FINAL DRAINAGE REPORT

for

WESTGATE AT POWERS
FILING NO. 3

Prepared for:

Powers and Airport, LLC
160 W. Canyon Road, #3
Alpine, UT 84004

May 15, 2021

Prepared by:

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JPS Project No. 020501

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Westgate at Powers – Filing No. 3

Engineer's Statement
This report and plan for the drainage design of Westgate at Powers – Filing No. 3 was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for liability caused by negligent acts, errors or omissions on my part in preparing this report.

SIGNATURE (Affix Seal):_____
Colorado P.E. No. Date

Developer's Statement
Powers and Airport LLC hereby certifies that the drainage facilities for Westgate at Powers – Filing No. 3 shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of Westgate at Powers – Filing No. 3, guarantee that final drainage design review will absolve Powers and Airport LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Powers and Airport LLC
Name of Developer

_____
Authorized Signature Date

_____
Printed Name

_____
Title

160 W. Canyon Road #3, Alpine, UT 84004
Address

City of Colorado Springs Statement:
Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

_____ _____
For City Engineer Date

Conditions:

I. INTRODUCTION

A. Background

Westgate at Powers is a master planned mixed-use development located on approximately 59-acres on the east side of Colorado Springs, Colorado. The development is located at the northwest corner of Powers Boulevard and Airport Road, as shown in Figure A1 (Appendix F). The Westgate at Powers Master Plan includes a mixture of commercial, retail, office, and multi-family apartment land uses in this infill area within the City of Colorado Springs. Phase 1 Development included re-alignment and channelization of the Sand Creek Center Tributary Channel along with re-alignment of Troy Hill Road, including a new roundabout and initial westerly segment of Joystone Drive.

Westgate at Powers Filing No. 1, recorded in March 2019, consists of 11.1 acres which includes the commercial area on the west side of the re-aligned Troy Hill Road along with public right-of-way for Troy Hill Road and Joystone Drive, as well as public drainage tracts for the Sand Creek Center Tributary Channel.

Westgate at Powers Filing No. 2, recorded in October 2019, consists of 6.1 acres including seven commercial lots and one drainage tract along the east side of the re-aligned Troy Hill Road, north of Airport Road.

Westgate at Powers Filing No. 3 consists of approximately 28.7 acres in the northwest corner of the Westgate at Powers Master Plan area. As a part of the Westgate at Powers Development Plan (CPC-DP-12-00017-A1MN18), this area has been approved for an apartment project consisting of 440 units. Infrastructure improvements for Filing No. 3 will include construction of Joystone Drive from its current termination northwest of the roundabout intersection with Troy Hill Road, extending to the north boundary of the Westgate at Powers property.

B. Purpose

The Westgate at Powers Concept Plan and Development Plan (CPC-DP-12-00017) were approved by the City in October, 2012. In support of the previous planning approvals, JPS Engineering prepared the "Master Development Drainage Plan (MDDP) for Westgate at Powers" dated April 30, 2012, which was approved by the City on June 11, 2012.

Drainage planning for this site was further studied in the "Final Drainage Report (FDR) for Westgate at Powers Phase 1" by JPS Engineering, Inc. dated March 28, 2018 (approved by City on April 4, 2018). According to the previously approved FDR, developed drainage impacts will be mitigated through on-site full-spectrum detention basins.

This "Final Drainage Report for Westgate at Powers Filing No. 3" has been prepared in support of the Construction Drawings for Filing No. 3 site development and the Subdivision Plat for Filing No. 3. This report is intended to meet the requirements of a Final Drainage Report in accordance with City of Colorado Springs drainage criteria. This Final Drainage Report is in full conformance with the previously approved Westgate at Powers MDDP and the "Final Drainage Report for Westgate at Powers Phase 1."

C. General Description

The Westgate at Powers Filing No. 3 site is comprised of several unplatted, vacant parcels (El Paso County Assessor's #64133-00-024, #64133-00-025, and #64130-00-143). The existing parcels are zoned C5 (commercial) and PBC (planned business center).

The site is located in the south half of Section 13**,** Township 14 South, Range 66 West of the 6th Principal Meridian. Ground elevations within the site range from 6,110 to 6,140 feet above mean sea level.

The Westgate at Powers Filing No. 3 property is bounded by the existing Golden Acres Mobile Home Park to the southwest, vacant property zoned PIP to the northwest, the existing Frazier's Garden Acres Subdivision (0.5-acre lots) to the northeast, and the previously developed Westgate at Powers Filing No. 1 (including Sand Creek Center Tributary Channel tracts) to the southeast.

The terrain is generally flat to gently rolling, with northeast to southwest slopes ranging from one to two percent. Historic drainage patterns from the site are conveyed overland to the south and west boundaries of the site. The site is currently vegetated with native grasses and limited shrubs.

Surface drainage in this area flows to the major drainage channel and associated tributaries of Sand Creek, which ultimately drains to Fountain Creek. This site is located entirely within the Sand Creek Drainage Basin. The eastern part of the Westgate at Powers property is bisected by the major drainage channel of the Sand Creek Center Tributary, which flows southwesterly through the site. The northwest corner of the property adjoins the main channel of Sand Creek.

The Westgate at Powers development consists of a mixture of land uses including commercial, retail, office, and apartments, with associated parking and open space areas. Site improvements will include overlot grading, roadway and parking improvements, site utilities, and commercial site development.

While Filings No. 1 and 2 provided new commercial lots, the proposed Filing No. 3 will establish lots for the proposed apartment complex in the northwest area of the site. In accordance with the approved Westgate at Powers Development Plan, Filing No. 3 will include construction of Joystone Drive as a new industrial collector roadway ("Joystone Drive") extending northwesterly from the roundabout to the north boundary of the development.

The drainage plan for the Westgate at Powers development includes extended detention basins serving as full spectrum detention and water quality facilities to mitigate developed drainage impacts.

D. Soil Conditions

According to the Soil Survey of El Paso County prepared by the Soil Conservation Service, on-site soils are comprised of the following soil types (see Appendix A):

- Type 11 (central part of site) - "Bresser sandy loam": moderate permeability, slow surface runoff, slight to moderate erosion hazard (Hydrologic Group B)
- Type 28 (eastern part of site, following existing Sand Creek Center Tributary channel) – "Ellicott loamy coarse sand": rapid permeability, slow surface runoff, high erosion hazard (Hydrologic Group A)
- Type 78 (southwest corner of site, adjacent to Sand Creek channel) – "Sampson loam": moderate permeability, slow surface runoff, slight erosion hazard (Hydrologic group B)
- Type 96 (northern part of site) – "Truckton sandy loam": moderately rapid permeability, slow surface runoff, moderate erosion hazard (Hydrologic Group B)
- Type 97 (southeast part of site) – "Truckton sandy loam": moderately rapid permeability, slow surface runoff, moderate erosion hazard (Hydrologic Group B)

As shown in Appendix A, the majority of the parcel is characterized as Truckton sandy loam, and classified as hydrologic soils group B.

E. References

ADP, "Final Drainage Report for Airport and Powers Filing No. 1," February, 2000.

City of Colorado Springs "Drainage Criteria Manual, Volume 1 and Volume 2," May, 2014.

CDOT, "CDOT Drainage Design Manual," July, 1995.

FEMA Letter of Map Revision Case No. 19-08-0754P, approved October 13, 2020.

H.J. Kraettli & Sons, "Drainage Report for Golden Acres Mobile Home Park," May 7, 1973.

JPS Engineering, Inc., "Channel Design Report for Westgate at Powers Sand Creek Center Tributary Channel," March 28, 2018 (approved by City 4/4/18).

JPS Engineering, Inc., "Final Drainage Report for Westgate at Powers Phase 1," March 28, 2018 (approved by City 4/4/18).

JPS Engineering, Inc., "Master Development Drainage Plan for Westgate at Powers," April 30, 2012 (approved by City 6/11/12).

JR Engineering Ltd., "Final Drainage Report for The Villages at Sand Creek Filing No. 3," December, 1997.

Kiowa Engineering Corporation, "Sand Creek Drainage Basin Planning Study – Preliminary Design Report," March, 1996.

USDA/NRCS, "Soil Survey of El Paso County Area, Colorado," June, 1981.

II. DRAINAGE CRITERIA

A. Hydrologic Criteria

Major basin hydrology for the off-site areas contributing flow to the Sand Creek Center Tributary Channel was previously completed using SCS methods as detailed in the Sand Creek Drainage Basin Planning Study (DBPS).

Tributary drainage areas impacting the on-site drainage analysis are all less than 100-acres, so Rational Method procedures were utilized for calculation of peak flows within the on-site drainage basins. In accordance with City of Colorado Springs Drainage Criteria Manual Volume 1 (DCM 1), Rational Method hydrologic calculations were based on the following assumptions:

- Design storm (minor): 5-year
- Design storm (major): 100-year

$$Q = CiA$$

Q = Peak Flow (cubic feet per second, cfs)
C = Runoff Coefficient
i = Rainfall Intensity (inches per hour, in/hr)
A = Tributary Drainage Area (acres, ac)

Runoff times of concentration were calculated based on guidance in DCM 1. Rainfall intensities were derived from City of Colorado Springs Intensity-Duration-Frequency (IDF) curves. Runoff coefficients were selected based on the existing and proposed land uses according to DCM 1 Table 6-6. Hydrologic calculations are enclosed in Appendix A, and peak design flows are identified on the drainage basin drawings.

B. Hydraulic Criteria

Hydraulic design criteria are based on guidelines delineated in the City of Colorado Springs Drainage Criteria Manual (DCM).

Storm inlet design and related gutter flow calculations have been performed using the "UD-Inlet_v4.05" design software published by the Denver Mile High Flood District (MHFD).

Storm sewer design calculations have been performed using the FHWA "Hydraulic Toolbox 4.2" software. Storm sewer calculations for the storm sewers within the site are generally based on 100-year inlet and pipe capacity to provide conveyance of developed flows to on-site stormwater detention facilities prior to discharge to the adjoining drainage channels.

Stormwater detention facilities have been designed using the "MH-Detention_v4.04" software package published by MHFD. Stormwater quality facilities have been designed using the "UD-BMP_v3.07" software package published by MHFD.

III. EXISTING DRAINAGE CONDITIONS

The existing site generally slopes downward to the southwest with average grades of approximately 1-4 percent. This site is a historically undeveloped property with vegetation comprised primarily of native grasses.

The Westgate at Powers development lies completely within the Sand Creek Drainage Basin. Surface drainage in the easterly part of the master plan area flows to the Sand Creek Center Tributary channel, and surface drainage from the west side of the site flows to the main channel of Sand Creek. The Sand Creek Drainage Basin comprises a total tributary area of 54.1 square miles. The Westgate at Powers master plan area represents approximately 59 acres of development, or less than 0.2 percent of the total basin area.

Historic drainage conditions are depicted in Figure EX1 (Appendix F). The site has been divided into three major basins (A-C). The undeveloped site had no existing drainage facilities within the property. The existing off-site drainage basins northeast of the site generally combine with on-site basins as shown on Figure EX1, flowing southwesterly through the site within existing drainage swales and channels.

The site is impacted by a significant off-site drainage area upstream of the Sand Creek Center Tributary Channel, which flows southwesterly through Basin A on the east side of the master plan area. The upstream area is identified in the "Sand Creek DBPS" as Basin "42", and these flows enter the site through the existing box culvert crossing Troy Hill Road (3-cell 16'x6' concrete box culvert).

The Center Tributary channel of Sand Creek running through this site drains a tributary area of 1.2 square miles, crossing Airport Road in an existing multiple box culvert (5-cell 6'x8' concrete box culvert). The Sand Creek DBPS identified a recommendation for an improved "100-year riprap channel" through this site, with a bottom width of 50-feet and a depth of 5 feet, and the channel improvements were completed as part of Westgate at Powers Phase 1.

In addition to the major off-site flows in the Sand Creek Center Tributary Channel, off-site Basins OA1, OA2, and OB1 also contribute flow to the Westgate at Powers site as shown on Figure EX1. Flows from two smaller off-site areas on the east side of Troy Hill Road south of the major channel are conveyed through existing culverts across Troy Hill Road.

Basins A and B

The east side of the Westgate at Powers site has been delineated as Basin A (33.5 acres), which drains southwesterly to the Sand Creek Center Tributary channel. Basins OA1 (20.8 acres) comprises the area within the CDOT right-of-way east of the Westgate property, which drains southwesterly towards the re-aligned intersection of Airport Road and the new Troy Hill Road. Basin OA1 flows westerly through an existing 30-inch RCP culvert crossing Troy Hill Road on the north side of Airport Road. These flows continue westerly in an existing swale on the north side of Airport Road, discharging into the Sand Creek Center Tributary Channel.

Basin OA2 (6.7 acres) comprises an off-site area on the south side of Pikes Peak Avenue, which sheet flows south to the Sand Creek Center Tributary Channel.

On the east side of Troy Hill Road, Basins OB1 (2.3 acres) and B (6.6 acres) flow westerly to an existing 24-inch culvert crossing Troy Hill Road and draining across the Westgate parcel.

Off-site flows from off-site Basins OA1, OA2, and OB1 combine with on-site flows from Basins A and B, draining southwesterly to Design Point #1 with historic peak flows calculated as $Q_5 = 12.0$ cfs and $Q_{100} = 88.4$ cfs.

The Sand Creek DBPS identifies peak flows of $Q_{10} = 950$ cfs and $Q_{100} = 1{,}960$ cfs in the Sand Creek Center Tributary Channel flowing through this site. Flows at the downstream confluence with the East Fork of Sand Creek are projected to be in the range of 15,600 cfs. As such, on-site flows from the proposed Westgate at Powers site are relatively small in comparison to projected flows in the East Fork of Sand Creek.

Basin C

The southwest part of the Westgate property has been delineated as Basin C1 (13.0 acres). This basin sheet flows southwester to Design Point #2, with historic peak flows calculated as $Q_5 = 2.2$ cfs and $Q_{100} = 16.1$ cfs.

The northwest part of the Westgate master plan area has been delineated as historic Basin C2 (16.6 acres). This part of the site receives off-site flow from Basin OC1 (10.0 acres) north of the property. Basins OC1 and C2 sheet flow westerly to the main channel of Sand Creek at the northwest corner of the property. Historic flows from Basins OC1 and C2 combine at Design Point #3, with peak flows calculated as $Q_5 = 4.0$ cfs and $Q_{100} = 29.3$ cfs.

IV. PROPOSED DRAINAGE CONDITIONS

The developed drainage basins and projected flows are shown in Figure D1 (Appendix F). The developed site has been divided into three major basins (A-C) and three design points (DP1-DP3). Hydrologic calculations are enclosed in Appendix A.

Surface runoff from the developed site will be conveyed by sheet flow and curb and gutter to storm sewer systems conveying flows to private stormwater detention basins providing stormwater detention and water quality treatment prior to discharge into the major drainage channels.

Phase 1 (Filing No. 1 and 2) Development Areas:

Developed Basin A consists of the proposed commercial, office, hotel, and retail area located between the existing Troy Hill Road and the re-aligned Sand Creek Center Tributary Channel. Filings No. 1 and 2 are located within developed Basins A1-A5. Drainage planning for these areas was addressed in detail in the previously approved "Final Drainage Report (FDR) for Westgate at Powers Phase 1" by JPS Engineering, Inc. dated March 28, 2018. Full-Spectrum Extended Detention Basins A1 and A2 were constructed with Filings No. 1 and 2 to provide stormwater detention and water quality for developed Basins A1-A5.

Filing No. 3 Development Areas:

Basin A8 (2.0 acres) comprises the public roadway area along Joystone Drive extending northwest of the Sand Creek Center Tributary Channel to the north subdivision boundary. The roadway drainage will be conveyed by curb and gutter to Inlets A8.1 and A8.2 (Public 5' Type D10R Inlets) located at the sump in the road profile, and Storm Sewer A8.1 (18" RCP) will flow to Storm Sewer A8.2 (24" HDPE) conveying these flows into Detention Pond A6. Developed flows from Basin A8 drain to Design Point #A8, with peak flows calculated as $Q_5 = 6.4$ cfs and $Q_{100} = 12.2$ cfs.

In the event of clogging, the overflow path for Inlets A8.1-A8.2 will be surface drainage northeasterly into Detention Pond A6 and the adjoining Sand Creek Center Tributary Channel.

Developed on-site flows from Basins A6-A8 combine at Design Point #A8a, with peak flows calculated as $Q_5 = 35.6$ cfs and $Q_{100} = 70.3$ cfs (see Sh. D1.3, Appendix F). Detention Pond A6 will provide full-spectrum stormwater detention and water quality for the combined flow from Basins A6-A8, including the Joystone Drive improvements constructed to serve Filing No. 3.

Previous Phase 1 development included construction of the Sand Creek Center Tributary Channel and related overlot grading within Basin A6, including some initial grading of Detention Pond A6 to serve as a sediment basin during overlot grading activities. Detention Basin A6 will be fully constructed as a part of the Filing No. 3 infrastructure improvements (including Joystone Drive construction).

Future Development Areas:

Basin A6

Basin A6 (13.4 acres) comprises the future commercial development area on the north side of Joystone Drive and west side of Troy Hill Road, southeast of the Sand Creek Center Tributary channel.

Surface runoff from Basin A6 will be conveyed southwesterly by sheet flow and curb and gutter to private storm inlets serving this area. The private storm sewer system will intercept surface flows and convey developed runoff to the proposed Detention Basin A6, which will discharge into the Sand Creek Center Tributary Channel. Developed flows from Basin A6 flow to Design Point #A6, with peak flows calculated as $Q_5 = 30.0$ cfs and $Q_{100} = 59.8$ cfs.

Basin A7 (1.2 acres) comprises the future office/retail area lying on the north side of the proposed Sand Creek Center Tributary Channel, east of the proposed Joystone Drive extension. The developed drainage plan for Basin A7 includes a porous landscape detention area (PLD #A7) for stormwater quality treatment within this development area. Flows from these PLD facilities will discharge into the adjoining drainage channel. Developed flows from Basin A7 flow to Design Point #A7, with peak flows calculated as $Q_5 = 3.6$ cfs and $Q_{100} = 7.2$ cfs.

On the north side of Basin A7, Off-site Basin OA2 flows southerly to the Sand Creek Center Tributary Channel, with peak flows at Design Point OA2 calculated as $Q_5 = 6.0$ cfs and $Q_{100} = 15.7$ cfs.

Basin A9 (Pond A9)

Basin A9 (6.3 acres) comprises the eastern fringe of the proposed apartment area planned for the northwest part of the Westgate at Powers site. Surface runoff from Basin A9 will be conveyed southeasterly by sheet flow and curb and gutter to storm inlets in the local street system serving this area. The storm sewer system will intercept surface flows and convey developed runoff to the proposed Detention Basin A9, which will discharge into the Sand Creek Center Tributary Channel. Developed flows from Basin A9 flow to Design Point #A9, with peak flows calculated as $Q_5 = 11.7$ cfs and $Q_{100} = 24.8$ cfs.

Detailed drainage planning for Basin C will be provided in a future Final Drainage Report for the Apartment Site.

Basin A10 has been delineated as the re-aligned Sand Creek Center Tributary Channel and adjoining undeveloped areas. Developed peak flows from Basin A10 are calculated as $Q_5 = 1.3$ cfs and $Q_{100} = 9.2$ cfs.

Basin C

Basin C (23.4 acres) comprises the northwest part of the Westgate at Powers site. Surface runoff from Basins C1-C4 will be conveyed westerly by sheet flow and curb and gutter to storm inlets in the local street system serving this area. A private storm sewer system within the west side of the apartment complex will intercept surface flows and convey developed runoff to the proposed Detention Basin C, which will discharge into the Sand Creek drainage channel at the northwest corner of the property.

Developed on-site flows from Basins C1-C4 combine at Design Point #3, with peak flows calculated as $Q_5 = 28.0$ cfs and $Q_{100} = 62.7$ cfs.

Detailed drainage planning for Basin C will be provided in a future Final Drainage Report for the Apartment Site.

Drainage Facility Design:

Hydrologic calculations are detailed in Appendix A, and hydraulic calculations for proposed drainage improvements are enclosed in Appendix B1-B2.

Storm Sewer A8

As detailed in the "Storm Inlet Sizing Summary" table in Appendix B1, inlet flows have been calculated based on the proportional basin area draining to each individual inlet, and the selected inlets have been sized to provide Inlet Capacity exceeding the calculated 100-year flow entering each inlet. As such, no bypass flow is anticipated from any of the inlets.

As shown in the "Storm Sewer Sizing Summary" table in Appendix B1, the selected storm drain pipes have been sized to provide pipe capacity exceeding the calculated 100-year flow entering each pipe.

Joystone Drive Box Culvert

Details for the previously completed major drainage channel improvements are provided in the "Channel Design Report for Westgate at Powers Sand Creek Center Tributary Channel" dated March 28, 2018 by JPS Engineering. The proposed box culvert improvements have been designed based on the future flows identified in the Sand Creek DBPS for the reach downstream of Troy Hill Road. According to the preliminary design profiles in the DBPS, design flows for this reach have been established as $Q_{10} = 950$ cfs and $Q_{100} = 1{,}960$ cfs. Based on the culvert hydraulic calculations in Appendix B2, the proposed triple 16'x6' concrete box culvert (matching the design of existing upstream box culvert crossing of Troy Hill Road) provides adequate capacity to safely convey the design 100-year flow of 1,960 cfs without any surcharge.

The FEMA Flood Insurance Study (FIS) utilizes a much lower 100-year flow of $Q_{100} = 790$ cfs, so the proposed box culvert design provides significantly higher capacity than required based on the FEMA drainage analysis.

Stormwater Detention Ponds

Construction of the proposed Detention Pond A6, along with future Detention Ponds A9 and C, will provide the required stormwater detention and water quality treatment for Westgate at Powers Filing No. 3 prior to discharging to the adjoining public drainage channels. Final design calculations for Detention Pond A6 are enclosed in Appendix C.

The proposed drainage plan (Sheets D1 and D1.3, Appendix F) complies with the previously approved "Master Development Drainage Plan for Westgate at Powers" and current City drainage criteria.

V. DRAINAGE PLANNING – FOUR STEP PROCESS

City of Colorado Springs Drainage Criteria require drainage planning to include a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls. As stated in DCM Volume 2, the Four Step Process is applicable to all new and re-development projects with construction activities that disturb 1 acre or greater or that disturb less than 1 acre but are part of a larger common plan of development.

The Four Step Process has been implemented as follows in the planning of this project:

Step 1: Employ Runoff Reduction Practices

- Minimize Directly Connected Impervious Areas (MDCIA): The drainage plan for the Filing No. 3 development areas includes proposed Extended Detention Basins A6, A9, and C. The stormwater detention basins will provide pervious areas to receive flow from the developed on-site impervious areas prior to discharge to the adjoining drainage channels.
- Final grading and drainage design of the apartment complex will be encouraged to divert roof drain downspouts from the new buildings to drain across pervious landscape strips where possible.

Step 2: Implement BMPs that Provide a Water Quality Capture Volume with Slow Release

- Extended Detention Basins: Stormwater Detention Basins will be provided to mitigate developed drainage impacts from the developed areas. On-site drainage will be routed through the private Extended Detention Basins, which will capture and slowly release the WQCV over a slow release period.

Step 3: Stabilize Drainageways

- During Phase 1 development of Westgate at Powers, the Sand Creek Center Tributary Channel was fully improved with buried riprap bank lining and a series of drop structures to provide a stable channel flowing through the site.
- Implementation of the proposed on-site drainage improvements and stormwater detention basins as part of the development of this property will improve on historic drainage conditions and minimize the downstream drainage impact from this site.

Step 4: Implement Site Specific and Other Source Control BMPs

- No outside storage or industrial uses are proposed for this site.
- The proposed commercial development project will implement a Stormwater Management Plan including proper housekeeping practices and spill containment procedures.
- On-site developed drainage will be routed through private Detention Basins to minimize introduction of contaminants to the City's public drainage system.

VI. GENERAL DRAINAGE RECOMMENDATIONS

The developed drainage plan for the site includes providing and maintaining positive drainage away from structures and conforming to the established drainage patterns for the overall site. JPS Engineering recommends that positive drainage be established and maintained away from all structures within the site in conformance with applicable building codes and geotechnical engineering recommendations.

In general, we recommend a minimum of 6 inches clearance from the top of concrete foundation walls to adjacent finished site grades. Positive drainage slopes should be maintained away from all structures, with a minimum recommended slope of 5 percent for the first 10 feet away from buildings in landscaped areas, a minimum recommended slope of 2 percent for the first 10 feet away from buildings in paved areas, and a minimum slope of 1 percent for paved areas beyond buildings.

VII. STORMWATER DETENTION AND WATER QUALITY

As required by City Engineering policies (DCM Volume 1 and 2) for development involving disturbed areas greater than one acre, stormwater detention and water quality improvements will be implemented with development of this site. Full-spectrum detention will be provided for the entire development per City drainage criteria.

The proposed drainage and grading plan for the public infrastructure improvements serving Filing No. 3 (extension of Joystone Drive) directs surface drainage from the Joystone Drive roadway corridor to the proposed Extended Detention Basins (EDB) A6 at the northeast corner of Joystone Drive and the Sand Creek Center Tributary Channel.

The detention basin has been designed as a Full-Spectrum Detention Pond providing the required stormwater detention and water quality capture volume in accordance with the "City Drainage Criteria Manual, Volumes 1 and 2."

The full-spectrum detention pond has been sized utilizing the Denver Mile High Flood District's "MH-Detention_v4.04" and "UD-BMP_v3.07" software. Design parameters for the proposed full-spectrum detention basin are detailed in Appendix C and summarized as follows:

Detention Pond	Sub-Basins	Tributary Area (ac)	Percent Impervious	Required 100-Yr FSD Volume (af)	Design Volume (af)
A6	A6,A8	15.4	80.3	2.3	2.7

The proposed on-site stormwater detention facilities will be owned and maintained by the Westgate at Powers Metropolitan District.

Detention Basin A6 will have a grass-lined bottom to encourage infiltration of stormwater prior to discharging into the downstream drainage channel. The proposed Detention Basin will have an outlet structure and discharge pipe draining into the Sand Creek Center Tributary channel. The detention basin has been designed with an emergency overflow spillway, allowing for emergency overtopping of the detention pond to flow into the adjoining channel.

The future apartment development area within Filing No. 3 will utilize Detention Basins A9 and C to mitigate developed drainage and water quality impacts. Final drainage design for Detention Ponds A9 and C will be completed as part of final design of the proposed Apartment Site, which will include a separate Final Drainage Report providing design details for the proposed drainage facilities.

VIII. EROSION / SEDIMENT CONTROL

The Contractor will be required to implement Best Management Practices (BMP's) for erosion control through the course of construction. Sediment control measures will include installation of silt fence along downgradient property boundaries to minimize off-site transport of construction sediment and other BMP's as depicted on the Grading and Erosion Control Plans (submitted separately). Cut slopes will be stabilized during excavation as necessary and vegetation will be established for stabilization of disturbed areas as soon as possible.

IX. FLOODPLAIN IMPACTS

The Westgate at Powers site is bisected by the FEMA 100-year floodplain of the existing Sand Creek Center Tributary channel, as delineated by the Federal Emergency Management Agency (FEMA). The floodplain limits in vicinity of the site are shown in Flood Insurance Rate Map (FIRM) Number 08041C0753G, dated December 7, 2018 (see

Firmette Exhibit in Appendix F). Following completion of the re-alignment and channelization improvements to the Sand Creek Center Tributary Channel between Troy Hill Road and Airport Road with Westgate at Powers Filing No. 1, FEMA approved a Letter of Map Revision (Case No. 19-08-0754P) dated October 13, 2020.

The proposed three-cell 16'x6' concrete box culvert matches the design of the existing box culvert crossing Troy Hill Road immediately upstream of the proposed Joystone Drive crossing. According to the FEMA Flood Insurance Study (FIS), 100-year flows at Airport Road have been established as 790 cfs, and the proposed box culvert has been designed for the much higher 100-year flow of 1,960 cfs identified in the Sand Creek DBPS, providing for a conservative design.

A "zero-rise certification" with supporting hydraulic calculations is enclosed in Appendix D1, demonstrating that the proposed box culvert crossing will have no significant impact on the FEMA floodway and floodplain.

A U.S. Army Corps of Engineers (USACE) 404 Permit has also been issued for both the channel and box culvert improvements (see 404 Permit No. SPA-2010-00110-SCO in Appendix D2), and the current permit allows for completion of the channel and box culvert improvements by December 31, 2023.

X. PUBLIC IMPROVEMENTS / DRAINAGE BASIN FEES

The Westgate at Powers project consists of a combination of public roadway and drainage improvements, along with private site development and associated private drainage improvements.

Westgate at Powers Filing No. 3 is located entirely within the Sand Creek Drainage Basin, which is subject to a current City of Colorado Springs 2021 drainage basin fee of $13,775 per acre, a bridge fee of $819 per acre, a pond land fee of $1,070 per acre, and a pond facility fee of $3,957 per acre.

The required fees for Filing No. 3 are calculated as follows:

Drainage Fee:	(28.747 ac.) @ ($13,775/ac.) =	$ 395,989.93
Bridge Fee:	(28.747 ac.) @ ($819/ac.) =	$ 23,543.79
Pond Land Fee:	(28.747 ac.) @ ($1,070/ac.) =	$ 30,759.29
Pond Facility Fee:	(28.747 ac.) @ ($3,957/ac.) =	$ 113,751.88
Total Basin Fees:		**$ 564,044.89**

During the July 11, 2019 Drainage Board meeting, the developer, Powers and Airport, LLC received drainage fee credits for completion of drainage channel improvements to the Sand Creek Center Tributary Channel with Westgate at Powers Filing No. 1.

XI. CONSTRUCTION COST OPINION

The developer will pay all capital costs for the proposed roadway and drainage improvements. Non-reimbursable public drainage facilities will include the box culvert, public storm inlets, and storm sewer pipes within the public right-of-way of Joystone Drive. As detailed in Appendix E, the estimated cost of non-reimbursable public drainage facilities is approximately $639,018.

Non-reimbursable private drainage facilities include the private storm sewer systems within each development area, as well as the private detention pond facilities. As detailed in Appendix E, the estimated cost of non-reimbursable private drainage facilities within the site is approximately $27,687.

XII. SUMMARY

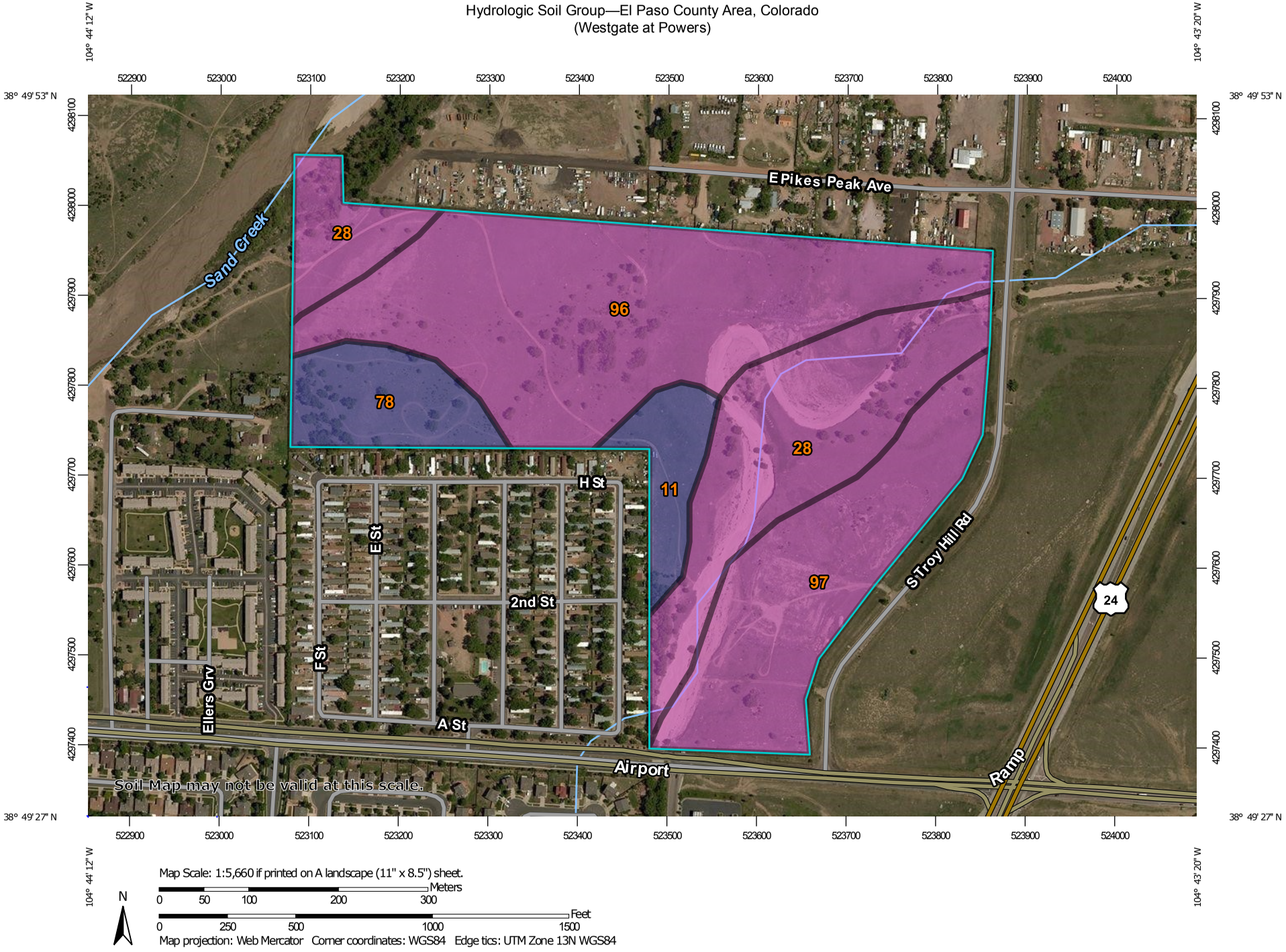
The proposed drainage patterns for the Westgate at Powers Filing No. 3 development will be consistent with the master drainage plan for this area. The site grading and drainage plans for the proposed site will convey developed runoff by sheet flow and curb and gutter to on-site storm sewer systems, draining through private full-spectrum extended detention basins prior to discharge into the adjoining public drainage channels (Sand Creek Center Tributary and Sand Creek main channel).

The proposed drainage plan for this development is in full conformance with the Westgate at Powers Master Development Drainage Plan and current City drainage criteria. The proposed detention ponds will provide stormwater detention and water quality mitigation in accordance with City of Colorado Springs requirements. Construction and proper maintenance of the proposed storm drainage facilities and detention ponds, in conjunction with proper erosion control practices during construction, will ensure that developed drainage from this site has no significant adverse impact on the downstream drainage system. Site runoff and storm drainage facilities and appurtenances will not adversely affect the downstream and surrounding developments.

APPENDIX A

HYDROLOGIC CALCULATIONS

Hydrologic Soil Group—El Paso County Area, Colorado
(Westgate at Powers)



Map Scale: 1:5,660 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

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 15, Oct 10, 2017

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

Date(s) aerial images were photographed: Jun 3, 2014—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
11	Bresser sandy loam, cool, 0 to 3 percent slopes	B	3.6	5.1%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	18.1	26.0%
78	Sampson loam, 0 to 3 percent slopes	B	5.6	8.0%
96	Truckton sandy loam, 0 to 3 percent slopes	A	27.7	39.9%
97	Truckton sandy loam, 3 to 9 percent slopes	A	14.6	21.0%
Totals for Area of Interest			**69.6**	**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

Typically, the surface layer is dark grayish brown sandy loam about 10 inches thick. The subsoil is dark grayish brown and brown sandy loam about 26 inches thick. The substratum is light brownish gray gravelly sandy loam.

Included with this soil in mapping are small areas of Blakeland loamy sand, 1 to 9 percent slopes; Bresser sandy loam, 0 to 3 percent slopes; Truckton sandy loam, 0 to 3 percent slopes; Ellicott loamy coarse sand, 0 to 5 percent slopes; and Ustic Torrifluvents, loamy.

Permeability of this Blendon soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazards of erosion and soil blowing are moderate.

Most areas of this soil are used as rangeland, but some small areas are cultivated. Some homesite development has taken place on this soil.

Native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, side-oats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of plant cover from the soil. Interseeding improves the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Proper location of livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are generally suited to this soil. Soil blowing is the principal limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, the provision of undisturbed nesting cover is vital and should be included in plans for habitat development. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for homesites. The main limitation for the construction of local roads and streets is a moderate frost action potential. Roads can be designed to overcome this limitation. Capability subclass IIIe.

11—Bresser sandy loam, 0 to 3 percent slopes. This deep, well drained soil formed in arkosic alluvium and residuum on terraces and uplands. Elevation ranges from 6,000 to 6,800 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown sandy loam about 5 inches thick. The subsoil is brown sandy clay loam about 31 inches thick. The substratum is light yellowish brown loamy coarse sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Truckton sandy loam, 0 to 3 percent slopes; Ascalon sandy loam, 1 to 3 percent slopes; Fort Collins loam, 0 to 3 percent slopes; and Yoder gravelly sandy loam, 1 to 8 percent slopes. Some areas of Ustic Torrifluvents, loamy, occur along narrow drainageways.

Permeability of this Bresser soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, the hazard of erosion is slight to moderate, and the hazard of soil blowing is moderate.

Most areas of this soil are cultivated. The remaining acreage is used as rangeland.

A rotation of winter wheat and fallow is used because precipitation is insufficient for annual cropping. A feedgrain crop such as millet or sorghum can be substituted for wheat in some years. Crop residue management and minimum tillage are needed to control erosion.

Native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, side-oats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of plant cover from the soil. Interseeding improves the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Proper location of livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are generally suited to this soil. Soil blowing is the principal limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, the provision of undisturbed nesting cover is vital and should be included in plans for habitat development. This is especially true in areas of intensive farming. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for homesites. Limiting the disturbance of the soil and the removal of existing plant cover during construction helps to control erosion. Capability subclass IIIc.

Woodland wildlife, such as mule deer and wild turkey, is attracted to this soil because of its potential to produce ponderosa pine, Gambel oak, and various grasses and shrubs. Water developments, such as guzzlers, would enhance populations of wild turkey as well as other kinds of wildlife. Where wildlife and livestock share the same range, proper grazing management is needed to prevent overuse and to reduce competition. Livestock watering facilities would also benefit wildlife on this soil.

This soil has good potential for use as homesites. The main limitation is the moderate shrink-swell potential in the subsoil and frost action potential. Special road design is necessary on this soil to overcome these limitations. Slope is also a limitation. Special planning is needed on this soil to minimize site disturbance and tree and seedling damage. During seasons of low precipitation, fire may become a hazard to homesites on this soil. The hazard can be minimized by installing firebreaks and reducing the amount of potential fuel on the forest floor. Capability subclass VIe.

27—Elbeth-Pring complex, 5 to 30 percent slopes. These moderately sloping to steep soils are on upland side slopes and ridges. Elevation ranges from 7,200 to 7,400 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

The Elbeth soil makes up about 60 percent of the complex, the Pring about 20 percent, and other soils about 20 percent. The Elbeth soil has slopes of 5 to 15 percent, and the Pring soil has slopes of 5 to 30 percent.

Included with these soils in mapping are areas of Peyton-Pring complex, 8 to 15 percent slopes, Kettle-Rock outcrop complex, and ridges that are covered with gravel and cobbles.

The Elbeth soil is deep and well drained. It formed in material transported from arkose deposits. Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is light gray loamy sand about 20 inches thick. The subsoil is brown sandy clay loam about 45 inches thick. The substratum is light brown sandy clay loam.

Permeability of the Elbeth soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is medium to rapid, and the hazard of erosion is moderate to high. Deep gullies occur throughout areas of this soil. Some soil slippage occurs on some of the steeper slopes.

The Pring soil is deep and well drained. It formed in arkosic sediment. Typically, the surface layer is dark grayish brown coarse sandy loam about 4 inches thick. The next layer is dark grayish brown coarse sandy loam about 10 inches thick. The underlying material is pale brown gravelly sandy loam to a depth of 60 inches.

Permeability of the Pring soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

The soils in this complex are used for woodland, recreation, livestock grazing, and homesites.

The Elbeth soil is suited to the production of ponderosa pine. It is capable of producing about 2,240 cubic feet, or 4,900 board feet (International rule), of merchantable timber per acre from a fully stocked, even-aged stand of 80-year-old trees. Conventional methods can be used for harvesting, but operations may be restricted during wet periods. Reforestation, after harvesting, must be carefully managed to reduce competition of undesirable understory plants.

The Pring soil is suited to the production of native vegetation suitable for grazing by cattle and sheep. Rangeland vegetation is mainly mountain muhly, little bluestem, needleandthread, Parry oatgrass, and junegrass.

Deferment of grazing in spring promotes plant vigor and reproduction of the cool-season bunchgrasses. Fencing and proper location of livestock watering facilities may be needed to obtain proper distribution of grazing. Locating salt blocks in areas not generally grazed increases the use of the available forage.

Woodland wildlife such as mule deer and wild turkey is attracted to the Elbeth soil because of its potential to produce ponderosa pine, Gambel oak, and various grasses and shrubs. Water developments, such as guzzlers, would enhance populations of wild turkey as well as other kinds of wildlife. Where wildlife and livestock share the same range, proper grazing management is needed to prevent overuse and to reduce competition. Livestock watering facilities would also benefit wildlife on this soil.

The Pring soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitations of this complex for construction are the moderate shrink-swell potential in the subsoil of the Elbeth soil and the steep slopes of both soils. Special site or building designs for dwellings and roads are required to offset these limitations. Special practices must be used to minimize surface runoff and keep soil erosion to a minimum. Capability subclass VIe.

28—Ellicott loamy coarse sand, 0 to 5 percent slopes. This deep, somewhat excessively drained soil is on terraces and flood plains (fig. 1). The average annual precipitation is about 14 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown loamy coarse sand about 4 inches thick. The underlying material to a depth of 60 inches is light brownish gray coarse sand stratified with layers of loamy sand, loamy coarse sand, and coarse sandy loam.

Included with this soil in mapping are small areas of Ustic Torrifluvents, loamy; Fluvaquentic Haploquolls, nearly level; Blakeland loamy sand, 1 to 9 percent slopes; Blendon sandy loam; and Truckton sandy loam, 0 to 3 percent slopes.

Permeability of this Ellicott soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is slow, the hazard of erosion is high, and the hazard of soil blowing is moderate.

Almost all areas of this soil are used as rangeland.

The rangeland vegetation on this soil is mainly switchgrass, needleandthread, sand bluestem, and prairie sand reedgrass.

Seeding is a good practice if the range is in poor condition. Seeding of the native grasses is desirable. Yellow or white sweetclover may be added to the seeding mixture to provide a source of nitrogen for the grasses. Too much clover can create a danger of bloat by grazing animals. This soil is subject to flooding and should be managed to keep a heavy cover of grass to protect the soil. Fencing is a necessary practice in range management. Brush control and grazing management may help to improve deteriorated range.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand and low available water capacity are the principal limitations for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival of trees. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited to skunkbush sumac, lilac, and Siberian peashrub.

Rangeland wildlife, such as antelope, cottontail, coyote, and scaled quail, is best adapted to life on this droughty soil. Forage production is typically low, and proper livestock grazing management is needed if wildlife and livestock share the range. Livestock watering developments are also important and are used by various wildlife species.

The main limitation of this soil for construction is the hazard of flooding. All construction on this soil should be kept off the flood plain as much as possible. Capability subclass VIw.

29—Fluvaquentic Haplaquolls, nearly level. These deep, poorly drained soils are in marshes, in swales, and on creek bottoms. The average annual precipitation is about 14 inches, and the average annual air temperature is about 47 degrees F.

Included with these soils in mapping are small areas of Ustic Torrifluvents, loamy; Blakeland loamy sand, 1 to 9 percent slopes; Columbine gravelly sandy loam, 0 to 3 percent slopes; and Ellicott loamy coarse sand, 0 to 5 percent slopes.

These soils are stratified. Typically, the surface layer is light gray to very dark gray loamy fine sand to gravelly loam 2 to 6 inches thick. The underlying material, 48 to 58 inches thick, is very pale brown to gray, stratified heavy sandy clay loam to sand and gravel. The lower part of some of the soils, at depths ranging from 18 to 48 inches, ranges from light blueish gray to greenish gray. The water table is usually at a depth of less than 48 inches, and it is on the surface during part of the year.

Permeability of these soils is moderate. Effective rooting depth is limited by the water table. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. At times overflow deposits a damaging amount of silt and sand in the lower lying areas.

These soils are in meadow. They are used for native hay or for grazing.

These soils are well suited to the production of native vegetation suitable for grazing. The vegetation is mainly switchgrass, indiangrass, sedges, rushes, prairie cordgrass, western wheatgrass, and bluegrass. Cattails and bulrushes commonly grow in the swampy areas.

Management of distribution of livestock and stocking rates is necessary on these soils to avoid abuse of the range. In large areas, fences should be used to control grazing.

Wetland wildlife can be attracted to these soils and the wetland habitat enhanced by several means. Shallow water developments can be created by digging or by blasting potholes to create open-water areas. Fencing to control livestock use is beneficial, and it allows wetland plants such as cattails, reed canarygrass, and rushes to grow. Control of unplanned burning and prevention of drainage that would remove water from the wetlands are also good practices. These shallow marsh areas are often especially important for winter cover if natural vegetation is allowed to grow.

These soils are severely limited for use as homesites. The main limitations are a high water table and a hazard of periodic flooding. Community sewerage systems are needed because the high water table prevents septic tank absorption fields from functioning properly. Roads must also be designed to prevent frost-heave damage. Capability subclass Vw.

30—Fort Collins loam, 0 to 3 percent slopes. This deep, well drained soil formed in medium textured alluvium on uplands. Elevation ranges from 5,200 to 6,500 feet. The average annual precipitation ranges from about 13 inches at the lower elevations to about 15 inches at the higher elevations; the average annual temperature is about 49 degrees F; and the average frost-free period is about 145 days.

Typically, the surface layer is brown loam about 6 inches thick. The subsoil is brown clay loam about 15 inches thick. The substratum is pale brown loam.

Included with this soil in mapping are small areas of Stoneham sandy loam, 3 to 8 percent slopes; Keith silt loam, 0 to 3 percent slopes; Olney sandy loam, 0 to 3 percent slopes; Bresser sandy loam, 0 to 3 percent slopes; and Wiley silt loam, 1 to 3 percent slopes.

Permeability of this Fort Collins soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used as rangeland and for dryland farming. Wheat and feed grains such as millet are the crops commonly grown. Crop residue management, minimum tillage

ble water capacity can influence seedling survival. Seedling mortality is severe on the Rizozo soil because of low available water capacity.

These soils are suited to habitat for wildlife such as antelope, mule deer, and wild turkey. The combination of juniper and pinyon on these soils makes them attractive to wild turkey, but a shortage of surface water may limit turkey populations. This limitation can be overcome by constructing watering facilities, such as guzzlers.

The main limitations of the Rizozo soil for construction are shallow depth to bedrock, a stony surface, and steep slopes. The main limitation of the Neville soil is its limited ability to support a load and shrink-swell potential. Buildings and roads must be designed to overcome these limitations. Access roads should have adequate cutslope grade and be provided with drains to control surface runoff. Capability subclass VIIe.

77—**Rock outcrop-Coldcreek-Tolman complex, 9 to 90 percent slopes.** This strongly sloping to extremely steep complex is on mountains. The average annual precipitation is about 20 inches, and the average annual air temperature is about 42 degrees F.

Rock outcrop makes up about 30 percent of the complex, the Coldcreek soil about 30 percent, the Tolman soil about 20 percent, and other soils about 20 percent.

Included with this complex in mapping are areas of Kutler-Broadmoor-Rock outcrop complex, 25 to 90 percent slopes; Fortwingate-Rock outcrop complex, 15 to 60 percent slopes; and Nederland cobbly sandy loam, 9 to 25 percent slopes. Areas of talus occur below some areas of Rock outcrop.

Rock outcrop occurs throughout the complex. It is most commonly on the upper part of the slopes. Runoff is rapid.

The Coldcreek soil is deep and well drained. It formed in mixed, acid igneous material. Typically, the surface layer is dark gray cobbly loam about 6 inches thick. The subsurface layer is light gray extremely cobbly sandy loam that is mixed with a lesser amount of brown clay loam and is about 25 inches thick. The subsoil is brown extremely cobbly clay loam that has coatings of light gray and is about 12 inches thick. Hard fractured bedrock is at a depth of about 43 inches.

Permeability of the Coldcreek soil is moderate. Effective rooting depth is 40 inches or more. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

The Tolman soil is shallow and well drained. It formed in medium textured residuum derived from acid igneous rock. Typically, the surface layer is dark grayish brown gravelly sandy loam about 4 inches thick. The subsoil is brown very cobbly sandy clay loam about 9 inches thick. Hard igneous bedrock is at a depth of 13 inches.

Permeability of the Tolman soil is moderate. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is medium, and the hazard of erosion is moderate.

The Coldcreek soil is used mainly for woodland, recreation, and wildlife habitat and as a source of gravel. The Tolman soil is used mainly as rangeland and for wildlife habitat.

The Coldcreek soil is suited to the production of Douglas-fir. It is capable of producing about 690 cubic feet, or 1,000 board feet (International rule), of merchantable timber per acre from a fully stocked, even-aged stand of 80-year-old trees. The main limitations for its use for timber production are slope, hazard of erosion, and the presence of stones on the surface. The stones can hinder felling, yarding, and other operations involving the use of equipment. Practices must be used to minimize erosion when harvesting timber.

The Tolman soil is suited to vegetation suitable for grazing and to the production of some firewood. Rangeland vegetation is mainly mountain muhly, big bluestem, little bluestem, side-oats grama, and western wheatgrass. The common shrubs and trees are mountainmahogany, skunkbush sumac, and Rocky Mountain juniper. There are lesser amounts of ponderosa pine.

Proper range management is necessary on the Tolman soil. Properly locating livestock watering facilities helps to control grazing. Deferment of grazing helps to maintain vigor and production of plants.

The Coldcreek soil is suited to habitat suitable for woodland wildlife, especially mule deer, wild turkey, and blue grouse. To encourage wild turkey in areas where there is little or no water, wildlife watering facilities, such as guzzlers, can be developed. Because of the steep slopes, livestock grazing should be discouraged, which would benefit the wildlife that use these areas.

Rangeland wildlife, such as antelope, cottontail, coyote, and scaled quail, is best adapted for life on the Tolman soil. Forage production is typically low, and proper livestock grazing management is necessary if wildlife and livestock share the range. Livestock watering developments are needed, and they are used by various wildlife species.

The main limitations of the soils of this complex for urban use or homesite development are rock outcrops, stones, depth to bedrock, especially on the Tolman soil, and steep slope. Homesites should be located in places where these limitations are the least severe. Special designs for buildings and roads are required to overcome these limitations. Capability subclass VIIe.

78—**Sampson loam, 0 to 3 percent slopes.** This deep, well drained soil formed in alluvium derived from sedimentary rock on terraces and alluvial fans and in small closed basins. Elevation ranges from about 5,500 to 6,500 feet. The average annual precipitation is about 14 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil, about 44 inches thick, is dark brown to brown clay loam that grades to light brownish gray sandy clay loam in the lower part. The substratum is light brownish gray sandy clay loam to a

depth of 60 inches. The lower part of the subsoil and the substratum have visible soft masses of lime.

Included with this soil in mapping are small areas of Bresser sandy loam, 0 to 3 percent slopes; Nunn clay loam, 0 to 3 percent slopes; and Olney sandy loam, 0 to 3 percent slopes. Also included are areas of Vona sandy loam, 1 to 3 percent slopes, and Ustic Torrifluvents, loamy.

Permeability of this Sampson soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

About one-third of the acreage of this soil is used for irrigated corn and alfalfa and for dryfarmed wheat. The slow surface runoff and slight hazard of erosion reduce the need for use of intensive conservation practices. Most of the remaining acreage is used as rangeland.

This soil is well suited to the production of native vegetation suitable for grazing. Native vegetation is mainly blue grama, western wheatgrass, side-oats grama, sand dropseed, and galleta. Needleandthread, big bluestem, and native bluegrasses are also present where this soil occurs in the northern part of the survey area.

Fencing and properly locating livestock watering facilities help to control grazing. Deferment of grazing may be necessary to maintain a needed balance between livestock demands and forage production. In areas where the plant cover has been depleted, pitting can be used to help the native vegetation recover. Chemical control may be needed in disturbed areas where dense stands of pricklypear occur. Ample amounts of litter and forage should be left on the soil because of the high hazard of soil blowing.

Windbreaks and environmental plantings generally are well suited to this soil. Summer fallow a year prior to planting and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. This is especially true in areas of intensive farming. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitations of this soil for homesites or urban use are limited ability to support a load, the shrink-swell potential of the subsoil, and frost-action potential. Special designs for buildings and roads and streets are necessary to overcome these limitations. Capability subclasses IVe, nonirrigated, and IIe, irrigated.

79—Satanta loam, 0 to 3 percent slopes. This deep, well drained soil formed in loamy eolian material derived from mixed sources on uplands. Elevation ranges from 5,900 to 6,500 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is brown loam about 4 inches thick. The lower part of the subsoil has visible soft masses of lime. The subsoil is brown clay loam about 35 inches thick. The substratum is pale brown silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Ascalon sandy loam, 1 to 3 percent slopes; Bresser sandy loam, 0 to 3 percent slopes; and Wiley silt loam, 1 to 3 percent slopes.

Permeability of this Satanta soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

Most areas of this soil in the northeastern part of the survey area are cultivated. Most areas in the southwestern part are used as rangeland, for wildlife habitat, and for military maneuvers.

Wheat, fallow, and feed grains are used in a flexible cropping system because precipitation is insufficient for annual cropping. Minimum tillage and crop residue management usually are adequate to control erosion. This soil is one of the best in the survey area.

This soil is well suited to native vegetation suitable for grazing. The native vegetation is mainly western wheatgrass, needlegrasses, side-oats grama, and blue grama. If the range has deteriorated, blue grama, junegrass, and native bluegrasses increase. Sleepygrass and annuals replace these grasses if the range has seriously deteriorated.

Seeding is a good practice if the range is in poor condition. Seeding of the native vegetation is desirable, but the range can also be seeded with tame species of grass such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass. Use of deferred grazing and other good range management practices helps to maintain vigor and growth of plants. Fencing and properly locating livestock watering facilities help to control grazing.

Windbreaks and environmental plantings generally are well suited to this soil. Summer fallow a year prior to planting and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting

Almost all areas of this soil are used as rangeland. A few areas of crops such as alfalfa and corn are grown under sprinkler irrigation.

This soil is well suited to the production of native vegetation suitable for grazing. It is best suited to deep-rooted grasses. The native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, sideoats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover. Interseeding is used to improve the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand is the main limitation for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to openland and rangeland wildlife habitat. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for use as homesites. The main limitation of this soil for roads and streets is frost action potential. Special designs for roads are needed to minimize this limitation. Practices are needed to control soil blowing and water erosion on construction sites where the plant cover has been removed. Capability subclass VIe, nonirrigated.

96—Truckton sandy loam, 0 to 3 percent slopes. This deep, well drained soil formed in alluvium and residuum derived from arkosic sedimentary rock on uplands. Elevation ranges from 6,000 to 7,000 feet. The average annual precipitation is about 15 inches, the average annual air temperatue is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown sandy loam about 5 inches thick. The next layer is dark grayish brown sandy loam about 3 inches thick. The subsoil is brown sandy loam about 16 inches thick. The substratum is light yellowish brown coarse sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Blakeland loamy sand, 1 to 9 percent slopes; Bresser sandy loam, 0 to 3 percent slopes; Ellicott loamy coarse sand, 0 to 5 percent slopes; and Ustic Torrifluvents, loamy.

Permeability of this Truckton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazards of erosion and soil blowing are moderate.

This soil is used mainly for cultivated crops. It is also used for livestock grazing, for wildlife habitat, and as homesites.

Crops are commonly grown in combination with summer fallow because moisture is insufficient for annual cropping. Alfalfa can also be grown on this soil. When this soil is used as cropland, crop residue management and minimum tillage are necessary conservation practices.

This soil is well suited to the production of native vegetation suitable for grazing (fig. 7). It favors deep-rooted grasses. The native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, sideoats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover. Interseeding is used to improve the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings generally are suited to this soil. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided in plans for habitat development. This is especially true in areas of intensive farming. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for use as homesites. The main limitation of this soil for roads and streets is frost-action potential. Special designs for roads are needed to overcome this limitation. Capability subclasses IIIe, nonirrigated, and IIe, irrigated.

97—Truckton sandy loam, 3 to 9 percent slopes. This deep, well drained soil formed in alluvium and residuum derived from arkosic sedimentary rock on uplands. Elevation ranges from 6,000 to 7,000 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown sandy loam about 5 inches thick. The next layer is dark grayish brown sandy loam about 3 inches thick. The subsoil is brown sandy loam about 16 inches thick. The substratum is light yellowish brown coarse sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Blakeland loamy sand, 1 to 9 percent slopes; Bresser sandy loam, 3 to 5 percent slopes; and Truckton sandy loam, 0 to 3 percent slopes. Also included are small areas of soils that have arkosic sandstone or shale at a depth of less than 40 inches.

Permeability of this Truckton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow to medium, and the hazards of erosion and soil blowing are moderate.

More than half of this soil is used as rangeland, for wildlife habitat, and as homesites. The rest, consisting of the less sloping areas, is used for wheat and sorghum. Rangeland or pastureland is the most suitable use because the permanent plant cover protects the soil.

This soil is well suited to the production of native vegetation suitable for grazing. Native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, side-oats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover from this soil. Interseeding improves the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings generally are well suited to this soil. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitation of this soil for construction is frost-action potential. Special designs for roads are needed to overcome this limitation. Because of the sandy nature of the soil, practices must be provided to minimize surface runoff and thus keep erosion to a minimum. Access roads must have adequate cut-slope grade and be provided with drains to control surface runoff. Capability subclasses VIe, nonirrigated, and IVe, irrigated.

98—Truckton-Blakeland complex, 9 to 20 percent slopes. These strongly sloping to moderately steep soils are on uplands. Elevation ranges from 6,000 to 7,000 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

The Truckton soil makes up about 60 percent of the complex, the Blakeland soil about 25 percent, and other soils about 15 percent.

Included with these soils in mapping are areas of Bresser sandy loam, 5 to 9 percent slopes, and Yoder gravelly sandy loam, 8 to 25 percent slopes.

The Truckton soil is deep and well drained. It formed in alluvium and residuum weathered from arkosic sedimentary rock. Typically, the surface layer is grayish brown sandy loam about 5 inches thick. The next layer is dark grayish brown sandy loam about 3 inches thick. The subsoil is brown sandy loam about 16 inches thick. The substratum is light yellowish brown coarse sandy loam to a depth of 60 inches or more.

Permeability of the Truckton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium to rapid, and the hazard of erosion is moderate to high. Soil slippage is common on the upper part of slopes.

The Blakeland soil is deep and somewhat excessively drained. It formed in arkosic sandy alluvium and eolian sediment derived from arkosic sedimentary rock. Typically, the surface layer is dark grayish brown loamy sand about 11 inches thick. The underlying material is brown loamy sand about 16 inches thick; it grades to pale brown sand that extends to a depth of 60 inches or more.

Permeability of the Blakeland soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is medium, and the hazard of erosion is moderate to high, and the hazard of soil blowing is high. Soil slippage is common on the upper part of slopes.

The soils in this complex are used for grazing livestock and wildlife habitat.

These soils are suited to the production of native vegetation suitable for grazing. The native vegetation is dominantly western wheatgrass, side-oats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover from these soils. Interseeding improves the existing vegetation. Deferment of grazing in spring improves plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

Soil blowing is the main limitation for the establishment of trees and shrubs on these soils. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Trees need to be planted in shallow furrows on the Blakeland soil because of its loose, sandy surface layer. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See "flooding" in Glossary for definition of terms as "rare," "brief," and "very brief." The symbol > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Alamosa: 1	C	Frequent	Brief	May-Jun	>60	---	High.
Ascalon: 2, 3	B	None	---	---	>60	---	Moderate.
Badland: 4	D	---	---	---	---	---	---
Bijou: 5, 6, 7	B	None	---	---	>60	---	Low.
Blakeland: 8	A	None	---	---	>60	---	Low.
[1]9: Blakeland part	A	None	---	---	>60	---	Low.
Fluvaquentic Haplaquolls part	D	Common	Very brief	Mar-Aug	>60	---	High.
Blendon: 10	B	None	---	---	>60	---	Moderate.
Bresser: 11, 12, 13	B	None	---	---	>60	---	Low.
Brussett: 14, 15	B	None	---	---	>60	---	Moderate.
Chaseville: 16, 17	A	None	---	---	>60	---	Low.
[1]18: Chaseville part	A	None	---	---	>60	---	Low.
Midway part	D	None	---	---	10-20	Rippable	Moderate.
Columbine: 19	A	None to rare	---	---	>60	---	Low.
Connerton: [1]20: Connerton part	B	None	---	---	>60	---	High.
Rock outcrop part	D	---	---	---	---	---	---
Cruckton: 21	B	None	---	---	>60	---	Moderate.
Cushman: 22, 23	C	None	---	---	20-40	Rippable	Moderate.
[1]24: Cushman part	C	None	---	---	20-40	Rippable	Moderate.
Kutch part	C	None	---	---	20-40	Rippable	Moderate.
Elbeth: 25, 26	B	None	---	---	>60	---	Moderate.
[1]27: Elbeth part	B	None	---	---	>60	---	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Elbeth: Pring part	B	None	---	---	>60	---	Moderate.
Ellicott: 28	A	Frequent	Brief	Mar-Jun	>60	---	Low.
Fluvaquentic Haplaquolls: 29	B/D	Frequent	Brief	Mar-Jul	>60	---	High.
Fort Collins: 30, 31	B	None to rare	---	---	>60	---	Moderate.
Fortwingate: [1]32: Fortwingate part	C	None	---	---	20-40	Hard	Low.
Rock outcrop part	D	---	---	---	---	---	---
Heldt: 33	C	None	---	---	>60	---	Moderate.
Holderness: 34, 35, 36	C	None	---	---	>60	---	Moderate.
Jarre: 37	B	None	---	---	>60	---	Moderate.
[1]38: Jarre part	B	None	---	---	>60	---	Moderate.
Tecolote part	B	None	---	---	>60	---	Moderate.
Keith: 39	B	None	---	---	>60	---	High.
Kettle: 40, 41	B	None	---	---	>60	---	Moderate.
[1]42: Kettle part	B	None	---	---	>60	---	Moderate.
Rock outcrop part	D	---	---	---	---	---	---
Kim: 43	B	None	---	---	>60	---	Moderate.
Kutch: 44, 45	C	None	---	---	20-40	Rippable	Moderate.
Kutler: [1]46: Kutler part	C	None	---	---	20-40	Rippable	Low.
Broadmoor part	C	None	---	---	20-40	Rippable	Low.
Rock outcrop part	D	---	---	---	---	---	---
Limon: 47	C	Occasional	Brief	May-Sep	>60	---	Moderate.
Louviers: 48	D	None	---	---	10-20	Rippable	Moderate.
49	D	None	---	---	10-20	Rippable	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Razor:							
[1]75:							
Razor part-----	C	None----------	---	---	20-40	Rippable	Moderate.
Midway part----	D	None----------	---	---	10-20	Rippable	Moderate.
Rizozo:							
[1]76:							
Rizozo part----	D	None----------	---	---	4-20	Hard	Low.
Neville part---	B	None----------	---	---	>60	---	High.
Rock outcrop:							
[1]77:							
Rock outcrop part----------	D	---	---	---	---	---	---
Coldcreek part-	B	None----------	---	---	40-60	Rippable	Moderate.
Tolman part----	D	None----------	---	---	10-20	Hard	Moderate.
Sampson:							
78----------	B	None----------	---	---	>60	---	Moderate.
Satanta:							
79, 80----------	B	None----------	---	---	>60	---	Moderate.
[1]81:							
Satanta part---	B	None----------	---	---	>60	---	Moderate.
Neville part---	B	None----------	---	---	>60	---	High.
Schamber:							
[1]82:							
Schamber part--	A	None----------	---	---	>60	---	Moderate.
Razor part-----	C	None----------	---	---	20-40	Rippable	Moderate.
Stapleton:							
83, 84----------	B	None----------	---	---	>60	---	Moderate.
[1]85:							
Stapleton part-	B	None----------	---	---	>60	---	Moderate.
Bernal part----	D	None----------	---	---	8-20	Hard	Moderate.
Stoneham:							
86, 87----------	B	None----------	---	---	>60	---	Moderate.
Stroupe:							
[1]88:							
Stroupe part---	C	None----------	---	---	20-40	Hard	Moderate.
Travessilla part----------	D	None----------	---	---	6-20	Hard	Low.
Rock outcrop part----------	D	---	---	---	---	---	---
Tassel:							
89----------	D	None----------	---	---	10-20	Rippable	Low.
Terry:							
90----------	B	None----------	---	---	20-40	Rippable	Moderate.
[1]91:							
Terry part-----	B	None----------	---	---	20-40	Rippable	Moderate.
Razor part-----	C	None----------	---	---	20-40	Rippable	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Tomah: [1]92, [1]93:							
Tomah part	B	None	---	---	>60	---	Moderate.
Crowfoot part	B	None	---	---	>60	---	Moderate.
Travessilla: [1]94:							
Travessilla part	D	None	---	---	6-20	Hard	Low.
Rock outcrop part	D	---	---	---	---	---	---
Truckton: 95, 96, 97	B	None	---	---	>60	---	Moderate.
[1]98:							
Truckton part	B	None	---	---	>60	---	Moderate.
Blakeland part	A	None	---	---	>60	---	Low.
[1]99, [1]100:							
Truckton part	B	None	---	---	>60	---	Moderate.
Bresser part	B	None	---	---	>60	---	Low.
Ustic Torrifluvents: 101	B	Occasional	Very brief	Mar-Aug	>60	---	Moderate.
Valent: 102, 103	A	None	---	---	>60	---	Low.
Vona: 104, 105	B	None	---	---	>60	---	Moderate.
Wigton: 106	A	None	---	---	>60	---	Low.
Wiley: 107, 108	B	None	---	---	>60	---	Low.
Yoder: 109, 110	B	None	---	---	>60	---	Low.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

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

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

$$t_c = t_i + t_t \quad \text{(Eq. 6-7)}$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

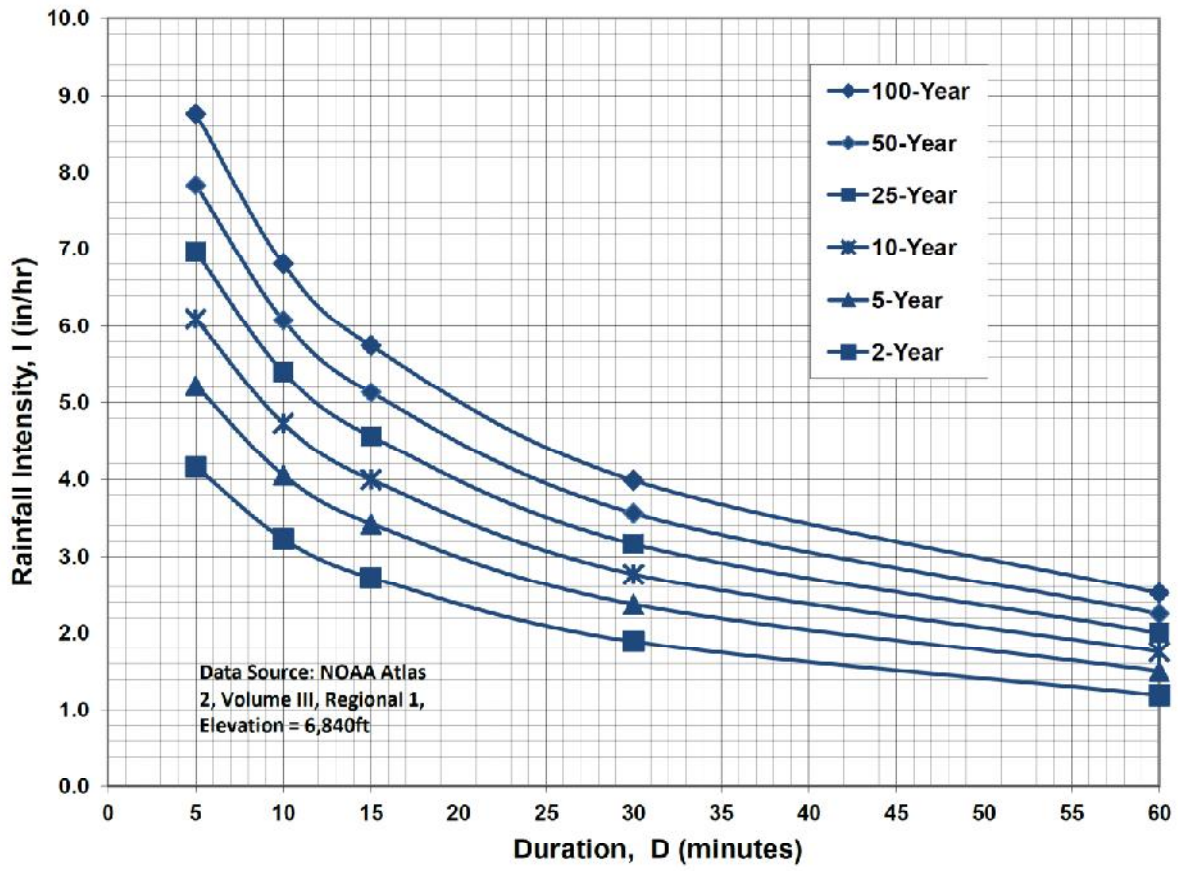
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

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.

WESTGATE AT POWERS
RATIONAL METHOD

HISTORIC FLOWS

					Overland Flow			Channel flow										
BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR[7]	C 100-YEAR[7]	LENGTH (FT)	SLOPE (FT/FT)	Tco[1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS[2] VELOCITY (FT/S)	Tt[3] (MIN)	TOTAL Tc[4] (MIN)	TOTAL Tc[4] (MIN)	INTENSITY[5] 5-YR (IN/HR)	INTENSITY[5] 100-YR (IN/HR)	PEAK FLOW Q5[6] (CFS)	PEAK FLOW Q100[6] (CFS)
OA1	OA1	20.78	0.080	0.350	100	0.02	14.8	2680	15	0.018	1.98	22.5	37.3	37.3	2.15	3.61	3.58	26.28
OA2		6.69	0.080	0.350	100	0.01	18.7	400	15	0.018	1.98	3.4	22.0	22.0	2.94	4.94	1.58	11.57
A		33.50	0.080	0.350			0.0	1400	15	0.015	1.84	12.7	12.7	12.7	3.77	6.33	10.10	74.22
OB1		2.34	0.080	0.350	100	0.01	18.7	110	15	0.010	1.50	1.2	19.9	19.9	3.10	5.20	0.58	4.26
B1		6.58	0.080	0.350			0.0	420	15	0.033	2.74	2.6	2.6	5.0	5.17	8.68	2.72	19.99
OA1,OA2,OB1,A,B	1	69.89	0.080	0.350									37.3	37.3	2.15	3.61	12.04	88.38
C1	2	13.00	0.080	0.350	300	0.02	27.7	1200	15	0.015	1.84	10.9	38.5	38.5	2.11	3.53	2.19	16.07
OC1		10.00	0.080	0.350	300	0.01	29.6	400	15	0.015	1.84	3.6	33.3	33.3	2.33	3.90	1.86	13.66
C2		16.60	0.080	0.350			0.0	1250	15	0.014	1.80	11.6	11.6	11.6	3.91	6.56	5.19	38.14
OC1,C2	3	26.60	0.080	0.350									44.8	44.8	1.88	3.15	4.00	29.34

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES
3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL
$I_5 = -1.5 * \ln(Tc) + 7.583$
$I_{100} = -2.52 * \ln(Tc) + 12.735$
6) Q = CiA

WESTGATE AT POWERS
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A1	4.56	2.84	BUILDING / PAVEMENT	0.90	1.72	LANDSCAPED	0.08				0.591
A3	1.17	0.97	PAVEMENT	0.90	0.21	LANDSCAPED	0.08				0.756
A1,A3	5.73										0.625
A2	6.11	3.97	BUILDING / PAVEMENT	0.90	2.14	LANDSCAPED	0.08				0.613
A4	1.45	1.20	PAVEMENT	0.90	0.25	LANDSCAPED	0.08				0.756
A5	2.74	2.26	PAVEMENT	0.90	0.48	LANDSCAPED	0.08				0.756
A2,A4,A5	10.30										0.671
OA1	20.78	2.80	ROADWAY	0.90	17.98	MEADOW	0.08				0.190
A2,A4,A5,OA1	31.08										0.350
A1-A5,OA1	36.81										0.393
A6	13.42	13.42	COMMERCIAL	0.59							0.590
A8	1.95	1.61	PAVEMENT	0.90	0.34	LANDSCAPED	0.08				0.757
A6,A8	15.37										0.611
OA2	6.69	2.60	COMMERCIAL	0.59	4.09	VACANT	0.08				0.278
A7	1.18	1.18	COMMERCIAL	0.59							0.590
OA2,A6-A8	23.24										0.514
A9	6.26	6.26	APARTMENTS	0.49							0.490
A10	5.47	5.47	CHANNEL / LANDSCAPE	0.08							0.080
OB1	2.34	2.34	MEADOW	0.08							0.080
B1	6.58	3.96	BUILDING / PAVEMENT	0.90	2.62	LANDSCAPED	0.08				0.573
OB1,B1	8.92										0.444
OA1,OA2,OB1,A,B	80.70										0.420
OC1	10.00	10.00	LIGHT INDUSTRIAL	0.59							0.590
C1	8.33	8.33	APARTMENTS	0.49							0.490
C2	3.02	3.02	APARTMENTS	0.49							0.490
C3	9.15	9.15	APARTMENTS	0.49							0.490
C1-C3	20.50	20.50	APARTMENTS	0.49							0.490
C4	2.85	2.85	MEADOW	0.08							0.080
C1-C4	23.35										0.440

WESTGATE AT POWERS
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A1	4.56	3.21	BUILDING / PAVEMENT	0.96	1.35	LANDSCAPED	0.35				0.779
A3	1.17	0.97	PAVEMENT	0.96	0.21	LANDSCAPED	0.35				0.853
A1,A3	5.73										0.794
A2	6.11	3.97	BUILDING / PAVEMENT	0.96	2.14	LANDSCAPED	0.35				0.746
A4	1.45	1.20	PAVEMENT	0.96	0.25	LANDSCAPED	0.35				0.853
A5	2.74	2.26	PAVEMENT	0.96	0.48	LANDSCAPED	0.35				0.853
A2,A4,A5	10.30										0.790
OA1	20.78	2.80	ROADWAY	0.96	17.98	MEADOW	0.35				0.432
A2,A4,A5,OA1	31.08										0.551
A1-A5,OA1	36.81										0.589
A6	13.42	13.42	COMMERCIAL	0.70							0.700
A8	1.95	1.61	PAVEMENT	0.96	0.34	LANDSCAPED	0.35				0.853
A6,A8	15.37										0.719
OA2	6.69	1.61	INDUSTRIAL	0.70	5.08	VACANT	0.35				0.434
A7	1.18	1.18	COMMERCIAL	0.70							0.700
OA2,A6-A8	23.24										0.636
A9	6.26	6.26	APARTMENTS	0.62							0.620
A10	5.47	5.47	CHANNEL / LANDSCAPE	0.35							0.350
OB1	2.34	2.34	MEADOW	0.35							0.350
B1	6.58	3.96	BUILDING / PAVEMENT	0.96	2.62	LANDSCAPED	0.35				0.717
OB1,B1	8.92										0.621
OA1,OA2,OB1,A,B	80.70										0.592
OC1	10.00	10.00	LIGHT INDUSTRIAL	0.70							0.700
C1	8.33	8.33	APARTMENTS	0.62							0.620
C2	3.02	3.02	APARTMENTS	0.62							0.620
C3	9.15	9.15	APARTMENTS	0.62							0.620
C1-C3	20.50	20.50	APARTMENTS	0.62							0.620
C4	2.85	2.85	MEADOW	0.35							0.350
C1-C4	23.35										0.587

WESTGATE AT POWERS
RATIONAL METHOD

DEVELOPED FLOWS

					Overland Flow			Channel flow										
			C					CHANNEL	CONVEYANCE		SCS [2]		TOTAL	TOTAL	INTENSITY [5]		PEAK FLOW	
BASIN	DESIGN POINT	AREA (AC)	5-YEAR [7]	100-YEAR [7]	LENGTH (FT)	SLOPE (FT/FT)	Tco [1] (MIN)	LENGTH (FT)	COEFFICIENT C	SLOPE (FT/FT)	VELOCITY (FT/S)	Tt [3] (MIN)	Tc [4] (MIN)	Tc [4] (MIN)	5-YR (IN/HR)	100-YR (IN/HR)	Q5 [6] (CFS)	Q100 [6] (CFS)
A1	A1	4.56	0.591	0.779	100	0.03	6.5	780	20	0.0218	2.95	4.4	10.9	10.9	4.00	6.72	10.79	23.88
A3	A3	1.17	0.756	0.853	28	0.02	2.6	1180	20	0.0169	2.60	7.6	10.2	10.2	4.10	6.88	3.62	6.87
A1,A3	A1a	5.73	0.625	0.794									10.9	10.9	4.00	6.72	14.34	30.59
A2	A2	6.11	0.613	0.746	100	0.02	7.1	980	20	0.0276	3.32	4.9	12.0	12.0	3.86	6.47	14.44	29.51
A4	A4	1.45	0.756	0.853	12	0.02	1.7	1310	20	0.0179	2.68	8.2	9.9	9.9	4.15	6.96	4.54	8.61
A5	A5	2.74	0.756	0.853	12	0.02	1.7	1890	20	0.0228	3.02	10.4	12.2	12.2	3.84	6.44	7.94	15.05
Tt A4-A2							0.0	680	20	0.0287	3.39	3.3	3.3					
A2,A4,A5	A2a	10.30	0.671	0.790									13.2	13.2	3.71	6.23	25.63	50.66
OA1	OA1	20.78	0.190	0.432	100	0.02	13.2	2680	15	0.0175	1.98	22.5	35.7	35.7	2.22	3.72	8.76	33.42
A2,A4,A5,OA1	A5a	31.08	0.350	0.551									35.7	35.7	2.22	3.72	24.14	63.76
A1-A5,OA1	A3a	36.81	0.393	0.589									35.7	35.7	2.22	3.72	32.10	80.72
A6	**A6**	**13.42**	**0.590**	**0.700**	**100**	**0.08**	**4.7**	**1150**	**20**	**0.0148**	**2.43**	**7.9**	**12.5**	**12.5**	**3.79**	**6.36**	**30.00**	**59.75**
A8	**A8**	**1.95**	**0.757**	**0.853**	**28**	**0.02**	**2.6**	**720**	**20**	**0.01**	**2.00**	**6.0**	**8.6**	**8.6**	**4.35**	**7.30**	**6.42**	**12.15**
A6,A8	**A8a**	**15.37**	**0.611**	**0.719**									**12.5**	**12.5**	**3.79**	**6.36**	**35.58**	**70.29**
OA2	OA2	6.69	0.278	0.434	100	0.01	15.0	400	15	0.0175	1.98	3.4	18.4	18.4	3.21	5.39	5.98	15.66
A7	A7	1.18	0.590	0.700	20	0.02	3.2	100	20	0.01	2.00	0.8	4.0	5.0	5.17	8.68	3.60	7.17
OA2,A6-A8	A6a	38.61	0.514	0.636									12.5	12.5	3.79	6.36	75.19	156.18
A9	A9	6.26	0.490	0.620	100	0.02	8.9	480	20	0.013	2.28	3.5	12.4	12.4	3.81	6.40	11.69	24.82
A10	A10	5.47	0.080	0.350			0.0	2276	15	0.012	1.64	23.1	23.1	23.1	2.87	4.82	1.26	9.24
OB1	OB1	2.34	0.080	0.350	100	0.01	17.0	110	15	0.01	1.50	1.2	18.2	18.2	3.23	5.42	0.60	4.44
B1		6.58	0.573	0.717			0.0	420	20	0.0333	3.65	1.9	1.9	5.0	5.17	8.68	19.49	40.95
OB1,B1	B1	8.92	0.444	0.621									20.1	20.1	3.08	5.17	12.20	28.64
OA1,OA2,OB1,A,B	1	96.07	0.420	0.592									35.7	35.7	2.22	3.72	89.53	211.75
OC1	OC1	10.00	0.590	0.700	300	0.01	14.8	400	15	0.015	1.84	3.6	18.4	18.4	3.21	5.39	18.94	37.73
C1	C1	8.33	0.490	0.620	50	0.02	6.3	1040	20	0.0115	2.14	8.1	14.4	14.4	3.59	6.02	14.64	31.10
C2	C2	3.02	0.490	0.620	70	0.02	7.4	1100	20	0.025	3.16	5.8	13.2	13.2	3.71	6.23	5.49	11.67
C1,C2	C2.1	11.35	0.490	0.620									14.4	14.4	3.59	6.02	19.95	42.38
C3	C3.1	9.15	0.490	0.620	0		0.0	120	20	0.005	1.41	1.4	1.4	5.0	5.17	8.68	23.17	49.24
Tt C1-C3							0.0	670	20	0.01	2.00	5.6	5.6	5.6				
C1-C3	C3.1	20.50	0.490	0.620									19.9	19.9	3.09	5.19	31.08	66.02
C4		2.85	0.080	0.350	0		0.0	215	20	0.005	1.41	2.5	2.5	5.0	5.17	8.68	1.18	8.66
C1-C4	3	23.35	0.440	0.587									25.5	25.5	2.72	4.57	27.99	62.66

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES
3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL
I_5 = -1.5 * ln(Tc) + 7.583
I_{100} = -2.52 * ln(Tc) + 12.735
6) Q = CiA

APPENDIX B1

HYDRAULIC CALCULATIONS
STORM SEWER A8

WESTGATE AT POWERS - FILING NO. 3
STORM INLET SIZING SUMMARY

	BASIN FLOW			INLET FLOW					
INLET	BASIN	Q5 FLOW (CFS)	Q100 FLOW (CFS)	INLET FLOW % OF BASIN	Q5 FLOW (CFS)	Q100 FLOW (CFS)	INLET CONDITION / TYPE	INLET SIZE	INLET CAPACITY (CFS)
A8.1	A8	6.4	12.2	50	3.2	6.1	SUMP D10R	5.0	8.4
A8.2	A8	6.4	12.2	50	3.2	6.1	SUMP D10R	5.0	8.4

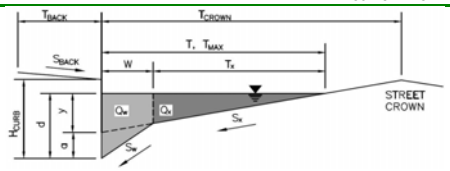
Version 4.05 Released March 2017

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

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

Project: Westgate at Powers - Inlet A8.1-A8.2

Inlet ID: Inlet A8.1-A8.2



Gutter Geometry (Enter data in the blue cells)

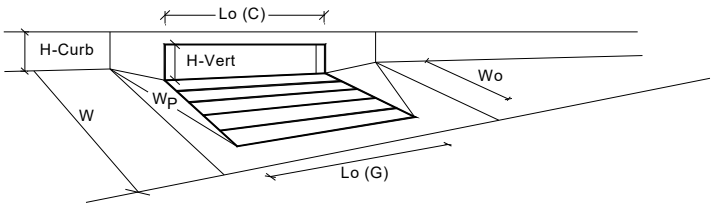
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.5	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.5	24.5	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	8.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	7.4	7.4	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	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) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.45	0.45	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.95	0.95	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.4**	**8.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.2	6.1	cfs

WESTGATE AT POWERS - FILING NO. 3
STORM SEWER SIZING SUMMARY

	PIPE FLOW				PIPE CAPACITY		
PIPE	BASINS	Q5 FLOW (CFS)	Q100 FLOW (CFS)		PIPE SIZE (IN)	MIN. PIPE SLOPE	FULL PIPE CAPACITY (CFS)
A8.1	A8.1	3.2	6.1		18	0.5%	7.4
A8.2	A8.1,A8.2	6.4	12.2		24	0.5%	16.0

ASSUMPTIONS:
1. STORM SEWER PIPE TO BE RCP OR HDPE

Hydraulic Analysis Report

Project Data

Project Title: Project - Westgate at Powers Filing No. 3

Designer: JPS

Project Date: Friday, May 14, 2021

Project Units: U.S. Customary Units

Notes:

Channel Analysis: SD-A8.1

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0130

Depth: 1.5000 ft

Result Parameters

Flow: 7.4277 cfs

Area of Flow: 1.7671 ft^2

Wetted Perimeter: 4.7124 ft

Hydraulic Radius: 0.3750 ft

Average Velocity: 4.2032 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.0554 ft

Critical Velocity: 5.5902 ft/s

Critical Slope: 0.0070 ft/ft

Critical Top Width: 1.37 ft

Calculated Max Shear Stress: 0.4680 lb/ft^2

Calculated Avg Shear Stress: 0.1170 lb/ft^2

Channel Analysis: SD-A8.2

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0130

Depth: 2.0000 ft

Result Parameters

Flow: 15.9965 cfs

Area of Flow: 3.1416 ft^2

Wetted Perimeter: 6.2832 ft

Hydraulic Radius: 0.5000 ft

Average Velocity: 5.0918 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.4414 ft

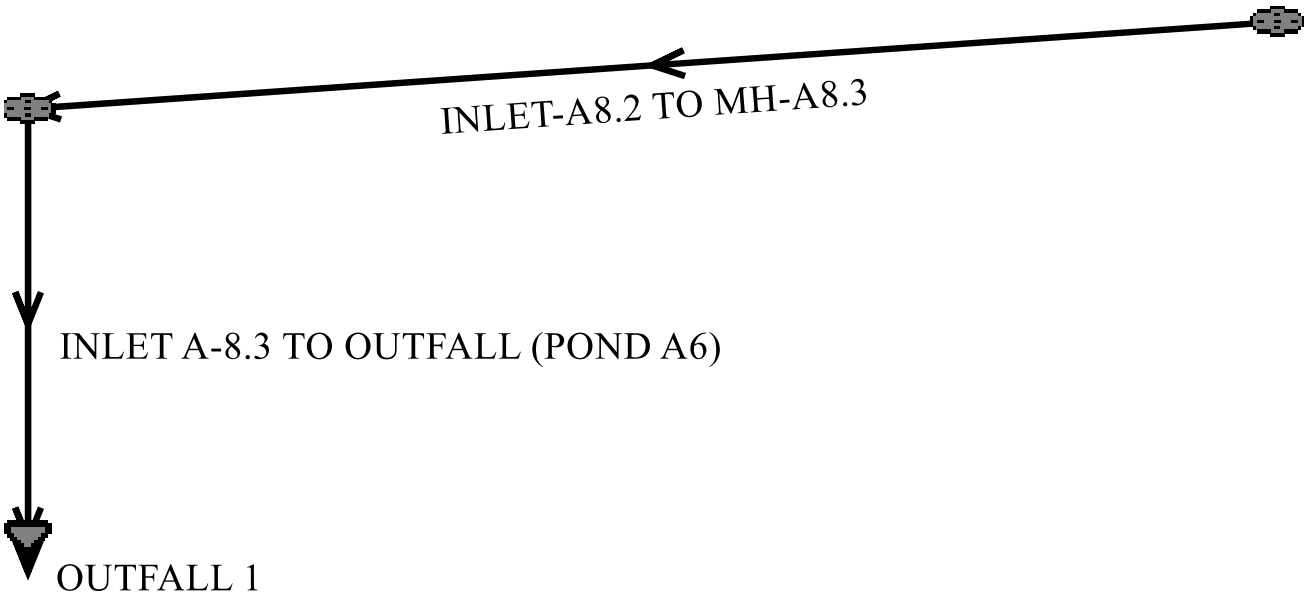
Critical Velocity: 6.5991 ft/s

Critical Slope: 0.0066 ft/ft

Critical Top Width: 1.79 ft

Calculated Max Shear Stress: 0.6240 lb/ft^2

Calculated Avg Shear Stress: 0.1560 lb/ft^2


INLET-A8.2 TO MH-A8.3
INLET A-8.3 TO OUTFALL (POND A6)
OUTFALL 1

UDSewer Results Summary

Project Title: Westgate - Storm Sewer A8 – 5-Year Analysis
Project Description: Default system

Table of Contents

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 1.50
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 12.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6123.73

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	6108.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INLET A-8.3 TO OUTFALL (POND A6)	6128.00	6.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INLET-A8.2 TO MH-A8.3	6128.07	6.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INLET A8.1-A8.2	6128.07	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	0.93	6.88	0.21	6.40	Surface Water Present (Upstream)
INLET A-8.3 TO OUTFALL (POND A6)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.40	Surface Water Present (Downstream)
INLET-A8.2 TO MH-A8.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.40	
INLET A8.1-A8.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
INLET A-8.3 TO OUTFALL (POND A6)	25.73	6121.50	1.0	6121.76	0.013	0.00	0.00	CIRCULAR	24.00 in	24.00 in
INLET-A8.2 TO MH-A8.3	149.38	6121.86	1.0	6123.35	0.013	0.94	1.00	CIRCULAR	24.00 in	24.00 in
INLET A8.1-A8.2	55.00	6123.45	0.5	6123.73	0.013	0.09	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
INLET A-8.3 TO OUTFALL (POND A6)	22.79	7.25	10.75	4.70	8.70	6.23	1.50	Supercritical Jump	6.40	24.71	
INLET-A8.2 TO MH-A8.3	22.66	7.21	10.75	4.70	8.73	6.20	1.49	Supercritical	6.40	0.00	
INLET A8.1-A8.2	7.51	4.25	8.17	4.10	8.20	4.08	0.99	Subcritical	3.20	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
INLET A-8.3 TO OUTFALL (POND A6)	6.40	CIRCULAR	24.00 in	24.00 in	15.00 in	15.00 in	24.00 in	24.00 in	3.14	
INLET-A8.2 TO MH-A8.3	6.40	CIRCULAR	24.00 in	24.00 in	15.00 in	15.00 in	24.00 in	24.00 in	3.14	
INLET A8.1-A8.2	3.20	CIRCULAR	18.00 in	18.00 in	15.00 in	15.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

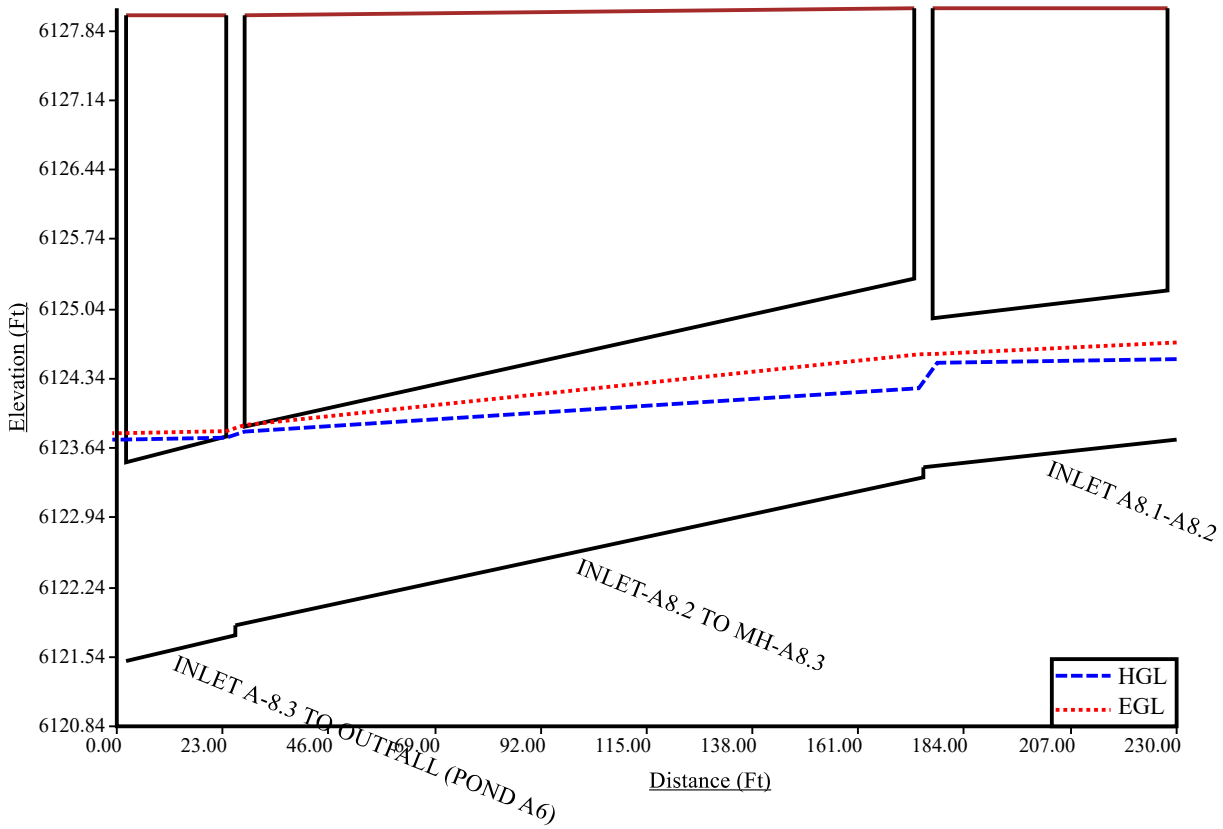
Grade Line Summary:

Tailwater Elevation (ft): 6123.73

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
INLET A-8.3 TO OUTFALL (POND A6)	6121.50	6121.76	0.00	0.00	6123.73	6123.75	6123.79	0.02	6123.81
INLET-A8.2 TO MH-A8.3	6121.86	6123.35	0.06	0.00	6123.81	6124.25	6123.88	0.71	6124.59
INLET A8.1-A8.2	6123.45	6123.73	0.00	0.00	6124.50	6124.54	6124.59	0.11	6124.71

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

PROFILE-SD8-5



UDSewer Results Summary

Project Title: Westgate - Storm Sewer A8 – 100-Year Analysis
Project Description: Default system

Table of Contents

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.52
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 12.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6125.11

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	6108.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INLET A-8.3 TO OUTFALL (POND A6)	6128.00	12.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INLET-A8.2 TO MH-A8.3	6128.07	12.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INLET A8.1-A8.2	6128.07	6.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	1.05	11.65	0.11	12.20	Surface Water Present (Upstream)
INLET A-8.3 TO OUTFALL (POND A6)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.20	Surface Water Present (Downstream)
INLET-A8.2 TO MH-A8.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.20	
INLET A8.1-A8.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
INLET A-8.3 TO OUTFALL (POND A6)	25.73	6121.50	1.0	6121.76	0.013	0.00	0.00	CIRCULAR	24.00 in	24.00 in
INLET-A8.2 TO MH-A8.3	149.38	6121.86	1.0	6123.35	0.013	0.94	1.00	CIRCULAR	24.00 in	24.00 in
INLET A8.1-A8.2	55.00	6123.45	0.5	6123.73	0.013	0.09	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
INLET A-8.3 TO OUTFALL (POND A6)	22.79	7.25	15.06	5.88	12.50	7.38	1.43	Pressurized	12.20	25.73	
INLET-A8.2 TO MH-A8.3	22.66	7.21	15.06	5.88	12.54	7.35	1.42	Pressurized	12.20	149.38	
INLET A8.1-A8.2	7.51	4.25	11.45	5.14	12.31	4.74	0.87	Pressurized	6.10	55.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
INLET A-8.3 TO OUTFALL (POND A6)	12.20	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
INLET-A8.2 TO MH-A8.3	12.20	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
INLET A8.1-A8.2	6.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

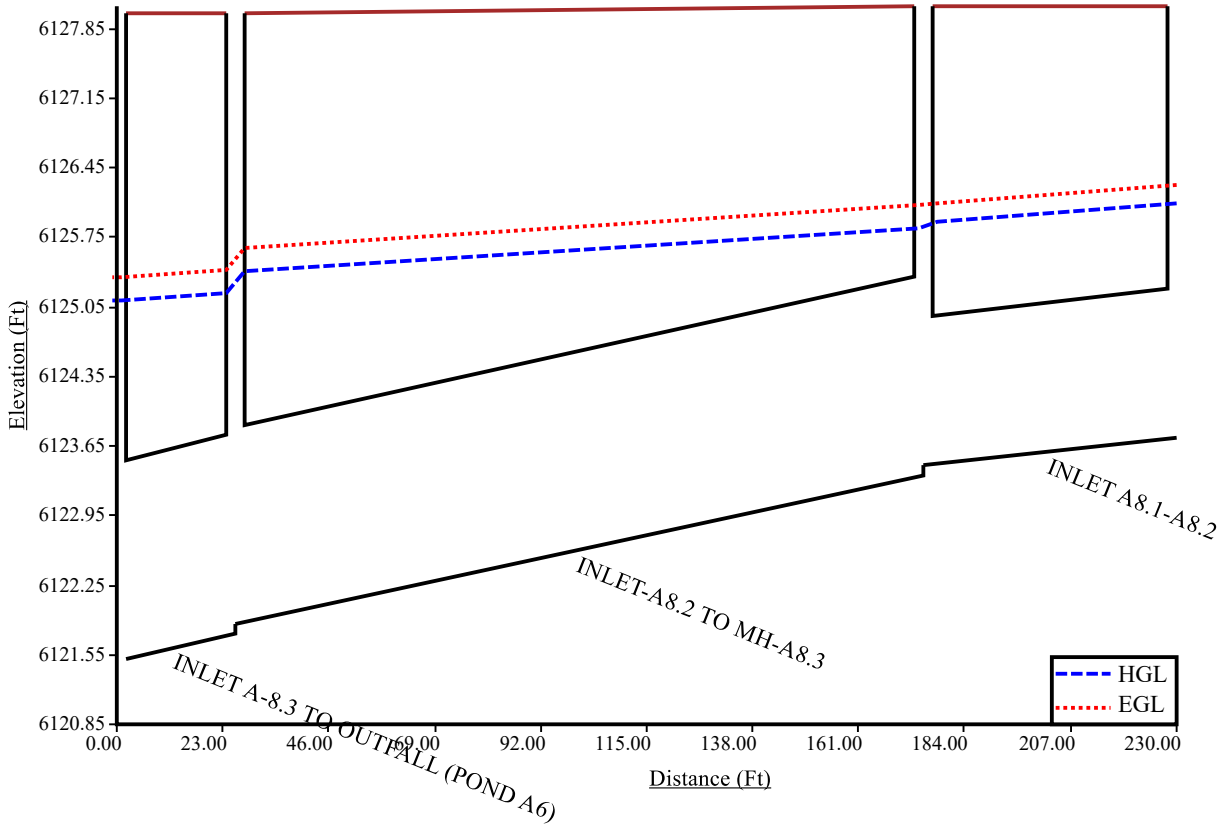
Grade Line Summary:

Tailwater Elevation (ft): 6125.11

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
INLET A-8.3 TO OUTFALL (POND A6)	6121.50	6121.76	0.00	0.00	6125.11	6125.18	6125.34	0.07	6125.42
INLET-A8.2 TO MH-A8.3	6121.86	6123.35	0.22	0.00	6125.40	6125.84	6125.64	0.43	6126.07
INLET A8.1-A8.2	6123.45	6123.73	0.02	0.00	6125.90	6126.09	6126.09	0.18	6126.27

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

PROFILE-SD-A8-100



APPENDIX B2

HYDRAULIC CALCULATIONS
JOYSTONE DRIVE BOX CULVERT

HY-8 Culvert Analysis Report

Crossing Discharge Data – Joystone Drive CBC – Sand Creek DBPS Flows

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 600 cfs

Design Flow: 950 cfs

Maximum Flow: 1960 cfs

Table 1 - Summary of Culvert Flows at Crossing: Crossing - Joystone CBC-DBPS

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert - Joystone CBC Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6121.53	600.00	600.00	0.00	1
6121.90	736.00	736.00	0.00	1
6122.27	872.00	872.00	0.00	1
6122.47	950.00	950.00	0.00	1
6122.95	1144.00	1144.00	0.00	1
6123.26	1280.00	1280.00	0.00	1
6123.56	1416.00	1416.00	0.00	1
6123.86	1552.00	1552.00	0.00	1
6124.15	1688.00	1688.00	0.00	1
6124.44	1824.00	1824.00	0.00	1
6124.73	1960.00	1960.00	0.00	1
6128.03	3306.01	3306.01	0.00	Overtopping

Flows

Rating Curve Plot for Crossing: Crossing - Joystone CBC-DBPS Flows

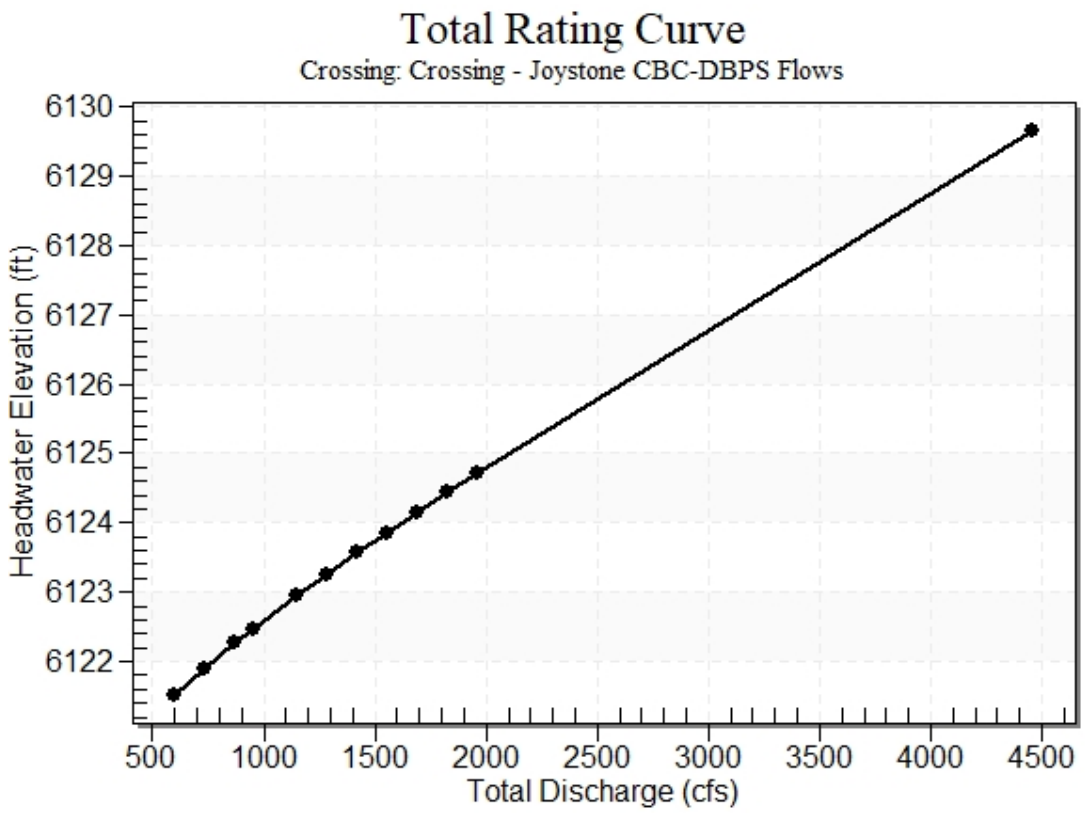


Table 2 - Culvert Summary Table: Culvert - Joystone CBC

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
600.00	600.00	6121.53	2.587	1.327	1-S2n	1.304	1.693	1.343	1.938	9.309	5.546
736.00	736.00	6121.90	2.965	1.627	1-S2n	1.486	1.940	1.543	2.184	9.939	5.959
872.00	872.00	6122.27	3.332	1.919	1-S2n	1.657	2.172	1.734	2.411	10.475	6.321
950.00	950.00	6122.47	3.532	2.085	1-S2n	1.751	2.300	1.841	2.533	10.752	6.510
1144.00	1144.00	6122.95	4.005	2.495	1-S2n	1.976	2.603	2.094	2.821	11.380	6.937
1280.00	1280.00	6123.26	4.319	2.783	1-S2n	2.126	2.806	2.265	3.010	11.772	7.205
1416.00	1416.00	6123.56	4.622	3.073	1-S2n	2.272	3.001	2.433	3.189	12.124	7.453
1552.00	1552.00	6123.86	4.918	3.366	1-S2n	2.414	3.190	2.594	3.361	12.463	7.684
1688.00	1688.00	6124.15	5.209	3.664	1-S2n	2.552	3.374	2.755	3.527	12.765	7.901
1824.00	1824.00	6124.44	5.498	3.967	1-S2n	2.687	3.553	2.910	3.686	13.060	8.105
1960.00	1960.00	6124.73	5.787	4.276	1-S2n	2.820	3.727	3.063	3.840	13.330	8.297

****

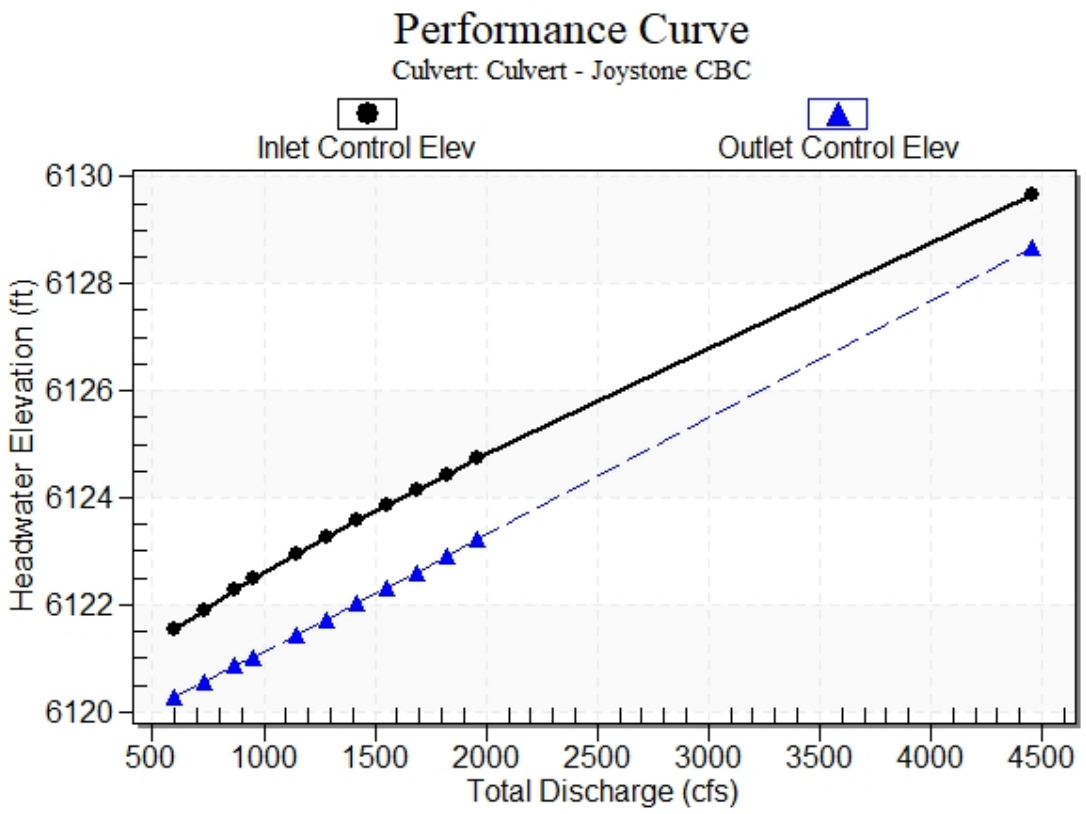
Straight Culvert

Inlet Elevation (invert): 6118.94 ft, Outlet Elevation (invert): 6118.22 ft

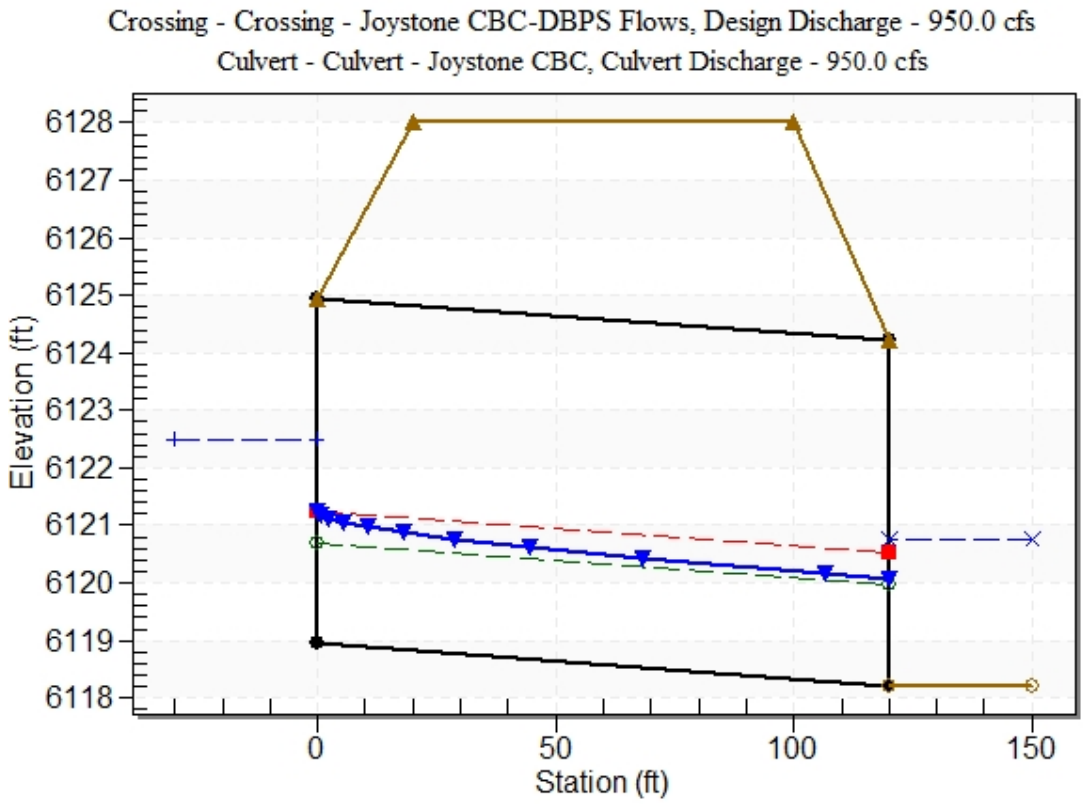
Culvert Length: 120.00 ft, Culvert Slope: 0.0060

****

Culvert Performance Curve Plot: Culvert - Joystone CBC



Water Surface Profile Plot for Culvert: Culvert - Joystone CBC



Site Data - Culvert - Joystone CBC

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6118.94 ft

Outlet Station: 120.00 ft

Outlet Elevation: 6118.22 ft

Number of Barrels: 3

Culvert Data Summary - Culvert - Joystone CBC

Barrel Shape: Concrete Box

Barrel Span: 16.00 ft

Barrel Rise: 6.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Crossing - Joystone CBC-DBPS Flows)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
600.00	6120.16	1.94	5.55	0.73	0.74
736.00	6120.40	2.18	5.96	0.82	0.75
872.00	6120.63	2.41	6.32	0.90	0.76
950.00	6120.75	2.53	6.51	0.95	0.77
1144.00	6121.04	2.82	6.94	1.06	0.78
1280.00	6121.23	3.01	7.21	1.13	0.79
1416.00	6121.41	3.19	7.45	1.19	0.79
1552.00	6121.58	3.36	7.68	1.26	0.80
1688.00	6121.75	3.53	7.90	1.32	0.80
1824.00	6121.91	3.69	8.10	1.38	0.81
1960.00	6122.06	3.84	8.30	1.44	0.81

Tailwater Channel Data - Crossing - Joystone CBC-DBPS Flows

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 50.00 ft

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0060

Channel Manning's n: 0.0300

Channel Invert Elevation: 6118.22 ft

Roadway Data for Crossing: Crossing - Joystone CBC-DBPS Flows

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 6128.03 ft

Roadway Surface: Paved

Roadway Top Width: 80.00 ft

Crossing Discharge Data – Joystone Drive CBC – FEMA Flows

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 340 cfs

Design Flow: 630 cfs

Maximum Flow: 790 cfs

Table 4 - Summary of Culvert Flows at Crossing: Crossing - Joystone CBC-FEMA

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert - Joystone CBC Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6120.71	340.00	340.00	0.00	1
6120.86	385.00	385.00	0.00	1
6121.01	430.00	430.00	0.00	1
6121.15	475.00	475.00	0.00	1
6121.29	520.00	520.00	0.00	1
6121.43	565.00	565.00	0.00	1
6121.61	630.00	630.00	0.00	1
6121.68	655.00	655.00	0.00	1
6121.81	700.00	700.00	0.00	1
6121.93	745.00	745.00	0.00	1
6122.05	790.00	790.00	0.00	1
6128.03	3306.04	3306.04	0.00	Overtopping

Flows

Rating Curve Plot for Crossing: Crossing - Joystone CBC-FEMA Flows

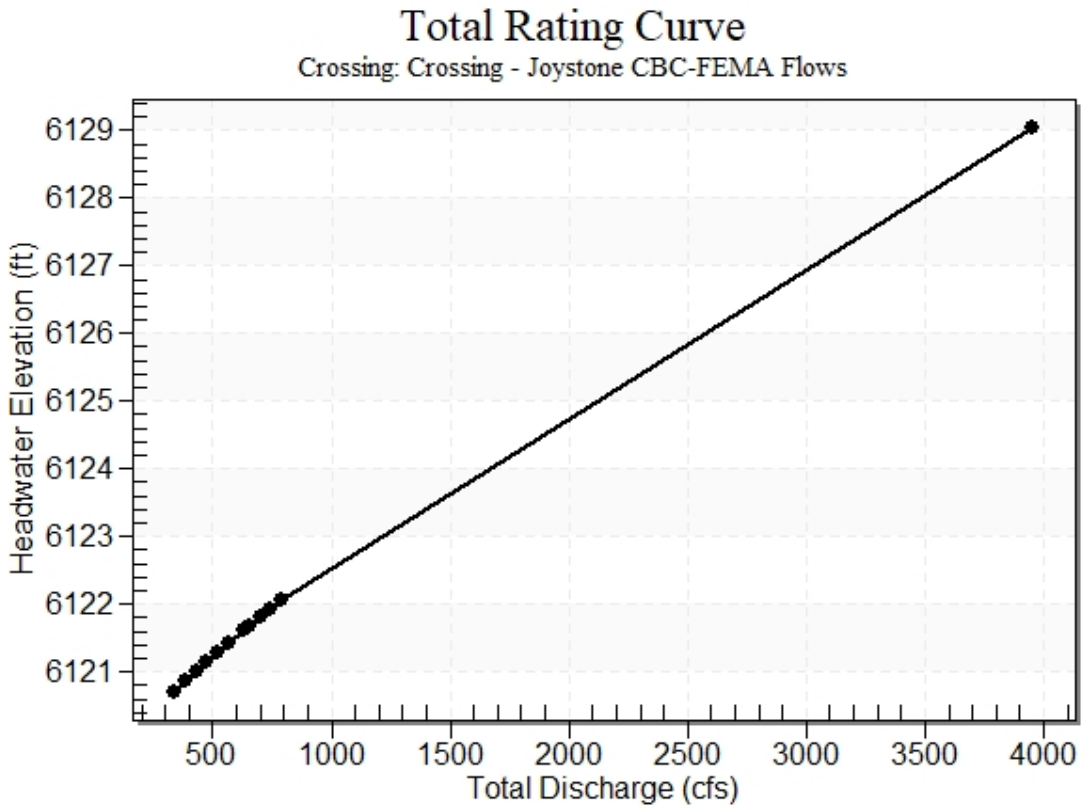


Table 5 - Culvert Summary Table: Culvert - Joystone CBC

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
340.00	340.00	6120.71	1.772	0.703	1-S2n	0.912	1.159	0.922	1.388	7.684	4.522
385.00	385.00	6120.86	1.925	0.818	1-S2n	0.984	1.259	1.001	1.494	8.015	4.731
430.00	430.00	6121.01	2.072	0.930	1-S2n	1.056	1.356	1.075	1.594	8.334	4.924
475.00	475.00	6121.15	2.214	1.038	1-S2n	1.124	1.449	1.148	1.690	8.623	5.103
520.00	520.00	6121.29	2.352	1.144	1-S2n	1.191	1.539	1.219	1.783	8.886	5.271
565.00	565.00	6121.43	2.486	1.247	1-S2n	1.255	1.626	1.289	1.871	9.129	5.429
630.00	630.00	6121.61	2.673	1.394	1-S2n	1.345	1.749	1.387	1.994	9.460	5.642
655.00	655.00	6121.68	2.743	1.450	1-S2n	1.380	1.795	1.424	2.040	9.580	5.720
700.00	700.00	6121.81	2.867	1.549	1-S2n	1.439	1.876	1.491	2.121	9.784	5.855
745.00	745.00	6121.93	2.989	1.647	1-S2n	1.497	1.956	1.555	2.200	9.984	5.984
790.00	790.00	6122.05	3.113	1.744	1-S2n	1.555	2.034	1.622	2.276	10.144	6.108

****

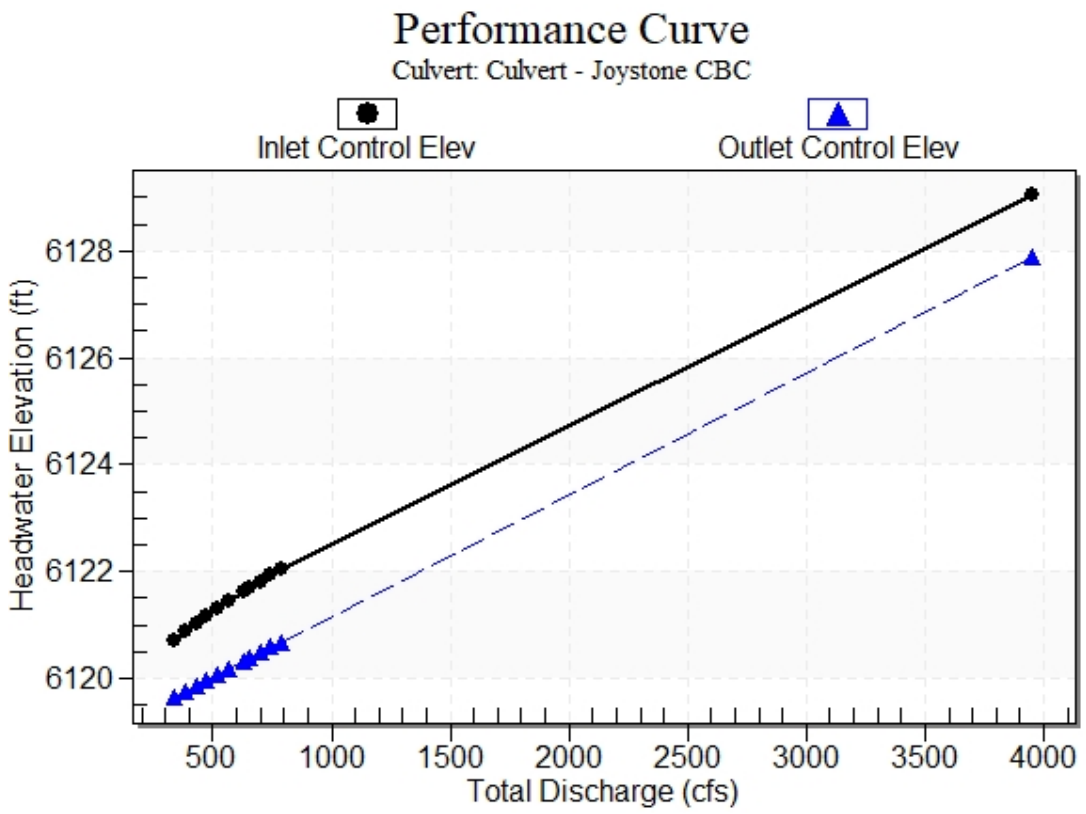
Straight Culvert

Inlet Elevation (invert): 6118.94 ft, Outlet Elevation (invert): 6118.22 ft

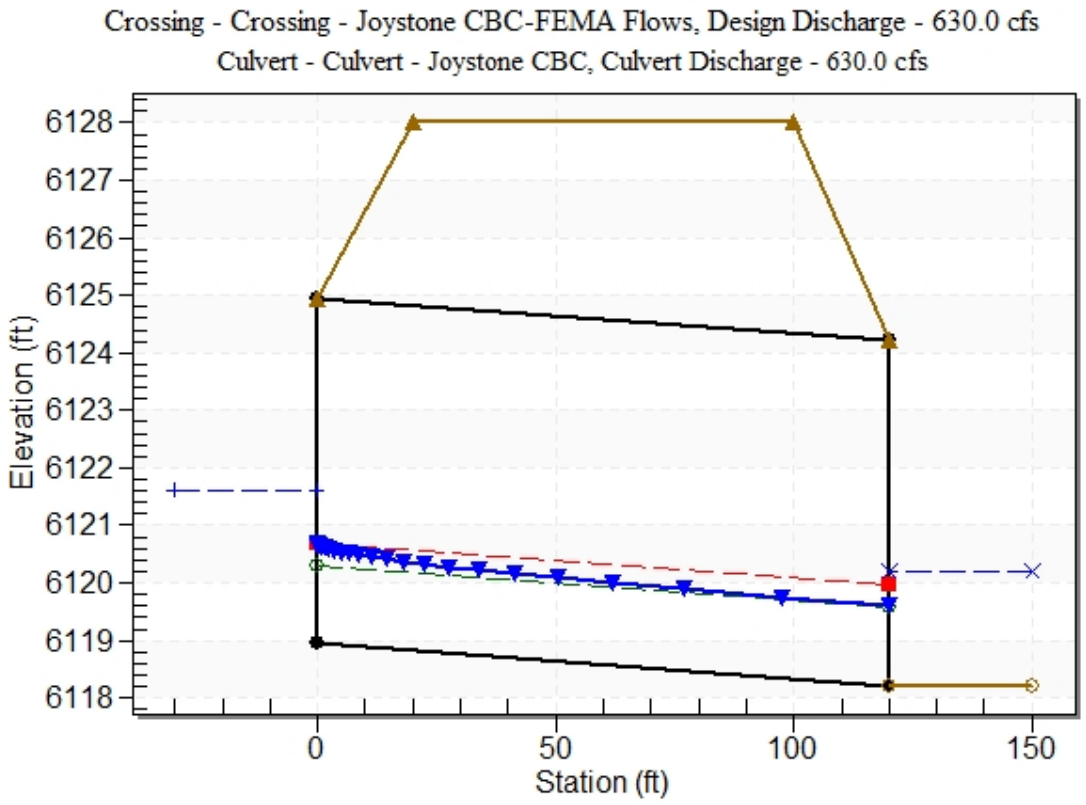
Culvert Length: 120.00 ft, Culvert Slope: 0.0060

****

Culvert Performance Curve Plot: Culvert - Joystone CBC



Water Surface Profile Plot for Culvert: Culvert - Joystone CBC



Site Data - Culvert - Joystone CBC

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6118.94 ft

Outlet Station: 120.00 ft

Outlet Elevation: 6118.22 ft

Number of Barrels: 3

Culvert Data Summary - Culvert - Joystone CBC

Barrel Shape: Concrete Box

Barrel Span: 16.00 ft

Barrel Rise: 6.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 6 - Downstream Channel Rating Curve (Crossing: Crossing - Joystone CBC-FEMA Flows)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
340.00	6119.61	1.39	4.52	0.52	0.70
385.00	6119.71	1.49	4.73	0.56	0.71
430.00	6119.81	1.59	4.92	0.60	0.72
475.00	6119.91	1.69	5.10	0.63	0.72
520.00	6120.00	1.78	5.27	0.67	0.73
565.00	6120.09	1.87	5.43	0.70	0.73
630.00	6120.21	1.99	5.64	0.75	0.74
655.00	6120.26	2.04	5.72	0.76	0.74
700.00	6120.34	2.12	5.86	0.79	0.75
745.00	6120.42	2.20	5.98	0.82	0.75
790.00	6120.50	2.28	6.11	0.85	0.76

Tailwater Channel Data - Crossing - Joystone CBC-FEMA Flows

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 50.00 ft

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0060

Channel Manning's n: 0.0300

Channel Invert Elevation: 6118.22 ft

Roadway Data for Crossing: Crossing - Joystone CBC-FEMA Flows

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 6128.03 ft

Roadway Surface: Paved

Roadway Top Width: 80.00 ft

APPENDIX C

STORMWATER DETENTION & WATER QUALITY CALCULATIONS

WESTGATE AT POWERS

IMPERVIOUS AREAS

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A1	4.56	2.84	BUILDING / PAVEMENT	100.00	1.72	LANDSCAPED	0				62.281
A3	1.17	0.97	PAVEMENT	100.00	0.21	LANDSCAPED	0				82.479
A1,A3	5.73										66.405
A2	6.11	3.97	BUILDING / PAVEMENT	100.00	2.14	LANDSCAPED	0				64.975
A4	1.45	1.20	PAVEMENT	100.00	0.25	LANDSCAPED	0				82.483
A5	2.74	2.26	PAVEMENT	100.00	0.48	LANDSCAPED	0				82.482
A2,A4,A5	10.30										72.097
A6	**13.42**	**13.42**	**COMMERCIAL**	**80.00**							**80.000**
A8	**1.95**	**1.61**	**PAVEMENT**	**100.00**	**0.34**	**LANDSCAPED**	**0**				**82.513**
A6,A8	**15.37**										**80.319**
A7	1.18	1.18	COMMERCIAL	80.00							80.000
A9	6.26	6.26	APARTMENTS	70.00							70.000
A10	5.47	5.47	CHANNEL / LANDSCAPE	0.00							0.000
OB1	2.34	2.34	MEADOW	0.00							0.000
B1	6.58	3.96	BUILDING / PAVEMENT	100.00	2.62	LANDSCAPED	0				60.182
OB1,B1	8.92										44.395
OC1	10.00	10.00	LIGHT INDUSTRIAL	80.00							80.000
C1	8.33	8.33	APARTMENTS	70.00							70.000
C2	3.02	3.02	APARTMENTS	70.00							70.000
C3	9.15	9.15	APARTMENTS	70.00							70.000
C1-C3	20.50	20.50	APARTMENTS	70.00							70.000
C4	2.85	2.85	MEADOW	0.00							0.000
C1-C4	23.35										61.456

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 1**

Designer:	**JPS**
Company:	**JPS**
Date:	**May 13, 2021**
Project:	**Westgate at Powers Filing No. 3**
Location:	**Basin A8**

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	DCIA											
Area ID	A8											
Downstream Design Point ID	A8											
Downstream BMP Type	EDB											
DCIA (ft^2)	70,132											
UIA (ft^2)	--											
RPA (ft^2)	--											
SPA (ft^2)	--											
HSG A (%)	--											
HSG B (%)	--											
HSG C/D (%)	--											
Average Slope of RPA (ft/ft)	--											
UIA:RPA Interface Width (ft)	--											

CALCULATED RUNOFF RESULTS

Area ID	A8											
UIA:RPA Area (ft^2)	--											
L / W Ratio	--											
UIA / Area	--											
Runoff (in)	0.50											
Runoff (ft^3)	2922											
Runoff Reduction (ft^3)	0											

CALCULATED WQCV RESULTS

Area ID	A8											
WQCV (ft^3)	2922											
WQCV Reduction (ft^3)	0											
WQCV Reduction (%)	0%											
Untreated WQCV (ft^3)	2922											

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	A8											
DCIA (ft^2)	70,132											
UIA (ft^2)	0											
RPA (ft^2)	0											
SPA (ft^2)	0											
Total Area (ft^2)	70,132											
Total Impervious Area (ft^2)	70,132											
WQCV (ft^3)	2,922											
WQCV Reduction (ft^3)	0											
WQCV Reduction (%)	0%											
Untreated WQCV (ft^3)	2,922											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

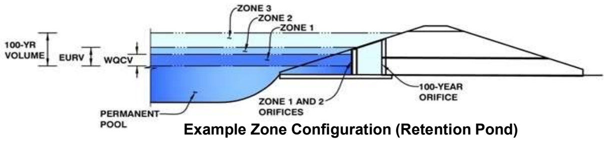
Total Area (ft^2)	70,132
Total Impervious Area (ft^2)	70,132
WQCV (ft^3)	2,922
WQCV Reduction (ft^3)	0
WQCV Reduction (%)	0%
Untreated WQCV (ft^3)	2,922

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Westgate at Powers - Filing No. 3**

Basin ID: **Detention Basin A6**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	15.37	acres
Watershed Length =	1,250	ft
Watershed Length to Centroid =	625	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	80.32%	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
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.423	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.625	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.142	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.480	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.751	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.068	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.377	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.735	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.529	acre-feet	3.14	inches
Approximate 2-yr Detention Volume =	1.067	acre-feet		
Approximate 5-yr Detention Volume =	1.388	acre-feet		
Approximate 10-yr Detention Volume =	1.656	acre-feet		
Approximate 25-yr Detention Volume =	1.967	acre-feet		
Approximate 50-yr Detention Volume =	2.148	acre-feet		
Approximate 100-yr Detention Volume =	2.316	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.423	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.202	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.690	acre-feet
Total Detention Basin Volume =	2.316	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	10	0.000		
Bot EL=6121.0	--	1.00	--	--	--	16,093	0.369	8,051	0.185
	--	2.00	--	--	--	18,405	0.423	25,300	0.581
	--	4.00	--	--	--	23,376	0.537	67,081	1.540
Spillway=6126.0	--	6.00	--	--	--	28,868	0.663	119,325	2.739
Top EL=6128.0	--	8.00	--	--	--	34,360	0.789	182,553	4.191
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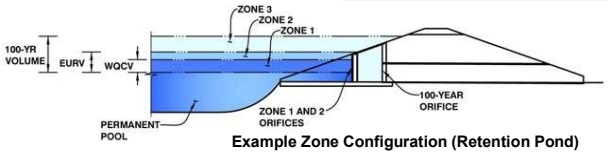
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Westgate at Powers - Filing No. 3**

Basin ID: **Detention Basin A6**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.62	0.423	Orifice Plate
Zone 2 (EURV)	4.16	1.202	Orifice Plate
Zone 3 (100-year)	5.35	0.690	Weir&Pipe (Restrict)
Total (all zones)		2.316	

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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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)	WQ Orifice Area per Row =	2.681E-02	ft^2
Depth at top of Zone using Orifice Plate =	4.16	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	17.10	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	3.86	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.39	2.77					
Orifice Area (sq. inches)	3.86	3.86	3.86					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.50	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	2.50	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	9.81	N/A	
Horiz. Length of Weir Sides =	2.50	N/A	feet	Overflow Grate Open Area w/o Debris =	6.96	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	3.48	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			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 Orifice Area =	0.71	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.37	N/A	feet
Restrictor Plate Height Above Pipe Invert =	7.60		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.41	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.89	feet
Spillway Crest Length =	16.00	feet	Stage at Top of Freeboard =	7.89	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.78	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	4.10	acre-ft

Calculated Parameters for Spillway

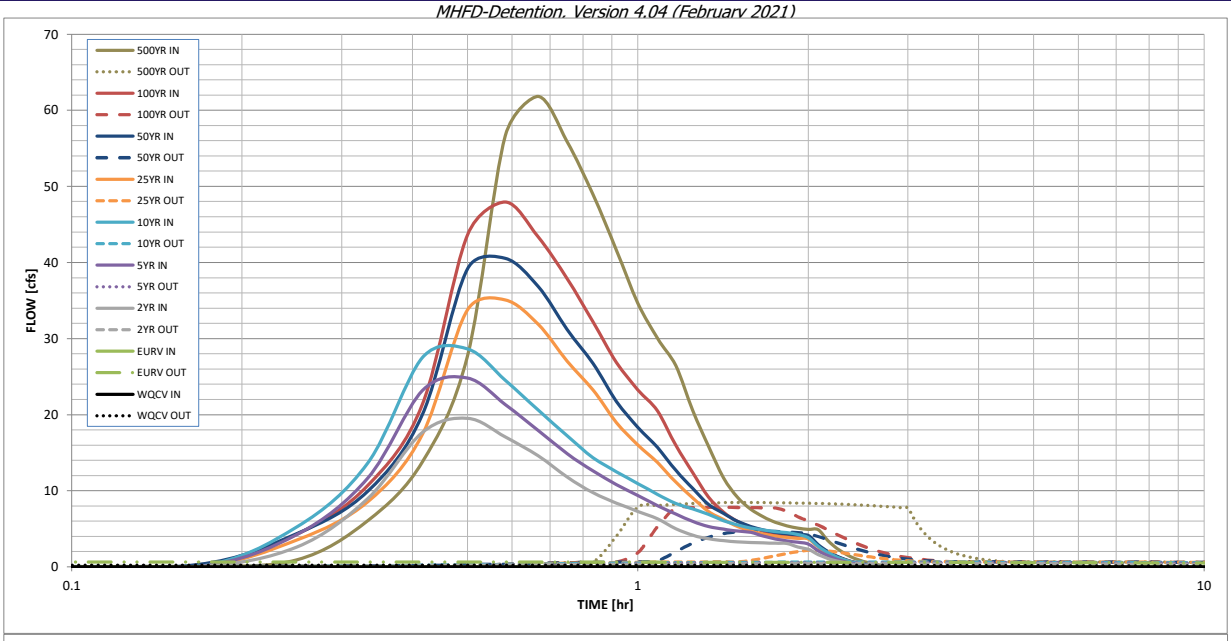
Routed Hydrograph Results

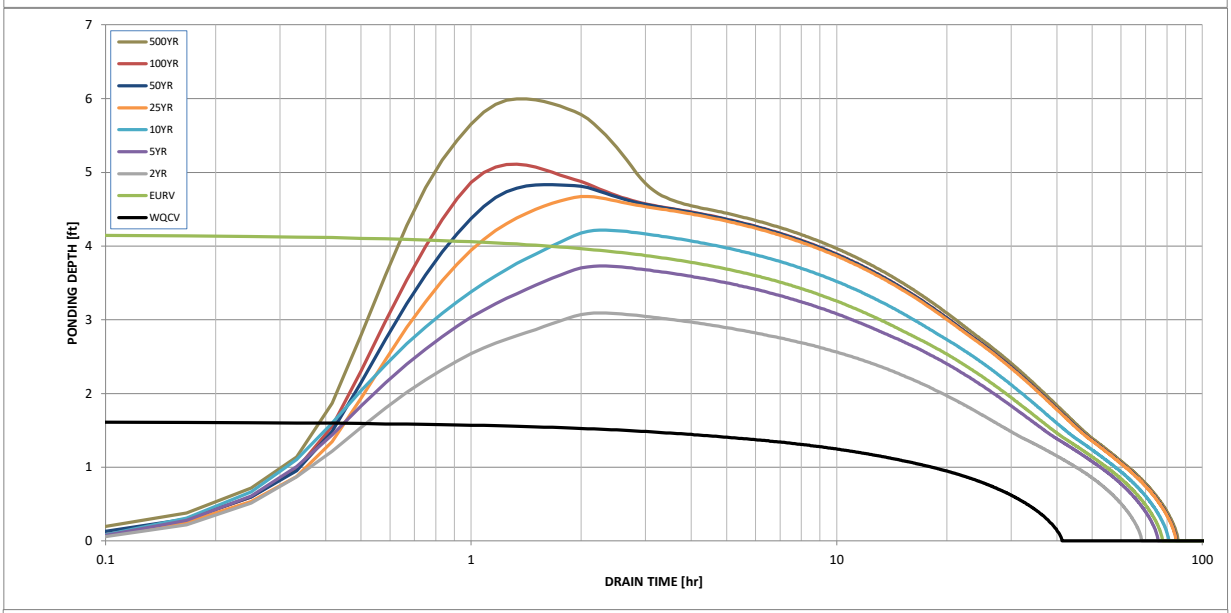
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

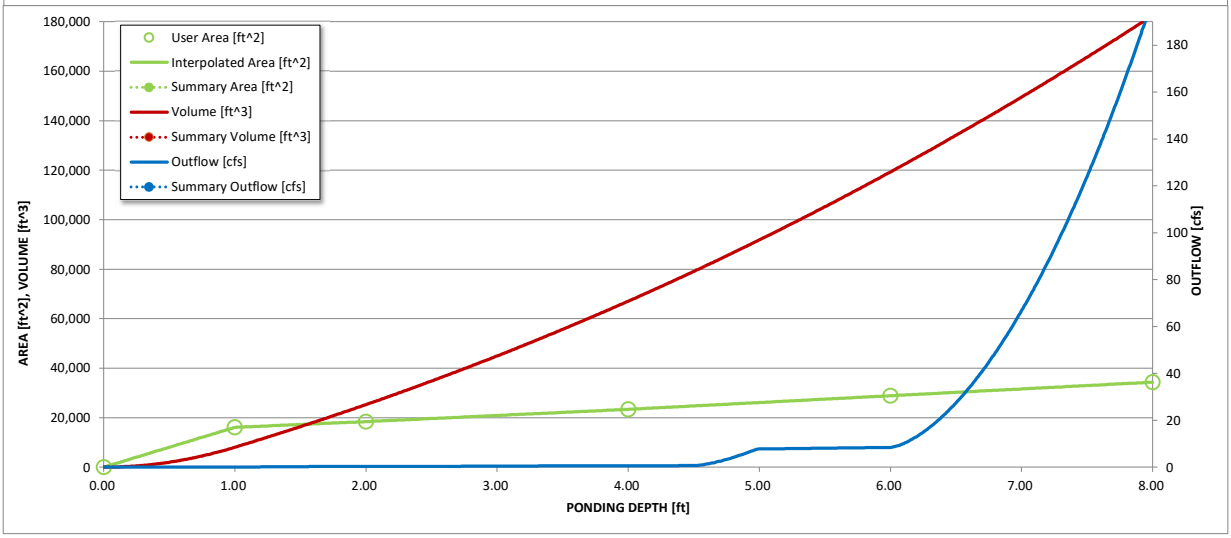
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.423	1.625	1.142	1.480	1.751	2.068	2.377	2.735	3.529
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.142	1.480	1.751	2.068	2.377	2.735	3.529
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	2.7	5.3	8.7	15.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.17	0.35	0.56	1.01
Peak Inflow Q (cfs) =	N/A	N/A	19.5	24.8	28.6	35.1	40.5	47.9	61.8
Peak Outflow Q (cfs) =	0.2	0.6	0.5	0.6	0.6	2.2	4.7	7.8	8.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.8	2.2	0.8	0.9	0.9	0.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.6	1.0	1.1
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	69	62	68	72	75	74	73	71
Time to Drain 99% of Inflow Volume (hours) =	**40**	74	65	72	77	80	80	80	79
Maximum Ponding Depth (ft) =	1.62	4.16	3.09	3.73	4.22	4.67	4.83	5.11	6.00
Area at Maximum Ponding Depth (acres) =	0.40	0.55	0.48	0.52	0.55	0.58	0.59	0.61	0.66
Maximum Volume Stored (acre-ft) =	0.424	1.627	1.075	1.392	1.654	1.914	2.007	2.168	2.733

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.03	0.95
	0:15:00	0.00	0.00	2.63	4.27	5.28	3.54	4.38	4.31	6.06
	0:20:00	0.00	0.00	8.98	11.65	13.64	8.56	9.92	10.68	13.81
	0:25:00	0.00	0.00	17.68	23.16	27.49	17.40	20.03	21.38	27.70
	0:30:00	0.00	0.00	19.53	24.80	28.65	33.78	39.17	43.63	56.63
	0:35:00	0.00	0.00	17.07	21.34	24.53	35.07	40.53	47.94	61.82
	0:40:00	0.00	0.00	14.60	17.94	20.59	31.89	36.84	43.34	55.90
	0:45:00	0.00	0.00	11.81	14.88	17.23	27.04	31.19	37.89	48.94
	0:50:00	0.00	0.00	9.75	12.62	14.37	23.24	26.74	32.21	41.64
	0:55:00	0.00	0.00	8.39	10.82	12.50	18.97	21.76	26.87	34.68
	1:00:00	0.00	0.00	7.30	9.37	10.96	16.03	18.35	23.28	30.03
	1:05:00	0.00	0.00	6.30	8.05	9.53	13.70	15.68	20.47	26.44
	1:10:00	0.00	0.00	5.03	6.95	8.34	11.14	12.70	15.97	20.54
	1:15:00	0.00	0.00	4.15	5.97	7.60	9.06	10.29	12.38	15.86
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	1:25:00	0.00	0.00	3.44	4.95	6.08	6.23	7.03	7.20	9.15
	1:30:00	0.00	0.00	3.30	4.71	5.51	5.32	5.99	5.99	7.57
	1:35:00	0.00	0.00	3.22	4.54	5.11	4.71	5.31	5.21	6.56
	1:40:00	0.00	0.00	3.15	4.05	4.83	4.31	4.85	4.68	5.87
	1:45:00	0.00	0.00	3.11	3.69	4.64	4.05	4.55	4.33	5.41
	1:50:00	0.00	0.00	3.08	3.42	4.50	3.86	4.34	4.09	5.10
	1:55:00	0.00	0.00	2.63	3.23	4.27	3.75	4.21	3.96	4.94
	2:00:00	0.00	0.00	2.30	3.00	3.85	3.67	4.13	3.91	4.87
	2:05:00	0.00	0.00	1.63	2.12	2.71	2.60	2.92	2.78	3.46
	2:10:00	0.00	0.00	1.12	1.47	1.88	1.81	2.03	1.94	2.41
	2:15:00	0.00	0.00	0.76	0.99	1.29	1.24	1.40	1.34	1.67
	2:20:00	0.00	0.00	0.51	0.65	0.86	0.83	0.93	0.89	1.11
	2:25:00	0.00	0.00	0.32	0.42	0.56	0.54	0.61	0.58	0.73
	2:30:00	0.00	0.00	0.19	0.27	0.35	0.35	0.39	0.38	0.47
	2:35:00	0.00	0.00	0.10	0.15	0.19	0.20	0.22	0.21	0.27
	2:40:00	0.00	0.00	0.04	0.07	0.08	0.09	0.10	0.10	0.12
	2:45:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.03
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: JPS
Company: JPS
Date: May 12, 2021
Project: WESTGATE AT POWERS
Location: DETENTION BASIN A6

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 80.3 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.803

C) Contributing Watershed Area — Area = 15.370 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- ○ Water Quality Capture Volume (WQCV)
- ◉ Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)
V_{DESIGN} = 0.423 ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$)
$V_{DESIGN\ OTHER}$ = ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)
$V_{DESIGN\ USER}$ = ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
i) Percentage of Watershed consisting of Type A Soils — HSG_A = 100 %
ii) Percentage of Watershed consisting of Type B Soils — HSG_B = 0 %
iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = 0 %

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
$EURV_{DESIGN}$ = 1.625 ac-f t

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)
$EURV_{DESIGN\ USER}$ = ac-f t

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)
L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred)
Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:
Concrete Forebay

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 3% of the WQCV)
V_{FMIN} = 0.013 ac-ft

B) Actual Forebay Volume
V_F = 0.013 ac-ft

C) Forebay Depth
(D_F = 18 inch maximum)
D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge
Q_{100} = 70.30 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$)
Q_F = 1.41 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ◉ Wall with Rect. Notch
- ○ Wall with V-Notch Weir

Flow too small for berm w/ pipe

F) Discharge Pipe Size (minimum 8-inches)
Calculated D_P = in

G) Rectangular Notch Width
Calculated W_N = 6.4 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer: JPS
Company: JPS
Date: May 12, 2021
Project: WESTGATE AT POWERS
Location: DETENTION BASIN A6

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 10 sq ft
C) Outlet Type	Choose One: (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 1.00 inches
E) Total Outlet Area	A_{ot} = 11.49 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 55 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 5.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 402 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*S.S. Well Screen with 60% Open Area*
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 670 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 4.16 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 77.92 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer: JPS
Company: JPS
Date: May 12, 2021
Project: WESTGATE AT POWERS
Location: DETENTION BASIN A6

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping: Buried Riprap Spillway

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = 3.00 ft / ft
DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

11. Vegetation

Choose One
- ○ Irrigated
- ◉ Not Irrigated

12. Access

A) Describe Sediment Removal Procedures

Periodic inspection and sediment removal as needed
Access ramp provided to pond bottom

Notes:

APPENDIX D1

SAND CREEK CENTER TRIBUTARY CHANNEL
BOX CULVERT - ZERO-RISE CERTIFICATION

JPS ENGINEERING
19 E. Willamette Avenue
Colorado Springs, CO 80903
(719)-477-9429
www.jpsengr.com

May 15, 2021

Keith Curtis, P.E.
Pikes Peak Regional Floodplain Administrator
2880 International Circle
Colorado Springs, CO 80910

SUBJECT: Zero Rise Certification - Joystone Drive Box Culvert Crossing
Sand Creek Center Tributary Channel (FIRM Panel 08041C0753G)
Westgate at Powers Filing No. 3

Dear Keith,

I certify that I am a duly qualified registered Professional Engineer licensed in the state of Colorado.

I certify that the proposed Joystone Drive Box Culvert project as detailed on the construction drawings entitled "Westgate at Powers Filing No. 3 Storm Sewer Plans" by JPS Engineering, Inc. will result in zero rise in the FEMA designated 100-year flood heights, and no increase in the 100-year discharge and no increase in the 100-year floodplain width, at published and unpublished cross section of the current FEMA floodplain of the Sand Creek Center Tributary Channel as shown on FEMA Map 08041C0753G dated December 7, 2018, revised by Letter of Map Revision Case No. 19-08-0754P dated October 13, 2020. This certification is intended as proof of meeting the requirements set forth in the Pikes Peak Regional Building Code RBC313.20.1.

I offer the following documentation in accordance with standard engineering practice to support my findings:

a) Development of Westgate at Powers Filing No. 3 includes extension of Joystone Drive northwest from its current termination to the north subdivision boundary. The proposed roadway extension requires crossing of the Sand Creek Center Tributary Channel and floodplain.
b) Based on the Preliminary Design profiles in the "Sand Creek DBPS," design flows for the Sand Creek Center Tributary Channel downstream of Troy Hill Road have been established as $Q_{10} = 950$ cfs and $Q_{100} = 1{,}960$ cfs. Design of the proposed three-cell 16'x6' concrete box culvert has ben performed based on the DBPS 100-year flow.

c) The proposed three-cell 16'x6' concrete box culvert matches the design of the existing box culvert crossing Troy Hill Road immediately upstream of the proposed Joystone Drive crossing.
d) According to the FEMA Flood Insurance Study (FIS), 100-year flows at Airport Road have been established as 790 cfs, which has been used as the basis for this floodplain permitting analysis. As noted above, the box culvert has been designed for the much higher flows identified in the Sand Creek DBPS.
e) The attached HEC-RAS hydraulic calculations are provided to demonstrate no significant impact to the FEMA floodplain from the proposed box culvert improvements. The following table summarizes the comparison between calculated 100-year water surface level (WSL) elevations with and without the proposed box culvert:

STA	Channel Location	Channel Inv EL	Calculated 100-yr WSL (no CBC)	Calculated 100-yr WSL (w/ CBC)
26+00	Upstream of CBC	6124.1	6126.1	6126.1
21+50	Downstream of CBC	6121.0	6122.9	6122.9

*HEC-RAS calculations are based on the NAVD88 datum for consistency with the FEMA LOMR

As detailed above, the proposed box culvert will result in "zero-rise" in the 100-year floodplain limits upstream and downstream of the Joystone Drive crossing.

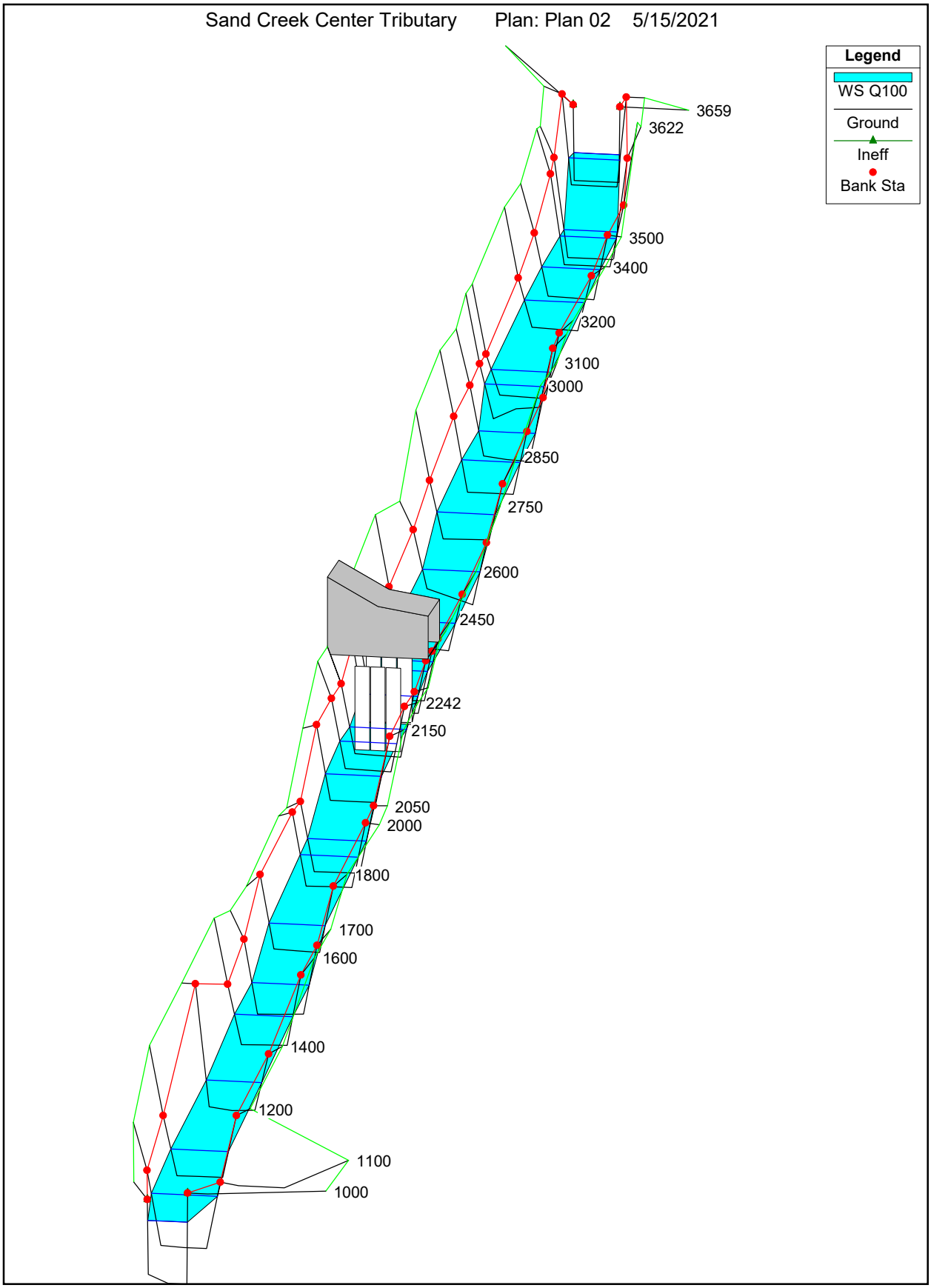
The proposed development limits within the Westgate at Powers project have been established well beyond the FEMA floodplain limits as delineated in the approved FEMA LOMR. In summary, the proposed box culvert crossing the Sand Creek Century Tributary Channel will have no significant impact on the FEMA floodplain.

Please contact me if you have any questions or need any additional information.

Sincerely,
JPS Engineering, Inc.

John P. Schwab, P.E.

cc: Spencer Hymas, Powers & Airport LLC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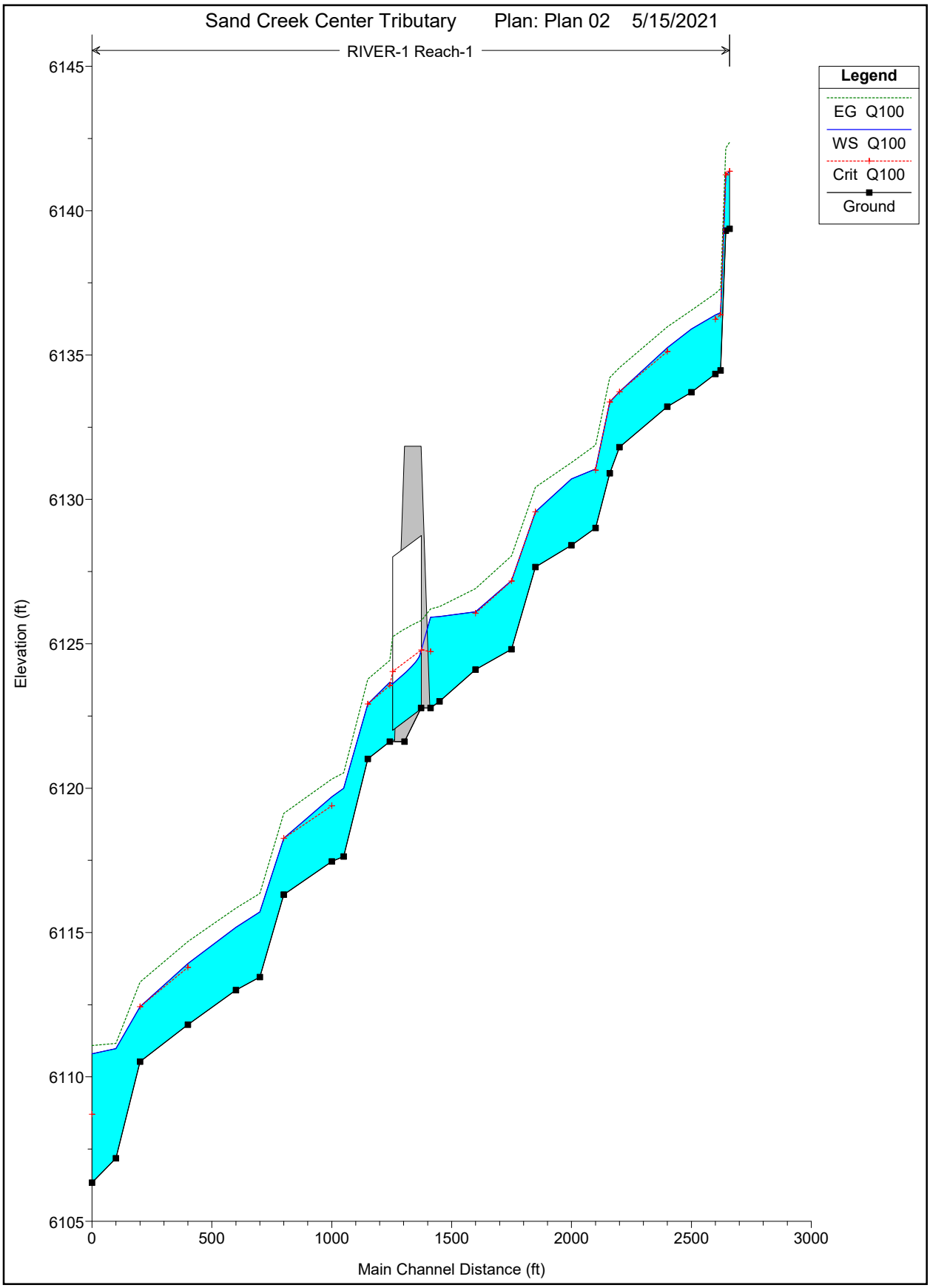
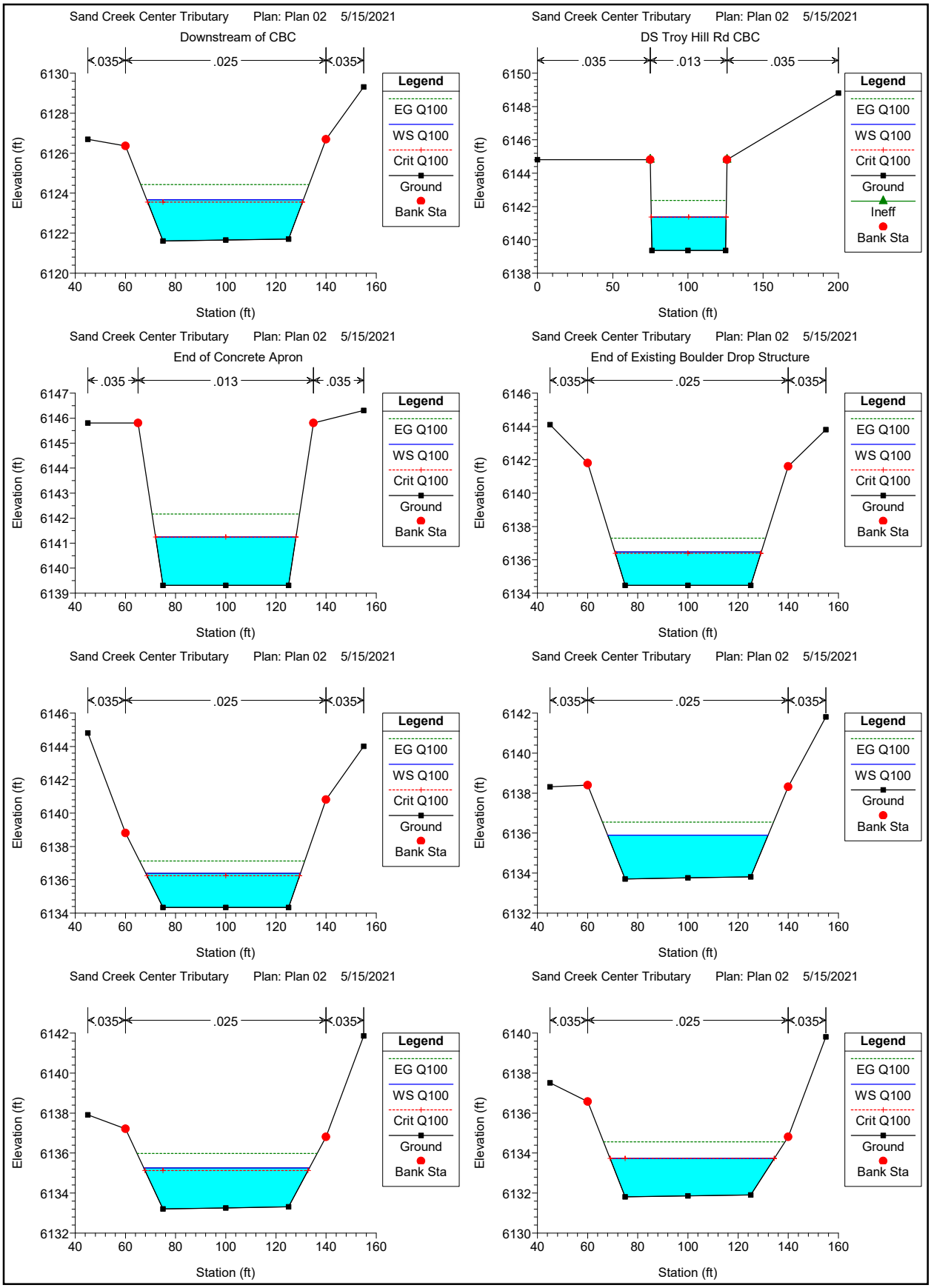
Legend
WS Q100
Ground
Ineff
Bank Sta
3659
3622
3500
3400
3200
3100
3000
2850
2750
2600
2450
2242
2150
2050
2000
1800
1700
1600
1400
1200
1100
1000


Sand Creek Center Tributary Plan: Plan 02 5/15/2021
RIVER-1 Reach-1
Legend
EG Q100
WS Q100
Crit Q100
Ground
Elevation (ft)
6145
6140
6135
6130
6125
6120
6115
6110
6105
0
500
1000
1500
2000
2500
3000
Main Channel Distance (ft)


Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Downstream of CBC
.035 .025 .035
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
DS Troy Hill Rd CBC
.035 .013 .035
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Ineff
Bank Sta
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
End of Concrete Apron
.035 .013 .035
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
End of Existing Boulder Drop Structure
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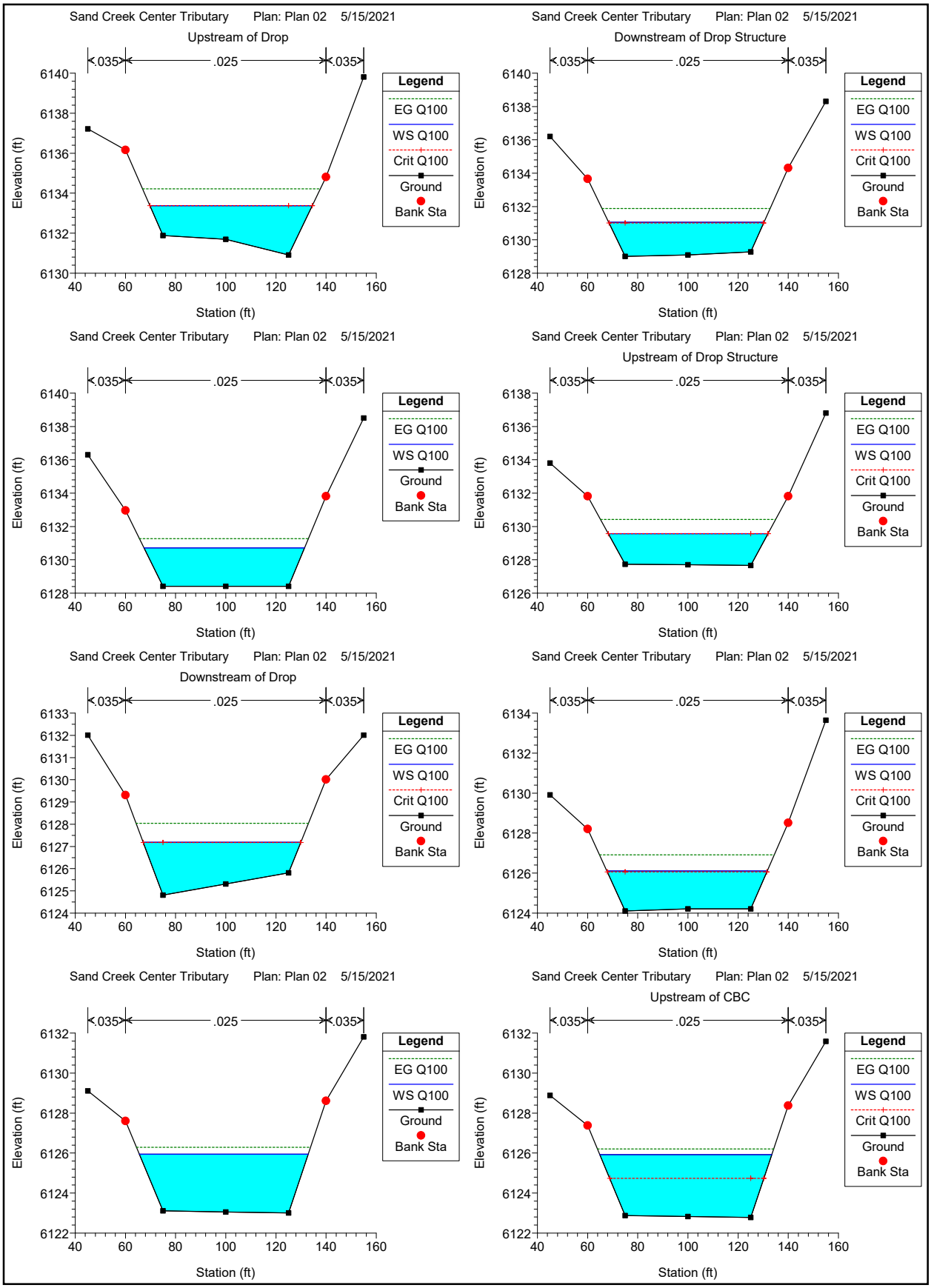
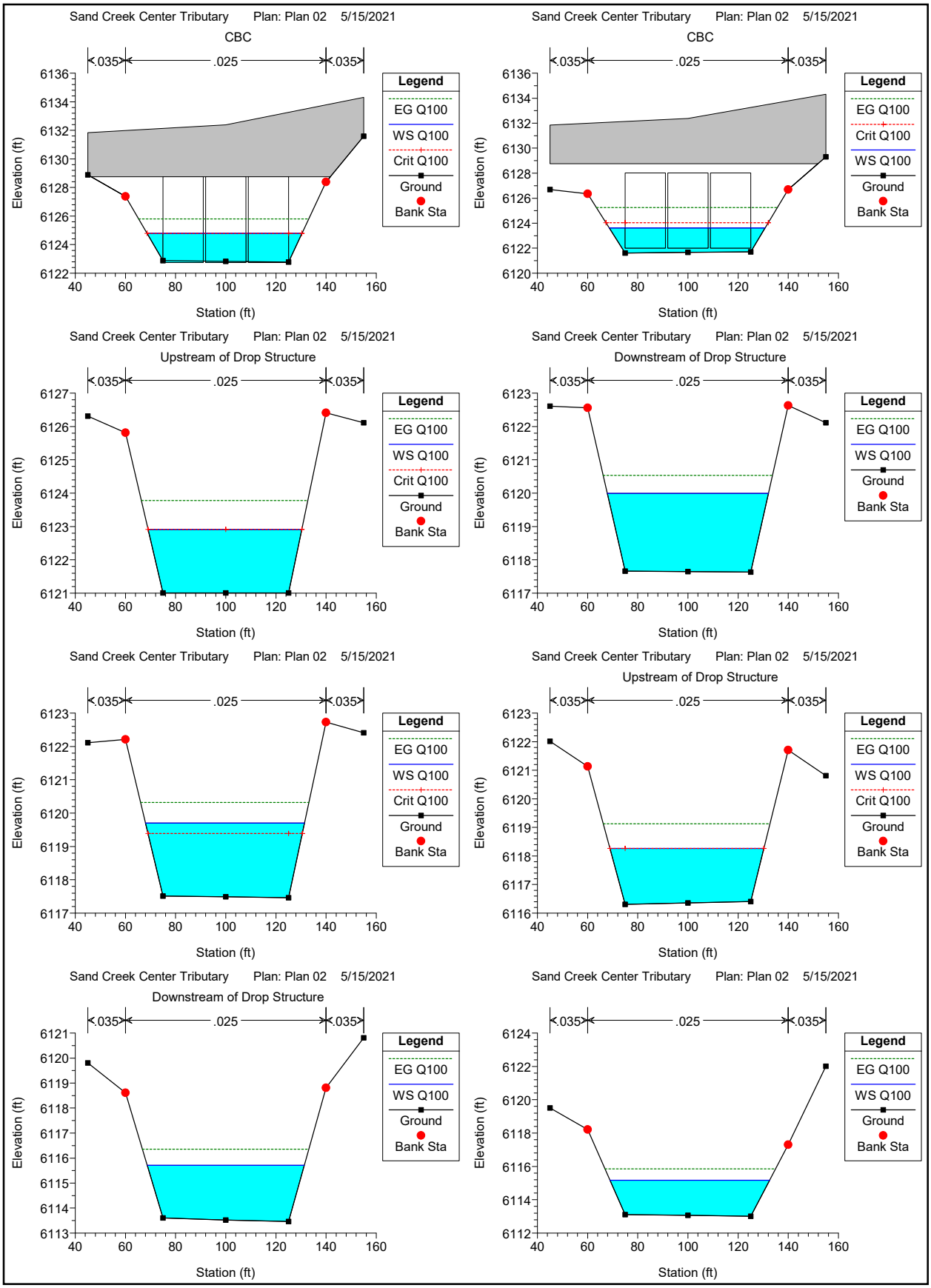
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
.035 .025 .035
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
.035 .025 .035
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Ground
Bank Sta
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
.035 .025 .035
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
.035 .025 .035
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta


Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Upstream of Drop
.035
.025
.035
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Downstream of Drop Structure
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Upstream of Drop Structure
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Downstream of Drop
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Upstream of CBC


Sand Creek Center Tributary Plan: Plan 02 5/15/2021
CBC
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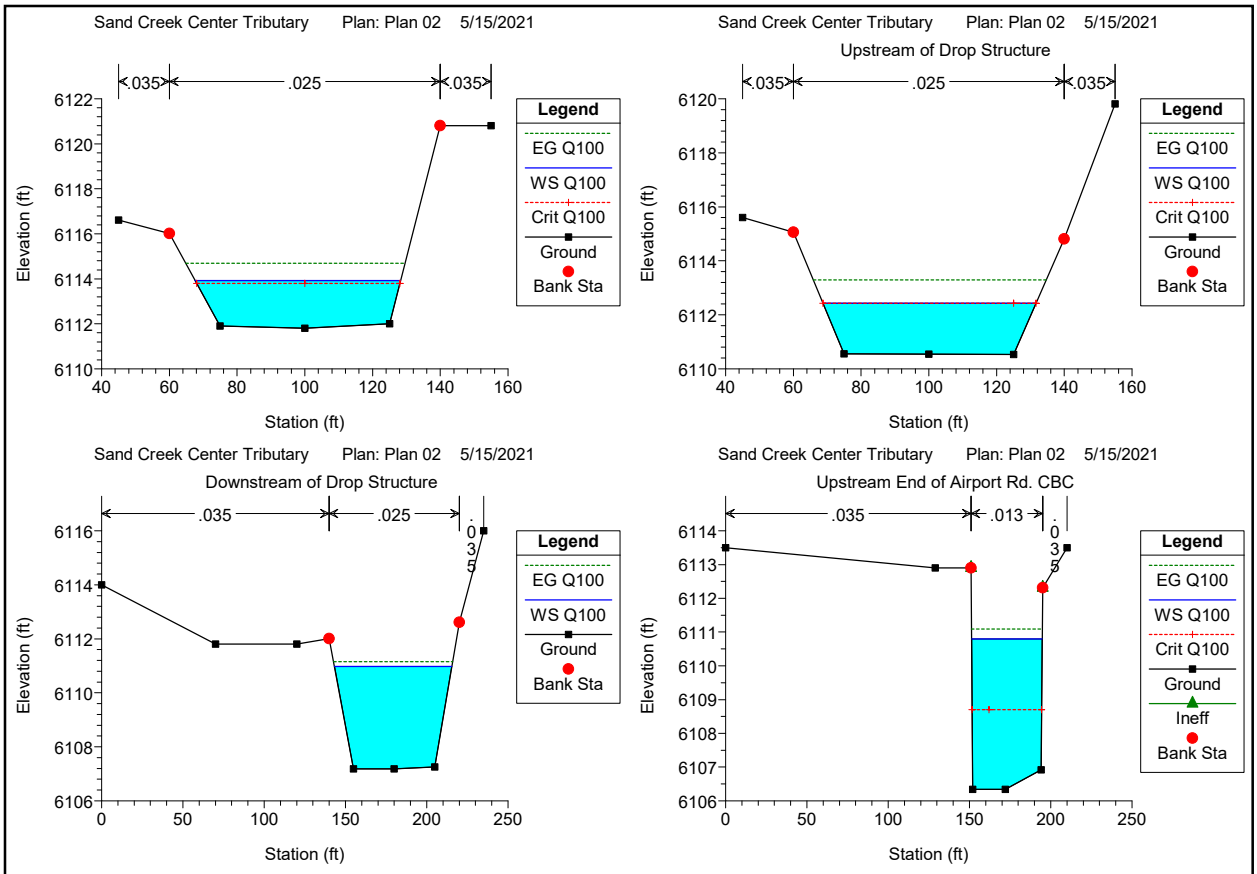
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
CBC
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Upstream of Drop Structure
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Downstream of Drop Structure
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Upstream of Drop Structure
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Downstream of Drop Structure
Sand Creek Center Tributary Plan: Plan 02 5/15/2021


Sand Creek Center Tributary Plan: Plan 02 5/15/2021
.035
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Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Upstream of Drop Structure
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Elevation (ft)
Station (ft)
Legend
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WS Q100
Crit Q100
Ground
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Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Downstream of Drop Structure
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Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Ground
Bank Sta
Sand Creek Center Tributary Plan: Plan 02 5/15/2021
Upstream End of Airport Rd. CBC
.035
.013
.035
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Ineff
Bank Sta

WITH BOX CULVERT

HEC-RAS Plan: Plan 02 River: RIVER-1 Reach: Reach-1 Profile: Q100

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3659	Q100	790.00	6139.37	6141.37	6141.37	6142.37	0.002145	8.01	98.69	49.73	1.00
Reach-1	3644	Q100	790.00	6139.31	6141.24	6141.24	6142.17	0.002089	7.71	102.43	55.95	1.00
Reach-1	3622	Q100	790.00	6134.47	6136.47	6136.39	6137.30	0.006735	7.30	108.29	58.29	0.94
Reach-1	3600	Q100	790.00	6134.34	6136.39	6136.24	6137.13	0.006003	6.90	114.44	61.63	0.89
Reach-1	3500	Q100	790.00	6133.71	6135.90		6136.55	0.005093	6.48	121.95	63.97	0.83
Reach-1	3400	Q100	790.00	6133.21	6135.26	6135.13	6135.98	0.006307	6.83	115.70	66.00	0.91
Reach-1	3200	Q100	790.00	6131.81	6133.73	6133.73	6134.56	0.007883	7.33	107.83	65.45	1.01
Reach-1	3160	Q100	790.00	6130.91	6133.38	6133.38	6134.22	0.007966	7.38	107.07	64.73	1.01
Reach-1	3100	Q100	790.00	6129.01	6131.06	6131.01	6131.88	0.007202	7.28	108.46	61.90	0.97
Reach-1	3000	Q100	790.00	6128.41	6130.71		6131.28	0.004000	6.02	131.21	63.99	0.74
Reach-1	2850	Q100	790.00	6127.66	6129.57	6129.57	6130.43	0.007939	7.42	106.45	63.67	1.01
Reach-1	2750	Q100	790.00	6124.81	6127.19	6127.18	6128.04	0.007673	7.38	107.05	62.89	1.00
Reach-1	2600	Q100	790.00	6124.11	6126.11	6126.06	6126.91	0.007181	7.19	109.92	63.95	0.97
Reach-1	2450	Q100	790.00	6123.01	6125.95		6126.29	0.001837	4.67	169.28	67.32	0.52
Reach-1	2412	Q100	790.00	6122.78	6125.92	6124.73	6126.21	0.001452	4.32	183.01	68.54	0.47
Reach-1	2387		Culvert									
Reach-1	2242	Q100	790.00	6121.61	6123.67	6123.56	6124.43	0.006380	7.00	112.85	62.38	0.92
Reach-1	2150	Q100	790.00	6121.01	6122.91	6122.91	6123.78	0.007710	7.47	105.83	61.23	1.00
Reach-1	2050	Q100	790.00	6117.63	6119.99		6120.53	0.003752	5.90	133.96	64.23	0.72
Reach-1	2000	Q100	790.00	6117.46	6119.70	6119.39	6120.32	0.004559	6.29	125.68	63.39	0.79
Reach-1	1800	Q100	790.00	6116.31	6118.26	6118.26	6119.13	0.007720	7.46	105.84	61.31	1.00
Reach-1	1700	Q100	790.00	6113.46	6115.71		6116.35	0.004811	6.42	123.08	62.63	0.81
Reach-1	1600	Q100	790.00	6113.01	6115.18		6115.85	0.005287	6.56	120.34	63.64	0.84
Reach-1	1400	Q100	790.00	6111.81	6113.92	6113.80	6114.69	0.006247	7.03	112.39	60.62	0.91
Reach-1	1200	Q100	790.00	6110.53	6112.43	6112.43	6113.29	0.007820	7.42	106.45	62.91	1.01
Reach-1	1100	Q100	790.00	6107.18	6110.98		6111.16	0.000723	3.43	230.57	72.21	0.34
Reach-1	1000	Q100	790.00	6106.34	6110.80	6108.71	6111.09	0.000252	4.30	183.85	43.40	0.37

WITHOUT BOX CULVERT

HEC-RAS Plan: Plan 03 River: RIVER-1 Reach: Reach-1 Profile: Q100

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3659	Q100	790.00	6139.37	6141.37	6141.37	6142.37	0.002145	8.01	98.69	49.73	1.00
Reach-1	3644	Q100	790.00	6139.31	6141.24	6141.24	6142.17	0.002089	7.71	102.43	55.95	1.00
Reach-1	3622	Q100	790.00	6134.47	6136.47	6136.39	6137.30	0.006735	7.30	108.29	58.29	0.94
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Reach-1	3160	Q100	790.00	6130.91	6133.38	6133.38	6134.22	0.007966	7.38	107.07	64.73	1.01
Reach-1	3100	Q100	790.00	6129.01	6131.06	6131.01	6131.88	0.007221	7.29	108.37	61.89	0.97
Reach-1	3000	Q100	790.00	6128.41	6130.71		6131.27	0.004020	6.03	130.99	63.96	0.74
Reach-1	2850	Q100	790.00	6127.66	6129.58	6129.58	6130.43	0.007840	7.39	106.89	63.72	1.01
Reach-1	2750	Q100	790.00	6124.81	6127.23	6127.18	6128.04	0.007211	7.23	109.23	63.12	0.97
Reach-1	2600	Q100	790.00	6124.11	6126.06	6126.06	6126.91	0.007808	7.39	106.96	63.62	1.00
Reach-1	2450	Q100	790.00	6123.01	6125.13	6124.96	6125.85	0.005767	6.79	116.38	62.42	0.88
Reach-1	2412	Q100	790.00	6122.78	6124.77	6124.73	6125.60	0.007172	7.28	108.44	61.65	0.97
Reach-1	2242	Q100	790.00	6121.61	6123.67	6123.56	6124.43	0.006380	7.00	112.85	62.38	0.92
Reach-1	2150	Q100	790.00	6121.01	6122.91	6122.91	6123.78	0.007710	7.47	105.83	61.23	1.00
Reach-1	2050	Q100	790.00	6117.63	6119.99		6120.53	0.003752	5.90	133.96	64.23	0.72
Reach-1	2000	Q100	790.00	6117.46	6119.70	6119.39	6120.32	0.004559	6.29	125.68	63.39	0.79
Reach-1	1800	Q100	790.00	6116.31	6118.26	6118.26	6119.13	0.007720	7.46	105.84	61.31	1.00
Reach-1	1700	Q100	790.00	6113.46	6115.71		6116.35	0.004811	6.42	123.08	62.63	0.81
Reach-1	1600	Q100	790.00	6113.01	6115.18		6115.85	0.005287	6.56	120.34	63.64	0.84
Reach-1	1400	Q100	790.00	6111.81	6113.92	6113.80	6114.69	0.006247	7.03	112.39	60.62	0.91
Reach-1	1200	Q100	790.00	6110.53	6112.43	6112.43	6113.29	0.007820	7.42	106.45	62.91	1.01
Reach-1	1100	Q100	790.00	6107.18	6110.98		6111.16	0.000723	3.43	230.57	72.21	0.34
Reach-1	1000	Q100	790.00	6106.34	6110.80	6108.71	6111.09	0.000252	4.30	183.85	43.40	0.37

APPENDIX D2

SAND CREEK CENTER TRIBUTARY CHANNEL
USACE 404 PERMIT

DEPARTMENT OF THE ARMY PERMIT

Permittee: Martin List, Signature Reality Capital Corp.

Permit No.: SPA-2010-00110-SCO

Issuing Office: Albuquerque District, U.S. Army Corps of Engineers

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: To discharge dredged and fill material into waters of the U.S. associated with the construction of the Westgate at Powers Commercial Development, which would involve impacts to approximately 2,370 linear feet of waters of the United States in Sand Creek Center Tributary. The project will be constructed in accordance with the attached drawings.

Project Location: Latitude 38.8272º, Longitude -104.7272º; El Paso County, CO

Permit Conditions: In accordance with attached Public Notice, Project Plans, and Colorado Department of Public Health and Environment Section 401 Water Quality Certification.

General Conditions:

1. The time limit for completing the work authorized ends on December 31, 2023. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to

determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

1. In order to prevent upland erosion into the creek, the permittee and/or their sub-contractors will treat all disturbed areas with erosion control measures within 21 calendar days after final grading in accordance with the erosion control plan required by El Paso County. Such measures will include placement of topsoil, seeding with native grass mixes appropriate for the various impacted habitat conditions, and mulching, to ensure seeds are not washed away before germination.

2. The stabilization efforts, including erosion control measures and revegetaion within the riparian zone, shall be maintained for 5 growing seasons unless the Corps determines that the efforts have been successful and monitoring is no longer necessary. The Corps will determine the efforts to be successful when all of the following conditions are achieved for two consecutive growing seasons: (1) total percent cover of the herbaceous community is at least 70% of the planted or similarly desirable species across all disturbed areas; (2) poles planting survival, if applicable, is at least 50%; and (3) the presence of noxious weeds does not exceed 5% of the total cover across all plant communities in the project area.

3. An annual monitoring report of the stabilization efforts is required and will be sent to the Corps of Engineers by December 31 of each year. The monitoring report will include at a minimum: (1) A drawing or sketch showing photographic monitoring points, (2) before and after photographs from fixed photographic location(s), and (3) a brief discussion of the overall success, any bare or erosional/problem areas, including noxious weeds, and (4) a plan to remedy any problem areas.

4. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

5. Any changes to the project must be approved by the Corps of Engineers through a permit modification prior to implementation of the changes.

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

☐ Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

☑ Section 404 of the Clean Water Act (33 U.S.C. 1344).

☐ Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

Signatures:

_____ _____
(PERMITTEE) (DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

_____ _____
(FOR THE DISTRICT ENGINEER) (DATE)

Larry D. Caswell, Jr.
Lieutenant Colonel, U.S. Army
District Commander

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

_____ _____
(TRANSFERREE) (DATE)

US Army Corps of Engineers
BUILDING STRONG®

SPA-2010-00110-SCO

Posted 4/17/2018

ATTACHMENTS

SPA-2010-00110-SCO Plans

SUBJECT: The U.S. Army Corps of Engineers, Albuquerque District, (Corps) is evaluating a permit application by the Signature Realty Capitol Corporation to construct the Westgate at Powers Commercial Development, which would involve impacts to approximately 2,370 linear feet of waters of the United States in Sand Creek Center Tributary. This project was previously authorized on June 1, 2010 but was not constructed prior to permit expiration on June 1, 2015. There have been no changes in the project design features. This notice is to inform interested parties of the proposed activity and to solicit comments.

AUTHORITY: This application is being evaluated under Section 404 of the Clean Water Act for the discharge of dredged or fill material in waters of the United States.

APPLICANT: Mr. Martin List, Signature Reality Capital Corp., 2082 Michelson Drive, Suite 212, Irvine, California 92612.

LOCATION: The project site is located on Sand Creek Center Tributary near the intersection of Troy Hill and Airport Roads, Section 13, Township 14 S, Range 66 W, Latitude 38.8272°, Longitude -104.7272°, Colorado Springs, El Paso County, Colorado.

PROJECT DESCRIPTION: The proposed project would involve realignment and stabilization of 2,370 approximately feet of stream channel with buried riprap bank linings and a 50-foot wide natural sand bottom. The banks of the channel would be 3:1 slope with a channel depth of 5 feet. A fifteen foot wide trail and maintenance access road would be constructed along the east side of the channel. Five vertical drops with concrete cutoff walls and riprap plunge pools are proposed to stabilize the channel. In addition, a box culvert road crossing for Westgate Road is proposed. Based on the available information, the overall project purpose is to construct an improved drainage channel to accommodate the adjacent commercial development. The applicant believes there is a need to meet the both the development goals of the Westgate at Powers project and regional drainage planning requirements. The attached drawings provide additional project details.

PROPOSED MITIGATION: No compensatory mitigation would be required for this project since there would be no impacts to wetlands.

OTHER AUTHORIZATIONS:

State Water Quality Certification. The applicant is required to obtain water quality certification, under Section 401 of the Clean Water Act, from the Colorado Department of Public Health and Environment. Section 401 requires that any applicant for an individual Section 404 permit provide proof of water quality certification to the Corps prior to permit issuance.

ADDITIONAL INFORMATION:

Environmental Setting. There are approximately 2,370 linear feet of ephemeral stream channel within the project area. The site is characterized by a wide sandy bottom stream channel with low banks and a few trees.

Alternatives. The applicant has provided information concerning project alternatives. Alternatives proposed by the applicant included two additional channel alignments. The first alternative would involve the same channel cross section as the preferred alternative but would not involve channel realignment. The second alternative reviewed would have the same channel cross section but would involve realignment of the channel to follow the west property boundary and would not have any meanders. Other alternatives may develop during the review process for this permit application. Additional information concerning project alternatives may be available from the applicant or their agent. All reasonable project alternatives, in particular those which may be less damaging to the aquatic environment, will be considered.

EVALUATION FACTORS: The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the described activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit, which reasonably may be expected to accrue from the described activity, must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the described activity will be considered, including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, consideration of property ownership and, in general, the needs and welfare of the people. The activity's impact on the public interest will include application of the Section 404(b)(1) guidelines promulgated by the Administrator, Environmental Protection Agency (40 CFR Part 230).

The Corps is soliciting comments from the public, Federal, State, and local agencies and officials, Indian tribes, and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received will be considered by the Corps to determine whether to issue, modify, condition, or deny a permit for this proposal. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and other public interest factors listed above. Comments are used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to

the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

HISTORIC PROPERTIES: The Corps consulted district files and records, the latest version of the National Register of Historic Places (NRHP), and state records of NRHP-eligible and potentially eligible historic properties to determine if there are any historic properties that may be affected by the proposed undertaking. The project area has not been recently surveyed for historic properties. Based on this initial information, the Corps has made a preliminary determination that the proposed project will not likely affect any historic properties that meet the criteria for inclusion in the NRHP.

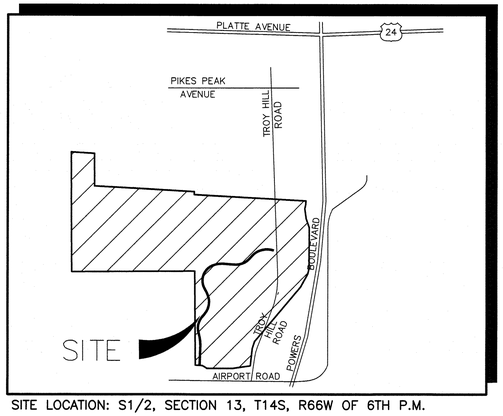
ENDANGERED SPECIES: The Corps has reviewed the U.S. Fish and Wildlife Service's latest published version of Federally-listed endangered and threatened species located in El Paso County, Colorado to determine if any listed species or their critical habitat may occur in the proposed project area. The Corps has made a preliminary determination that the proposed project will not affect any Federally-listed endangered or threatened species or their critical habitat that are protected by the Endangered Species Act.

FLOODPLAIN MANAGEMENT: The Corps is sending a copy of this public notice to the local floodplain administrator. In accordance with 44 CFR part 60 (Flood Plain Management Regulations Criteria for Land Management and Use), the floodplain administrators of participating communities are required to review all proposed development to determine if a floodplain development permit is required and maintain records of such review.

CLOSE OF COMMENT PERIOD: All comments pertaining to this Public Notice must reach this office on or before May 8, 2018, which is the close of the comment period. Extensions of the comment period may be granted for valid reasons provided a written request is received by the limiting date. If no comments are received by that date, it will be considered that there are no objections. Anyone may request, in writing, that a public hearing be held to consider this application. Requests shall specifically state, with particularity, the reason(s) for holding a public hearing. If the Corps determines that the information received in response to this notice is inadequate for thorough evaluation, a public hearing may be warranted. If a public hearing is warranted, interested parties will be notified of the time, date, and location. Comments and requests for additional information should be submitted to:

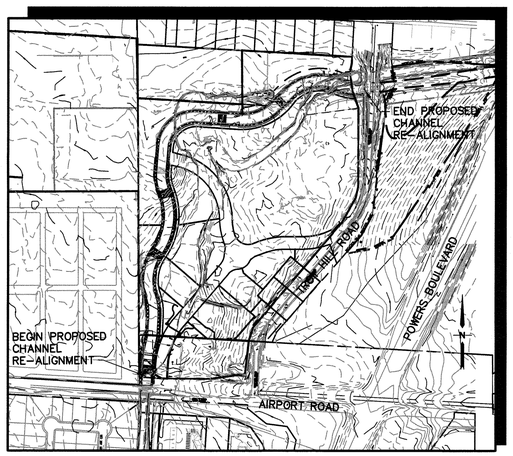
U.S. Army Corps of Engineers, Albuquerque District
ATTN: Joshua G. Carpenter
200 South Santa Fe Avenue, Suite 301
Pueblo, Colorado 81003-4270
719-543-6914
E-mail: joshua.g.carpenter@usace.army.mil

Please note that names and addresses of those who submit comments in response to this public notice may be made publicly available through the Freedom of Information Act.



SITE LOCATION: S1/2, SECTION 13, T14S, R66W OF 6TH P.M.

VICINITY MAP
NTS



SITE MAP
SCALE: 1"=400'

SHEET INDEX

BENCHMARK:
CONCRETE NAIL IN CENTER OF MEDIAN IN CENTER OF AIRPORT ROAD ON BRIDGE OVER SAND CREEK.
ELEVATION= 6109.59 (NGVD 29)

WESTGATE AT POWERS
Sand Creek Center Tributary Channel Improvements
Colorado Springs, Colorado

PREPARED FOR:

Powers and Airport, LLC
9891 Irvine Center Drive, Suite 200
Irvine, CA 92618

PREPARED BY:

JPS ENGINEERING

19 East Willamette Avenue
Colorado Springs, Colorado 80903
www.jpsengr.com
March, 2018

AGENCIES/CONTACTS

DEVELOPER:	POWERS AND AIRPORT, LLC 9891 IRVINE CENTER DRIVE, SUITE 200 IRVINE, CA 92618 MR. AL COHEN (949) 398-8209
CIVIL ENGINEER:	JPS ENGINEERING, INC. 19 E. WILLAMETTE AVE. COLORADO SPRINGS, CO 80903 MR. JOHN P. SCHWAB, P.E. (719) 477-9429
CITY PLANNING:	CITY OF COLORADO SPRINGS 30 S. NEVADA AVENUE COLORADO SPRINGS, CO 80903 MR. MIKE SCHULTZ (719) 385-5089
ENGINEERING DIVISION:	CITY OF COLORADO SPRINGS 30 S. NEVADA AVENUE COLORADO SPRINGS, CO 80903 MR. JONATHAN SCHERER (719) 385-5546
WATER RESOURCES:	COLORADO SPRINGS UTILITIES 111 S. CASCADE COLORADO SPRINGS, CO 80903 MR. MATT WILLIAMS (719) 668-7211
GAS/ELECTRICAL:	COLORADO SPRINGS UTILITIES 101 S. CONEJOS STREET COLORADO SPRINGS, CO 80903 MS. GINNY HALVORSON (719) 668-5567
TELEPHONE COMPANY:	QWEST COMMUNICATIONS (LOCATORS) (800) 922-1987 A.T. & T. (LOCATORS) (719) 625-3674

APPROVALS

DETAILED IMPROVEMENT PLANS AND SPECIFICATIONS ENGINEER'S STATEMENT:

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE CITY FOR DETAILED DRAINAGE PLANS AND SPECIFICATIONS, AND SAID DETAILED PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH THE MASTER PLAN OF THE DRAINAGE BASIN. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITY IS DESIGNED. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS, OR OMISSIONS ON MY PART IN PREPARING THESE DETAILED DRAINAGE PLANS AND SPECIFICATIONS.

COLORADO REGISTERED JOHN P. SCHWAB 29091 PROFESSIONAL ENGINEER

JOHN P. SCHWAB, COLORADO P.E. #29091 — 3/28/18
FOR AND ON BEHALF OF JPS ENGINEERING — DATE

Jonathan B. Scherer — 04/04/2018
CITY ENGINEERING REVIEW — DATE

J:\jpsprojects\020501.airport MP\dwg\Civil\channel dwgs 2017\G1.dwg Mar 28, 2018 - 10:34am

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

CALL UTILITY NOTIFICATION CENTER OF COLORADO 1-800-922-1987
CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

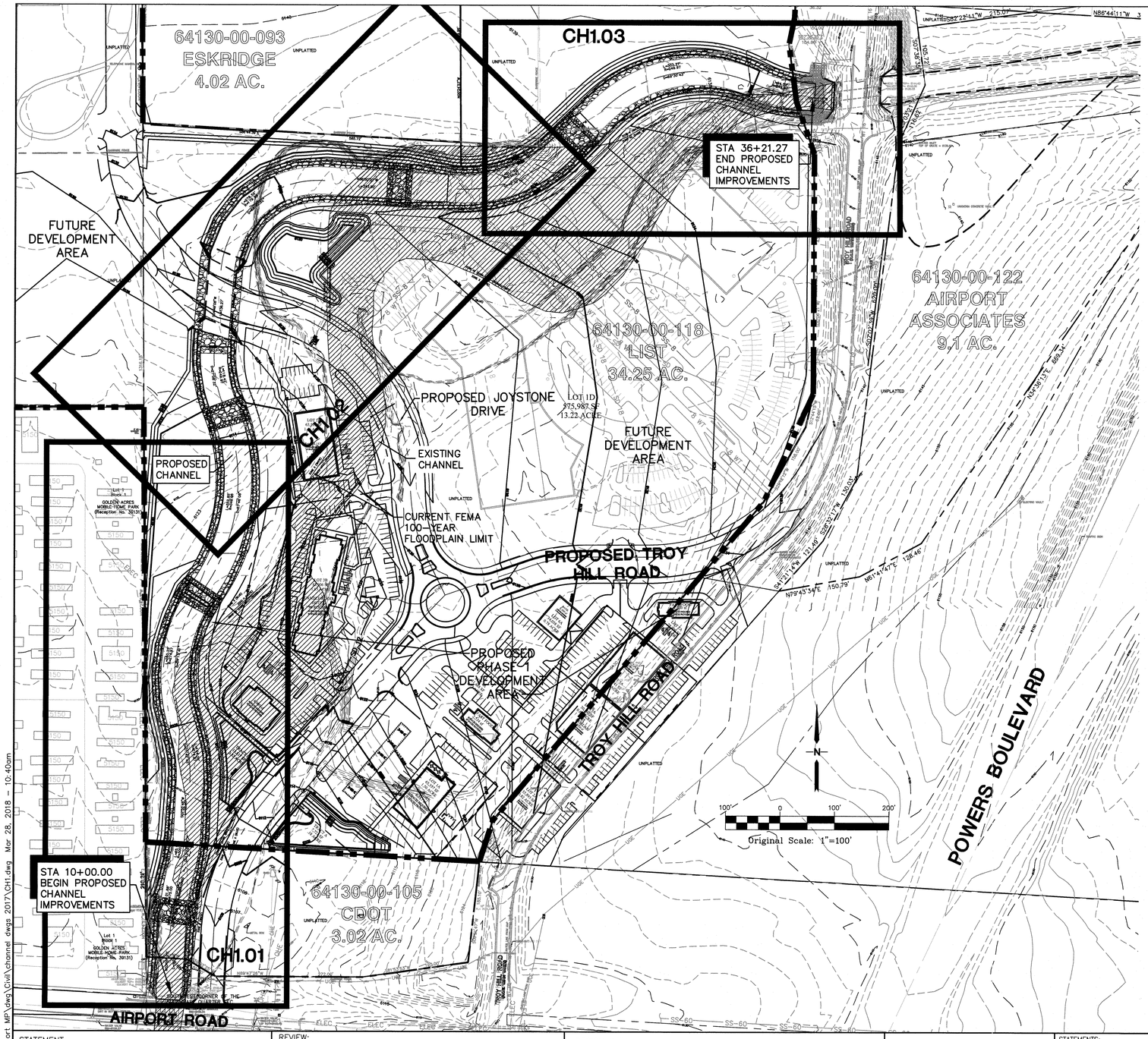
No.	REVISION	BY	DATE
1	CITY SUBMITTAL	JPS	2/20/18
2	CITY COMMENTS	JPS	3/09/18
3	CITY COMMENTS	JPS	3/28/18

WESTGATE AT POWERS
SAND CREEK CENTER TRIBUTARY CHANNEL IMPROVEMENTS

COVER SHEET

HORZ. SCALE:	N/A	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LDC	CHECKED:	JPS
CREATED:	10/16/08	LAST MODIFIED:	3/28/18
PROJECT NO:	020501	MODIFIED BY:	BJJ

SHEET: G1



LEGEND:

- NEW/EXISTING
- SECTION LINE
- EASEMENT LINE
- 6230 — 6230 — CONTOUR
- PROPERTY LINE
- FENCE
- OHE — OHE — OVERHEAD ELECTRIC LINE W/ POWER POLE
- UGE — UGE — UNDERGROUND ELECTRIC LINE
- SANITARY SEWER LINE
- UGE — UGE — UNDERGROUND ELECTRIC
- TEL — TEL — TELEPHONE – NEW/EXISTING
- GAS — GAS — GAS – NEW/EXISTING
- WT — WT — WATER – NEW/EXISTING
- PROPOSED RIPRAP BANK LINING
- PROPOSED GRAVEL TRAIL
- FEMA 100-YEAR FLOODPLAIN LIMITS
- STREAMSIDE OVERLAY ZONE BOUNDARY
- GRASS BUFFER STRIP

1 / P1 — 1 = SECTION NUMBER; P1 = SHEET ON WHICH SECTION IS SHOWN

COLORADO REGISTERED JOHN P. SCHWAB 29891 PROFESSIONAL ENGINEER

GENERAL NOTES:

1. ALL CONSTRUCTION SHALL MEET THE STANDARDS & SPECIFICATIONS OF THE CITY OF COLORADO SPRINGS ENGINEERING DIVISION AND COLORADO SPRINGS UTILITIES.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE NOTIFICATION AND FIELD LOCATION OF ALL EXISTING UTILITIES, WHETHER SHOWN ON THE PLANS OR NOT, BEFORE BEGINNING CONSTRUCTION. LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO ACTUAL CONSTRUCTION.

3. THE CONTRACTOR SHALL HAVE ONE (1) SIGNED COPY OF THESE APPROVED PLANS AND ONE (1) COPY OF THE APPROPRIATE DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS AT THE JOB SITE AT ALL TIMES:
   A. COLORADO SPRINGS ENGINEERING DIVISION STANDARD SPECIFICATIONS.

4. STORM DRAIN PIPE SHALL BE RCP CLASS III WITH CLASS C BEDDING UNLESS OTHERWISE NOTED.

5. STATIONING IS AT CENTERLINE UNLESS OTHERWISE NOTED. ALL ELEVATIONS ARE AT FLOWLINE UNLESS OTHERWISE NOTED. ALL DIMENSIONS ARE FROM FACE OF CURB UNLESS OTHERWISE NOTED. LENGTHS SHOWN FOR STORM SEWER PIPES ARE TO CENTER OF MANHOLE.

6. CONTRACTOR SHALL COORDINATE WITH GAS, ELECTRIC, TELEPHONE AND CABLE T.V. UTILITY SUPPLIERS FOR INSTALLATION OF ALL UTILITIES. MINIMUM COVER FOR ALL NON-CITY UTILITIES SHALL BE 36".

7. CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL EXISTING STRUCTURES, DEBRIS, WASTE AND OTHER UNSUITABLE FILL MATERIAL FOUND WITHIN THE LIMITS OF EXCAVATION.

8. MATCH INTO EXISTING GRADES AT 3:1 MAX CUT AND FILL SLOPES.

9. REVEGETATION OF ALL DISTURBED AREAS SHALL BE DONE WITH 4" TOPSOIL AND DRY LAND GRASS SEED AFTER FINE GRADING IS COMPLETE. ("FOOTHILLS SEED MIX").

10. EROSION CONTROL SHALL CONSIST OF SILT FENCE AND HAY BALES AS SHOWN ON THE DRAWING, AND TOPSOIL WITH GRASS SEED, WHICH WILL BE WATERED UNTIL VEGETATION HAS BEEN REESTABLISHED.

11. THE EROSION CONTROL MEASURES OUTLINED ON THIS PLAN ARE THE RESPONSIBILITY OF THE DEVELOPER TO MONITOR AND REPLACE, REGRADE, AND REBUILD AS NECESSARY UNTIL VEGETATION IS REESTABLISHED.

12. CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES IN A MANNER THAT WILL PROTECT ADJACENT PROPERTIES AND PUBLIC FACILITIES FROM THE ADVERSE EFFECTS OF EROSION AND SEDIMENTATION AS A RESULT OF CONSTRUCTION AND EARTHWORK ACTIVITIES WITHIN THE PROJECT SITE.

13. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS DETERMINED BY SITE CONDITIONS.

14. THE CONTRACTOR WILL TAKE THE NECESSARY PRECAUTIONS TO PROTECT EXISTING UTILITIES FROM DAMAGE DUE TO THIS OPERATION. ANY DAMAGE TO THE UTILITIES WILL BE REPAIRED AT THE CONTRACTOR'S EXPENSE, AND ANY SERVICE DISRUPTION WILL BE SETTLED BY THE CONTRACTOR.

15. ALL BACKFILL, SUB-BASE, AND/OR BASE COURSE MATERIAL SHALL BE COMPACTED PER THE CITY OF COLORADO SPRINGS ENGINEERING DIVISION STANDARD SPECIFICATIONS, SECTION 205 (92% MAX. MODIFIED PROCTOR DENSITY).

16. ALL FINISHED GRADES SHALL HAVE A MINIMUM 0.5% SLOPE TO PROVIDE POSITIVE DRAINAGE.

17. CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS PRIOR TO BEGINNING WORK.

STATEMENT:

PLAN REVIEW BY CITY IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH DESIGN CRITERIA. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE CITY, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

RESUBMITTAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 180 DAYS AFTER REVIEW DATE.

REVIEW:

STREET DESIGN:
CURB & GUTTER REVIEW _____ DATE: _____
FINAL REVIEW _____ DATE: _____

DRAINAGE DESIGN:
CITY REVIEW: Jonathan B. Schwab DATE: 04/04/2018
DRAINAGE BASIN SAND CREEK

THIS IS FILED IN ACCORDANCE WITH SECTION 7.7.906 (DRAINAGE ORDINANCE) OF THE CODE OF THE CITY OF COLORADO SPRINGS, 2001, AS AMENDED

DESIGN DATA:

SIDEWALKS: WIDTH NA
LOCATION: ATTACHED ☐
DETACHED, 6" FROM P/L ☐

CURB TYPE 1 ☐ 2 ☐ 3 ☐
R/W WIDTH _____ F/C-F/C _____
STREET TYPE _____
HVEEM

ASPHALT THICKNESS:
AC SURFACE _____
AC BASE _____

AGGREGATE BASE THICKNESS:
CLASS 6 _____
CLASS 5 _____
CLASS 2

BENCHMARK:
CONCRETE NAIL IN CENTER OF MEDIAN IN CENTER OF AIRPORT ROAD ON BRIDGE OVER SAND CREEK.
ELEVATION= 6109.59 (NGVD 29)

STATEMENTS:

A. SEWER – ANY CHANGES OR ALTERATIONS EFFECTING THE GRADE, ALIGNMENT, ELEVATION, AND DEPTH OF COVER OF SEWERS AND RESPONSIBILITY OF THE OWNER/DEVELOPER. THE OWNER/DEVELOPER SHALL BE RESPONSIBLE FOR ALL OPERATIONAL DAMAGES AND DEFECTS IN INSTALLATION AND MATERIAL FOR MAINS AND SERVICES FROM THE DATE OF APPROVAL UNTIL FINAL ACCEPTANCE IS ISSUED.

B. WATER – THIS APPROVAL SUBJECT TO THE FINAL STREET GRADE LEAVING A MINIMUM COVER OF 5' (FIVE FEET) OVER THE WATER MAIN. ANY CHANGES SHALL BE AT THE EXPENSE OF THE OWNER OR DEVELOPER.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JPS ENGINEERING.

JOHN P. SCHWAB, CO. PE. #29891 DATE

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO
80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL TWO BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

No.	REVISION	BY	DATE
1	SUBMITTAL TO CITY ENGINEER	JPS	11/13/09
2	CITY ENGINEERING COMMENTS	JPS	1/22/10
3	EXTEND CHANNEL TO S. AIRPORT	JPS	11/25/15
4	CITY SUBMITTAL	JPS	2/20/18

WESTGATE AT POWERS
SAND CREEK CENTER TRIBUTARY CHANNEL

CHANNEL IMPROVEMENT PLAN & GENERAL NOTES

HORZ. SCALE:	1"=100'
VERT. SCALE:	N/A
SURVEYED:	LDC
CREATED:	12/05/08
PROJECT NO:	020501
DRAWN:	BJJ
DESIGNED:	JPS
CHECKED:	JPS
LAST MODIFIED:	3/28/18
MODIFIED BY:	BJJ

SHEET: CH1

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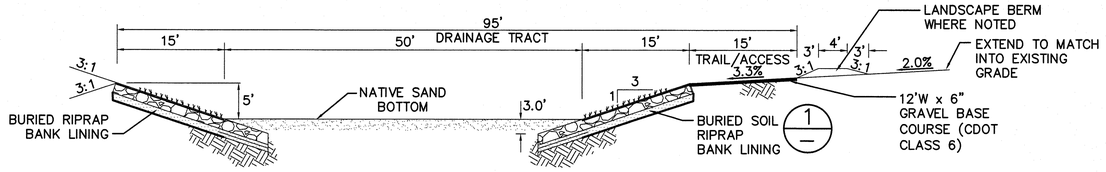
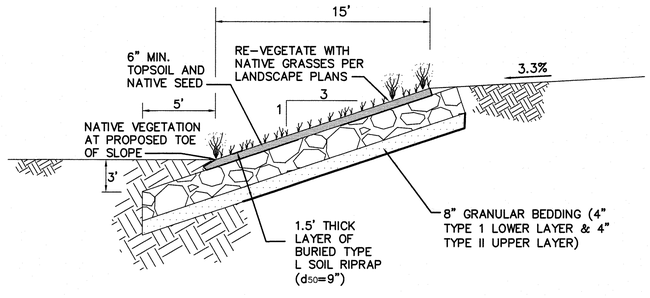


TYPICAL CHANNEL SECTION (A)
SCALE : 1"=10'



TYPICAL BURIED RIPRAP BANK STABILIZATION SECTION (1)
SCALE : 1"=5'

GENERAL CHANNEL CONSTRUCTION NOTES:

1. CONTRACTOR SHALL MAINTAIN FLOW CONVEYANCE IN CHANNEL THROUGHOUT CONSTRUCTION PERIOD.

2. RIPRAP SHALL CONSIST OF HARD, DENSE, DURABLE STONE, ANGULAR IN SHAPE AND RESISTANT TO WEATHERING. ROUNDED STONE OR BOULDERS WILL NOT BE ACCEPTED AS RIPRAP MATERIAL. THE STONE SHALL HAVE A SPECIFIC GRAVITY OF AT LEAST 2.5. EACH PIECE SHALL HAVE ITS GREATEST DIMENSION NOT GREATER THAN THREE TIMES ITS LEAST DIMENSION. FOLLOW SECTION 624 IN THE COLORADO SPRINGS ENGINEERING DIVISION STANDARD SPECIFICATIONS.

3. STONES WITH TYPICAL STONE DIMENSIONS THAT ARE EQUAL TO D50 AND LARGER SHALL BE PLACED AT THE TOP SURFACE WITH FACES AND SHAPES MATCHED TO MINIMIZE VOIDS AND FORM AS SMOOTH A SURFACE AS PRACTICAL. DUMPING AND BACKHOE PLACEMENT ALONE IS NOT SUFFICIENT TO ENSURE A PROPERLY INTERLOCKED SYSTEM. THE MATERIAL MAY BE MACHINE-PLACED AND THEN ARRANGED AS NECESSARY BY USE OF GRADE-ALL WITH MULTI-PRONG GRAPPLE DEVICE OR BY HAND TO INTERLOCK AND FORM A SUBSTANTIAL BOND.

4. TYPE 2 GRANULAR BEDDING SHALL CONFORM TO THE FOLLOWING GRADATION:
(SLIGHTLY COARSER THAN CDOT'S CLASS A FILTER MATERIAL)

SIEVE	% PASSING
3"	90-100
3/4"	20-90
#4	0-20
#200	0-3

5. RIPRAP SHALL CONFORM TO THE FOLLOWING GRADATION:

	STONE SIZE d_{50} (inches)	% OF MATERIAL SMALLER THAN TYPICAL STONE	TYPICAL STONE DIMENSIONS (inches)
RIPRAP TYPE H	18	100 50-70 35-50 2-10	30 24 18 6
RIPRAP TYPE M	12	70-100 50-70 35-50 2-10	21 18 12 4

6. RIPRAP GRADATION SHALL CONFORM TO THE FOLLOWING LIMITS:

$\frac{D_{max}}{D_{50}} = 1.25$

$\frac{D_{max}}{D_{50}} = 2\text{-}3$

7. CONTRACTOR SHALL SUBMIT RIPRAP GRADATION TO ENGINEER FOR APPROVAL PRIOR TO DELIVERY.

8. GROUTED RIPRAP SHALL CONFORM TO SECTION 624.02 IN THE COLORADO SPRINGS ENGINEERING DIVISION STANDARD SPECIFICATIONS.

9. UTILITY INFORMATION AS SHOWN ON THE PLAN SHEETS IS PLOTTED FROM BEST AVAILABLE INFORMATION. THE CONTRACTOR SHALL CALL 1-800-922-1987 FOR UTILITY LOCATIONS AT LEAST THREE (3) WORKING DAYS PRIOR TO ANY DIGGING, NOT INCLUDING THE DAY OF ACTUAL CONTACT.

10. EROSION CONTROL MEASURES FOR THE PROJECT ARE REQUIRED. THE CONTRACTOR SHALL IMMEDIATELY RE-SEED AND MULCH ALL DISTURBED AREAS ALONG THE CHANNEL EMBANKMENT ONCE FINAL GRADES ARE REACHED AND/OR AS DIRECTED BY THE ENGINEER.

11. ALL CONSTRUCTION AND MATERIALS SHALL BE IN CONFORMANCE WITH THE COLORADO SPRINGS ENGINEERING DIVISION STANDARD SPECIFICATIONS, SEE SECTION 620, DRAINAGE CHANNELS.

12. ANY EXCAVATION SHALL BE DEWATERED TO THE EXTENT REQUIRED FOR CONSTRUCTION OPERATIONS TO PROCEED UNDER DRY CONDITION PER SECTION 621.04 IN THE COLORADO SPRINGS ENGINEERING DIVISION STANDARD SPECIFICATIONS MANUAL.

13. WITHIN THE LIMITS OF DISTURBANCE, THE CONTRACTOR SHALL CLEAR AND GRUB THE SITE, AS REQUIRED TO INSTALL THE PROPOSED CHANNEL IMPROVEMENTS. ALL SURFACE OBJECTS, TREES, STUMPS, ROOTS, AND OTHER PROTRUDING OBSTRUCTIONS SHALL BE CLEARED AND GRUBBED BY THE CONTRACTOR, INCLUDING MOWING, AS REQUIRED. ALL HOLES RESULTING FROM THE REMOVAL OF OBSTRUCTIONS SHALL BE BACKFILLED WITH SUITABLE MATERIAL AND COMPACTED IN ACCORDANCE WITH CITY STANDARDS. ALL DEBRIS SHALL BE DISPOSED OF OFF SITE BY THE CONTRACTOR.

COLORADO REGISTERED JOHN P. SCHMID 29391 PROFESSIONAL ENGINEER

WESTGATE AT POWERS
SAND CREEK CENTER TRIBUTARY CHANNEL

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Colorado Springs, CO
80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

No.	REVISION	BY	DATE
1	SUBMITTAL TO CITY ENGINEER	JPS	11/13/09
2	CITY ENGINEERING COMMENTS	JPS	1/22/10
3	EXTEND CHANNEL TO AIRPORT	JPS	11/25/15
4	CITY SUBMITTAL	JPS	2/20/18
5	CITY COMMENTS	JPS	3/09/18

TYPICAL CHANNEL SECTIONS & DETAILS

HORZ. SCALE:	AS SHOWN	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LDC	CHECKED:	JPS
CREATED:	9/01/09	LAST MODIFIED:	3/09/18
PROJECT NO:	020501	MODIFIED BY:	BJJ

SHEET: TY1

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APR 04 2018

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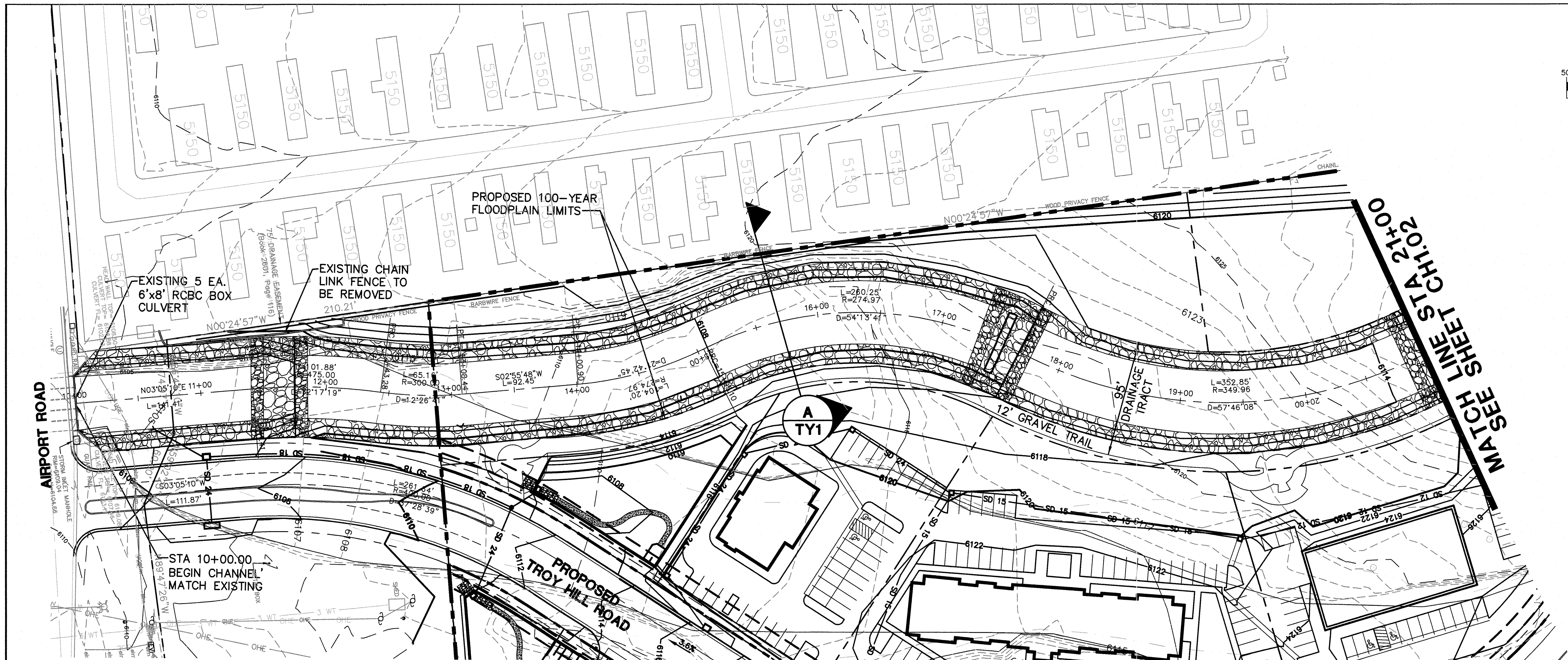


50' 0 50' 100'

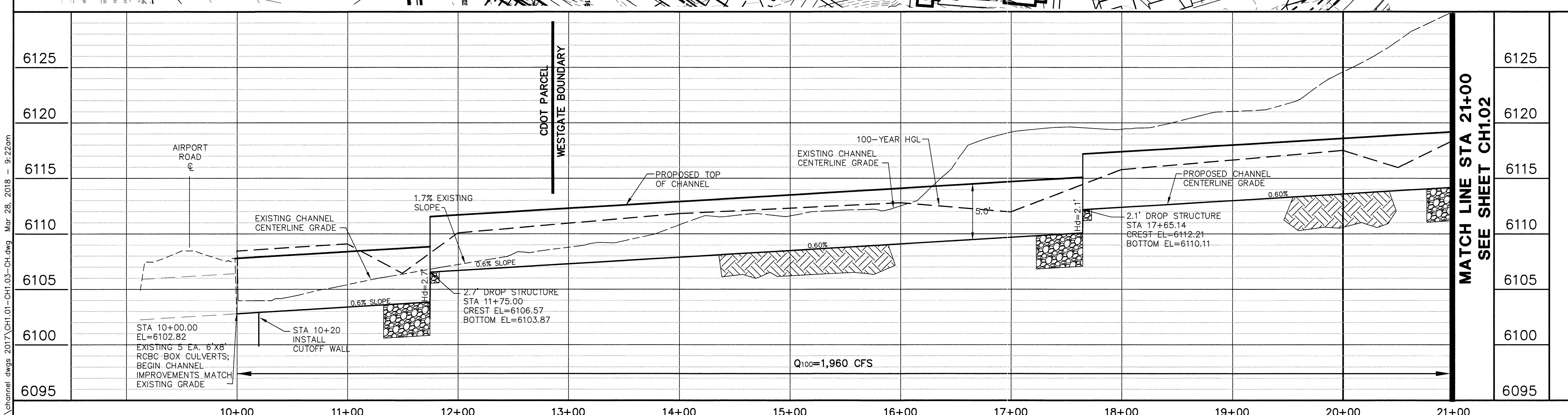
Original Scale: 1"=50'
Contour Interval=1'

CHANNEL IMPROVEMENT NOTES:

1. CONTRACTOR SHALL FIELD VERIFY LIMITS AND GRADES FOR ALL CHANNEL IMPROVEMENTS WITH ENGINEER AFTER STAKING AND PRIOR TO BEGINNING WORK.

2. CONTRACTOR SHALL MINIMIZE DISTURBANCE BEYOND VICINITY OF CHANNEL IMPROVEMENT AREAS.

COLORADO REGISTERED PROFESSIONAL ENGINEER JOHN P. SCHWAB 29891



WESTGATE AT POWERS
SAND CREEK CENTER TRIBUTARY CHANNEL
CHANNEL PLAN & PROFILE

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No.	REVISION	BY	DATE
A	SUBMITTAL TO CITY ENGINEER	JPS	11/13/09
B	CITY ENGINEERING COMMENTS	JPS	1/22/10
C	EXTEND CHANNEL S. TO AIRPORT	JPS	11/09/17
D	CITY SUBMITTAL	JPS	2/20/18

STATEMENT:

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RESUBMITTAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 180 DAYS AFTER REVIEW DATE.

REVIEW:
STREET DESIGN:
CURB & GUTTER REVIEW ______ DATE: ______
FINAL REVIEW ______ DATE: ______

DRAINAGE DESIGN:
CITY REVIEW: Jonathan B. Scherer DATE: 04/04/2018
DRAINAGE BASIN SAND CREEK
THIS IS FILED IN ACCORDANCE WITH SECTION 7.7.906 (DRAINAGE ORDINANCE) OF THE CODE OF THE CITY OF COLORADO SPRINGS, 2001, AS AMENDED

DESIGN DATA:
SIDEWALKS: WIDTH NA
LOCATION: ATTACHED ☐
DETACHED, 6" FROM P/L ☐
CURB TYPE 1 ☐ 2 ☐ 3 ☐
R/W WIDTH ______ F/C-F/C ______
STREET TYPE ______
HVEEM
ASPHALT THICKNESS:
AC SURFACE ______
AC BASE ______
AGGREGATE BASE THICKNESS:
CLASS 6 ______
CLASS 5 ______
CLASS 2 ______

BENCHMARK:
CONCRETE NAIL IN CENTER OF MEDIAN IN CENTER OF AIRPORT ROAD ON BRIDGE OVER SAND CREEK.
ELEVATION= 6109.59 (NGVD 29)

STATEMENTS:

A. SEWER - ANY CHANGES OR ALTERATIONS EFFECTING THE GRADE, ALIGNMENT, ELEVATION, AND DEPTH OF COVER OF SEWERS AND RESPONSIBILITY OF THE OWNER/DEVELOPER. THE OWNER/DEVELOPER SHALL BE RESPONSIBLE FOR ALL OPERATIONAL DAMAGES AND DEFECTS IN INSTALLATION AND MATERIAL FOR MAINS AND SERVICES FROM THE DATE OF APPROVAL UNTIL FINAL ACCEPTANCE IS ISSUED.

B. WATER - THIS APPROVAL SUBJECT TO THE FINAL STREET GRADE LEAVING A MINIMUM COVER OF 5' (FIVE FEET) OVER THE WATER MAIN. ANY CHANGES SHALL BE AT THE EXPENSE OF THE OWNER OR DEVELOPER.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JPS ENGINEERING.

JOHN P. SCHWAB, CO. PE. #29891 ______ DATE

HORZ. SCALE:	1"=50'	DRAWN:	RMD
VERT. SCALE:	1"=5'	DESIGNED:	JPS
SURVEYED:	LDC	CHECKED:	JPS
CREATED:	8/2/06	LAST MODIFIED:	3/28/18
PROJECT NO:	020501	MODIFIED BY:	BJJ

SHEET: CH1.01

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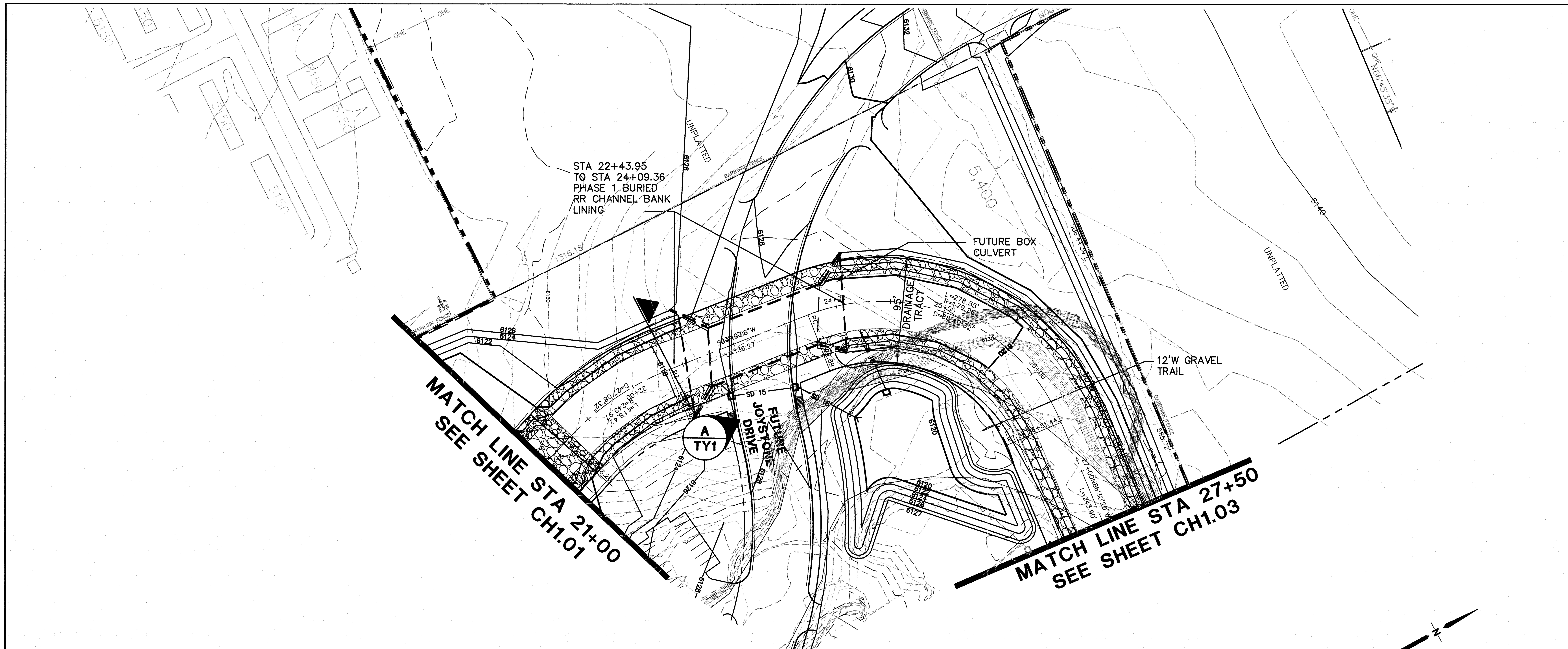

50' 0 50' 100'

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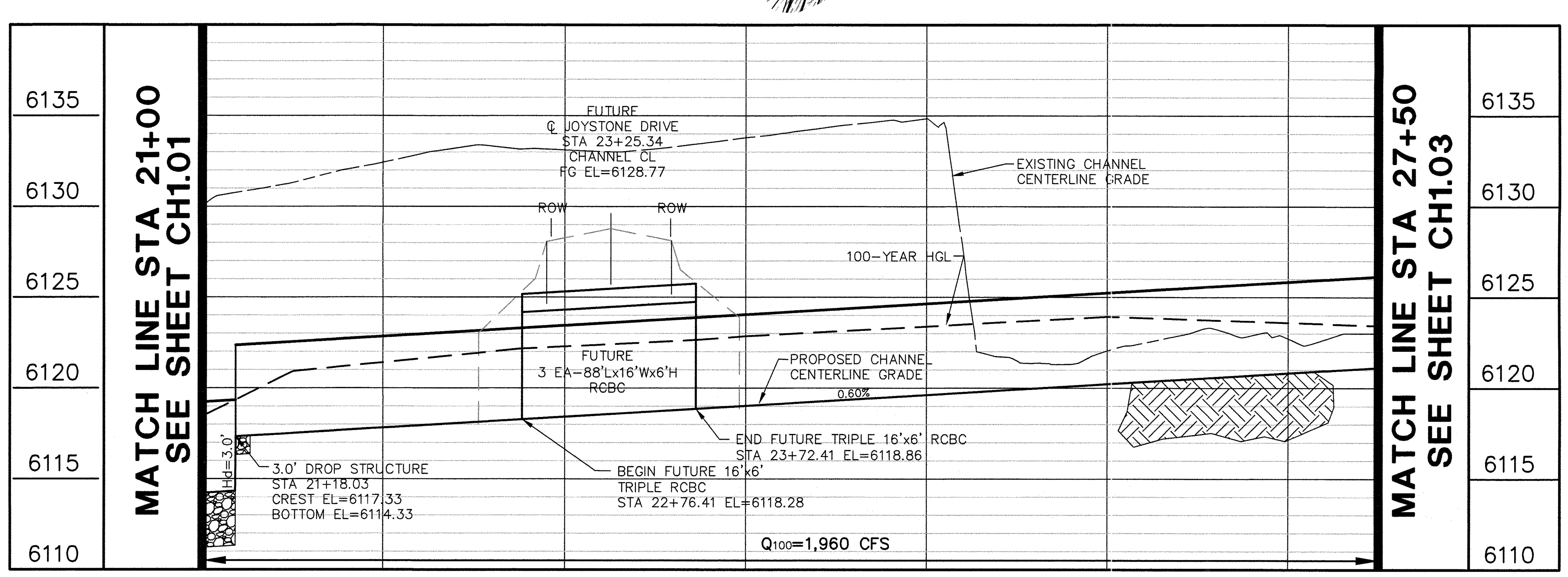
Contour Interval=1'



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1. CONTRACTOR SHALL FIELD VERIFY LIMITS AND GRADES FOR ALL CHANNEL IMPROVEMENTS WITH ENGINEER AFTER STAKING AND PRIOR TO BEGINNING WORK.

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COLORADO REGISTERED JOHN P. SCHWAB 29891 PROFESSIONAL ENGINEER

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REVIEW:
STREET DESIGN:
CURB & GUTTER REVIEW ______ DATE: ______
FINAL REVIEW ______ DATE: ______
DRAINAGE DESIGN:
CITY REVIEW: Jonathan B. Salvar DATE: 04/24/2018
DRAINAGE BASIN SAND CREEK
THIS IS FILED IN ACCORDANCE WITH SECTION 7.7.906 (DRAINAGE ORDINANCE) OF THE CODE OF THE CITY OF COLORADO SPRINGS, 2001, AS AMENDED

DESIGN DATA:
SIDEWALKS: WIDTH NA
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DETACHED, 6" FROM P/L ☐
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STREET TYPE ______
HVEEM
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AC SURFACE ______
AC BASE ______
AGGREGATE BASE THICKNESS:
CLASS 6 ______
CLASS 5 ______
CLASS 2 ______

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STATEMENTS:

A. SEWER – ANY CHANGES OR ALTERATIONS EFFECTING THE GRADE, ALIGNMENT, ELEVATION, AND DEPTH OF COVER OF SEWERS AND RESPONSIBILITY OF THE OWNER/DEVELOPER. THE OWNER/DEVELOPER SHALL BE RESPONSIBLE FOR ALL OPERATIONAL DAMAGES AND DEFECTS IN INSTALLATION AND MATERIAL FOR MAINS AND SERVICES FROM THE DATE OF APPROVAL UNTIL FINAL ACCEPTANCE IS ISSUED.

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PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JPS ENGINEERING.

JOHN P. SCHWAB, CO. PE. #29891 DATE

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

No.	REVISION	BY	DATE
A	SUBMITTAL TO CITY ENGINEER	JPS	11/13/09
B	CITY ENGINEERING COMMENTS	JPS	1/22/10
C	EXTEND CHANNEL S. TO AIRPORT	JPS	12/19/17
D	CITY SUBMITTAL	JPS	2/20/18

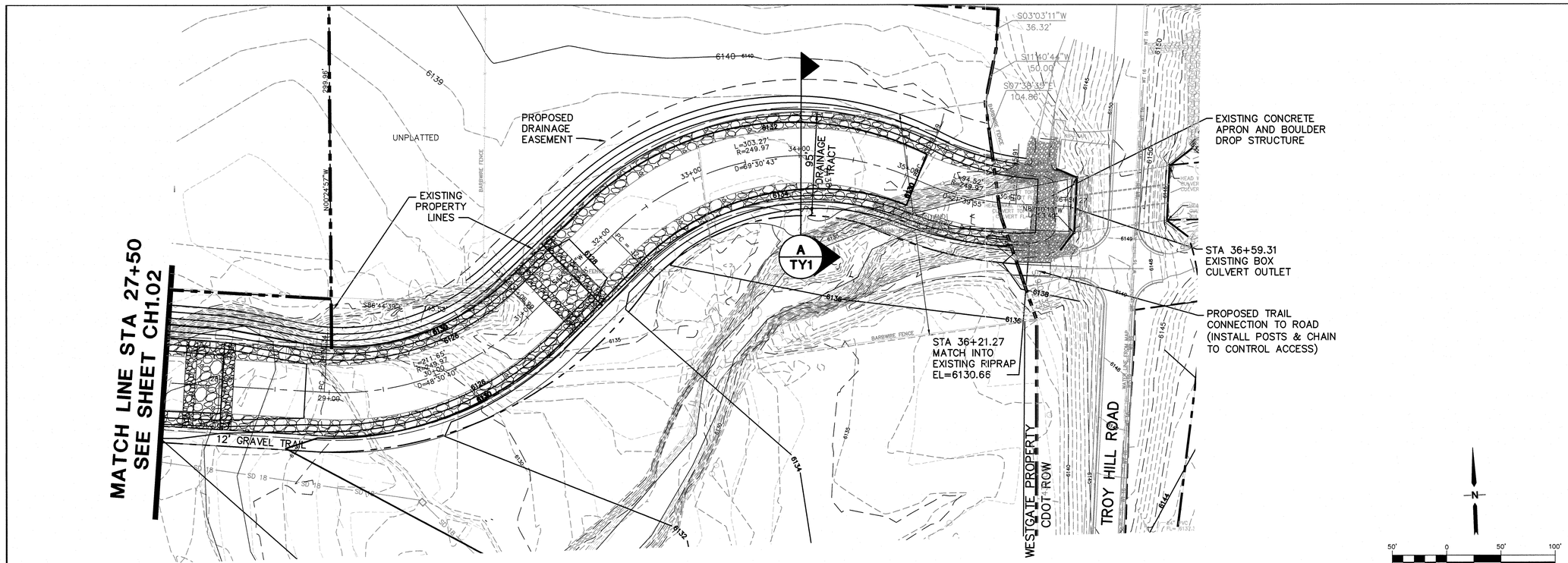
WESTGATE AT POWERS
SAND CREEK CENTER TRIBUTARY CHANNEL

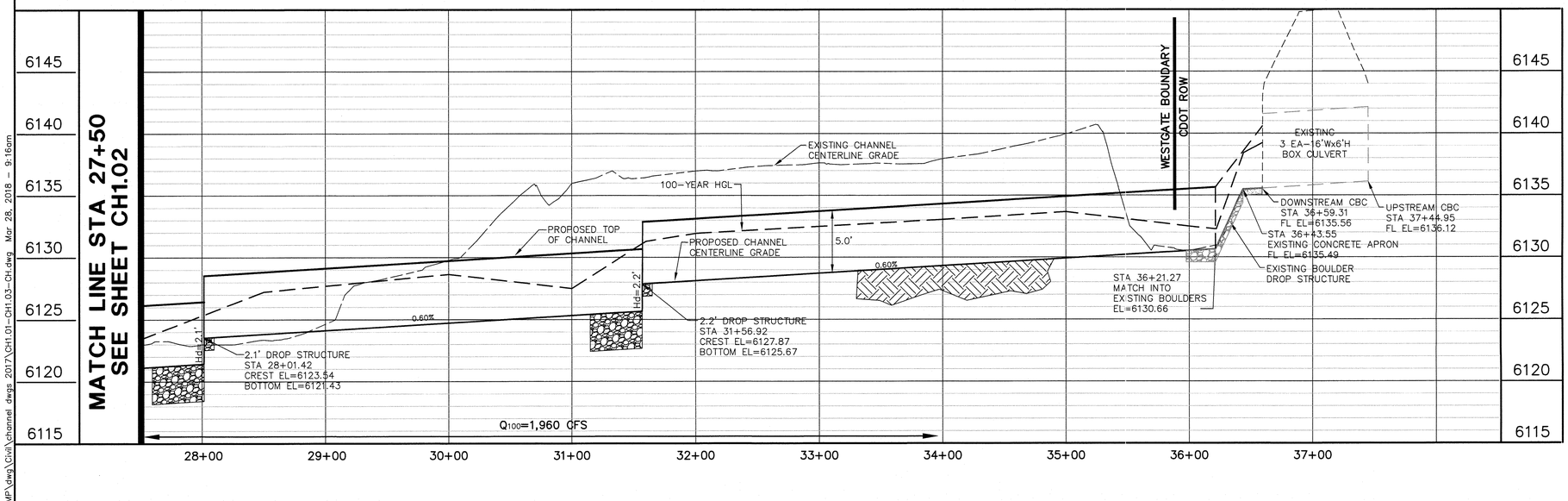
CHANNEL PLAN & PROFILE

HORZ. SCALE: 1"=50'	DRAWN: RMD
VERT. SCALE: 1"=5'	DESIGNED: JPS
SURVEYED: LDC	CHECKED: JPS
CREATED: 8/2/06	LAST MODIFIED: 3/28/18
PROJECT NO: 020501	MODIFIED BY: BJJ

SHEET: CH1.02

J:\jpsprojects\020501.airport MP\dwg\Civil\channel dwgs 2017\CH1.01-CH1.03-CH.dwg Mar 28, 2018 - 9:18am





CHANNEL IMPROVEMENT NOTES:

1. CONTRACTOR SHALL FIELD VERIFY LIMITS AND GRADES FOR ALL CHANNEL IMPROVEMENTS WITH ENGINEER AFTER STAKING AND PRIOR TO BEGINNING WORK.

2. CONTRACTOR SHALL MINIMIZE DISTURBANCE BEYOND IMMEDIATE VICINITY OF CHANNEL IMPROVEMENT AREAS.

COLORADO REGISTERED 29891 PROFESSIONAL ENGINEER

WESTGATE AT POWERS
SAND CREEK CENTER TRIBUTARY CHANNEL

CHANNEL PLAN & PROFILE

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2	CITY ENGINEERING COMMENTS	JPS	1/22/10
3	EXTEND CHANNEL S. TO AIRPORT	JPS	11/09/17
4	CITY SUBMITTAL	JPS	2/20/18

STATEMENT:

PLAN REVIEW BY CITY IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH DESIGN CRITERIA. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE CITY, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

RESUBMITTAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 180 DAYS AFTER REVIEW DATE.

REVIEW:
STREET DESIGN:
CURB & GUTTER REVIEW _____ DATE: _____
FINAL REVIEW _____ DATE: _____

DRAINAGE DESIGN:
CITY REVIEW: Jonathan B. Schwab DATE: 04/04/2018
DRAINAGE BASIN: SAND CREEK
THIS IS FILED IN ACCORDANCE WITH SECTION 7.7.906 (DRAINAGE ORDINANCE) OF THE CODE OF THE CITY OF COLORADO SPRINGS, 2001, AS AMENDED

DESIGN DATA:
SIDEWALKS: WIDTH NA
LOCATION: ATTACHED ☐
DETACHED, 6" FROM P/L ☐
CURB TYPE 1 ☐ 2 ☐ 3 ☐
R/W WIDTH _____ F/C-F/C _____
STREET TYPE _____
HVEEM

ASPHALT THICKNESS:
AC SURFACE _____
AC BASE _____
AGGREGATE BASE THICKNESS:
CLASS 6 _____
CLASS 5 _____
CLASS 2

BENCHMARK:
CONCRETE NAIL IN CENTER OF MEDIAN IN CENTER OF AIRPORT ROAD ON BRIDGE OVER SAND CREEK.
ELEVATION= 6109.59 (NGVD 29)

STATEMENTS:

A. SEWER – ANY CHANGES OR ALTERATIONS EFFECTING THE GRADE, ALIGNMENT, ELEVATION, AND DEPTH OF COVER OF SEWERS AND RESPONSIBILITY OF THE OWNER/DEVELOPER. THE OWNER/DEVELOPER SHALL BE RESPONSIBLE FOR ALL OPERATIONAL DAMAGES AND DEFECTS IN INSTALLATION AND MATERIAL FOR MAINS AND SERVICES FROM THE DATE OF APPROVAL UNTIL FINAL ACCEPTANCE IS ISSUED.

B. WATER – THIS APPROVAL SUBJECT TO THE FINAL STREET GRADE LEAVING A MINIMUM COVER OF 5' (FIVE FEET) OVER THE WATER MAIN. ANY CHANGES SHALL BE AT THE EXPENSE OF THE OWNER OR DEVELOPER.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JPS ENGINEERING.

JOHN P. SCHWAB, CO. PE. #29891 DATE

HORZ. SCALE:	1"=50'	DRAWN:	RMD
VERT. SCALE:	1"=5'	DESIGNED:	JPS
SURVEYED:	LDC	CHECKED:	JPS
CREATED:	8/2/06	LAST MODIFIED:	3/28/18
PROJECT NO:	020501	MODIFIED BY:	BJJ

SHEET: CH1.03

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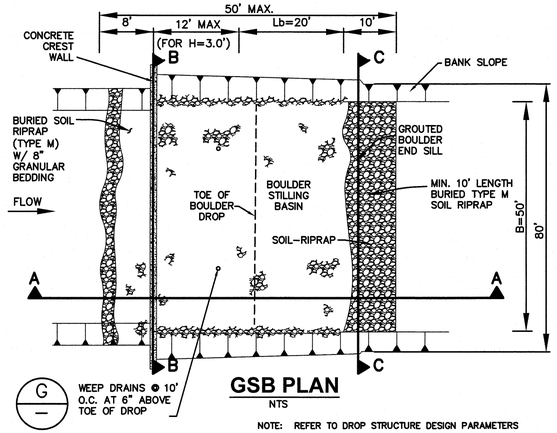
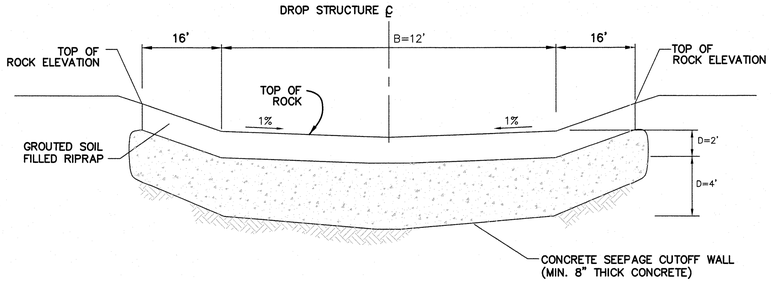
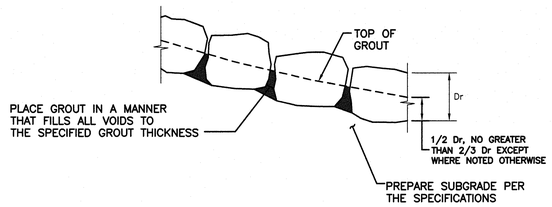


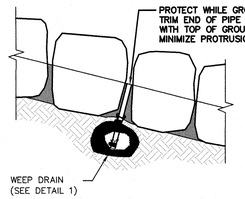
GSB PLAN
NTS

NOTE: REFER TO DROP STRUCTURE DESIGN PARAMETERS

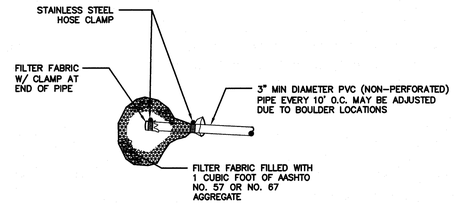


CUTOFF WALL SECTION (D)
NTS



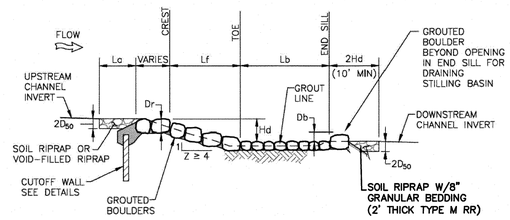


GROUTED BOULDERS



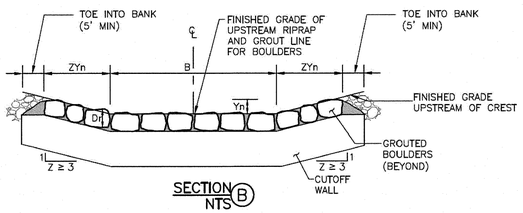
WEEP DRAINS

WEEP DRAIN DETAILS (G)
NTS

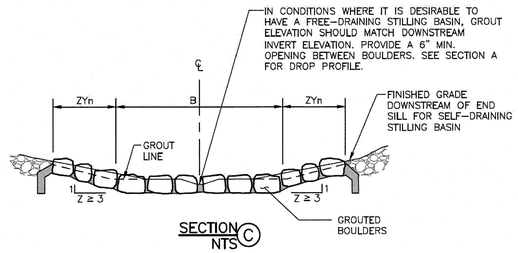


GROUTED BOULDER DROP PROFILE (A)
NTS

NOTE: REFER TO DROP STRUCTURE DESIGN PARAMETERS



SECTION (B)
NTS



SECTION (C)
NTS

GROUTED SLOPING BOULDER DROP DETAIL (1)
NTS

NOTE: REFER TO DROP STRUCTURE DESIGN PARAMETERS

BOULDER PLACEMENT NOTES:
1. PLACE BOULDERS WITH THE REQUIRED BOULDER HEIGHT VERTICAL. PLACE BOULDERS AS TIGHTLY TOGETHER AS POSSIBLE (WITHOUT TOUCHING) WHILE PROVIDING ENOUGH ROOM BETWEEN THEM TO THOROUGHLY VIBRATE THE GROUT AND TO ENSURE NO GAPS IN THE GROUT. THE SMALL DIMENSION OF A 2X4 CAN BE USED AS A GUIDE TO CHECK MINIMUM SPACING.
2. BEFORE GROUTING, CLEAN ALL DIRT AND MATERIAL FROM ROCK THAT COULD PREVENT THE GROUT FROM BINDING TO THE ROCK. KEEP BOULDERS FROM TOUCHING. AVOID SLIDING BOULDERS AGAINST SUBGRADE TO PROPERLY POSITION.

MATERIAL SPECIFICATIONS:
1. ALL GROUT SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH EQUAL TO 3200 PSI.
2. ONE CUBIC YARD OF GROUT SHALL HAVE A MINIMUM OF SIX (6) SACKS OF TYPE II PORTLAND CEMENT.
3. A MAXIMUM OF 25% TYPE F FLY ASH MAY BE SUBSTITUTED FOR THE PORTLAND CEMENT.
4. THE AGGREGATE SHALL BE COMPRISED OF 70% NATURAL SAND (FINES) AND 30% ⅜-INCH ROCK (COARSE).
5. THE GROUT SLUMP SHALL BE BETWEEN 4-INCHES TO 6-INCHES.
6. AIR ENTRAINMENT SHALL BE BETWEEN 5.5% AND 7.5%.
7. TO CONTROL SHRINKAGE AND CRACKING, 1.5 POUNDS OF FIBERMESH, OR EQUIVALENT, SHALL BE USED PER CUBIC YARD OF GROUT.
8. COLOR ADDITIVE IN REQUIRED AMOUNTS SHALL BE USED WHEN SO SPECIFIED BY CONTRACT.

GROUT PLACEMENT SPECIFICATIONS:
1. SPECIAL PROCEDURES SHALL BE REQUIRED FOR GROUT PLACEMENT WHEN THE AIR TEMPERATURES ARE LESS THAN 40°F OR GREATER THAN 90°F. CONTRACTOR SHALL OBTAIN PRIOR APPROVAL FROM THE DESIGN ENGINEER OF THE PROCEDURES TO BE USED FOR PROTECTING THE GROUT.
2. GROUT SHALL BE DELIVERED BY MEANS OF A LOW PRESSURE (LESS THAN 10 PSI) GROUT PUMP USING A 2-INCH DIAMETER (MAXIMUM) NOZZLE.
3. FULL DEPTH PENETRATION OF THE GROUT INTO THE BOULDER VOIDS SHALL BE ACHIEVED BY INJECTING GROUT STARTING WITH THE NOZZLE NEAR THE BOTTOM AND RAISING IT AS THE GROUT FILLS, WHILE VIBRATING GROUT INTO PLACE USING A PENCIL VIBRATOR.
4. ALL GROUT BETWEEN BOULDERS SHALL BE TREATED WITH A BROOM FINISH.
5. AFTER GROUT PLACEMENT, EXPOSED BOULDER FACES SHALL BE CLEANED AND FREE OF GROUT.
6. ALL FINISHED GROUT SURFACES SHALL BE SPRAYED WITH A CLEAR LIQUID MEMBRANE CURING COMPOUND AS SPECIFIED IN ASTM C309.

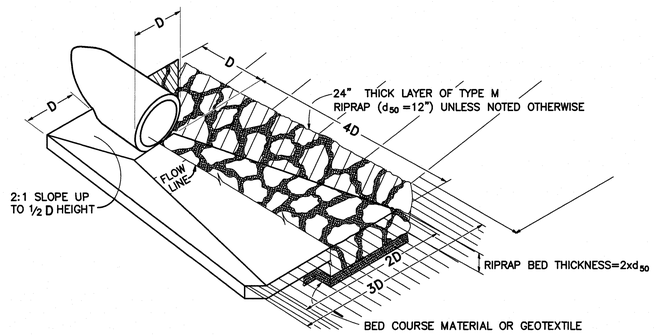
GROUTED BOULDER PLACEMENT DETAIL (E)
NTS

GROUTED SLOPING BOULDER DROP STRUCTURE DESIGN DATA:
(PER UDFCD TABLE 9-1)

CHANNEL SECTION:
B = 50'
Z = 3:1
Yn = 5.0'

DROP STRUCTURE DESIGN:
Hd = 3.0' MAX. DROP HEIGHT
S = 4:1 MAX. LONGITUDINAL SLOPE
Db = 1' STILLING BASIN DEPRESSION
La = 8' LENGTH OF APPROACH RIPRAP
Lb = 20' LENGTH OF STILLING BASIN
B = 50' STILLING BASIN WIDTH (=CREST WIDTH)
Dc = 6' CUTOFF WALL DEPTH
Ld = 10' LENGTH OF RIPRAP DOWNSTREAM OF STILLING BASIN
D50 = 12" RIPRAP SIZE FOR APPROACH AND DOWNSTREAM LENGTH
Dr = 30" BOULDER SIZE

DROP STRUCTURE DESIGN PARAMETERS (F)



NOTE: TYPICAL RIPRAP APRON DIMENSIONS SHALL BE 12'Lx9'Wx1.5'D UNLESS NOTED OTHERWISE

TYPICAL OUTLET PROTECTION / RIPRAP APRON DETAIL (3)
NTS

STORM SEWER OUTLET DESIGN TABLE

CHANNEL STATION	PIPE SIZE (IN)	APRON LENGTH (FT)	APRON WIDTH (FT)	RR SIZE (d_{50})	RIPRAP THICKNESS (FT)
10+60.70 (25.51' R)	36"	15'	9'	12	2
24+19.10 (25.17' R)	18"	7.5'	4.5'	12	2

COLORADO REGISTERED JOHN P. SCHWAB 29891 PROFESSIONAL ENGINEER

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No.	REVISION	BY	DATE
1	CITY SUBMITTAL	JPS	2/20/18
2	CITY COMMENTS	JPS	3/09/18
3	CITY COMMENTS	JPS	3/28/18

WESTGATE AT POWERS
SAND CREEK CENTER TRIBUTARY CHANNEL

CHANNEL DETAILS

HORZ. SCALE:	AS SHOWN	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LDC	CHECKED:	JPS
CREATED:	2/20/18	LAST MODIFIED:	3/28/18
PROJECT NO:	020501	MODIFIED BY:	BJJ

SHEET: CH2

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APR 04 2018

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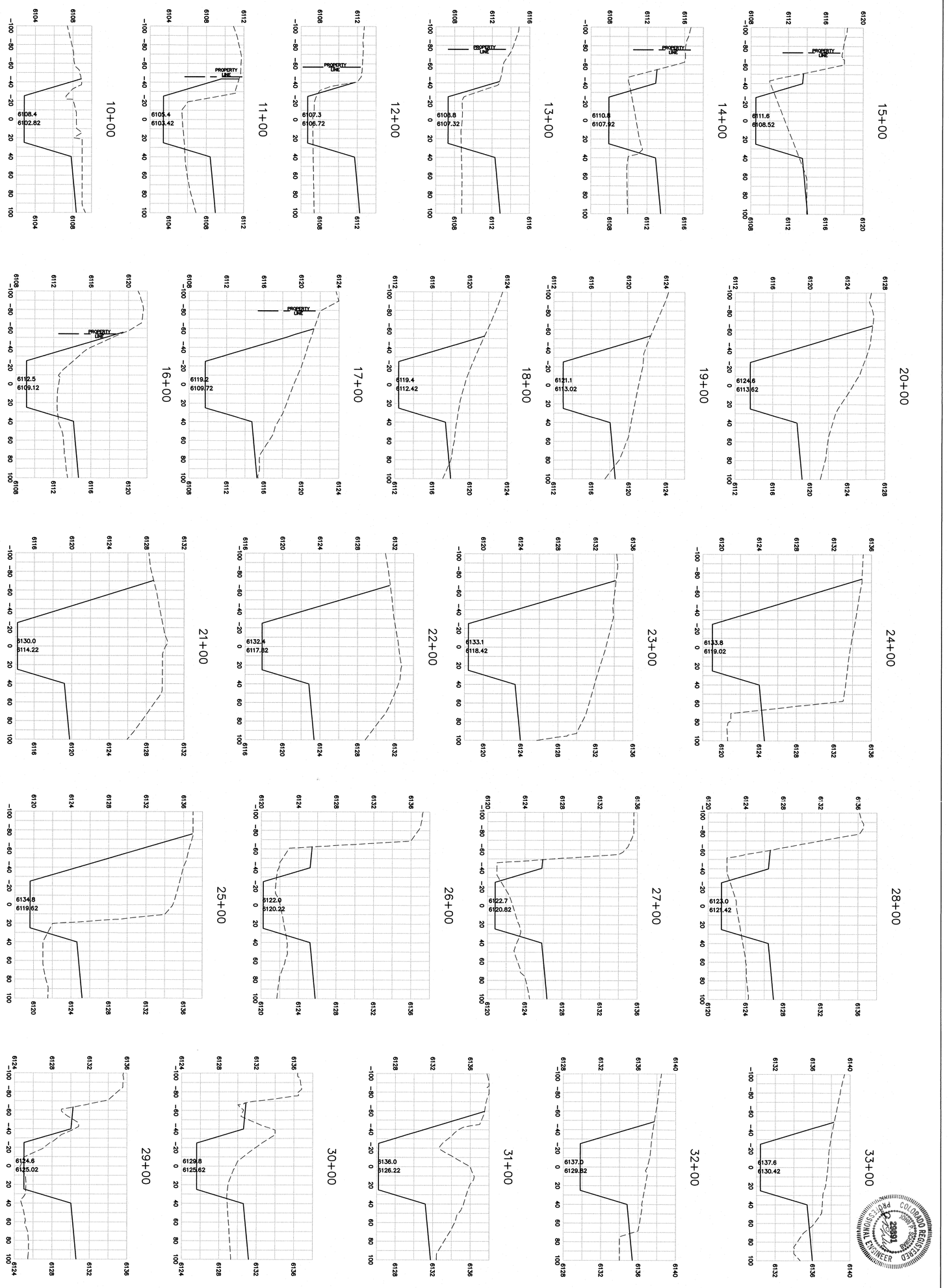

APR 04 2018

WESTGATE AT POWERS
SAND CREEK CENTER TRIBUTARY CHANNEL

CHANNEL SECTIONS

No.	REVISION	BY	DATE
1	SUBMITTAL TO CITY ENGINEER	JPS	11/13/09
2	CITY ENGINEERING COMMENTS	JPS	1/22/10
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HORIZ. SCALE: 1"=50' DRAWN: BAJ
VERT. SCALE: 1"=5' DESIGNED: BAJ
SURVEYED: LDC CHECKED: JPS
CREATED: 9/15/09 LAST MODIFIED: 2/20/18 JPS
PROJECT NO: 020501 MODIFIED BY: BAJ
SHEET: CS1

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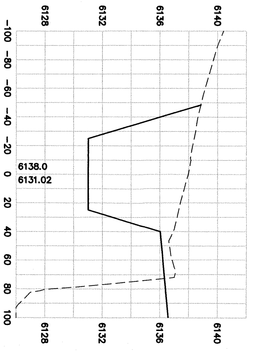

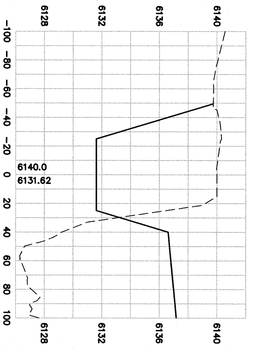

APR 04 2018

WESTGATE AT POWERS
SAND CREEK CENTER TRIBUTARY CHANNEL

CS2

CHANNEL SECTIONS

HORZ. SCALE: 1"=50' DRAWN: BJJ
VERT. SCALE: 1"=5' DESIGNED: BJJ
SURVEYED: LDC CHECKED: JPS
CREATED: 9/15/09 LAST MODIFIED: 2/20/18
PROJECT NO: 020501 MODIFIED BY: BJJ
SHEET:

No.	REVISION	BY	DATE
1	SUBMITTAL TO CITY ENGINEER	JPS	11/13/09
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80903
PH: 719-477-9429
FAX: 719-477-0786
www.jpseng-co.com

STATE OF COLORADO

Bill Ritter, Jr., Governor
Martha E. Rudolph, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.
Denver, Colorado 80246-1530
Phone (303) 692-2000
TDD Line (303) 691-7700
Located in Glendale, Colorado

http://www.cdphe.state.co.us

Laboratory Services Division
8100 Lowry Blvd.
Denver, Colorado 80230-6928
(303) 692-3090

Colorado Department
of Public Health
and Environment

May 13, 2010

Signature Realty Capital Corporation
Attn: Martin List
2082 Michelson Drive, Suite 212
Irvine, California 92612

Re: Section 401 Water Quality Certification
Colorado 401 Certification No.: 4254
US Army Corps of Engineers 404 Permit No.: SPA-2010-00110-SCO
Description: Construct a commercial development project to include riprap with vertical drop concrete walls to stabilize the channel. Install culvert and construct trail and maintenance access road
Location: Section 13, Township 14 South, Range 66 West, Latitude 38.827221566407, Longitude -104-727237224579 in El Paso County, Colorado
Watercourse: Sand Creek tributary, Arkansas River Basin, Segment COARFO04 of Fountain Creek Sub-basin
Designation: Use Protected

Dear Mr. List:

The Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division (Division) has completed its review of the subject Clean Water Act (CWA) Section 404 Permit Application, and our preliminary determination with the issuance of the State of Colorado 401 Certification Public Notice (5 CCR 1002-82.5(B)). This segment is designated "Use Protected" thus no antidegradation review is required (5 CCR 1002-31.8(2)).

This letter shall serve as official notification that the Division is issuing "Regular Certification" in accordance with 5 CCR 1002-82.5(A)(2).

The 401 Certification issued by the Division pursuant to 5 CCR 1002-82.3(C) shall apply to both the construction and operation of the project for which a federal license or permit is required, and shall apply to the water quality impacts associated with the project. This certification does not constitute a relinquishment of the Division's authority as defined in the Colorado Water Quality Control Act, nor does it fulfill or waive any other local, state, or federal regulations.

If you have any questions or need additional information, please contact me at (303) 692-3586.

Sincerely,

John C. Hranac
Water Quality Assessor
Water Quality Control Division
Colorado Department of Public Health and Environment

Attachment

cc: US Army Corps of Engineers, Southern Colorado Regulatory Office
File

JPS Engineering, Inc

APPENDIX E

DRAINAGE COST ESTIMATE

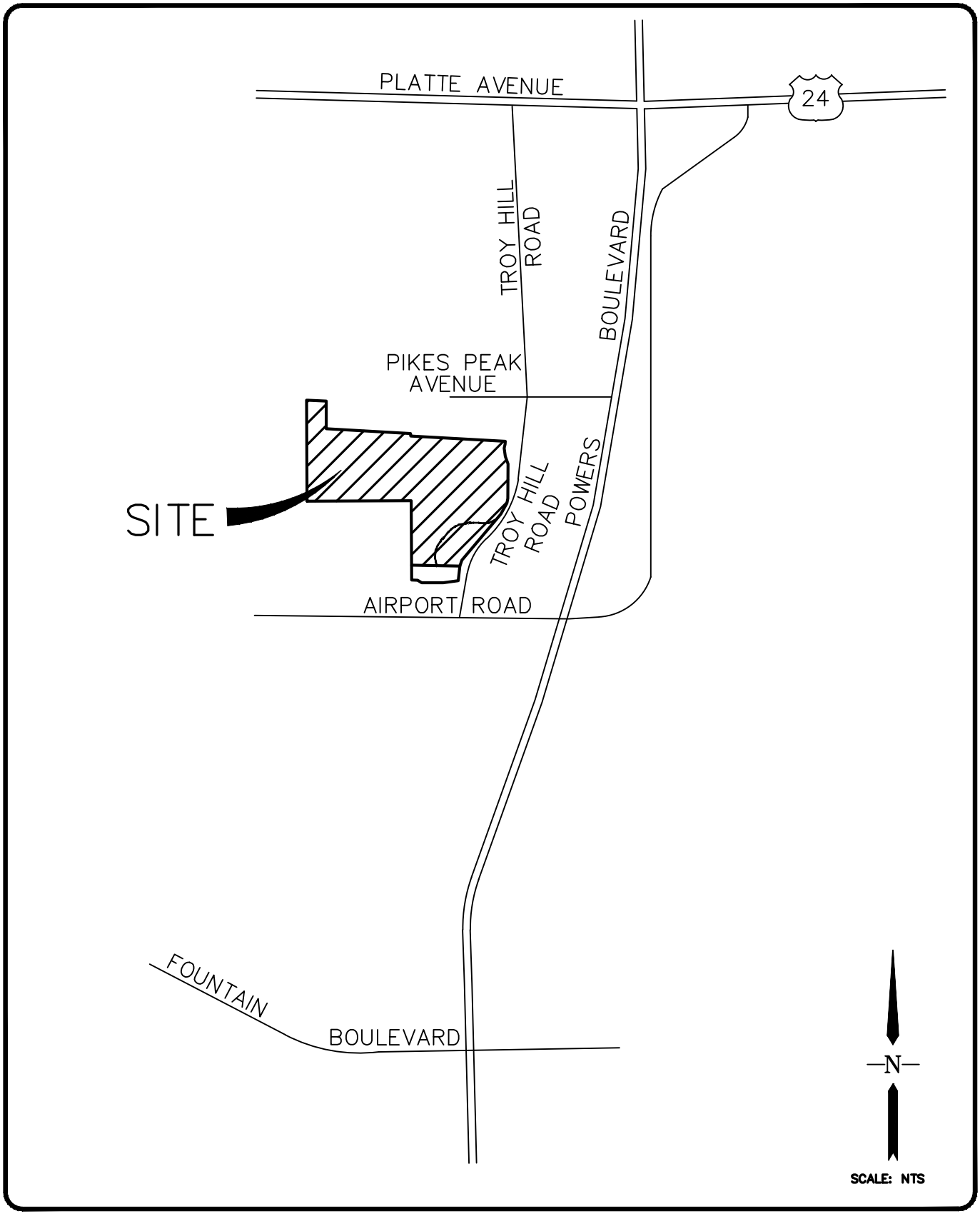
WESTGATE AT POWERS - FILING NO. 3
ENGINEER'S COST ESTIMATE
DRAINAGE IMPROVEMENTS

Item No.	Description	Quantity	Unit	Unit Cost ($$$)	Total Cost ($$$)
	PUBLIC DRAINAGE FACILITIES - JOYSTONE DRIVE CBC & STORM SEWER (NON-REIMBURSABLE)				
301	Concrete Box Culvert Wingwalls	2	LS	$20,000	$40,000
603	3-Cell 16'w x 6'H Concrete Box Culvert	120	LF	$4,200	$504,000
603	18" RCP Storm Drain	55	LF	$70	$3,850
603	24" HDPE Storm Drain	175	LF	$85	$14,875
604	5' Type D10R Storm Inlet	2	EA	$5,800	$11,600
604	Storm Sewer Manhole	1	EA	$6,600	$6,600
	SUBTOTAL				**$580,925**
	Engineering @ 10%				$58,093
	TOTAL (REIMBURSABLE)				**$639,018**
	PRIVATE DRAINAGE FACILITIES (NON-REIMBURSABLE)				
203	Detention Pond A6 Earthwork	1	LS	$10,000	$10,000
301	Detention Pond A6 Forebay	1	LS	$1,500	$1,500
603	18" RCP Storm Drain (Pond Outlet Pipe)	81	LF	$70	$5,670
604	Detention Pond Outlet Structure A6	1	LS	$8,000	$8,000
	SUBTOTAL				**$25,170**
	Engineering @ 10%				$2,517
	TOTAL (NON-REIMBURSABLE)				**$27,687**
	TOTAL DRAINAGE FACILITIES (PUBLIC AND PRIVATE)				**$666,705**
	Note: This estimate does not include costs for street improvements and general civil costs (curb & gutter, crosspans, retaining walls, etc.)				

The cost estimate submitted herein is based on time-honored practices within the construction industry. As such the engineer does not control the cost of labor, materials, equipment or a contractor's method of determining prices and competitive bidding practices or market conditions. The estimate represents our best judgement as design professionals using current information available at the time of the preparation. The engineer cannot guarantee that proposals, bids and/or construction costs will not vary from this cost estimate.

APPENDIX F

FIGURES



VICINITY MAP

JPS ENGINEERING

WESTGATE AT POWERS

FIGURE A1

JPS PROJ NO. 020501

National Flood Hazard Layer FIRMette

FEMA

104°44'7"W 38°49'58"N

104°43'29"W 38°49'30"N

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

1:6,000

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

Legend

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

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

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

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

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

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

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

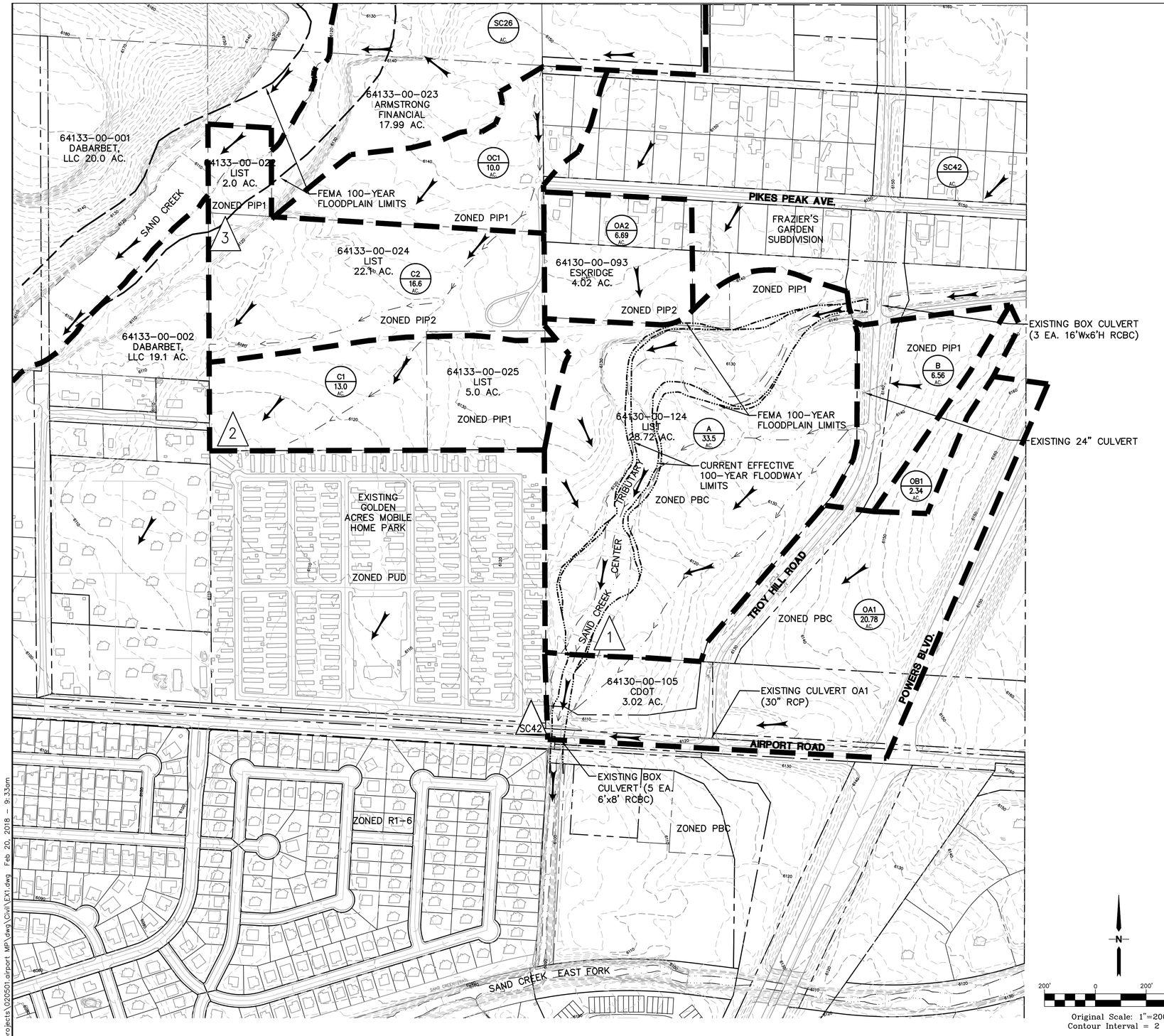
N

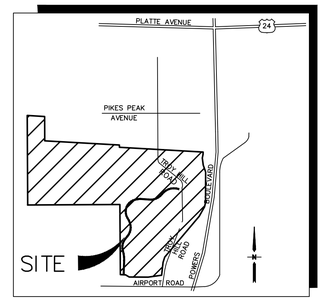
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/15/2021 at 10:20 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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





VICINITY MAP
NTS

DRAINAGE LEGEND

- RIPRAP
- FLOW DIRECTION ARROW
- FLOWLINE
- DRAINAGE BASIN BOUNDARY
- 1 / 20.6 / 50.3 — DESIGN POINT; Q_5 (cfs); Q_{100} (cfs) (HISTORIC FLOW)
- C14 / 23.21 AC. — BASIN DESIGNATION; BASIN AREA (ACRES)

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q_5 (CFS)	Q_{100} (CFS)
1	12.0	88.4
2	2.2	16.1
3	4.0	29.3
SC42	950	1,960

N

200' 0 200' 400'

Original Scale: 1"=200'
Contour Interval = 2 ft.

WESTGATE AT POWERS

HISTORIC DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO
80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

No.	REVISION	BY	DATE

HORZ. SCALE: 1"=200'	DRAWN: RMD
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: LDC	CHECKED: JPS
CREATED: 2/2/05	LAST MODIFIED: 2/20/18
PROJECT NO: 020501	MODIFIED BY: JPS

SHEET: EX1

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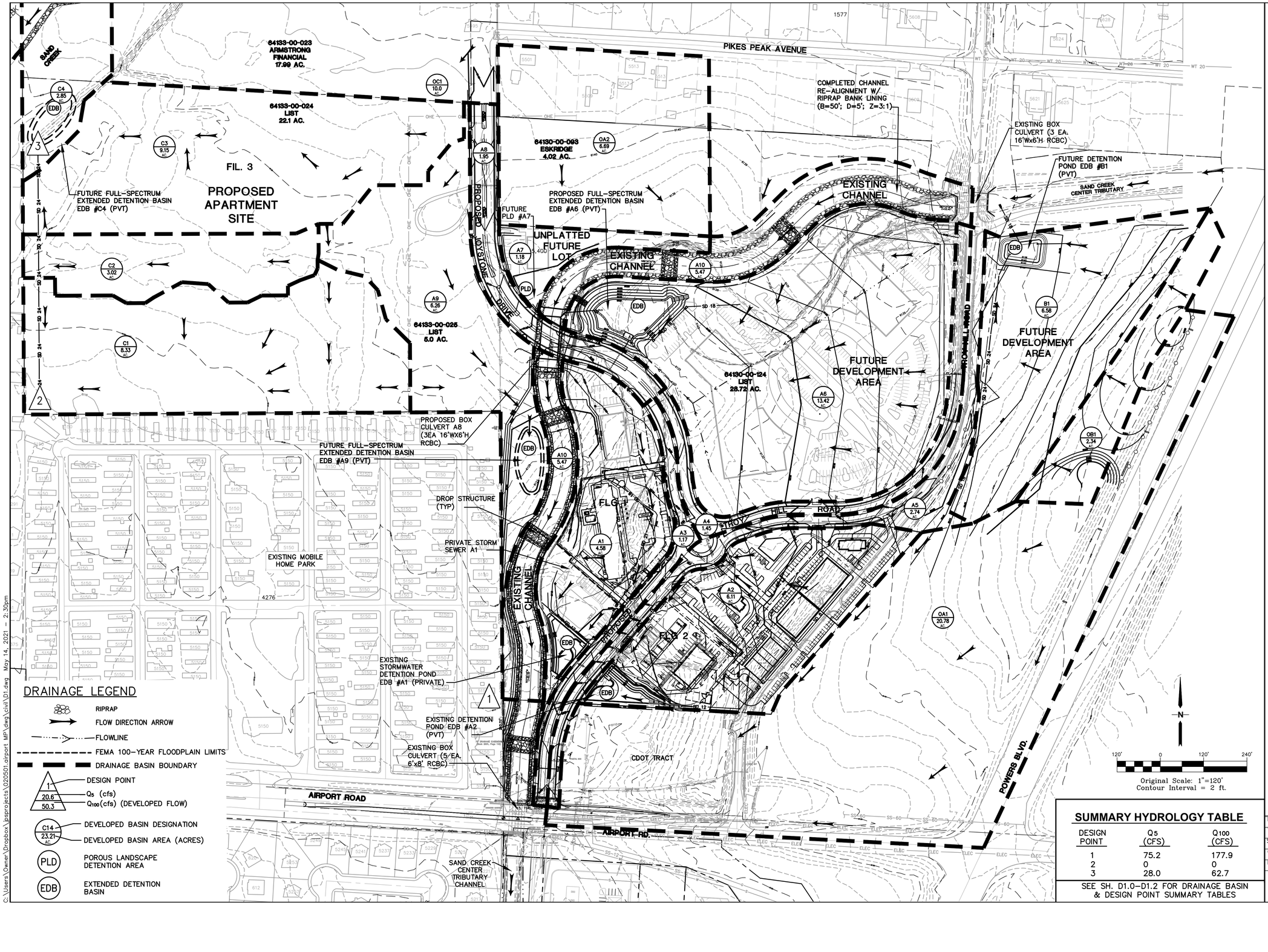
WESTGATE AT POWERS

MASTER DEVELOPMENT DRAINAGE PLAN



Original Scale: 1"=120'
Contour Interval = 2 ft.

DRAINAGE LEGEND

- RIPRAP
- FLOW DIRECTION ARROW
- FLOWLINE
- FEMA 100-YEAR FLOODPLAIN LIMITS
- DRAINAGE BASIN BOUNDARY
- DESIGN POINT
  - Q_5 (cfs)
  - Q_{100} (cfs) (DEVELOPED FLOW)
- DEVELOPED BASIN DESIGNATION
- DEVELOPED BASIN AREA (ACRES)
- PLD — POROUS LANDSCAPE DETENTION AREA
- EDB — EXTENDED DETENTION BASIN

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
1	75.2	177.9
2	0	0
3	28.0	62.7

SEE SH. D1.0–D1.2 FOR DRAINAGE BASIN & DESIGN POINT SUMMARY TABLES

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NO.	REVISION	BY	DATE

HORZ. SCALE:	1"=120'	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LDC	CHECKED:	JPS
CREATED:	2/2/05	LAST MODIFIED:	5/14/21
PROJECT NO:	020501	MODIFIED BY:	BJJ

SHEET: D1

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WESTGATE AT POWERS

NORTHWEST SITE DRAINAGE PLAN

SUMMARY HYDROLOGY TABLE

DESIGN POINT	BASIN	Q5 (CFS)	Q100 (CFS)
A6	A6	30.0	59.8
A8	A8	6.4	12.2
A8a	A6, A8	35.6	70.3

Original Scale: 1"=50'
Contour Interval = 2 ft.

PARCEL #64133-00-023
ARMSTRONG FINACIAL
(17.99 AC.)

OC1
10.0
AC.

64130-00-093
ESKRIDGE
4.02 AC.

OA2
6.69
AC.

A8
1.95
AC.

JOYSTONE DRIVE

FULL-SPECTRUM
DETENTION POND A6
BOT EL=6121.0
100-YR WSL=6126.0
TOP EL=6128.0
REQ'D 100-YR
VOL=2.4 AF
DSN VOL=2.7 AF

A6a

FUTURE
WESTGATE
APARTMENT
DEVELOPMENT
AREA

FUTURE
WESTGATE
FILING

A7
1.18
AC.

PROPOSED CHANNEL

SILT FENCE SF

SB EDB

A6

PROPOSED PUBLIC
INLET A8.2
(5' D10R)

A8a

PROPOSED
18" SD 8.2

AS8
1.95
AC.

A8

PROPOSED
18" SD 8.1

PROPOSED PUBLIC
INLET A8.1 (5' D10R)

END PHASE 1 ROADWAY
IMPROVEMENTS

JOYSTONE
DRIVE

SM

VT

A9
6.26
AC.

64133-00-025
LIST
5.0 AC.

64130-00-124
LIST
28.72 AC.

FUTURE
WESTGATE
DEVELOPMENT
AREA

FILING
NO. 1

A6
13.42
AC.

LEGEND:

- DRAINAGE BASIN BOUNDARY
- DESIGN POINT (5)
- DEVELOPED BASIN DESIGNATION (C14)
- DEVELOPED BASIN AREA (ACRES) (23.21 AC)
- FLOW DIRECTION
- FLOWLINE
- CURRENT FEMA 100-YEAR FLOODPLAIN LIMITS
- FEMA 100-YEAR FLOOD ELEVATIONS (6126)
- SILT FENCE
- EXISTING CONTOURS (6490)
- PROPOSED CONTOURS (6490)
- PROPOSED SPOT ELEVATION (FLOWLINE) (99.00)
- EXIST. SPOT ELEVATION (99.00)
- TW TOP OF WALL
- BW BOTTOM FACE OF WALL AT FINISHED GRADE
- ROOF DRAIN DOWNSPOUT W/CONNECTION TO 6" PVC UNDERGROUND COLLECTION LINE
- EDB EXTENDED DETENTION BASIN

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No.	REVISION	BY	DATE

HORZ. SCALE: 1"=50'	DRAWN: BJJ
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: LDC	CHECKED: JPS
CREATED: 3/31/21	LAST MODIFIED: 5/03/21
PROJECT NO: 020501	MODIFIED BY: BJJ
SHEET: D1.3	

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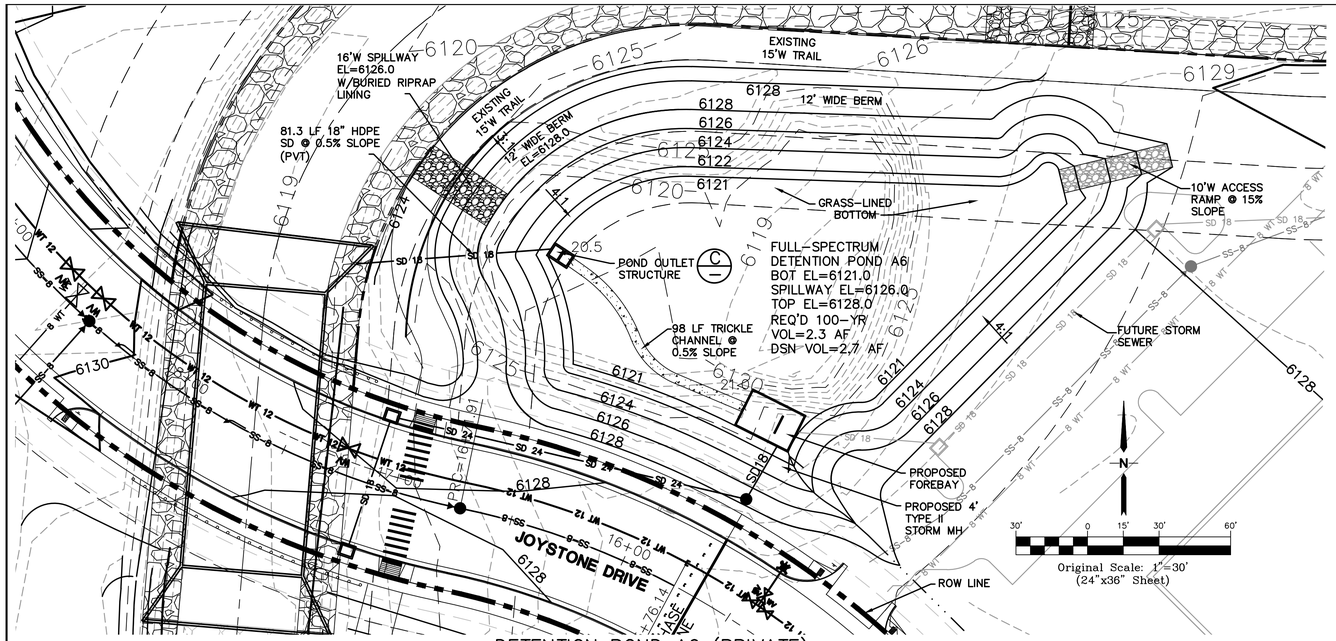
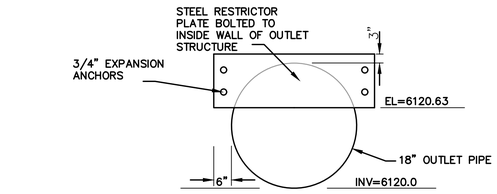
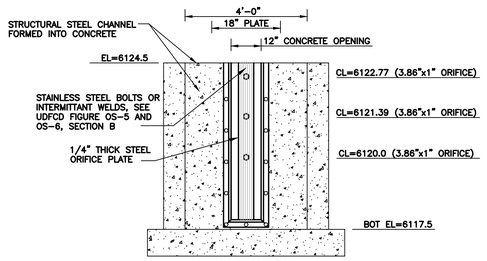


DETENTION POND A6 (PRIVATE)



RESTRICTOR PLATE DETAIL (D)

SCALE: 1"=2'



ELEVATION

ORIFICE PLATE NOTES:

1. MINIMIZE THE NUMBER OF COLUMNS.
2. PROVIDE GASKET MATERIAL BETWEEN THE ORIFICE PLATE AND CONCRETE.
3. BOLT PLATE TO CONCRETE 12" MAX. ON CENTER.

EURV AND WQCV TRASH RACKS:

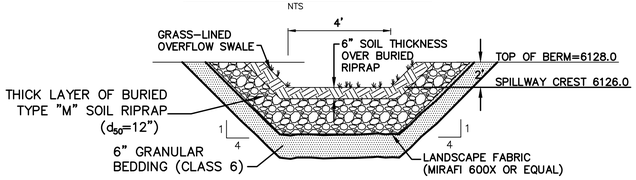
1. WELL-SCREEN TRASH RACKS (FOR CIRCULAR ORIFICES) SHALL BE STAINLESS STEEL AND SHALL BE ATTACHED BY INTERMITTENT WELDS ALONG THE EDGE OF THE MOUNTING FRAME.
2. STRUCTURAL DESIGN OF TRASH RACKS SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.

OVERFLOW TRASH RACKS:

1. ALL TRASH RACKS SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.
2. TRASH RACKS SHALL BE STAINLESS STEEL, ALUMINUM, OR STEEL. STEEL TRASH RACKS SHALL BE HOT DIP GALVANIZED AND MAY BE HOT POWDER COATED AFTER GALVANIZING.
3. TRASH RACKS SHALL BE DESIGNED SUCH THAT THE DIAGONAL DIMENSION OF EACH OPENING IS SMALLER THAN THE DIAMETER OF THE OUTLET PIPE.
4. STRUCTURAL DESIGN OF TRASH RACKS SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.

ORIFICE PLATE AND TRASH RACK
DETAILS AND NOTES (E)

NTS



PROPOSED SPILLWAY SECTION (F)

SCALE: NTS

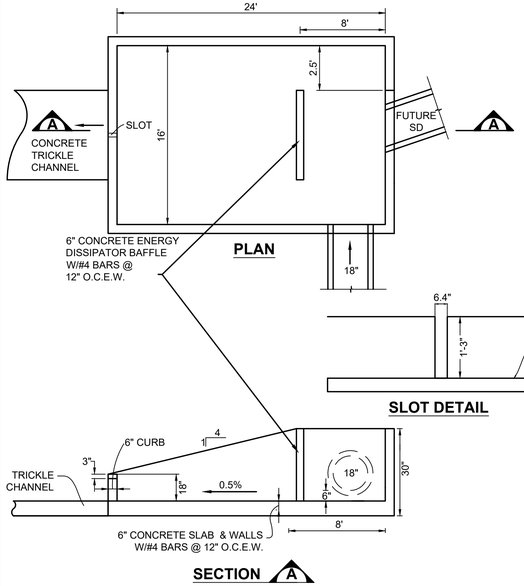
POND SIGNAGE NOTE:

TWO SIGNS, EACH WITH A MINIMUM AREA OF 3 SQUARE FEET, SHALL BE PROVIDED AROUND THE PERIMETER OF ALL DETENTION FACILITIES. THE SIGNS SHALL BE FABRICATED OF DURABLE MATERIALS, SUCH AS METAL OR PLASTIC, USING RED LETTERING ON A WHITE BACKGROUND WITH THE FOLLOWING MESSAGE:

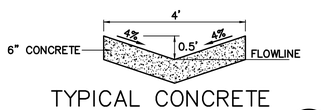
WARNING
THIS AREA IS A STORMWATER FACILITY
AND IS SUBJECT TO PERIODIC FLOODING

SIGN DETAIL (G)

NTS

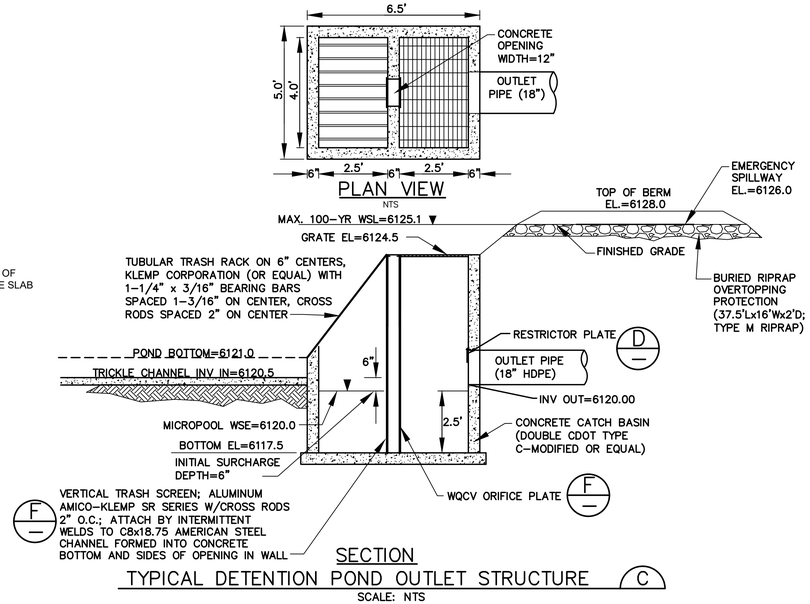


TYPICAL INTEGRAL FOREBAY DETAIL (A)



TYPICAL CONCRETE
TRICKLE CHANNEL (B)

NOT TO SCALE



TYPICAL DETENTION POND OUTLET STRUCTURE (C)

SCALE: NTS

WESTGATE AT POWERS - FILING NO. 3

DETENTION POND A6
PLAN & DETAILS

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No.	REVISION	BY	DATE
1	CITY SUBMITTAL	JPS	5/14/21

HORZ. SCALE:	AS SHOWN	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LDC	CHECKED:	JPS
CREATED:	4/13/21	LAST MODIFIED:	5/14/21
PROJECT NO:	020501	MODIFIED BY:	BJJ

SHEET: C3.1

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