.4 | 4.4 | 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 | $d_{Grate}$ = | 0.389 | 0.389 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.20 | 0.20 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.41 | 0.41 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.86 | 0.86 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.41 | 0.41 | |

| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **3.2** | **3.2** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 0.8 | 3.0 | cfs |

# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 28 2020

## BASIN A10 SWALE

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 3.00, 3.00 |
| Total Depth (ft) | = 0.65 |
| Invert Elev (ft) | = 1.00 |
| Slope (%) | = 1.82 |
| N-Value | = 0.013 |

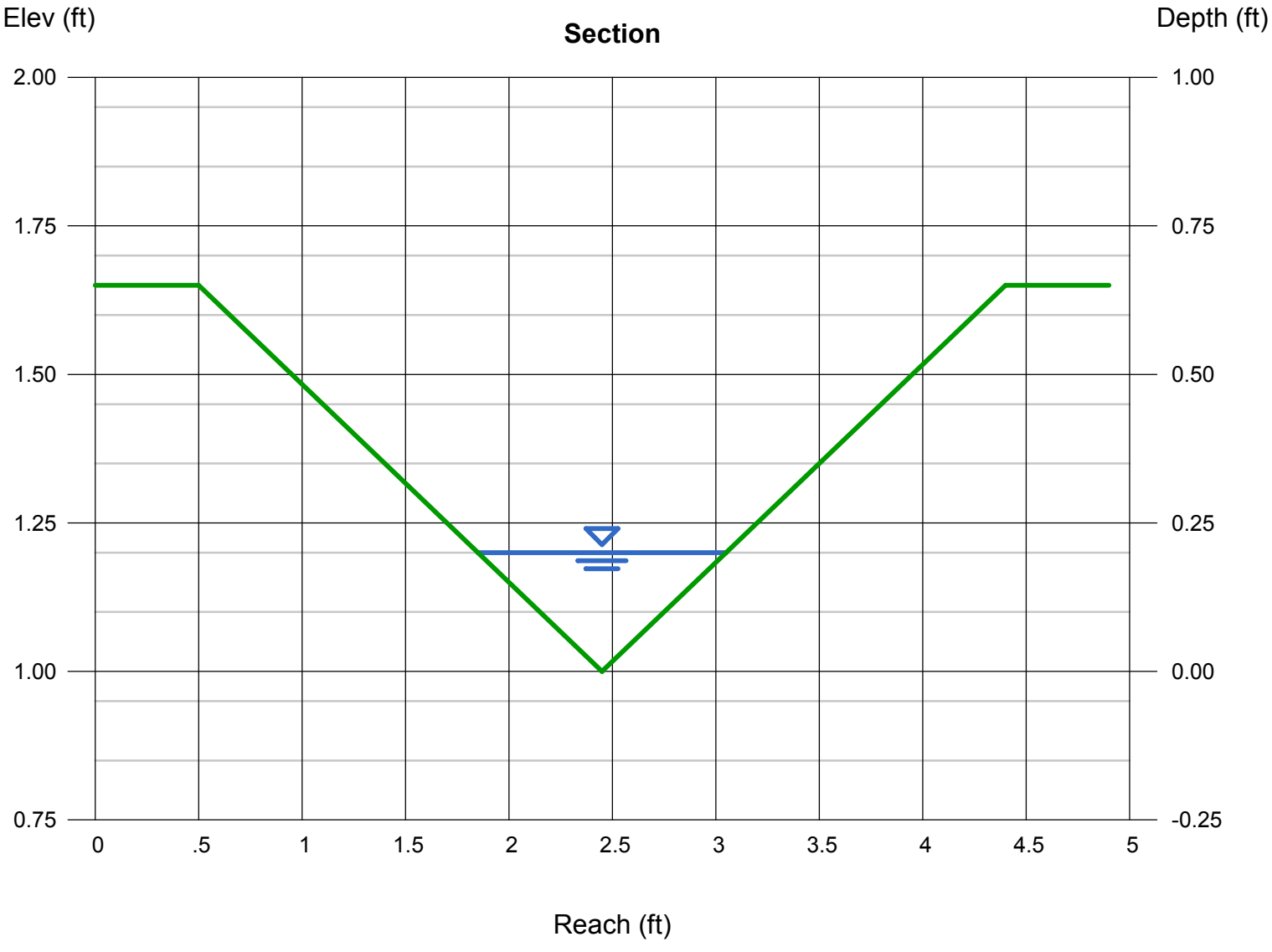
**Calculations**

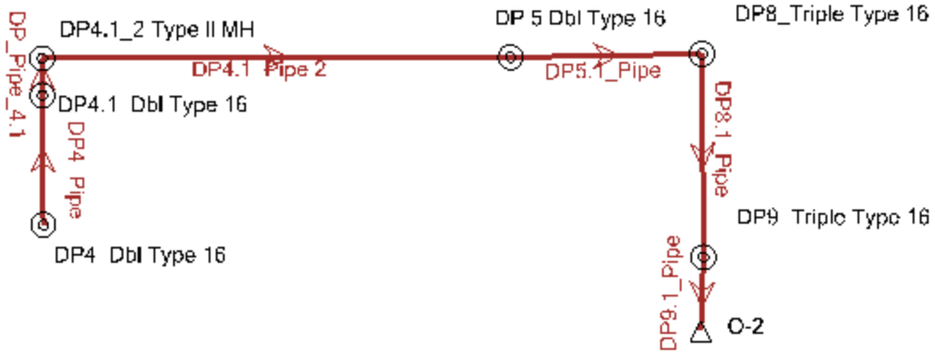
| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.38 |

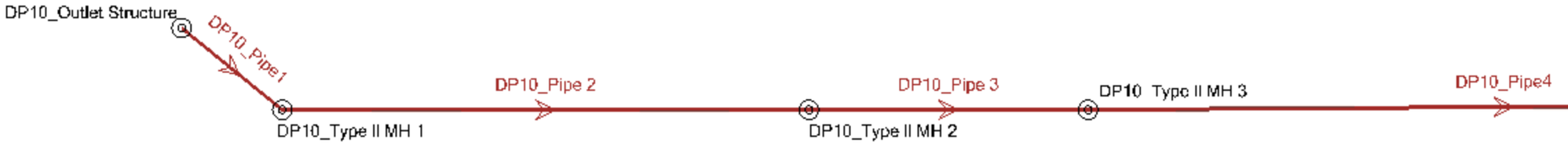
**Highlighted**

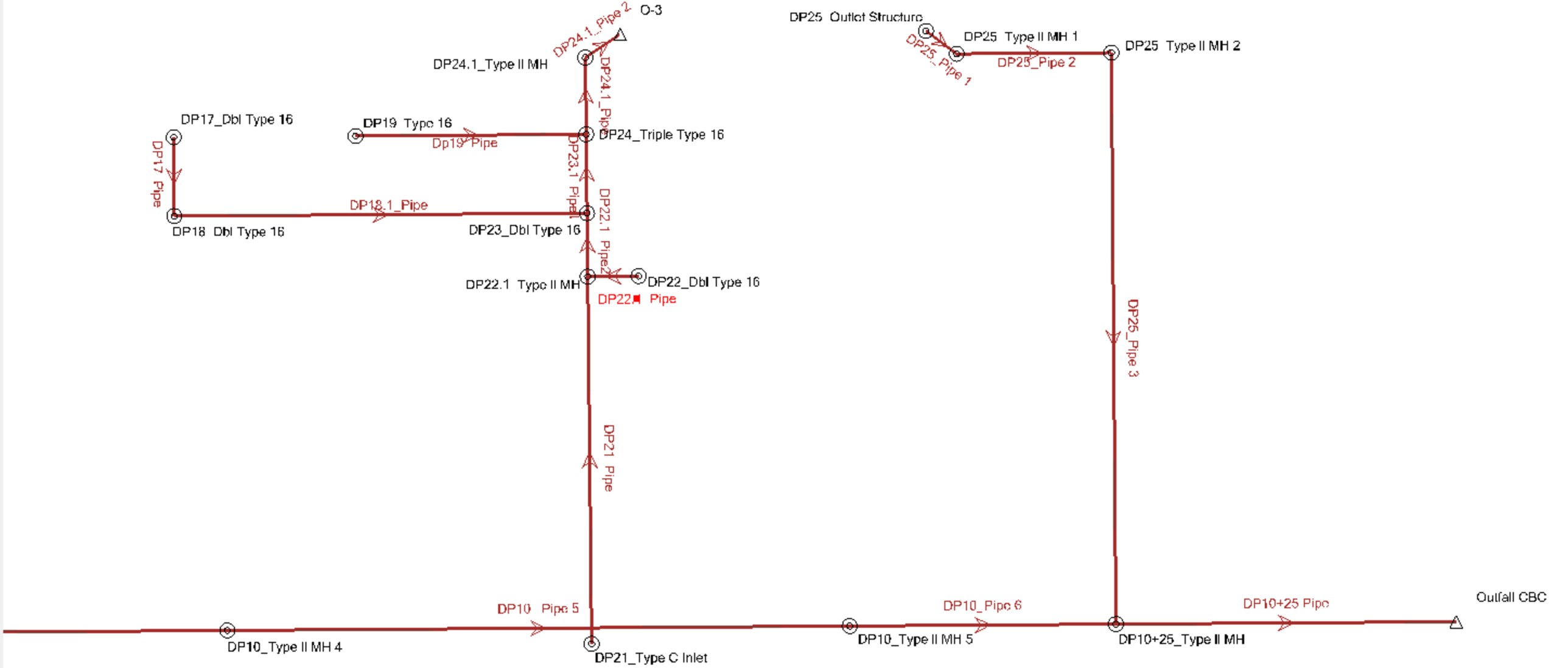
| | |
|---|---|
| Depth (ft) | = 0.20 |
| Q (cfs) | = 0.380 |
| Area (sqft) | = 0.12 |
| Velocity (ft/s) | = 3.17 |
| Wetted Perim (ft) | = 1.26 |
| Crit Depth, Yc (ft) | = 0.26 |
| Top Width (ft) | = 1.20 |
| EGL (ft) | = 0.36 |

100-year Flow Calculation:
Area drainage to swale: 0.14 ac
Basin A10 area: 0.78 ac
Percentage of Basin A10 draining to swale: 18%
Basin A10 Q100: 2.1 cfs
Q100 in swale: 0.38 cfs (2.1 cfs * 18%)




DP4.1_2 Type II MH
DP 5 Dbl Type 16
DP8_Triple Type 16
DP4.1 Pipe 2
DP5.1_Pipe
DP_Pipe_4.1
DP4.1 Dbl Type 16
DP8.1_Pipe
DP4 Pipe
DP9 Triple Type 16
DP4 Dbl Type 16
DP9.1_Pipe
O-2


DP10_Outlet Structure
DP10_Pipe1
DP10_Pipe 2
DP10_Pipe 3
DP10 Type II MH 3
DP10_Pipe4
DP10_Type II MH 1
DP10_Type II MH 2

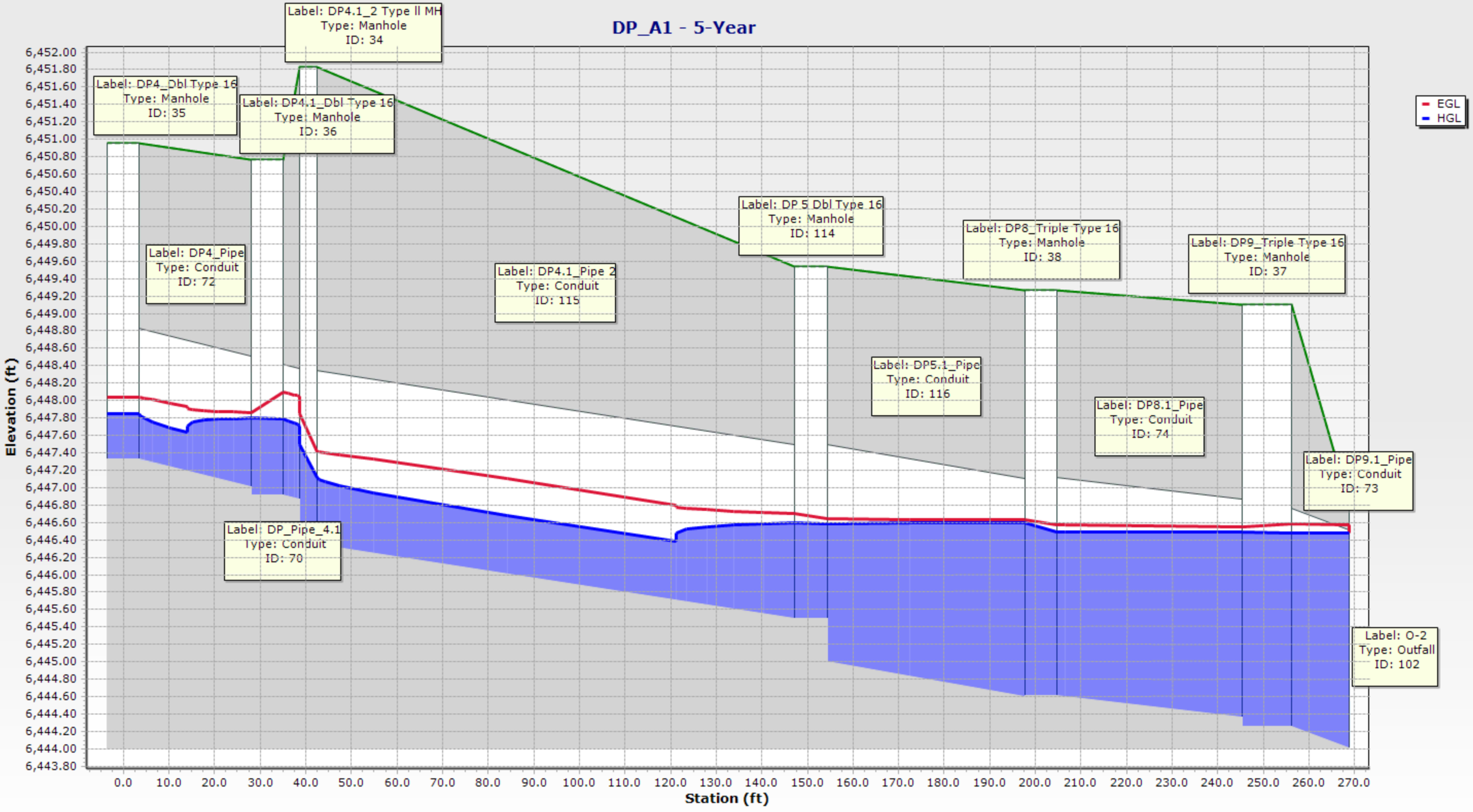

O-3
DP24.1_Pipe 2
DP24.1_Type II MH
DP24.1_Pipe
DP17_Dbl Type 16
DP19 Type 16
DP24_Triple Type 16
Dp19 Pipe
DP17 Pipe
DP23.1 Pipe
DP22.1 Pipe2
DP18.1_Pipe
DP18 Dbl Type 16
DP23_Dbl Type 16
DP22.1 Type II MH
DP22_Dbl Type 16
DP22.1 Pipe
DP21 Pipe
DP25 Outlet Structure
DP25 Type II MH 1
DP25 Type II MH 2
DP25_Pipe 1
DP25_Pipe 2
DP25_Pipe 3
DP10 Pipe 5
DP10_Pipe 6
DP10+25 Pipe
Outfall CBC
DP10_Type II MH 4
DP21_Type C Inlet
DP10_Type II MH 5
DP10+25_Type II MH

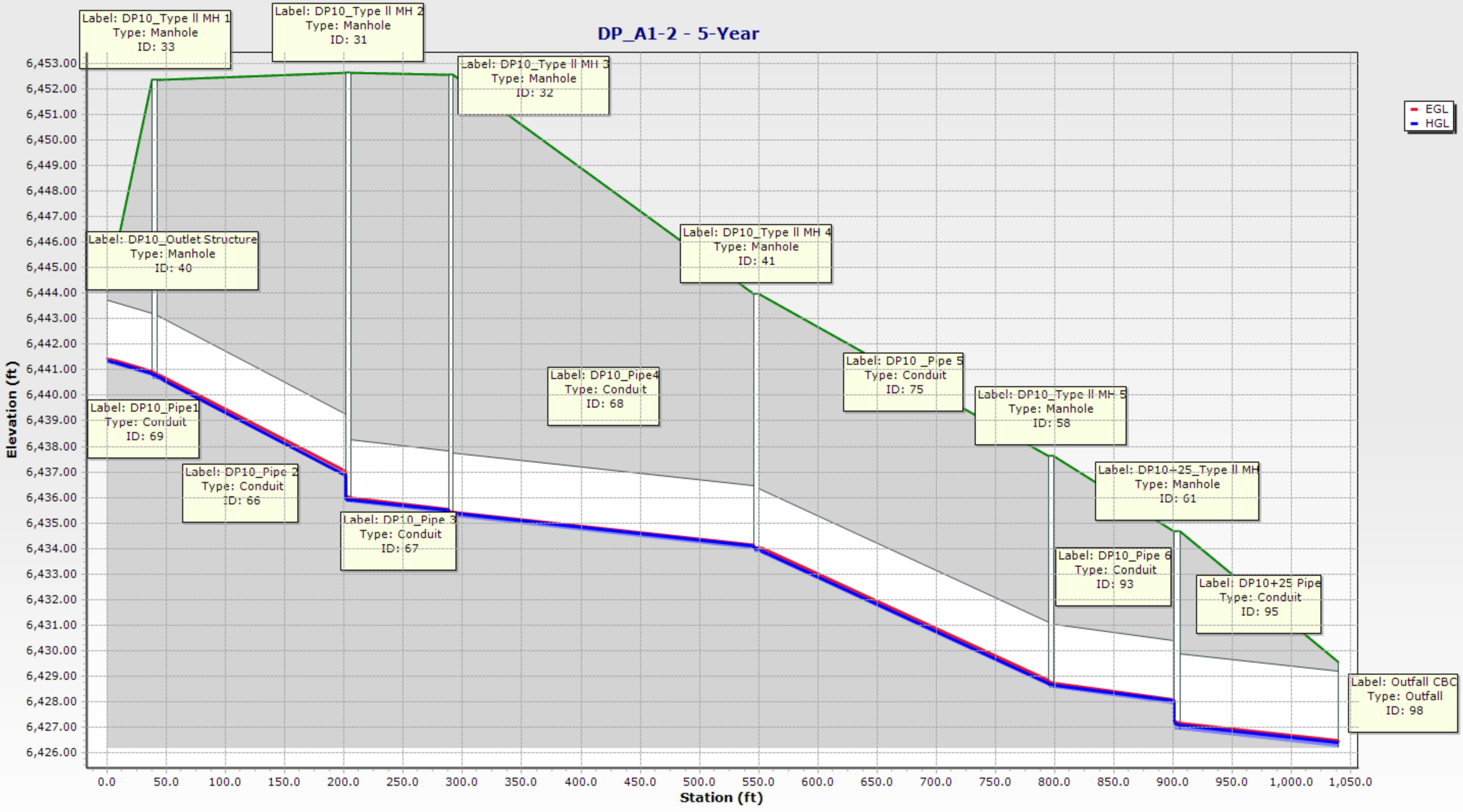
Storm CAD Pipe and Node Report - 5-Year

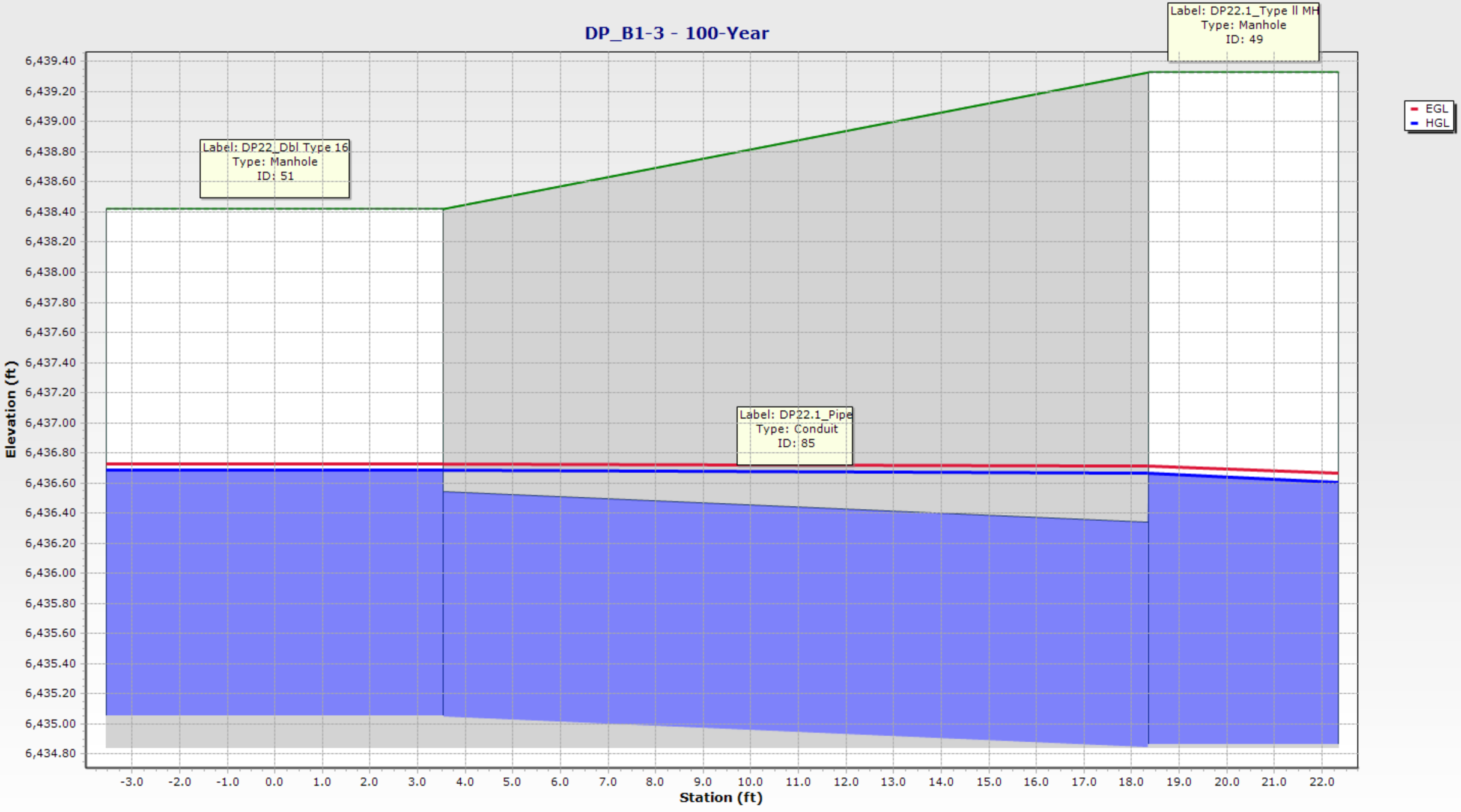
| Upstream Structure | Label | Flow (cfs) | Diameter (in) | Slope (Calculated) (ft/ft) | Invert (Start) (ft) | Invert (Stop) (ft) | Elevation Ground (Start) (ft) | Elevation Ground (Stop) (ft) | HGL (Up) (ft) | HGL (Down) (ft) | Energy Grade Line (In) (ft) | Energy Grade Line (Out) (ft) | Velocity (ft/s) | Upstream Structure Headloss Coefficient | Length (User Defined) (ft) | Capacity (Full Flow) (cfs) | Manning's n |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DP10_Type II MH 1 | DP10_Pipe 2 | 0.2 | 30 | 0.024 | 6,440.62 | 6,436.77 | 6,452.37 | 6,452.64 | 6,440.77 | 6,436.88 | 6,440.82 | 6,437.01 | 2.90 | 1.32 | 163.4 | 62.96 | 0.013 |
| DP10_Type II MH 2 | DP10_Pipe 3 | 0.2 | 30 | 0.005 | 6,435.77 | 6,435.34 | 6,452.64 | 6,452.54 | 6,435.92 | 6,435.48 | 6,435.97 | 6,435.53 | 1.69 | 0.05 | 86.6 | 29 | 0.013 |
| DP10_Type II MH 3 | DP10_Pipe 4 | 0.2 | 30 | 0.005 | 6,435.24 | 6,433.94 | 6,452.54 | 6,443.98 | 6,435.39 | 6,434.09 | 6,435.44 | 6,434.14 | 1.70 | 0.05 | 257.9 | 29.11 | 0.013 |
| DP10_Outlet Structure | DP10_Pipe 1 | 0.2 | 30 | 0.013 | 6,441.24 | 6,440.73 | 6,444.03 | 6,452.37 | 6,441.39 | 6,440.84 | 6,441.44 | 6,440.93 | 2.35 | 0 | 40.2 | 46.54 | 0.013 |
| DP4.1_Dbl Type 16 | DP_Pipe4.1 | 4.8 | 18 | 0.005 | 6,446.91 | 6,446.87 | 6,450.77 | 6,451.83 | 6,447.79 | 6,447.71 | 6,448.10 | 6,448.05 | 4.47 | 0.05 | 9 | 7.43 | 0.013 |
| DP4.1_2 Type II MH | DP4.1_Pipe 2 | 4.8 | 18 | 0.006 | 6,446.56 | 6,445.61 | 6,451.83 | 6,449.22 | 6,447.41 | 6,446.49 | 6,447.75 | 6,446.80 | 4.77 | 1.32 | 160.7 | 8.08 | 0.013 |
| DP4_Dbl Type 16 | DP4_Pipe | 1.9 | 18 | 0.01 | 6,447.33 | 6,447.01 | 6,450.95 | 6,450.77 | 6,447.85 | 6,447.79 | 6,448.04 | 6,447.85 | 4.51 | 0 | 31.5 | 10.5 | 0.013 |
| DP9_Triple Type 16 | DP9.1_Pipe | 11.5 | 30 | 0.014 | 6,444.26 | 6,444.01 | 6,449.11 | 6,446.80 | 6,446.48 | 6,446.48 | 6,446.58 | 6,446.57 | 8.02 | 0.05 | 18 | 47.87 | 0.013 |
| DP8_Dbl Type 16 | DP8.1_Pipe | 8.3 | 30 | 0.005 | 6,444.61 | 6,444.36 | 6,449.22 | 6,449.11 | 6,446.49 | 6,446.48 | 6,446.56 | 6,446.54 | 5.10 | 1.32 | 49.5 | 29 | 0.013 |
| DP10_Type II MH4 | DP10_Pipe 5 | 0.2 | 30 | 0.021 | 6,433.84 | 6,428.61 | 6,443.98 | 6,437.61 | 6,433.99 | 6,428.72 | 6,434.04 | 6,428.84 | 2.79 | 0.05 | 248.8 | 59.46 | 0.013 |
| DP17DblType 16 | DP17_Pipe | 1.4 | 18 | 0.01 | 6,437.63 | 6,437.31 | 6,441.89 | 6,441.71 | 6,438.07 | 6,437.80 | 6,438.23 | 6,437.92 | 4.13 | 0 | 31.5 | 10.5 | 0.013 |
| DP18_Dbl Type 16 | DP18.1_Pipe | 4.2 | 18 | 0.014 | 6,437.01 | 6,434.73 | 6,441.71 | 6,438.07 | 6,437.80 | 6,435.34 | 6,438.11 | 6,435.96 | 6.32 | 1.32 | 165 | 12.35 | 0.013 |
| DP19_Type 16 | Dp19_Pipe | 1.2 | 18 | 0.009 | 6,435.37 | 6,434.57 | 6,439.82 | 6,438.25 | 6,435.78 | 6,434.93 | 6,435.92 | 6,435.15 | 3.75 | 0 | 92.2 | 9.75 | 0.013 |
| DP22_Dbl Type 16 | DP22.1_Pipe | 2.2 | 18 | 0.01 | 6,435.05 | 6,434.84 | 6,438.42 | 6,439.33 | 6,435.61 | 6,435.32 | 6,435.81 | 6,435.65 | 4.70 | 0 | 20.3 | 10.5 | 0.013 |
| DP22.1_Type II MH | DP22.1_Pipe2 | 1.6 | 18 | 0.005 | 6,434.86 | 6,434.73 | 6,439.33 | 6,438.07 | 6,435.33 | 6,435.24 | 6,435.51 | 6,435.38 | 3.35 | 1.02 | 25.4 | 7.42 | 0.013 |
| DP21_Type C Inlet | DP22.1_Pipe | 0.1 | 18 | 0.005 | 6,435.70 | 6,434.96 | 6,438.01 | 6,439.33 | 6,435.82 | 6,435.33 | 6,435.85 | 6,435.34 | 1.48 | 0 | 146.8 | 7.43 | 0.013 |
| DP24_Triple Type 16 | DP24.1_Pipe | 10 | 30 | 0.005 | 6,433.57 | 6,433.41 | 6,438.25 | 6,438.48 | 6,434.63 | 6,434.42 | 6,435.03 | 6,434.87 | 5.41 | 1.02 | 30.7 | 29.34 | 0.013 |
| Dp24.1_Type II MH | DP24.1_Pipe 2 | 10 | 30 | 0.007 | 6,433.11 | 6,433.00 | 6,438.48 | 6,435.79 | 6,434.46 | 6,434.48 | 6,434.68 | 6,434.65 | 5.97 | 1.32 | 16.6 | 33.58 | 0.013 |
| DP23_Dbl Type 16 | DP23.1Pipe1 | 8.1 | 24 | 0.005 | 6,434.23 | 6,434.07 | 6,438.07 | 6,438.25 | 6,435.24 | 6,435.08 | 6,435.64 | 6,435.49 | 5.11 | 1.02 | 31.5 | 16 | 0.013 |
| DP25_Type II MH 1 | DP25_Pipe 2 | 0.2 | 30 | 0.005 | 6,430.25 | 6,430.56 | 6,436.82 | 6,438.04 | 6,430.71 | 6,430.39 | 6,430.75 | 6,430.44 | 1.70 | 0.64 | 61.8 | 29.04 | 0.013 |
| DP25_Outlet Structure | DP25_Pipe 1 | 0.2 | 30 | 0.005 | 6,430.77 | 6,430.84 | 6,438.04 | 6,433.63 | 6,430.99 | 6,430.91 | 6,431.03 | 6,430.96 | 1.64 | 0 | 15.3 | 27.74 | 0.013 |
| DP10_Type IIMH 5 | DP10_Pipe 6 | 0.2 | 30 | 0.006 | 6,428.51 | 6,427.88 | 6,437.61 | 6,434.67 | 6,428.66 | 6,428.02 | 6,428.71 | 6,428.08 | 1.80 | 0.05 | 106.4 | 31.61 | 0.013 |
| DP25_Type II MH 2 | DP25_Pipe 3 | 0.2 | 30 | 0.011 | 6,427.38 | 6,429.95 | 6,434.67 | 6,436.82 | 6,430.09 | 6,427.50 | 6,430.14 | 6,427.58 | 2.25 | 1.32 | 228.4 | 43.5 | 0.013 |
| DP10+25_Type II MH | DP10+25 Pipe | 0.4 | 36 | 0.005 | 6,426.88 | 6,426.20 | 6,434.67 | 6,429.54 | 6,427.08 | 6,426.40 | 6,427.14 | 6,426.46 | 2.04 | 1.52 | 136.1 | 47.16 | 0.013 |

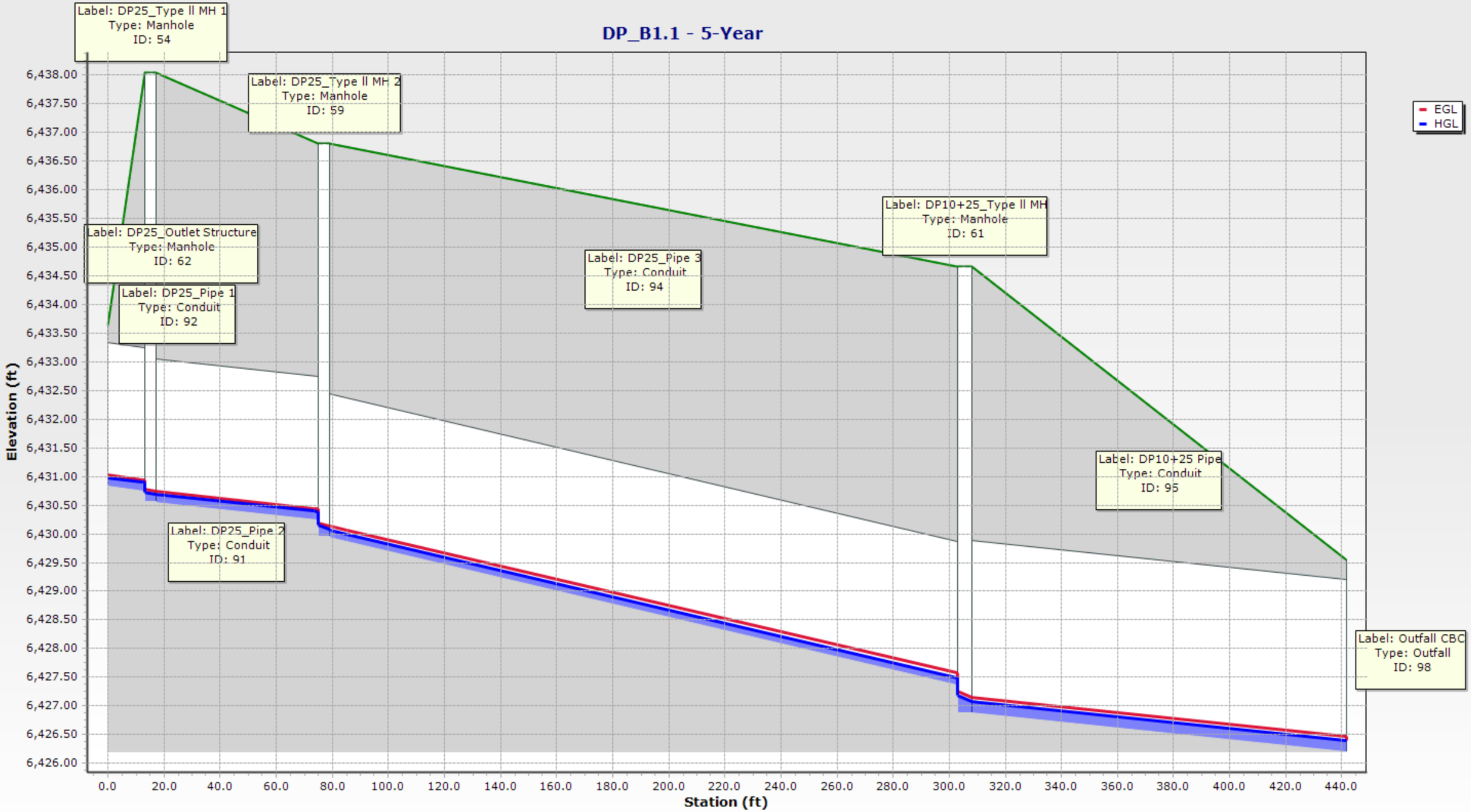
Storm CAD Pipe and Node Report - 100-Year

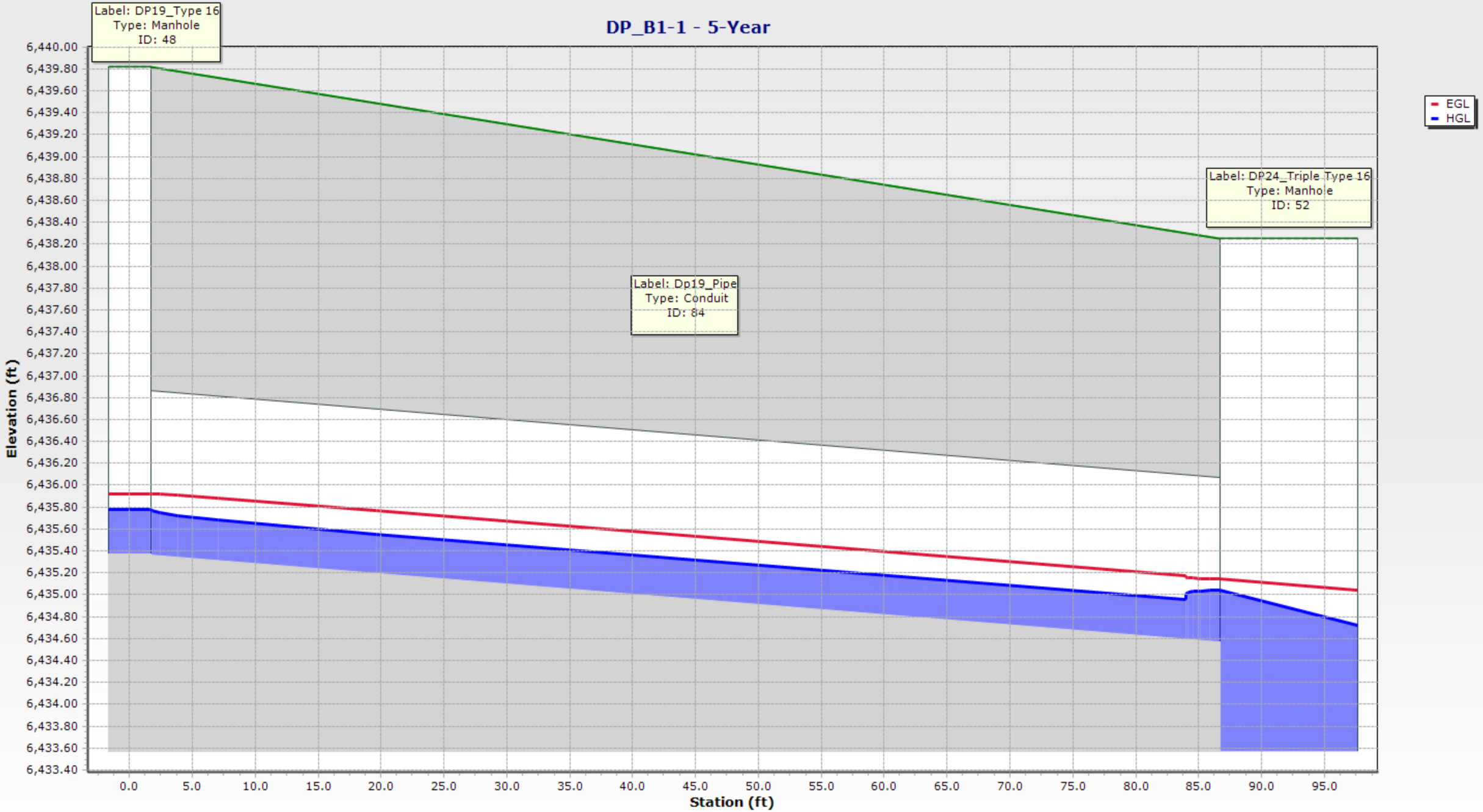
| Upstream Structure | Label | Flow (cfs) | Diameter (in) | Slope (Calculated) (ft/ft) | Invert (Start) (ft) | Invert (Stop) (ft) | Elevation Ground (Start) (ft) | Elevation Ground (Stop) (ft) | HGL (Up) (ft) | HGL (Down) (ft) | Energy Grade Line (In) (ft) | Energy Grade Line (Out) (ft) | Velocity (ft/s) | Upstream Structure Headloss Coefficient | Length (User Defined) (ft) | Capacity (Full Flow) (cfs) | Manning's n |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DP10_Type II MH 1 | DP10_Pipe 2 | 26.5 | 30 | 0.024 | 6,440.62 | 6,436.77 | 6,452.37 | 6,452.64 | 6,442.38 | 6,437.90 | 6,443.18 | 6,440.25 | 12.27 | 1.32 | 163.4 | 62.96 | 0.013 |
| DP10_Type II MH 2 | DP10_Pipe 3 | 26.5 | 30 | 0.005 | 6,435.77 | 6,435.34 | 6,452.64 | 6,452.54 | 6,437.65 | 6,437.12 | 6,438.35 | 6,437.90 | 6.70 | 0.05 | 86.6 | 29 | 0.013 |
| DP10_Type II MH 3 | DP10_Pipe 4 | 26.5 | 30 | 0.005 | 6,435.24 | 6,433.94 | 6,452.54 | 6,443.98 | 6,437.12 | 6,435.70 | 6,437.82 | 6,436.50 | 6.72 | 0.05 | 257.9 | 29.11 | 0.013 |
| DP10_Outlet Structure | DP10_Pipe 1 | 26.5 | 30 | 0.013 | 6,441.24 | 6,440.73 | 6,444.03 | 6,452.37 | 6,443.00 | 6,442.16 | 6,443.80 | 6,443.44 | 9.79 | 0 | 40.2 | 46.54 | 0.013 |
| DP4.1_Dbl Type 16 | DP_Pipe4.1 | 9.3 | 18 | 0.005 | 6,446.91 | 6,446.87 | 6,450.77 | 6,451.83 | 6,449.77 | 6,449.70 | 6,450.21 | 6,450.13 | 5.26 | 0.05 | 9 | 7.43 | 0.013 |
| DP4.1_2 Type II MH | DP4.1_Pipe 2 | 9.3 | 18 | 0.006 | 6,446.56 | 6,445.61 | 6,451.83 | 6,449.22 | 6,449.70 | 6,448.44 | 6,450.13 | 6,448.88 | 5.26 | 1.32 | 160.7 | 8.08 | 0.013 |
| DP4_Dbl Type 16 | DP4_Pipe | 3.4 | 18 | 0.01 | 6,447.33 | 6,447.01 | 6,450.95 | 6,450.77 | 6,449.81 | 6,449.77 | 6,449.87 | 6,449.83 | 1.92 | 0 | 31.5 | 10.5 | 0.013 |
| DP9_Triple Type 16 | DP9.1_Pipe | 24.7 | 30 | 0.014 | 6,444.26 | 6,444.01 | 6,449.11 | 6,446.80 | 6,448.17 | 6,448.10 | 6,448.56 | 6,448.49 | 5.03 | 0.05 | 18 | 47.87 | 0.013 |
| DP8_Dbl Type 16 | DP8.1_Pipe | 17.4 | 30 | 0.005 | 6,444.61 | 6,444.36 | 6,449.27 | 6,449.11 | 6,446.49 | 6,446.49 | 6,446.56 | 6,446.54 | 3.54 | 1.32 | 49.5 | 29 | 0.013 |
| DP10_Type II MH4 | DP10_Pipe 5 | 26.5 | 30 | 0.021 | 6,433.84 | 6,428.61 | 6,443.98 | 6,437.61 | 6,435.60 | 6,429.78 | 6,436.40 | 6,431.93 | 11.77 | 0.05 | 248.8 | 59.46 | 0.013 |
| DP17DblType 16 | DP17_Pipe | 2.3 | 18 | 0.01 | 6,437.63 | 6,437.31 | 6,441.89 | 6,441.71 | 6,438.20 | 6,438.10 | 6,438.41 | 6,438.19 | 4.76 | 0 | 31.5 | 10.5 | 0.013 |
| DP18_Dbl Type 16 | DP18.1_Pipe | 7.8 | 18 | 0.014 | 6,437.01 | 6,434.73 | 6,441.71 | 6,438.07 | 6,438.10 | 6,435.83 | 6,438.60 | 6,436.32 | 7.39 | 1.32 | 165 | 12.35 | 0.013 |
| DP19_Type 16 | Dp19_Pipe | 2.1 | 18 | 0.009 | 6,435.37 | 6,434.57 | 6,439.82 | 6,438.25 | 6,435.91 | 6,435.14 | 6,436.12 | 6,435.32 | 4.40 | 0 | 92.2 | 9.75 | 0.013 |
| DP22_Dbl Type 16 | DP22.1_Pipe | 3 | 18 | 0.01 | 6,435.05 | 6,434.84 | 6,438.42 | 6,439.33 | 6,435.80 | 6,435.85 | 6,435.98 | 6,435.94 | 5.13 | 0 | 20.3 | 10.5 | 0.013 |
| DP22.1_Type II MH | DP22.1_Pipe2 | 2.5 | 18 | 0.005 | 6,434.86 | 6,434.73 | 6,439.33 | 6,438.07 | 6,435.85 | 6,435.83 | 6,435.97 | 6,435.93 | 4.14 | 1.02 | 25.4 | 7.42 | 0.013 |
| DP21_Type C Inlet | DP22.1_Pipe | 0.9 | 18 | 0.005 | 6,435.70 | 6,434.96 | 6,438.01 | 6,439.33 | 6,436.05 | 6,435.85 | 6,436.17 | 6,435.86 | 2.84 | 0 | 146.8 | 7.43 | 0.013 |
| DP24_Triple Type 16 | DP24.1_Pipe | 21.12 | 30 | 0.005 | 6,433.57 | 6,433.41 | 6,438.25 | 6,438.48 | 6,435.14 | 6,434.97 | 6,435.80 | 6,435.64 | 6.51 | 1.02 | 30.7 | 29.34 | 0.013 |
| Dp24.1_Type II MH | DP24.1_Pipe 2 | 21.2 | 30 | 0.007 | 6,433.11 | 6,433.00 | 6,438.48 | 6,435.79 | 6,434.68 | 6,434.47 | 6,435.35 | 6,435.25 | 7.23 | 1.32 | 16.6 | 33.58 | 0.013 |
| DP23_Dbl Type 16 | DP23.1Pipe1 | 16.4 | 24 | 0.005 | 6,434.23 | 6,434.07 | 6,438.07 | 6,438.25 | 6,435.83 | 6,435.53 | 6,436.41 | 6,436.23 | 5.79 | 1.02 | 31.5 | 16 | 0.013 |
| DP25_Type II MH 1 | DP25_Pipe 2 | 22.7 | 30 | 0.005 | 6,430.25 | 6,430.56 | 6,436.82 | 6,438.04 | 6,432.22 | 6,431.87 | 6,432.89 | 6,432.58 | 6.55 | 0.64 | 61.8 | 29.04 | 0.013 |
| DP25_Outlet Structure | DP25_Pipe 1 | 22.7 | 30 | 0.005 | 6,430.77 | 6,430.84 | 6,438.04 | 6,433.63 | 6,432.53 | 6,432.39 | 6,433.17 | 6,433.10 | 6.30 | 0 | 15.3 | 27.74 | 0.013 |
| DP10_Type IIMH 5 | DP10_Pipe 6 | 26.5 | 30 | 0.006 | 6,428.51 | 6,427.88 | 6,437.61 | 6,434.67 | 6,430.27 | 6,429.63 | 6,431.08 | 6,430.44 | 7.21 | 0.05 | 106.4 | 31.61 | 0.013 |
| DP25_Type II MH 2 | DP25_Pipe 3 | 22.7 | 30 | 0.011 | 6,427.38 | 6,429.95 | 6,434.67 | 6,436.82 | 6,431.57 | 6,429.43 | 6,432.28 | 6,429.86 | 8.96 | 1.32 | 228.4 | 43.5 | 0.013 |
| DP10+25_Type II MH | DP10+25 Pipe | 49.2 | 36 | 0.005 | 6,426.88 | 6,426.20 | 6,434.67 | 6,429.54 | 6,429.43 | 6,428.49 | 6,430.35 | 6,429.62 | 7.57 | 1.52 | 136.1 | 47.16 | 0.013 |

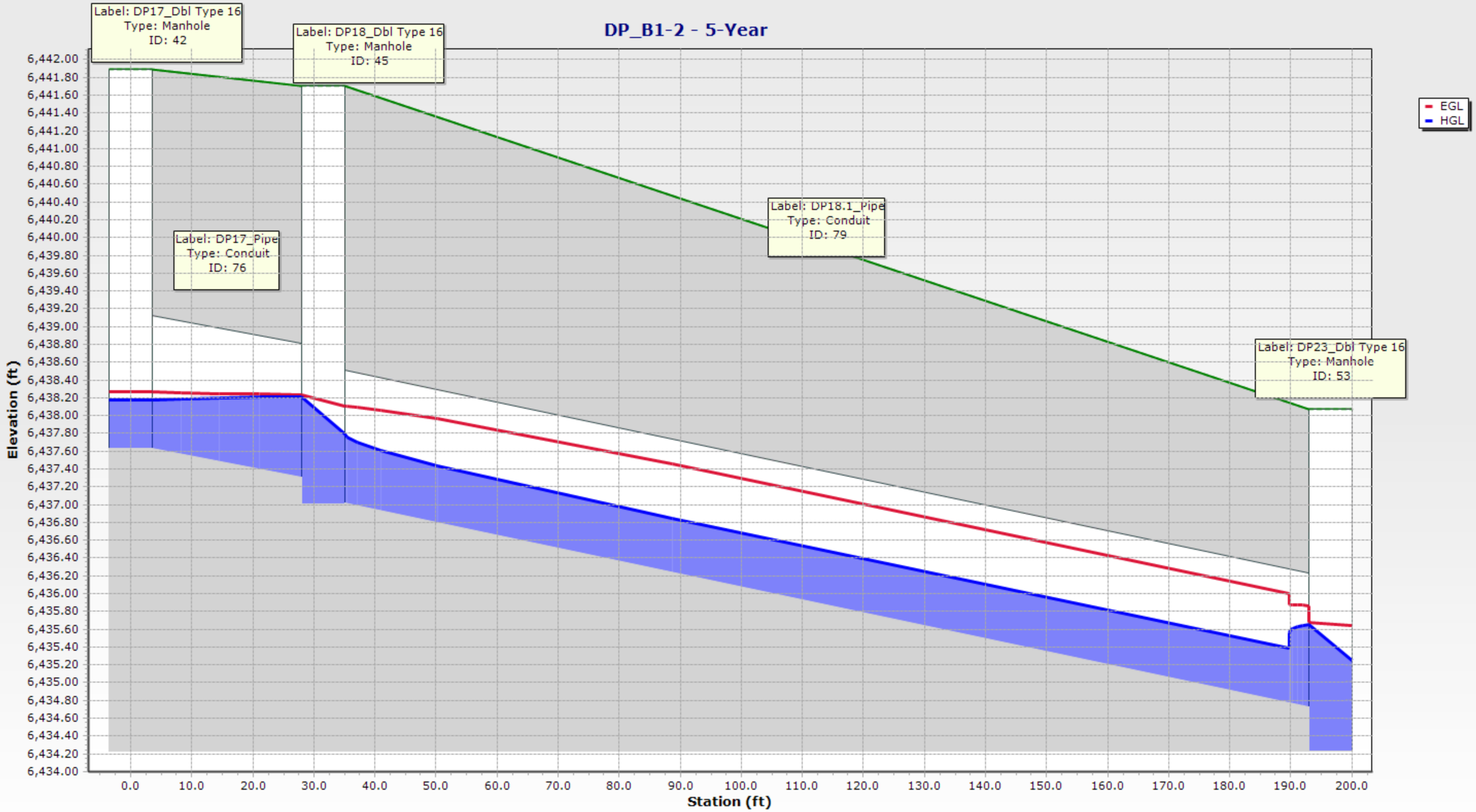

DP_A1 - 5-Year
Label: DP4.1_2 Type II MH
Type: Manhole
ID: 34
Label: DP4_Dbl Type 16
Type: Manhole
ID: 35
Label: DP4.1_Dbl Type 16
Type: Manhole
ID: 36
Label: DP 5 Dbl Type 16
Type: Manhole
ID: 114
Label: DP8_Triple Type 16
Type: Manhole
ID: 38
Label: DP9_Triple Type 16
Type: Manhole
ID: 37
Label: DP4_Pipe
Type: Conduit
ID: 72
Label: DP4.1_Pipe 2
Type: Conduit
ID: 115
Label: DP5.1_Pipe
Type: Conduit
ID: 116
Label: DP8.1_Pipe
Type: Conduit
ID: 74
Label: DP9.1_Pipe
Type: Conduit
ID: 73
Label: DP_Pipe_4.1
Type: Conduit
ID: 70
Label: O-2
Type: Outfall
ID: 102
EGL
HGL
Elevation (ft)
6,452.00
6,451.80
6,451.60
6,451.40
6,451.20
6,451.00
6,450.80
6,450.60
6,450.40
6,450.20
6,450.00
6,449.80
6,449.60
6,449.40
6,449.20
6,449.00
6,448.80
6,448.60
6,448.40
6,448.20
6,448.00
6,447.80
6,447.60
6,447.40
6,447.20
6,447.00
6,446.80
6,446.60
6,446.40
6,446.20
6,446.00
6,445.80
6,445.60
6,445.40
6,445.20
6,445.00
6,444.80
6,444.60
6,444.40
6,444.20
6,444.00
6,443.80
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
210.0
220.0
230.0
240.0
250.0
260.0
270.0
Station (ft)

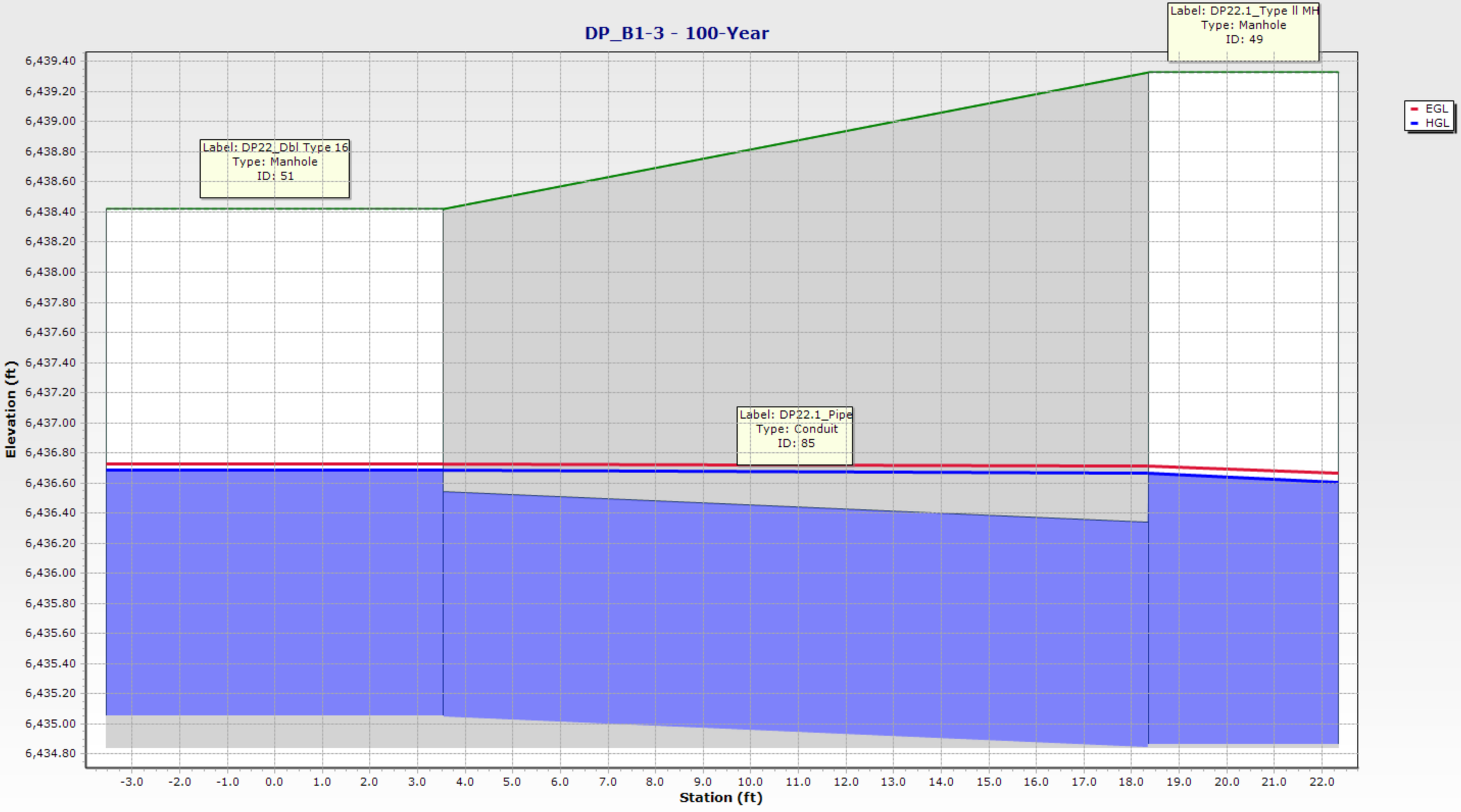

DP_A1-2 - 5-Year
Label: DP10_Type II MH 1
Type: Manhole
ID: 33
Label: DP10_Type II MH 2
Type: Manhole
ID: 31
Label: DP10_Type II MH 3
Type: Manhole
ID: 32
Label: DP10_Outlet Structure
Type: Manhole
ID: 40
Label: DP10_Type II MH 4
Type: Manhole
ID: 41
Label: DP10 _Pipe 5
Type: Conduit
ID: 75
Label: DP10_Type II MH 5
Type: Manhole
ID: 58
Label: DP10+25_Type II MH
Type: Manhole
ID: 61
Label: DP10_Pipe4
Type: Conduit
ID: 68
Label: DP10_Pipe1
Type: Conduit
ID: 69
Label: DP10_Pipe 2
Type: Conduit
ID: 66
Label: DP10_Pipe 3
Type: Conduit
ID: 67
Label: DP10_Pipe 6
Type: Conduit
ID: 93
Label: DP10+25 Pipe
Type: Conduit
ID: 95
Label: Outfall CBC
Type: Outfall
ID: 98
EGL
HGL
Elevation (ft)
6,453.00
6,452.00
6,451.00
6,450.00
6,449.00
6,448.00
6,447.00
6,446.00
6,445.00
6,444.00
6,443.00
6,442.00
6,441.00
6,440.00
6,439.00
6,438.00
6,437.00
6,436.00
6,435.00
6,434.00
6,433.00
6,432.00
6,431.00
6,430.00
6,429.00
6,428.00
6,427.00
6,426.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
800.0
850.0
900.0
950.0
1,000.0
1,050.0
Station (ft)

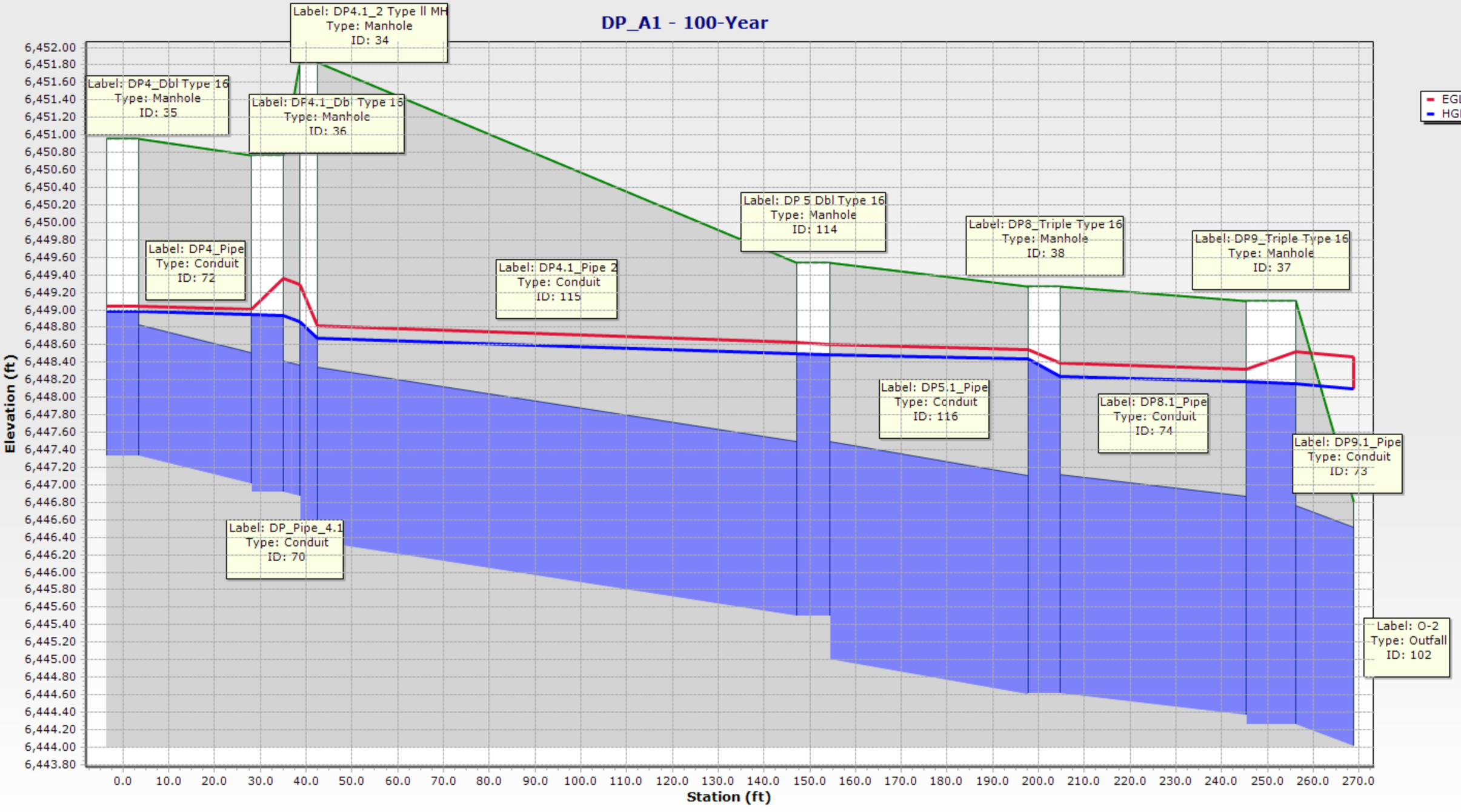

DP_B1-3 - 100-Year
Label: DP22.1_Type II MH
Type: Manhole
ID: 49
Label: DP22_Dbl Type 16
Type: Manhole
ID: 51
Label: DP22.1_Pipe
Type: Conduit
ID: 85
EGL
HGL
Elevation (ft)
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
21.0
22.0
Station (ft)

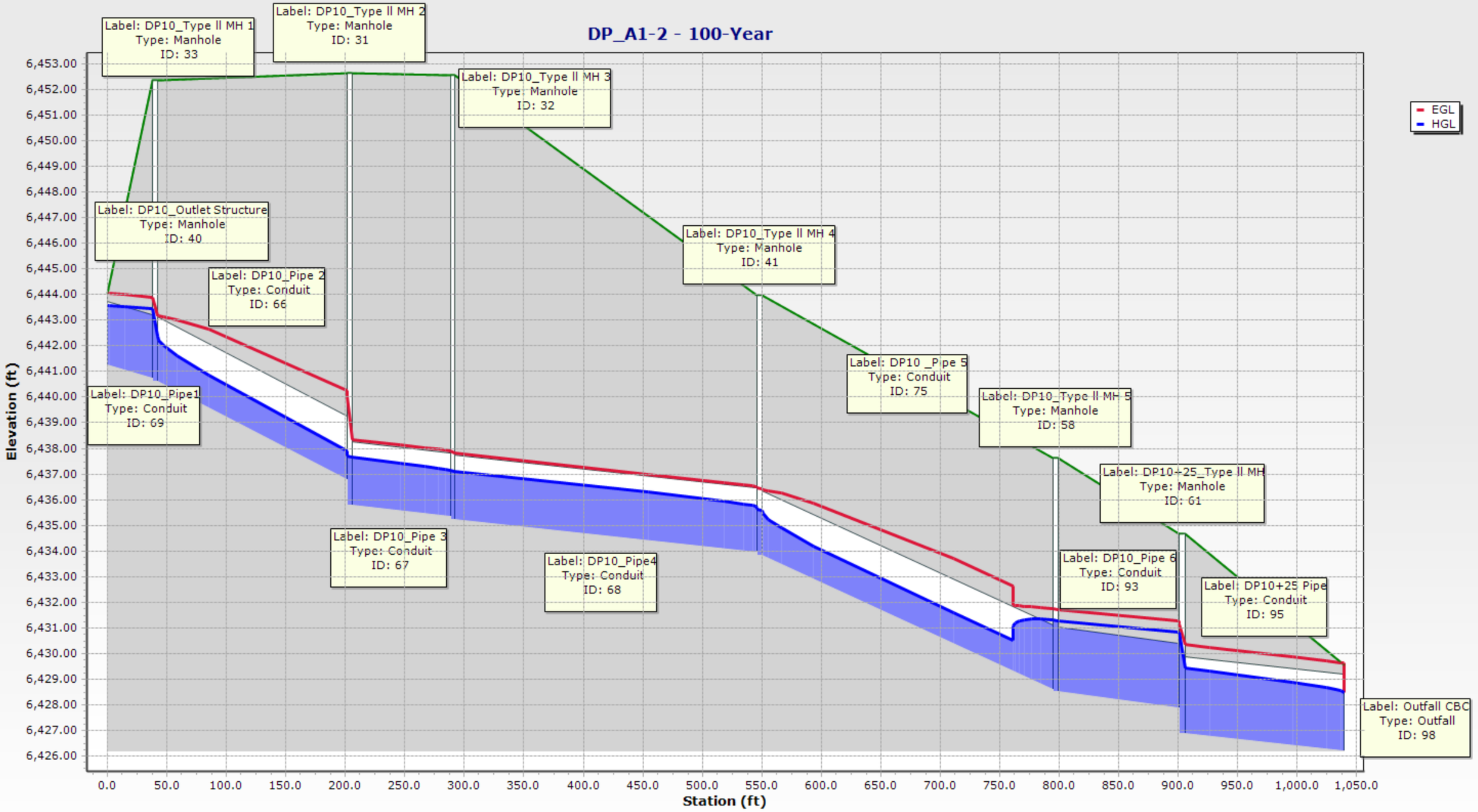

DP_B1.1 - 5-Year
Label: DP25_Type II MH 1
Type: Manhole
ID: 54
Label: DP25_Type II MH 2
Type: Manhole
ID: 59
Label: DP10+25_Type II MH
Type: Manhole
ID: 61
Label: DP25_Outlet Structure
Type: Manhole
ID: 62
Label: DP25_Pipe 1
Type: Conduit
ID: 92
Label: DP25_Pipe 3
Type: Conduit
ID: 94
Label: DP10+25 Pipe
Type: Conduit
ID: 95
Label: DP25_Pipe 2
Type: Conduit
ID: 91
Label: Outfall CBC
Type: Outfall
ID: 98
EGL
HGL
Elevation (ft)
6,438.00
6,437.50
6,437.00
6,436.50
6,436.00
6,435.50
6,435.00
6,434.50
6,434.00
6,433.50
6,433.00
6,432.50
6,432.00
6,431.50
6,431.00
6,430.50
6,430.00
6,429.50
6,429.00
6,428.50
6,428.00
6,427.50
6,427.00
6,426.50
6,426.00
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
280.0
300.0
320.0
340.0
360.0
380.0
400.0
420.0
440.0
Station (ft)

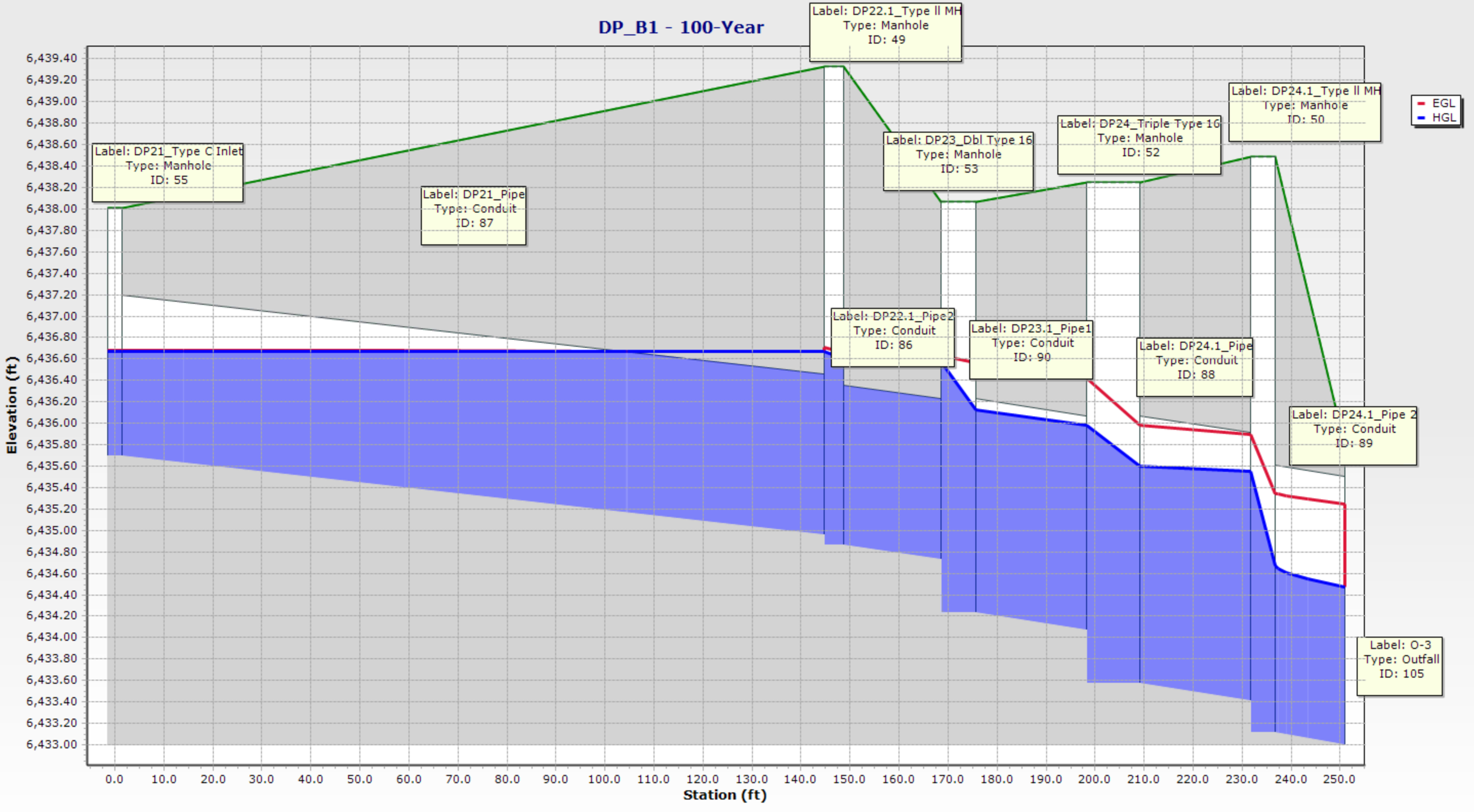

DP_B1-1 - 5-Year
Label: DP19_Type 16
Type: Manhole
ID: 48
Label: DP24_Triple Type 16
Type: Manhole
ID: 52
Label: Dp19_Pipe
Type: Conduit
ID: 84
EGL
HGL
Elevation (ft)
6,440.00
6,439.80
6,439.60
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
6,434.60
6,434.40
6,434.20
6,434.00
6,433.80
6,433.60
6,433.40
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
Station (ft)

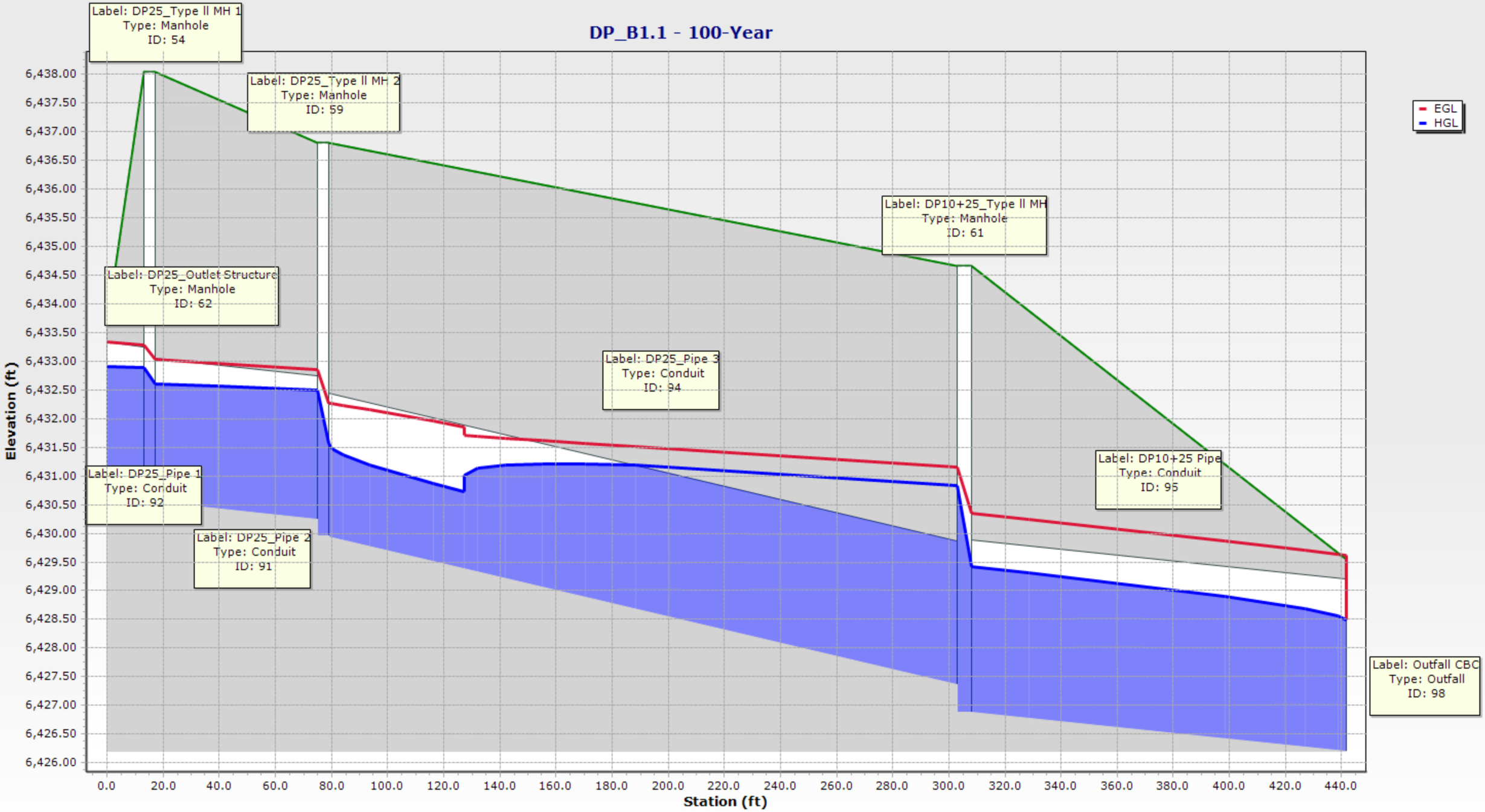

DP_B1-2 - 5-Year
Label: DP17_Dbl Type 16
Type: Manhole
ID: 42
Label: DP18_Dbl Type 16
Type: Manhole
ID: 45
Label: DP17_Pipe
Type: Conduit
ID: 76
Label: DP18.1_Pipe
Type: Conduit
ID: 79
Label: DP23_Dbl Type 16
Type: Manhole
ID: 53
EGL
HGL
Elevation (ft)
6,442.00
6,441.80
6,441.60
6,441.40
6,441.20
6,441.00
6,440.80
6,440.60
6,440.40
6,440.20
6,440.00
6,439.80
6,439.60
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
6,434.60
6,434.40
6,434.20
6,434.00
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
Station (ft)

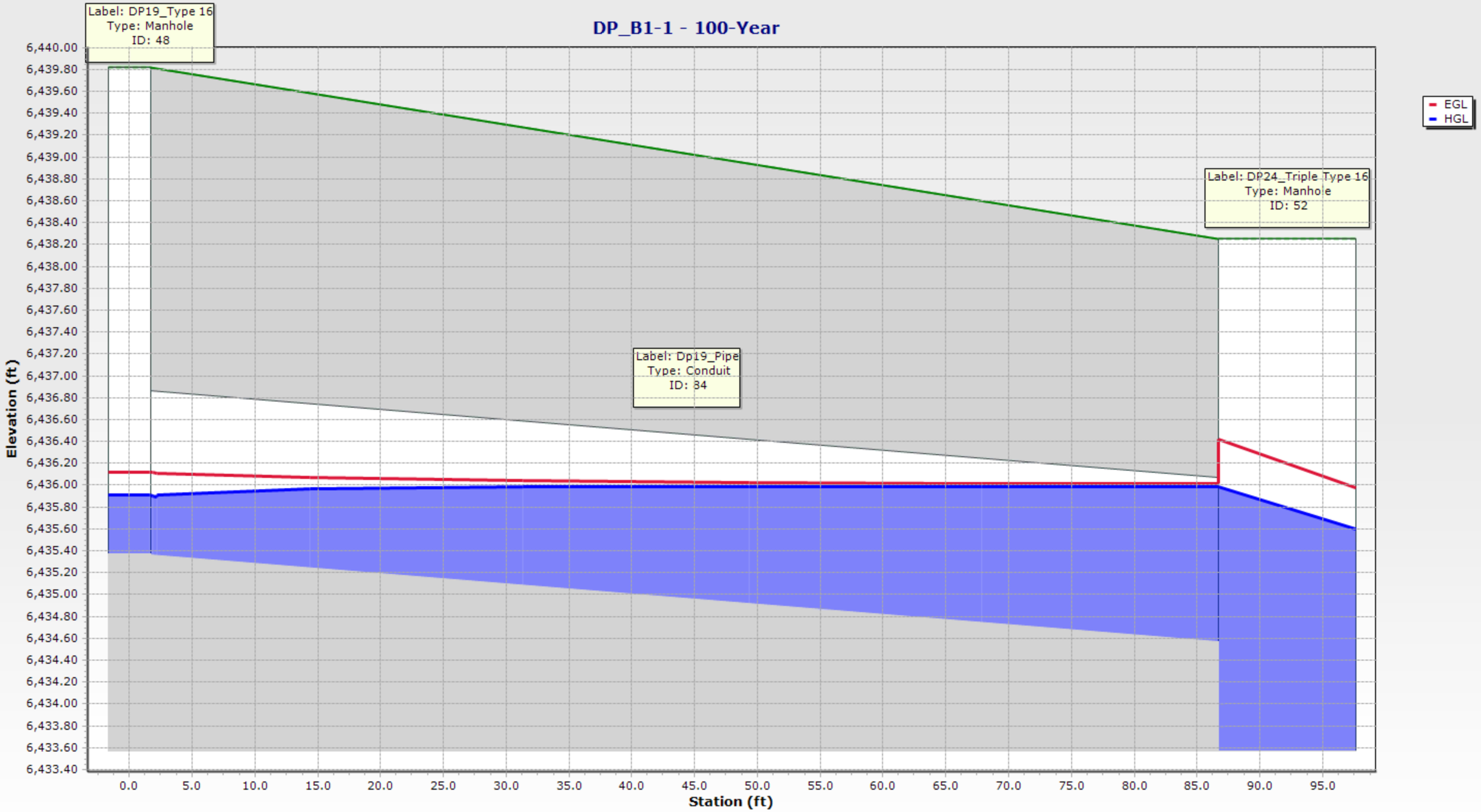

DP_B1-3 - 100-Year
Label: DP22.1_Type II MH
Type: Manhole
ID: 49
Label: DP22_Dbl Type 16
Type: Manhole
ID: 51
Label: DP22.1_Pipe
Type: Conduit
ID: 85
EGL
HGL
Elevation (ft)
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
21.0
22.0
Station (ft)

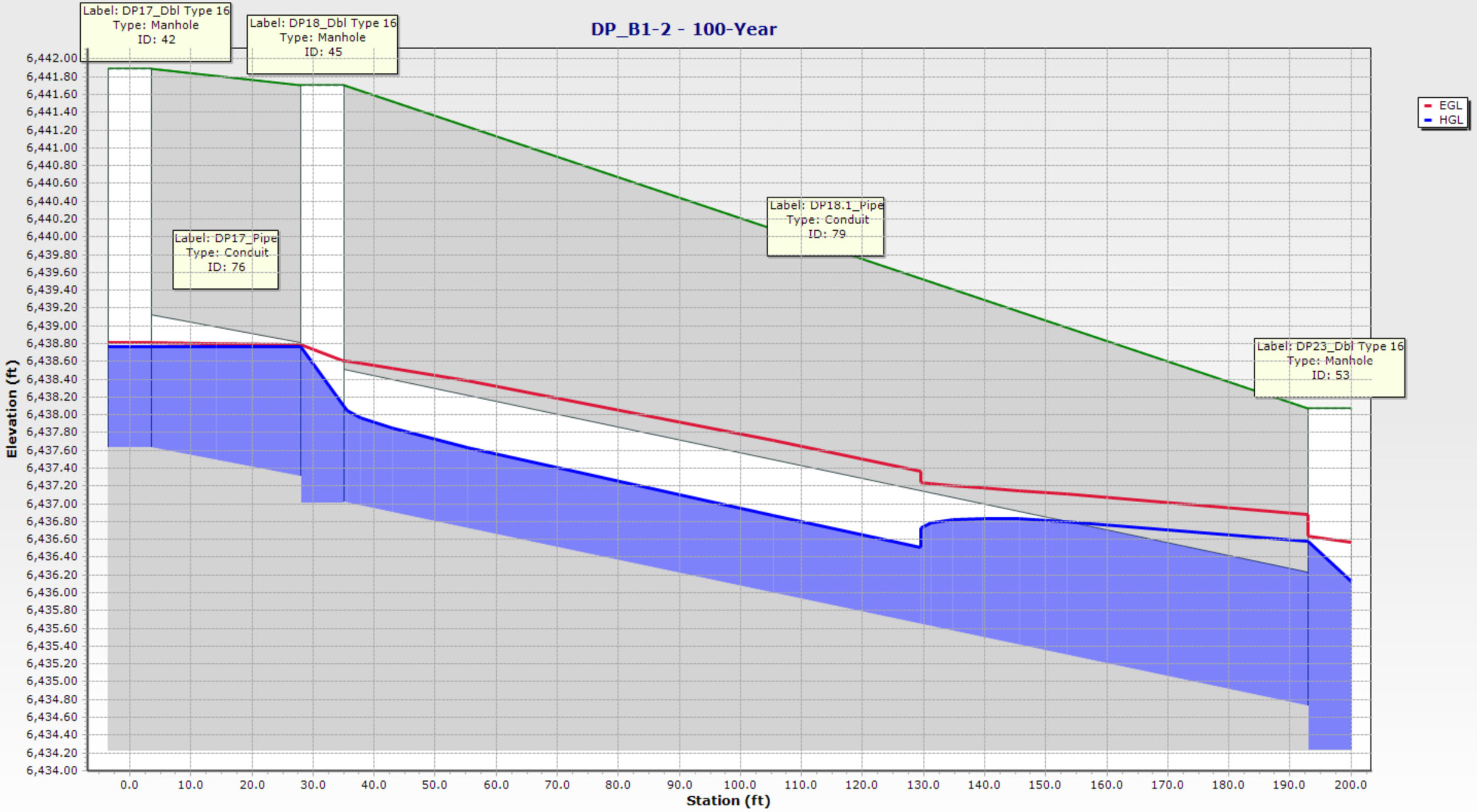

DP_A1 - 100-Year
Label: DP4.1_2 Type II MH
Type: Manhole
ID: 34
Label: DP4_Dbl Type 16
Type: Manhole
ID: 35
Label: DP4.1_Db Type 16
Type: Manhole
ID: 36
Label: DP 5 Dbl Type 16
Type: Manhole
ID: 114
Label: DP8_Triple Type 16
Type: Manhole
ID: 38
Label: DP9_Triple Type 16
Type: Manhole
ID: 37
Label: DP4_Pipe
Type: Conduit
ID: 72
Label: DP4.1_Pipe 2
Type: Conduit
ID: 115
Label: DP5.1_Pipe
Type: Conduit
ID: 116
Label: DP8.1_Pipe
Type: Conduit
ID: 74
Label: DP9.1_Pipe
Type: Conduit
ID: 73
Label: DP_Pipe_4.1
Type: Conduit
ID: 70
Label: O-2
Type: Outfall
ID: 102
EGL
HGL
Elevation (ft)
6,452.00
6,451.80
6,451.60
6,451.40
6,451.20
6,451.00
6,450.80
6,450.60
6,450.40
6,450.20
6,450.00
6,449.80
6,449.60
6,449.40
6,449.20
6,449.00
6,448.80
6,448.60
6,448.40
6,448.20
6,448.00
6,447.80
6,447.60
6,447.40
6,447.20
6,447.00
6,446.80
6,446.60
6,446.40
6,446.20
6,446.00
6,445.80
6,445.60
6,445.40
6,445.20
6,445.00
6,444.80
6,444.60
6,444.40
6,444.20
6,444.00
6,443.80
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
210.0
220.0
230.0
240.0
250.0
260.0
270.0
Station (ft)

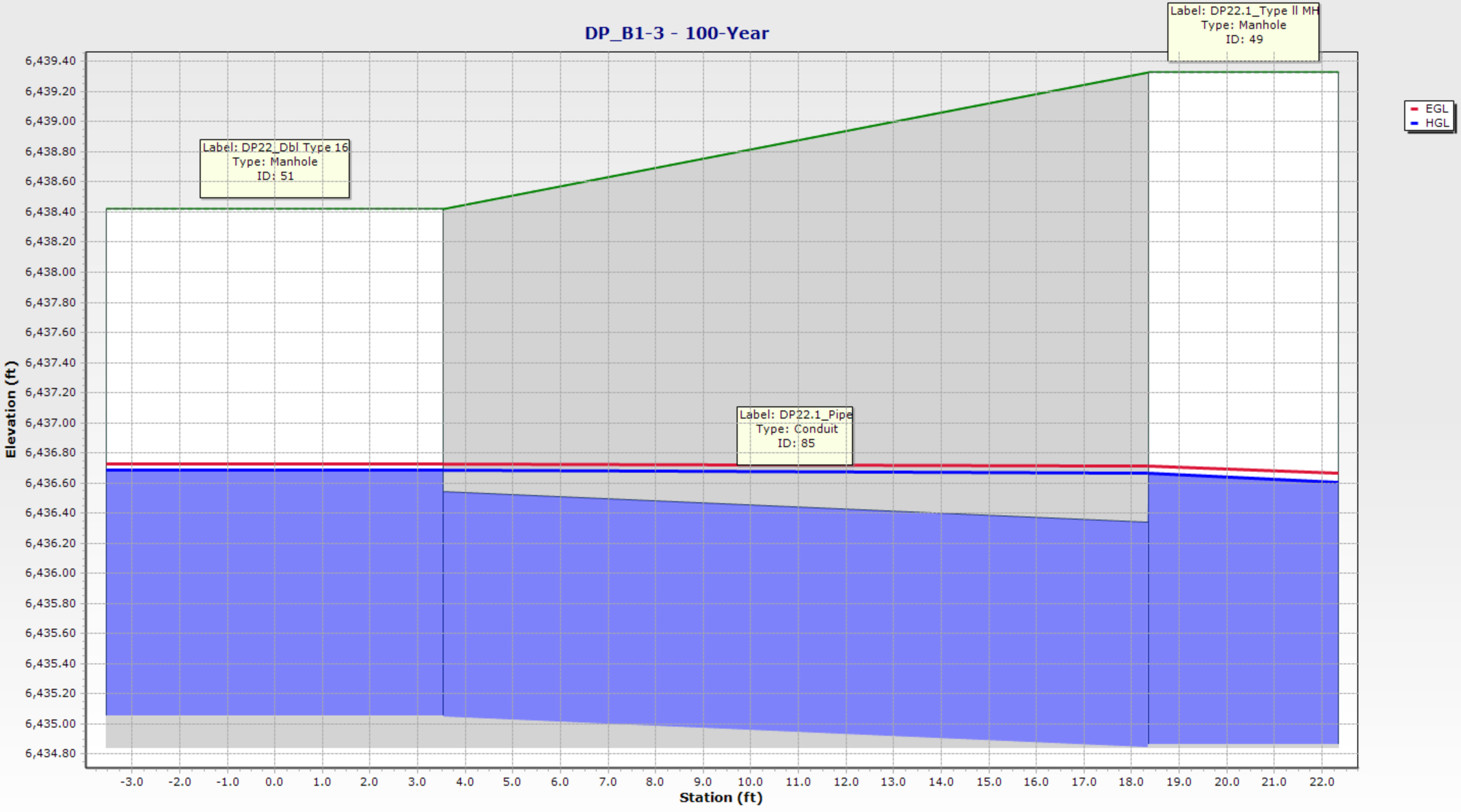

DP_A1-2 - 100-Year
Label: DP10_Type II MH 1
Type: Manhole
ID: 33
Label: DP10_Type II MH 2
Type: Manhole
ID: 31
Label: DP10_Type II MH 3
Type: Manhole
ID: 32
Label: DP10_Outlet Structure
Type: Manhole
ID: 40
Label: DP10_Type II MH 4
Type: Manhole
ID: 41
Label: DP10_Pipe 2
Type: Conduit
ID: 66
Label: DP10 _Pipe 5
Type: Conduit
ID: 75
Label: DP10_Type II MH 5
Type: Manhole
ID: 58
Label: DP10_Pipe1
Type: Conduit
ID: 69
Label: DP10+25_Type II MH
Type: Manhole
ID: 61
Label: DP10_Pipe 3
Type: Conduit
ID: 67
Label: DP10_Pipe4
Type: Conduit
ID: 68
Label: DP10_Pipe 6
Type: Conduit
ID: 93
Label: DP10+25 Pipe
Type: Conduit
ID: 95
Label: Outfall CBC
Type: Outfall
ID: 98
EGL
HGL
Elevation (ft)
6,453.00
6,452.00
6,451.00
6,450.00
6,449.00
6,448.00
6,447.00
6,446.00
6,445.00
6,444.00
6,443.00
6,442.00
6,441.00
6,440.00
6,439.00
6,438.00
6,437.00
6,436.00
6,435.00
6,434.00
6,433.00
6,432.00
6,431.00
6,430.00
6,429.00
6,428.00
6,427.00
6,426.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
800.0
850.0
900.0
950.0
1,000.0
1,050.0
Station (ft)


DP_B1 - 100-Year
Label: DP22.1_Type II MH
Type: Manhole
ID: 49
Label: DP24.1_Type II MH
Type: Manhole
ID: 50
Label: DP23_Dbl Type 16
Type: Manhole
ID: 53
Label: DP24_Triple Type 16
Type: Manhole
ID: 52
Label: DP21_Type C Inlet
Type: Manhole
ID: 55
Label: DP21_Pipe
Type: Conduit
ID: 87
Label: DP22.1_Pipe2
Type: Conduit
ID: 86
Label: DP23.1_Pipe1
Type: Conduit
ID: 90
Label: DP24.1_Pipe
Type: Conduit
ID: 88
Label: DP24.1_Pipe 2
Type: Conduit
ID: 89
Label: O-3
Type: Outfall
ID: 105
EGL
HGL
Elevation (ft)
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
6,434.60
6,434.40
6,434.20
6,434.00
6,433.80
6,433.60
6,433.40
6,433.20
6,433.00
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
210.0
220.0
230.0
240.0
250.0
Station (ft)


DP_B1.1 - 100-Year
Label: DP25_Type II MH 1
Type: Manhole
ID: 54
Label: DP25_Type II MH 2
Type: Manhole
ID: 59
Label: DP10+25_Type II MH
Type: Manhole
ID: 61
Label: DP25_Outlet Structure
Type: Manhole
ID: 62
Label: DP25_Pipe 3
Type: Conduit
ID: 94
Label: DP25_Pipe 1
Type: Conduit
ID: 92
Label: DP25_Pipe 2
Type: Conduit
ID: 91
Label: DP10+25 Pipe
Type: Conduit
ID: 95
Label: Outfall CBC
Type: Outfall
ID: 98
EGL
HGL
Elevation (ft)
6,438.00
6,437.50
6,437.00
6,436.50
6,436.00
6,435.50
6,435.00
6,434.50
6,434.00
6,433.50
6,433.00
6,432.50
6,432.00
6,431.50
6,431.00
6,430.50
6,430.00
6,429.50
6,429.00
6,428.50
6,428.00
6,427.50
6,427.00
6,426.50
6,426.00
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
280.0
300.0
320.0
340.0
360.0
380.0
400.0
420.0
440.0
Station (ft)


DP_B1-1 - 100-Year
Label: DP19_Type 16
Type: Manhole
ID: 48
Label: DP24_Triple Type 16
Type: Manhole
ID: 52
Label: Dp19_Pipe
Type: Conduit
ID: 84
EGL
HGL
Elevation (ft)
Station (ft)
6,440.00
6,439.80
6,439.60
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
6,434.60
6,434.40
6,434.20
6,434.00
6,433.80
6,433.60
6,433.40
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0


DP_B1-2 - 100-Year
Label: DP17_Dbl Type 16
Type: Manhole
ID: 42
Label: DP18_Dbl Type 16
Type: Manhole
ID: 45
Label: DP17_Pipe
Type: Conduit
ID: 76
Label: DP18.1_Pipe
Type: Conduit
ID: 79
Label: DP23_Dbl Type 16
Type: Manhole
ID: 53
EGL
HGL
Elevation (ft)
6,442.00
6,441.80
6,441.60
6,441.40
6,441.20
6,441.00
6,440.80
6,440.60
6,440.40
6,440.20
6,440.00
6,439.80
6,439.60
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
6,434.60
6,434.40
6,434.20
6,434.00
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
Station (ft)


DP_B1-3 - 100-Year
Label: DP22.1_Type II MH
Type: Manhole
ID: 49
Label: DP22_Dbl Type 16
Type: Manhole
ID: 51
Label: DP22.1_Pipe
Type: Conduit
ID: 85
EGL
HGL
Elevation (ft)
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
21.0
22.0
Station (ft)

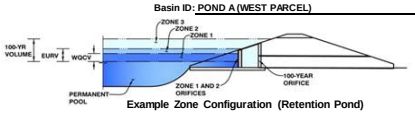
# Appendix D
# Water Quality & Detention

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** PALMER VILLAGE

**Basin ID:** POND A (WEST PARCEL)




**Example Zone Configuration (Retention Pond)**

## Required Volume Calculation

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 5.91 | acres |
| Watershed Length = | 700 | ft |
| Watershed Slope = | 0.012 | ft/ft |
| Watershed Imperviousness = | 50.20% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |
| Water Quality Capture Volume (WQCV) = | 0.102 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.342 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.234 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.307 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.378 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.471 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 0.587 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 0.725 | acre-feet |
| 500-yr Runoff Volume (P1 = 3 in.) = | 0.995 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.220 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.290 | acre-feet |
| Approximate 10-yr Detention Volume = | 0.354 | acre-feet |
| Approximate 25-yr Detention Volume = | 0.433 | acre-feet |
| Approximate 50-yr Detention Volume = | 0.483 | acre-feet |
| Approximate 100-yr Detention Volume = | 0.544 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| 3.00 | inches |

## Stage-Storage Calculation

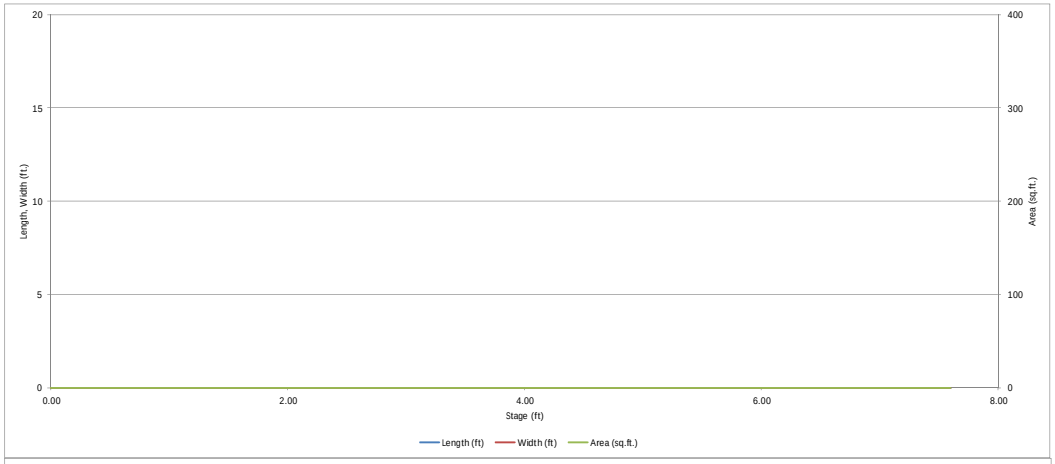
| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.102 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.241 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.201 | acre-feet |
| Total Detention Basin Volume = | 0.544 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial 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 |

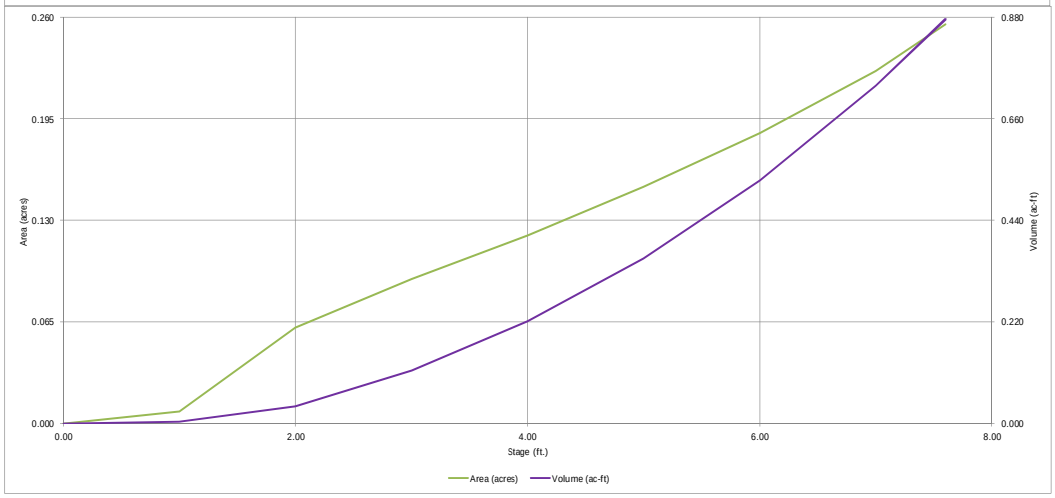
Depth Increment = 0.1 ft

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 6442 **Top of Micropool** | -- | 0.00 | -- | -- | -- | 0 | 0.000 | | |
| **6443** | -- | 1.00 | -- | -- | -- | 339 | 0.008 | 166 | 0.004 |
| **6444** | -- | 2.00 | -- | -- | -- | 2,668 | 0.061 | 1,646 | 0.038 |
| **6445** | -- | 3.00 | -- | -- | -- | 4,030 | 0.093 | 5,022 | 0.115 |
| **6446** | -- | 4.00 | -- | -- | -- | 5,239 | 0.120 | 9,656 | 0.222 |
| **6447** | -- | 5.00 | -- | -- | -- | 6,588 | 0.151 | 15,570 | 0.357 |
| **6448** | -- | 6.00 | -- | -- | -- | 8,089 | 0.186 | 22,908 | 0.526 |
| **6449** | -- | 7.00 | -- | -- | -- | 9,817 | 0.225 | 31,861 | 0.731 |
| **6449.6** | -- | 7.60 | -- | -- | -- | 11,129 | 0.255 | 38,145 | 0.876 |

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**



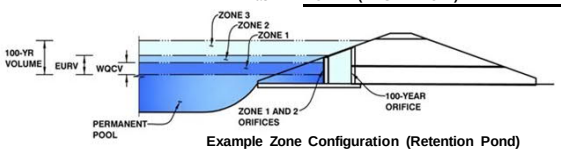



# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

**Project:** PALMER VILLAGE

**Basin ID:** POND A (WEST PARCEL)




**Example Zone Configuration (Retention Pond)**

| | Stage (ft) | Zone Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 2.86 | 0.102 | Orifice Plate |
| Zone 2 (EURV) | 4.90 | 0.241 | Orifice Plate |
| Zone 3 (100-year) | 6.10 | 0.201 | Weir&Pipe (Restrict) |
| | | 0.544 | Total |

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

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

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

| | | | Calculated Parameters for Plate | | |
|---|---|---|---|---|---|
| Invert of Lowest Orifice = | 0.00 | ft (relative to basin bottom at Stage = 0 ft) | WQ Orifice Area per Row = | N/A | $ft^2$ |
| Depth at top of Zone using Orifice Plate = | 4.88 | ft (relative to basin bottom at Stage = 0 ft) | Elliptical Half-Width = | N/A | feet |
| Orifice Plate: Orifice Vertical Spacing = | N/A | inches | Elliptical Slot Centroid = | N/A | feet |
| Orifice Plate: Orifice Area per Row = | N/A | inches | Elliptical Slot Area = | N/A | $ft^2$ |

**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 | 1.25 | 2.50 | | | | | |
| Orifice Area (sq. inches) | 0.39 | 0.39 | 0.39 | | | | | |

| | 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 | | Calculated Parameters for Vertical Orifice | Not Selected | Not Selected | |
|---|---|---|---|---|---|---|---|
| Invert of Vertical Orifice = | 3.60 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Area = | 0.03 | N/A | $ft^2$ |
| Depth at top of Zone using Vertical Orifice = | 4.90 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Centroid = | 0.08 | N/A | feet |
| Vertical Orifice Diameter or Height = | 2.00 | N/A | inches | | | | |
| Vertical Orifice Width = | 2.00 | | inches | | | | |

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

| | Zone 3 Weir | Not Selected | | Calculated Parameters for Overflow Weir | Zone 3 Weir | Not Selected | |
|---|---|---|---|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 6.00 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Height of Grate Upper Edge, $H_t$ = | 6.00 | N/A | feet |
| Overflow Weir Front Edge Length = | 3.00 | N/A | feet | Over Flow Weir Slope Length = | 3.00 | N/A | feet |
| Overflow Weir Slope = | 0.00 | N/A | H:V (enter zero for flat grate) | Grate Open Area / 100-yr Orifice Area = | 32.54 | N/A | should be $\geq 4$ |
| Horiz. Length of Weir Sides = | 3.00 | N/A | feet | Overflow Grate Open Area w/o Debris = | 6.30 | N/A | $ft^2$ |
| Overflow Grate Open Area % = | 70% | N/A | %, grate open area/total area | Overflow Grate Open Area w/ Debris = | 3.15 | N/A | $ft^2$ |
| Debris Clogging % = | 50% | N/A | % | | | | |

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

| | Zone 3 Restrictor | Not Selected | | Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|---|---|---|---|
| Depth to Invert of Outlet Pipe = | 0.67 | N/A | ft (distance below basin bottom at Stage = 0 ft) | Outlet Orifice Area = | 0.19 | N/A | $ft^2$ |
| Outlet Pipe Diameter = | 18.00 | N/A | inches | Outlet Orifice Centroid = | 0.15 | N/A | feet |
| Restrictor Plate Height Above Pipe Invert = | 3.00 | | inches | Half-Central Angle of Restrictor Plate on Pipe = | 0.84 | N/A | radians |

User Input: Emergency Spillway (Rectangular or Trapezoidal)

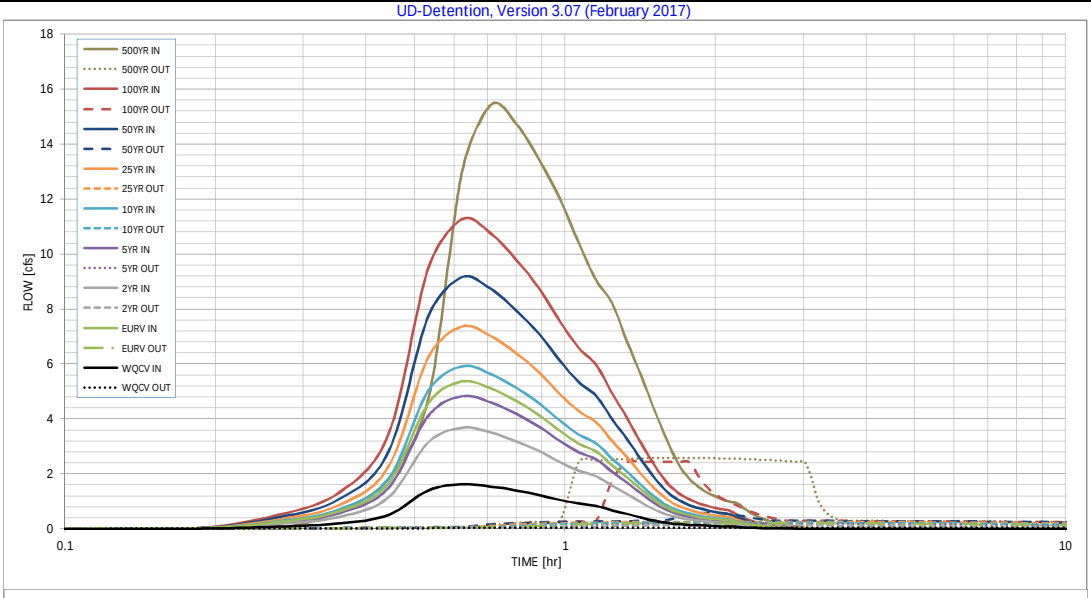
| | | | Calculated Parameters for Spillway | | |
|---|---|---|---|---|---|
| Spillway Invert Stage= | | ft (relative to basin bottom at Stage = 0 ft) | Spillway Design Flow Depth= | | feet |
| Spillway Crest Length = | | feet | Stage at Top of Freeboard = | | feet |
| Spillway End Slopes = | | H:V | Basin Area at Top of Freeboard = | | acres |
| Freeboard above Max Water Surface = | | feet | | | |

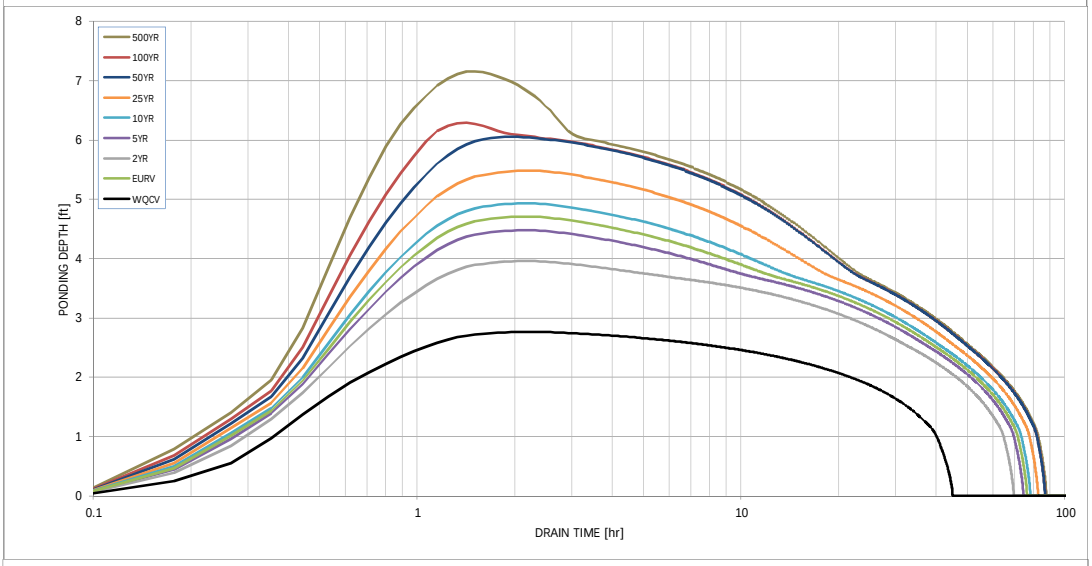
Routed Hydrograph Results

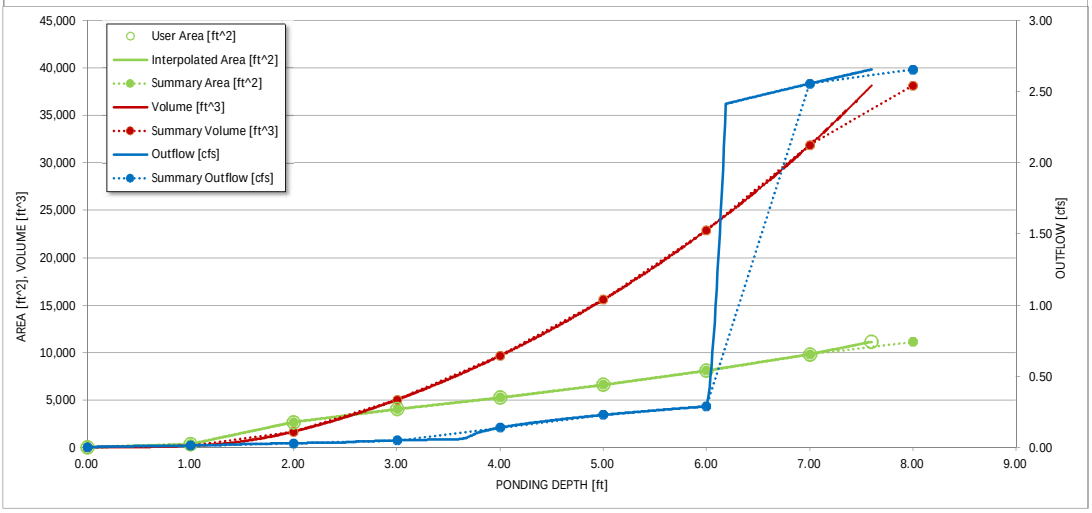
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | 0.53 | 1.07 | 1.19 | 1.50 | 1.75 | 2.00 | 2.25 | 2.52 | 3.00 |
| Calculated Runoff Volume (acre-ft) = | 0.102 | 0.342 | 0.234 | 0.307 | 0.378 | 0.471 | 0.587 | 0.725 | 0.995 |
| OPTIONAL Override Runoff Volume (acre-ft) = | | | | | | | | | |
| Inflow Hydrograph Volume (acre-ft) = | 0.101 | 0.342 | 0.233 | 0.307 | 0.377 | 0.471 | 0.587 | 0.724 | 0.995 |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.18 | 0.44 | 0.96 |
| Predevelopment Peak Q (cfs) = | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 1.1 | 2.6 | 5.7 |
| Peak Inflow Q (cfs) = | 1.6 | 5.4 | 3.7 | 4.8 | 5.9 | 7.4 | 9.2 | 11.3 | 15.4 |
| Peak Outflow Q (cfs) = | 0.0 | 0.2 | 0.1 | 0.2 | 0.2 | 0.3 | 0.6 | 2.4 | 2.6 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 6.8 | 3.5 | 1.8 | 0.5 | 0.9 | 0.5 |
| Structure Controlling Flow = | Plate | Vertical Orifice 1 | Vertical Orifice 1 | Vertical Orifice 1 | Vertical Orifice 1 | Vertical Orifice 1 | Overflow Grate 1 | Outlet Plate 1 | Outlet Plate 1 |
| Max Velocity through Grate 1 (fps) = | N/A | N/A | N/A | N/A | N/A | N/A | 0.0 | 0.3 | 0.4 |
| 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) = | 41 | 67 | 62 | 65 | 68 | 71 | 73 | 71 | 68 |
| Time to Drain 99% of Inflow Volume (hours) = | 43 | 72 | 66 | 70 | 74 | 77 | 80 | 79 | 78 |
| Maximum Ponding Depth (ft) = | 2.77 | 4.71 | 3.96 | 4.48 | 4.93 | 5.49 | 6.05 | 6.29 | 7.16 |
| Area at Maximum Ponding Depth (acres) = | 0.09 | 0.14 | 0.12 | 0.14 | 0.15 | 0.17 | 0.19 | 0.20 | 0.23 |
| Maximum Volume Stored (acre-ft) = | 0.094 | 0.313 | 0.217 | 0.283 | 0.347 | 0.434 | 0.535 | 0.581 | 0.766 |

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)




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

# Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs UD-Detention, Version 3.07 (February 2017)

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

| Time Interval | SOURCE | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK |
|---|---|---|---|---|---|---|---|---|---|---|
| | 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] |
| 5.33 min | 0:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:05:20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrograph | 0:10:40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Constant | 0:15:59 | 0.07 | 0.24 | 0.17 | 0.22 | 0.27 | 0.33 | 0.41 | 0.50 | 0.68 |
| 0.938 | 0:21:19 | 0.20 | 0.64 | 0.44 | 0.58 | 0.71 | 0.88 | 1.09 | 1.34 | 1.83 |
| | 0:26:39 | 0.51 | 1.66 | 1.14 | 1.49 | 1.82 | 2.27 | 2.81 | 3.45 | 4.70 |
| | 0:31:59 | 1.40 | 4.55 | 3.14 | 4.10 | 5.02 | 6.23 | 7.72 | 9.47 | 12.91 |
| | 0:37:19 | 1.62 | 5.36 | 3.68 | 4.82 | 5.91 | 7.36 | 9.15 | 11.26 | 15.42 |
| | 0:42:38 | 1.54 | 5.11 | 3.50 | 4.59 | 5.63 | 7.02 | 8.73 | 10.75 | 14.74 |
| | 0:47:58 | 1.40 | 4.65 | 3.18 | 4.18 | 5.13 | 6.39 | 7.95 | 9.79 | 13.42 |
| | 0:53:18 | 1.23 | 4.14 | 2.83 | 3.72 | 4.57 | 5.70 | 7.10 | 8.74 | 12.01 |
| | 0:58:38 | 1.05 | 3.56 | 2.42 | 3.19 | 3.93 | 4.91 | 6.12 | 7.56 | 10.39 |
| | 1:03:58 | 0.92 | 3.10 | 2.12 | 2.79 | 3.43 | 4.28 | 5.34 | 6.58 | 9.05 |
| | 1:09:17 | 0.83 | 2.81 | 1.91 | 2.52 | 3.10 | 3.88 | 4.83 | 5.96 | 8.20 |
| | 1:14:37 | 0.67 | 2.30 | 1.56 | 2.07 | 2.55 | 3.19 | 3.99 | 4.93 | 6.79 |
| | 1:19:57 | 0.54 | 1.87 | 1.26 | 1.68 | 2.07 | 2.60 | 3.25 | 4.03 | 5.57 |
| | 1:25:17 | 0.40 | 1.43 | 0.96 | 1.28 | 1.58 | 1.99 | 2.50 | 3.11 | 4.32 |
| | 1:30:37 | 0.29 | 1.05 | 0.70 | 0.94 | 1.17 | 1.47 | 1.86 | 2.32 | 3.24 |
| | 1:35:56 | 0.21 | 0.77 | 0.51 | 0.68 | 0.85 | 1.07 | 1.35 | 1.68 | 2.35 |
| | 1:41:16 | 0.17 | 0.60 | 0.40 | 0.53 | 0.66 | 0.83 | 1.05 | 1.30 | 1.81 |
| | 1:46:36 | 0.14 | 0.49 | 0.33 | 0.44 | 0.55 | 0.69 | 0.86 | 1.07 | 1.48 |
| | 1:51:56 | 0.12 | 0.42 | 0.28 | 0.38 | 0.46 | 0.58 | 0.73 | 0.91 | 1.26 |
| | 1:57:16 | 0.11 | 0.37 | 0.25 | 0.33 | 0.41 | 0.51 | 0.64 | 0.79 | 1.10 |
| | 2:02:35 | 0.10 | 0.33 | 0.22 | 0.30 | 0.37 | 0.46 | 0.58 | 0.72 | 0.99 |
| | 2:07:55 | 0.09 | 0.31 | 0.21 | 0.28 | 0.34 | 0.43 | 0.53 | 0.66 | 0.91 |
| | 2:13:15 | 0.07 | 0.23 | 0.15 | 0.20 | 0.25 | 0.31 | 0.39 | 0.48 | 0.67 |
| | 2:18:35 | 0.05 | 0.17 | 0.11 | 0.15 | 0.18 | 0.23 | 0.29 | 0.35 | 0.49 |
| | 2:23:55 | 0.03 | 0.12 | 0.08 | 0.11 | 0.13 | 0.17 | 0.21 | 0.26 | 0.36 |
| | 2:29:14 | 0.03 | 0.09 | 0.06 | 0.08 | 0.10 | 0.12 | 0.15 | 0.19 | 0.27 |
| | 2:34:34 | 0.02 | 0.06 | 0.04 | 0.06 | 0.07 | 0.09 | 0.11 | 0.14 | 0.19 |
| | 2:39:54 | 0.01 | 0.04 | 0.03 | 0.04 | 0.05 | 0.06 | 0.08 | 0.10 | 0.14 |
| | 2:45:14 | 0.01 | 0.03 | 0.02 | 0.03 | 0.03 | 0.04 | 0.06 | 0.07 | 0.10 |
| | 2:50:34 | 0.01 | 0.02 | 0.01 | 0.02 | 0.02 | 0.03 | 0.04 | 0.05 | 0.07 |
| | 2:55:53 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.03 | 0.04 |
| | 3:01:13 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 |
| | 3:06:33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| | 3:11:53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:17:13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:22:32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:27:52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:33:12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:38:32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:43:52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:49:11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:54:31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:59:51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:05:11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:10:31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:15:50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:21:10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:26:30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:31:50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:37:10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:42:29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:47:49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:53:09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:58:29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:03:49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:09:08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:14:28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:19:48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:25:08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:30:28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:35:47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:41:07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:46:27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:51:47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:57:07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:02:26 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:07:46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:13:06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:18:26 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:23:46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

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] |
|---|---|---|---|---|---|---|
| | 0.00 | 0 | 0.000 | 0 | 0.000 | 0.00 |
| | 1.00 | 336 | 0.008 | 166 | 0.004 | 0.01 |
| | 2.00 | 2,645 | 0.061 | 1,646 | 0.038 | 0.03 |
| | 3.00 | 4,030 | 0.093 | 5,022 | 0.115 | 0.05 |
| | 4.00 | 5,239 | 0.120 | 9,656 | 0.222 | 0.14 |
| | 5.00 | 6,588 | 0.151 | 15,570 | 0.357 | 0.23 |
| | 6.00 | 8,089 | 0.186 | 22,908 | 0.526 | 0.29 |
| | 7.00 | 9,817 | 0.225 | 31,861 | 0.731 | 2.56 |
| | 8.00 | 11,129 | 0.255 | 38,145 | 0.876 | 2.66 |

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

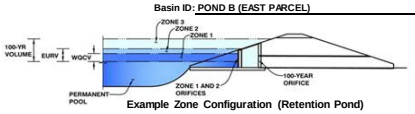
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** PALMER VILLAGE

**Basin ID:** POND B (EAST PARCEL)




**Example Zone Configuration (Retention Pond)**

## Required Volume Calculation

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 4.49 | acres |
| Watershed Length = | 700 | ft |
| Watershed Slope = | 0.028 | ft/ft |
| Watershed Imperviousness = | 54.10% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |
| Water Quality Capture Volume (WQCV) = | 0.081 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.286 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.196 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.257 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.315 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.390 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 0.479 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 0.584 | acre-feet |
| 500-yr Runoff Volume (P1 = 3 in.) = | 0.790 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.185 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.243 | acre-feet |
| Approximate 10-yr Detention Volume = | 0.295 | acre-feet |
| Approximate 25-yr Detention Volume = | 0.359 | acre-feet |
| Approximate 50-yr Detention Volume = | 0.399 | acre-feet |
| Approximate 100-yr Detention Volume = | 0.446 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| 3.00 | inches |

## Stage-Storage Calculation

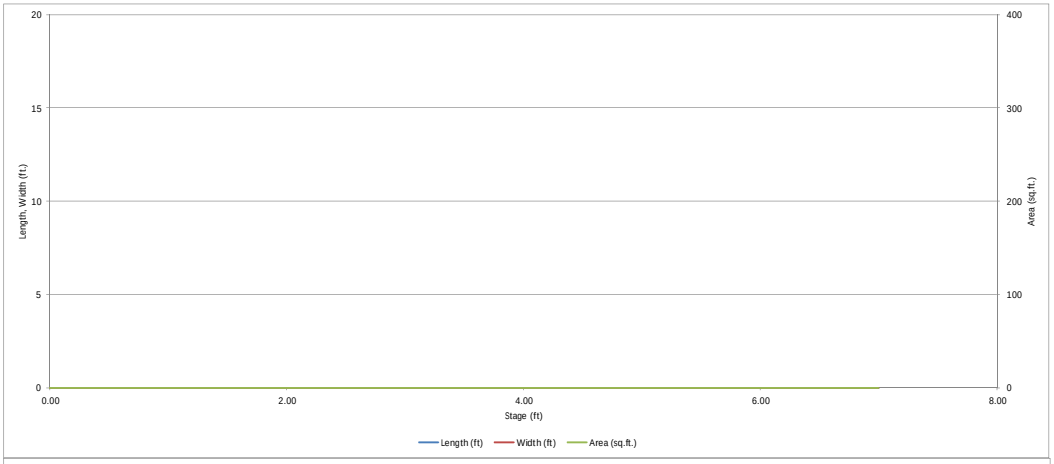
| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.081 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.205 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.160 | acre-feet |
| Total Detention Basin Volume = | 0.446 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial 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 |

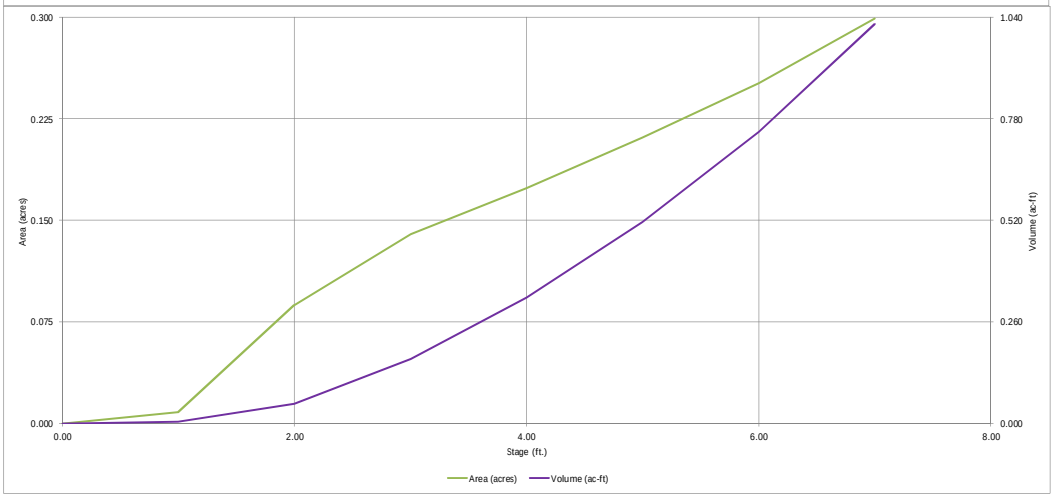
Depth Increment = 0.1 ft

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 6431 **Top of Micropool** | -- | 0.00 | -- | -- | -- | 0 | 0.000 | | |
| **6432** | -- | 1.00 | -- | -- | -- | 376 | 0.009 | 184 | 0.004 |
| **6433** | -- | 2.00 | -- | -- | -- | 3,794 | 0.087 | 2,235 | 0.051 |
| **6434** | -- | 3.00 | -- | -- | -- | 6,080 | 0.140 | 7,210 | 0.166 |
| **6435** | -- | 4.00 | -- | -- | -- | 7,575 | 0.174 | 14,037 | 0.322 |
| **6436** | -- | 5.00 | -- | -- | -- | 9,196 | 0.211 | 22,423 | 0.515 |
| **6437** | -- | 6.00 | -- | -- | -- | 10,931 | 0.251 | 32,486 | 0.746 |
| **6438** | -- | 7.00 | -- | -- | -- | 13,012 | 0.299 | 44,458 | 1.021 |

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**



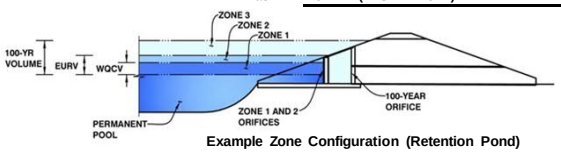



# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

**Project:** PALMER VILLAGE

**Basin ID:** POND B (EAST PARCEL)




**Example Zone Configuration (Retention Pond)**

| | Stage (ft) | Zone Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 2.31 | 0.081 | Orifice Plate |
| Zone 2 (EURV) | 3.79 | 0.205 | Orifice Plate |
| Zone 3 (100-year) | 4.67 | 0.160 | Weir&Pipe (Restrict) |
| | | 0.446 | Total |

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

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

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

| | | | Calculated Parameters for Plate | | |
|---|---|---|---|---|---|
| Invert of Lowest Orifice = | 0.00 | ft (relative to basin bottom at Stage = 0 ft) | WQ Orifice Area per Row = | 2.222E-03 | $ft^2$ |
| Depth at top of Zone using Orifice Plate = | 3.90 | ft (relative to basin bottom at Stage = 0 ft) | Elliptical Half-Width = | N/A | feet |
| Orifice Plate: Orifice Vertical Spacing = | N/A | inches | Elliptical Slot Centroid = | N/A | feet |
| Orifice Plate: Orifice Area per Row = | 0.32 | sq. inches (diameter = 5/8 inch) | Elliptical Slot Area = | N/A | $ft^2$ |

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

| | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|---|---|---|---|---|---|---|---|---|
| Stage of Orifice Centroid (ft) | 0.00 | 1.00 | 2.00 | | | | | |
| Orifice Area (sq. inches) | 0.32 | 0.32 | 0.32 | | | | | |

| | 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 | | Calculated Parameters for Vertical Orifice | Not Selected | Not Selected | |
|---|---|---|---|---|---|---|---|
| Invert of Vertical Orifice = | 2.70 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Area = | 0.03 | N/A | $ft^2$ |
| Depth at top of Zone using Vertical Orifice = | 3.79 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Centroid = | 0.08 | N/A | feet |
| Vertical Orifice Diameter or Height = | 2.00 | N/A | inches | | | | |
| Vertical Orifice Width = | 2.00 | | inches | | | | |

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

| | Zone 3 Weir | Not Selected | | Calculated Parameters for Overflow Weir | Zone 3 Weir | Not Selected | |
|---|---|---|---|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 4.37 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Height of Grate Upper Edge, $H_t$ = | 4.37 | N/A | feet |
| Overflow Weir Front Edge Length = | 3.00 | N/A | feet | Over Flow Weir Slope Length = | 3.00 | N/A | feet |
| Overflow Weir Slope = | 0.00 | N/A | H:V (enter zero for flat grate) | Grate Open Area / 100-yr Orifice Area = | 42.38 | N/A | should be $\geq 4$ |
| Horiz. Length of Weir Sides = | 3.00 | N/A | feet | Overflow Grate Open Area w/o Debris = | 6.30 | N/A | $ft^2$ |
| Overflow Grate Open Area % = | 70% | N/A | %, grate open area/total area | Overflow Grate Open Area w/ Debris = | 3.15 | N/A | $ft^2$ |
| Debris Clogging % = | 50% | N/A | % | | | | |

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

| | Zone 3 Restrictor | Not Selected | | Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|---|---|---|---|
| Depth to Invert of Outlet Pipe = | 0.00 | N/A | ft (distance below basin bottom at Stage = 0 ft) | Outlet Orifice Area = | 0.15 | N/A | $ft^2$ |
| Outlet Pipe Diameter = | 18.00 | N/A | inches | Outlet Orifice Centroid = | 0.12 | N/A | feet |
| Restrictor Plate Height Above Pipe Invert = | 2.50 | | inches | Half-Central Angle of Restrictor Plate on Pipe = | 0.76 | N/A | radians |

User Input: Emergency Spillway (Rectangular or Trapezoidal)

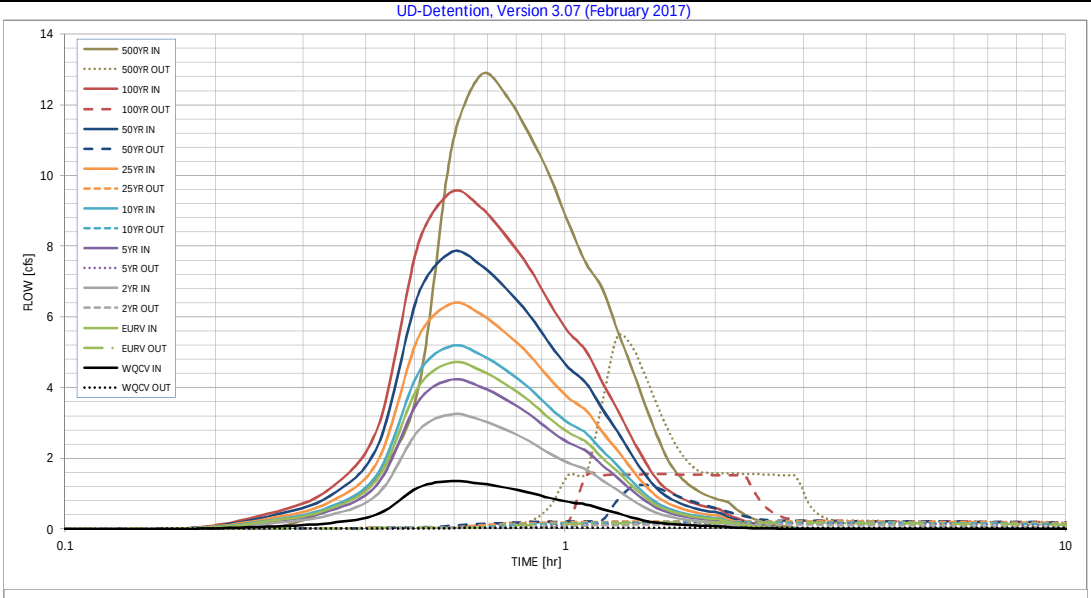
| | | | Calculated Parameters for Spillway | | |
|---|---|---|---|---|---|
| Spillway Invert Stage= | 5.00 | ft (relative to basin bottom at Stage = 0 ft) | Spillway Design Flow Depth= | 0.27 | feet |
| Spillway Crest Length = | 20.00 | feet | Stage at Top of Freeboard = | 6.27 | feet |
| Spillway End Slopes = | 4.00 | H:V | Basin Area at Top of Freeboard = | 0.26 | acres |
| Freeboard above Max Water Surface = | 1.00 | feet | | | |

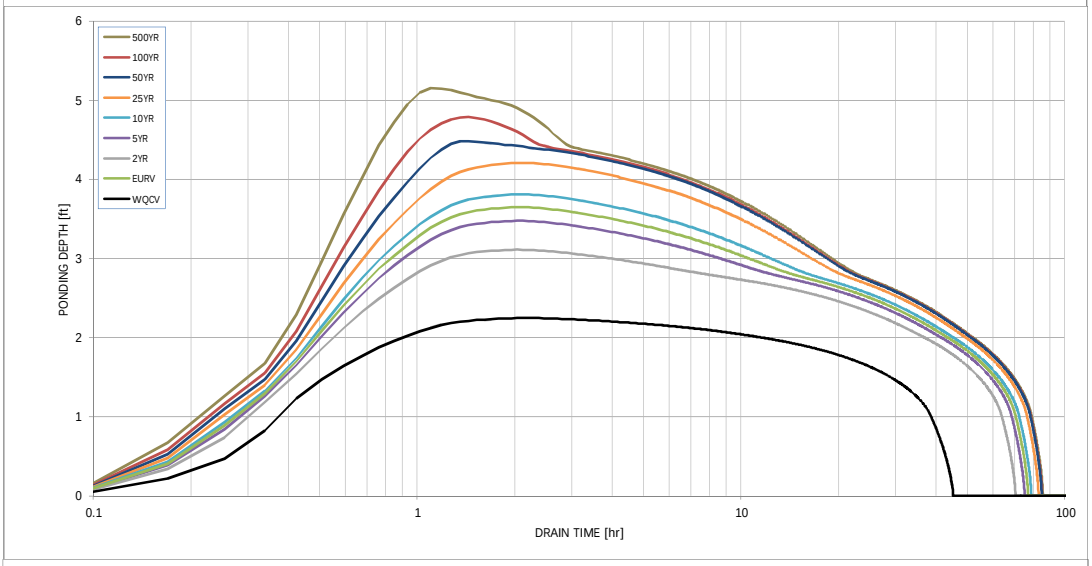
Routed Hydrograph Results

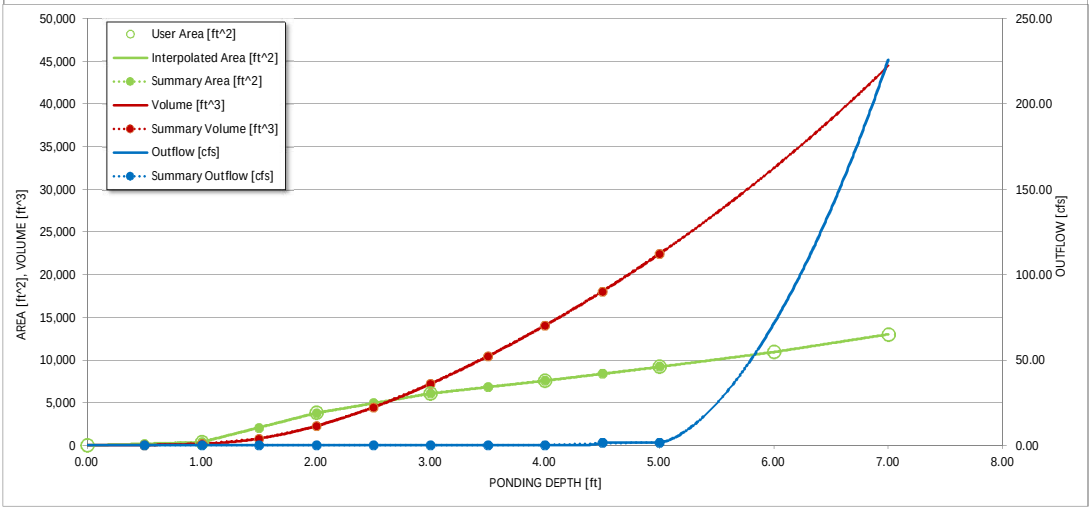
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | 0.53 | 1.07 | 1.19 | 1.50 | 1.75 | 2.00 | 2.25 | 2.52 | 3.00 |
| Calculated Runoff Volume (acre-ft) = | 0.081 | 0.286 | 0.196 | 0.257 | 0.315 | 0.390 | 0.479 | 0.584 | 0.790 |
| OPTIONAL Override Runoff Volume (acre-ft) = | | | | | | | | | |
| Inflow Hydrograph Volume (acre-ft) = | 0.081 | 0.286 | 0.196 | 0.256 | 0.315 | 0.389 | 0.479 | 0.584 | 0.789 |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.03 | 0.19 | 0.46 | 1.00 |
| Predevelopment Peak Q (cfs) = | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.9 | 2.1 | 4.5 |
| Peak Inflow Q (cfs) = | 1.4 | 4.7 | 3.2 | 4.2 | 5.2 | 6.4 | 7.8 | 9.5 | 12.8 |
| Peak Outflow Q (cfs) = | 0.0 | 0.2 | 0.1 | 0.2 | 0.2 | 0.2 | 1.2 | 1.5 | 5.4 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 7.2 | 3.6 | 1.8 | 1.5 | 0.7 | 1.2 |
| Structure Controlling Flow = | Plate | Vertical Orifice 1 | Vertical Orifice 1 | Vertical Orifice 1 | Vertical Orifice 1 | Vertical Orifice 1 | Overflow Grate 1 | Outlet Plate 1 | Spillway |
| Max Velocity through Grate 1 (fps) = | N/A | N/A | N/A | N/A | N/A | N/A | 0.2 | 0.2 | 0.2 |
| Max Velocity through Grate 2 (fps) = | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Time to Drain 97% of Inflow Volume (hours) = | 41 | 67 | 63 | 66 | 68 | 71 | 71 | 70 | 67 |
| Time to Drain 99% of Inflow Volume (hours) = | 43 | 72 | 67 | 71 | 74 | 77 | 78 | 77 | 76 |
| Maximum Ponding Depth (ft) = | 2.25 | 3.65 | 3.11 | 3.48 | 3.81 | 4.21 | 4.49 | 4.79 | 5.16 |
| Area at Maximum Ponding Depth (acres) = | 0.10 | 0.16 | 0.14 | 0.16 | 0.17 | 0.18 | 0.19 | 0.20 | 0.22 |
| Maximum Volume Stored (acre-ft) = | 0.075 | 0.263 | 0.181 | 0.235 | 0.290 | 0.360 | 0.410 | 0.469 | 0.547 |

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)




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

# Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename: _____

Storm Inflow Hydrographs UD-Detention, Version 3.07 (February 2017)

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

| Time Interval | SOURCE | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK |
|---|---|---|---|---|---|---|---|---|---|---|
| | 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] |
| 5.09 min | 0:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:05:05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrograph | 0:10:11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Constant | 0:15:16 | 0.06 | 0.21 | 0.15 | 0.19 | 0.23 | 0.29 | 0.35 | 0.42 | 0.57 |
| 0.982 | 0:20:22 | 0.17 | 0.57 | 0.39 | 0.51 | 0.62 | 0.77 | 0.94 | 1.14 | 1.53 |
| | 0:25:27 | 0.42 | 1.46 | 1.01 | 1.31 | 1.60 | 1.97 | 2.41 | 2.93 | 3.93 |
| | 0:30:32 | 1.17 | 4.01 | 2.77 | 3.60 | 4.40 | 5.41 | 6.62 | 8.05 | 10.79 |
| | 0:35:38 | 1.35 | 4.71 | 3.24 | 4.22 | 5.18 | 6.38 | 7.83 | 9.54 | 12.84 |
| | 0:40:43 | 1.28 | 4.48 | 3.08 | 4.02 | 4.93 | 6.08 | 7.47 | 9.10 | 12.26 |
| | 0:45:49 | 1.16 | 4.08 | 2.80 | 3.66 | 4.49 | 5.53 | 6.80 | 8.28 | 11.16 |
| | 0:50:54 | 1.03 | 3.63 | 2.49 | 3.25 | 3.99 | 4.93 | 6.06 | 7.39 | 9.98 |
| | 0:55:59 | 0.87 | 3.11 | 2.13 | 2.79 | 3.43 | 4.24 | 5.22 | 6.38 | 8.63 |
| | 1:01:05 | 0.77 | 2.72 | 1.86 | 2.44 | 2.99 | 3.70 | 4.56 | 5.56 | 7.51 |
| | 1:06:10 | 0.69 | 2.46 | 1.68 | 2.20 | 2.71 | 3.35 | 4.13 | 5.04 | 6.81 |
| | 1:11:16 | 0.56 | 2.01 | 1.37 | 1.80 | 2.22 | 2.75 | 3.39 | 4.15 | 5.63 |
| | 1:16:21 | 0.45 | 1.63 | 1.11 | 1.46 | 1.80 | 2.24 | 2.76 | 3.39 | 4.61 |
| | 1:21:26 | 0.33 | 1.24 | 0.84 | 1.11 | 1.37 | 1.71 | 2.12 | 2.61 | 3.56 |
| | 1:26:32 | 0.23 | 0.91 | 0.61 | 0.81 | 1.01 | 1.26 | 1.57 | 1.94 | 2.66 |
| | 1:31:37 | 0.17 | 0.67 | 0.45 | 0.59 | 0.74 | 0.92 | 1.14 | 1.40 | 1.92 |
| | 1:36:43 | 0.14 | 0.52 | 0.35 | 0.46 | 0.57 | 0.71 | 0.89 | 1.09 | 1.49 |
| | 1:41:48 | 0.12 | 0.43 | 0.29 | 0.38 | 0.47 | 0.59 | 0.73 | 0.90 | 1.22 |
| | 1:46:53 | 0.10 | 0.36 | 0.25 | 0.33 | 0.40 | 0.50 | 0.62 | 0.76 | 1.04 |
| | 1:51:59 | 0.09 | 0.32 | 0.22 | 0.29 | 0.35 | 0.44 | 0.54 | 0.67 | 0.91 |
| | 1:57:04 | 0.08 | 0.29 | 0.20 | 0.26 | 0.32 | 0.40 | 0.49 | 0.60 | 0.82 |
| | 2:02:10 | 0.07 | 0.27 | 0.18 | 0.24 | 0.30 | 0.37 | 0.45 | 0.56 | 0.75 |
| | 2:07:15 | 0.05 | 0.20 | 0.13 | 0.18 | 0.22 | 0.27 | 0.33 | 0.41 | 0.55 |
| | 2:12:20 | 0.04 | 0.14 | 0.10 | 0.13 | 0.16 | 0.20 | 0.24 | 0.30 | 0.41 |
| | 2:17:26 | 0.03 | 0.11 | 0.07 | 0.09 | 0.12 | 0.14 | 0.18 | 0.22 | 0.30 |
| | 2:22:31 | 0.02 | 0.08 | 0.05 | 0.07 | 0.08 | 0.11 | 0.13 | 0.16 | 0.22 |
| | 2:27:37 | 0.01 | 0.05 | 0.04 | 0.05 | 0.06 | 0.08 | 0.09 | 0.12 | 0.16 |
| | 2:32:42 | 0.01 | 0.04 | 0.03 | 0.03 | 0.04 | 0.05 | 0.07 | 0.08 | 0.11 |
| | 2:37:47 | 0.01 | 0.03 | 0.02 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.08 |
| | 2:42:53 | 0.00 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 | 0.03 | 0.04 | 0.05 |
| | 2:47:58 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.03 |
| | 2:53:04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 |
| | 2:58:09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| | 3:03:14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:08:20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:13:25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:18:31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:23:36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:28:41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:33:47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:38:52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:43:58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:49:03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:54:08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:59:14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:04:19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:09:25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:14:30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:19:35 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:24:41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:29:46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:34:52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:39:57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:45:02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:50:08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:55:13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:00:19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:05:24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:10:29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:15:35 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:20:40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:25:46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:30:51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:35:56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:41:02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:46:07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:51:13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:56:18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:01:23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:06:29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

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] |
|---|---|---|---|---|---|---|
| | 0.50 | 184 | 0.004 | 45 | 0.001 | 0.01 |
| | 1.00 | 372 | 0.009 | 184 | 0.004 | 0.01 |
| | 1.50 | 2,051 | 0.047 | 783 | 0.018 | 0.02 |
| | 2.00 | 3,760 | 0.086 | 2,235 | 0.051 | 0.03 |
| | 2.50 | 4,937 | 0.113 | 4,456 | 0.102 | 0.04 |
| | 3.00 | 6,080 | 0.140 | 7,210 | 0.166 | 0.11 |
| | 3.50 | 6,827 | 0.157 | 10,437 | 0.240 | 0.16 |
| | 4.00 | 7,575 | 0.174 | 14,037 | 0.322 | 0.20 |
| | 4.50 | 8,385 | 0.193 | 18,028 | 0.414 | 1.45 |
| | 5.00 | 9,196 | 0.211 | 22,423 | 0.515 | 1.58 |

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).

# Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 28 2020

## POND A FOREBAY NOTCH

**Rectangular Weir**

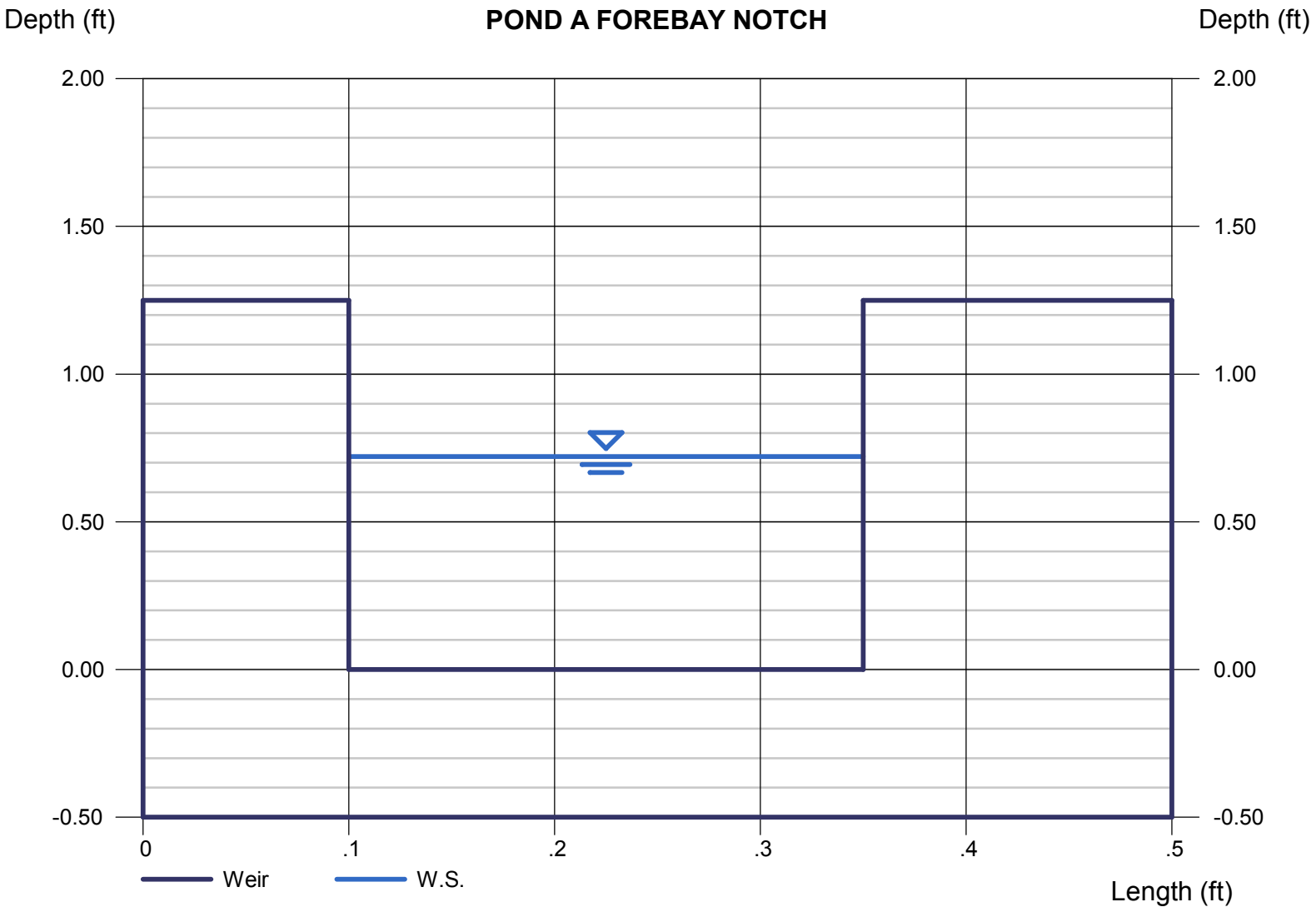
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 0.25 |
| Total Depth (ft) | = 1.25 |

**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.33 |
| Compute by: | Known Q |
| Known Q (cfs) | = 0.51 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.72 |
| Q (cfs) | = 0.510 |
| Area (sqft) | = 0.18 |
| Velocity (ft/s) | = 2.83 |
| Top Width (ft) | = 0.25 |



# Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 28 2020

## POND B FOREBAY NOTCH

**Rectangular Weir**

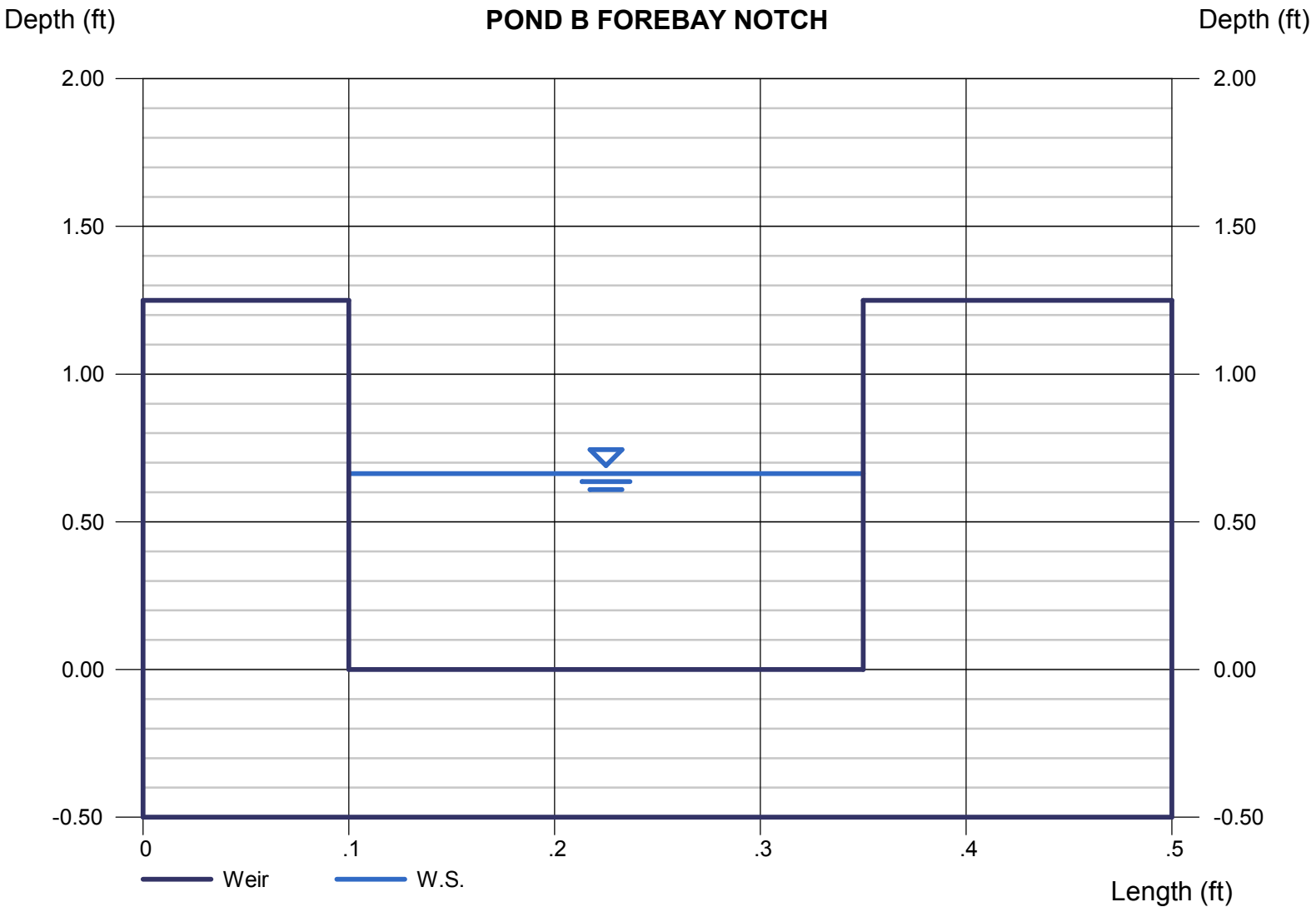
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 0.25 |
| Total Depth (ft) | = 1.25 |

**Calculations**

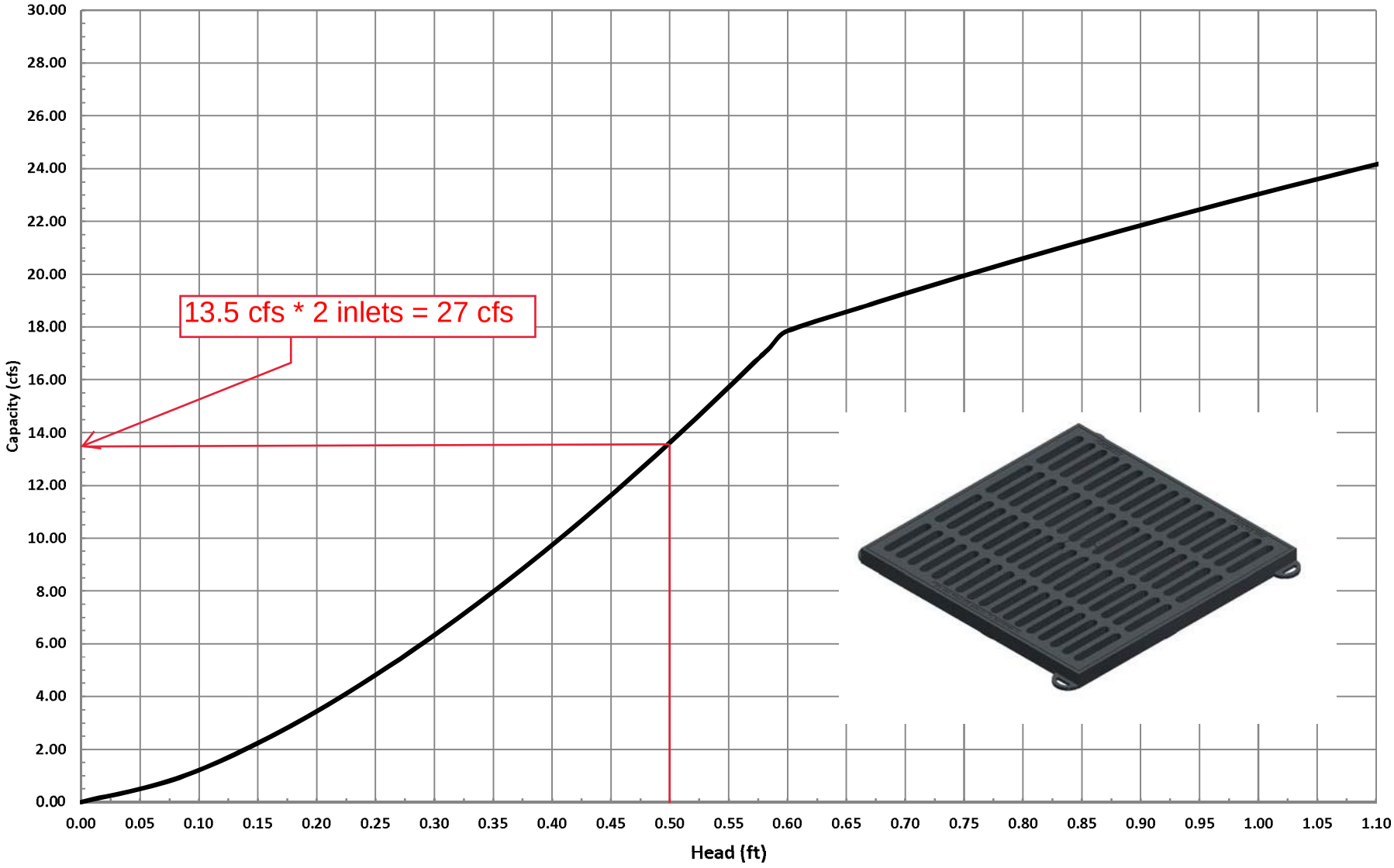
| | |
|---|---|
| Weir Coeff. Cw | = 3.33 |
| Compute by: | Known Q |
| Known Q (cfs) | = 0.45 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.66 |
| Q (cfs) | = 0.450 |
| Area (sqft) | = 0.17 |
| Velocity (ft/s) | = 2.71 |
| Top Width (ft) | = 0.25 |



# Nyloplast 3' x 3' Road & Highway Inlet Capacity Chart




100-year peak flow to pond (SF-3):
Pond A: 25.6 cfs
Pond B: 22.6 cfs

Nyloplast
3130 Verona Avenue • Buford, GA 30518
(866) 888-8479 / (770) 932-2443 • Fax: (770) 932-2490

# Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 28 2020

## POND B SPILLWAY (Q100 = 22.6 CFS PER SF-3 MAJOR (RATIONAL CALCULATIONS))

**Trapezoidal Weir**

| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 20.00 |
| Total Depth (ft) | = 1.50 |
| Side Slope (z:1) | = 4.00 |

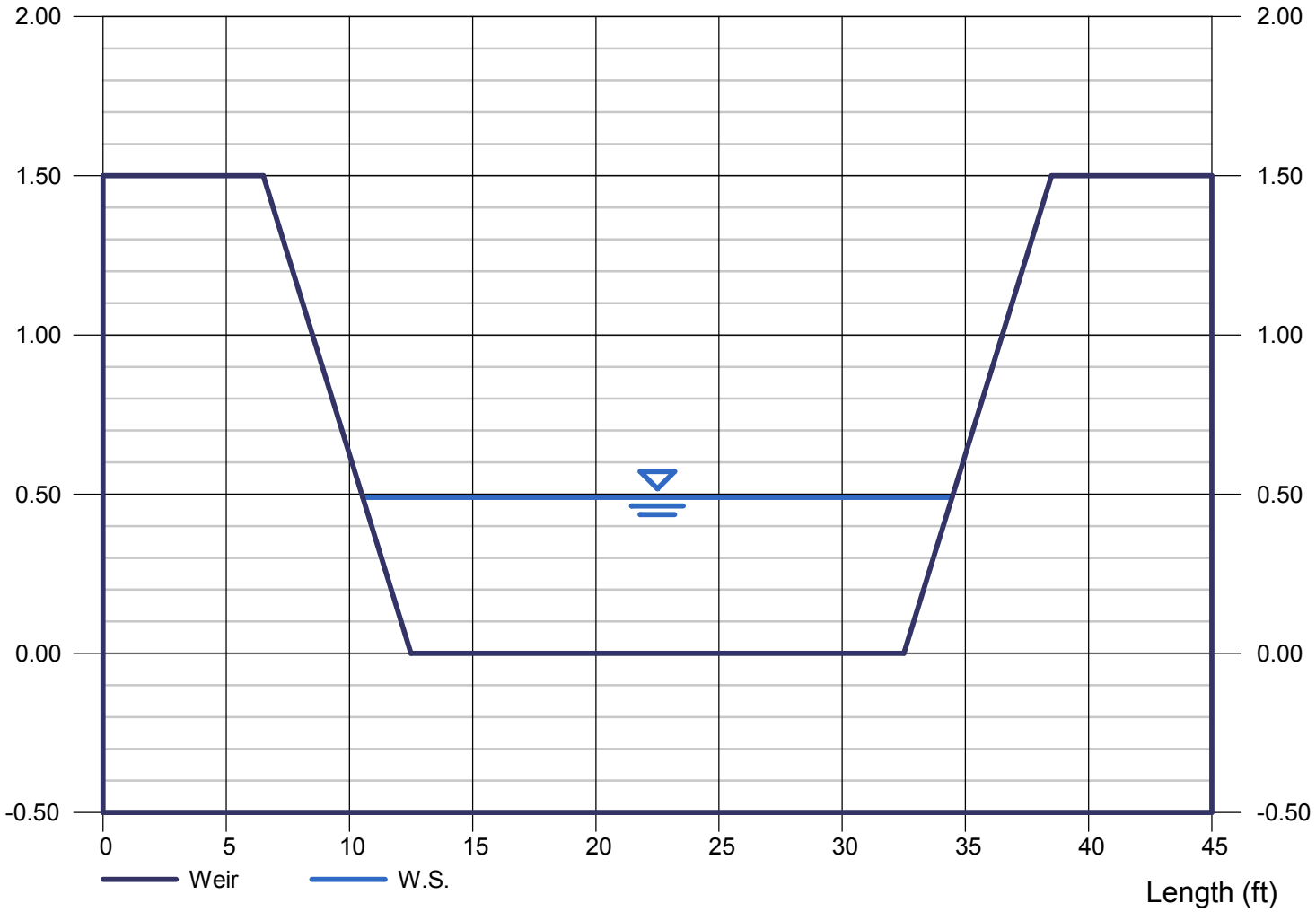
**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.10 |
| Compute by: | Known Q |
| Known Q (cfs) | = 22.60 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.49 |
| Q (cfs) | = 22.60 |
| Area (sqft) | = 10.76 |
| Velocity (ft/s) | = 2.10 |
| Top Width (ft) | = 23.92 |

Depth (ft) **POND B SPILLWAY (Q100 = 22.6 CFS PER SF-3 MAJOR (RATIONAL CALCULATIONS))** Depth (ft)



# Appendix E
# Reference Material

Provide the 2020 fees

# *El Paso County Drainage Basin Fees*

Resolution No. 18-470

| Basin Number | Receiving Waters | Year Studied | Drainage Basin Name | 2019 Drainage Fee (per Impervious Acre) | 2019 Bridge Fee (per Impervious Acre) |
|---|---|---|---|---|---|
| ***Drainage Basins with DBPS's:*** | | | | | |
| CHMS0200 | Chico Creek | 2013 | Haegler Ranch | $10,324 | $1,524 |
| CHWS1200 | Chico Creek | 2001 | Bennett Ranch | $11,558 | $4,433 |
| CHWS1400 | Chico Creek | 2013 | Falcon | $29,622 | $4,069 |
| FOFO2000 | Fountain Creek | 2001 | West Fork Jimmy Camp Creek | $12,564 | $3,717 |
| FOFO2600 | Fountain Creek | 1991* | Big Johnson / Crews Gulch | $18,350 | $2,370 |
| FOFO2800 | Fountain Creek | 1988* | Widefield | $18,350 | $0 |
| FOFO2900 | Fountain Creek | 1988* | Security | $18,350 | $0 |
| FOFO3000 | Fountain Creek | 1991* | Windmill Gulch | $18,350 | $275 |
| FOFO3100 / FOFO3200 | Fountain Creek | 1988* | Carson Street / Little Johnson | $11,192 | $0 |
| FOFO3400 | Fountain Creek | 1984* | Peterson Field | $13,235 | $1,004 |
| FOFO3600 | Fountain Creek | 1991* | Fisher's Canyon | $18,350 | $0 |
| FOFO4000 | Fountain Creek | 1996 | Sand Creek | $18,940 | $5,559 |
| FOFO4200 | Fountain Creek | 1977 | Spring Creek | $9,517 | $0 |
| FOFO4600 | Fountain Creek | 1984* | Southwest Area | $18,350 | $0 |
| FOFO4800 | Fountain Creek | 1991 | Bear Creek | $18,350 | $1,004 |
| FOFO5400 | Fountain Creek | 1977 | 21st Street | $5,521 | $0 |
| FOFO5600 | Fountain Creek | 1964 | 19th Street | $3,611 | $0 |
| FOFO5800 | Fountain Creek | 1964 | Camp Creek | $2,033 | $0 |
| FOMO0400 | Monument Creek | 1986* | Mesa | $9,598 | $0 |
| FOMO1000 | Monument Creek | 1981 | Douglas Creek | $11,540 | $255 |
| FOMO1200 | Monument Creek | 1977 | Templeton Gap | $11,847 | $275 |
| FOMO1400 | Monument Creek | 1976 | Pope's Bluff | $3,676 | $627 |
| FOMO1600 | Monument Creek | 1976 | South Rockrimmon | $4,314 | $0 |
| FOMO1800 | Monument Creek | 1973 | North Rockrimmon | $5,521 | $0 |
| FOMO2000 | Monument Creek | 1971 | Pulpit Rock | $6,085 | $0 |
| FOMO2200 | Monument Creek | 1994 | Cottonwood Creek / S. Pine | $18,350 | $1,004 |
| FOMO2400 | Monument Creek | 1966 | Dry Creek | $14,486 | $524 |
| FOMO3600 | Monument Creek | 1989* | Black Squirrel Creek | $8,331 | $524 |
| FOMO3700 | Monument Creek | 1987* | Middle Tributary | $15,312 | $0 |
| FOMO3800 | Monument Creek | 1987* | Monument Branch | $18,350 | $0 |
| FOMO4000 | Monument Creek | 1996 | Smith Creek | $7,481 | $1,004 |
| FOMO4200 | Monument Creek | 1989* | Black Forest | $18,350 | $500 |
| FOMO5200 | Monument Creek | 1993* | Dirty Woman Creek | $18,350 | $1,004 |
| FOMO5300 | Fountain Creek | 1993* | Crystal Creek | $18,350 | $1,004 |
| ***Miscellaneous Drainage Basins:*** [1] | | | | | |
| CHBS0800 | Chico Creek | | Book Ranch | $17,217 | $2,492 |
| CHEC0400 | Chico Creek | | Upper East Chico | $9,380 | $272 |
| CHWS0200 | Chico Creek | | Telephone Exchange | $10,306 | $241 |
| CHWS0400 | Chico Creek | | Livestock Company | $16,976 | $202 |
| CHWS0600 | Chico Creek | | West Squirrel | $8,849 | $3,672 |
| CHWS0800 | Chico Creek | | Solberg Ranch | $18,350 | $0 |
| FOFO1200 | Fountain Creek | | Crooked Canyon | $5,540 | $0 |
| FOFO1400 | Fountain Creek | | Calhan Reservoir | $4,625 | $270 |
| FOFO1600 | Fountain Creek | | Sand Canyon | $3,342 | $0 |
| FOFO2000 | Fountain Creek | | Jimmy Camp Creek[3] | $18,350 | $858 |
| FOFO2200 | Fountain Creek | | Fort Carson | $14,486 | $524 |
| FOFO2700 | Fountain Creek | | West Little Johnson | $1,209 | $0 |
| FOFO3800 | Fountain Creek | | Stratton | $8,801 | $394 |
| FOFO5000 | Fountain Creek | | Midland | $14,486 | $524 |
| FOFO6000 | Fountain Creek | | Palmer Trail | $14,486 | $524 |
| FOFO6800 | Fountain Creek | | Black Canyon | $14,486 | $524 |
| FOMO4600 | Monument Creek | | Beaver Creek | $10,970 | $0 |
| FOMO3000 | Monument Creek | | Kettle Creek | $9,909 | $0 |
| FOMO3400 | Monument Creek | | Elkhorn | $1,665 | $0 |
| FOMO5000 | Monument Creek | | Monument Rock | $7,953 | $0 |
| FOMO5400 | Monument Creek | | Palmer Lake | $12,717 | $0 |
| FOMO5600 | Monument Creek | | Raspberry Mountain | $4,278 | $0 |
| PLPL0200 | Monument Creek | | Bald Mountain | $9,116 | $0 |
| ***Interim Drainage Basins:*** [2] | | | | | |
| FOFO1800 | Fountain Creek | | Little Fountain Creek | $2,346 | $0 |
| FOMO4400 | Monument Creek | | Jackson Creek | $7,263 | $0 |
| FOMO4800 | Monument Creek | | Teachout Creek | $5,044 | $758 |

1. The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies perform

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies or the Drainage Basin Identification and Fee Estimation Report. (Best availabl

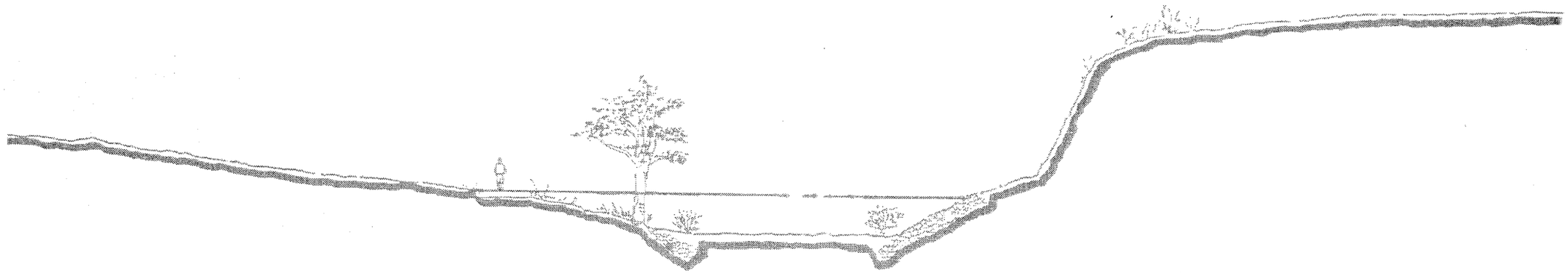
3. This is an interim fee and will be adjusted when a DBPS is completed. In addition to the Drainage Fee a surety in the amount of $7,285 per impervious acre sh the DBPS results in a fee greater than the current fee. Fees paid in excess of the future revised fee will be reimbursed. See Resolution 06-326 (9/14/06) and Res

EPC Stormwater Management — *Jennifer Irvine, P.E.*

SAND CREEK DRAINAGE BASIN PLANNING STUDY

# PRELIMINARY DESIGN REPORT

CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO



**PREPARED FOR:**

City of Colorado Springs
Department of Comprehensive Planning, Development and Finance
Engineering Division
30 S. Nevada
Colorado Springs, Colorado 80903

**PREPARED BY:**

Kiowa Engineering Corporation
1011 North Weber
Colorado Springs, CO 80903

# II. STUDY AREA DESCRIPTION

The Sand Creek drainage basin is a left-bank tributary to the Fountain Creek lying in the west-central portions of El Paso County. Sand Creek's drainage area at Fountain Creek is approximately 54 square miles of which approximately 18.8 square miles are inside the City of Colorado Springs corporate limits. The basin is divided into five major sub-basins, the Sand Creek mainstem, the East Fork Sand Creek, the Central Tributary to East Fork, the West Fork, and the East Fork Subtributary. Figure II-1 shows the location of the Sand Creek basin.

Basin Description

The Sand Creek basin covers a total of 54 square miles in unincorporated El Paso County and Colorado Springs, Colorado. Of this total, approximately 28 square miles is encompassed by the Sand Creek basin, and 26 square miles for the East Fork Sand Creek basin. The basin trends in generally a south to southwesterly direction, entering the Fountain Creek approximately two miles upstream of the Academy Boulevard bridge over Fountain Creek. Two main tributaries drain the basin, those being the mainstem of Sand Creek and East Fork Sand Creek. Development presence in most evident along the mainstream. At this time, approximately 25 percent of the basin is developed. This alternative evaluation focuses upon the Sand Creek basin only.

The maximum basin elevation is approximately 7,620 feet above mean sea level, and falls to approximately 5,790 feet at the confluence with Fountain Creek. The headwaters of the basin originate in the conifer covered areas of The Black Forest. The middle eastern portions of the basin are typified by rolling range land with fair to good vegetative cover associated with semi-arid climates.

Climate

This area of El Paso County can be described, in general as high plains, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry. Precipitation ranges from 14 to 16 inches per year, with the majority of this precipitation occurring in spring and summer in the form of rainfall. Thunderstorms are common during the summer months, and are typified by quick-moving low pressure cells which draw moisture from the Gulf of Mexico into the region. Average temperatures range from about 30$^{O}$F in the winter to 75$^{O}$ in the summer. The relative humidity ranges from about 25 percent in the summer to 45 percent in the winter.

Soils and Geology

Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium and residium, derived from sedimentary rock. The soils have high to moderate infiltration rates, and are extremely susceptible to wind and water erosion where poor vegetation cover exists. In undeveloped areas, the predominance of Type A and B soils give this basin a lower runoff per unit area as compared to basins with soils dominated by Types C and D. Presented on Figure II-2 is the Hydrologic Soil distribution map for the Sand Creek basin.

Property Ownership and Impervious Land Densities

Property ownership along the major drainageway within the Sand Creek basin vary from public to private. Along the developed reaches, drainage right-of-ways and greenbelts have been dedicated during the development of the adjacent residential and commercial land. Where development has not occurred, the drainageways remain under private ownership with no delineated drainage right-of-way or easements. There are several public parks which abut the mainstem of Sand Creek. Roadway and utility easements abutting or crossing the major drainageways occur most frequently in the developed portions of the basin.

Land use information for the existing and future conditions were reviewed as part of the planning effort. This information is used in the hydrologic analysis to predict runoff rates and volumes for the purposes of facility evaluation. The identification of land uses abutting the drainageways is also useful in the identification of feasible plans for stabilization and aesthetic treatment of the creek. Presented on Figure II-3 is the proposed land use map used in the evaluation of impervious land densities discussed in the hydrologic section of this report. Figure II-3 is not intended to reflect the future zoning or land use policies of the City or the County.

The land use information within the Banning-Lewis Ranch property was obtained from Aries Properties during the time the draft East Fork Sand Creek Drainage Basin Planning Study was being prepared. The land use information was again reviewed with the City of Colorado Springs Department of Planning and was found to be appropriate for use in the estimation of hydrology for the East Fork Basin. The location of future arterial streets and roadways within

N

EAST BIERSTADT CREEK

WEST BIERSTADT CREEK

EAST FORK SAND CREEK

SITE

WEST TRIB TO RANCHES BASIN SAND CREEK

CENTER TRIBUTARY SAND CREEK

LOWER BASIN SAND CREEK

UPPER BASIN SAND CREEK

WEST FORK SAND CREEK

FOUNTAIN CREEK

WOODMEN

HILLTOP BLVD

STETSON

CONSTITUTION

VOLLMER RD.

MARKSHEFFEL RD.

POWERS BLVD.

GALLEY

PLATTE

FOUNTAIN

HANCOCK

Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

REGIONAL SUB-BASINS

| | |
|---|---|
| Project No | 90-04-09 |
| Date: | 11/90 |
| Design: | |
| Drawn: | EAK |
| Check: | |
| Revisions: | |

11

FIG. III-1

# HANNAH RIDGE AT FEATHERGRASS
# MASTER DRAINAGE DEVELOPMENT PLAN

**November 15, 2007**
**Project No. 60754**

**PREPARED FOR:**

**FEATHERGRASS INVESTMENTS, LLC**
**4715 North Chestnut Street**
**Colorado Springs, CO 80907**
**(719) 593-8367**

**Kenneth P. Driscoll, Manager**

**PREPARED BY:**

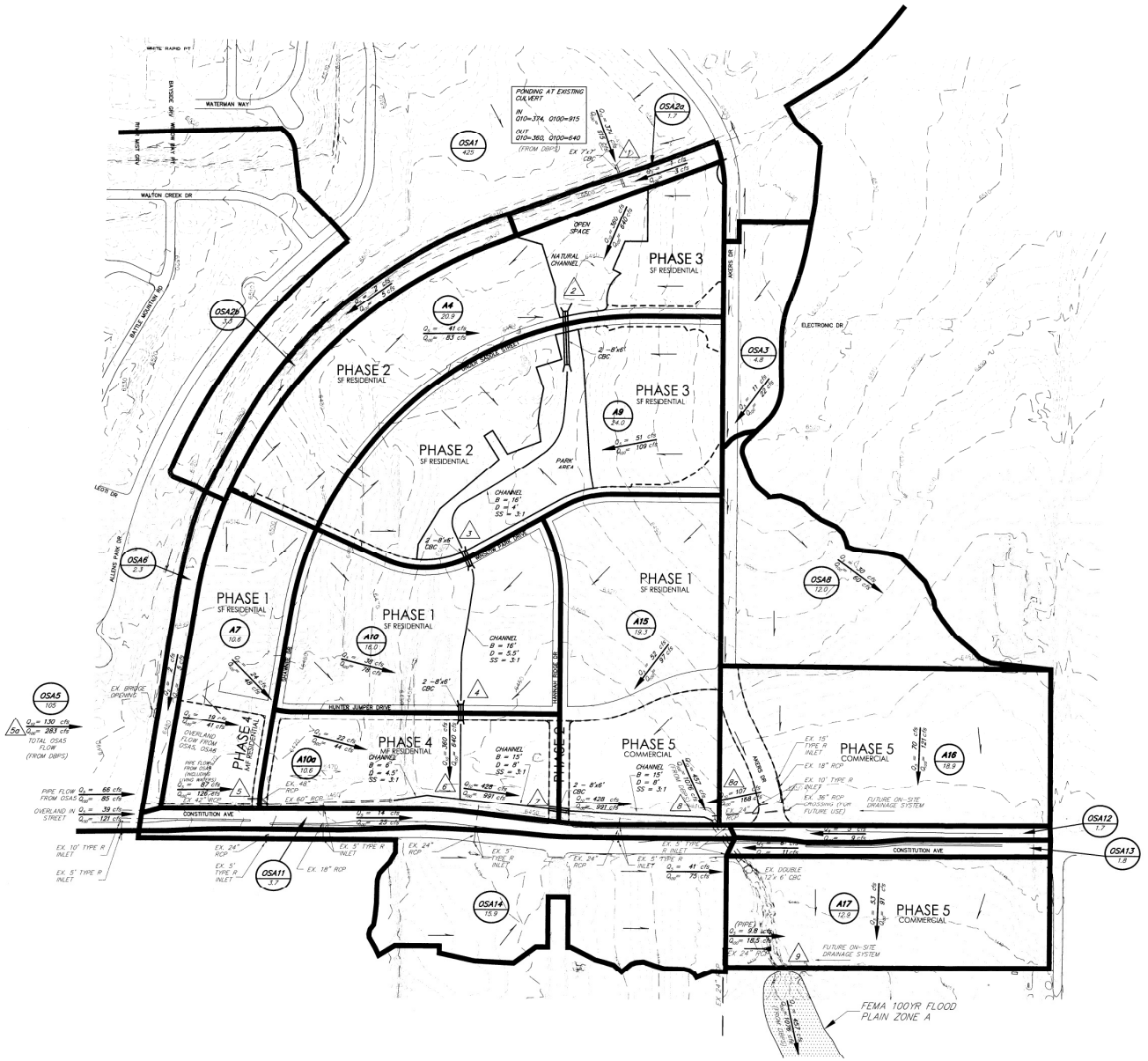
**M.V.E., Inc.**
**1903 Lelaray Street, Suite 200**
**Colorado Springs, CO 80909**
**(719) 635-5736**

discharges of $Q_5 = 2$ cfs and $Q_{100} = 5$ cfs. Basin OSA8, on the east side of Akers Drive, drains south onto the eastern section of the property with peak discharges of $Q_5 = 30$ cfs and $Q_{100} = 60$ cfs. Flows from Basin OSA3 and a portion of Basin OSA8 enters Akers Drive. The existing Akers Drive and Akers drainage improvements were designed by M.V.E., Inc. and approved by El Paso County D.O.T. in September 2006. The system was designed to capture and convey developed flows in Akers Drive. One 10 ft Type R inlet and one 15 ft Type R inlet, connected by an 18" RCP are installed on the east side of Akers, just north of the Constitution intersection. A 10 ft Type R inlet is located on the west side of Akers. The flows collected by the inlets are discharged at the CBC opening, just to the west, with a 24" RCP. The inlets and connecting pipes are adequate to collect and route developed 100 year flows of 20.9 cfs to the creek. In the 100-year event, bypass flows of 5.1 cfs reaches Constitution and travels west to the sump inlet at the CBC crossing. Off-site basins OSA11, OSA12, and OSA13 contain portions of Constitution Avenue. These basins drain to the existing double 12' x 6' CBC under Constitution Avenue. Runoff from Basin OSA14 drains easterly onto the southern portion of the proposed project located on the south side of Constitution Avenue with flows of $Q_5 = 14$ cfs and $Q_{100} = 27$ cfs. Basin OSA14 is currently undeveloped commercial property, just north of the Jessica Heights Filing Nol. 1 residential subdivision. A storm drain pipe from Jessica Heights delivers an additional $Q_5 = 9.8$ cfs and $Q_{100} = 18.5$ cfs to the Tributary 6 channel. These flow enter the property and then travel to the creek flowing to the south.

## IV. ON-SITE DRAINAGE BASINS

The existing site drains southerly and easterly from the old Rock Island Railroad that bounds the property on the north and west. Tributary 6 to the East Fork of Sand Creek runs north to south through the property to Constitution Avenue. Offsite storm discharges from the Tributary enter onsite Basin A4 at Design Point 1 (the existing 7'x7' CBC). The existing channel area from the railroad culvert to existing Electronic Drive will be maintained in nearly existing condition. Basin A4 will contain single family residential development with open space components and produce runoff quantities of $Q_5 = 41$ cfs and $Q_{100} = 83$ cfs. Flows from Basin A4, along with the Tributary flows will drain to Design Point 2 at proposed Under Saddle Street. A new CBC beneath the street will allow runoff into Basin A9, where flows will enter a park area by way of an improved channel from the DP 2 culvert. Basin A9 contains single family residential development and open space. Developed runoff discharges of $Q_5 = 51$ cfs and $Q_{100} = 109$ cfs are generated by the basin. A storm

# MASTER DEVELOPMENT DRAINAGE PLAN




## SCALE

200' 100' 0 100' 200' 400'

150' 50'

1"= 200' 1:2400

NORTH

## DEVELOPED SITE HYDROLOGY DATA

| DESIGN POINT | AREA (Ac) | $Q_{10}$ (cfs) | $Q_{100}$ (cfs) | INCL. BASINS |
|---|---|---|---|---|
| 1 | 425.0 ($Q_{10}$) | 360 | 640 | OSA1 |
| 2 | 450.9 ($Q_{10}$) | 360 | 640 | OSA1, OSA2a, OSA2b, A4 |
| 3 | 474.9 ($Q_{10}$) | 360 | 640 | OSA1, OSA2, OSA2b, A4, A9 |
| 4 | 490.9 ($Q_{10}$) | 360 | 640 | OSA1, OSA2, A4, A9, A10 |
| 5a | 105.0 ($Q_{10}$) | 130 | 283 | OSA5 |
| 5 | 117.9 ($Q_{10}$) | 130 | 283 | OSA5, OSA6, A7 |
| 6 | 619.4 ($Q_{10}$) | 428 | 991 | OSA1, OSA2, OSA3, A4, OSA5, OSA6, A7, A9, A10 |
| 7 | 619.4 ($Q_{10}$) | 428 | 991 | OSA1, OSA2, OSA3, A4, OSA5, OSA6, A7, A9, A10 |
| 8a | 35.7 ($Q_{10}$) | 107 | 168 | OSA3, OSA8, A16 |
| 8 | 679.8 ($Q_{10}$) | 457 | 1076 | OSA1, OSA2, OSA3, A4, OSA5, OSA6 A7, OSA8, A9, A10, A10a, OSA11, OSA12 A15, A16 |
| 9 | 710.4 ($Q_{10}$) | 457 | 1076 | OSA1, OSA2, OSA3, A4, OSA5, OSA6 A7, OSA8, A9, A10, A10a, OSA11, OSA12 OSA13, OSA14, A15, A16, A17 |

## LEGEND

- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING STORM DRAIN CURB INLET
- EXISTING STORM DRAIN LINE
- EXISTING PROPERTY LINE
- EXISTING ROAD
- PROPOSED CULVERT W/ RIPRAP APRON
- PROPOSED DRAINAGE CHANNEL
- PROPOSED PROJECT PHASE LINE
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN DESIGNATION (OSA2, 14.9)
- DRAINAGE BASIN AREA (A5, 2.56)
- FLOW DIRECTION AND QUANTITIES ($Q_{10}$ = 3.3 cfs, $Q_{100}$ = 7.4 cfs)
- FLOW DIRECTION
- DESIGN POINT DESIGNATION (8)

PROJECT: HANNAH RIDGE

TITLE: MDDP DEVELOPED MAP


MONUMENT VALLEY ENGINEERS INC.
ENGINEERS • SURVEYORS
1903 LAKE AVENUE
COLORADO SPRINGS, COLORADO 80909
PHONE (719) 635-5736


DISK NO.
XREFS

PROJ. NO. 60754
DRAWN: DRG
ENGINEER: DRG
CHECKED:
SCALE: 1" = 200'
DATE: 11/15/07
REVISIONS:

| NO.: | DATE: | ITEM |
|---|---|---|

SHEET 1 OF 1

DRAWING NO. 60754077

# JESSICA HEIGHTS FILING NO. 1
# FINAL DRAINAGE REPORT

**April 27, 2005**
**Project No. 60742**

**PREPARED FOR:**

**Sand Creek Investments South, LLC**
**%**
**Equity Investments**
**90 South Cascade, Suite 1500**
**Colorado Springs, CO 80903**

**PREPARED BY:**

**M.V.E., Inc.**
**1903 Lelaray Street, Suite 200**
**Colorado Springs, CO 80909**
**(719) 635-5736**

roads will be paved county streets within 50 to 80 foot of right-of-ways. Curb & gutter will be constructed on the streets and route storm water flows to storm water inlets. Grading operations will be done in order to improve drainage conditions and to direct runoff to a desired location. Overlot grading will be necessary for subdivision development.

The included **Drainage Map - Developed Condition** shows the proposed road scheme, lot layout, and developed drainage basins with basin designations. The basin sizes and estimated peak storm runoff flows are shown in the table below and on the included map.

Table 3.1 - Developed Condition Hydrologic Data

| Design Point or Basin | | Cumulative Drainage Area (Ac) | 5-yr Discharge (cfs) | 100-yr Discharge (cfs) |
|---|---|---|---|---|
| | OSA | 0.15 | 0.6 | 1.1 |
| | OSB | 0.46 | 1.8 | 3.3 |
| | OSC | 0.88 | 3.3 | 6.0 |
| | A1 | 0.96 | 2.0 | 4.0 |
| | A2 | 5.25 | 3.2 | 7.6 |
| | A3 | 0.51 | 1.4 | 2.8 |
| | A4 | O.32 | 1.3 | 2.3 |
| | B1 | 2.27 | 4.1 | 8.2 |
| DP 2 | B2 | 0.70 | 2.0 | 3.8 |
| DP 3a | B3a | 0.77 | 1.7 | 3.4 |
| DP 3b | B3b | 2.53 | 4.8 | 9.6 |
| | B3c | 1.35 | 3.2 | 6.6 |
| DP3 | B3+3b+3c | 4.65 | 8.4 | 16.9 |
| | B4 | 0.51 | 1.4 | 2.7 |
| | B5 | 1.06 | 2.5 | 5.0 |
| DP5 | B6 | 0.53 | 1.4 | 2.6 |
| DP6 | B8 | 1.98 | 3.9 | 7.8 |

| Table 3.1 - Developed Condition Hydrologic Data | | | | |
|---|---|---|---|---|
| Design Point or Basin | | Cumulative Drainage Area (Ac) | 5-yr Discharge (cfs) | 100-yr Discharge (cfs) |
| DP7 | B9 | 1.29 | 3.3 | 6.3 |
| DP8 | B10 | 1.75 | 3.7 | 7.6 |
| | B11 | 1.88 | 3.9 | 7.9 |
| DP10 | B12 | 2.48 | 4.9 | 9.8 |
| DP11 | B13 | 2.30 | 5.1 | 10.2 |
| | B14 | 0.98 | 2.4 | 4.9 |
| | B15 | 0.24 | 1.1 | 2.1 |
| | C1 | 5.99 | 2.8 | 6.8 |
| | OSA+OSB+C1 | 6.19 | 3.6 | 8.1 |
| DP1 | OSC+B1 | 3.15 | 6.6 | 12.8 |
| | OSC1+B1+B2+B4 | 4.36 | 8.7 | 17.1 |
| DP4 | OSC1+B1+B2+B4+B5 | 5.42 | 10.3 | 20.3 |
| | OSC1+B1+B2+B4+B5+B8 | 7.40 | 14.0 | 27.6 |
| | OSC1+B1+B2+B4+B5+B8+B9 | 8.69 | 15.2 | 30.5 |
| DP9 | B10+B11 | 3.63 | 7.5 | 15.2 |
| | A1+A2 | 6.21 | 4.6 | 10.6 |
| | B10+B11+B13+B15+A3 | 6.68 | 13.8 | 27.9 |

The future lot owners in Jessica Heights Filing No. 1 will adhere to proper construction technics and erosion control. The recommendations within this report need to be followed by the new lot owners. We also recommend that the existing down gradient lot owners not construct their homes in existing drainage swales or flow paths.

The developed conditions will route storm water flows over the site in sheet flow and shallow concentrated flow, depending on the topography and the contributing flow areas. These flows will be routed to the streets. The five and one hundred year frequency storm water flows will be collected and routed to the offsite earthen channel.

The nature of this development dictates that some lots will contribute storm flows onto other lots. This cross-lot drainage cannot be avoided. It is the responsibility of the individual lot owners and the building contractors to locate new structures on each lot so that the structures do not interfere with the proposed drainage pathways. The individual lot owners and contractors should provide positive drainage away from all structures. Individual lot owners are also responsible for maintaining their properties in such a manner that does not allow soil movement from one lot to another.

### 3.2 Offsite

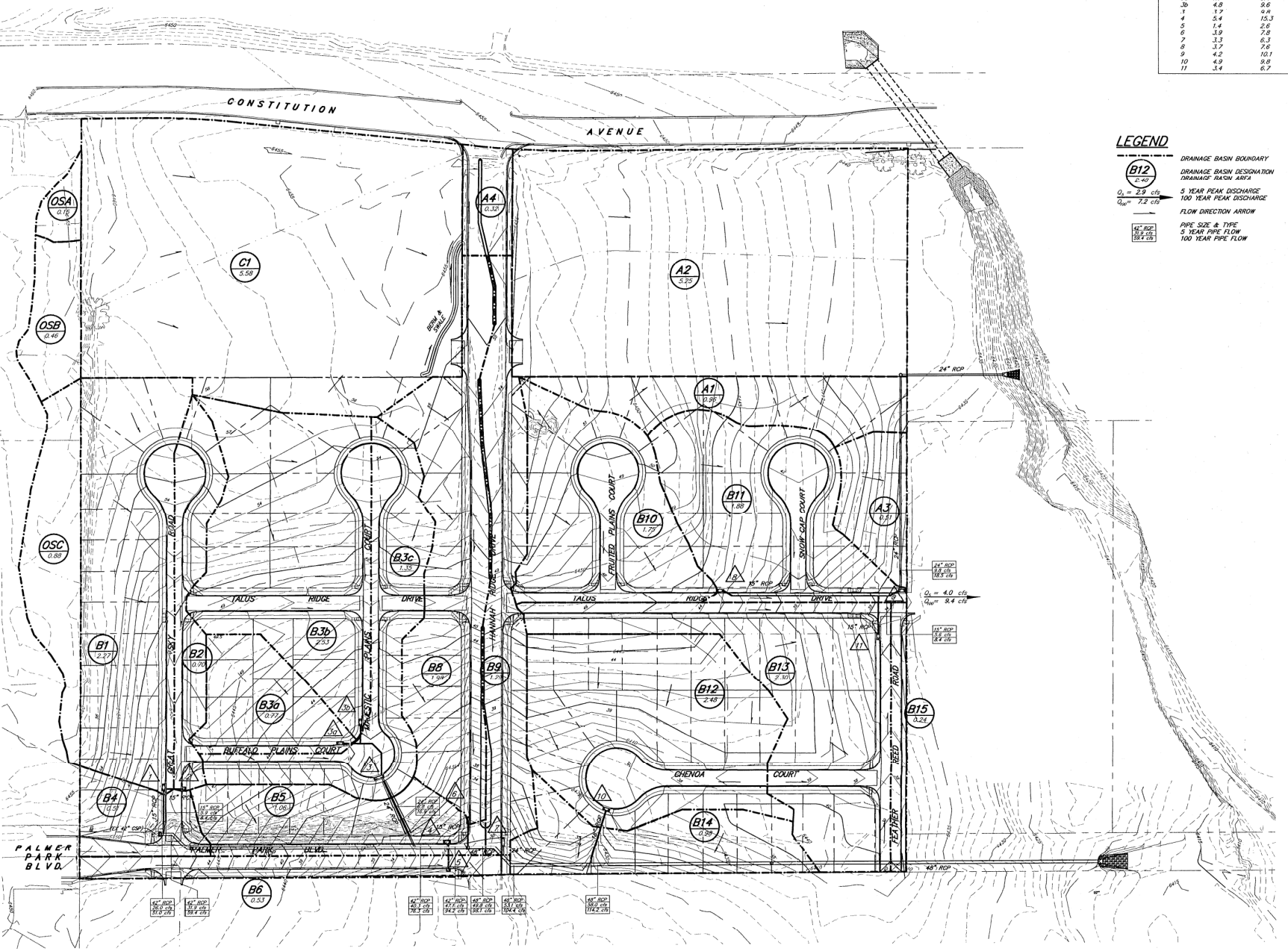
The offsite pipe flow will continue to drain easterly. The pipe will be extended easterly and shall, in addition to the offsite flow, carry the proposed pipe flows from Jessica Heights. The small strip of land adjacent to the west boundary of the site shall continue to drain onto the site as defined by Basin OSC to the north and Basin OSB to the south. Basin C1, which is not being developed at this time, will continue to drain to the east. A berm and swale will direct runoff to the northeast where the flow will enter Hannah Ridge Drive and flow north. When Basin C1 is developed, all flows will be collected and piped to the east. Basin A2 is also not to be developed at this time. Basin A2 will continue to drain to the east.

### 3.3 Onsite

Basin OSC overland storm water flows enter the subdivision along the western boundary of Basin B1 and travel easterly overland to Great Sky Road. These flows then travel southerly in the street section of said Great Sky Road to a 10' inlet at Design Point No.1. The inlet intercepts $Q_5$ = 4.5 cfs / $Q_{100}$= 6.5 cfs of the calculated storm water runoff.

Basin B2 overland storm water flows enter Great Sky Road from the adjacent lots and travel southerly in the street section of said Great Sky Road to a 5' inlet at Design Point No. 2. The inlet intercepts $Q_5$ = 1.4 cfs / $Q_{100}$= 1.9 cfs of the calculated storm water runoff. This collected inlet runoff flows via a 15" reinforced concrete pipe (RC Pipe) to the 10' inlet at Design Point No. 1. The combined collected flows of Design Point No's 1 & 2 then flow in a 24" RC Pipe which connects to a Type I Manhole along with the extended existing 42" corrugated metal pipe in Palmer Park Boulevard. A 42" RC Pipe continues east in Palmer Park Boulevard.

Basins B3a, B3b and B3c overland storm water flows enter Buffalo Plains Court, Majestic plains Court, and Talus Ridge Drive. These flows travel via street section easterly, westerly, and




## PROPOSED DRAINAGE INLET DATA

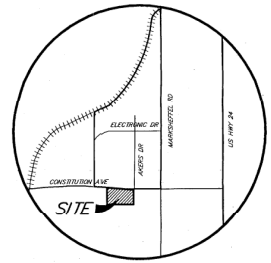
| POINT OF INTEREST | Q5 W/ INLETS | Q100 W/ INLETS | INLET SIZE | Q5 INTERCEPTED | Q5 BYPASS | Q100 INTERCEPTED | Q100 BYPASS |
|---|---|---|---|---|---|---|---|
| 1 | 6.6 | 12.8 | 10 | 4.5 | 2.1 | 6.5 | 6.3 |
| 2 | 2.0 | 3.8 | 5 | 1.4 | 0.6 | 1.9 | 1.9 |
| 3a | 1.7 | 3.4 | 10 | 1.6 | 0.1 | 2.6 | 0.8 |
| 3b | 4.8 | 9.6 | 10 | 3.1 | 1.7 | 4.5 | 5.1 |
| 1 | 1.7 | 9.4 | 14 (SUMP) | 1.7 | 0.0 | 9.4 | 0.0 |
| 4 | 5.4 | 15.3 | 10 (SUMP) | 5.4 | 0.0 | 15.3 | 0.0 |
| 5 | 1.4 | 2.6 | 5 (SUMP) | 1.4 | 0.0 | 2.6 | 0.0 |
| 6 | 3.9 | 7.8 | 10 | 2.7 | 1.2 | 3.9 | 3.9 |
| 7 | 3.3 | 6.3 | 15 (SUMP) | 3.3 | 0.0 | 6.3 | 0.0 |
| 8 | 3.7 | 7.6 | 10 | 2.3 | 1.4 | 3.3 | 4.3 |
| 9 | 4.2 | 10.1 | 10 (SUMP) | 4.2 | 0.0 | 10.1 | 0.0 |
| 10 | 4.9 | 9.8 | 10 (SUMP) | 4.9 | 0.0 | 9.8 | 0.0 |
| 11 | 3.4 | 6.7 | 10 | 3.3 | 0.1 | 5.1 | 1.6 |

## LEGEND

- DRAINAGE BASIN BOUNDARY
- B12 / 2.40 — DRAINAGE BASIN DESIGNATION / DRAINAGE BASIN AREA
- $Q_5$ = 2.9 cfs, $Q_{100}$ = 7.2 cfs — 5 YEAR PEAK DISCHARGE / 100 YEAR PEAK DISCHARGE
- FLOW DIRECTION ARROW
- 42" RCP 59.8 cfs 59.4 cfs — PIPE SIZE & TYPE / 5 YEAR PIPE FLOW / 100 YEAR PIPE FLOW

## DEVELOPED DRAINAGE BASIN DATA

| | BASIN | AREA | Q5 | Q100 |
|---|---|---|---|---|
| | OSA | 0.15 | 0.6 | 1.1 |
| | OSB | 0.46 | 1.8 | 3.3 |
| | OSC | 0.88 | 3.3 | 6.0 |
| | A1 | 0.96 | 2.0 | 4.0 |
| | A2 | 5.25 | 3.2 | 7.6 |
| | A3 | 0.51 | 1.4 | 2.8 |
| | A4 | 0.32 | 1.3 | 2.3 |
| | B1 | 2.27 | 4.1 | 8.2 |
| 1 | B2 | 0.70 | 2.0 | 3.8 |
| 3a | B3a | 0.77 | 1.7 | 3.4 |
| 3b | B3b | 2.53 | 4.8 | 9.6 |
| | B3c | 1.35 | 3.2 | 6.6 |
| | B4 | 0.51 | 1.4 | 2.7 |
| | B5 | 1.06 | 2.5 | 5.0 |
| 2 | B6 | 0.53 | 1.4 | 2.6 |
| 4 | B8 | 1.98 | 3.9 | 7.8 |
| 5 | B9 | 1.29 | 3.3 | 6.3 |
| 6 | B10 | 1.75 | 3.7 | 7.6 |
| | B11 | 1.88 | 3.9 | 7.9 |
| 10 | B12 | 2.48 | 4.9 | 9.8 |
| 11 | B13 | 2.30 | 5.1 | 10.2 |
| | B14 | 0.98 | 2.4 | 4.9 |
| | B15 | 0.24 | 1.1 | 2.1 |
| | C1 | 5.99 | 2.8 | 6.8 |
| | OSA+OSB+C1 | 6.19 | 3.6 | 8.1 |
| 3 | B3a+B3b+B3c | 4.65 | 8.4 | 16.9 |
| 7 | OSC+B1 | 3.15 | 6.6 | 12.8 |
| | OSC+B1+B2+B4 | 4.36 | 8.7 | 17.1 |
| 8 | OSC+B1+B2+B4+B5 | 5.42 | 10.3 | 20.3 |
| | OSC+B1+B2+B4+B5+B8 | 7.40 | 14.0 | 27.6 |
| 9 | OSC+B1+B2+B4+B5+B8+B9 | 8.69 | 15.2 | 30.5 |
| | B10+B11 | 3.63 | 7.5 | 15.2 |
| | A1+A2 | 6.21 | 4.6 | 10.6 |
| | B10+B11+B13+B15+A3 | 6.68 | 13.8 | 27.9 |




VICINITY MAP
N.T.S.

NORTH

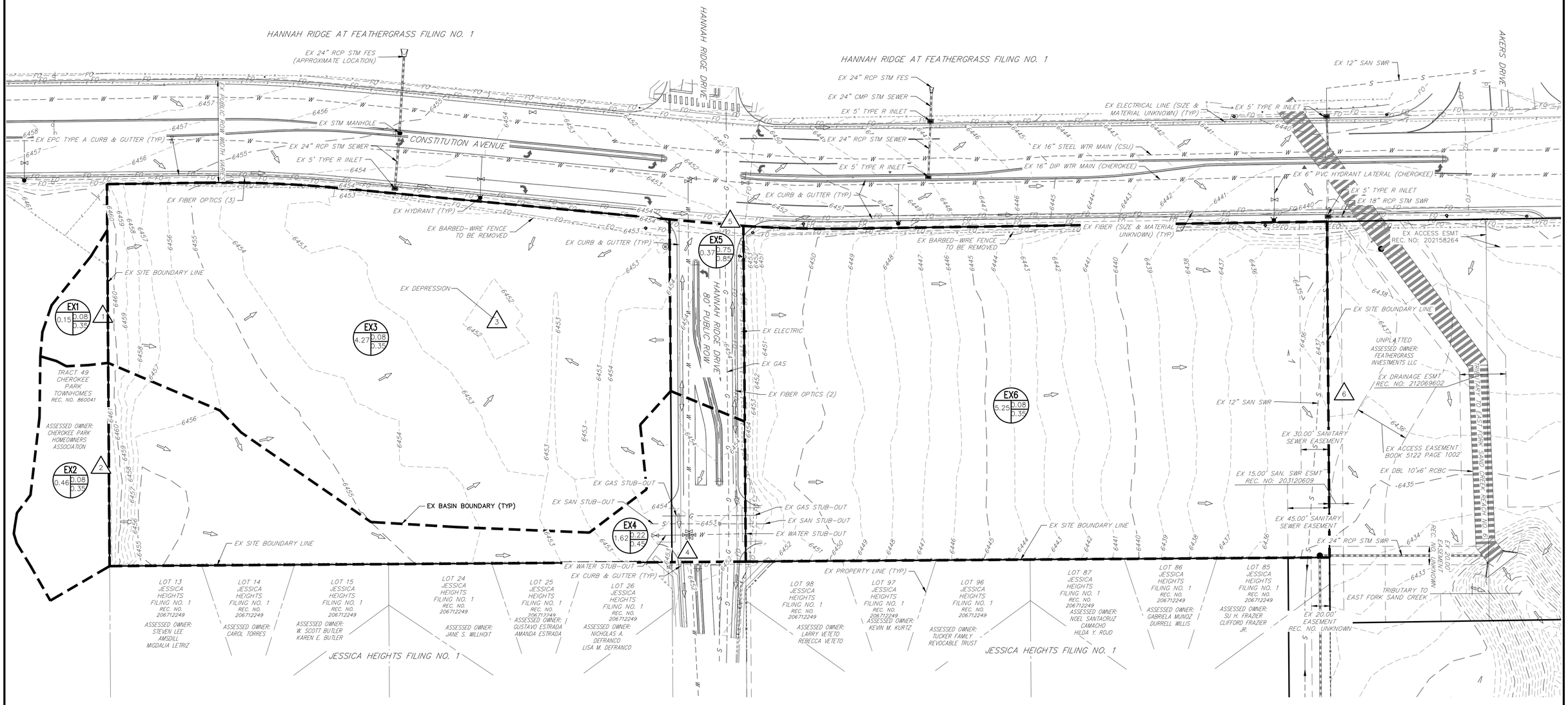
SCALE

80' 40' 0 40' 80' 160'
60' 20'
1"=80' 1:960

# Appendix F
# Drainage Maps

# URBAN COLLECTION AT PALMER VILLAGE

## EXISTING DRAINAGE MAP




### EXISTING BASIN SUMMARY TABLE

| Tributary Sub-basin | Area (acres) | Percent Impervious | $C_5$ | $C_{100}$ | $t_c$ (min) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|---|---|---|---|
| EX1 | 0.15 | 2% | 0.08 | 0.35 | 7.9 | 0.04 | 0.4 |
| EX2 | 0.46 | 2% | 0.08 | 0.35 | 8.1 | 0.2 | 1.2 |
| EX3 | 4.27 | 2% | 0.08 | 0.35 | 14.2 | 1.2 | 9.0 |
| EX4 | 1.62 | 19% | 0.22 | 0.45 | 17.9 | 1.1 | 4.0 |
| EX5 | 0.37 | 82% | 0.75 | 0.85 | 5.0 | 1.4 | 2.7 |
| EX6 | 5.25 | 2% | 0.08 | 0.35 | 14.4 | 1.5 | 11.1 |

### EXISTING DESIGN POINT SUMMARY TABLE

| DP | $Q_5$ | $Q_{100}$ |
|---|---|---|
| 1 | 0.04 | 0.4 |
| 2 | 0.2 | 1.2 |
| 3 | 1.3 | 9.3 |
| 4 | 1.3 | 4.9 |
| 5 | 1.4 | 2.7 |
| 6 | 1.5 | 11.1 |

### LEGEND

- I.D. (A: BASIN AREA, B: MINOR COEFFICIENT, C: MAJOR COEFFICIENT) — BASIN DESIGNATION
- I.D.: BASIN IDENTIFIER
- X — DESIGN POINT
- BASIN DELINEATION
- --6100-- EXISTING INDEX CONTOURS
- --6101-- EXISTING INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION

N

50 25 0 50

ORIGINAL SCALE: 1" = 50'

EXISTING DRAINAGE MAP
URBAN COLLECTION AT PALMER VILLAGE
JOB NO. 25149.01
01/30/2020
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

## BASIN 'A' SUMMARY TABLE

| Tributary Sub-basin | Area (acres) | Percent Impervious | $C_5$ | $C_{100}$ | $t_c$ (min) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|---|---|---|---|
| EX1 | 0.15 | 0% | 0.08 | 0.35 | 7.9 | 0.0 | 0.2 |
| EX2 | 0.46 | 0% | 0.08 | 0.35 | 8.1 | 0.2 | 0.7 |
| A1 | 0.78 | 74% | 0.65 | 0.77 | 5.5 | 2.6 | 5.0 |
| A2 | 0.22 | 67% | 0.63 | 0.76 | 7.8 | 0.6 | 1.3 |
| A3 | 0.11 | 63% | 0.60 | 0.74 | 6.2 | 0.3 | 0.7 |
| A4 | 0.62 | 75% | 0.65 | 0.76 | 5.2 | 2.0 | 4.0 |
| A5 | 0.83 | 54% | 0.50 | 0.65 | 7.0 | 1.9 | 4.2 |
| A6 | 0.18 | 84% | 0.74 | 0.84 | 7.9 | 0.6 | 1.1 |
| A7 | 0.46 | 67% | 0.60 | 0.73 | 5.8 | 1.3 | 2.7 |
| A8 | 0.74 | 47% | 0.44 | 0.61 | 7.8 | 1.5 | 3.5 |
| A9 | 0.57 | 72% | 0.66 | 0.77 | 6.9 | 1.8 | 3.5 |
| A10 | 0.78 | 5% | 0.12 | 0.38 | 9.4 | 0.4 | 2.1 |
| A11 | 0.17 | 43% | 0.44 | 0.61 | 9.5 | 0.3 | 0.7 |
| A12 | 0.14 | 36% | 0.37 | 0.57 | 8.0 | 0.2 | 0.6 |

## DESIGN POINT SUMMARY TABLE

| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|
| EX1 | 0.04 | 0.2 |
| EX2 | 0.2 | 0.7 |
| 1 | 2.3 | 4.8 |
| 2 | 2.0 | 4.7 |
| 3 | 3.0 | 6.1 |
| 4 | 2.4 | 5.7 |
| 4.1 | 4.8 | 9.3 |
| 5 | 1.9 | 4.2 |
| 5.1 | 6.6 | 13.4 |
| 6 | 1.8 | 4.8 |
| 7 | 1.5 | 3.5 |
| 8 | 2.3 | 5.9 |
| 8.1 | 8.7 | 14.9 |
| 9 | 3.4 | 9.2 |
| 9.1 | 11.8 | 23.8 |
| 10 | 12.1 | 25.6 |
| 11 | 0.3 | 0.7 |
| 12 | 0.2 | 0.6 |

## LEGEND

- I.D. (A: BASIN AREA, B: $C_5$, C: $C_{100}$) — BASIN DESIGNATION
- I.D.: BASIN IDENTIFIER
- X — DESIGN POINT
- BASIN DELINEATION
- 6100 — EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 6100 — PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED WATER LINE
- EXISTING FLOW DIRECTION
- PROPOSED FLOW DIRECTION

ORIGINAL SCALE: 1" = 30'

Know what's below. Call before you dig.

## ENGINEER'S STATEMENT

PREPARED UNDER MY DIRECT SUPERVISION AND ON BEHALF OF JR ENGINEERING

GLENN D. ELLIS, P.E.
COLORADO P.E. 38861
FOR AND ON BEHALF OF JR ENGINEERING, LLC

DATE

COLORADO REGISTERED PROFESSIONAL ENGINEER 38861 GLENN DAVID ELLIS

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
RICHMOND AMERICAN HOMES
4350 S. MONACO STREET
DENVER, CO 80237
(720) 977-3827
JASON.POCK@MDCH.COM

J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

| No. | REVISION | BY | DATE |
|---|---|---|---|
| | | | |

H-SCALE 1" = 30'
V-SCALE N/A
DATE 10/29/20
DESIGNED BY RPD
DRAWN BY RPD
CHECKED BY

URBAN COLLECTION AT PALMER VILLAGE

WEST DRAINAGE MAP

SHEET 1 OF 2

JOB NO. 25149.01

Label all tracts

label RCP and size

Label road / surfacing

Is this size right?

| BASIN 'B' SUMMARY TABLE | | | | | | | |
|---|---|---|---|---|---|---|---|
| Tributary Sub-basin | Area (acres) | Percent Impervious | $C_5$ | $C_{100}$ | $t_c$ (min) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
| B1 | 0.59 | 54% | 0.49 | 0.64 | 6.4 | 1.4 | 3.1 |
| B2 | 0.08 | 100% | 0.90 | 0.96 | 5.0 | 0.4 | 0.6 |
| B3 | 0.12 | 87% | 0.79 | 0.88 | 5.0 | 0.5 | 0.9 |
| B4 | 0.76 | 75% | 0.66 | 0.77 | 5.9 | 2.5 | 4.9 |
| B5 | 0.65 | 52% | 0.48 | 0.64 | 6.3 | 1.5 | 3.3 |
| B6 | 0.08 | 85% | 0.78 | 0.87 | 5.0 | 0.3 | 0.6 |
| B7 | 0.13 | 84% | 0.77 | 0.86 | 5.0 | 0.5 | 1.0 |
| B8 | 0.72 | 68% | 0.60 | 0.72 | 5.5 | 2.2 | 4.4 |
| B9 | 0.31 | 2% | 0.10 | 0.36 | 5.6 | 0.1 | 0.9 |
| B10 | 0.53 | 63% | 0.57 | 0.71 | 6.5 | 1.4 | 3.0 |
| B11 | 0.53 | 3% | 0.10 | 0.37 | 5.6 | 0.3 | 1.7 |
| B12 | 0.07 | 30% | 0.33 | 0.54 | 5.0 | 0.1 | 0.3 |
| B13 | 0.21 | 33% | 0.35 | 0.55 | 7.3 | 0.3 | 0.9 |
| B14 | 0.19 | 27% | 0.30 | 0.52 | 5.2 | 0.3 | 0.9 |
| B15 | 0.18 | 10% | 0.17 | 0.41 | 5.0 | 0.2 | 0.6 |
| B16 | 0.12 | 0% | 0.08 | 0.35 | 5.0 | 0.1 | 0.3 |

| DESIGN POINT SUMMARY TABLE | | |
|---|---|---|
| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
| 15 | 1.4 | 3.1 |
| 16 | 2.5 | 4.9 |
| 17 | 1.7 | 3.5 |
| 18 | 2.8 | 5.4 |
| 18.1 | 4.2 | 7.8 |
| 19 | 1.8 | 4.6 |
| 20 | 2.2 | 4.4 |
| 21 | 0.1 | 0.9 |
| 22 | 1.4 | 3.0 |
| 22.1 | 1.5 | 3.5 |
| 23 | 2.6 | 5.4 |
| 23.1 | 8.1 | 16.3 |
| 24 | 0.8 | 3.0 |
| 24.1 | 10.0 | 21.1 |
| 25 | 10.2 | 22.6 |
| 26 | 0.3 | 1.7 |
| 27 | 0.1 | 0.3 |
| 28 | 0.3 | 0.9 |
| 29 | 0.3 | 0.9 |
| 30 | 0.1 | 0.3 |

## LEGEND

- I.D. (A: BASIN AREA, B: $C_5$, C: $C_{100}$) — BASIN DESIGNATION
- I.D.: BASIN IDENTIFIER
- X — DESIGN POINT
- BASIN DELINEATION
- 6100 — EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 6100 — PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED WATER LINE
- EXISTING FLOW DIRECTION
- PROPOSED FLOW DIRECTION

ORIGINAL SCALE: 1" = 30'

Know what's below. Call before you dig.

## ENGINEER'S STATEMENT

PREPARED UNDER MY DIRECT SUPERVISION AND ON BEHALF OF JR ENGINEERING

GLENN D. ELLIS, P.E.
COLORADO P.E. 38861
FOR AND ON BEHALF OF JR ENGINEERING, LLC

DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
RICHMOND AMERICAN HOMES
4350 S. MONACO STREET
DENVER, CO 80237
(720) 977-3827
JASON.POCK@MDCH.COM

J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

| No. | REVISION | BY | DATE |
|---|---|---|---|
| | | | |

H-SCALE 1" = 30'
V-SCALE N/A
DATE 10/29/20
DESIGNED BY RPD
DRAWN BY RPD
CHECKED BY

URBAN COLLECTION AT PALMER VILLAGE

EAST DRAINAGE MAP

SHEET 2 OF 2

JOB NO. 25149.01