PRELIMINARY 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

July 2020
Project No. 25149.01

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

J·R ENGINEERING

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

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

COLORADO LICENSED GLENN DEAN ELLIS 38861 7/7/2020 PROFESSIONAL ENGINEER

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: Jason J.W. Peck

Title: VP of Land Acquisition & Entitlements

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:

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APPENDIX

PURPOSE

This document is the Preliminary 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 on six un-platted parcels 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. The parcels are planned to be platted after approval of the Development Plan. Refer to the vicinity map in Appendix A.

DESCRIPTION OF PROPERTY

A 100-unit residential development is proposed on the four western parcels (totaling 10.83 acres) (hereby referred to as the "site") per the corresponding preliminary Development Plan this drainage report supports. Two parcels are on the east side of Hannah Ridge Drive, and two are on the west side. The two parcels 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 plat of the proposed development. Any development of these two parcels shall require separate drainage analysis and drainage reports. The existing western parcels are undeveloped other than a sanitary sewer easement that follows the eastern border of the two parcels 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 inlet and discharges into a tributary to the East Fork Sand Creek.

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 travels along the Constitution Avenue curb and gutter until reaching an inlet and discharges into a tributary to the East Fork Sand Creek.

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

Basin A1 consists of approximately 0.74 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=2.0 cfs and Q_{100}=4.2 cfs) will be collected and conveyed in a 3.0' concrete pan, that follows the centerline of Vanhoutte View, to DP1. At DP1, flow enters Type A curb and gutter and is conveyed to an on-grade Double Denver Type 16 Combination Inlet (Double Type 16) at DP3, where it combines with Basin A2 flow. Discussion of DP3 captured flow versus flow-by is presented in the Basin A2 description.

Basin A2 consists of approximately 0.17 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 Type A curb and gutter in Wayfaring Tree Heights to an on-grade Double Type 16 at DP3. Total flows at DP3 are Q_5=2.4 cfs and Q_{100}=5.3 cfs. In the 5-year event, 1.9 cfs is captured, and 3.3 cfs is captured in the 100-year event. DP3 flow-by of Q_5=0.5 cfs and Q_{100}=2.0 cfs continues in curb and gutter to DP5 where it combines with Basin A5 flow. DP3 captured flows are piped in 18" RCP to DP8.1 before discharging into Pond A at DP10.

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 Type A curb and gutter in Wayfaring Tree Heights to an on-grade Double Type 16 at DP4, where it combines with Basin A4 flow. Total flows at DP4 are Q_5=2.4 cfs and Q_{100}=5.8 cfs. In the 5-year event, 1.9 cfs is captured and 3.5 cfs is captured in the 100-year event. DP4 flow-by of Q_5=0.5 cfs and Q_{100}=2.3 cfs continues in curb and gutter to DP6 where it combines with Basin A7 flow. DP4 captured flows are piped in 18" RCP to DP4.1, where it combines with flow from DP3 and ultimately discharges into Pond A at DP10.

Basin A4 consists of approximately 0.72 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=2.0 cfs and Q_{100}=4.2 cfs) will be collected and conveyed in a 3.0' concrete pan that follows the centerline of Vanhoutte View, to DP2. At DP2, flow enters Type A curb and gutter and is conveyed to an on-grade Double Type 16 at DP4, where it combines with Basin A3 flow. Discussion of DP4 captured flow versus flow-by is presented in the Basin A3 description.

Basin A5 consists of approximately 0.77 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.7 cfs and Q_{100}=3.8 cfs) will be collected and conveyed in a 3.0' concrete pan that follows the centerline of Serviceberry Grove, to DP5. At DP5, flow enters Type A curb and gutter and combines with DP3 flow-by. The combined flow is conveyed to a sump Double Type 16 at DP8, where it combines with Basin A6 and DP7 flow. Discussion of DP8 captured flow is presented in the Basin A6 description.

Basin A6 consists of approximately 0.26 acres and includes walks, drives, and landscape areas. Flow from this basin (Q_5=0.9 cfs and Q_{100}=1.6 cfs) will be collected and conveyed in Type A curb and gutter in Wayfaring Tree Heights to a sump Double Type 16 at DP8. The total combined flow at DP8 from DP5, DP7 and Basin A6 is Q_5=4.1 cfs and Q_{100}=10.0 cfs. All flow at DP8 is captured and piped in a 30" RCP to DP9.1, and discharges into Pond A at DP10. If the sump inlet at DP8 were to become clogged, overflows would spill over the crown to the Denver Triple Type 16 at DP9.

Basin A7 consists of approximately 0.54 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.3 cfs and Q_{100}=2.8 cfs) will be collected and conveyed in a 3.0' concrete pan that follows the centerline of Serviceberry Grove, to DP6. At DP6, flow enters Type A curb and gutter and combines with DP4 flow-by. The combined flow is conveyed to a sump Denver Triple Type 16 at DP9, where it combines with Basin A9 flow. Discussion of DP9 captured flow is presented in the Basin A9 description.

Basin A8 consists of approximately 0.70 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.4 cfs and Q_{100}=3.2 cfs) will be collected and conveyed in a 3.0' concrete pan that follows the centerline of Fountain Grass Grove, to DP7. At DP7, flow enters Type A curb and gutter and is conveyed to a sump Double Type 16 at DP8 where it combines with DP5 and Basin A6 flows. Discussion of DP8 captured flow is presented in the Basin A6 description.

Basin A9 consists of approximately 0.72 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.8 cfs and Q_{100}=3.8 cfs) will be collected and conveyed in Type A curb and gutter in Fountain Grass Grove to a sump Triple Type 16 at DP9. The total combined flow at DP9 from DP6 and Basin A9 is Q_5=3.3 cfs and Q_{100}=8.4 cfs. All flow at DP9 is captured and piped in 30" RCP to DP10. If the sump inlet at DP9 were to become clogged, overflows would overtop the curb and discharge directly into Pond A.

Basin A10 consists of approximately 0.46 acres of landscaped areas and contains Full Spectrum Water Quality and Detention Pond A. Flow from this basin (Q_5=0.2 cfs and Q_{100}=1.2 cfs) is captured in a grass-lined swale that discharges directly into Pond A where it combines with flow from Basins A1-A9. A detailed discussion of Full Spectrum Water Quality and Detention Pond A is presented in the Water Quality section later in this report.

Basin A11 consists of approximately 0.29 acres of landscaped area, emergency access, and sidewalk. Due to topographical constraints and the degree of development therein, Basin A11 (Q_5=0.4 cfs and Q_{1oo}=1.2 cfs) will discharge directly into Constitution Avenue curb and gutter.

Basin A12 consists of approximately 0.14 acres of landscaped area and sidewalk. Due to topographical constraints and the degree of development therein, Basin A11 (Q_5=0.2 cfs and Q_{1oo}=0.6 cfs) flow will discharge directly into Constitution Avenue curb and gutter.

Basin B1 consists of approximately 0.65 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.4 cfs and Q_{1oo}=3.3 cfs) will be collected and conveyed in a 3.0' concrete pan that follows the centerline of Fountain Grass Grove, to DP15. At DP15, flow enters Type A curb and gutter and is conveyed to an on-grade Double Denver Type 16 Combination Inlet (Double Type 16) at DP17, where it combines with Basin B2 flow. Discussion of DP17 captured flow versus flow-by is presented in the Basin B2 description.

Basin B2 consists of approximately 0.08 acres and includes walks and drives. Flow from this basin (Q_5=0.4 cfs and Q_{1oo}=0.7 cfs) will be collected and conveyed in Type A curb and gutter in Blue Avena View to an on-grade Double Type 16 at DP17. Total flows at DP17 from DP15 and Basin B2 are Q_5=1.7 cfs and Q_{1oo}=3.8 cfs. In the 5-year event, 1.4 cfs is captured and 2.4 cfs is captured in the 100-year event. DP17 flow-by of Q_5=0.3 cfs and Q_{1oo}=1.4 cfs continues in curb and gutter to 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, before discharging into Pond B at DP25.

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_{1oo}=0.9 cfs) will be collected and conveyed in Type A curb and gutter in Blue Avena View to an on-grade Double Type 16 at DP18, where it combines with DP16 flow. Total flows at DP18 from DP16 and Basin B3 are Q_5=2.8 cfs and Q_{1oo}=5.6 cfs. In the 5-year event, 2.0 cfs is captured and 3.1 cfs is captured in the 100-year event. DP18 flow-by of Q_5=0.8 cfs and Q_{1oo}=2.5 cfs continues in curb and gutter to DP20 where it combines with Basin B8 flow. DP18 captured flows are piped in 18" RCP to DP18.1 before discharging into Pond B at DP25.

Basin B4 consists of approximately 0.88 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=2.5 cfs and Q_{1oo}=5.1 cfs) will be collected and conveyed in a 3.0' concrete pan that follows the centerline of Fountain Grass Grove, to DP16. At DP16, flow enters Type A curb and gutter and is conveyed to an on-grade Double Type 16 at DP18, where it combines with Basin B3 flow. Discussion of DP18 captured flow versus flow-by is presented in the Basin B3 description.

Basin B5 consists of approximately 0.60 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.4 cfs and Q_{1oo}=3.1 cfs) will be collected and conveyed in a 3.0' concrete pan that follows the centerline of Purple Fountain Point, to an on-grade Single Type 16 at DP19, where it combines with DP17 flow-by. Total flows at DP19 from Basin B5 and DP17 flow-by are

Q_5=1.7 cfs and Q_{1oo}=4.6 cfs. In the 5-year event, 1.2 cfs is captured and 2.1 cfs is captured in the 100-year event. DP19 flow-by of Q_5=0.5 cfs and Q_{1oo}=2.5 cfs continues in curb and gutter to DP24 where it combines with Basin B6 flow. DP19 captured flow is conveyed to DP19 and piped in 18" RCP to DP 24.1 before discharging into Pond B at DP25.

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_{1oo}=0.6 cfs) will be collected and conveyed in Type A curb and gutter in Blue Avena View to a sump Triple Type 16 at DP24. The total combined flow at DP24 from Basin B6 and DP19 flow-by is Q_5=0.8 cfs and Q_{1oo}=3.0 cfs. All flow at DP24 is captured and piped in 30" RCP to DP24.1 before discharging into Pond B at DP25. If the sump inlet at DP24 were to become clogged, flow would overtop the curb and discharge directly into 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_{1oo}=1.0 cfs) will be collected and conveyed in Type A curb and gutter in Blue Avena View to a sump Denver Double Type 16 at DP23. The total combined flow at DP23 from Basin B7, DP20, and DP21 flow-by is Q_5=3.3 cfs and Q_{1oo}=8.3 cfs. All flow at DP23 is captured in the 5-year event, however; in the 100-year event 0.4 cfs is not captured and will overtop the street crown to the Triple Type 16 at DP24. Captured flows are piped to DP23.1 where it combines with flows from DP22.1 before discharging into Pond B at DP25.

Basin B8 consists of approximately 0.73 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=2.1 cfs and Q_{1oo}=4.3 cfs) will be collected and conveyed in a 3.0' concrete pan, that follows the centerline of Purple Fountain Point, to DP20. At DP20, flow enters Type A curb and gutter and combines with DP18 flow-by for a total flow of Q_5=2.6 cfs and Q_{1oo}=6.4 cfs. The combined flow is conveyed to a sump Denver Double Type 16 at DP23, where it combines with Basin B7 and DP22 flow-by flow. Discussion of DP23 captured flow is presented in the Basin B7 description.

Basin B9 consists of approximately 0.54 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.5 cfs and Q_{1oo}=3.1 cfs) will be collected and conveyed in Type A curb and gutter in Foerster Grass View, to DP22. At DP22, flow is captured in a Denver Double Type 16 (Q_5=1.4 cfs and Q_{1oo}=2.3 cfs). DP21 flow-by (Q_5=0.1 cfs and Q_{1oo}=0.8 cfs) continues in Type A curb and gutter to DP23 where it combines with Basin B7 and DP20 flow. Discussion of DP23 captured flow is presented in the Basin B7 description.

Basin B10 consists of approximately 0.48 acres of landscaped areas and contains Full Spectrum Water Quality and Detention Pond B. Flow from this basin (Q_5=0.2 cfs and Q_{1oo}=1.5 cfs) sheet flows directly into Pond B where it combines with flow from Basins B1-B9 and B15. A detailed discussion of Full Spectrum Water Quality and Detention Pond B is presented in the Water Quality section later in this report.

Basin B11 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=0.5 cfs and Q_{100}=1.2 cfs) follows historic drainage patterns and sheet flows offsite, along the eastern site boundary, eventually flowing directly into the Tributary to Sand Creek – East Fork Reach No. 6.

Basin B12 consists of approximately 0.07 acres of landscaped areas and sidewalk. Due to topographical constraints and the degree of development therein, flow from this basin (Q_5=0.1 cfs and Q_{100}=0.3 cfs) will discharge directly into Constitution Avenue curb and gutter.

Basin B13 consists of approximately 0.23 acres of landscaped areas and sidewalk. Due to topographical constraints and the degree of development therein, flow from this basin (Q_5=0.3 cfs and Q_{100}=0.9 cfs) will discharge directly into Constitution Avenue curb and gutter.

Basin B14 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}=0.4 cfs) follows historic drainage patterns and sheet flows easterly offsite to Tributary to Sand Creek – East Fork Reach No. 6.

Basin B15 consists of approximately 0.24 acres of landscaped areas and sidewalk. Flow from this basin (Q_5=0.4 cfs and Q_{100}=1.0 cfs) is conveyed in a grass-lined swale to a Type C Inlet at DP21. All Basin B15 flow is captured at DP21 and is piped in 18" RCP to DP22.1 (Q_5=1.7 cfs and Q_{100}=3.2 cfs) where it combines with captured flows at DP22. Basin B15's ultimate outfall is Pond B at DP25.

Basin B16 consists of approximately 0.11 acres of landscaped areas and will remain undeveloped. Flow from this basin (Q_5=0.1 cfs and Q_{100}=0.4 cfs) is conveyed in a grass-lined swale onsite before discharging to the east. 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 will be used to model the proposed storm sewer system and to analyze the proposed HGL calculations for Construction Drawings.

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.

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.

WATER QUALITY

The site is split by Hannah Ridge Drive, therefore; a full spectrum water quality and detention pond is provided on both sides. Basin A, located west of Hannah Ridge Drive, will discharge to Pond A, while the east side of Hannah Ridge Drive, Basin B, 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 5.80 acres at 48.4% impervious from Basins A1-A10. The total WQCV is 0.098 ac-ft, the excess urban runoff volume (EURV) is 0.223 ac-ft, and the total required detention volume is 0.514 ac-ft. The WQCV is released over 41 hours, the EURV is released over 72 hours, and the 100-year volume is released over 86 hours. The 100-year discharge of 2.2 cfs is equal to 90% of predevelopment rates. A riprap spillway is provided that conveys the full undetained, peak 100-year flow of 25.3 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 below the emergency spillway to capture emergency flows. 12” RCP connects overflow inlets to the next downstream manhole.

Pond A’s outlet structure outfalls into an 18” RCP, eventually upsizing to 24” RCP, that flows along the site’s southern property line before discharging into the existing double 10 x 6’ RCBC located in the adjacent parcel, east of the eastern parcel. 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 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 4.28 acres at 56.5% impervious from Basins B1-B10 & B15. The total WQCV is 0.080 ac-ft, the excess urban runoff volume (EURV) is 0.208 ac-ft and the total required detention volume is 0.444 ac-ft. The WQCV is released over 40 hours, the

EURV is released over 76 hours and the 100-year volume is released over 95 hours. The 100-year discharge of 1.7 cfs is equal to 90% of predevelopment rates. A riprap spillway is provided that conveys the full undetained, peak 100-year flow of 21.9 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 below the emergency spillway to capture emergency flows. 12" RCP connects overflow inlets to the next downstream manhole.

The pond outfalls into an 18" RCP that flows easterly before discharging into the existing double 10' x 6' RCBC located in the adjacent parcel to the east. 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

We respectfully request that the Erosion Control Plan and Cost Estimate be submitted in conjunction with the grading and erosion control plan and construction assurances posted prior to obtaining a grading permit. The PUDSP plan set includes a preliminary grading plan.

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.

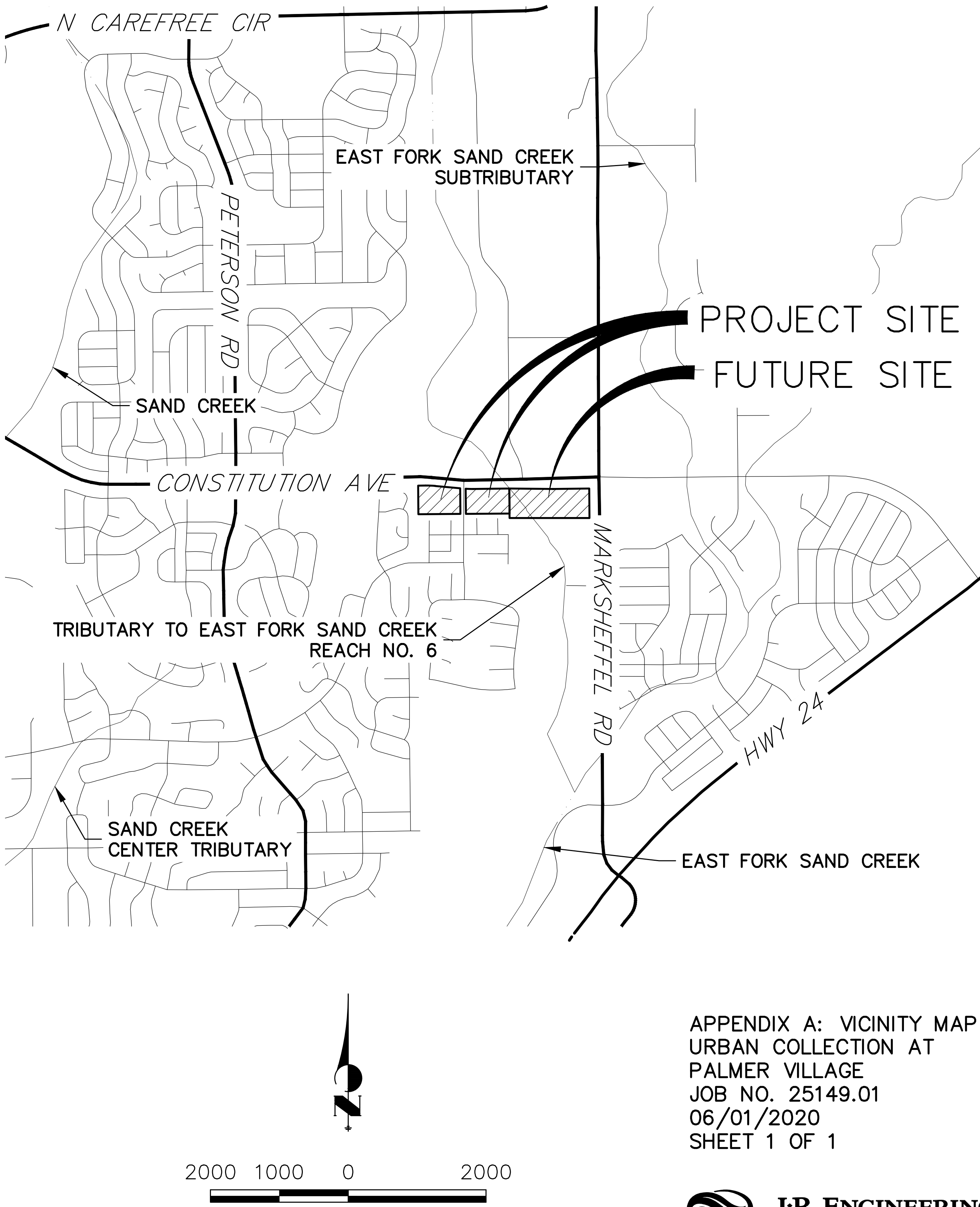
2. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.

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



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

X:\2510000.all\2514901\Drawings\Blocks\2514901_VicinityMap.dwg, Drainage, 5/29/2020 8:55:07 AM, CS

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.

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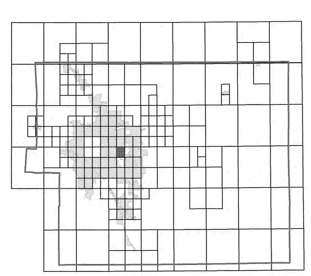
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

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	

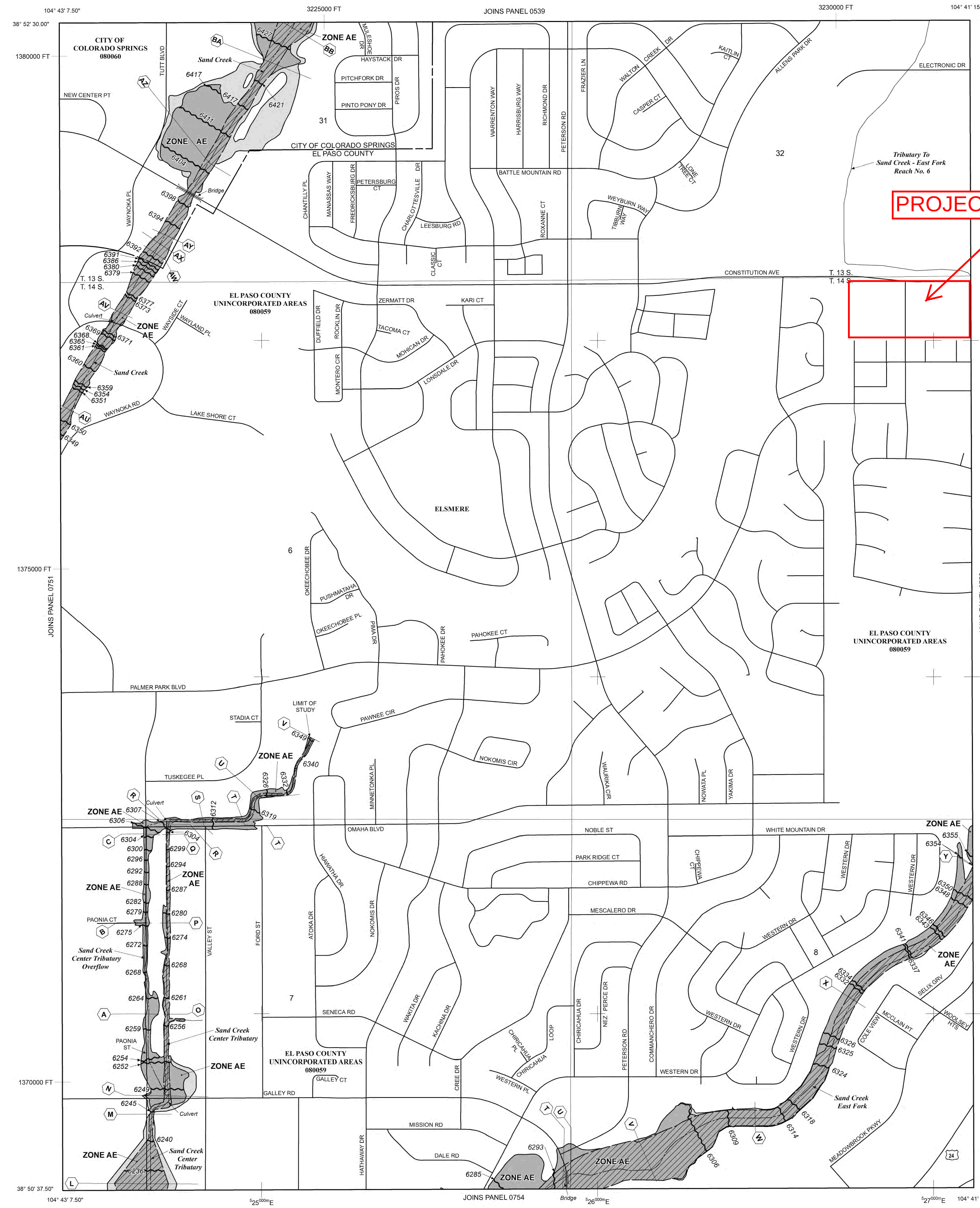
Panel Location Map



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).

COLORADO WATER CONSERVATION BOARD · STATE OF COLORADO · NIL SINE NUMINE · 1876 · 1937

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
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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.

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N

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0752G

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

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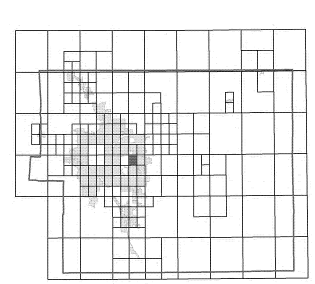

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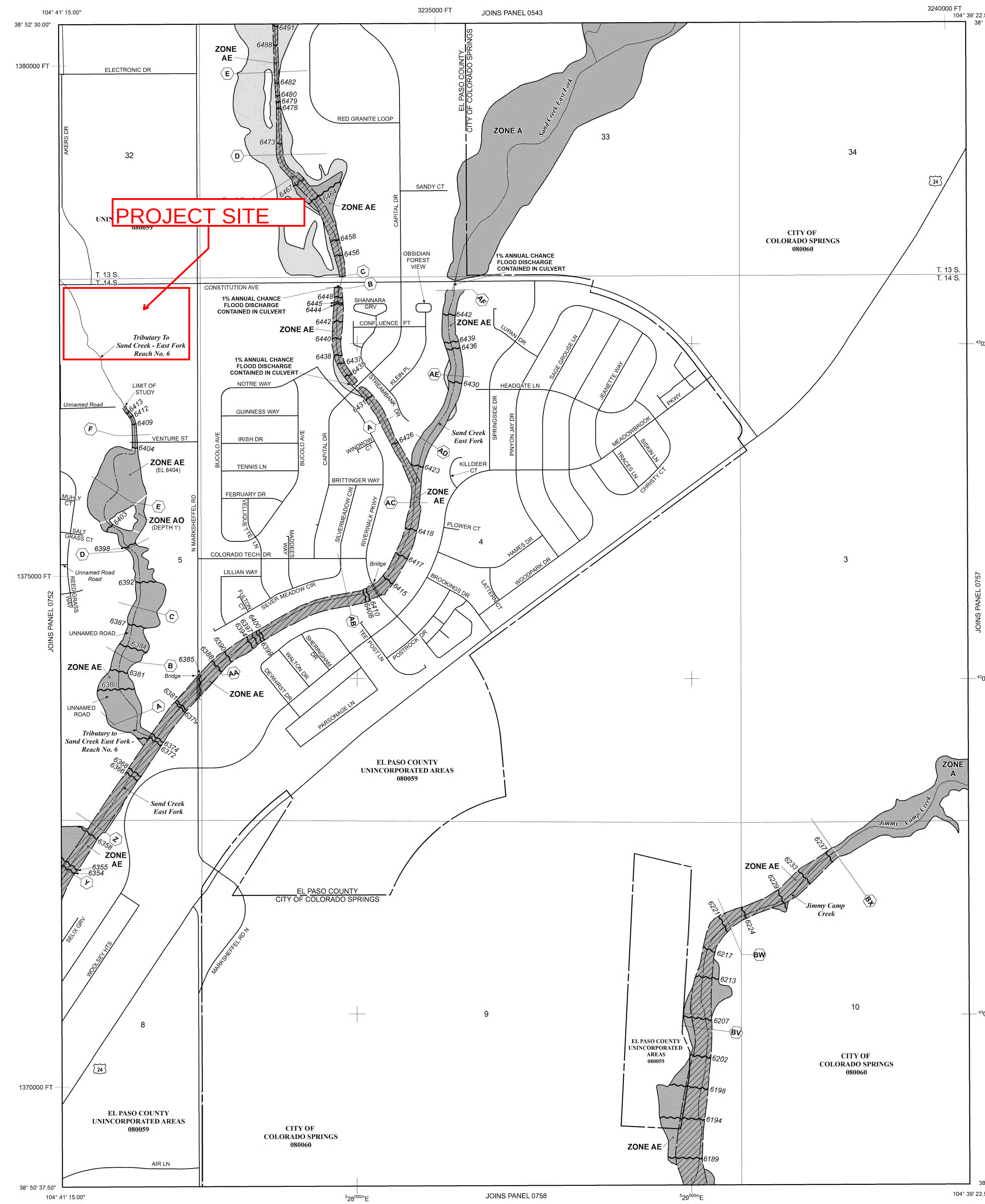

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST, AND TOWNSHIP 14 SOUTH, RANGE 65 WEST.

LEGEND

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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

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	Floodway boundary
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	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
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(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
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6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
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MAP REPOSITORIES
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EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
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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


104° 41' 33" W
104° 41' 13" W
526690
526740
526790
526840
526890
526940
526990
527040
527090
527140
38° 52' 7" N
38° 51' 57" N
4302260
4302210
4302160
4302110
4302060
4302010
4301960
Constitution
Constitution Ave
8
Soil Map may not be valid at this scale.
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).

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

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ 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).

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

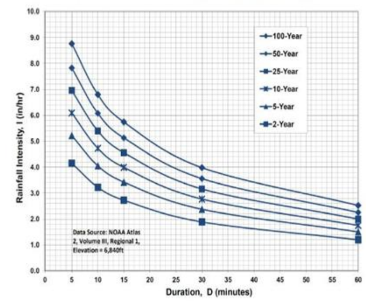
Subdivision: PALMER VILLAGE
Location: Colorado Springs
Design Storm: 5-Year

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

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

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

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

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

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

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	0.04	0.4
EX2	0.46	0%	0.08	0.35	8.1	0.2	1.2
A1	0.74	63%	0.56	0.70	6.4	2.0	4.2
A2	0.17	71%	0.66	0.78	7.4	0.5	1.0
A3	0.11	64%	0.60	0.74	6.1	0.3	0.7
A4	0.72	65%	0.58	0.71	5.9	2.0	4.2
A5	0.77	51%	0.47	0.63	7.2	1.7	3.8
A6	0.26	83%	0.74	0.84	7.9	0.9	1.6
A7	0.54	54%	0.50	0.66	6.8	1.3	2.8
A8	0.70	47%	0.44	0.61	7.8	1.4	3.2
A9	0.72	60%	0.56	0.70	8.0	1.8	3.8
A10	0.46	4%	0.12	0.38	9.5	0.2	1.2
A11	0.29	28%	0.33	0.61	11.0	0.4	1.2
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	1.9	4.3
2	2.0	5.0
3	2.4	5.3
4	2.4	5.8
4.1	3.8	6.7
5	2.1	5.6
6	1.7	4.9
7	1.4	3.3
8	4.1	10.0
8.1	7.7	16.3
9	3.3	8.4
9.1	10.8	24.1
10	11.0	25.3

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	0.65	51%	0.47	0.63	6.5	1.4	3.3
B2	0.08	100%	0.90	0.96	5.0	0.4	0.7
B3	0.11	91%	0.83	0.90	5.0	0.5	0.9
B4	0.88	66%	0.59	0.72	6.7	2.5	5.1
B5	0.60	53%	0.49	0.64	6.2	1.4	3.1
B6	0.08	88%	0.80	0.88	5.0	0.3	0.6
B7	0.13	85%	0.77	0.87	5.0	0.5	1.0
B8	0.73	65%	0.58	0.71	5.7	2.1	4.3
B9	0.54	64%	0.58	0.71	6.5	1.5	3.1
B10	0.48	2%	0.10	0.36	5.7	0.2	1.5
B11	0.19	58%	0.55	0.70	5.0	0.5	1.2
B12	0.07	29%	0.31	0.52	5.1	0.1	0.3
B13	0.23	30%	0.33	0.54	7.5	0.3	0.9
B14	0.12	0%	0.08	0.35	5.0	0.1	0.4
B15	0.24	25%	0.29	0.50	5.0	0.4	1.0
B16	0.11	9%	0.15	0.41	5.0	0.1	0.4

DESIGN POINT SUMMARY TABLE		
Design Point	Q_5 (cfs)	Q_{100} (cfs)
15	1.4	3.3
16	2.5	5.1
17	1.7	3.8
18	2.8	5.6
18.1	3.4	5.5
19	1.7	4.6
20	2.6	6.4
21	0.4	1.0
22	1.5	3.1
22.1	1.7	3.2
23	3.3	8.3
23.1	8.1	16.0
24	0.8	3.0
24.1	9.9	20.7
25	10.1	21.9

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: NQJ
Checked By:
Date: 2/6/20

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	0.74	100%	0.19	25.7%	90%	0.31	37.7%	0%	0.24	0.0%	63.4%
A2	0.17	100%	0.12	70.6%	90%	0.00	0.0%	0%	0.05	0.0%	70.6%
A3	0.11	100%	0.07	63.6%	90%	0.00	0.0%	0%	0.04	0.0%	63.6%
A4	0.72	100%	0.19	26.4%	90%	0.31	38.8%	0%	0.22	0.0%	65.1%
A5	0.77	100%	0.16	20.8%	90%	0.26	30.4%	0%	0.35	0.0%	51.2%
A6	0.26	100%	0.17	65.4%	90%	0.05	17.3%	0%	0.04	0.0%	82.7%
A7	0.54	100%	0.15	27.8%	90%	0.16	26.7%	0%	0.23	0.0%	54.4%
A8	0.70	100%	0.14	20.0%	90%	0.21	27.0%	0%	0.35	0.0%	47.0%
A9	0.72	100%	0.34	47.2%	90%	0.10	12.5%	0%	0.28	0.0%	59.7%
A10	0.46	100%	0.02	4.3%	90%	0.00	0.0%	0%	0.44	0.0%	4.3%
A11	0.29	100%	0.08	27.6%	90%	0.00	0.0%	0%	0.29	0.0%	27.6%
A12	0.14	100%	0.05	35.7%	90%	0.00	0.0%	0%	0.09	0.0%	35.7%
B1	0.65	100%	0.14	21.5%	90%	0.21	29.1%	0%	0.30	0.0%	50.6%
B2	0.08	100%	0.08	100.0%	90%	0.00	0.0%	0%	0.00	0.0%	100.0%
B3	0.11	100%	0.10	90.9%	90%	0.00	0.0%	0%	0.01	0.0%	90.9%
B4	0.88	100%	0.31	35.2%	90%	0.30	30.7%	0%	0.27	0.0%	65.9%
B5	0.60	100%	0.13	21.7%	90%	0.21	31.5%	0%	0.26	0.0%	53.2%
B6	0.08	100%	0.07	87.5%	90%	0.00	0.0%	0%	0.01	0.0%	87.5%
B7	0.13	100%	0.11	84.6%	90%	0.00	0.0%	0%	0.02	0.0%	84.6%
B8	0.73	100%	0.19	26.0%	90%	0.32	39.5%	0%	0.22	0.0%	65.5%
B9	0.54	100%	0.20	37.0%	90%	0.16	26.7%	0%	0.18	0.0%	63.7%
B10	0.48	100%	0.01	2.1%	90%	0.00	0.0%	0%	0.47	0.0%	2.1%
B11	0.19	100%	0.11	57.9%	90%	0.00	0.0%	0%	0.08	0.0%	57.9%
B12	0.07	100%	0.02	28.6%	90%	0.00	0.0%	0%	0.05	0.0%	28.6%
B13	0.23	100%	0.07	30.4%	90%	0.00	0.0%	0%	0.16	0.0%	30.4%
B14	0.12	100%	0.00	0.0%	90%	0.00	0.0%	0%	0.12	0.0%	0.0%
B15	0.24	100%	0.06	25.0%	90%	0.00	0.0%	0%	0.18	0.0%	25.0%
B16	0.11	100%	0.01	9.1%	90%	0.00	0.0%	0%	0.10	0.0%	9.1%
SITE TOTAL	11.47									SITE	49.1%
WEST POND	5.80									WEST POND	48.4%
EAST POND	4.28									EAST POND	56.5%

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: NQJ
Checked By:
Date: 2/6/20

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	0.74	63%	0.74	0.00	0.00	0.19	0.31	0.24	0.90	0.73	0.08	0.96	0.81	0.35	0.56	0.70
A2	0.17	71%	0.17	0.00	0.00	0.12	0.00	0.05	0.90	0.73	0.08	0.96	0.81	0.35	0.66	0.78
A3	0.11	64%	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	0.72	65%	0.72	0.00	0.00	0.19	0.31	0.22	0.90	0.73	0.08	0.96	0.81	0.35	0.58	0.71
A5	0.77	51%	0.77	0.00	0.00	0.16	0.26	0.35	0.90	0.73	0.08	0.96	0.81	0.35	0.47	0.63
A6	0.26	83%	0.26	0.00	0.00	0.17	0.05	0.04	0.90	0.73	0.08	0.96	0.81	0.35	0.74	0.84
A7	0.54	54%	0.54	0.00	0.00	0.15	0.16	0.23	0.90	0.73	0.08	0.96	0.81	0.35	0.50	0.66
A8	0.70	47%	0.70	0.00	0.00	0.14	0.21	0.35	0.90	0.73	0.08	0.96	0.81	0.35	0.44	0.61
A9	0.72	60%	0.72	0.00	0.00	0.34	0.10	0.28	0.90	0.73	0.08	0.96	0.81	0.35	0.56	0.70
A10	0.46	4%	0.46	0.00	0.00	0.02	0.00	0.44	0.90	0.73	0.08	0.96	0.81	0.35	0.12	0.38
A11	0.29	28%	0.29	0.00	0.00	0.08	0.00	0.29	0.90	0.73	0.08	0.96	0.81	0.35	0.33	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	0.65	51%	0.65	0.00	0.00	0.14	0.21	0.30	0.90	0.73	0.08	0.96	0.81	0.35	0.47	0.63
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	0.11	91%	0.11	0.00	0.00	0.10	0.00	0.01	0.90	0.73	0.08	0.96	0.81	0.35	0.83	0.90
B4	0.88	66%	0.88	0.00	0.00	0.31	0.30	0.27	0.90	0.73	0.08	0.96	0.81	0.35	0.59	0.72
B5	0.60	53%	0.60	0.00	0.00	0.13	0.21	0.26	0.90	0.73	0.08	0.96	0.81	0.35	0.49	0.64
B6	0.08	88%	0.08	0.00	0.00	0.07	0.00	0.01	0.90	0.73	0.08	0.96	0.81	0.35	0.80	0.88
B7	0.13	85%	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	0.87
B8	0.73	65%	0.73	0.00	0.00	0.19	0.32	0.22	0.90	0.73	0.08	0.96	0.81	0.35	0.58	0.71
B9	0.54	64%	0.54	0.00	0.00	0.20	0.16	0.18	0.90	0.73	0.08	0.96	0.81	0.35	0.58	0.71
B10	0.48	2%	0.48	0.00	0.00	0.01	0.00	0.47	0.90	0.73	0.08	0.96	0.81	0.35	0.10	0.36
B11	0.19	58%	0.19	0.00	0.00	0.11	0.00	0.08	0.90	0.73	0.08	0.96	0.81	0.35	0.55	0.70
B12	0.07	29%	0.07	0.00	0.00	0.02	0.00	0.05	0.90	0.73	0.08	0.96	0.81	0.35	0.31	0.52
B13	0.23	30%	0.23	0.00	0.00	0.07	0.00	0.16	0.90	0.73	0.08	0.96	0.81	0.35	0.33	0.54
B14	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
B15	0.24	25%	0.24	0.00	0.00	0.06	0.00	0.18	0.90	0.73	0.08	0.96	0.81	0.35	0.29	0.50
B16	0.11	9%	0.11	0.00	0.00	0.01	0.00	0.10	0.90	0.73	0.08	0.96	0.81	0.35	0.15	0.41
TOTAL	11.47	49.1%	11.47	0.00	0.00	3.29	2.60	5.66	---	---	---	---	---	---	0.46	0.63

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: NQJ
Checked By:
Date: 2/6/20

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	0.74	A	63%	0.56	0.70	87	5.0%	5.3	155	1.4%	20.0	2.4	1.1	6.4	242.0	16.4	6.4
A2	0.17	A	71%	0.66	0.78	87	2.0%	5.9	180	1.0%	20.0	2.0	1.5	7.4	267.0	15.6	7.4
A3	0.11	A	64%	0.60	0.74	87	6.0%	4.6	180	1.0%	20.0	2.0	1.5	6.1	267.0	16.9	6.1
A4	0.72	A	65%	0.58	0.71	87	6.0%	4.9	150	1.6%	20.0	2.5	1.0	5.9	237.0	16.0	5.9
A5	0.77	A	51%	0.47	0.63	87	5.0%	6.2	150	1.6%	20.0	2.5	1.0	7.2	237.0	18.5	7.2
A6	0.26	A	83%	0.74	0.84	99	1.0%	6.4	178	1.0%	20.0	2.0	1.5	7.9	277.0	13.4	7.9
A7	0.54	A	54%	0.50	0.66	87	5.5%	5.8	153	1.6%	20.0	2.5	1.0	6.8	240.0	18.0	6.8
A8	0.70	A	47%	0.44	0.61	90	4.5%	6.9	115	1.1%	20.0	2.1	0.9	7.8	205.0	19.2	7.8
A9	0.72	A	60%	0.56	0.70	87	3.0%	6.4	200	1.0%	20.0	2.0	1.7	8.0	287.0	17.8	8.0
A10	0.46	A	4%	0.12	0.38	50	15.0%	5.1	325	0.7%	15.0	1.3	4.3	9.5	375.0	32.0	9.5
A11	0.29	A	28%	0.33	0.61	90	2.0%	10.5	55	1.0%	20.0	2.0	0.5	11.0	145.0	22.0	11.0
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	0.65	A	51%	0.47	0.63	97	8.0%	5.7	105	1.0%	20.0	2.0	0.9	6.5	202.0	18.5	6.5
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	0.11	A	91%	0.83	0.90	12	2.0%	1.4	190	2.3%	20.0	3.0	1.0	2.4	202.0	11.5	5.0
B4	0.88	A	66%	0.59	0.72	120	6.0%	5.6	183	2.0%	20.0	2.8	1.1	6.7	303.0	16.0	6.7
B5	0.60	A	53%	0.49	0.64	97	8.0%	5.5	103	1.6%	20.0	2.5	0.7	6.2	200.0	17.8	6.2
B6	0.08	A	88%	0.80	0.88	12	2.0%	1.5	160	2.5%	20.0	3.2	0.8	2.3	172.0	11.9	5.0
B7	0.13	A	85%	0.77	0.87	12	2.0%	1.6	170	2.5%	20.0	3.2	0.9	2.5	182.0	12.5	5.0
B8	0.73	A	65%	0.58	0.71	97	9.0%	4.5	145	1.0%	20.0	2.0	1.2	5.7	242.0	16.2	5.7
B9	0.54	A	64%	0.58	0.71	87	5.0%	5.2	155	1.0%	20.0	2.0	1.3	6.5	242.0	16.6	6.5
B10	0.48	A	2%	0.10	0.36	15	2.0%	5.6	40	33.0%	15.0	8.6	0.1	5.7	55.0	25.8	5.7
B11	0.19	A	58%	0.55	0.70	20	2.0%	3.5	20	2.0%	20.0	2.8	0.1	3.6	40.0	16.3	5.0
B12	0.07	A	29%	0.31	0.52	20	2.0%	5.0	19	2.5%	20.0	3.2	0.1	5.1	39.0	21.3	5.1
B13	0.23	A	30%	0.33	0.54	20	2.0%	4.9	450	2.2%	20.0	3.0	2.5	7.5	470.0	24.6	7.5
B14	0.12	A	0%	0.08	0.35	20	25.0%	2.8	35	25.0%	15.0	7.5	0.1	2.9	55.0	26.1	5.0
B15	0.24	A	25%	0.29	0.50	15	10.0%	2.7	365	3.0%	15.0	2.6	2.3	5.0	380.0	24.6	5.0
B16	0.11	A	9%	0.15	0.41	15	10.0%	3.1	150	1.5%	15.0	1.9	1.3	4.4	165.0	26.4	5.0

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Project Name: PALMER VILLAGE

ɔdivision: PALMER VILLAGE — Project No.: 2514901

Location: Colorado Springs — Calculated By: NQJ

ɟn Storm: 5-Year — Checked By:

Date: 2/6/20

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	0.04															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	0.74	0.56	6.4	0.42	4.80	2.0	7.9	0.43	4.49	1.9	1.9	0.43	1.0					170	2.0	1.4	BASIN A1 & DPEX1 FLOW @ DP1, C&G FLOW TO DP3
		A2	0.17	0.66	7.4	0.11	4.58	0.5															BASIN A2 FLOW @ DP3 (ROUTED IN SF2)
		A3	0.11	0.60	6.1	0.07	4.86	0.3															BASIN A3 FLOW @ DP4 (ROUTED IN SF2)
	2	A4	0.72	0.58	5.9	0.41	4.92	2.0	8.1	0.45	4.45	2.0	2.0	0.45	1.0					170	2.0	1.4	BASIN A4 & DPEX2 FLOW @ DP2, C&G TO DP4
	3								7.8	0.54	4.50	2.4	0.5	0.12	1.0	1.9	0.42	2.0	18	60 5	2.0 5.6	0.5 0.0	DP3 FLOW-BY, C&G FLOW TO DP5 DP1 & BASIN A2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET, PIPE TO DP4.1
	4								7.3	0.52	4.60	2.4	0.5	0.11	1.0	1.9	0.41	2.0	18	60 31	2.0 5.6	0.5 0.1	DP4 FLOW-BY, C&G FLOW TO DP6 BASIN A3 & DP2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET, PIPE TO DP4.1
	4.1								7.8	0.84	4.50	3.8				3.8	4.50	2.0	18	123	6.9	0.3	COMBINED DP3&DP4 CAPTURED FLOW, PIPE FLOW TO DP8.1
	5	A5	0.77	0.47	7.2	0.36	4.61	1.7	8.3	0.48	4.41	2.1	2.1	0.48	1.0					115	2.0	1.0	BASIN A5 & DP3 FLOW by @ DP5, C&G FLOW TO DP8
		A6	0.26	0.74	7.9	0.19	4.48	0.9															BASIN A6 FLOW @ DP8 (ROUTED IN SF2)
	6	A7	0.54	0.50	6.8	0.27	4.71	1.3	7.8	0.38	4.50	1.7	1.7	0.38	1.0					130	2.0	1.1	BASIN A7 FLOW & DP4 FLOW-BY @ DP6, C&G FLOW TO DP9
	7	A8	0.70	0.44	7.8	0.31	4.50	1.4					1.4	0.31	1.0					100	2.0	0.8	BASIN A8 FLOW @ DP7, C&G FLOW TO DP8
	8								9.3	0.98	4.24	4.1				4.1	0.98	2.0	30	5	6.7	0.0	BASIN A6, DP5 & DP7 FLOW @ DP8, CAPTURED BY DBL. DENVER TYPE 16 COMBO INLET, PIPE FLOW TO DP9.1
	8.1								9.3	1.81	4.24	7.7				7.7	1.81	2.0	30	55	2.0	0.5	DP4.1 & DP8 FLOW @ DP8.1, PIPE FLOW TO DP9.1
	9	A9	0.72	0.56	8.0	0.40	4.46	1.8	8.9	0.78	4.31	3.3				3.3	0.78	2.0	30	5	6.4	0.0	DP6 & BASIN A9 FLOW @ DP9, CAPTURED BY TRP. DENVER TYPE 16 COMBO INLET, PIPE FLOW TO DP9.1
	9.1								9.7	2.59	4.17	10.8				10.8	2.59	5.0	30	55	12.5	0.1	DP8.1 & DP9 FLOW @ DP9.1, PIPE FLOW TO DP10 (WATER QUALITY POND)
	10	A10	0.46	0.12	9.5	0.05	4.21	0.2	9.8	2.64	4.16	11.0											BASIN A1-10 FLOW @ DP10, TOTAL FLOW ENTERING WATER QUALITY POND
		A11	0.29	0.33	11.0	0.10	3.99	0.4															BASIN A11 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE
		A12	0.14	0.37	8.0	0.05	4.47	0.2															BASIN A12 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE

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: NQJ
Checked By:
Date: 2/6/20

		DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			
STREET	Design Point	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)	REMARKS
													1.4	0.30	2.33					160	3.1	0.9	BASIN B1 FLOW @ DP15, C&G FLOW TO DP17
	15	B1	0.65	0.47	6.5	0.30	4.76	1.4															
													0.3	0.06	2.3					70	3.1	0.4	DP17 FLOW-BY, C&G FLOW TO DP19
	17	B2	0.08	0.90	5.0	0.07	5.17	0.4	7.4	0.37	4.58	1.7				1.4	0.31	5.0	18	33	7.2	0.1	BASIN B2 AND DP15 FLOW @ DP17, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET, PIPE TO DP18.1
		B3	0.11	0.83	5.0	0.09	5.17	0.5															BASIN B3 FLOW @ DP18 (ROUTED IN SF2)
													2.5	0.52	2.3					185	3.1	1.0	BASIN B4 FLOW @ DP16, C&G FLOW TO DP18
	16	B4	0.88	0.59	6.7	0.52	4.74	2.5															
													0.8	0.17	2.3					75	3.0	0.4	DP18 FLOW-BY, C&G FLOW TO DP20
	18								7.7	0.61	4.53	2.8				2.0	0.44	2.0	18	5	5.7	0.0	BASIN B3 & DP16 FLOW @ DP18, CAPTURED BY DBL. DENVER TYPE 16 COMBO INLET, PIPE TO DP18.1
	18.1								7.7	0.75	4.52	3.4				3.4	0.75	2.0	18	160	6.7	0.4	DP17 & DP18 CAPTURED FLOW, PIPE FLOW TO DP22.1
													0.5	0.11	2.5					103	3.2	0.5	DP19 FLOW-BY, C&G FLOW TO DP23
	19	B5	0.60	0.49	6.2	0.29	4.85	1.4	6.2	0.35	4.85	1.7				1.2	0.25	2.0	18	103	5.0	0.3	BASIN B5 & DP17 FLOW-BY @ DP19, CAPTURED IN SINGLE DENVER TYPE 16 COMBO INLET, PIPE TO DP23.1
		B6	0.08	0.80	5.0	0.06	5.17	0.3															BASIN B6 FLOW AT DP23 (ROUTED IN SF2)
		B7	0.13	0.77	5.0	0.10	5.17	0.5															BASIN B7 FLOW AT DP22 (ROUTED IN SF2)
													2.6	0.59	2.5					125	3.2	0.7	BASIN B8 & DP18 FLOW-BY @DP20, C&G FLOW TO DP22
	20	B8	0.73	0.58	5.7	0.42	4.97	2.1	8.1	0.59	4.45	2.6											
	21	B15	0.24	0.29	5.0	0.07	5.17	0.4								0.4	0.07	1.0	18	145	2.6	0.9	BASIN B15 FLOW @ DP21, CAPTURED IN TYPE C INLET, PIPED TO DP22.1
													0.1	0.02	1					65	2.0	0.5	DP22 FLOW-BY, C&G FLOW TO DP23
	22	B9	0.54	0.58	6.5	0.31	4.78	1.5								1.4	0.29	2.0	18	45	5.1	0.1	BASIN B9 FLOW CAPTURED BY DBL DENVER TYPE 16 COMBO INLET, PIPE TO DP22.1
	22.1								6.6	0.36	4.75	1.7				1.7	0.36	2.0	18	25	5.5	0.1	COMBINED DP21 & DP22 CAPTURED FLOW, PIPE TO DP23.1
	23								7.0	0.71	4.66	3.3				3.3	0.71	5.0	18	33	9.3	0.1	BASIN B7, DP20 FLOW-BY & DP22 FLOW-BY@ DP23, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET, PIPE TO DP23.1
	23.1								8.1	1.82	4.45	8.1				8.1	1.82	3.0	24	33	9.7	0.1	DP23 CAPTURED FLOW & DP22.1 FLOW, PIPE TO DP24.1
	24								6.7	0.17	4.72	0.8				0.8	0.17	5.0	24	5	5.6	0.0	BASIN B6 & DP19 FLOW-BY @ DP24, CAPTURED IN TRIPLE DENVER TYPE 16 COMBO INLET, PIPE TO DP24.1
	24.1								8.1	2.23	4.44	9.9				9.9	2.23	5.0	30	55	12.1	0.1	COMBINED DP23.1 & DP24 FLOW, PIPE TO DP25
	25	B10	0.48	0.10	5.7	0.05	4.98	0.2	8.2	2.28	4.42	10.1											DP24.1 AND BASIN B10 FLOW, TOTAL FLOW @ DP25 (FSD WATER QUALITY POND)
		B11	0.19	0.55	5.0	0.11	5.17	0.6															BASIN B11 FLOW, FOLLOW EX PATTERNS & FLOWS EAST OFF SITE
		B12	0.07	0.31	5.1	0.02	5.13	0.1															BASIN B12 FLOW, FOLLOW EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE
		B13	0.23	0.33	7.5	0.08	4.57	0.4															BASIN B13 FLOW, FOLLOW EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE
		B14	0.12	0.08	5.0	0.01	5.17	0.1															BASIN B11 FLOW, FOLLOW EX PATTERNS & FLOWS EAST OFF SITE
		B16	0.11	0.15	5.0	0.02	5.17	0.1															BASIN B11 FLOW, SWALE CONVEYS FLOW OFFSITE EAST (FOLLLOWS HISTORIC PATTERNS)

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: NQJ
Checked By:
Date: 2/6/20

		DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			
TREE	Design Point	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)	REMARKS
	EX1	EX1	0.15	0.35	7.9	0.05	4.49	0.2															OFFSITE BASIN EX1 FLOW @ DPEX1, FLOW INTO BASIN A1
	EX2	EX2	0.46	0.35	8.1	0.16	4.45	0.7															BASIN EX2 FLOW @ DPEX2,
	1	A1	0.74	0.70	6.4	0.52	8.06	4.2	7.9	0.57	7.54	4.3	4.3	0.57	1.0					170	2.0	1.4	BASIN A1 & DPEX1 FLOW @ DP1, C&G FLOW TO DP3
		A2	0.17	0.78	7.4	0.13	7.69	1.0															BASIN A2 FLOW @ DP3 (ROUTED IN SF2)
		A3	0.11	0.74	6.1	0.08	8.16	0.7															BASIN A3 FLOW @ DP4 (ROUTED IN SF2)
	2	A4	0.72	0.71	5.9	0.51	8.27	4.2	8.1	0.67	7.47	5.0	5.0	0.67	1.0					170	2.0	1.4	BASIN A4 & DPEX2 FLOW @ DP2, C&G TO DP4
	3								7.8	0.70	7.55	5.3	2.0	0.26	1	3.3	0.44	2.0	18	60 5	2.0 6.8	0.5 0.0	DP3 FLOW-BY, C&G FLOW TO DP5 DP1 & BASIN A2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET, PIPE TO DP4.1
	4								7.3	0.75	7.72	5.8	2.3	0.3	1	3.5	0.45	2.0	18	60 31	2.0 6.8	0.5 0.1	DP4 FLOW-BY, C&G FLOW TO DP6 BASIN A3 & DP2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET, PIPE TO DP4.1
	4.1								7.8	0.89	7.55	6.7				6.7	7.55	2.0	18	123	8.2	0.3	COMBINED DP3 & DP4 CAPTURED FLOW, PIPE FLOW TO DP8.1
	5	A5	0.77	0.63	7.2	0.49	7.75	3.8	8.3	0.75	7.40	5.6	5.6	0.75	1					115	2.0	1.0	BASIN A5 & DP3 FLOW-BY @ DP5, C&G FLOW TO DP8
		A6	0.26	0.84	7.9	0.22	7.52	1.7															BASIN A6 FLOW @ DP8 (ROUTED IN SF2)
	6	A7	0.54	0.66	6.8	0.35	7.91	2.8	7.8	0.65	7.56	4.9	4.9	0.65	1					130	2.0	1.1	BASIN A7 FLOW & DP4 FLOW-BY @ DP6, C&G FLOW TO DP9
	7	A8	0.70	0.61	7.8	0.43	7.56	3.3					3.3	0.43	1					100	2.0	0.8	BASIN A8 FLOW @ DP7, C&G FLOW TO DP8
	8								9.3	1.40	7.12	10.0				10.0	1.40	2.0	30	5	8.7	0.0	BASIN A6, DP5 & DP7 FLOW @ DP8, CAPTURED BY DBL. DENVER TYPE 16 COMBO INLET, PIPE FLOW TO DP9.1
	8.1								9.3	2.29	7.12	16.3				16.3	2.29	2.0	30	55	2.0	0.5	DP4.1 & DP8 FLOW @ DP8.1, PIPE FLOW TO DP9.1
	9	A9	0.72	0.70	8.0	0.51	7.49	3.8	8.9	1.16	7.23	8.4				8.4	1.16	2.0	30	5	8.3	0.0	DP6 & BASIN A9 FLOW @DP9, CAPTURED BY TPL. DENVER TYPE 16 COMBO INLET, PIPE FLOW TO DP9.1
	9.1								9.7	3.45	7.00	24.1				24.1	3.45	5.0	30	55	15.7	0.1	DP8.1 & DP9 FLOW @ DP9.1, PIPE FLOW TO DP10 (WATER QUALITY POND)
	10	A10	0.46	0.38	9.5	0.17	7.07	1.2	9.8	3.62	6.98	25.3											BASIN A1-10 FLOW @ DP10, TOTAL FLOW ENTERING WATER QUALITY POND
		A11	0.29	0.61	11.0	0.18	6.70	1.2															BASIN A11 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE
		A12	0.14	0.57	8.0	0.08	7.50	0.6															BASIN A12 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: NQJ
Checked By:
Date: 2/6/20

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

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)	
													3.3	0.41	2.3					160	3.1	0.9	BASIN B1 FLOW @ DP15, C&G FLOW TO DP17
	15	B1	0.65	0.63	6.5	0.41	8.00	3.3															
													1.4	0.18	2.3					70	3.1	0.4	DP17 FLOW-BY, C&G FLOW TO DP19
	17	B2	0.08	0.96	5.0	0.08	8.68	0.7	7.4	0.49	7.68	3.8				2.4	0.31	5.0	18	33	8.3	0.1	BASIN B2 AND DP15 FLOW @ DP17, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET, PIPE TO DP18.1
		B3	0.11	0.90	5.0	0.10	8.68	0.9															BASIN B3 FLOW @ DP18 (ROUTED IN SF2)
													5.1	0.64	2.3					185	3.1	1.0	BASIN B4 FLOW @ DP16, C&G FLOW TO DP18
	16	B4	0.88	0.72	6.7	0.64	7.96	5.1															
													2.5	0.33	2.3					75	3.0	0.4	DP18 FLOW-BY, C&G FLOW TO DP20
	18								7.7	0.74	7.60	5.6				3.1	0.41	2.0	18	5	6.6	0.0	BASIN B3 & DP16 FLOW @ DP18, CAPTURED BY DBL. DENVER TYPE 16 COMBO INLET, PIPE TO DP18.1
	18.1								7.7	0.72	7.60	5.5				5.5	0.72	2.0	18	160	7.8	0.3	DP17 & DP18 CAPTURED FLOW, PIPE FLOW TO DP22.1
													2.5	0.31	2.5					103	3.2	0.5	DP19 FLOW-BY, C&G FLOW TO DP23
	19	B5	0.60	0.64	6.2	0.39	8.14	3.2	6.2	0.57	8.14	4.6				2.1	0.26	2.0	18	103	5.8	0.3	BASIN B5 & DP17 FLOW-BY @ DP19, CAPTURED IN SINGLE DENVER TYPE 16 COMBO INLET, PIPE TO DP23.1
		B6	0.08	0.88	5.0	0.07	8.68	0.6															BASIN B6 FLOW AT DP23 (ROUTED IN SF2)
		B7	0.13	0.87	5.0	0.11	8.68	1.0															BASIN B7 FLOW AT DP22 (ROUTED IN SF2)
													6.4	0.85	2.5					125	3.2	0.7	BASIN B8 & DP18 FLOW-BY @DP20, C&G FLOW TO DP22
	20	B8	0.73	0.71	5.7	0.52	8.35	4.3	8.1	0.85	7.47	6.4											
	21	B15	0.24	0.50	5.0	0.12	8.68	1.0								1.0	0.12	1.0	18	145	3.8	0.6	BASIN B15 FLOW @ DP21, CAPTURED IN TYPE C INLET, PIPED TO DP22.1
													0.8	0.09	1					65	2.0	0.5	DP22 FLOW-BY, C&G FLOW TO DP23
	22	B9	0.54	0.71	6.5	0.38	8.03	3.1								2.3	0.29	2.0	18	45	6.1	0.1	BASIN B9 FLOW CAPTURED BY DBL DENVER TYPE 16 COMBO INLET, PIPE TO DP22.1
	22.1								6.6	0.41	7.98	3.2				3.2	0.41	2.0	18	25	6.7	0.1	COMBINED DP21 & DP22 CAPTURED FLOW, PIPE TO DP23.1
													0.4	0.05	2								DP23 FLOW BY, OVERTOP CROWN TO DP24
	23								7.0	1.06	7.82	8.3				7.9	1.01	5.0	18	33	12.0	0.0	BASIN B7, DP20 FLOW-BY & DP22 FLOW-BY@ DP23, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET, PIPE TO DP23.1
	23.1								8.0	2.14	7.49	16.0				16.0	2.14	3.0	24	33	11.8	0.0	DP23 CAPTURED FLOW & DP22.1 FLOW, PIPE TO DP24.1
	24								6.7	0.38	7.93	3.0				3.0	0.38	5.0	24	5	8.5	0.0	BASIN B6 & DP19 FLOW-BY @ DP24, CAPTURED IN TRIPLE DENVER TYPE 16 COMBO INLET, PIPE TO DP24.1
	24.1								8.1	2.77	7.47	20.7				20.7	2.77	5.0	30	55	15.1	0.1	COMBINED DP23.1 & DP24 FLOW, PIPE TO DP25
	25	B10	0.48	0.36	5.7	0.17	8.37	1.4	8.1	2.94	7.45	21.9											DP24.1 AND BASIN B10 FLOW, TOTAL FLOW @ DP25 (FSD WATER QUALITY POND)
		B11	0.19	0.70	5.0	0.13	8.68	1.1															BASIN B11 FLOW, FOLLOW EX PATTERNS & FLOWS EAST OFF SITE
		B12	0.07	0.52	5.1	0.04	8.61	0.3															BASIN B12 FLOW, FOLLOW EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE
		B13	0.23	0.54	7.5	0.12	7.67	0.9															BASIN B13 FLOW, FOLLOW EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE
		B14	0.12	0.35	5.0	0.04	8.68	0.3															BASIN B11 FLOW, FOLLOW EX PATTERNS & FLOWS EAST OFF SITE
		B16	0.11	0.41	5.0	0.04	8.68	0.3															BASIN B11 FLOW, SWALE CONVEYS FLOW OFFSITE EAST (FOLLLOWS HISTORIC PATTERNS)

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

Appendix C
Hydraulic Calculations

Channel Report

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

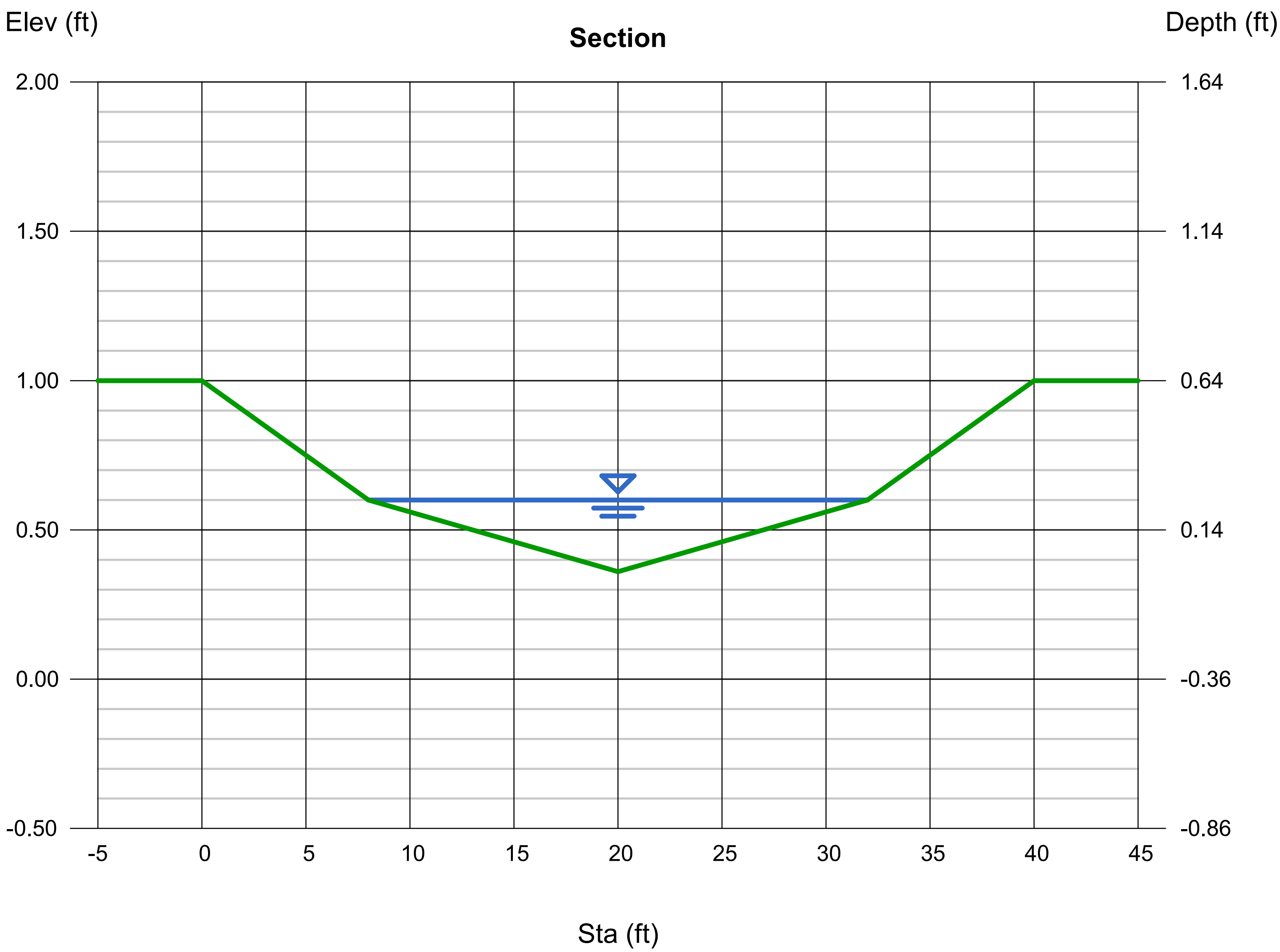
Compute by:	Known Q
Known Q (cfs)	= 6.00

(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)

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



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

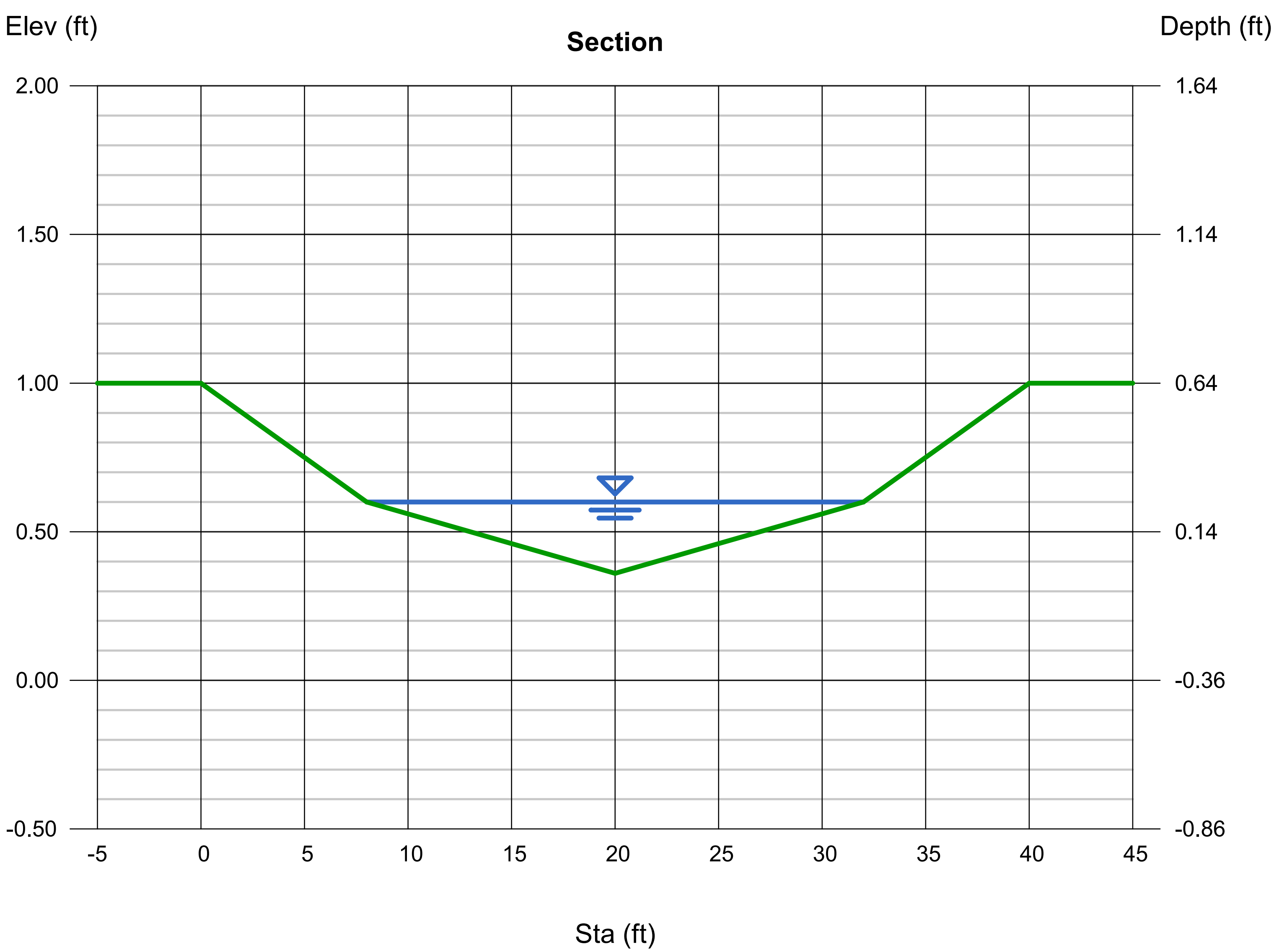
Compute by:	Known Q
Known Q (cfs)	= 8.00

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	On Grade	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)	2.4	2.4	2.4	4.1	3.3	0.8
Major Q_{Known} (cfs)	5.3	5.8	5.8	10.0	8.4	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)	**2.4**	**2.4**	**2.4**	**4.1**	**3.3**	**0.8**
Major Total Design Peak Flow, Q (cfs)	**5.3**	**5.8**	**5.8**	**10.0**	**8.4**	**3.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.5	0.5		N/A	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	2.0	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	On Grade	On Grade	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)	3.3	1.7	2.8	1.5	1.7	0.4
Major Q_{Known} (cfs)	8.3	3.8	5.6	3.1	4.6	1.0

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)	**3.3**	**1.7**	**2.8**	**1.5**	**1.7**	**0.4**
Major Total Design Peak Flow, Q (cfs)	**8.3**	**3.8**	**5.6**	**3.1**	**4.6**	**1.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	0.3	0.8	0.1	0.5	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	1.4	2.5	0.8	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

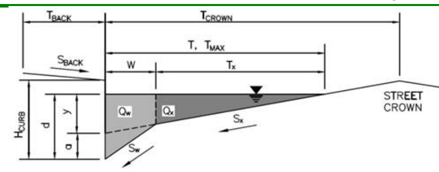
Version 4.05 Released March 2017

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 =	0.010	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	21.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.4	7.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

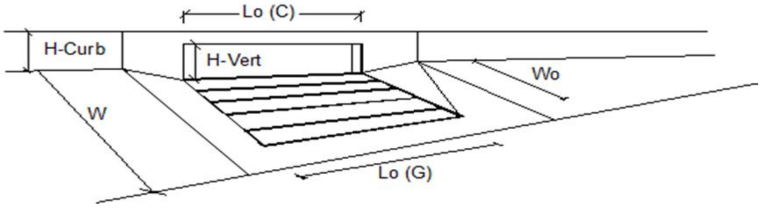
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**5.4**	**21.1**	**cfs**

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 =**	**1.9**	**3.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.5**	**2.0**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**81**	**62**	**%**

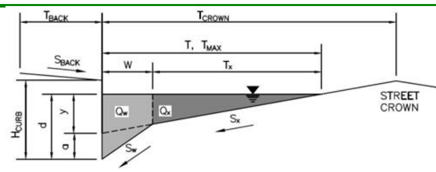
Version 4.05 Released March 2017

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)

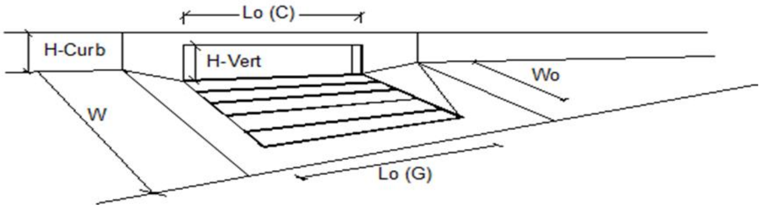
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		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 =	0.010		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} =	**5.4**	**5.4**	**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**	**3.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.5**	**2.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**81**	**61**	**%**

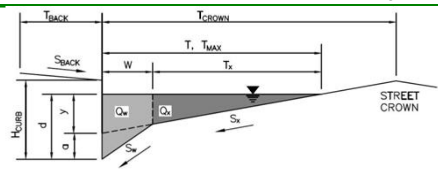
Version 4.05 Released March 2017

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)

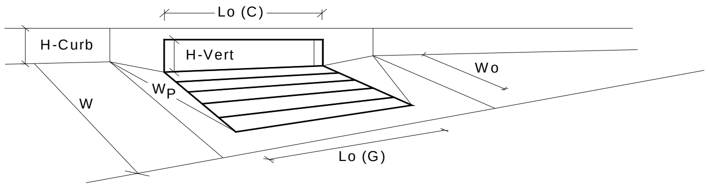
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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} =	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 (Denver No. 16 Combination)	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	8.0	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.523	0.689	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.71	0.94	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.71	0.94	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**6.2**	**12.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.1	10.0	cfs

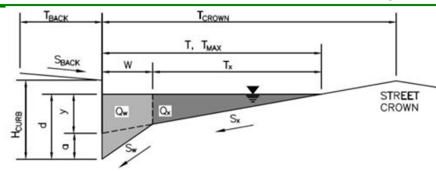
Version 4.05 Released March 2017

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: DP9



Gutter Geometry (Enter data in the blue cells)

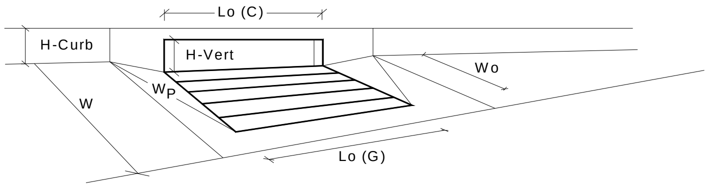
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
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)	Denver No. 16 Combination		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)	$Q_{PEAK\ REQUIRED}$ =	3.3	8.4	cfs

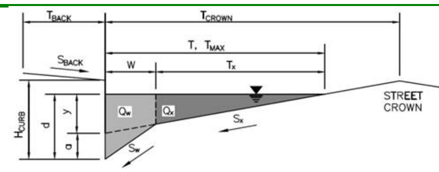
Version 4.05 Released March 2017

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: 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 =	0.023	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

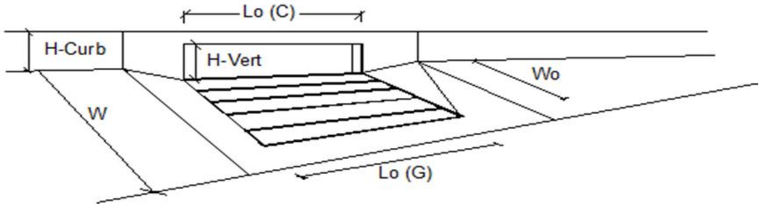
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**8.2**	**8.2**	**cfs**

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**	**2.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.3**	**1.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**84**	**64**	**%**

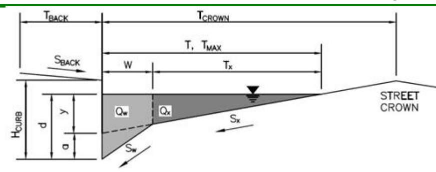
Version 4.05 Released March 2017

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: 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 =	0.023	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

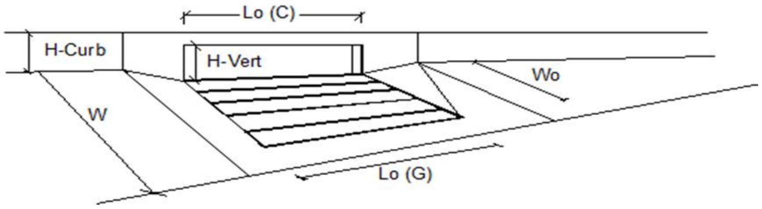
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	21.0	21.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**22.0**	**32.1**	**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 =**	**2.0**	**3.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.8**	**2.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**72**	**55**	**%**

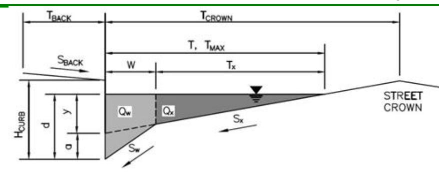
Version 4.05 Released March 2017

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

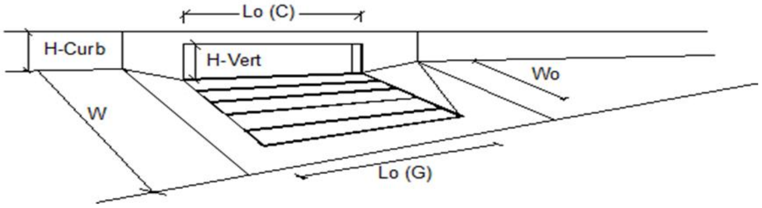
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**8.5**	**8.5**	**cfs**

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

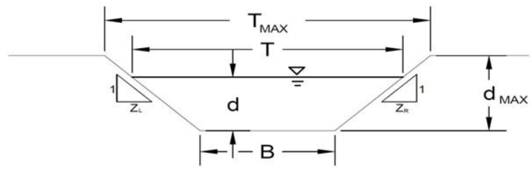


Design Information (Input)		MINOR	MAJOR	
Type of Inlet — Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit 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 =**	**0.5**	**2.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**70**	**46**	**%**

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 =	**0.4**	**1.0**	**cfs**
Water Depth	d =	**0.52**	**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'

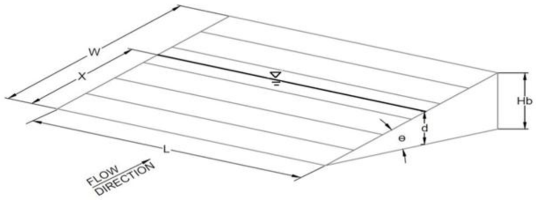
AREA INLET IN A SWALE

PALMER VILLAGE

DP21

Inlet Design Information (Input)

Type of Inlet	CDOT Type C	Inlet Type =	CDOT Type C	
Angle of Inclined Grate (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	3.00	feet
Length of Grate		L =	3.00	feet
Open Area Ratio		A_{RATIO} =	0.70	
Height of Inclined Grate		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 =	0.52	0.67	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.9**	**10.2**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

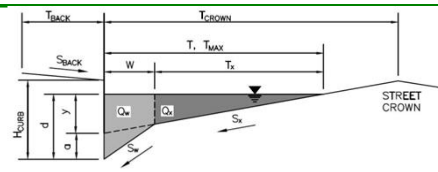
Version 4.05 Released March 2017

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 =	0.010	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
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

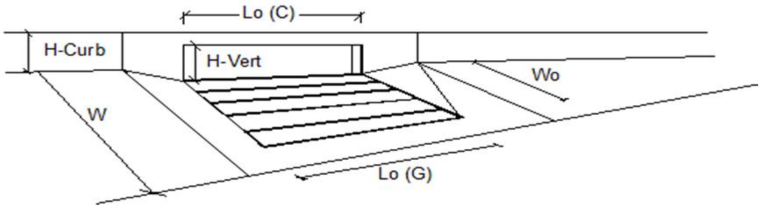
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**5.4**	**5.4**	**cfs**

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 =**	**0.1**	**0.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**92**	**75**	**%**

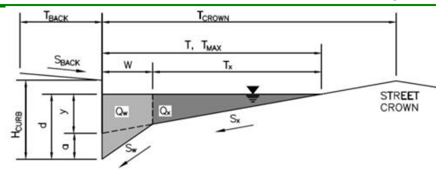
Version 4.05 Released March 2017

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)

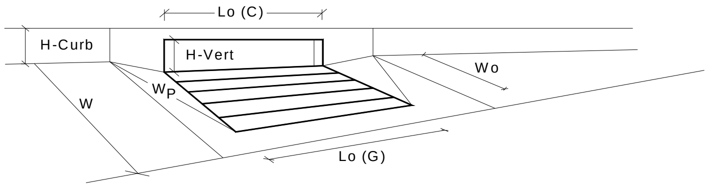
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
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



		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet — Denver No. 16 Combination	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**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	3.3	8.3	cfs

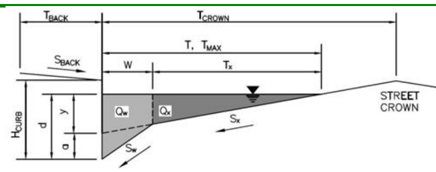
Version 4.05 Released March 2017

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)

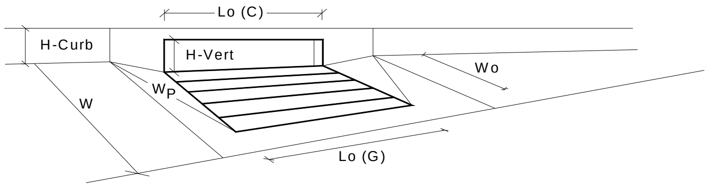
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
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

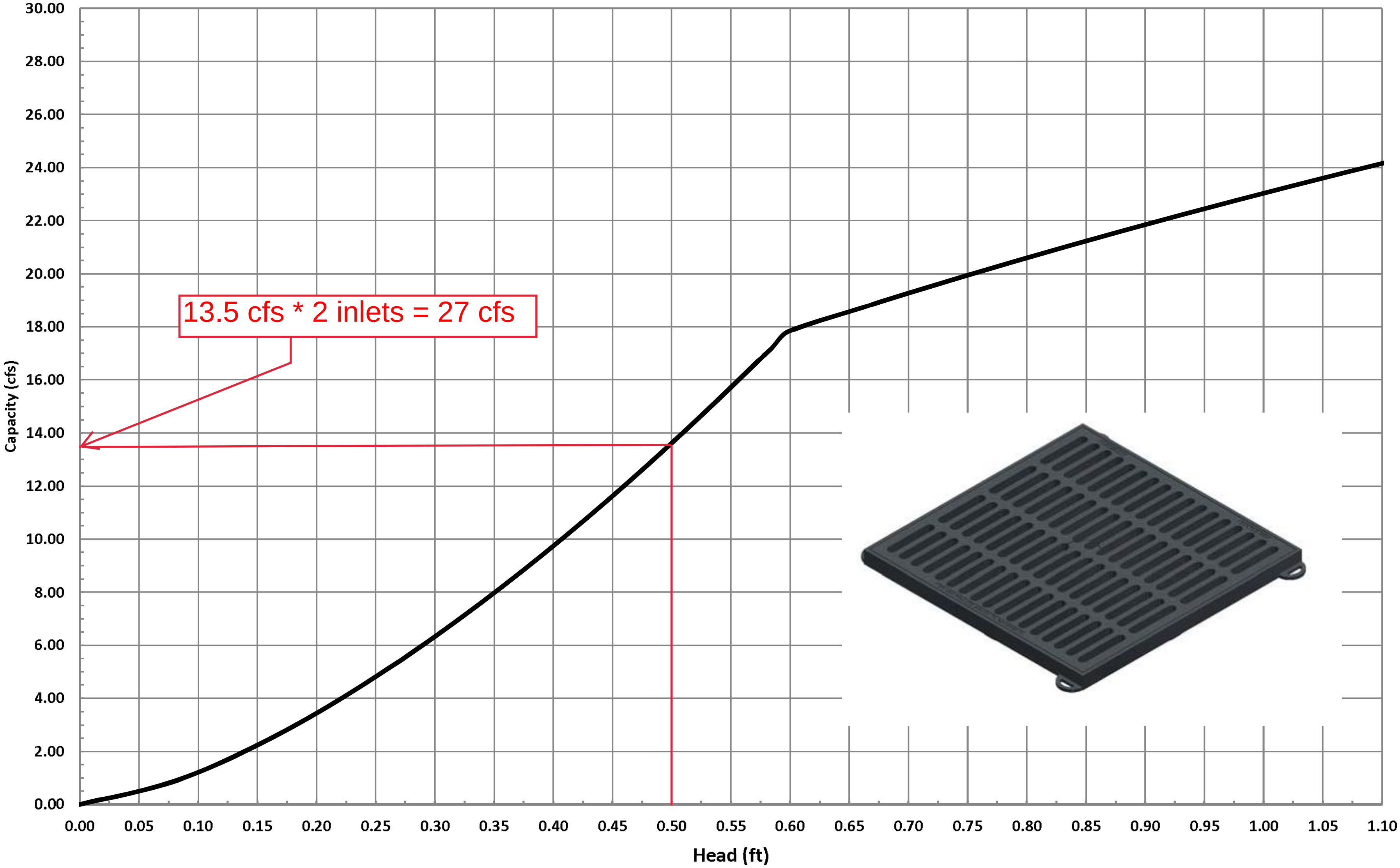


Design Information (Input)	Denver No. 16 Combination		MINOR	MAJOR	
Type of Inlet		Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (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

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



100-year peak flow to pond (SF-3):
Pond A: 25.3 cfs
Pond B: 21.9 cfs

Nyloplast

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

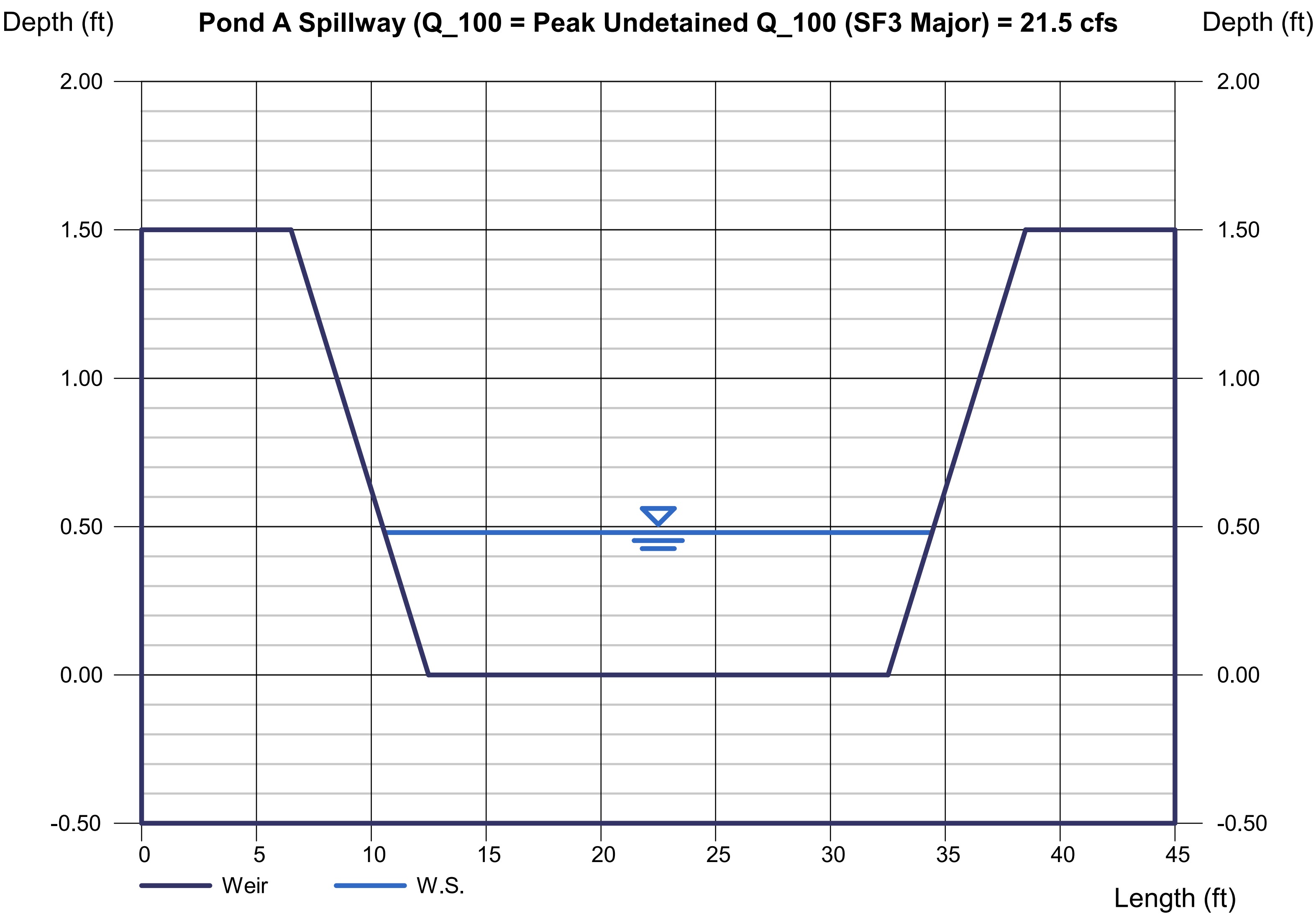
Weir Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Nov 18 2019

Pond A Spillway (Q_100 = Peak Undetained Q_100 (SF3 Major) = 21.5 cfs

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)	= 21.50

Highlighted	
Depth (ft)	= 0.48
Q (cfs)	= 21.50
Area (sqft)	= 10.52
Velocity (ft/s)	= 2.04
Top Width (ft)	= 23.84



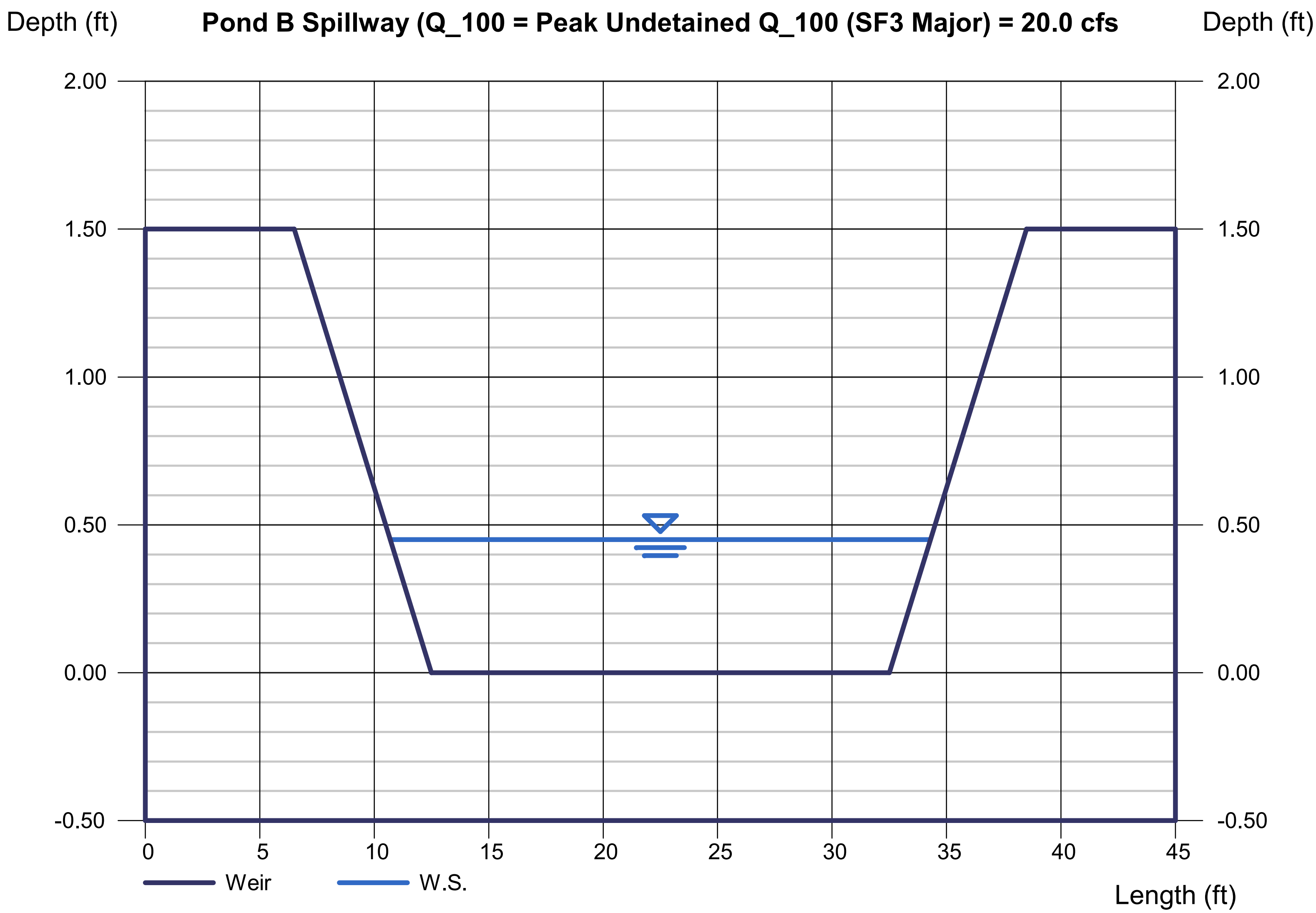
Weir Report

Pond B Spillway (Q_100 = Peak Undetained Q_100 (SF3 Major) = 20.0 cfs

Trapezoidal Weir		**Highlighted**	
Crest	= Sharp	Depth (ft)	= 0.45
Bottom Length (ft)	= 20.00	Q (cfs)	= 20.00
Total Depth (ft)	= 1.50	Area (sqft)	= 9.81
Side Slope (z:1)	= 4.00	Velocity (ft/s)	= 2.04
		Top Width (ft)	= 23.60

Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 20.00



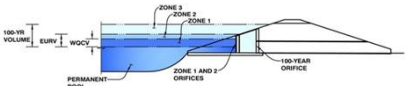
Appendix D
Water Quality & Detention

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 =	5.80	acres		
Watershed Length =	700	ft		
Watershed Slope =	0.012	ft/ft		
Watershed Imperviousness =	48.40%	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) =	0.098	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.321	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.219	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.288	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.355	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.444	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.557	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.691	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.206	acre-feet		
Approximate 5-yr Detention Volume =	0.271	acre-feet		
Approximate 10-yr Detention Volume =	0.332	acre-feet		
Approximate 25-yr Detention Volume =	0.407	acre-feet		
Approximate 50-yr Detention Volume =	0.455	acre-feet		
Approximate 100-yr Detention Volume =	0.514	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.098	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.223	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.194	acre-feet
Total Detention Basin Volume =	0.514	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

6444.4

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
6445	--	0.60	--	--	--	2,120	0.049	615	0.014
6446	--	1.60	--	--	--	2,883	0.066	3,109	0.071
6447	--	2.60	--	--	--	3,690	0.085	6,424	0.147
6448	--	3.60	--	--	--	4,573	0.105	10,555	0.242
6449	--	4.60	--	--	--	5,532	0.127	15,608	0.358
6450	--	5.60	--	--	--	6,566	0.151	21,657	0.497
6451	--	6.60	--	--	--	7,676	0.176	28,778	0.661
6451.62	--	7.22	--	--	--	8,455	0.194	33,778	0.775
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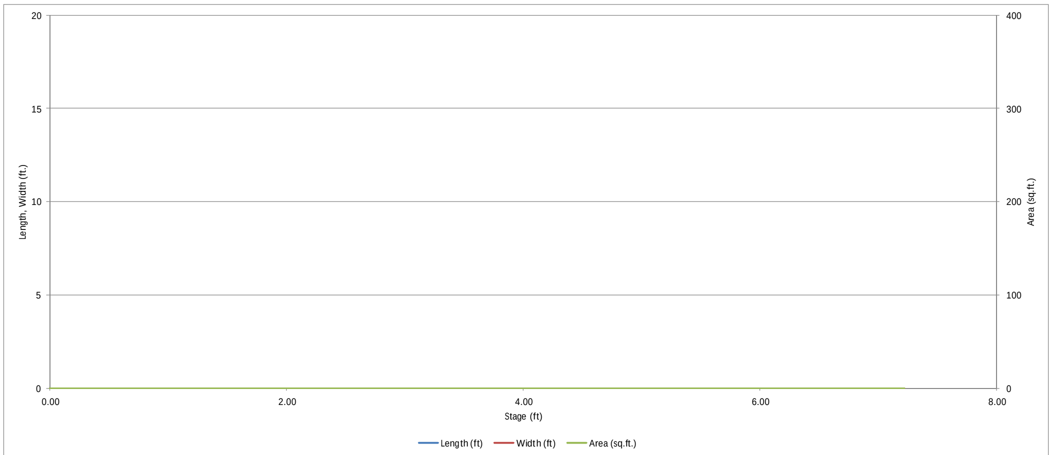
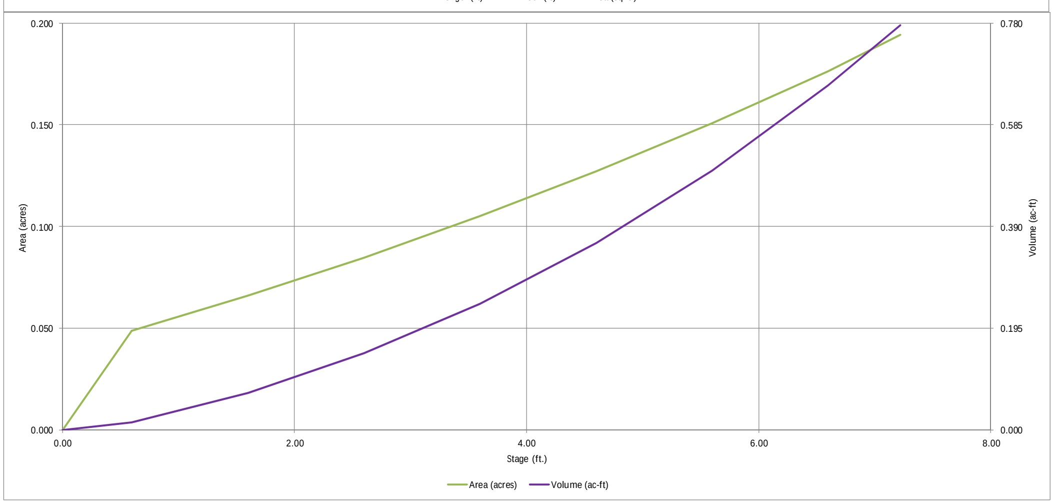
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



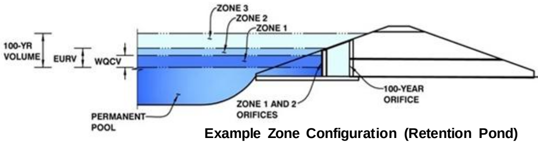


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: PALMER VILLAGE

Basin ID: POND A (WEST PARCEL)



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.97	0.098	Orifice Plate
Zone 2 (EURV)	4.30	0.223	Orifice Plate
'one 3 (100-year)	5.72	0.194	Weir&Pipe (Restrict)
		0.514	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
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)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.30	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.43	2.87	4.00				
Orifice Area (sq. inches)	0.82	0.50	1.10	0.38				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.73	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.73	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	34.18	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	6.30	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.15	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	2.90		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.18	N/A	ft^2
Outlet Orifice Centroid =	0.14	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.83	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.22	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	20.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

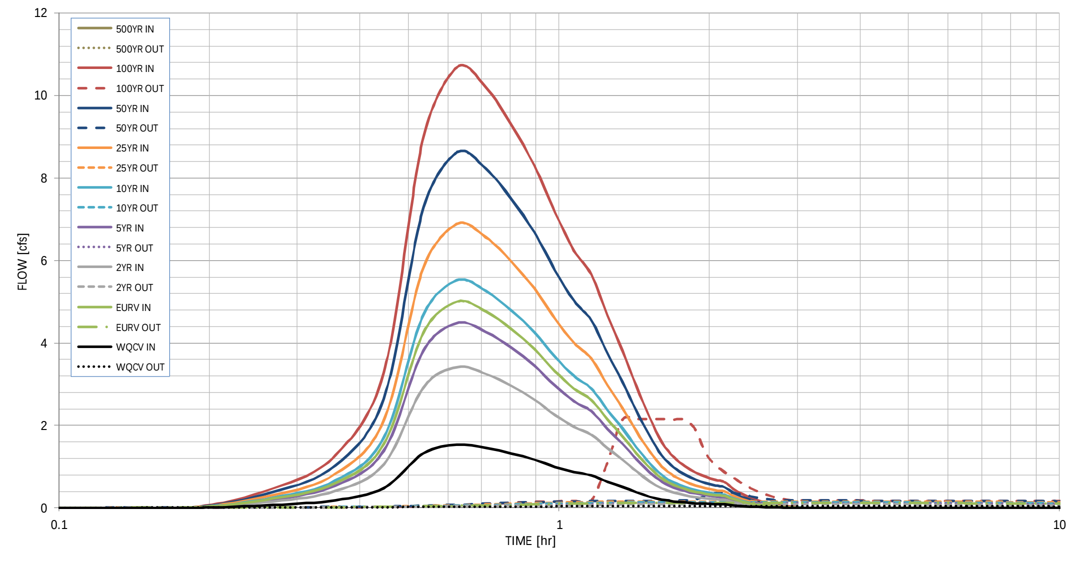
Spillway Design Flow Depth=	0.34	feet
Stage at Top of Freeboard =	8.56	feet
Basin Area at Top of Freeboard =	0.19	acres

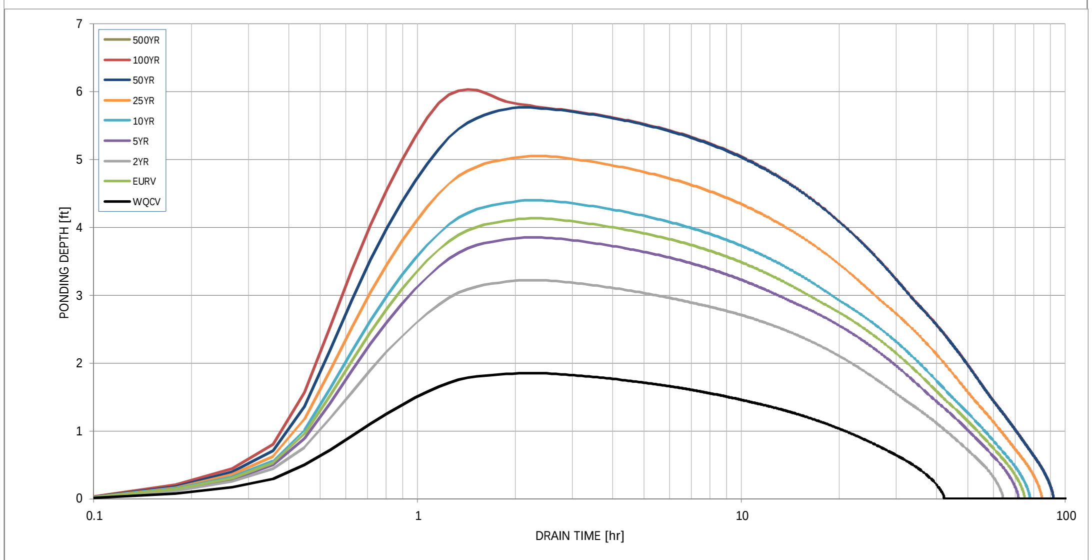
Routed Hydrograph Results

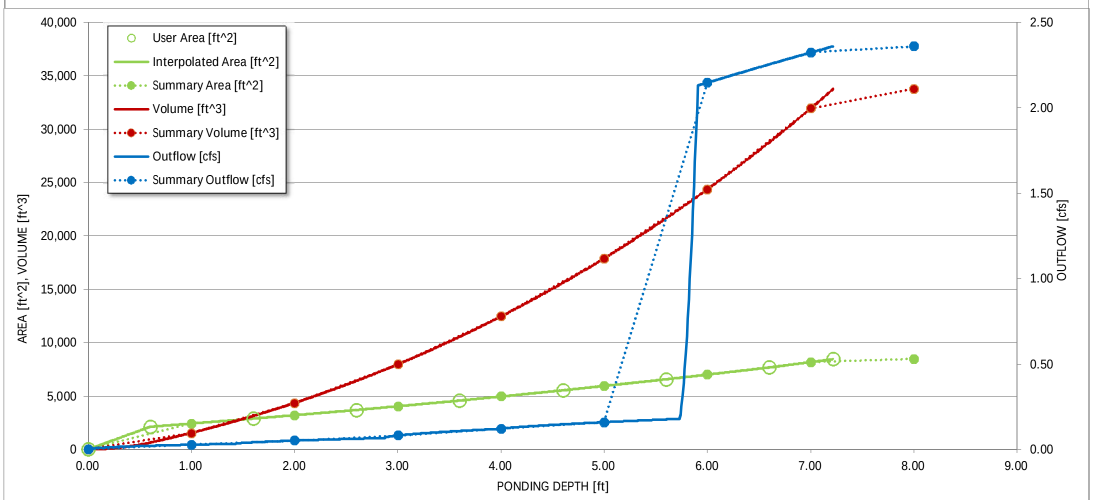
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.098	0.321	0.219	0.288	0.355	0.444	0.557	0.691	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.097	0.320	0.218	0.287	0.354	0.443	0.556	0.690	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.02	0.18	0.44	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.1	0.1	1.0	2.5	0.0
Peak Inflow Q (cfs) =	1.5	5.0	3.4	4.5	5.5	6.9	8.6	10.7	#N/A
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	0.1	0.2	0.4	2.2	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	4.3	2.2	1.2	0.4	0.9	#N/A
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.3	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	39	67	58	64	69	74	80	78	#N/A
Time to Drain 99% of Inflow Volume (hours) =	41	72	62	69	74	80	87	86	#N/A
Maximum Ponding Depth (ft) =	1.85	4.13	3.22	3.85	4.40	5.05	5.77	6.04	#N/A
Area at Maximum Ponding Depth (acres) =	0.07	0.12	0.10	0.11	0.12	0.14	0.15	0.16	#N/A
Maximum Volume Stored (acre-ft) =	0.089	0.301	0.204	0.269	0.333	0.418	0.522	0.564	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

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: 5.36 min

Hydrograph Constant: 0.932

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
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]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:05:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:10:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:16:05	0.07	0.23	0.16	0.20	0.25	0.31	0.38	0.47	#N/A
0:21:26	0.19	0.60	0.41	0.54	0.66	0.83	1.03	1.27	#N/A
0:26:48	0.48	1.55	1.06	1.39	1.71	2.12	2.65	3.27	#N/A
0:32:10	1.32	4.25	2.92	3.82	4.69	5.83	7.28	9.00	#N/A
0:37:31	1.54	5.00	3.42	4.48	5.52	6.89	8.62	10.69	#N/A
0:42:53	1.46	4.76	3.25	4.27	5.26	6.56	8.22	10.20	#N/A
0:48:14	1.32	4.34	2.96	3.88	4.79	5.97	7.49	9.29	#N/A
0:53:36	1.17	3.86	2.63	3.45	4.26	5.33	6.68	8.30	#N/A
0:58:58	1.00	3.32	2.25	2.97	3.66	4.59	5.76	7.17	#N/A
1:04:19	0.87	2.89	1.97	2.59	3.20	4.00	5.02	6.24	#N/A
1:09:41	0.79	2.62	1.78	2.34	2.90	3.62	4.55	5.66	#N/A
1:15:02	0.64	2.15	1.45	1.92	2.37	2.98	3.75	4.67	#N/A
1:20:24	0.51	1.74	1.17	1.55	1.93	2.42	3.06	3.82	#N/A
1:25:46	0.38	1.33	0.89	1.18	1.47	1.86	2.35	2.94	#N/A
1:31:07	0.27	0.97	0.65	0.87	1.08	1.37	1.75	2.19	#N/A
1:36:29	0.20	0.71	0.47	0.63	0.79	1.00	1.27	1.59	#N/A
1:41:50	0.16	0.56	0.37	0.50	0.62	0.78	0.98	1.23	#N/A
1:47:12	0.13	0.46	0.31	0.41	0.51	0.64	0.81	1.01	#N/A
1:52:34	0.11	0.39	0.26	0.35	0.43	0.54	0.69	0.86	#N/A
1:57:55	0.10	0.34	0.23	0.31	0.38	0.48	0.60	0.75	#N/A
2:03:17	0.09	0.31	0.21	0.28	0.34	0.43	0.54	0.68	#N/A
2:08:38	0.08	0.29	0.19	0.26	0.32	0.40	0.50	0.63	#N/A
2:14:00	0.06	0.21	0.14	0.19	0.23	0.29	0.37	0.46	#N/A
2:19:22	0.05	0.15	0.10	0.14	0.17	0.21	0.27	0.34	#N/A
2:24:43	0.03	0.11	0.08	0.10	0.12	0.16	0.20	0.25	#N/A
2:30:05	0.02	0.08	0.06	0.07	0.09	0.11	0.15	0.18	#N/A
2:35:26	0.02	0.06	0.04	0.05	0.06	0.08	0.10	0.13	#N/A
2:40:48	0.01	0.04	0.03	0.04	0.05	0.06	0.07	0.09	#N/A
2:46:10	0.01	0.03	0.02	0.03	0.03	0.04	0.05	0.07	#N/A
2:51:31	0.00	0.02	0.01	0.02	0.02	0.03	0.03	0.04	#N/A
2:56:53	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	#N/A
3:02:14	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	#N/A
3:07:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:12:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:18:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:23:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:29:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:34:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:39:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:45:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:50:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:55:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:01:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:06:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:11:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:17:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:22:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:28:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:33:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:38:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:44:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:49:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:54:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:00:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:05:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:10:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:16:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:21:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:26:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:32:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:37:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:43:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:48:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:53:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:59:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
6:04:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
6:09:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
6:15:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
6:20:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
6:25:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

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	2,418	0.055	1,521	0.035	0.03
	2.00	3,198	0.073	4,323	0.099	0.05
	3.00	4,043	0.093	7,971	0.183	0.08
	4.00	4,957	0.114	12,461	0.286	0.12
	5.00	5,946	0.136	17,903	0.411	0.16
	6.00	7,010	0.161	24,372	0.560	2.15
	7.00	8,179	0.188	31,949	0.733	2.32
	8.00	8,455	0.194	33,778	0.775	2.36

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'.

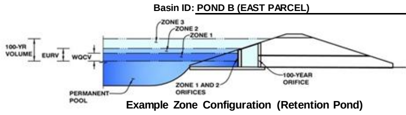
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

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 =	4.28	acres		
Watershed Length =	700	ft		
Watershed Slope =	0.028	ft/ft		
Watershed Imperviousness =	56.50%	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) =	0.080	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.289	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.198	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.259	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.317	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.390	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.476	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.577	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.187	acre-feet		
Approximate 5-yr Detention Volume =	0.245	acre-feet		
Approximate 10-yr Detention Volume =	0.297	acre-feet		
Approximate 25-yr Detention Volume =	0.361	acre-feet		
Approximate 50-yr Detention Volume =	0.400	acre-feet		
Approximate 100-yr Detention Volume =	0.444	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.080	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.208	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.156	acre-feet
Total Detention Basin Volume =	0.444	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

6433

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
6434	--	1.00	--	--	--	7,212	0.166	3,534	0.081
6435	--	2.00	--	--	--	8,536	0.196	11,394	0.262
6436	--	3.00	--	--	--	9,917	0.228	20,706	0.475
6437	--	4.00	--	--	--	11,391	0.262	31,360	0.720
6437.62	--	4.62	--	--	--	12,397	0.285	38,735	0.889
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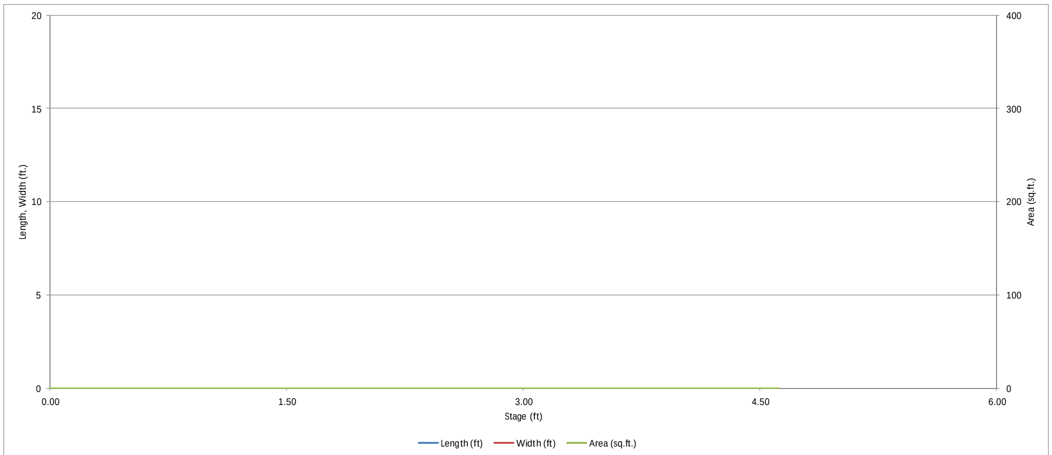
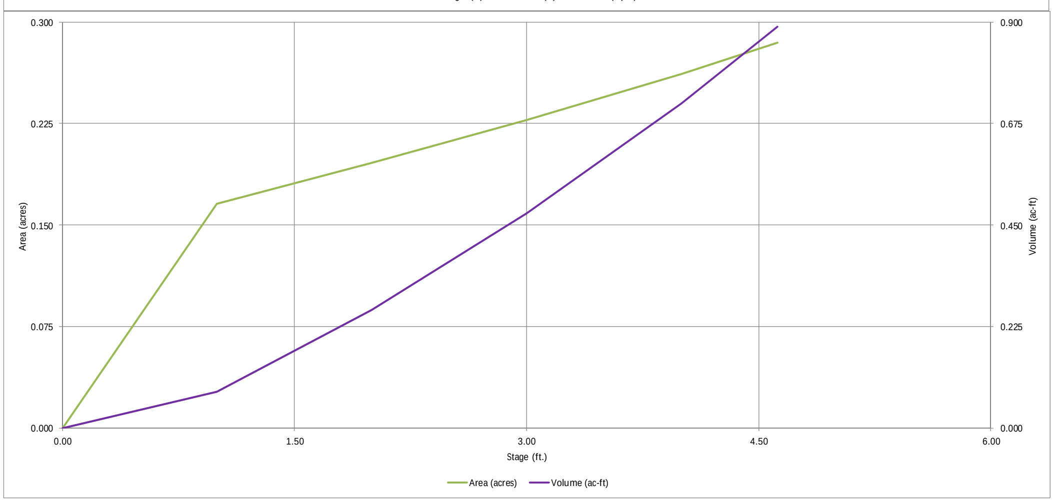
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



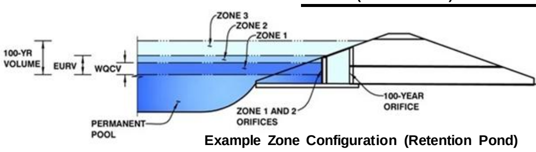


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: PALMER VILLAGE

Basin ID: POND B (EAST PARCEL)



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.99	0.080	Orifice Plate
Zone 2 (EURV)	2.13	0.208	Orifice Plate
Zone 3 (100-year)	2.87	0.156	Weir&Pipe (Restrict)
		0.444	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
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)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.13	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	8.50	inches
Orifice Plate: Orifice Area per Row =	0.85	sq. inches (diameter = 1 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	5.903E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.71	1.42					
Orifice Area (sq. inches)	0.85	0.85	0.85					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.00	N/A	feet
Over Flow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	124.16	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	25.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	12.60	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	3.10		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.20	N/A	ft^2
Outlet Orifice Centroid =	0.15	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.86	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.62	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	20.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

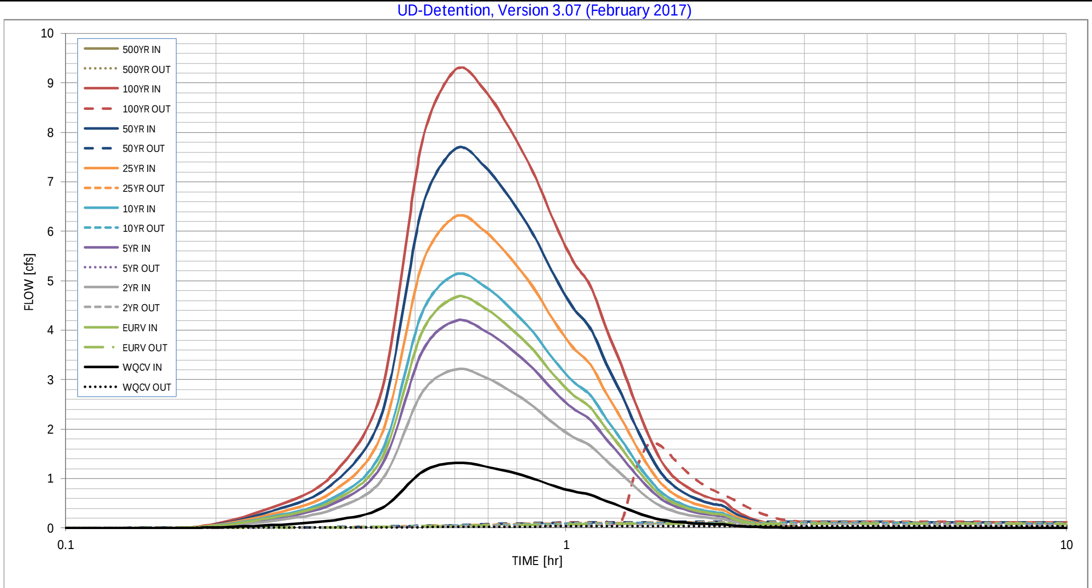
Spillway Design Flow Depth=	0.27	feet
Stage at Top of Freeboard =	5.89	feet
Basin Area at Top of Freeboard =	0.28	acres

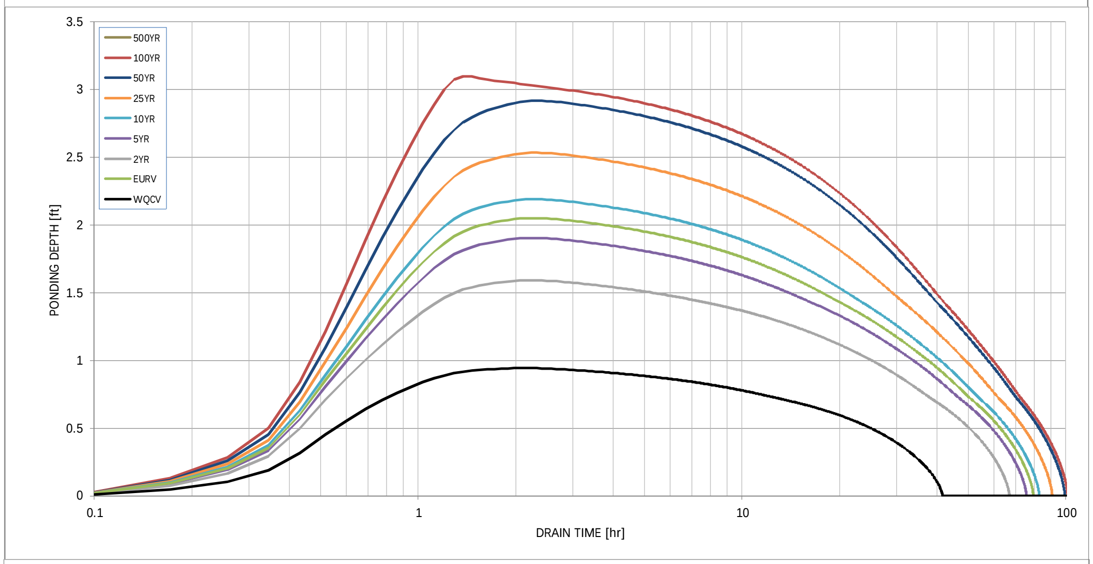
Routed Hydrograph Results

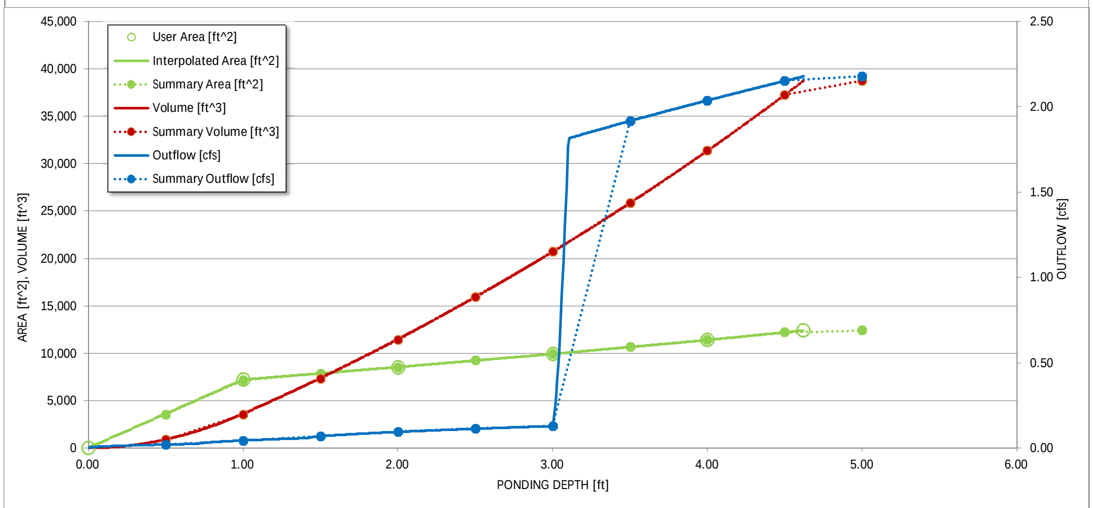
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.080	0.289	0.198	0.259	0.317	0.390	0.476	0.577	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.080	0.288	0.197	0.258	0.317	0.390	0.476	0.577	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.03	0.19	0.45	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.1	0.8	1.9	0.0
Peak Inflow Q (cfs) =	1.3	4.7	3.2	4.2	5.1	6.3	7.7	9.3	#N/A
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	0.1	0.1	0.1	1.7	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	4.3	2.1	1.0	0.2	0.9	#N/A
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	38	71	61	68	74	80	87	87	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	76	64	72	79	86	94	95	#N/A
Maximum Ponding Depth (ft) =	0.94	2.05	1.59	1.90	2.19	2.53	2.92	3.10	#N/A
Area at Maximum Ponding Depth (acres) =	0.16	0.20	0.18	0.19	0.20	0.21	0.22	0.23	#N/A
Maximum Volume Stored (acre-ft) =	0.073	0.273	0.186	0.244	0.301	0.372	0.455	0.496	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

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	Hydrograph Constant
5.17 min	0.968

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
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]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:05:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:10:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:15:31	0.06	0.21	0.15	0.19	0.23	0.28	0.34	0.41	#N/A
0:20:41	0.16	0.56	0.39	0.51	0.62	0.76	0.92	1.11	#N/A
0:25:51	0.41	1.45	1.00	1.30	1.59	1.94	2.36	2.85	#N/A
0:31:01	1.14	3.98	2.74	3.57	4.36	5.34	6.49	7.83	#N/A
0:36:11	1.32	4.67	3.21	4.19	5.13	6.30	7.67	9.28	#N/A
0:41:22	1.25	4.45	3.05	3.99	4.89	6.01	7.32	8.85	#N/A
0:46:32	1.13	4.05	2.78	3.63	4.45	5.47	6.66	8.05	#N/A
0:51:42	1.00	3.60	2.46	3.23	3.96	4.87	5.94	7.19	#N/A
0:56:52	0.85	3.09	2.11	2.77	3.40	4.19	5.12	6.20	#N/A
1:02:02	0.75	2.70	1.84	2.42	2.97	3.66	4.46	5.41	#N/A
1:07:13	0.67	2.44	1.67	2.19	2.69	3.31	4.04	4.90	#N/A
1:12:23	0.54	2.00	1.36	1.79	2.20	2.72	3.32	4.04	#N/A
1:17:33	0.43	1.62	1.10	1.45	1.79	2.21	2.71	3.29	#N/A
1:22:43	0.32	1.23	0.83	1.10	1.36	1.69	2.08	2.53	#N/A
1:27:53	0.23	0.90	0.60	0.80	1.00	1.25	1.54	1.88	#N/A
1:33:04	0.17	0.66	0.44	0.59	0.73	0.91	1.12	1.36	#N/A
1:38:14	0.14	0.52	0.35	0.46	0.57	0.71	0.87	1.06	#N/A
1:43:24	0.11	0.43	0.29	0.38	0.47	0.58	0.71	0.87	#N/A
1:48:34	0.10	0.36	0.24	0.32	0.40	0.49	0.61	0.74	#N/A
1:53:44	0.08	0.32	0.22	0.28	0.35	0.44	0.53	0.65	#N/A
1:58:55	0.08	0.29	0.19	0.26	0.32	0.39	0.48	0.59	#N/A
2:04:05	0.07	0.27	0.18	0.24	0.29	0.36	0.44	0.54	#N/A
2:09:15	0.05	0.20	0.13	0.17	0.22	0.27	0.33	0.40	#N/A
2:14:25	0.04	0.14	0.10	0.13	0.16	0.20	0.24	0.29	#N/A
2:19:35	0.03	0.10	0.07	0.09	0.12	0.14	0.18	0.21	#N/A
2:24:46	0.02	0.08	0.05	0.07	0.08	0.10	0.13	0.16	#N/A
2:29:56	0.01	0.05	0.04	0.05	0.06	0.07	0.09	0.11	#N/A
2:35:06	0.01	0.04	0.03	0.03	0.04	0.05	0.06	0.08	#N/A
2:40:16	0.01	0.03	0.02	0.02	0.03	0.04	0.05	0.06	#N/A
2:45:26	0.00	0.02	0.01	0.02	0.02	0.02	0.03	0.04	#N/A
2:50:37	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	#N/A
2:55:47	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	#N/A
3:00:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:06:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:11:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:16:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:21:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:26:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:31:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:37:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:42:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:47:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:52:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:57:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:02:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:08:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:13:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:18:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:23:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:28:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:34:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:39:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:44:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:49:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:54:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:59:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:05:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:10:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:15:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:20:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:25:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:30:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:36:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:41:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:46:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:51:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:56:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
6:01:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
6:07:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
6:12:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

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	3,534	0.081	866	0.020	0.02
	1.00	7,140	0.164	3,534	0.081	0.04
	1.50	7,861	0.180	7,299	0.168	0.07
	2.00	8,523	0.196	11,394	0.262	0.09
	2.50	9,226	0.212	15,920	0.365	0.11
	3.00	9,917	0.228	20,706	0.475	0.13
	3.50	10,654	0.245	25,849	0.593	1.92
	4.00	11,391	0.262	31,360	0.720	2.04
	4.50	12,202	0.280	37,259	0.855	2.15
	5.00	12,397	0.285	38,735	0.889	2.18

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

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

Appendix E
Reference Material

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

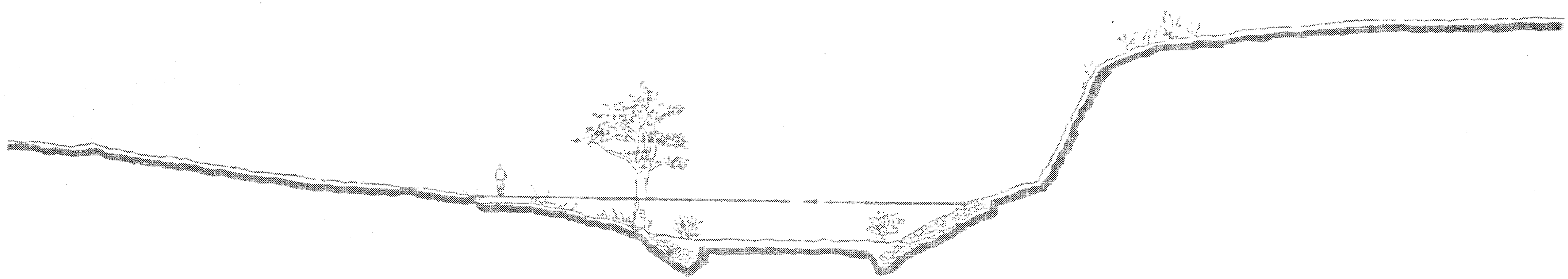
3. This is an interim fee and will be adjusted when a DBPS is completed. In addition to the Drainage Fee a surety in the amount of $7,285 per impervious acre sh the DBPS results in a fee greater than the current fee. Fees paid in excess of the future revised fee will be reimbursed. See Resolution 06-326 (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°F in the winter to 75° in the summer. The relative humidity ranges from about 25 percent in the summer to 45 percent in the winter.

Soils and Geology

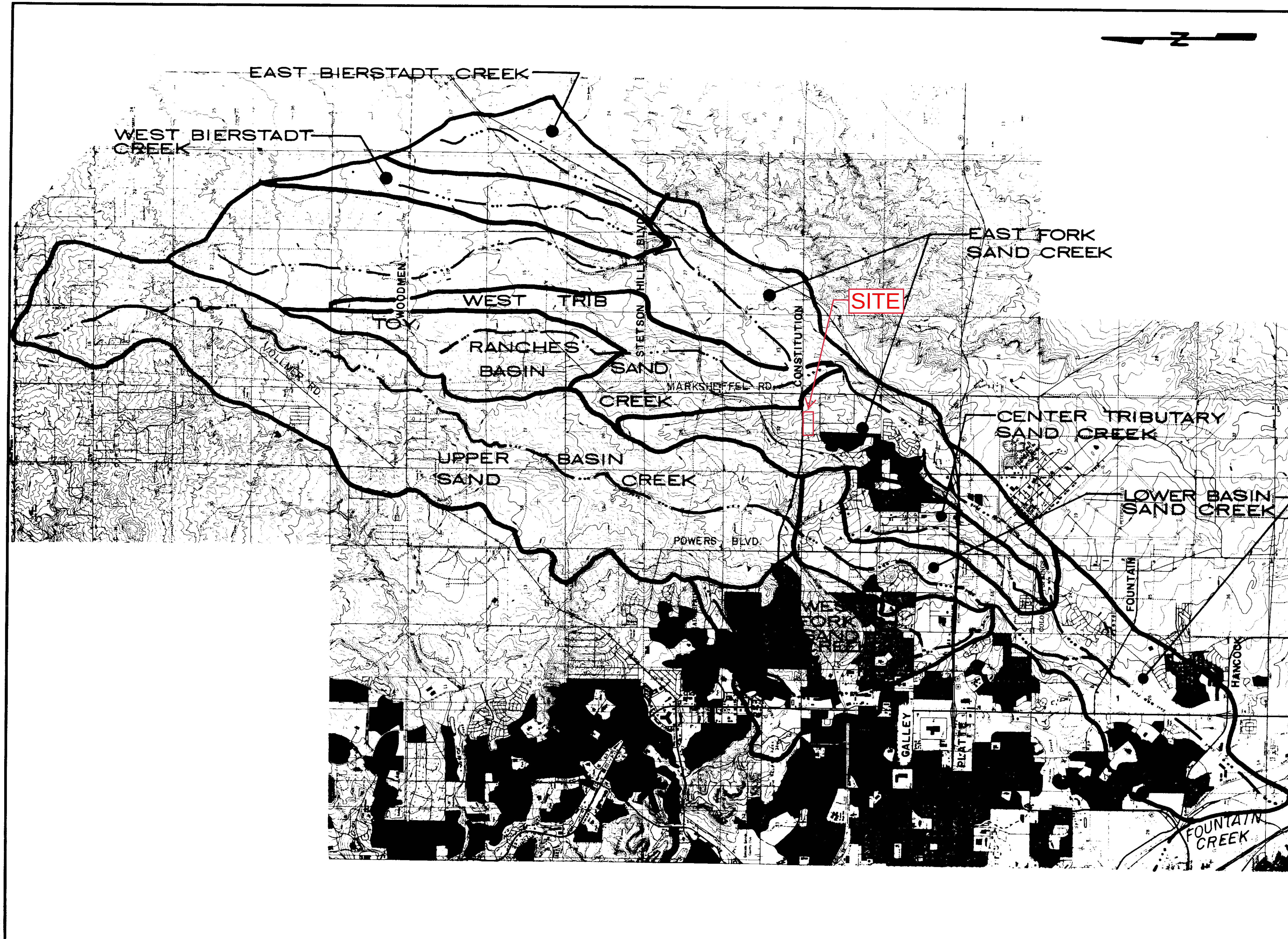
Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium 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



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

NEW DOC

RECEIVED

Mar. 20, 2012

EPC DEVELOPMENT SERVICES

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:

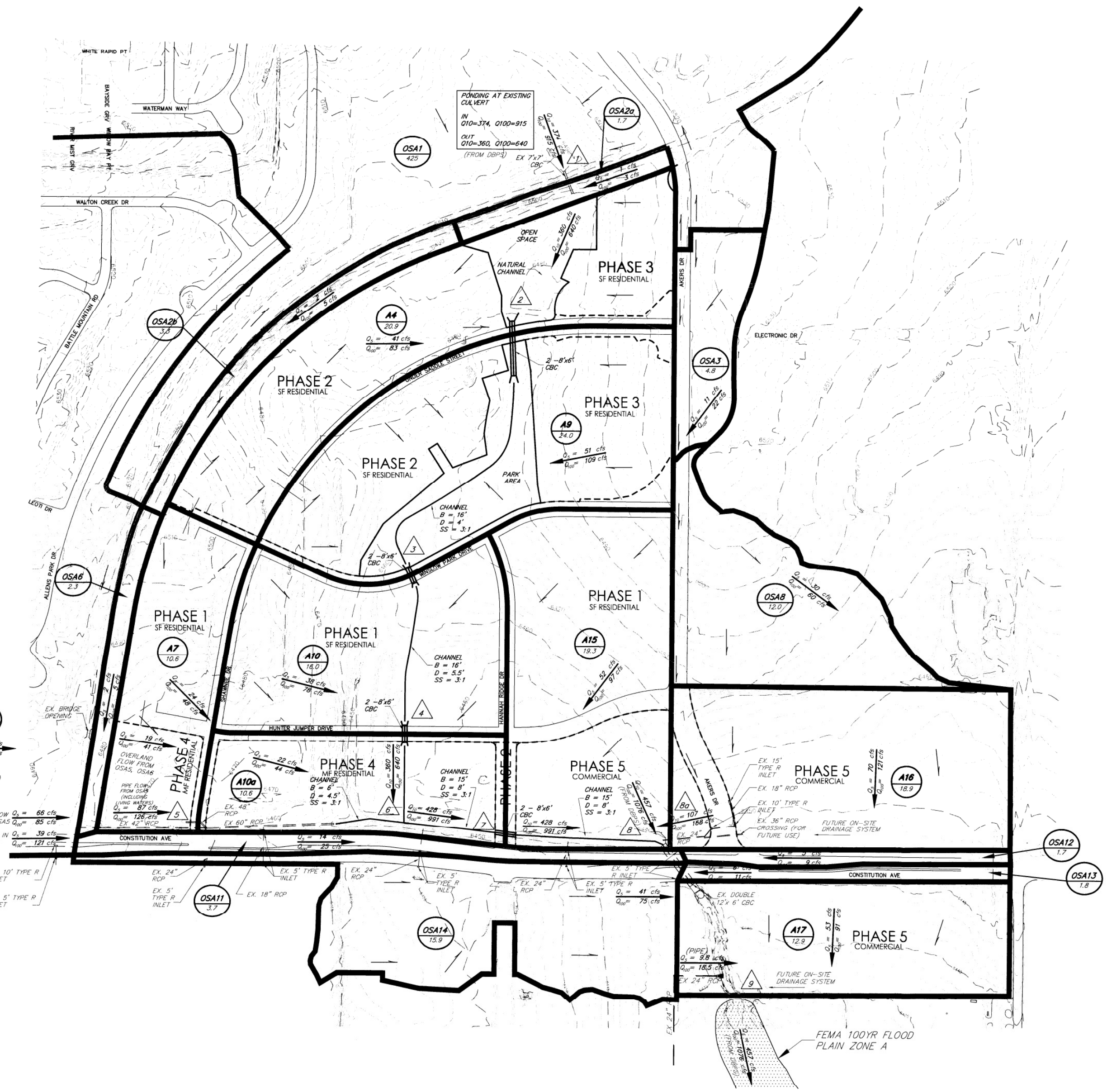
M.V.E., Inc.
1903 Lelaray Street, Suite 200
Colorado Springs, CO 80909
(719) 635-5736

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

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
- EX. 24" RCP — EXISTING STORM DRAIN LINE
- EXISTING PROPERTY LINE
- EXISTING ROAD
- PROPOSED CULVERT W/ RIPRAP APRON
- PROPOSED DRAINAGE CHANNEL
- PROPOSED PROJECT PHASE LINE
- DRAINAGE BASIN BOUNDARY
- OSA2 / A5 — DRAINAGE BASIN DESIGNATION
- 14.9 / 2.56 — DRAINAGE BASIN AREA
- Q_5 = 3.3 cfs, Q_{100} = 7.4 cfs — FLOW DIRECTION AND QUANTITIES
- FLOW DIRECTION
- 8 — DESIGN POINT DESIGNATION

PROJECT: HANNAH RIDGE

TITLE: MDDP DEVELOPED MAP

MONUMENT VALLEY ENGINEERS INC.
ENGINEERS • SURVEYORS
1903 LELARAY STREET
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.

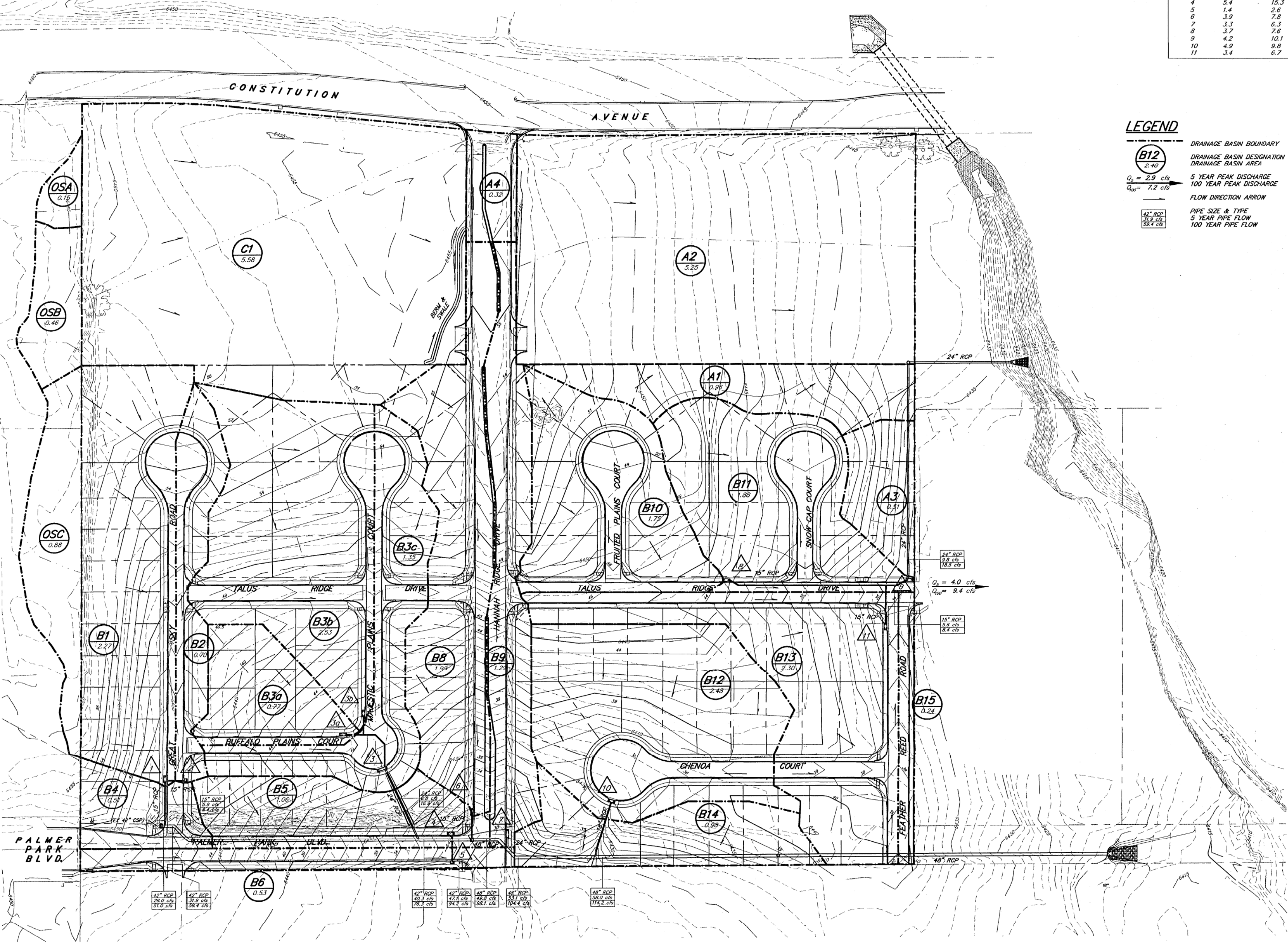
3.3 Onsite

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

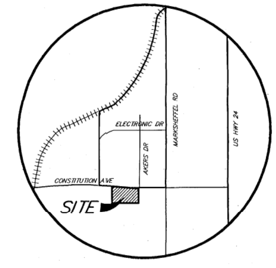
PROPOSED DRAINAGE INLET DATA							
POINT OF INTEREST	Q5 W/ INLETS	Q100 W/ INLETS	INLET SIZE	Q5 INTERCEPTED	Q5 BYPASS	Q100 INTERCEPTED	Q100 BYPASS
1	6.6	12.8	10	4.5	2.1	6.5	6.3
2	2.0	3.8	5	1.4	0.6	1.9	1.9
3a	1.7	3.4	10	1.6	0.1	2.6	0.8
3b	4.8	9.6	10	3.1	1.7	4.5	5.1
3	3.7	9.8	15 (SUMP)	3.7	0.0	9.8	0.0
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

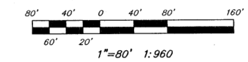
— · — · —	DRAINAGE BASIN BOUNDARY
B12 / 2.48	DRAINAGE BASIN DESIGNATION DRAINAGE BASIN AREA
Q_5 = 2.9 cfs Q_{100} = 7.2 cfs	5 YEAR PEAK DISCHARGE 100 YEAR PEAK DISCHARGE
⟶	FLOW DIRECTION ARROW
42" RCP 31.9 cfs 59.4 cfs	PIPE SIZE & TYPE 5 YEAR PIPE FLOW 100 YEAR PIPE FLOW

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
2	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
5	B6	0.53	1.4	2.6
6	B8	1.98	3.9	7.8
7	B9	1.29	3.3	6.3
8	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
1	OSC+B1	3.15	6.6	12.8
	OSC+B1+B2+B4	4.36	8.7	17.1
4	OSC+B1+B2+B4+B5	5.42	10.3	20.3
	OSC+B1+B2+B4+B5+B8	7.40	14.0	27.6
	OSC+B1+B2+B4+B5+B8+B9	8.69	15.2	30.5
9	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.

SCALE



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PROJECT:

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

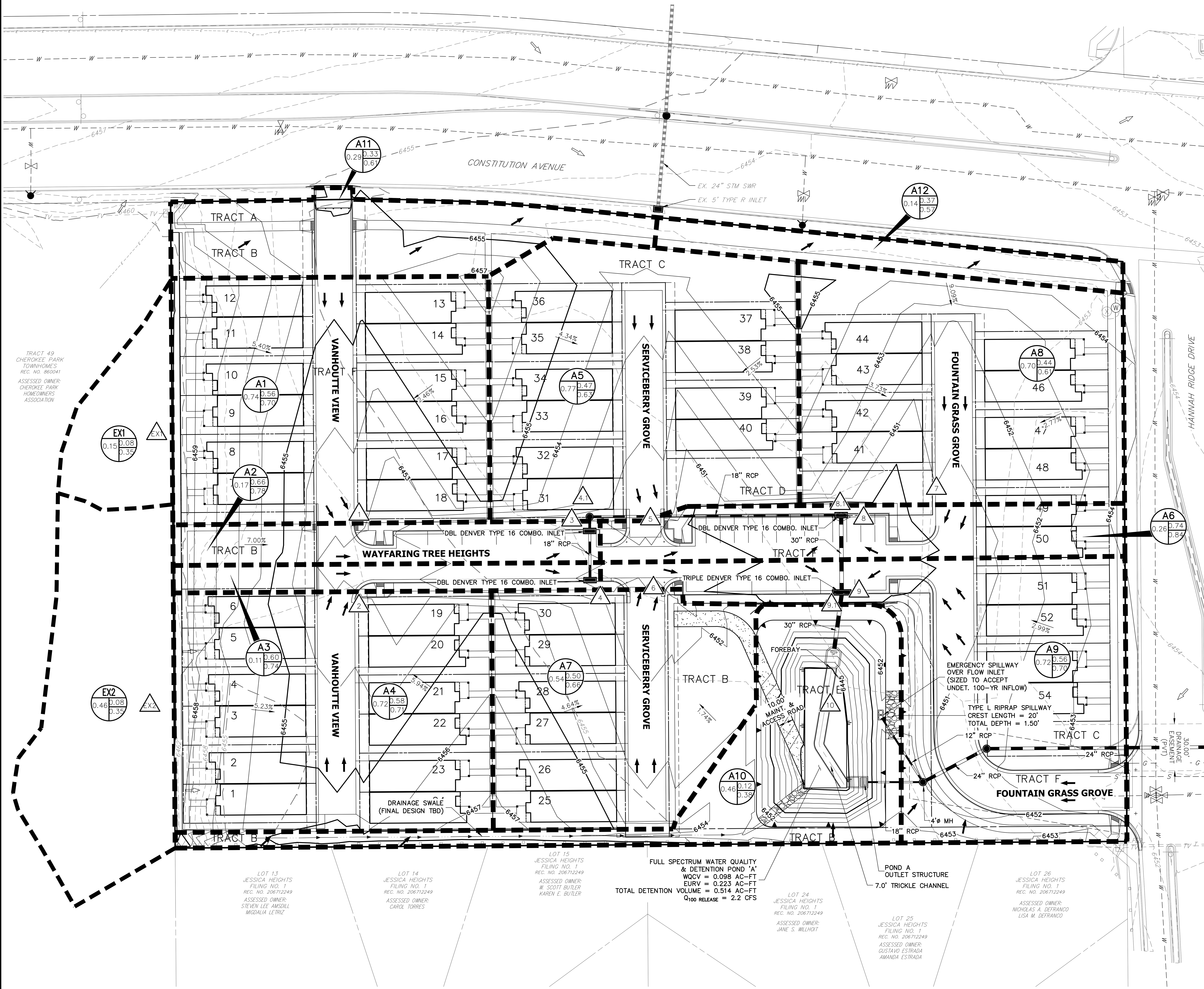
- BASIN DESIGNATION — I.D.: BASIN IDENTIFIER; A: BASIN AREA; B: MINOR COEFFICIENT; C: MAJOR COEFFICIENT
- DESIGN POINT
- BASIN DELINEATION
- 6100 — EXISTING INDEX CONTOURS
- 6101 — EXISTING INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION

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	0.04	0.4
EX2	0.46	0%	0.08	0.35	8.1	0.2	1.2
A1	0.74	63%	0.56	0.70	6.4	2.0	4.2
A2	0.17	71%	0.66	0.78	7.4	0.5	1.0
A3	0.11	64%	0.60	0.74	6.1	0.3	0.7
A4	0.72	65%	0.58	0.71	5.9	2.0	4.2
A5	0.77	51%	0.47	0.63	7.2	1.7	3.8
A6	0.26	83%	0.74	0.84	7.9	0.9	1.6
A7	0.54	54%	0.50	0.66	6.8	1.3	2.8
A8	0.70	47%	0.44	0.61	7.8	1.4	3.2
A9	0.72	60%	0.56	0.70	8.0	1.8	3.8
A10	0.46	4%	0.12	0.38	9.5	0.2	1.2
A11	0.29	28%	0.33	0.61	11.0	0.4	1.2
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	1.9	4.3
2	2.0	5.0
3	2.4	5.3
4	2.4	5.8
4.1	3.8	6.7
5	2.1	5.6
6	1.7	4.9
7	1.4	3.3
8	4.1	10.0
8.1	7.7	16.3
9	3.3	8.4
9.1	10.8	24.1
10	11.0	25.3

LEGEND

- I.D. / A B C — BASIN DESIGNATION
  - I.D.: BASIN IDENTIFIER
  - A: BASIN AREA
  - B: C_5
  - C: C_{100}
- X (triangle) — 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

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

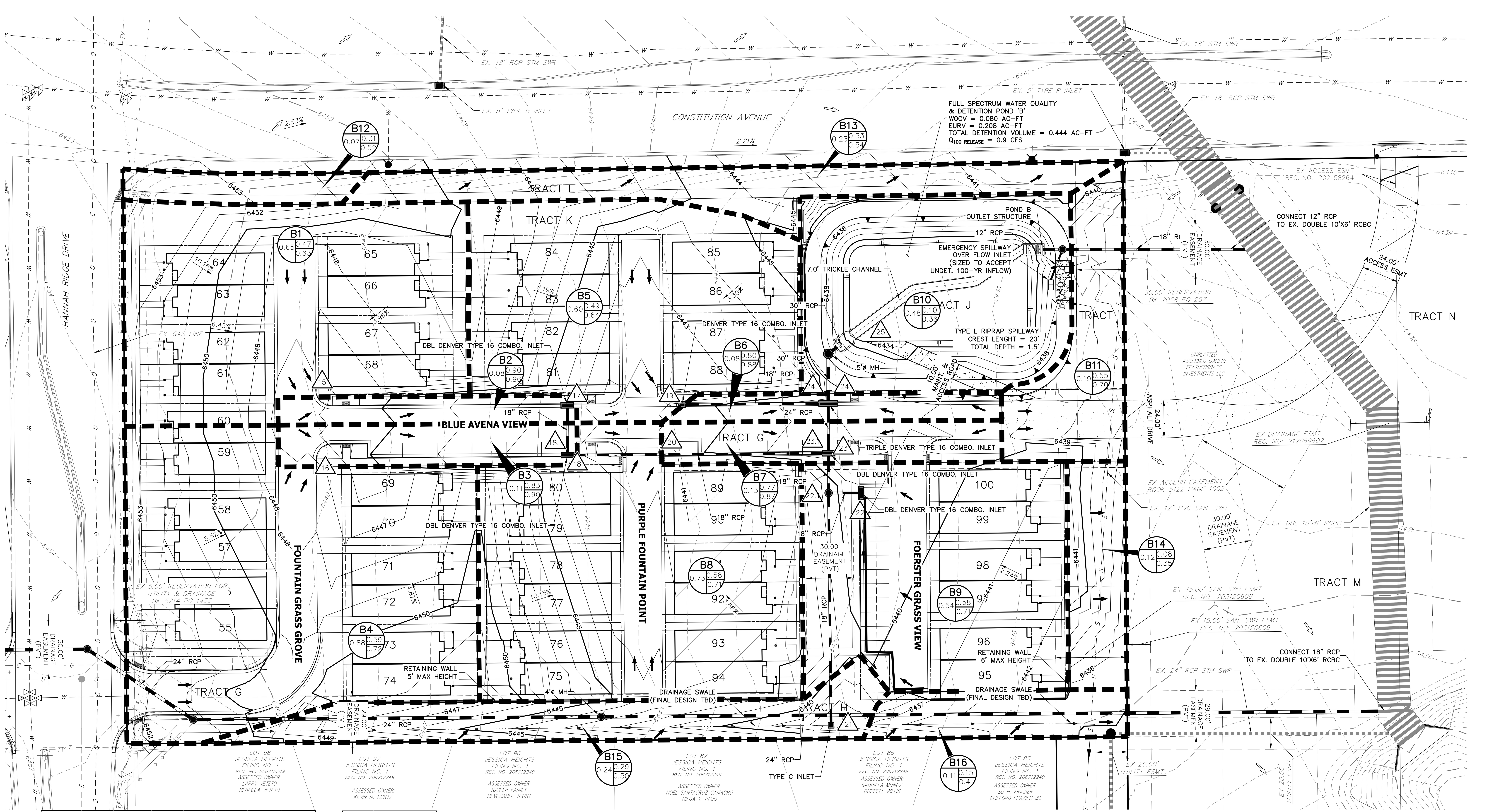
No.	REVISION	BY	DATE
1	REVISIONS PER COMMENTS	RD	03/11/20

H-SCALE	1"=30'
V-SCALE	N/A
DATE	02/07/20
DESIGNED BY	NQJ
DRAWN BY	NQJ
CHECKED BY	

URBAN COLLECTION AT PALMER VILLAGE
WEST DRAINAGE MAP

SHEET 1 OF 2
JOB NO. 25149.01

X:\2510000.all\2514901\Drawings\Sheet Dwgs\Drainage\2514901_Pr Drainage Map.dwg, DR01, 5/29/2020 1:14:33 PM, CS



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	0.65	51%	0.47	0.63	6.5	1.4	3.3
B2	0.08	100%	0.90	0.96	5.0	0.4	0.7
B3	0.11	91%	0.83	0.90	5.0	0.5	0.9
B4	0.88	66%	0.59	0.72	6.7	2.5	5.1
B5	0.60	53%	0.49	0.64	6.2	1.4	3.1
B6	0.08	88%	0.80	0.88	5.0	0.3	0.6
B7	0.13	85%	0.77	0.87	5.0	0.5	1.0
B8	0.73	65%	0.58	0.71	5.7	2.1	4.3
B9	0.54	64%	0.58	0.71	6.5	1.5	3.1
B10	0.48	2%	0.10	0.36	5.7	0.2	1.5
B11	0.19	58%	0.55	0.70	5.0	0.5	1.2
B12	0.07	29%	0.31	0.52	5.1	0.1	0.3
B13	0.23	30%	0.33	0.54	7.5	0.3	0.9
B14	0.12	0%	0.08	0.35	5.0	0.1	0.4
B15	0.24	25%	0.29	0.50	5.0	0.4	1.0
B16	0.11	9%	0.15	0.41	5.0	0.1	0.4

DESIGN POINT SUMMARY TABLE		
Design Point	Q_5 (cfs)	Q_{100} (cfs)
15	1.4	3.3
16	2.5	5.1
17	1.7	3.8
18	2.8	5.6
18.1	3.4	5.5
19	1.7	4.6
20	2.6	6.4
21	0.4	1.0
22	1.5	3.1
22.1	1.7	3.2
23	3.3	8.3
23.1	8.1	16.0
24	0.8	3.0
24.1	9.9	20.7
25	10.1	21.9

LEGEND

BASIN DESIGNATION
I.D.: BASIN IDENTIFIER
A: BASIN AREA
B: C_5
C: C_{100}

DESIGN POINT

BASIN DELINEATION

EXISTING INDEX CONTOURS

EXISTING INTERMEDIATE CONTOURS

PROPOSED INDEX CONTOURS

PROPOSED INTERMEDIATE CONTOURS

PROPOSED SANITARY SEWER

PROPOSED STORM SEWER

PROPOSED WATER LINE

EXISTING FLOW DIRECTION

PROPOSED FLOW DIRECTION

30 15 0 30 60
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
1	REVISIONS PER COMMENTS	RD	03/11/20
2	REVISIONS PER COMMENTS	GE	06/30/20

H-SCALE	1"=30'
V-SCALE	N/A
DATE	06/01/20
DESIGNED BY	NQJ
DRAWN BY	NQJ
CHECKED BY	

URBAN COLLECTION AT PALMER VILLAGE
EAST DRAINAGE MAP

SHEET 2 OF 2
JOB NO. 25149.01