Galloway
Planning. Architecture. Engineering.

Master Development Drainage Plan for
SPRING CREEK SOUTHWEST QUAD
&
Final Drainage Report for
THE VISTAS AT SPRING CREEK FILING NO. 1

Colorado Springs, Colorado

Prepared for:
Challenger Homes Inc.
13570 Northgate Estates Dr.
Colorado Springs, CO 80921
Phone (719) 598-5192
Attn: Bryan Kniep

Prepared by:
Galloway & Company, Inc.
1755 Telstar Drive, Suite 107
Colorado Springs, CO 80918
Phone (719) 900-7220
Attn: Scott Brown

Prepared: June 19, 2015
Updated: November 21, 2017
Updated: February 20, 2018
Updated: March 22, 2018

Table of Contents

SIGNATURE PAGE

The Vistas at Spring Creek Filing #1, Phase 1

Engineer's Statement
This report and plan for the drainage design of The Vistas at Spring Creek Filing #1, Phase 1 was prepared by me (of 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 any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

45900

SIGNATURE (Affix Seal): Scott Brown
Colorado P. E. No. 45900
Date
03/22/2018

Developer's Statement
Goodwin-Knight hereby certifies that the drainage facilities for The Vistas at Spring Creek Filing #1, Phase 1 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 The Vistas at Spring Creek Filing #1, Phase 1, guarantee that final drainage design review will absolve Goodwin-Knight 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.

GOODWIN KNIGHT
Name of Developer

3.12.18
Authorized Signature Date

BRYAN D. KNIEP
Printed Name

DIR. OF PLANNING
Title

8605 EXPLORER DR #250
Address:

CITY OF COLORADO SPRINGS:
Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

Jonathan B.
For City Engineer

04/09/2018
Date

Conditions:

I. GENERAL LOCATION AND DESCRIPTION

A. Purpose

This is a Master Drainage Development Plan (MDDP) for The Vistas at Spring Creek and Final Drainage Report (FDR) for The Vistas at Spring Creek Filing No 1. This report identifies on-site and off-site drainage patterns, storm sewer, culvert and inlet locations, are tributary to the site, and to safely route developed storm water to adequate outfalls. This MDDP is intended to provide drainage analysis for multiple phase of the Vistas at Springs Creek in their fully developed condition.

B. Location

The Spring Creek Southwest Quad Development (TND) project property is located in a portion of the West one-half (W1/2) of Section 25, Township 14 South, Range 66 West of the 6th Principal Meridian, in the City of Colorado Springs, El Paso County, Colorado. The site is bounded on the north by Hancock Expressway; on the east by S. Union Blvd; and to the southwest by an irrigation channel, railroads (Atchison, Topeka, and Santa Fe RR right-of-way), and property owned by the City of Colorado Springs and undeveloped privately-owned property. To the north across Hancock Expressway is the Broadmoor View at Spring Creek Filing No. 1 subdivision. The east across S. Union Blvd is the Spring Creek Traditional Neighborhood Filing No. 5 subdivision.

The proposed development consists of apartments units and the associated subdivision roadways, sidewalks, parking, open space, and landscaping improvements on approximately 30.5 acres.

A Vicinity Map is located in Appendix A for reference.

C. Description of Property

The existing site property covers an area of approximately 30.5 acres in size of undeveloped land, covered mostly by native grasses after having been disturbed previously. The site consists of the old Hancock Expressway alignment aligned through the site in a general north-south direction. Existing asphalt paving still exists along with a high-pressure gas line (150 psi). The design direction for this project has been to maintain the existing grades over the HPG line as closely as possible and propose a layout where the existing HPG is in primarily a new roadway alignment. The intent will be to avoid relocating or having to raise or lower the gas line for the ultimate development.

The site generally slopes in a southwesterly direction with a significant “knob” or hill near the northeast corner of the site near the intersection of Hancock Expressway and S. Union Blvd.

Existing improvements bound the site on the north and east sides along the Hancock Expressway and S. Union Blvd roads mentioned. There are existing utility infrastructure for water, wastewater, gas, electric, and telecommunications. On the west side is also an existing 8-inch sanitary sewer main located within an easement along the west property line. In addition, there is a storm sewer system that was master planned to include this project site including an existing large grate inlet and 72-inch outfall for our site connection. Curb and gutter exists along the Hancock Expressway and S Union Blvd roadways; however, there is no sidewalk adjacent our property site. Those improvements would typically be a part of this property development.

The Spring Creek Southwest Quad consists of 30.5 acres. The Vistas at Spring Creek Filing No. 1 is wholly contained in Spring Creek Southwest Quad and consists of 20.5 acres. Filing 1 is also phase 1 in the report and on the drainage map. Filing 1 consists of one lot. The numbering of future phases may vary depending on the timing of each phase. One of the future phases is intended to be multifamily townhome or townhome like development with multiple 3 and 4 plex units possibly on individual lots or one common lot. Another of the future phases is intended to be a one lot multifamily development consisting of approximately 3 apartment buildings. The other future phase is intended to be a park. This would be one lot and may be privately owned or public. The first plat will consist of 5 lots that correspond to the above-mentioned phases some of which are divided by the main interior private drive.

II. EXISTING DRAINAGE CONDITIONS

A. Existing Studies

The site is located in the Spring Creek Drainage Basin. The Drainage Basin Planning Study (DBPS) is the Spring Creek DBPS, dated October 1993. A MDDP was originally prepared by JR Engineering in August 2001 and subsequently updated numerous times with the latest revision performed in June 2002 for the Spring Creek Master Development. The MDDP divided the study into five sections for reference in its study. This project site is referred to in the JR Engineering MDDP as the “Southwest Quadrant”. This Master Drainage Development Plan (MDDP) and Final Drainage Report (FDR) is in general conformance to the approved JR Engineering MDDP. See reference listing later in this report.

B. Existing Condition

The existing topography for the site generally falls in a southwesterly direction. The grades vary quite a bit and range from gentle 1% slopes to some locations having a 25% (4:1) existing grade. The overall site from the northeast corner to the southwest corner of the property has a change in vertical elevation of approximately 110 feet over the horizontal distance of 4400 feet for an overall average of 2.5% through the site in that direction. The existing site runoff flows to the west toward the existing drainage way, Fountain Creek. The undeveloped land to the west is mature with various native grasses and trees creating a relatively stable landscape with natural water quality treating capabilities.

The project site generally has two locations of off-site runoff entering the site because of the existing roadways on the north and east sides at the project’s highest points. Basin OS1 is associated with Hancock Expressway from the intersection of Union Boulevard to the site entrance. The existing roadway maintains a standard crown and the site grading will be such that the runoff in the curb & gutter will enter the site. Basin OS2 is associated with South Union Boulevard from the intersection of Hancock Expressway to the site entrance. There is an existing curb cut at the site entrance. The existing drainage pattern is for runoff in Union to enter the site via the curb cut. This will be maintained due to the site grading.

As mentioned, the site is currently undeveloped and is generally covered with native grasses. According to the U.S. Department of Agriculture Natural Resources Conservation Service Soil Survey of El Paso County, Colorado the primary soil found is the Schamber-Razor complex for approximately 72% of the site (Soil No. 82). These soils are classified as Soil Conservation Service (SCS) hydrologic soil group “A & C”. The other 28% of the site is covered by Nelson- Tassel fine sandy loams having a hydrologic soil group of “C & D”. Runoff coefficients for this study were selected based on “C/D” type soils. This agrees with the MDDP report which also identified these soil classifications and hydrologic soil groups for the area. A copy of the soil map for the site can be found in the Appendix B.

At some point in time uncontrolled fill was placed on the site. This fill slightly alters the pre-developed drainage pattern; however, the overall pattern remains the same. The site is in an extreme export scenario and the uncontrolled fill will be removed from the site. The geotechnical report has identified areas where this fill has been encountered and it will be addressed during construction.

The overall site itself appears to be relatively encumbered with various utility and easements running through the site, primarily due to the old Hancock Expressway alignment. There are a number of utility structures at the very southerly end of the property, including an existing gas vault. The project developer will seek to work through the various issues to create a viable developable site for the proposed land use.

Basin EA (30.5 acres) (Q_5=18 cfs, Q_{100}=43 cfs) the existing site was considered as one basin with runoffs more or less sheet flowing to the west leaving he site as sheet flow with small random concentrations.

The existing drainage patterns can be observed in Appendix E, Figure H1.

C. Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), the project site is not located within a designated floodplain. The FEMA Flood Insurance Rate Map Number 08041C0741 F, effective Date March 17, 1997 shows the proposed development is located outside the 100-year floodplain. The site lies within Zone X, determined to be outside the 500-year floodplain. The Fountain Creek Floodplain lies approximately 500 to 1000 feet to the west on the far side (west side) of the railroad and Las Vegas Street. A copy of the FIRM map is included for reference in the Appendix A.

III. DRAINAGE BASINS AND SUBBASINS

A. Major Basin and Subbasins

The project site includes one overall major basin with the outfall located within the middle of what is known as the "Southwest Quadrant" in the MDDP. The site is roughly aligned with basins ESW-1 and ESW-4 from the MDDP. The first phase of construction will include an Full Spectrum Detention Basin (FSD) for the site at the south end of the property. All runoff from the project will be conveyed to the south corner of the property and will enter into an existing 72" RCP.

B. Four Step Process

The Four Step Process to minimize the adverse impacts of urbanization is vital component of developing a balanced, sustainable project. Below identifies the approach to the four-step process:

a. Employ Runoff Reduction Practices

This step uses low impact development (LID) practices to reduce runoff at the source. Generally, rather than creating point discharges that are directly connected to impervious areas runoff is routed through pervious areas to promote infiltration. A combination of grass buffers and swales are used around the perimeters of all buildings.

b. Implement BMPs That Provide a Water Quality Capture Volume with Slow Release

This step utilizes formalized water quality capture volume to slow the release of runoff from the site. Both proposed ponds will provide EURV volume for the new development which incorporates a 72-hour release. These ponds will also provide WQCV for the entire tributary area which will release in no less than 40 hours.

c. Stabilize Drainageways

There are no drainageways on this site to stabilize. Drainage basin fees, which will be paid prior to platting, will contribute to stream channel stabilization. In addition the site has implemented FSD through the use of an EDB which will reduce runoff to predevelopment rates. At predevelopment rates no stabilization to downstream drainageways is required.

d. Implement Site Specific and Other Source Control BMPs

Source control BMPs for the residential homeowners include the use of garages as the primary area where pollutants can be stored. The single-family detached homes provide garages which can act as storage areas. The biggest source control BMP is public education which can be found on the City of Colorado Springs website and discuss topics such as: pet waste, car washing, lawn care, fall leaves, and snow melt and deicer. The development will provide pet waste stations which will aide in source control on pet waste from the site.

C. Subbasin Description

The project has been subdivided into sub-basins, as described below. All internal roads and storm sewer inlets, pipes and facilities are private including St. Claire Heights.

The proposed drainage patterns can be observed in Appendix E, Figure PDR1.

All inlets and storm sewer have been sized for the 100-year event. All sump inlets will capture the 100-year event routed to them, while not all Continuous Grade inlets will fully capture the 100-year event. The routing of these bypass flows is accounted for in the narrative and the hydrologic calculations included in the appendices. All proposed storm drain infrastructure (storm sewer pipe, storm sewer manholes, and inlets) are all private.

Basin OS1 (1.05 acres) (Q_5=2.7 cfs, Q_{100}=5.0 cfs) consists of the southern portion of existing Hancock Expressway. Runoff will bypass the site in a cross pan that will be installed across the site entrance drive to allow the runoff to continue southwest along Hancock Expressway to the existing storm drain.

Basin OS2 (1.46 acres) (Q_5=4.1 freacfs, Q_{100}=7.6 cfs) consists of a portion of southbound Union Blvd. Runoff will bypass the site in a cross pan that will be installed across the site entrance drive to allow the runoff to continue southwest along Union Blvd. to the existing storm drain.

Basin A1 (0.19 acres) (Q_5=0.5 cfs, Q_{100}=1.0 cfs) consists of a portion of residential apartments and the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4’ D-10-R Continuous Grade (CG) inlet Design Point (DP) A1. Collected runoff will be piped to the inlet at DP A2. This inlet will capture Q_5=0.5 cfs, Q_{100}=1.0 cfs. This CG inlet will have a flow by of Q_5=0.0 cfs, Q_{100}=0.0 cfs.

Basin A2 (0.37 acres) (Q_5=0.7 cfs, Q_{100}=1.2 cfs) consists of roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4’ D-10-R Continuous Grade inlet DP A2. Collected runoff will be piped to the inlet at DP A3. This inlet will capture Q_5=0.7 cfs, Q_{100}=1.2 cfs. This CG inlet will have a flow by of Q_5=0.0 cfs, Q_{100}=0.0 cfs.

Basin A3 (0.22 acres) (Q_5=0.5 cfs, Q_{100}=0.8 cfs) consists of roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4’ D-10-R Continuous Grade inlet DP A3. Captured runoff will be piped to the inlet at DP A4. This inlet will capture Q_5=0.5 cfs, Q_{100}=0.6 cfs. This CG inlet will have a flow by of Q_5=0.0 cfs, Q_{100}=0.2 cfs.

Basin A4 (0.19 acres) (Q_5=0.8 cfs, Q_{100}=1.5 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4’ D-10-R Continuous Grade inlet DP A4. Captured runoff will be piped to the inlet at DP A5. This inlet will capture Q_5=0.8 cfs, Q_{100}=1.2 cfs. This CG inlet will have a flow by of Q_5=0.0 cfs, Q_{100}=0.3 cfs. The flow by will continue on the surface to DP A5.

Basin A5 (0.35 acres) (Q_5=1.3 cfs, Q_{100}=2.5 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4’ D-10-R Sump inlet DP A5. Captured runoff will be piped to the inlet at DP A6. This sump inlet has no flow by. The emergency overflow is south west overland primarily in street curb and gutter to DP A6.

Basin A6 (1.75 acres) (Q_5=5.3 cfs, Q_{100}=9.5 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4’ D-10-R Sump inlet DP A6. Captured runoff will be piped to the MH at DP A7. This sump inlet has no flow by. The emergency overflow is overland to the south west toward the adjacent CSU easement.

Basin C1 (1.45 acres) (Q_5=5.7 cfs, Q_{100}=10.7 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed gutter inlet DP C1. Captured runoff will be piped to the inlet at DP C2. This inlet will capture Q_5=2.1 cfs, Q_{100}=2.9 cfs. This CG inlet will have a flow by of Q_5=3.4 cfs, Q_{100}=7.8 cfs. The flow by will continue on the surface to DP C2.

Basin C2 (1.65 acres) (Q_5=4.2 cfs, Q_{100}=8.0 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4’ D-10-R Sump inlet DP C1. Captured runoff will be piped to the inlet at MH A7. This sump inlet has no flow by. The emergency overflow is overland to the south west toward the adjacent CSU easement.

Basin D1 (0.62 acres) (Q_5=2.3 cfs, Q_{100}=4.3 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4’ D-10-R Sump inlet DP D1. Captured runoff will be piped to DP A9. This sump inlet has no flow by. The emergency overflow is overland to the south west toward the adjacent CSU easement.

Basin E1 (3.38 acres) (Q_5=6.3 cfs, Q_{100}=13 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 8' D-10-R Continuous Grade inlet DP E1. Captured runoff will be piped to the inlet at DP E2. This inlet will capture Q_5=4.3 cfs, Q_{100}=7.7 cfs. This CG inlet will have a flow by of Q_5=2.0 cfs, Q_{100}=5.0 cfs. The flow by will continue on the surface to DP E3.

Basin E2 (0.37 acres) (Q_5=0.8 cfs, Q_{100}=1.7 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4' D-10-R Continuous Grade inlet DP E2. Captured runoff will be piped to the inlet at DP E3. This inlet will capture Q_5=0.8 cfs, Q_{100}=1.3 cfs. This CG inlet will have a flow by of Q_5=0.0 cfs, Q_{100}=0.4 cfs. The flow by will continue on the surface to DP E3.

Basin E3 (0.54 acres) (Q_5=1.3 cfs, Q_{100}=2.4 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4' D-10-R sump inlet DP E3. Captured runoff will be piped to the inlet at DP E4. This sump inlet has no flow by. The emergency overflow is south west overland in street curb and gutter to DP E5.

Basin E4 (0.55 acres) (Q_5= 1.8 cfs, Q_{100}=3.5 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4' D-10-R sump inlet DP E4. Captured runoff will be piped to DP E5. This sump inlet has no flow by. The emergency overflow is south west overland in street curb and gutter to DP E5.

Basin E5 (2.15 acres) (Q_5= 5.2 cfs, Q_{100}=9.5 cfs) will consist of residential apartments, the adjacent roads and landscaping when the site is fully developed. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4' D-10-R sump inlet DP E5. Captured runoff will be piped to DP A9. This sump inlet has no flow by. The emergency overflow is overland to the south west toward the adjacent CSU easement.

Basin F1 (4.69 acres) (Q_5=5.8 cfs, Q_{100}=13 cfs) consists of open space park, parking, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 10' D-10-R Continuous Grade inlet DP F1. Captured runoff will be piped to the inlet at DP E4. This inlet will capture Q_5=4.4 cfs, Q_{100}=8.0 cfs. This CG inlet will have a flow by of Q_5=1.5 cfs, Q_{100}=4.7 cfs. The flow by will continue on the surface to DP E4.

Basin F2 (0.64 acres) (Q_5=2.0 cfs, Q_{100}=3.5 cfs) consists of residential apartments, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4' D-10-R Continuous Grade inlet DP F2. Captured runoff will be piped to the inlet at DP E4. This inlet will capture Q_5=1.5 cfs, Q_{100}=2.2 cfs. This CG inlet will have a flow by of Q_5=0.5 cfs, Q_{100}=1.4 cfs. The flow by will continue on the surface to DP E4.

Basin G1 (3.25 acres) (Q_5= 6.8 cfs, Q_{100}=13 cfs) will consist of residential apartments, the adjacent roads and landscaping when the site is fully developed. The basin storm water runoff is sheet and concentrated flows collected in a proposed 4' D-10-R sump inlet DP G1. Captured runoff will be piped to DP A10. This sump inlet has no flow by. The emergency overflow is overland to the south toward the onsite FSD.

Basin H1 (0.53 acres) (Q_5= 0.7 cfs, Q_{100}=1.8 cfs) will consist of landscaping. The basin storm water runoff sheet flows offsite to design point H1.

Basin H2 (2.32 acres) (Q_5= 4.0 cfs, Q_{100}=9.4 cfs) will consist of landscaping. The basin storm water runoff sheet flows offsite to design point H2.

Basin H3 (0.52 acres) (Q_5= 0.7 cfs, Q_{100}=1.9 cfs) will consist of landscaping. The basin storm water runoff sheet flows offsite to design point H3.

Basin H4 (1.66 acres) (Q_5= 2.0 cfs, Q_{100}=4.9 cfs) will consist of landscaping. The basin storm water runoff sheet flows offsite to design point H4.

Basin P1 (1.96 acres) (Q_5=4.2 cfs, Q_{100}=8.6 cfs) will consists of residential apartments, parking lot, open space, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in a proposed Culvert inlet DP P1. Captured runoff will be piped to the EDB DP A11. This sump inlet has no flow by. The emergency overflow for this inlet is south in the street to DP G1

Basin P2 (1.81 acres) (Q_5=2.1 cfs, Q_{100}=5.2 cfs) consists of the FSD EDB, the adjacent roads and landscaping. The basin storm water runoff is sheet and concentrated flows collected in DP A11.

Design Point 60 (DP A11) (located at the FSD EDB) receives 21 cfs in the minor storm and 55 cfs in the major storm. The EDB will have a maximum release of Q_5=8.1 cfs, Q_{100}= 30.9 cfs which is less than the pre-developed release rate (Q_5=18 cfs, Q_{100}=43 cfs) from the site.

IV. DRAINAGE DESIGN CRITERIA

A. Development Criteria Reference

The site has been studied by the Master Development Drainage Plan for Spring Creek Development, dated June 2002, by JR Engineering. This report identifies proposed drainage patterns for the site. It identifies the future outfall for the site at the southern corner of the property. This outfall will be into an existing 72” RCP. The storm infrastructure for the all phases will be constructed with phase 1 or filing 1. The basins in phase 2 & 3 will have significantly less runoff until the phases are developed. The report was written for the fully developed condition. The FSD EDB for the full build out will be installed with phase 1. The basins ESW-1 and ESW-4 in the JR MDDP cover the pre-developed pattern well for the site and will be used for the pre-developed analysis.

This report has been prepared in accordance to the criteria set forth in the City of Colorado Springs Drainage Criteria Manual (DCM) Volumes 1 and 2.

B. Hydrologic Criteria

For this report the rational method was utilized to determine runoff from the site. The minor storm is defined as being the 5-year event and the major storm is defined as being the 100-year event. The one-hour point rainfall value for them minor storm is 1.50 inches and the one-hour point rainfall value for the major storm is 2.52 inches. Runoff coefficients and percent impervious values utilized are in conformance with Table 6-6 from the DCM.

The full spectrum detention method (FSD) was used to size the proposed water quality/detention ponds. This method attributes two design volumes; one being the Excess Urban Runoff Volume (EURV) and the other being the 100-year detention volume. This approach includes the Water Quality Capture Volume

(WQCV) with the EURV; therefore, no additional volume for the WQCV is required. The latest UD-Detention spreadsheet from UDFCD was utilized (see appendix). Outlet structure design will be provided with final drainage reports and the drain time will be verified using the State's SDI spreadsheet.

The outlet structure has been designed with two stages. The first stage is through an orifice plate on the face of the outlet structure. This orifice plate has been designed with three holes to release the EURV volume in 72 hours. The provided EURV volume is 1.303 acre feet. The second stage of the pond is controlled by the outlet pipe of the outlet structure. A standard 24" pipe is sufficient to control the 100-year release from the pond without needing a restrictor plate. The 100-year volume provided is 2.445 acre feet. The 100-year release is 35.3 cfs which is less than the 43 cfs release from the site in the predeveloped conditions. All calculations for the pond are included in the appendices of this report.

V. DRAINAGE FACILITY DESIGN

A. General Concept

The proposed drainage system design is to safely convey the storm runoff generated from the proposed development. Based on the overall planning for this area, the MDDP has provided a discharge location on the south side of the project property.

The majority of the runoff will flow via the on-site private streets (including St. Claire Hts) and associated private storm pipe system. As this is a proposed higher density TND project, we expect a greater degree of imperviousness on the north portion of the site where the apartments and parking lots cover a large portion of the site area. It is anticipated that phase 2 of the property will consist of multi- family residential. Phase 2 is the south half of the property.

Phase 1 will include a water quality & full spectrum detention EDB and it will be located at the south end of the property and will connect into the existing 72" RCP that was designed to convey undetained flows from the property. This FSD EDB will reduce developed flows to pre-developed rates and will discharge them back to pre-developed patterns.

Ultimately, the developed flows are carried to Fountain Creek to the west of the project and across the FMIC ditch, railroad, and west of Las Vegas Street.

A final drainage report will be required for phase 2 the multifamily development to the south of phase 1. That report may require the modification of the storm sewer system outlined in this report.

B. Specific Details

The on-site roadways are private as well as the various utility infrastructure. At this stage of the project, it is proposed that the storm system will be private. The FSD EDB will also be a private system

The proposed storm drain system consists of catch basins, storm drain manholes, storm drain pipes ranging from 8" to 36", and outlets. StormCAD V8i by Bentley software was used to evaluate the hydraulic grade line (HGL) throughout the storm drain system. The HGL calculation criteria used HEC-22 Energy Method. All of the HGL water surface tables are located in Appendix C. Bend losses at the manholes/junctions were determined by using the bend loss coefficients as shown on Table 9-4 in the DCM. See Appendix C for the StormCAD output.

The proposed pond will be designed as a Full Spectrum Detention EDB the UDFCD FSD criteria. From the outlet structure of the pond a proposed public 24” HDPE pipe will convey flows to an existing public 72” storm sewer south of the FSD EDB. The FSD EDB will be sized to release at or below pre-developed runoff values for the site. The 100-year release from the FSD EDB is 35.3 cfs while the pre-developed 100-yr flow is 43 cfs. The riprap calculations for the two storm sewer outlets into the pond, the forebay weir sizing, along with the ponds emergency overflow weir are provided in Appendix D. The riprap calculations recommend minimum D50 sizes for the two rundowns of 3.4” and 9.9”. The D50 for Type L 9”. Since both of the rundowns are grouted Type L, the riprap will be sufficient.

C. Drainage Basin Fees

The project is located within the Spring Creek Drainage Basin. The “Drainage, Bridge, and Pond Fees-City of Colorado Springs”, effective January 2018 table identifies the following fees associated with the basin. These fees have been applied and summarized here for this 30.5-acre site.

Basin: Spring Creek
Effective January 2018

Basin Fees-2015	Total Area (Acres)	Basin Fee (per Acre)	Total Cost Basin Fee
Drainage Fee	30.5	$ 9,943	$ 303,261
Bridge Fee	30.5	$ -	$ -
Pond Fee-Land	30.5	$ -	$ -
Pond Fee-Facility	30.5	$ -	$ -
Total			$ 303,261

Fees are due prior to plat recording.

D. Construction Cost Estimate

Items are private. All items are non-reimbursable.

Description	***Qty***	***Unit***	***Price***		***Cost***
18” R.C.P.	1,200	L.F.	$ 35	/LF	$ 42,000
24" R.C.P.	400	L.F.	$ 40	/LF	$ 16,000
30" R.C.P.	300	L.F.	$ 45	/LF	$ 13,500
36" R.C.P.	200	L.F.	$ 55	/LF	$ 11,000
JUNC - MANHOLE	13	EACH	$ 3,200	/EA	$ 41,600
4' D-10-R Inlet	12	EACH	$ 3,000	/EA	$ 36,000
10' D-10-R Inlet	3	EACH	$ 4,200	/EA	$ 12,600
engineering contingency	10%				$ 17,270
Grand Total					$ 189,970

Galloway cannot and does not guarantee that the construction cost will not vary from these opinions of probably construction costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular.

VI. CONCLUSIONS

The overall drainage design concepts adhere to the Spring Creek DBPS and the approved MDDP for the Spring Creek Master Plan Development. The methodologies and drainage criteria used in the overall drainage design meet the current City DCM requirements. Runoff from the Vistas at Spring Creek Filing No. 1 development will not adversely affect any adjacent and/or downstream developments, irrigation ditches and/or property owners.

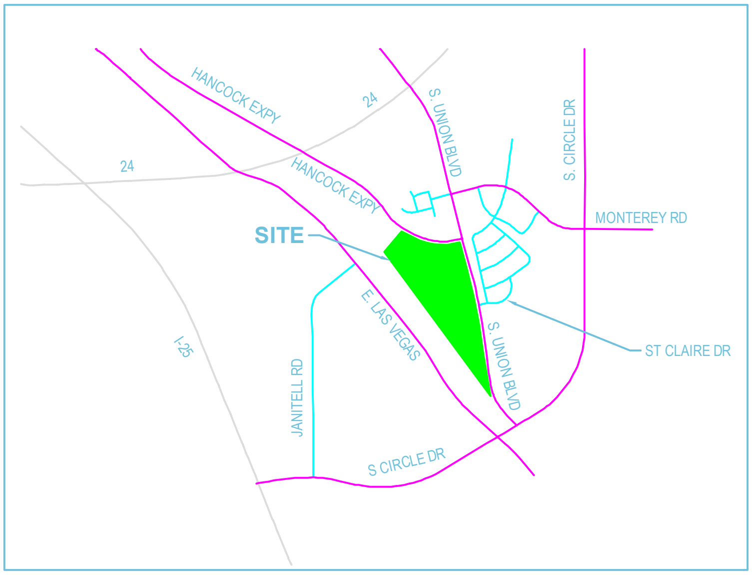
A final drainage report will be required for phase 2 the multifamily development to the south of the phase 1 development.

VII. REFERENCES

1. *Drainage Criteria Manual Volumes 1 & 2,* City of Colorado Springs, most recent version.
2. *Urban Storm Drainage and Criteria Manual*, Urban Drainage and Flood Control District, most recent version.
3. *Master Development Drainage Plan for Spring Creek Development (Spring Creek and Miscellaneous Drainage Basins)*, Latest Revision June 2002, by JR Engineering.
4. *Spring Creek Drainage Basin Planning Study*, October 1993, by URS Consultants.

Appendix A

Figure and Exhibits

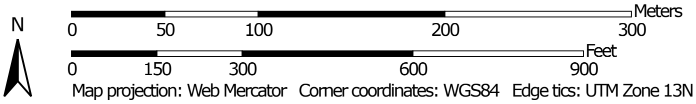


VICINITY MAP

1"=2000'

Soil Map—El Paso County Area, Colorado
(Spring Creek)

Map Scale: 1:4,050 if printed on A portrait (8.5" x 11") sheet.



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

MAP LEGEND

Area of Interest (AOI)

- ▭ Area of Interest (AOI)

Soils

- ▭ Soil Map Unit Polygons
- 〰 Soil Map Unit Lines
- ■ Soil Map Unit Points

Special Point Features

- ◉ Blowout
- ⊠ Borrow Pit
- ✱ Clay Spot
- ◇ Closed Depression
- ✕ Gravel Pit
- ∴ Gravelly Spot
- ● Landfill
- ⋀ Lava Flow
- ⩛ Marsh or swamp
- ⚒ Mine or Quarry
- ◎ Miscellaneous Water
- ○ Perennial Water
- ∨ Rock Outcrop
- + Saline Spot
- ∷ Sandy Spot
- ⊖ Severely Eroded Spot
- ◇ Sinkhole
- ⋗ Slide or Slip
- ⌀ Sodic Spot
- ≡ Spoil Area
- ◊ Stony Spot
- ◊◊ Very Stony Spot
- ♆ Wet Spot
- △ Other
- ⁃ Special Line Features

Water Features

- 〰 Streams and Canals

Transportation

- ┼┼┼ Rails
- 🟥 Interstate Highways
- 🟧 US Routes
- 🟨 Major Roads
- ⬜ Local Roads

Background

- 🟩 Aerial Photography

MAP INFORMATION

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

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: http://websoilsurvey.nrcs.usda.gov
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 10, Dec 23, 2013

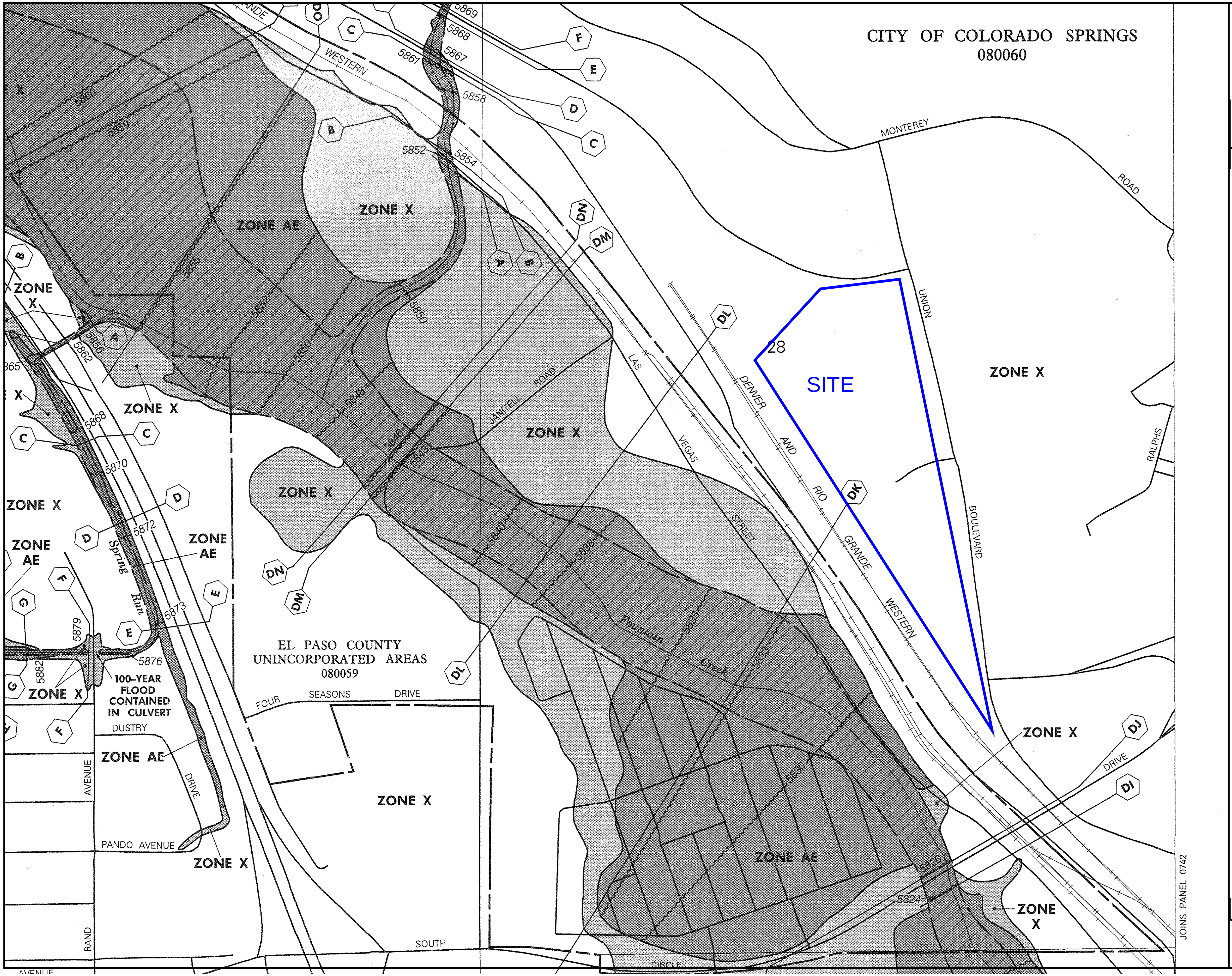
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

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

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	7.6	28.4%
82	Schamber-Razor complex, 8 to 50 percent slopes	19.3	71.6%
Totals for Area of Interest		**26.9**	**100.0%**



APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS

PANEL 741 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0741	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0741	F

MAP NUMBER
08041C0741 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

Appendix B

Hydrologic Calculations

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Area Runoff Coefficient Summary - EXISTING

			DEVELOPED			UNDEVELOPED			WEIGHTED	
BASIN	**TOTAL AREA**		**AREA**	**C_5**	**C_{100}**	**AREA**	**C_5**	**C_{100}**	**C_5**	**C_{100}**
	(SF)	***(Acres)***	***(Acres)***			***(Acres)***				
EX-1		2.2		0.90	0.95	2.2	0.30	0.45	***0.30***	***0.45***
EX-2		23.6		0.90	0.95	23.6	0.30	0.45	***0.30***	***0.45***
EX-3		5.6		0.90	0.95	5.6	0.30	0.45	***0.30***	***0.45***

Calculated by: GAH
Date: 2/2/2018
Checked by: SMB

Spring Creek Southwest Quad - MDDP
Vistas at Spring Creek Filing No 1 - Final Drainage Report
Area Drainage Summary - EXISTING

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*					*T_t*	*CA*		*INTENSITY*		*TOTAL FLOW*	
BASIN	***AREA TOTAL***	***C_5***	***C_{100}***	***C_5***	***Length***	***Height***	***T_C***	***Grass/ Paved***	***Length***	***Slope***	***Velocity***	***T_t***	***TOTAL***	***CA_5***	***CA_{100}***	***I_5***	***I_{100}***	***Q_5***	***Q_{100}***
	(Acres)	*** For Calcs See Runoff Summary**			***(ft)***	***(ft)***	***(min)***		***(ft)***	***(%)***	***(fps)***	***(min)***	***(min)***			***(in/hr)***	***(in/hr)***	***(c.f.s.)***	***(c.f.s.)***
EX-1	2.2	0.30	0.45	0.15	221	35	10.6	Paved	706	2.5%	1.5	8.1	18.7	0.66	0.99	3.1	5.3	***2***	***5***
EX-2	31.5	0.30	0.45	0.15	300	80	10.4	Grass	1638	1.7%	1.3	20.8	31.2	9.45	14.18	2.4	4.0	***23***	***56***
EX-3	5.6	0.30	0.45	0.15	300	25	15.3	Grass	174	6.9%	1.4	2.0	17.3	1.68	2.52	3.3	5.5	***5***	***14***

Calculated by: GAH
Date: 2/2/2018
Checked by: SMB

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Area Runoff Coefficient Summary - PROPOSED

		DEVELOPED			*UNDEVELOPED*			*WEIGHTED*	
BASIN	*TOTAL AREA*	*AREA*	C_{5}	C_{100}	*AREA*	C_{5}	C_{100}	C_{5}	C_{100}
	(Acres)	*(Acres)*			*(Acres)*				
A1	0.19	0.08	0.90	0.95	0.11	0.30	0.45	***0.54***	***0.65***
A2	0.37	0.07	0.90	0.95	0.30	0.30	0.45	***0.42***	***0.55***
A3	0.22	0.06	0.90	0.95	0.17	0.30	0.45	***0.45***	***0.58***
A4	0.19	0.16	0.90	0.95	0.03	0.30	0.45	***0.81***	***0.88***
A5	0.35	0.30	0.90	0.95	0.05	0.30	0.45	***0.81***	***0.88***
A6	1.75	1.66	0.90	0.95	0.09	0.30	0.45	***0.87***	***0.93***
C1	1.45	1.38	0.90	0.95	0.07	0.30	0.45	***0.87***	***0.93***
C2	1.65	1.16	0.90	0.95	0.50	0.30	0.45	***0.72***	***0.80***
D1	0.62	0.59	0.90	0.95	0.03	0.30	0.45	***0.87***	***0.93***
E1	3.38	1.52	0.90	0.95	1.86	0.30	0.45	***0.57***	***0.68***
E2	0.37	0.19	0.90	0.95	0.19	0.30	0.45	***0.60***	***0.70***
E3	0.54	0.32	0.90	0.95	0.22	0.30	0.45	***0.66***	***0.75***
E4	0.55	0.47	0.90	0.95	0.08	0.30	0.45	***0.81***	***0.88***
E5	2.15	1.72	0.90	0.95	0.43	0.30	0.45	***0.78***	***0.85***
F1	4.69	0.94	0.90	0.95	3.75	0.30	0.45	***0.42***	***0.55***
F2	0.64	0.64	0.90	0.95	0.00	0.30	0.45	***0.90***	***0.95***
G1	3.25	1.79	0.90	0.95	1.46	0.30	0.45	***0.63***	***0.73***
H1	0.53	0.03	0.90	0.95	0.50	0.30	0.45	***0.33***	***0.48***
H2	2.32	0.35	0.90	0.95	1.97	0.30	0.45	***0.39***	***0.53***
H3	0.52	0.03	0.90	0.95	0.49	0.30	0.45	***0.33***	***0.48***
H4	2.16	0.11	0.90	0.95	2.05	0.30	0.45	***0.33***	***0.48***
OS1	1.05	0.89	0.90	0.95	0.16	0.30	0.45	***0.81***	***0.88***
OS2	1.46	1.24	0.90	0.95	0.22	0.30	0.45	***0.81***	***0.88***
P1	1.96	0.59	0.90	0.95	1.37	0.30	0.45	***0.48***	***0.60***
P2	1.81	0.09	0.90	0.95	1.72	0.30	0.45	***0.33***	***0.48***

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Area Runoff Coefficient Summary - PROPOSED

		DEVELOPED			***UNDEVELOPED***			***WEIGHTED***	
BASIN	***TOTAL AREA***	***AREA***	***C_5***	***C_{100}***	***AREA***	***C_5***	***C_{100}***	***C_5***	***C_{100}***
	(Acres)	***(Acres)***			***(Acres)***				
% Impervious									
A1	0.19	0.08	100%		0.11	0%			40%
A2	0.37	0.07	100%		0.30	0%			20%
A3	0.22	0.06	100%		0.17	0%			25%
A4	0.19	0.16	100%		0.03	0%			85%
A5	0.35	0.30	100%		0.05	0%			85%
A6	1.75	1.66	100%		0.09	0%			95%
C1	1.45	1.38	100%		0.07	0%			95%
C2	1.65	1.16	100%		0.50	0%			70%
D1	0.62	0.59	100%		0.03	0%			95%
E1	3.38	1.52	100%		1.86	0%			45%
E2	0.37	0.19	100%		0.19	0%			50%
E3	0.54	0.32	100%		0.22	0%			60%
E4	0.55	0.47	100%		0.08	0%			85%
E5	2.15	1.72	100%		0.43	0%			80%
F1	4.69	0.94	100%		3.75	0%			20%
F2	0.64	0.64	100%		0.00	0%			100%
G1	3.25	1.79	100%		1.46	0%			55%
H1	0.53	0.03	100%		0.50	0%			5%
H2	2.32	0.35	100%		1.97	0%			15%
H3	0.52	0.03	100%		0.49	0%			5%
H4	2.16	0.11	100%		2.05	0%			5%
OS1	1.05	0.89	100%		0.16	0%			85%
OS2	1.46	1.24	100%		0.22	0%			85%
P1	1.96	0.59	100%		1.37	0%			30%
P2	1.81	0.09	100%		1.72	0%			5%
	34.2								**48%**

Total Percent Impervious for site: **48%**

Calculated by: RCG
Date: 2/16/2018
Checked by: TAC

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Area Drainage Summary - PROPOSED

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*					*T_t*	*CA*		*INTENSITY*		*TOTAL FLOW*	
BASIN	***AREA TOTAL***	***C_5***	***C_{100}***	***C_5***	***Length***	***Height***	***T_C***	***Grass/ Paved***	***Length***	***Slope***	***Velocity***	***T_t***	***TOTAL***	***CA_5***	***CA_{100}***	***I_5***	***I_{100}***	***Q_5***	***Q_{100}***
	(Acres)	**** For Calcs See Runoff Summary***			***(ft)***	***(ft)***	***(min)***		***(ft)***	***(%)***	***(fps)***	***(min)***	***(min)***			***(in/hr)***	***(in/hr)***	***(c.f.s.)***	***(c.f.s.)***
A1	***0.19***	0.54	0.65	0.25	30	1	5.9 0.0 0.0	Paved	200	8.0%	1.6	2.1 0.0 0.0	8.0	0.10	0.12	4.4	7.7	***0.5***	***1.0***
A2	***0.37***	0.42	0.55 0.00	0.25	50	10	4.2 0.0 0.0	Grass Paved	100 190	33.0% 8.0%	1.8 1.6	0.9 2.0 0.0	7.1	0.16	0.20	4.5	8.1	***0.7***	***1.6***
A3	***0.22***	0.45	0.43 0.00	0.25	50	5	5.3 0.0 0.0	Grass Paved	50 100	33.0% 7.0%	1.8 1.6	0.5 1.1 0.0	6.8	0.10	0.09	4.6	8.2	***0.5***	***0.8***
A4	***0.19***	0.81	0.88	0.25	10	1	2.4 0.0 0.0	Grass	170	7.5%	1.5	1.9 0.0 0.0	5.0 MIN 5 USE	0.15	0.17	5.0	9.1	***0.8***	***1.5***
A5	***0.35***	0.81	0.88	0.25	50	10	4.2 0.0 0.0	Grass Paved	50 200	2.0% 2.0%	1.3 1.4	0.6 2.3 0.0	7.1	0.28	0.31	4.5	8.1	***1.3***	***2.5***
A6	***1.75***	0.87	0.93	0.25	50	1	8.9 0.0 0.0	Grass Paved	50 460	2.0% 1.5%	1.3 1.4	0.6 5.4 0.0	15.0	1.52	1.62	3.5	5.9	***5.3***	***9.5***
C1	***1.45***	0.87	0.93	0.25	10	1	2.4 0.0 0.0	Grass Paved	70 350	2.5% 2.0%	1.3 1.4	0.9 4.0 0.0	7.3	1.26	1.34	4.5	8.0	***5.7***	***10.7***
C2	***1.65***	0.72	0.80	0.25	25	6	2.8 0.0 0.0	Grass Paved	70 900	2.5% 1.5%	1.3 1.4	0.9 10.5 0.0	14.2	1.19	1.32	3.6	6.0	***4.2***	***8.0***
D1	***0.62***	0.87	0.93	0.25	25	1	5.0 0.0 0.0	Paved	300	2.0%	1.4	3.5 0.0 0.0	8.5	0.54	0.57	4.3	7.6	***2.3***	***4.3***
E1	***3.38***	0.57	0.68	0.25	35	1	6.7 0.0 0.0	Grass Grass Paved	140 100 640	0.6% 13.6% 2.1%	1.3 1.5 1.4	1.9 1.1 7.4	17.0	1.93	2.28	3.3	5.5	***6.3***	***13***

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Area Drainage Summary - PROPOSED

		WEIGHTED		OVERLAND				STREET / CHANNEL FLOW					T_t	CA		INTENSITY		TOTAL FLOW	
BASIN	AREA TOTAL	C_5	C_{100}	C_5	Length	Height	T_C	Grass/ Paved	Length	Slope	Velocity	T_t	TOTAL	CA_5	CA_{100}	I_5	I_{100}	Q_5	Q_{100}
	(Acres)	* For Calcs See Runoff Summary			(ft)	(ft)	(min)		(ft)	(%)	(fps)	(min)	(min)			(in/hr)	(in/hr)	(c.f.s.)	(c.f.s.)
E2	***0.37***	0.60	0.70	0.25	44	1	8.0 0.0 0.0	Paved	330	1.5%	1.4	3.9 0.0 0.0	11.9	0.22	0.26	3.8	6.6	***0.8***	***1.7***
E3	***0.54***	0.66	0.75	0.25	70	1	11.8 0.0 0.0	Grass Paved	115 120	12.0% 2.0%	1.5 1.4	1.3 1.4 0.0	14.5	0.36	0.41	3.5	6.0	***1.3***	***2.4***
E4	***0.55***	0.81	0.88	0.25	50	3	6.2 0.0 0.0	Grass Paved	80 225	2.5% 5.0%	1.3 1.5	1.0 2.5 0.0	9.7	0.45	0.48	4.1	7.2	***1.8***	***3.5***
E5	***2.15***	0.78	0.85	0.25	100	3	11.1 0.0 0.0	Grass Grass	15 620	1.5% 1.5%	1.3 1.3	0.2 7.9 0.0	19.2	1.68	1.83	3.1	5.2	***5.2***	***9.5***
F1	***4.69***	0.42	0.55	0.25	100	3	11.1 0.0 0.0	Grass Grass Paved	200 275 400	3.0% 10.0% 2.5%	1.4 1.5 1.5	2.5 3.1 4.6	21.2	1.97	2.58	3.0	4.9	***5.8***	***13***
F2	***0.64***	0.90	0.95	0.25	10	1	2.4 0.0 0.0	Paved	1155	2.5%	1.5	13.2 0.0 0.0	15.6	0.58	0.61	3.4	5.8	***2.0***	***3.5***
G1	***3.25***	0.63	0.73	0.25	50	2	7.1 0.0 0.0	Grass Paved	50 780	4.0% 2.5%	1.4 1.5	0.6 8.9 0.0	16.6	2.05	2.36	3.3	5.6	***6.8***	***13***
H1	***0.53***	0.33	0.48	0.25	75	10	5.9 0.0 0.0	Grass	320	15.0%	1.6	3.4 0.0 0.0	9.3	0.17	0.25	4.2	7.3	***0.7***	***1.8***
H2	***2.32***	0.39	0.53	0.25	95	10	7.1 0.0 0.0	Grass	85	20.0%	1.6	0.9 0.0 0.0	8.0	0.90	1.22	4.4	7.7	***4.0***	***9.4***
H3	***0.52***	0.33	0.48	0.25	95	10	7.1 0.0 0.0	Grass	130	13.0%	1.5	1.4 0.0 0.0	8.5	0.17	0.25	4.3	7.5	***0.7***	***1.9***

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Area Drainage Summary - PROPOSED

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*					*T_t*	*CA*		*INTENSITY*		*TOTAL FLOW*	
BASIN	*AREA TOTAL (Acres)*	*C_5*	*C_{100}*	*C_5*	*Length (ft)*	*Height (ft)*	*T_C (min)*	*Grass/ Paved*	*Length (ft)*	*Slope (%)*	*Velocity (fps)*	*T_t (min)*	*TOTAL (min)*	*CA_5*	*CA_{100}*	*I_5 (in/hr)*	*I_{100} (in/hr)*	*Q_5 (c.f.s.)*	*Q_{100} (c.f.s.)*
		** For Calcs See Runoff Summary*																	
H4	***2.16***	0.33	0.48	0.25	100	3	11.1 0.0 0.0	Grass	180	5.0%	1.4	2.1 0.0 0.0	13.2	0.71	1.03	3.7	6.3	***2.6***	***6.4***
OS1	***1.05***	0.81	0.88	0.25	50	1	8.9 0.0 0.0	Paved	800	4.0%	1.5	8.9 0.0 0.0	17.8	0.85	0.92	3.2	5.4	***2.7***	***5.0***
OS2	***1.46***	0.81	0.88	0.25	20	1	4.2 0.0 0.0	Paved	965	4.0%	1.5	10.7 0.0 0.0	14.9	1.18	1.28	3.5	5.9	***4.1***	***7.6***
P1	***1.96***	0.48	0.60	0.25	50	1	8.9 0.0 0.0	Grass Grass	95 500	11.0% 2.0%	1.5 1.3	1.0 6.3 0.0	16.3	0.94	1.18	3.3	5.7	***3.1***	***6.7***
P2	***1.81***	0.33	0.48	0.25	100	3	11.1 0.0 0.0	Grass Grass	50 210	11.0% 1.2%	1.5 1.3	0.6 2.7 0.0	14.3	0.60	0.86	3.5	6.0	***2.1***	***5.2***

Calculated by: RCG
Date: 2/12/2018
Checked by: TAC

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Surface Routing Summary

Design Points	***Contributing Basins & Design Points***				***STREET / CHANNEL FLOW***				***T_t***	***INTENSITY***		***FLOW***	
		Equivalent CA_5	***Equivalent CA_{100}***	***Maximum T_C***	***Length (ft)***	***Slope (%)***	***Velocity (fps)***	***T_t (min)***	***TOTAL (min)***	***I_5***	***I_{100}***	***Q_5***	***Q_{100}***
A1	**A1**	0.10	0.12	8.0					8.0				
		0.10	0.12						8.0	4.4	7.7	***0.5***	***1.0***
A2	**A2**	0.16	0.20	7.1					7.1				
		0.16	0.15						7.1	4.5	8.1	***0.7***	***1.2***
A3	**A3**	0.10	0.09	6.8					6.8				
		0.10	0.09						6.8	4.6	8.2	***0.5***	***0.8***
A4	**A4**	0.15	0.17	5.0					5.0				
		0.15	0.17						5.0	5.0	9.1	***0.8***	***1.5***
A5	**A5**	0.28	0.31	7.1					7.1				
	FB-A3	0.00	0.02	6.8	160	4.0%	4.0	0.7					
	FB-A4	0.00	0.04	5.0	150	4.0%	4.0	0.6					
		0.28	0.37						7.1	4.5	8.1	***1.3***	***3.0***
A6	**A6**	1.52	1.62	15.0					15.0				
		1.52	1.62						15.0	3.5	5.9	***5.3***	***9.5***
A11	**A10**	15.68	17.76	23.6					23.6				
	P1	0.94	1.18	16.3	150	1.0%	2.0	1.3	17.5				
	P2	0.60	0.86	14.3					14.3				
		17.22	19.80						23.6	2.8	4.7	***48***	***92***
C1	**C1**	1.23	1.34	7.3					7.3				
		1.23	1.34						7.3	4.5	8.0	***5.6***	***11***
C2	**C2**	1.19	1.32	14.2					14.2				
	FB-A1	0.00	0.00	8.0	910	3.0%	3.5	4.4					
	FB-A2	0.00	0.00	7.1	920	3.0%	3.5	4.4					
	FB-C1	0.76	0.98	7.3	135	1.5%	2.4	0.9	8.2				
		1.95	2.30						14.2	3.6	6.0	***6.9***	***14***

Design Points	***Contributing Basins & Design Points***	***Equivalent CA_5***	***Equivalent CA_{100}***	***Maximum T_C***	***STREET / CHANNEL FLOW***				***T_t***	***INTENSITY***		***FLOW***	
					Length (ft)	***Slope (%)***	***Velocity (fps)***	***T_t (min)***	***TOTAL (min)***	***I_5***	***I_{100}***	***Q_5***	***Q_{100}***
D1	**D1**	0.54	0.57	8.5					8.5				
		0.54	0.57						8.5	4.3	7.6	***2.3***	***4.3***
E1	**E1**	1.93	2.28	17.0					17.0				
		1.93	2.28						17.0	3.3	5.5	***6.3***	***12.6***
E2	**E2**	0.22	0.26	11.9					11.9				
		0.22	0.26						11.9	3.8	6.6	***0.8***	***1.7***
E3	**E3**	0.36	0.41	14.5					14.5				
	FB-E1	0.60	0.90	17.0	105	1.5%	2.4	0.7	17.7				
	FB-E2	0.00	0.06	11.9	95	2.0%	2.8	0.6	12.5				
		0.96	1.36						17.7	3.2	5.4	***3.1***	***7.4***
E4	**E4**	0.45	0.48	9.7					9.7				
	OS2	1.18	1.28	14.9	500	3.0%	3.5	2.4	17.3				
	FB-F1	0.50	0.95	21.2	220	3.0%	3.5	1.1	22.2				
	FB-F2	0.14	0.23	15.6	215	3.0%	3.5	1.0	16.6				
		2.27	2.94						22.2	2.9	4.8	***6.6***	***14.2***
E5	**E5**	1.68	1.83	19.2					19.2				
		1.68	1.83						19.2	3.1	5.2	***5.2***	***9.5***
F1	**F1**	1.97	2.58	21.2					21.2				
		1.97	2.58						21.2	3.0	4.9	***5.8***	***12.7***
F2	**F2**	0.58	0.61	15.6					15.6				
		0.58	0.61						15.6	3.4	5.8	***2.0***	***3.5***
G1	**G1**	2.05	2.36	16.6					16.6				
		2.05	2.36						16.6	3.3	5.6	***6.8***	***13.2***
P1	**P1**	0.94	1.18	16.3					16.3				
		0.94	1.18						16.3	3.3	5.7	***3.1***	***6.7***

Calculated by: RCG
Date: 2/12/2018
Checked by: TAC

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Pipe Routing Summary

Design Points	*Contributing Design Points*	*Equivalent* CA_5	*Equivalent* CA_{100}	*Maximum* T_C	*STREET / CHANNEL FLOW* *Length (ft)*	*Slope (%)*	*Velocity (fps)*	T_t *(min)*	T_t *TOTAL (min)*	*INTENSITY* I_5	I_{100}	*FLOW* Q_5	Q_{100}
A1	**A1**	0.10	0.12	8.0					8.0				
									0.0				
		0.10	0.12						8.0	4.4	7.7	***0.5***	***1.0***
A2	**A2**	0.16	0.15	7.1					7.1				
	A1	0.10	0.12	8.0	30	0.5%	2.9	0.2	8.2				
		0.26	0.25						8.2	4.3	7.7	***1.1***	***1.9***
A3	**A3**	0.10	0.09	6.8					6.8				
	A2	0.26	0.25	8.2	71	0.5%	3.5	0.3	8.5				
		0.36	0.34						8.5	4.3	7.5	***1.5***	***2.6***
A4	**A4**	0.15	0.13	5.0					5.0				
	A3	0.36	0.34	8.5	36	1.0%	3.8	0.2	8.7				
		0.51	0.47						8.7	4.3	7.5	***2.2***	***3.5***
A5	**A5**	0.28	0.37	7.1					7.1				
	A4	0.51	0.47	8.7	173	2.5%	4.1	0.7	9.4				
		0.79	0.83						9.4	4.2	7.3	***3.3***	***6.0***
A6	**A6**	1.52	1.62	15.0					15.0				
	A5	0.79	0.83	9.4	217	5.3%	4.7	0.8	10.2				
		2.32	2.45						15.0	3.5	5.9	***8.0***	***14***
C1	**C1**	0.47	0.36	7.3					7.3				
									0.0				
		0.47	0.36						7.3	4.5	8.0	***2.1***	***2.9***
C2	**C2**	1.95	2.30	14.2					14.2				
	C1	0.47	0.36	7.3	140	1.2%	5.4	0.4	7.7				
		2.42	2.66						14.2	3.6	6.0	***8.6***	***16.1***
D1	**D1**	0.54	0.57	8.5					8.5				
									0.0				
		0.54	0.57						8.5	4.3	7.6	***2.3***	***4.3***
A7	**A6**	2.32	2.45	15.0	440	0.5%	5.7	1.3	16.3				
	C2	2.42	2.66	14.2	51	3.7%	3.8	0.2	14.4				
		4.73	5.11						16.3	3.3	5.7	***16***	***29***
A8	**A7**	4.73	5.11	8.5	220	1.2%	8.1	0.5	8.9				
	D1	0.54	0.57	8.5	50	4.0%	4.0	0.2	8.7				
		5.27	5.69						16.8	3.3	5.6	***17***	***32***

Design Points	***Contributing Design Points***	***Equivalent CA_5***	***Equivalent CA_{100}***	***Maximum T_C***	***STREET / CHANNEL FLOW***				***T_t***	***INTENSITY***		***FLOW***	
					Length (ft)	***Slope (%)***	***Velocity (fps)***	***T_t (min)***	***TOTAL (min)***	***I_5***	***I_{100}***	***Q_5***	***Q_{100}***
F1	**F1**	1.47	1.63	21.2					21.2				
									0.0				
		1.47	1.63						21.2	3.0	4.9	***4.4***	***8.0***
F2	**F2**	0.43	0.37	15.6					15.6				
	F1	1.47	1.63	21.2	30	0.5%	6.1	0.1	21.3				
		1.91	2.00						21.3	3.0	4.9	***5.6***	***9.9***
E1	**E1**	1.32	1.38	17.0					17.0				
									0.0				
		1.32	1.38						17.0	3.3	5.5	***4.3***	***7.7***
E2	**E2**	0.22	0.20	11.9					11.9				
	E1	1.32	1.38	17.0	47	0.5%	4.8	0.2	17.1				
		1.54	1.58						17.2	3.3	5.5	***5.0***	***8.7***
E3	**E3**	0.96	1.36	17.7					17.7				
	E2	1.54	1.58	17.2	79	0.5%	4.8	0.3	17.5				
		2.51	2.95						17.7	3.2	5.4	***8.1***	***16***
E4	**E4**	2.27	2.94	22.2					22.2				
	E3	2.51	2.95	17.7	30	0.5%	6.1	0.1	17.8				
	F2	1.91	2.00	21.3	171	7.0%	14.4	0.2	21.5				
		6.68	7.89						22.2	2.9	4.8	***19***	***38***
E5	**E5**	1.68	1.83	19.2					19.2				
	E4	6.68	7.89	22.2	50	0.5%	7.4	0.1	22.3				
		8.36	9.72						22.3	2.9	4.8	***24***	***47***
A9	**A8**	5.27	5.69	16.8	338	0.5%	7.4	0.8	17.6				
	E5	8.36	9.72	22.3	50	0.5%	7.4	0.1	22.4				
		13.63	15.41						22.4	2.9	4.8	***39***	***74***
A10	**G1**	2.05	2.36	16.6	263	0.5%	2.7	1.6	18.3				
	A9	13.63	15.41	22.4	460	0.5%	8.4	0.9	23.3				
		15.68	17.76						23.3	2.8	4.7	***44***	***83***
A11	**A10**	15.68	17.76	23.3	145	0.5%	8.4	0.3	23.6				
									0.0				
		15.68	17.76						23.6	2.8	4.7	***44***	***83***
P1	**P1**	0.94	1.18	16.3					16.3				
									0.0				
		0.94	1.18						16.3	3.3	5.7	***3.1***	***6.7***

Calculated by: GAH
Date: 2/8/2018
Checked by: SMB

Appendix C

Hydraulic Calculations

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed A1 4' Inlet in South Side of Local

5-YR. FLOW

Q(5)	0.5	I(5)	4.4	Inlet size ? L(i) =	4
DEPTH	0.12	Fr		If Li < L(2) then Qi =	
SPREAD	-0.3	L(1)		If Li > L(2) then Qi =	0.5
CROSS SLOPE	2.0%	L(2)		Q RECEIVED =	0.5
				CA RECEIVED =	0.10
STREET SLOPE	4.0%	L(3)			
				FB =	
				FB CA(eqv.)=	

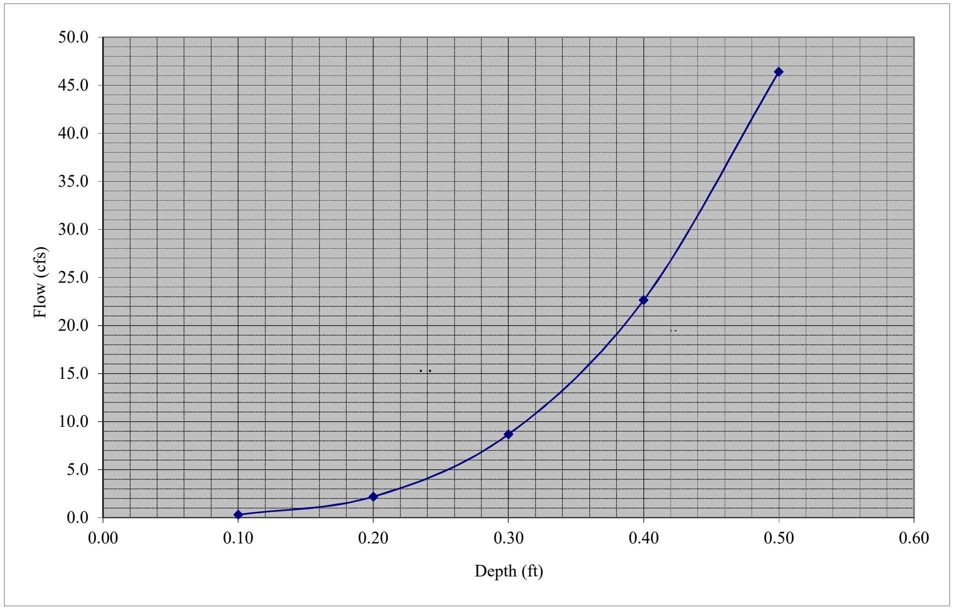
100-YR. FLOW

Q(100)	1.0	I(100)	7.7	Inlet size ? L(i) =	4
DEPTH	0.15	Fr		If Li < L(2) then Qi =	
SPREAD	1.0	L(1)		If Li > L(2) then Qi =	1.0
CROSS SLOPE	2.0%	L(2)		Q RECEIVED =	1.0
				CA RECEIVED =	0.12
STREET SLOPE	4.0%	L(3)			
				FB =	
				FB CA(eqv.)=	

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

Q = 0.56 (z/n) d^(8/3) s^(1/2)
Street slope (s) = 0.04 ft/ft
nA = 0.016 zA = 50
nB = 0.013 zB = 16
z = 1/s

Total Depth dT (ft)	*Depth of A dA (ft)*	*Depth of B dB (ft)*	*Depth of C dC (ft)*	*Flow Q (cfs)*
0.10	----	0.10		0.3
0.20	0.07	0.20		2.2
0.30	0.17	0.30		8.7
0.40	0.27	0.40		22.6
0.50	0.37	0.50		46.4



Spring Creek Southwest Quad - MDDP
Vistas at Spring Creek Filing No 1 - Final Drainage Report
Proposed A2 4' Inlet in North Side of Local

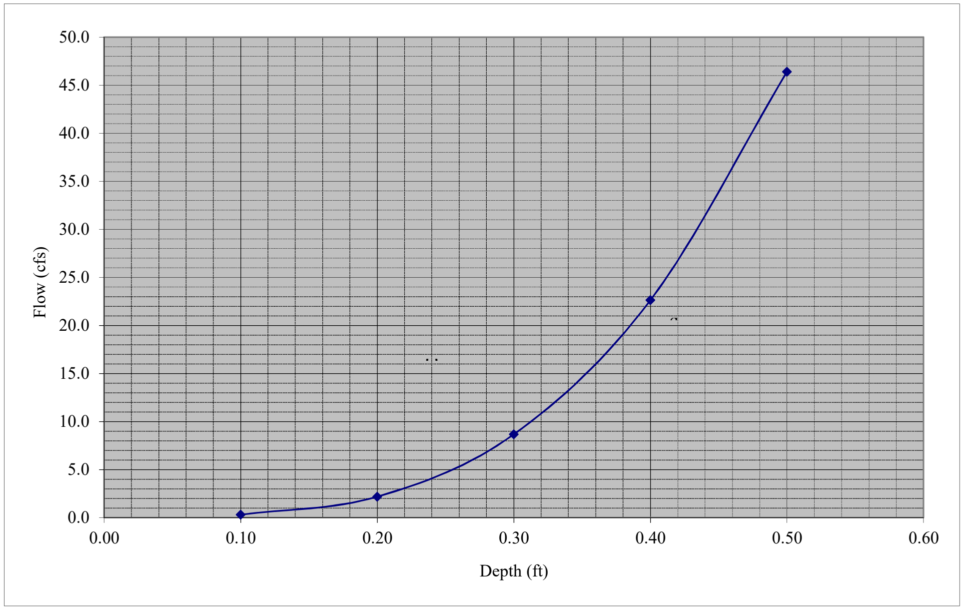
5-YR. FLOW					
Q(5)	0.7	I(5)	4.5	Inlet size ? L(i) =	4
DEPTH	0.12	Fr		If Li < L(2) then Qi =	
SPREAD	-0.3	L(1)		If Li > L(2) then Qi =	0.7
CROSS SLOPE	2.0%	L(2)		Q RECEIVED =	0.7
				CA RECEIVED =	0.16
STREET SLOPE	4.0%	L(3)			
				FB =	
				FB CA(eqv.)=	

100-YR. FLOW					
Q(100)	1.2	I(100)	8.1	Inlet size ? L(i) =	4
DEPTH	0.16	Fr		If Li < L(2) then Qi =	
SPREAD	1.5	L(1)		If Li > L(2) then Qi =	1.2
CROSS SLOPE	2.0%	L(2)		Q RECEIVED =	1.2
				CA RECEIVED =	0.15
STREET SLOPE	4.0%	L(3)			
				FB =	
				FB CA(eqv.)=	

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

Q = 0.56 (z/n) d^(8/3) s^(1/2) nA = 0.016 zA = 50
Street slope (s) = 0.04 ft/ft nB = 0.013 zB = 16
z = 1/s

Total Depth dT (ft)	*Depth of A dA (ft)*	*Depth of B dB (ft)*	*Depth of C dC (ft)*	*Flow Q (cfs)*
0.10	----	0.10		0.3
0.20	0.07	0.20		2.2
0.30	0.17	0.30		8.7
0.40	0.27	0.40		22.6
0.50	0.37	0.50		46.4



Spring Creek Southwest Quad - MDDP
Vistas at Spring Creek Filing No 1 - Final Drainage Report
Proposed A3 4' Inlet in East Side of Chippenham Dr.

5-YR. FLOW					
Q(5)	0.5	I(5)	4.6	Inlet size ? L(i) =	4
DEPTH	0.12	Fr		If Li < L(2) then Qi =	
SPREAD	-0.3	L(1)		If Li > L(2) then Qi =	0.5
CROSS SLOPE	2.0%	L(2)		Q RECEIVED =	0.5
				CA RECEIVED =	0.10
STREET SLOPE	6.0%	L(3)			
				FB =	
				FB CA(eqv.)=	

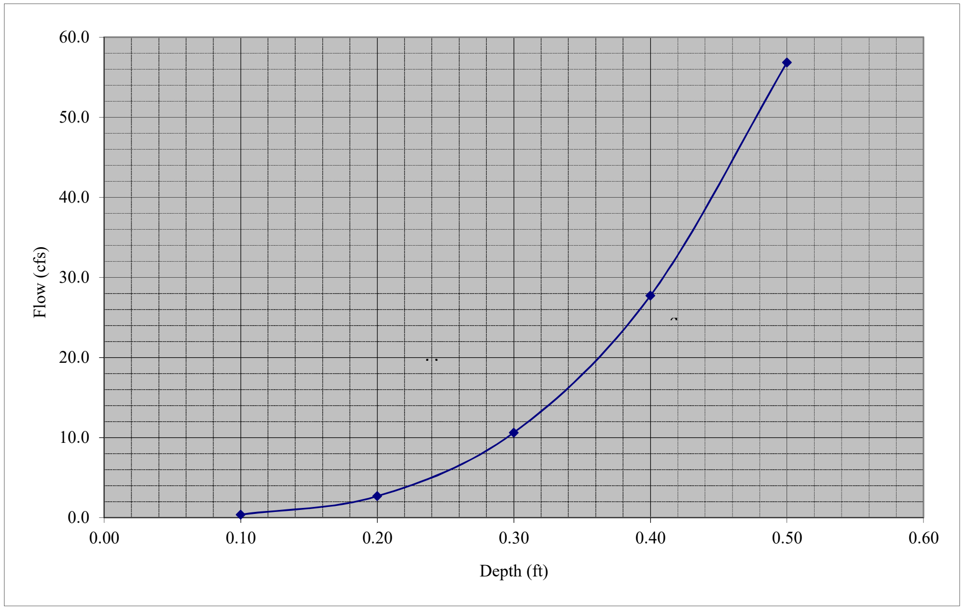
100-YR. FLOW					
Q(100)	0.8	I(100)	8.2	Inlet size ? L(i) =	4
DEPTH	0.18	Fr	1.86	If Li < L(2) then Qi =	
SPREAD	2.5	L(1)	3.6	If Li > L(2) then Qi =	0.6
CROSS SLOPE	2.0%	L(2)	2.2	Q RECEIVED =	0.6
				CA RECEIVED =	0.07
STREET SLOPE	6.0%	L(3)	7.7		
				FB =	0.2
				FB CA(eqv.)=	0.02

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

Q = 0.56 (z/n) d^(8/3) s^(1/2)
Street slope (s) = 0.06 ft/ft

nA = 0.016 zA = 50
nB = 0.013 zB = 16
z = 1/s

Total Depth dT (ft)	*Depth of A dA (ft)*	*Depth of B dB (ft)*	*Depth of C dC (ft)*	*Flow Q (cfs)*
0.10	----	0.10		0.4
0.20	0.07	0.20		2.7
0.30	0.17	0.30		10.6
0.40	0.27	0.40		27.7
0.50	0.37	0.50		56.8



Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed A4 4' Inlet in West Side of Chippenham Dr.

5-YR. FLOW					
Q(5)	0.8	I(5)	5.0	Inlet size ? L(i) =	4
DEPTH	0.14	Fr		If Li < L(2) then Qi =	
SPREAD	0.8	L(1)		If Li > L(2) then Qi =	0.8
CROSS SLOPE	2.0%	L(2)		Q RECEIVED =	0.8
				CA RECEIVED =	0.15
STREET SLOPE	6.0%	L(3)			
				FB =	
				FB CA(eqv.)=	

100-YR. FLOW					
Q(100)	1.5	I(100)	9.1	Inlet size ? L(i) =	4
DEPTH	0.18	Fr	1.86	If Li < L(2) then Qi =	
SPREAD	2.5	L(1)	3.6	If Li > L(2) then Qi =	1.2
CROSS SLOPE	2.0%	L(2)	2.2	Q RECEIVED =	1.2
				CA RECEIVED =	0.13
STREET SLOPE	6.0%	L(3)	7.7		
				FB =	0.3
				FB CA(eqv.)=	0.04

Calculated by: RCG

Date: 12/20/2017

Checked by: TAC

Q = 0.56 (z/n) d^(8/3) s^(1/2)

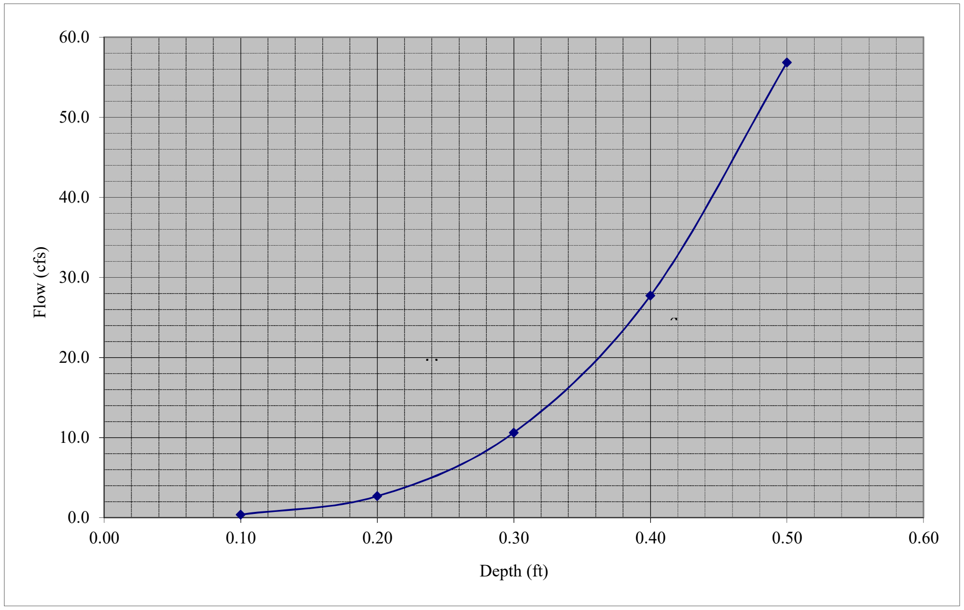
Street slope (s) = 0.06 ft/ft

nA = 0.016 zA = 50

nB = 0.013 zB = 16

z = 1/s

Total Depth dT (ft)	*Depth of A dA (ft)*	*Depth of B dB (ft)*	*Depth of C dC (ft)*	*Flow Q (cfs)*
0.10	----	0.10		0.4
0.20	0.07	0.20		2.7
0.30	0.17	0.30		10.6
0.40	0.27	0.40		27.7
0.50	0.37	0.50		56.8



Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed A5 4' Sump Inlet in South Side of Local

Total Flow: Q_5 = **1.3** cfs

Q_{100} = **3.0** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 1.00

W = 3 FT

w = 4 IN

Qi = 1.7(Li+1.8(W))(D + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **4*** foot inlet required

100-Year Event: **4*** foot inlet required

(Install a 4' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

****** Indicates minimum 4' used.***

Calculated by: RCG

Date: 12/20/2017

Checked by: TAC

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed A6 4' Sump Inlet in South Side of Parking Lot

Total Flow:

Q_5 = **5.3** cfs

Q_{100} = **9.5** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 1.00

W = 3 FT

w = 4 IN

Qi = 1.7(Li+1.8(W))(D + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event:	**4***	foot inlet required
100-Year Event:	**4***	foot inlet required

(Install a 4' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

**** Indicates minimum 4' used.***

Calculated by: RCG

Date: 12/20/2017

Checked by: TAC

Spring Creek Southwest Quad - MDDP
Vistas at Spring Creek Filing No 1 - Final Drainage Report
Proposed C1 4' Inlet in North Side of Local

5-YR. FLOW

Q(5)	5.6	I(5)	4.5	Inlet size ? L(i) =	4
DEPTH	0.29	Fr	1.64	If Li < L(2) then Qi =	2
SPREAD	8.3	L(1)	10.4	If Li > L(2) then Qi =	
CROSS SLOPE	2.0%	L(2)	6.2	Q RECEIVED =	2.1
				CA RECEIVED =	0.47
STREET SLOPE	2.0%	L(3)	22.3		
				FB =	3.4
				FB CA(eqv.)=	***0.76***

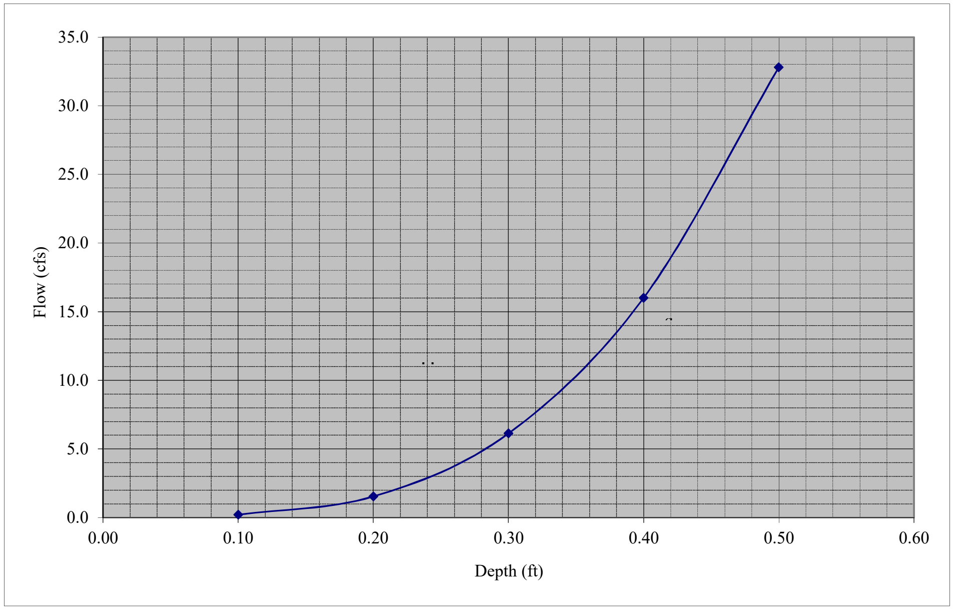
100-YR. FLOW

Q(100)	10.7	I(100)	8.0	Inlet size ? L(i) =	4
DEPTH	0.35	Fr	1.74	If Li < L(2) then Qi =	2.9
SPREAD	11.0	L(1)	14.7	If Li > L(2) then Qi =	
CROSS SLOPE	2.0%	L(2)	8.9	Q RECEIVED =	2.9
				CA RECEIVED =	0.36
STREET SLOPE	2.0%	L(3)	31.6		
				FB =	7.8
				FB CA(eqv.)=	0.98

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

Q = 0.56 (z/n) d^(8/3) s^(1/2)
Street slope (s) = 0.02 ft/ft
nA = 0.016 zA = 50
nB = 0.013 zB = 16
z = 1/s

Total Depth dT (ft)	***Depth of A dA (ft)***	***Depth of B dB (ft)***	***Depth of C dC (ft)***	***Flow Q (cfs)***
0.10	----	0.10		0.2
0.20	0.07	0.20		1.5
0.30	0.17	0.30		6.1
0.40	0.27	0.40		16.0
0.50	0.37	0.50		32.8



Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed C2 4' Sump Inlet in South Side of Local

Total Flow: Q_5 = **6.9** cfs

Q_{100} = **13.9** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 1.00

W = 3 FT

w = 4 IN

Qi = 1.7(Li+1.8(W))(D + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **4*** foot inlet required

100-Year Event: **4*** foot inlet required

(Install a 4' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

**** Indicates minimum 4' used.***

Calculated by: RCG

Date: 12/20/2017

Checked by: TAC

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed D1 4' Sump Inlet in South Side of Local

Total Flow:

Q_5 = **2.3** cfs

Q_{100} = **4.3** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 1.00

W = 3 FT

w = 4 IN

Qi = 1.7(Li+1.8(W))(D + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event:	**4***	foot inlet required
100-Year Event:	**4***	foot inlet required

(Install a 4' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

**** Indicates minimum 4' used.***

Calculated by: RCG

Date: 12/20/2017

Checked by: TAC

Spring Creek Southwest Quad - MDDP
Vistas at Spring Creek Filing No 1 - Final Drainage Report
Proposed E1 10' Inlet in West Side of Chippenham Dr.

5-YR. FLOW					
Q(5)	6.3	I(5)	3.3	Inlet size ? L(i) =	10
DEPTH	0.31	Fr	1.68	If Li < L(2) then Qi =	
SPREAD	9.3	L(1)	12.0	If Li > L(2) then Qi =	4.3
CROSS SLOPE	2.0%	L(2)	7.2	Q RECEIVED =	4.3
				CA RECEIVED =	1.32
STREET SLOPE	2.0%	L(3)	25.6		
				FB =	2.0
				FB CA(eqv.)=	***0.60***

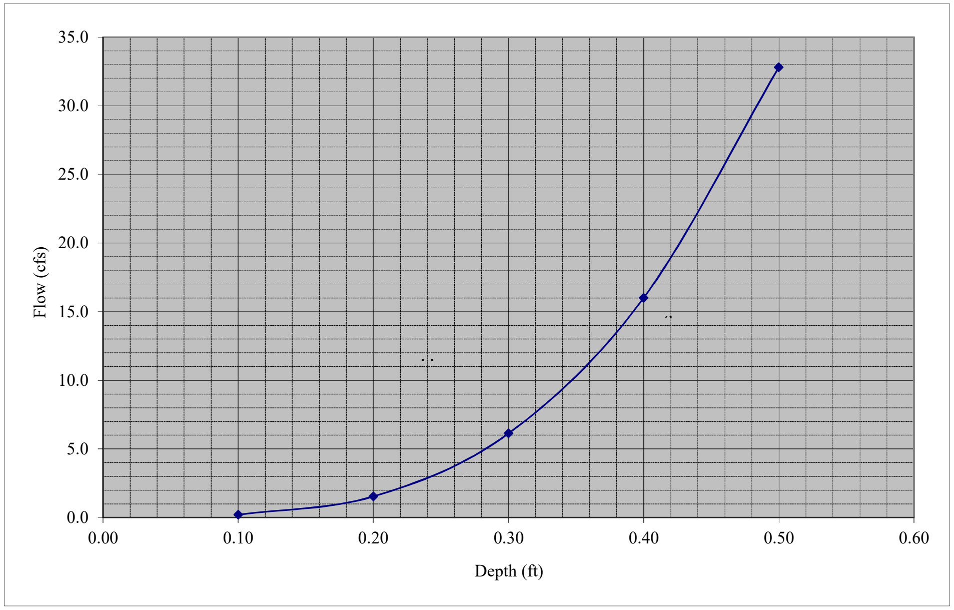
100-YR. FLOW					
Q(100)	12.6	I(100)	5.5	Inlet size ? L(i) =	10
DEPTH	0.37	Fr	1.77	If Li < L(2) then Qi =	
SPREAD	12.0	L(1)	16.4	If Li > L(2) then Qi =	7.7
CROSS SLOPE	2.0%	L(2)	9.8	Q RECEIVED =	7.7
				CA RECEIVED =	1.38
STREET SLOPE	2.0%	L(3)	35.1		
				FB =	5.0
				FB CA(eqv.)=	0.90

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

Q = 0.56 (z/n) d^(8/3) s^(1/2)
Street slope (s) = 0.02 ft/ft

nA = 0.016 zA = 50
nB = 0.013 zB = 16
z = 1/s

Total Depth dT (ft)	***Depth of A dA (ft)***	***Depth of B dB (ft)***	***Depth of C dC (ft)***	***Flow Q (cfs)***
0.10	----	0.10		0.2
0.20	0.07	0.20		1.5
0.30	0.17	0.30		6.1
0.40	0.27	0.40		16.0
0.50	0.37	0.50		32.8



Spring Creek Southwest Quad - MDDP
Vistas at Spring Creek Filing No 1 - Final Drainage Report
Proposed E2 4' Inlet in West Side of Chippenham Dr.

5-YR. FLOW

Q(5)	0.8	I(5)	3.8	Inlet size ? L(i) =	4
DEPTH	0.16	Fr		If Li < L(2) then Qi =	
SPREAD	1.8	L(1)		If Li > L(2) then Qi =	0.8
CROSS SLOPE	2.0%	L(2)		Q RECEIVED =	0.8
				CA RECEIVED =	0.22
STREET SLOPE	2.0%	L(3)			
				FB =	
				FB CA(eqv.)=	

100-YR. FLOW

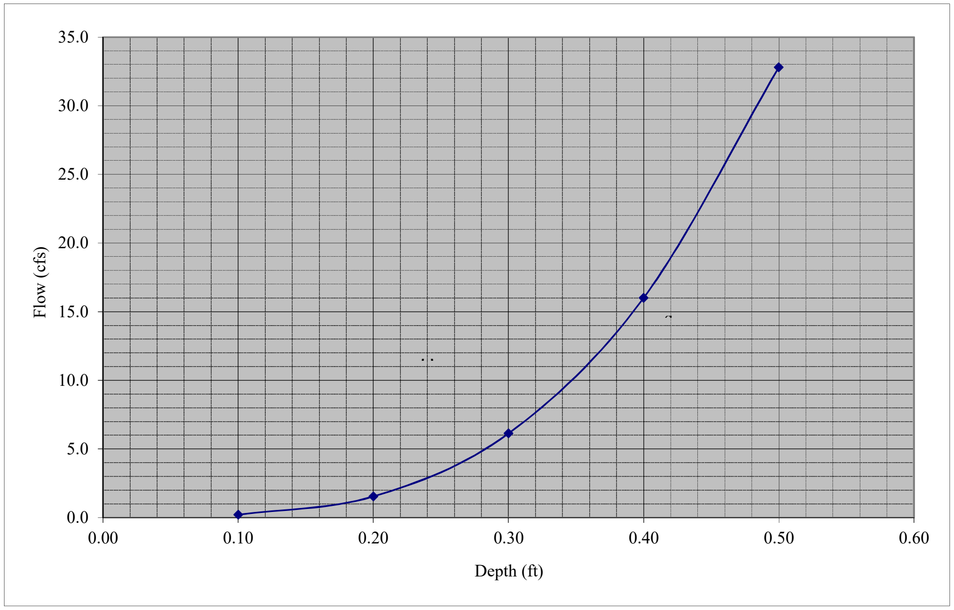
Q(100)	1.7	I(100)	6.6	Inlet size ? L(i) =	4
DEPTH	0.20	Fr	1.29	If Li < L(2) then Qi =	
SPREAD	3.5	L(1)	3.5	If Li > L(2) then Qi =	1.3
CROSS SLOPE	2.0%	L(2)	2.1	Q RECEIVED =	1.3
				CA RECEIVED =	0.20
STREET SLOPE	2.0%	L(3)	7.5		
				FB =	0.4
				FB CA(eqv.)=	0.06

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

Q = 0.56 (z/n) d^(8/3) s^(1/2)
Street slope (s) = 0.02 ft/ft

nA = 0.016 zA = 50
nB = 0.013 zB = 16
z = 1/s

Total Depth dT (ft)	***Depth of A dA (ft)***	***Depth of B dB (ft)***	***Depth of C dC (ft)***	***Flow Q (cfs)***
0.10	----	0.10		0.2
0.20	0.07	0.20		1.5
0.30	0.17	0.30		6.1
0.40	0.27	0.40		16.0
0.50	0.37	0.50		32.8



Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed E3 4' Sump Inlet in North Side of Local

Total Flow: Q_5 = **3.1** cfs
Q_{100} = **7.4** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50
D_{100} = 1.00

W = 3 FT
w = 4 IN

Qi = 1.7(Li+1.8(W))(D + w/12)^1.85

Clogging Factor = 1.25
Li (1.25) = Length of inlet opening

5-Year Event: **4*** foot inlet required

100-Year Event: **4*** foot inlet required

(Install a 4' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

**** Indicates minimum 4' used.***

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed E4 0' Sump Inlet in South Side of Local

Total Flow: Q_5 = **6.6** cfs

Q_{100} = **14.2** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 1.00

W = 3 FT

w = 4 IN

Qi = 1.7(Li+1.8(W))(D + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **4*** foot inlet required

100-Year Event: **4*** foot inlet required

(Install a 4' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

**** Indicates minimum 4' used.***

Calculated by: RCG

Date: 12/20/2017

Checked by: TAC

Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed E5 0' Sump Inlet in South Side of Local

Total Flow:

Q_5 = **5.2** cfs
Q_{100} = **9.5** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50
D_{100} = 1.00

W = 3 FT
w = 4 IN

Qi = 1.7(Li+1.8(W))(D + w/12)^1.85

Clogging Factor = 1.25
Li (1.25) = Length of inlet opening

5-Year Event: **4*** foot inlet required

100-Year Event: **4*** foot inlet required

(Install a 4' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

**** Indicates minimum 4' used.***

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

Spring Creek Southwest Quad - MDDP
Vistas at Spring Creek Filing No 1 - Final Drainage Report
Proposed F1 10' Inlet in East Side of Local

5-YR. FLOW

Q(5)	5.8	I(5)	3.0	Inlet size ? L(i) =	10
DEPTH	0.28	Fr	1.61	If Li < L(2) then Qi =	
SPREAD	7.8	L(1)	9.6	If Li > L(2) then Qi =	4.4
CROSS SLOPE	2.0%	L(2)	5.8	Q RECEIVED =	4.4
				CA RECEIVED =	1.47
STREET SLOPE	2.0%	L(3)	20.7		
				FB =	1.5
				FB CA(eqv.)=	***0.50***

100-YR. FLOW

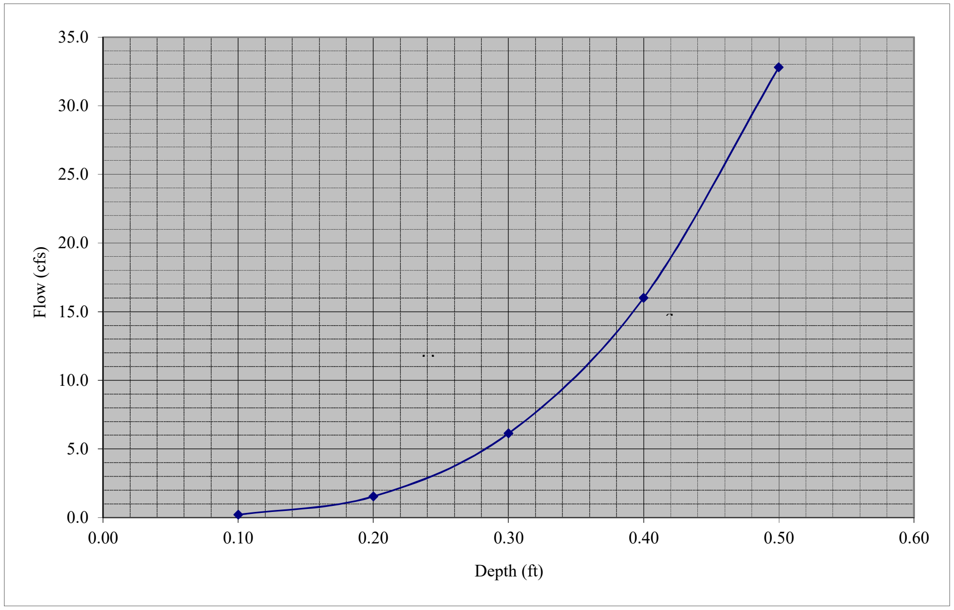
Q(100)	12.7	I(100)	4.9	Inlet size ? L(i) =	10
DEPTH	0.35	Fr	1.74	If Li < L(2) then Qi =	
SPREAD	11.0	L(1)	14.7	If Li > L(2) then Qi =	8.0
CROSS SLOPE	2.0%	L(2)	8.9	Q RECEIVED =	8.0
				CA RECEIVED =	1.63
STREET SLOPE	2.0%	L(3)	31.6		
				FB =	4.7
				FB CA(eqv.)=	0.95

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

Q = 0.56 (z/n) d^(8/3) s^(1/2)
Street slope (s) = 0.02 ft/ft

nA = 0.016 zA = 50
nB = 0.013 zB = 16
z = 1/s

Total Depth dT (ft)	***Depth of A dA (ft)***	***Depth of B dB (ft)***	***Depth of C dC (ft)***	***Flow Q (cfs)***
0.10	----	0.10		0.2
0.20	0.07	0.20		1.5
0.30	0.17	0.30		6.1
0.40	0.27	0.40		16.0
0.50	0.37	0.50		32.8



Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed F2 4' Inlet in West Side of Local

5-YR. FLOW					
Q(5)	2.0	I(5)	3.4	Inlet size ? L(i) =	4
DEPTH	0.20	Fr	1.32	If Li < L(2) then Qi =	
SPREAD	3.8	L(1)	3.8	If Li > L(2) then Qi =	1.5
CROSS SLOPE	2.0%	L(2)	2.3	Q RECEIVED =	1.5
				CA RECEIVED =	0.43
STREET SLOPE	2.0%	L(3)	8.2		
				FB =	0.5
				FB CA(eqv.)=	***0.14***

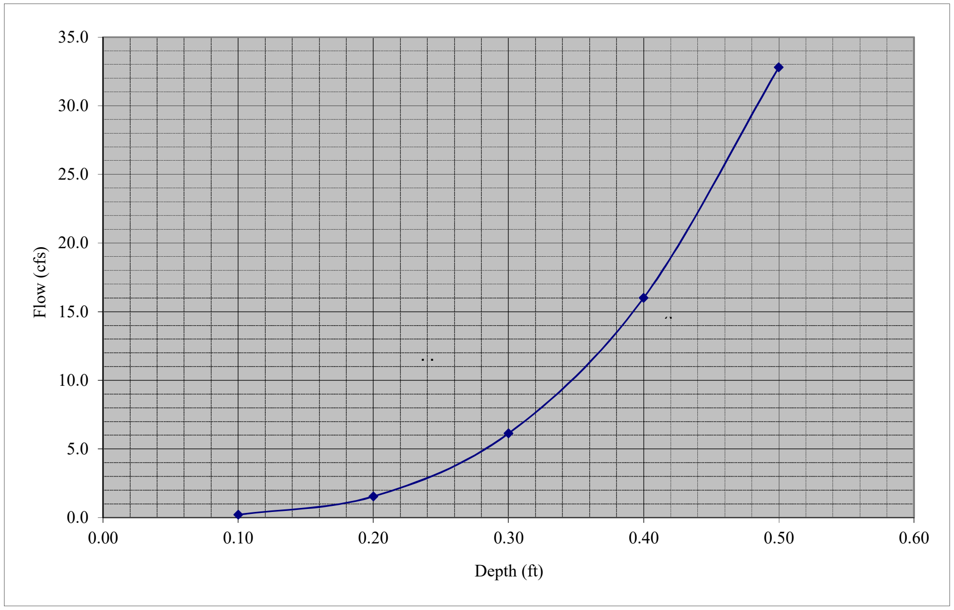
100-YR. FLOW					
Q(100)	3.5	I(100)	5.8	Inlet size ? L(i) =	4
DEPTH	0.24	Fr	1.49	If Li < L(2) then Qi =	
SPREAD	5.5	L(1)	6.3	If Li > L(2) then Qi =	2.2
CROSS SLOPE	2.0%	L(2)	3.8	Q RECEIVED =	2.2
				CA RECEIVED =	0.37
STREET SLOPE	2.0%	L(3)	13.5		
				FB =	1.4
				FB CA(eqv.)=	0.23

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

Q = 0.56 (z/n) d^(8/3) s^(1/2)
Street slope (s) = 0.02 ft/ft

nA = 0.016 zA = 50
nB = 0.013 zB = 16
z = 1/s

Total Depth dT (ft)	***Depth of A dA (ft)***	***Depth of B dB (ft)***	***Depth of C dC (ft)***	***Flow Q (cfs)***
0.10	----	0.10		0.2
0.20	0.07	0.20		1.5
0.30	0.17	0.30		6.1
0.40	0.27	0.40		16.0
0.50	0.37	0.50		32.8



Spring Creek Southwest Quad - MDDP

Vistas at Spring Creek Filing No 1 - Final Drainage Report

Proposed G1 0' Sump Inlet in South Side of Local

Total Flow:

Q_5 = **6.8** cfs

Q_{100} = **13.2** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 1.00

W = 3 FT

w = 4 IN

Qi = 1.7(Li+1.8(W))(D + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **4*** foot inlet required

100-Year Event: **4*** foot inlet required

(Install a 4' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

**** Indicates minimum 4' used.***

Calculated by: RCG

Date: 12/20/2017

Checked by: TAC

Spring Creek Southwest Quad - MDDP
Vistas at Spring Creek Filing No 1 - Final Drainage Report
Proposed P1 0' Sump Inlet in West Side of Local

Total Flow:

Q_5 = **3.1** cfs
Q_{100} = **6.7** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50
D_{100} = 1.00

W = 3 FT
w = 4 IN

Qi = 1.7(Li+1.8(W))(D + w/12)^1.85

Clogging Factor = 1.25
Li (1.25) = Length of inlet opening

5-Year Event: **4*** foot inlet required

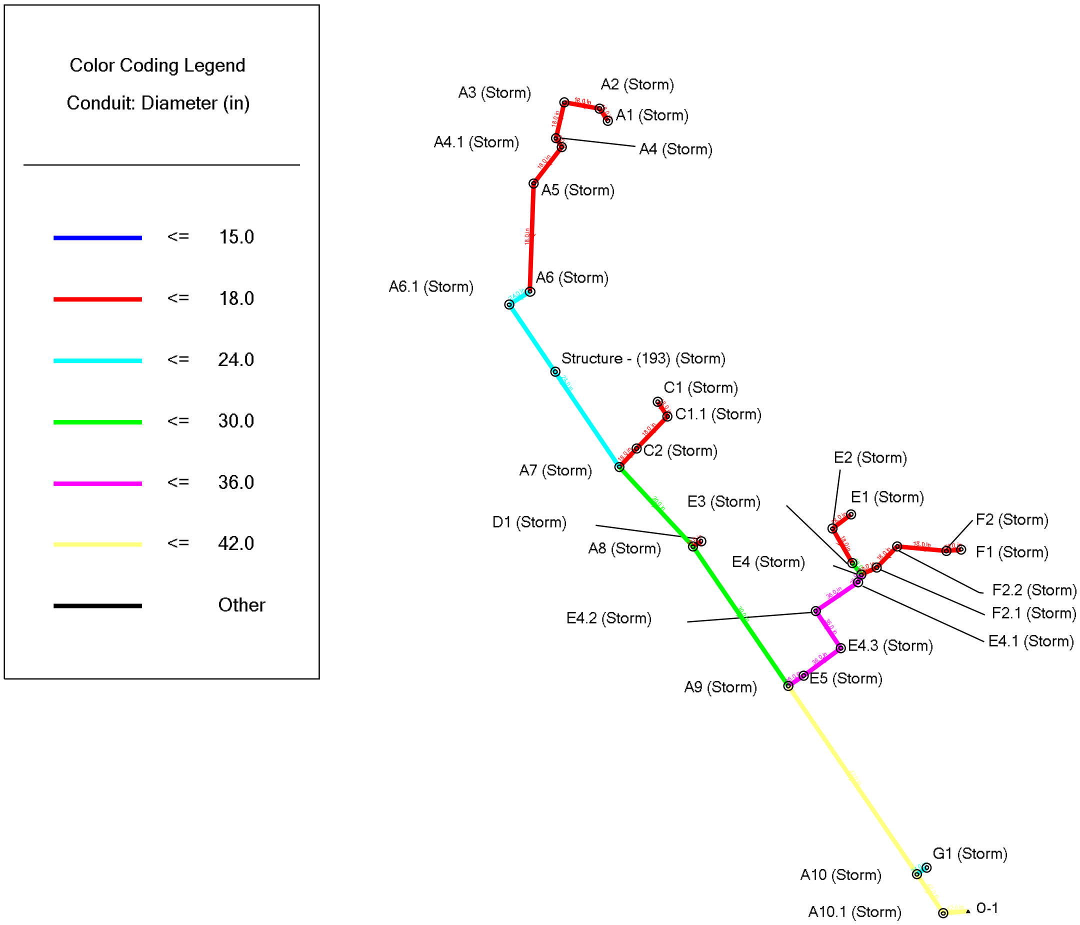
100-Year Event: **4*** foot inlet required

(Install a 4' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

**** Indicates minimum 4' used.***

Calculated by: RCG
Date: 12/20/2017
Checked by: TAC

100-yr Design Storm



100-yr Design Storm

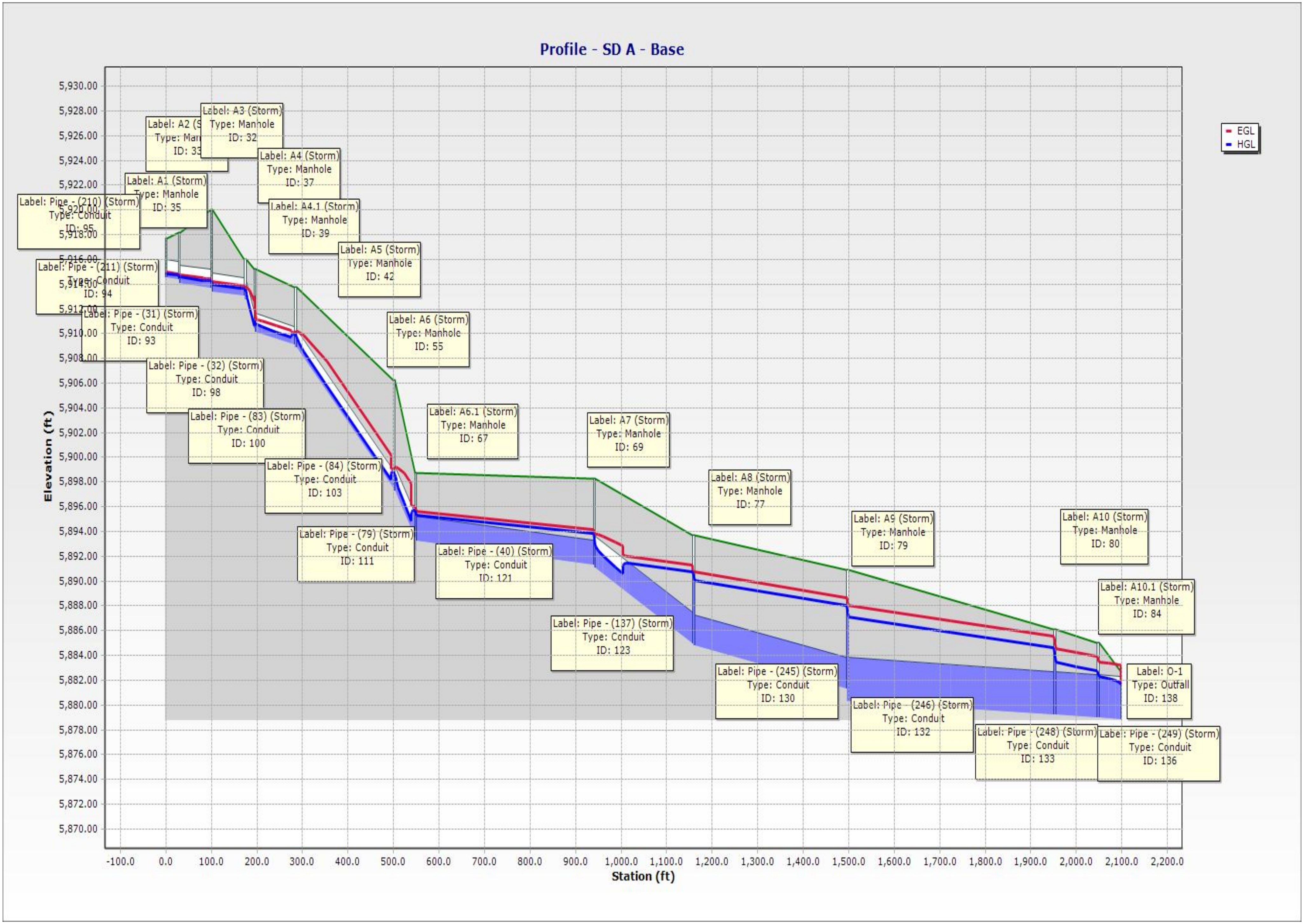
Label	Start Node	Stop Node	Flow (cfs)	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
Pipe - (31) (Storm)	A3 (Storm)	A4 (Storm)	2.6	5,913.39	5,913.03	73.4	0.005	18.0	0.013	3.8	7.3	35.7	5,914.01	5,913.64
Pipe - (32) (Storm)	A4 (Storm)	A4.1 (Storm)	3.5	5,912.73	5,910.32	20.8	0.116	18.0	0.013	12.9	35.8	9.8	5,913.45	5,910.67
Pipe - (40) (Storm)	A6.1 (Storm)	A7 (Storm)	14.0	5,893.25	5,891.29	392.2	0.005	24.0	0.013	4.5	16.0	87.5	5,895.32	5,893.82
Pipe - (78) (Storm)	C1 (Storm)	C1.1 (Storm)	2.9	5,896.91	5,896.20	34.1	0.021	18.0	0.013	6.6	15.2	19.1	5,897.56	5,896.65
Pipe - (79) (Storm)	A6 (Storm)	A6.1 (Storm)	14.0	5,897.25	5,893.45	47.6	0.080	24.0	0.013	16.3	63.9	21.9	5,898.60	5,895.73
Pipe - (83) (Storm)	A4.1 (Storm)	A5 (Storm)	3.5	5,910.12	5,909.06	89.9	0.012	18.0	0.013	5.7	11.4	30.6	5,910.84	5,909.97
Pipe - (84) (Storm)	A5 (Storm)	A6 (Storm)	6.0	5,908.86	5,897.45	216.6	0.053	18.0	0.013	11.3	24.1	24.9	5,909.81	5,898.84
Pipe - (85) (Storm)	C1.1 (Storm)	C2 (Storm)	2.9	5,895.80	5,894.86	89.2	0.011	18.0	0.013	5.2	10.8	26.9	5,896.45	5,896.15
Pipe - (97) (Storm)	C2 (Storm)	A7 (Storm)	16.1	5,894.66	5,892.81	50.3	0.037	18.0	0.013	12.7	20.1	80.0	5,896.08	5,893.88
Pipe - (137) (Storm)	A7 (Storm)	A8 (Storm)	29.0	5,891.09	5,884.97	217.5	0.028	30.0	0.013	13.4	68.8	42.2	5,892.93	5,890.75
Pipe - (200) (Storm)	E1 (Storm)	E2 (Storm)	0.0	5,884.78	5,884.55	47.0	0.005	18.0	0.013	0.0	7.4	0.0	5,892.00	5,892.00
Pipe - (201) (Storm)	E2 (Storm)	E3 (Storm)	8.7	5,884.35	5,883.95	79.2	0.005	18.0	0.013	4.9	7.4	117.1	5,891.51	5,890.96
Pipe - (202) (Storm)	E3 (Storm)	E4 (Storm)	16.0	5,882.95	5,882.80	29.9	0.005	30.0	0.013	3.3	29.0	55.2	5,890.95	5,890.91
Pipe - (203) (1) (Storm)	E4.1 (Storm)	E4.2 (Storm)	38.0	5,882.18	5,881.66	102.6	0.005	36.0	0.013	5.4	47.2	80.6	5,890.35	5,890.02
Pipe - (203) (Storm)	E4 (Storm)	E4.1 (Storm)	38.0	5,882.30	5,882.18	16.1	0.008	36.0	0.013	5.4	58.9	64.5	5,890.45	5,890.40
Pipe - (204) (Storm)	E4.2 (Storm)	E4.3 (Storm)	38.0	5,881.56	5,881.11	90.0	0.005	36.0	0.013	5.4	47.2	80.6	5,889.43	5,889.13
Pipe - (205) (Storm)	E4.3 (Storm)	E5 (Storm)	38.0	5,880.98	5,880.52	92.7	0.005	36.0	0.013	5.4	47.2	80.6	5,888.54	5,888.24
Pipe - (207) (Storm)	F1 (Storm)	F2 (Storm)	8.0	5,904.19	5,904.05	29.4	0.005	18.0	0.013	4.5	7.4	107.7	5,905.44	5,905.14
Pipe - (208) (Storm)	F2.2 (Storm)	E4 (Storm)	9.9	5,882.97	5,882.80	33.9	0.005	18.0	0.013	5.6	7.4	133.3	5,891.21	5,890.91
Pipe - (210) (Storm)	A1 (Storm)	A2 (Storm)	1.0	5,914.49	5,914.34	29.2	0.005	18.0	0.013	2.9	7.4	13.5	5,914.86	5,914.71
Pipe - (211) (Storm)	A2 (Storm)	A3 (Storm)	1.9	5,914.04	5,913.69	71.6	0.005	18.0	0.013	3.5	7.4	25.7	5,914.56	5,914.30
Pipe - (220) (1) (Storm)	F2 (Storm)	F2.1 (Storm)	9.9	5,901.73	5,893.36	98.6	0.085	18.0	0.013	15.5	30.6	32.4	5,902.94	5,893.95

100-yr Design Storm

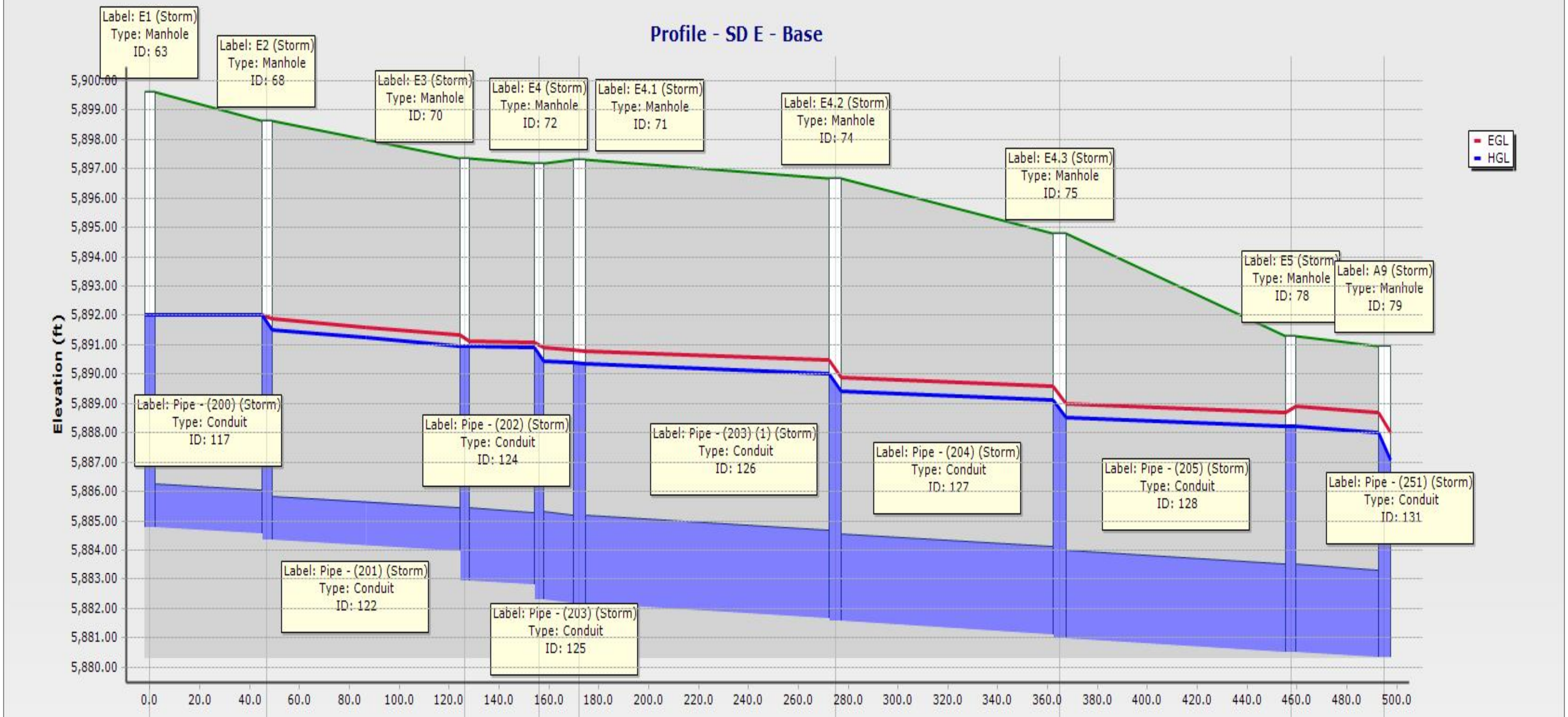
Label	Start Node	Stop Node	Flow (cfs)	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
Pipe - (220) (Storm)	F2.1 (Storm)	F2.2 (Storm)	9.9	5,891.86	5,884.47	59.3	0.125	18.0	0.013	17.8	37.1	26.7	5,893.07	5,891.26
Pipe - (236) (Storm)	D1 (Storm)	A8 (Storm)	4.3	5,886.54	5,884.97	19.6	0.080	18.0	0.013	2.4	29.7	14.5	5,890.78	5,890.75
Pipe - (245) (Storm)	A8 (Storm)	A9 (Storm)	32.0	5,884.77	5,881.33	337.9	0.010	30.0	0.013	6.5	41.4	77.3	5,890.08	5,888.02
Pipe - (246) (Storm)	A9 (Storm)	A10 (Storm)	74.0	5,880.33	5,879.19	456.5	0.002	42.0	0.013	7.7	50.3	147.1	5,887.08	5,884.61
Pipe - (248) (Storm)	A10 (Storm)	A10.1 (Storm)	83.0	5,879.19	5,878.95	94.5	0.002	42.0	0.013	8.6	50.3	165.0	5,883.43	5,882.79
Pipe - (249) (Storm)	A10.1 (Storm)	O-1	83.0	5,878.96	5,878.83	50.0	0.002	42.0	0.013	8.6	50.3	165.0	5,882.31	5,881.67
Pipe - (251) (Storm)	E5 (Storm)	A9 (Storm)	47.0	5,880.52	5,880.33	37.4	0.005	36.0	0.013	6.6	47.2	99.7	5,888.21	5,888.02
Pipe - (261) (Storm)	A10 (Storm)	G1 (Storm)	13.2	5,879.46	5,879.39	24.3	0.003	24.0	0.013	4.2	12.4	106.5	5,884.70	5,884.61

100-yr Design Storm

ID	Label	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Headloss Method	Headloss Coefficient (Standard)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Structure Type
32	A3 (Storm)	5,920.02	5,913.69	Standard	1.320	5,914.30	5,914.01	Box Structure
33	A2 (Storm)	5,918.14	5,914.34	Standard	0.100	5,914.58	5,914.56	Box Structure
35	A1 (Storm)	5,917.72	(N/A)	Standard	0.000	5,914.86	5,914.86	Box Structure
37	A4 (Storm)	5,915.98	5,913.03	Standard	0.400	5,913.56	5,913.45	Box Structure
39	A4.1 (Storm)	5,915.20	5,910.32	Standard	0.640	5,911.01	5,910.84	Circular Structure
42	A5 (Storm)	5,913.78	5,909.06	Standard	0.400	5,909.97	5,909.81	Box Structure
51	F1 (Storm)	5,909.00	(N/A)	Standard	0.000	5,905.44	5,905.44	Box Structure
52	F2 (Storm)	5,908.59	5,904.05	Standard	0.100	5,903.01	5,902.94	Box Structure
55	A6 (Storm)	5,906.20	5,897.45	Standard	0.400	5,898.84	5,898.60	Box Structure
59	C1 (Storm)	5,901.73	(N/A)	Standard	1.020	5,897.81	5,897.56	Box Structure
61	C1.1 (Storm)	5,901.07	5,896.20	Standard	1.320	5,896.77	5,896.45	Circular Structure
62	F2.1 (Storm)	5,900.50	5,893.36	Standard	0.400	5,893.33	5,893.07	Circular Structure
63	E1 (Storm)	5,899.62	(N/A)	Standard	0.050	5,892.00	5,892.00	Box Structure
64	C2 (Storm)	5,899.49	5,894.86	Standard	0.050	5,896.15	5,896.08	Box Structure
66	F2.2 (Storm)	5,898.74	5,884.47	Standard	0.100	5,891.26	5,891.21	Circular Structure
67	A6.1 (Storm)	5,898.73	5,893.45	Standard	1.320	5,895.73	5,895.32	Circular Structure
68	E2 (Storm)	5,898.62	5,884.55	Standard	1.320	5,892.00	5,891.51	Box Structure
69	A7 (Storm)	5,898.23	5,892.81	Standard	1.020	5,893.82	5,892.93	Circular Structure
70	E3 (Storm)	5,897.34	5,883.95	Standard	0.050	5,890.96	5,890.95	Box Structure
71	E4.1 (Storm)	5,897.30	5,882.18	Standard	0.100	5,890.40	5,890.35	Circular Structure
72	E4 (Storm)	5,897.20	5,882.80	Standard	1.020	5,890.91	5,890.45	Box Structure
73	Structure - (193) (Storm)	5,896.89	(N/A)	Standard	0.000	(N/A)	(N/A)	Circular Structure
74	E4.2 (Storm)	5,896.67	5,881.66	Standard	1.320	5,890.02	5,889.43	Circular Structure
75	E4.3 (Storm)	5,894.81	5,881.11	Standard	1.320	5,889.13	5,888.54	Circular Structure
76	D1 (Storm)	5,894.05	(N/A)	Standard	0.000	5,890.78	5,890.78	Box Structure
77	A8 (Storm)	5,893.68	5,884.97	Standard	1.020	5,890.75	5,890.08	Circular Structure
78	E5 (Storm)	5,891.31	5,880.52	Standard	0.050	5,888.24	5,888.21	Box Structure
79	A9 (Storm)	5,890.94	5,881.33	Standard	1.020	5,888.02	5,887.08	Circular Structure
80	A10 (Storm)	5,886.12	5,879.19	Standard	1.020	5,884.61	5,883.43	Circular Structure
84	A10.1 (Storm)	5,885.00	5,878.95	Standard	0.400	5,882.79	5,882.31	Circular Structure
85	G1 (Storm)	5,883.47	(N/A)	Standard	0.000	5,883.47	5,883.47	Box Structure

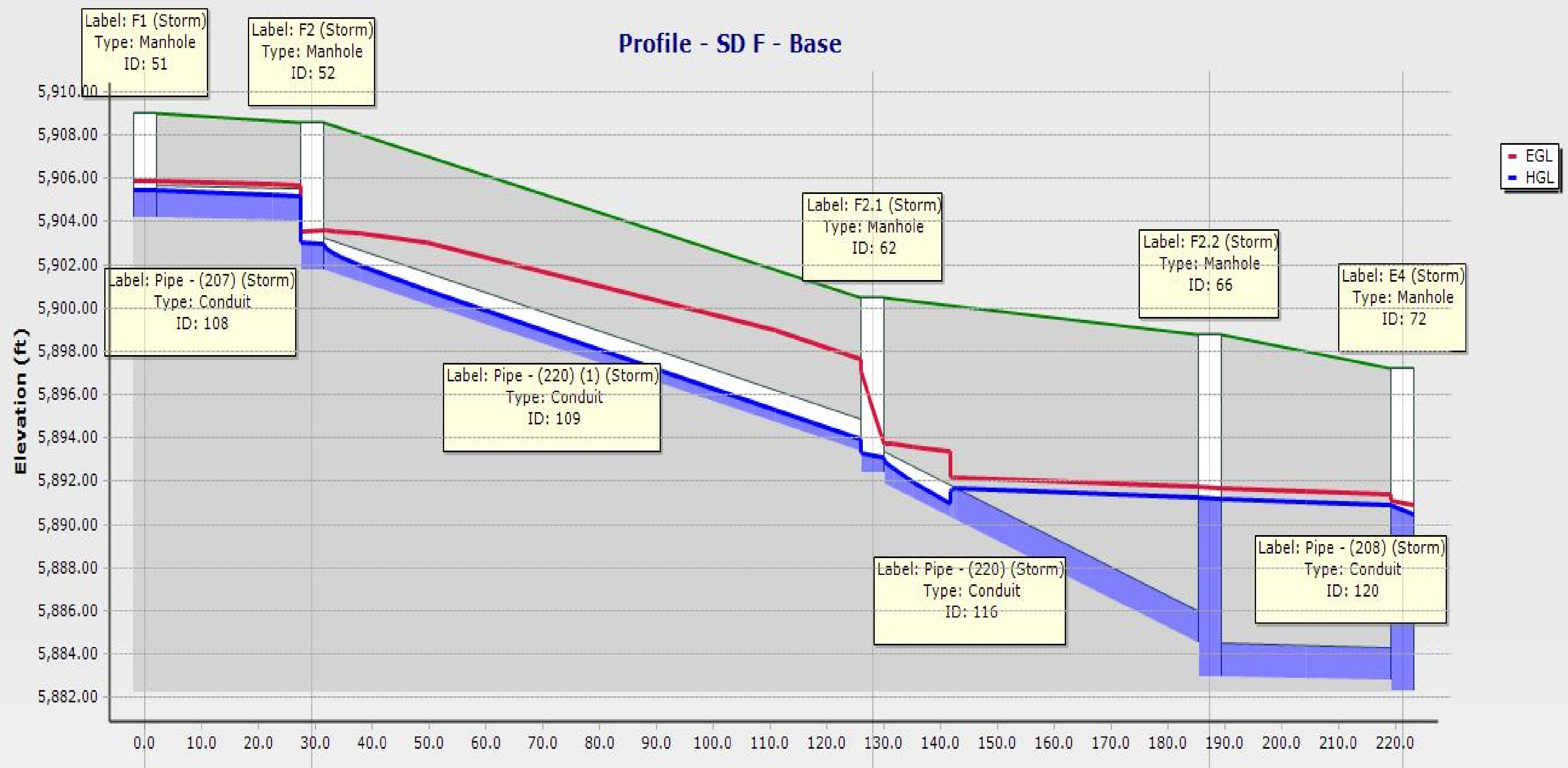


Profile - SD A - Base



ID\Label	117 \ Pipe - (200) (Storm)	122 \ Pipe - (201) (Storm)	124 \ Pipe - (202) (Storm)	125 \ Pipe - (203) (Storm)	126 \ Pipe - (203) (1) (Storm)	127 \ Pipe - (204) (Storm)	128 \ Pipe - (205) (Storm)	131 \ Pipe - (251) (Storm)
Link Length (ft)	47.0	79.2	29.9	16.1	102.6	90.0	92.7	37.4
Rise (in)\Material	18.0 \	18.0 \	30.0 \	36.0 \	36.0 \	36.0 \	36.0 \	36.0 \
Flow (cfs)	0.0	8.7	16.0	38.0	38.0	38.0	38.0	47.0
Slope (ft/ft)	0.005	0.005	0.005	0.008	0.005	0.005	0.005	0.005

ID\Label	63 \ E1 (Storm)	68 \ E2 (Storm)	70 \ E3 (Storm)	72 \ E4 (Storm)	71 \ E4.1 (Storm)	74 \ E4.2 (Storm)	75 \ E4.3 (Storm)	78 \ E5 (Storm)	79 \ A9 (Storm)
Ground (ft)	5899.62	5898.62	5897.34	5897.20	5897.30	5896.67	5894.81	5891.31	5890.94
Invert (ft)	5884.78	5884.35	5882.95	5882.30	5882.18	5881.56	5880.98	5880.52	5880.33
Station (ft)	0.0	47.0	126.2	156.1	172.2	274.8	364.8	457.6	495.0



ID\Label	108 \ Pipe - (207) (Storm)	109 \ Pipe - (220) (1) (Storm)	116 \ Pipe - (220) (Storm)	120 \ Pipe - (208) (Storm)
Link Length (ft)	29.4	98.6	59.3	33.9
Rise (in)\Material	18.0 \	18.0 \	18.0 \	18.0 \
Flow (cfs)	8.0	9.9	9.9	9.9
Slope (ft/ft)	0.005	0.085	0.125	0.005

ID\Label	51 \ F1 (Storm)	52 \ F2 (Storm)	62 \ F2.1 (Storm)	66 \ F2.2 (Storm)	72 \ E4 (Storm)
Ground (ft)	5909.00	5908.59	5900.50	5898.74	5897.20
Invert (ft)	5904.19	5901.73	5892.36	5882.97	5882.30
Station (ft)	0.0	29.4	128.0	187.3	221.2

Appendix D

Pond Calculations

Detention Pond Tributary Areas

ubdivision:

Location: Colorado Springs

Project Name: Spring Creek F1

Project No.: CLH000002.01

Calculated By: SMB

Checked By: SMB

Date: 3/21/18

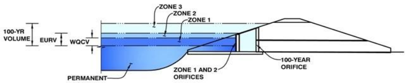
Basin	Area	% Imp
A1	0.19	40.0
A2	0.37	20.0
A3	0.22	25.0
A4	0.19	85.0
A5	0.35	85.0
A6	1.75	95.0
C1	1.45	95.0
C2	1.65	70.0
D1	0.62	95.0
E1	3.38	45.0
E2	0.37	50.0
E3	0.54	60.0
E4	0.55	85.0
E5	2.15	80.0
F1	4.69	20.0
F2	0.64	100.0
G1	3.25	55.0
P1	1.96	30.0
P2	1.81	5.0
Total	**26.13**	**52.5**

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: ______________________________

Basin ID: ______________________________



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type = **EDB**
Watershed Area = 26.13 acres
Watershed Length = 1,350 ft
Watershed Slope = 0.010 ft/ft
Watershed Imperviousness = 52.50% percent
Percentage Hydrologic Soil Group A = 0.0% percent
Percentage Hydrologic Soil Group B = 0.0% percent
Percentage Hydrologic Soil Groups C/D = 100.0% percent
Desired WQCV Drain Time = 40.0 hours
Location for 1-hr Rainfall Depths = User Input
Water Quality Capture Volume (WQCV) = 0.464 acre-feet
Excess Urban Runoff Volume (EURV) = 1.303 acre-feet

Optional User Override 1-hr Precipitation

2-yr Runoff Volume (P1 = 1.19 in.) = 1.229 acre-feet — 1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) = 1.805 acre-feet — 1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) = 2.301 acre-feet — 1.75 inches
25-yr Runoff Volume (P1 = 2 in.) = 3.104 acre-feet — 2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) = 3.716 acre-feet — 2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) = 4.478 acre-feet — 2.52 inches
500-yr Runoff Volume (P1 = 3.63 in.) = 6.950 acre-feet — 3.63 inches
Approximate 2-yr Detention Volume = 1.153 acre-feet
Approximate 5-yr Detention Volume = 1.701 acre-feet
Approximate 10-yr Detention Volume = 1.939 acre-feet
Approximate 25-yr Detention Volume = 2.092 acre-feet
Approximate 50-yr Detention Volume = 2.165 acre-feet
Approximate 100-yr Detention Volume = 2.445 acre-feet

Stage-Storage Calculation

Zone 1 Volume (WQCV) = 0.464 acre-feet
Zone 2 Volume (EURV - Zone 1) = 0.839 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) = 1.142 acre-feet
Total Detention Basin Volume = 2.445 acre-feet
Initial Surcharge Volume (ISV) = user ft^3
Initial Surcharge Depth (ISD) = user ft
Total Available Detention Depth (H_{total}) = user ft
Depth of Trickle Channel (H_{TC}) = user ft
Slope of Trickle Channel (S_{TC}) = user ft/ft
Slopes of Main Basin Sides (S_{main}) = user H:V
Basin Length-to-Width Ratio ($R_{L/W}$) = user

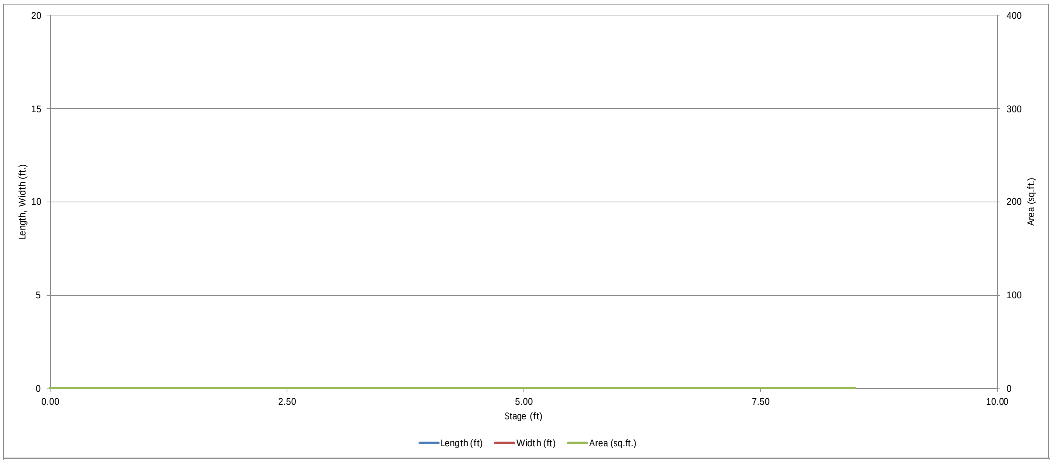
Initial Surcharge Area (A_{ISV}) = user ft^2
Surcharge Volume Length (L_{ISV}) = user ft
Surcharge Volume Width (W_{ISV}) = user ft
Depth of Basin Floor (H_{FLOOR}) = user ft
Length of Basin Floor (L_{FLOOR}) = user ft
Width of Basin Floor (W_{FLOOR}) = user ft
Area of Basin Floor (A_{FLOOR}) = user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

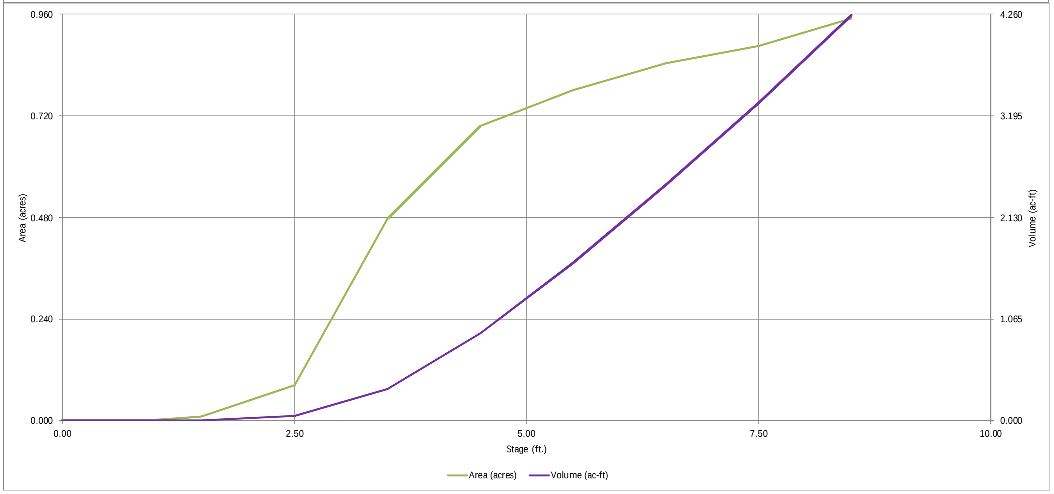
Depth Increment = ____ ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	60	0.001		
5,271.50	--	1.00	--	--	--	60	0.001	59	0.001
5,272.00	--	1.50	--	--	--	420	0.010	176	0.004
5,273.00	--	2.50	--	--	--	3,650	0.084	2,215	0.051
5,274.00	--	3.50	--	--	--	20,779	0.477	14,429	0.331
5,275.00	--	4.50	--	--	--	30,278	0.695	39,958	0.917
5,276.00	--	5.50	--	--	--	34,025	0.781	72,109	1.655
5,277.00	--	6.50	--	--	--	36,733	0.843	107,488	2.468
5,278.00	--	7.50	--	--	--	38,515	0.884	145,112	3.331
5,279.00	--	8.50	--	--	--	41,375	0.950	185,057	4.248
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



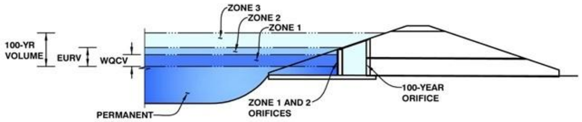


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.77	0.464	Orifice Plate
Zone 2 (EURV)	5.04	0.839	Orifice Plate
Zone 3 (100-year)	6.48	1.142	Weir&Pipe (Circular)
		2.445	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.05	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	20.00	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.70	3.40					
Orifice Area (sq. inches)	1.29	1.29	4.20					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.05	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.05	N/A	feet
Over Flow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	5.35	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	16.80	N/A	ft^2
Overflow Grate Open Area w/ Debris =	8.40	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	24.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	3.14	N/A	ft^2
Outlet Orifice Centroid =	1.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	45.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

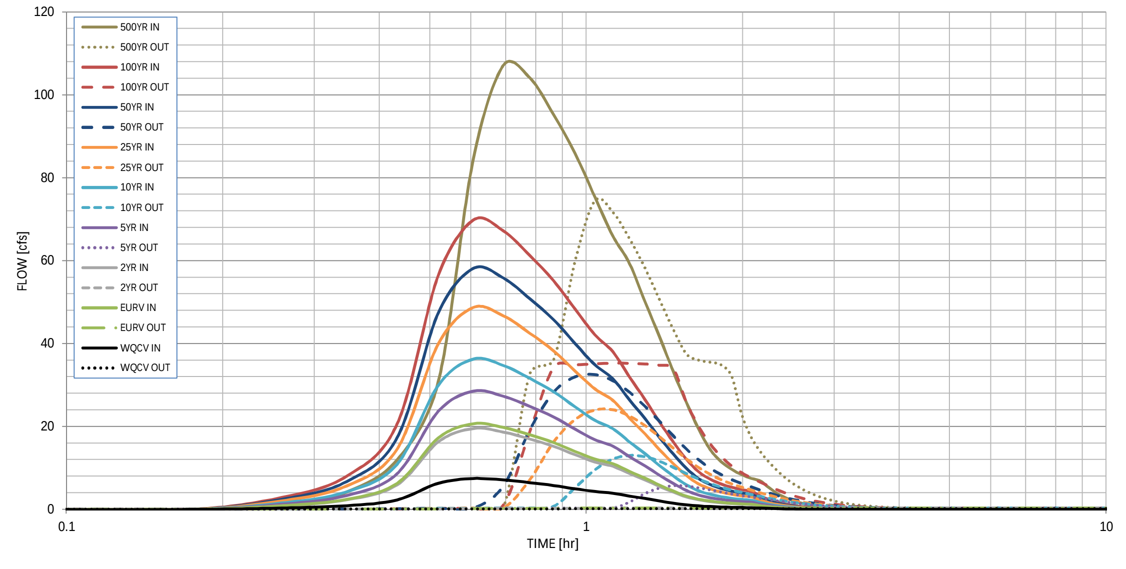
Spillway Design Flow Depth=	0.61	feet
Stage at Top of Freeboard =	8.11	feet
Basin Area at Top of Freeboard =	0.92	acres

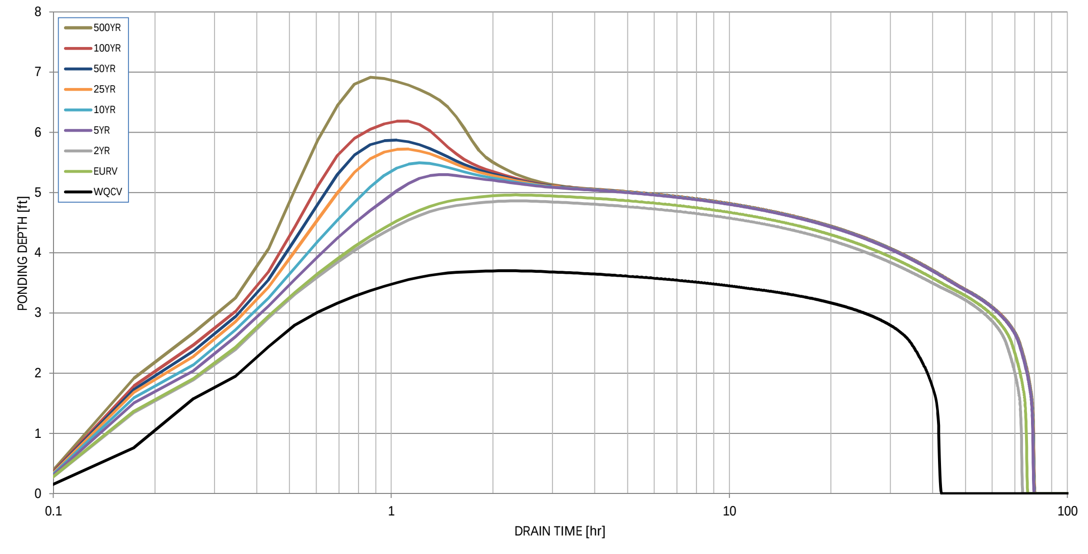
Routed Hydrograph Results

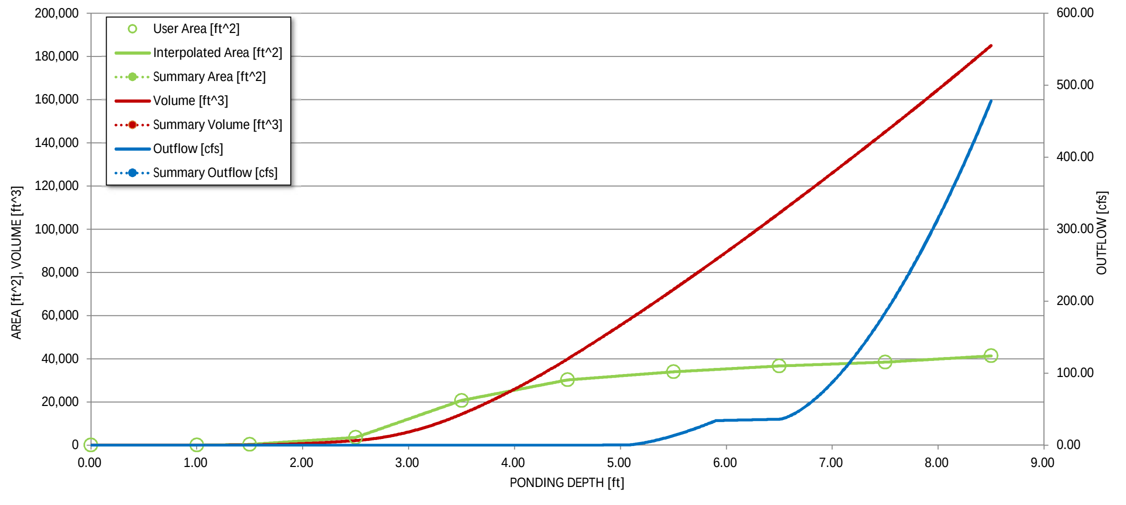
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.63
Calculated Runoff Volume (acre-ft) =	0.464	1.303	1.229	1.805	2.301	3.104	3.716	4.478	6.950
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.464	1.303	1.229	1.805	2.301	3.104	3.716	4.478	6.943
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.12	0.32	0.76	1.00	1.30	2.19
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	3.1	8.5	19.8	26.1	34.1	57.1
Peak Inflow Q (cfs) =	7.5	20.7	19.5	28.5	36.3	48.7	58.1	69.8	107.1
Peak Outflow Q (cfs) =	0.2	0.3	0.3	5.7	13.0	24.0	32.5	35.3	74.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.9	1.5	1.2	1.2	1.0	1.3
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.3	0.7	1.4	1.9	2.1	2.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	70	68	72	70	68	66	64	57
Time to Drain 99% of Inflow Volume (hours) =	41	73	71	76	75	75	74	73	70
Maximum Ponding Depth (ft) =	3.70	4.96	4.86	5.30	5.49	5.72	5.87	6.19	6.91
Area at Maximum Ponding Depth (acres) =	0.52	0.73	0.73	0.76	0.78	0.79	0.80	0.82	0.86
Maximum Volume Stored (acre-ft) =	0.431	1.239	1.166	1.493	1.648	1.821	1.949	2.201	2.817

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
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]
5.19 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph Constant	0:10:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:15:34	0.33	0.90	0.85	1.23	1.55	2.06	2.43	2.88	4.19
0.964	0:20:46	0.89	2.44	2.31	3.36	4.25	5.67	6.73	8.02	11.98
	0:25:57	2.29	6.28	5.93	8.62	10.91	14.56	17.29	20.59	30.76
	0:31:08	6.31	17.24	16.29	23.66	29.93	39.95	47.41	56.45	84.20
	0:36:20	7.45	20.67	19.51	28.53	36.25	48.70	58.12	69.78	107.10
	0:41:31	7.11	19.77	18.66	27.31	34.73	46.72	55.84	67.22	104.13
	0:46:43	6.47	18.00	16.98	24.86	31.61	42.52	50.82	61.26	95.25
	0:51:54	5.77	16.13	15.22	22.31	28.41	38.26	45.77	55.19	85.89
	0:57:05	4.97	13.98	13.19	19.38	24.73	33.39	40.01	48.31	75.42
	1:02:17	4.33	12.16	11.47	16.83	21.51	29.10	34.91	42.19	65.98
	1:07:28	3.92	11.02	10.40	15.27	19.48	26.32	31.54	38.06	59.32
	1:12:40	3.23	9.16	8.64	12.72	16.26	22.00	26.40	31.93	50.04
	1:17:51	2.63	7.53	7.09	10.48	13.42	18.20	21.86	26.47	41.57
	1:23:02	2.01	5.86	5.52	8.21	10.55	14.36	17.30	20.99	33.21
	1:28:14	1.49	4.43	4.16	6.24	8.06	11.04	13.34	16.23	25.82
	1:33:25	1.08	3.23	3.03	4.58	5.95	8.20	9.94	12.14	19.46
	1:38:37	0.84	2.47	2.32	3.48	4.50	6.18	7.47	9.09	14.47
	1:43:48	0.69	2.02	1.90	2.84	3.66	4.99	6.02	7.30	11.54
	1:48:59	0.59	1.71	1.61	2.40	3.08	4.20	5.07	6.14	9.69
	1:54:11	0.52	1.50	1.41	2.10	2.69	3.66	4.41	5.34	8.40
	1:59:22	0.47	1.34	1.27	1.88	2.41	3.28	3.95	4.78	7.49
	2:04:34	0.43	1.24	1.16	1.73	2.21	3.01	3.61	4.37	6.85
	2:09:45	0.32	0.91	0.86	1.27	1.64	2.23	2.69	3.27	5.19
	2:14:56	0.23	0.66	0.63	0.93	1.19	1.62	1.95	2.36	3.74
	2:20:08	0.17	0.49	0.46	0.68	0.88	1.19	1.44	1.75	2.77
	2:25:19	0.12	0.36	0.34	0.51	0.65	0.89	1.07	1.30	2.06
	2:30:31	0.09	0.26	0.25	0.37	0.47	0.65	0.78	0.95	1.52
	2:35:42	0.06	0.19	0.17	0.26	0.34	0.46	0.56	0.69	1.10
	2:40:53	0.04	0.13	0.13	0.19	0.25	0.34	0.41	0.50	0.79
	2:46:05	0.03	0.09	0.08	0.13	0.17	0.23	0.28	0.35	0.56
	2:51:16	0.02	0.06	0.05	0.08	0.11	0.15	0.18	0.23	0.37
	2:56:28	0.01	0.03	0.03	0.04	0.06	0.08	0.10	0.13	0.22
	3:01:39	0.00	0.01	0.01	0.02	0.02	0.04	0.05	0.06	0.10
	3:06:50	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03
	3:12:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:17:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:22:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:27:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:32:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:37:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:43:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:48:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:53:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:58:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:03:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:09:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:14:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:19:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:24:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:29:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:01:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:06:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:11:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:16:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:21:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:26:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:32:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:37:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:42:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:47:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:52:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:58:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:03:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:08:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:13:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Design Values

Angular D_{50} dia. = 9.9 in.
Rock_{chute} thickness = 19.9 in.
Inlet apron length = 8 ft.
Outlet apron length = 12 ft.
Radius = 28 ft.
Will bedding be used? Yes

Rock Gradation Envelope

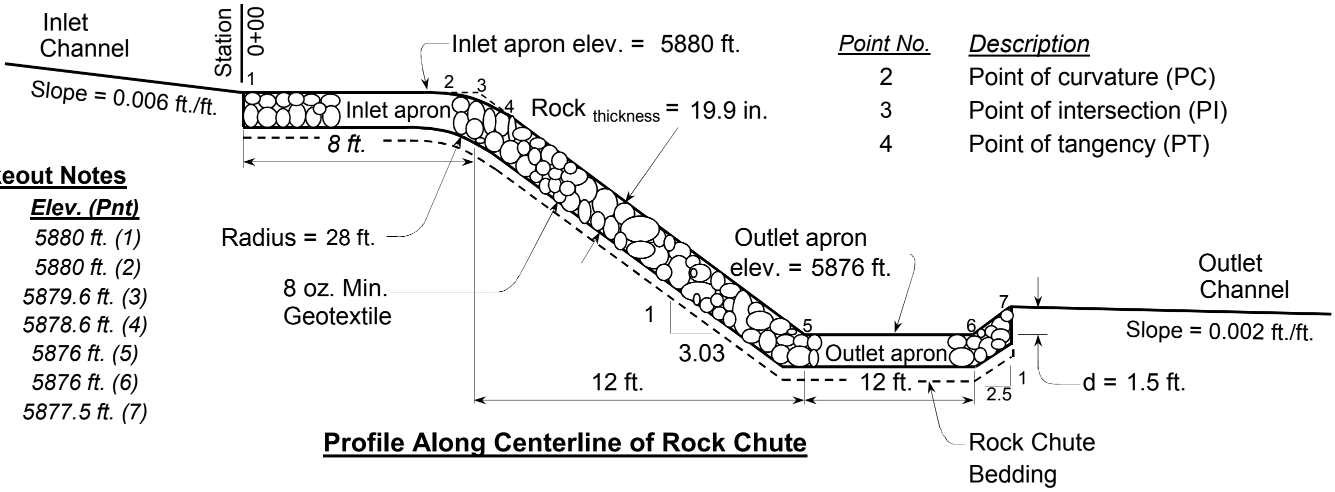
% Passing	*Diameter, in. (weight, lbs.)*
D_{100} ---------	15 - 20 (239 - 566)
D_{85} ---------	13 - 18 (155 - 412)
D_{50} ---------	10 - 15 (71 - 239)
D_{10} ---------	8 - 13 (36 - 155)

Coefficient of Uniformity, $(D_{60})/(D_{10}) \le 2.0$

Quantities[a]

Angular Rock = 214 yd^3
Geotextile (8 oz.)[b] = 523 yd^2
Bedding (6 in.) = 94 yd^3
Excavation = 0 yd^3
Earthfill = 0 yd^3
Seeding = 0.0 acres

Notes: [a] *Rock, bedding, and geotextile quantities are determined from x-section below (neglect radius).*
[b] *Geotextile shall be overlapped (18-in. minimum) and anchored (18-in. minimum along sides and 24-in. minimum on the ends) --- quantity not included.*

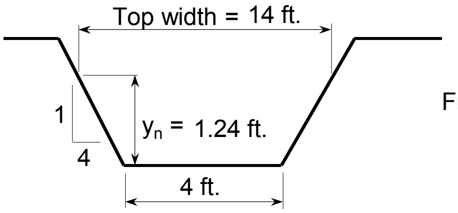


Point No.	*Description*
2	Point of curvature (PC)
3	Point of intersection (PI)
4	Point of tangency (PT)

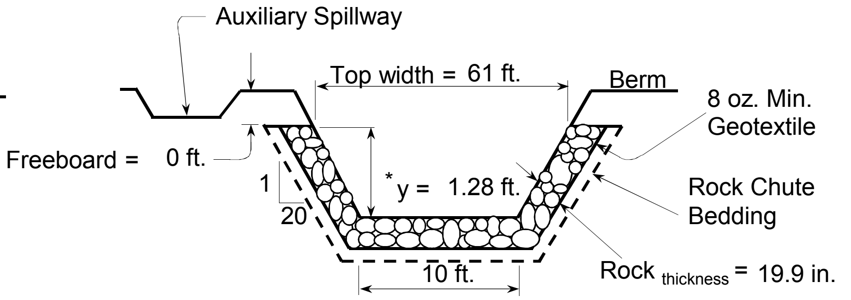
Stakeout Notes

Sta.	***Elev. (Pnt)***
0+00	*5880 ft. (1)*
0+3.5	*5880 ft. (2)*
0+8	*5879.6 ft. (3)*
0+12.3	*5878.6 ft. (4)*
0+20	*5876 ft. (5)*
0+32	*5876 ft. (6)*
0+35.8	*5877.5 ft. (7)*

Profile Along Centerline of Rock Chute

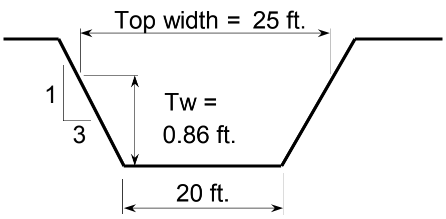


Inlet Channel Cross Section



Rock Chute Cross Section

* Use H_p throughout chute but not less than z_2.



Outlet Channel Cross Section

Profile, Cross Sections, and Quantities

Project: Spring Creek run down to Forbay #1
Location: El Paso County

U.S. Department of Agriculture
Natural Resources Conservation Service

Designed: GAH
Drawn: NRCS Standard Dwg.
Traced:
Checked: SMB
Approved by:
Title:
Sheet No. of
Drawing No.

Design Values

Angular D_{50} dia. = 3.4 in.
$Rock_{chute}$ thickness = 6.8 in.
Inlet apron length = 2 ft.
Outlet apron length = 4 ft.
Radius = 9 ft.
Will bedding be used? Yes

Rock Gradation Envelope

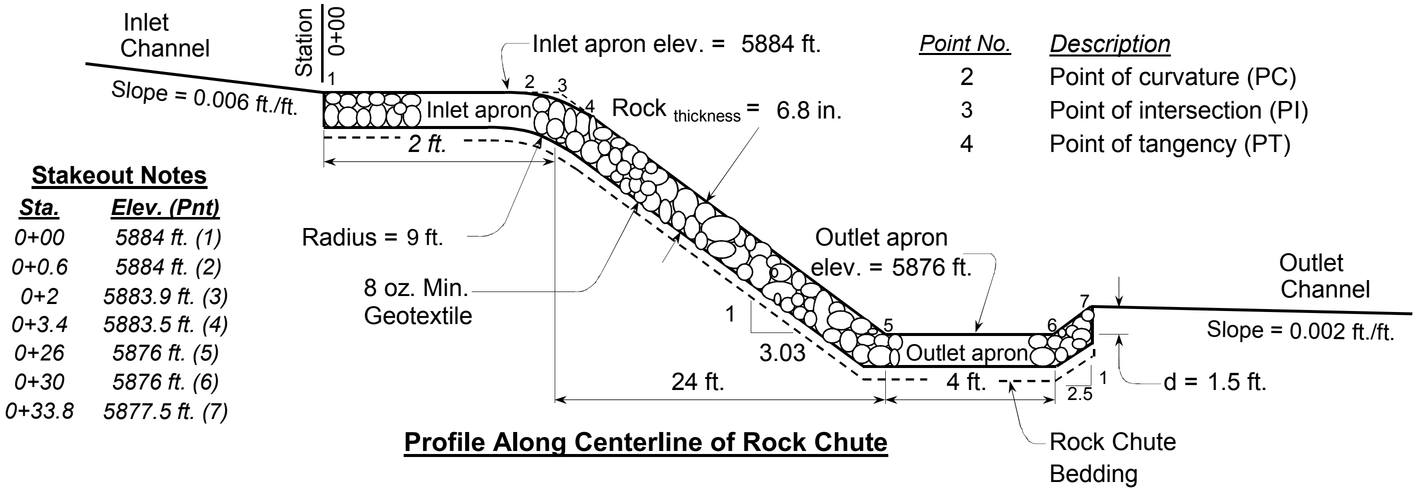
% Passing	_Diameter, in. (weight, lbs.)_
D_{100} ---------	5 - 7 (10 - 23)
D_{85} ---------	4 - 6 (6 - 17)
D_{50} ---------	3 - 5 (3 - 10)
D_{10} ---------	3 - 4 (1 - 6)

Coefficient of Uniformity, $(D_{60})/(D_{10}) \leq 2.0$

Quantities [a]

Angular Rock = 26 yd^3
Geotextile (8 oz.)[b] = 183 yd^2
Bedding (6 in.) = 37 yd^3
Excavation = 0 yd^3
Earthfill = 0 yd^3
Seeding = 0.0 acres

Notes: [a] *Rock, bedding, and geotextile quantities are determined from x-section below (neglect radius).*
[b] *Geotextile shall be overlapped (18-in. minimum) and anchored (18-in. minimum along sides and 24-in. minimum on the ends) --- quantity not included.*

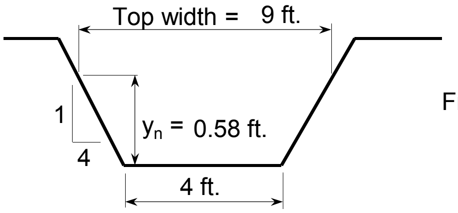


Point No.	*Description*
2	Point of curvature (PC)
3	Point of intersection (PI)
4	Point of tangency (PT)

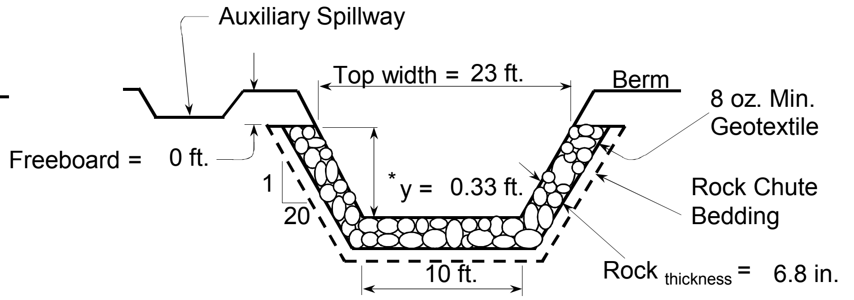
Stakeout Notes

Sta.	***Elev. (Pnt)***
0+00	*5884 ft. (1)*
0+0.6	*5884 ft. (2)*
0+2	*5883.9 ft. (3)*
0+3.4	*5883.5 ft. (4)*
0+26	*5876 ft. (5)*
0+30	*5876 ft. (6)*
0+33.8	*5877.5 ft. (7)*

Profile Along Centerline of Rock Chute

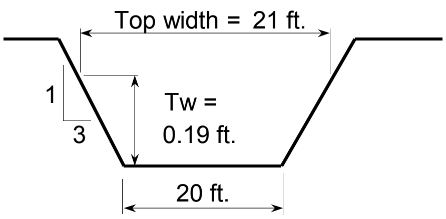


Inlet Channel Cross Section



Rock Chute Cross Section

* Use H_p throughout chute but not less than z_2.



Outlet Channel Cross Section

Profile, Cross Sections, and Quantities

Project: Spring Creek run down to Forbay #2
Location: County

U.S. Department of Agriculture
Natural Resources Conservation Service

Designed: GAH
Drawn: NRCS Standard Dwg.
Traced:
Checked: SMB
Approved by:
Title:
Sheet No.
of
Drawing No.

Design Values

Angular D_{50} dia. = 8.4 in.
$Rock_{chute}$ thickness = 16.9 in.
Inlet apron length = 7 ft.
Outlet apron length = 11 ft.
Radius = 23 ft.
Will bedding be used? Yes

Rock Gradation Envelope

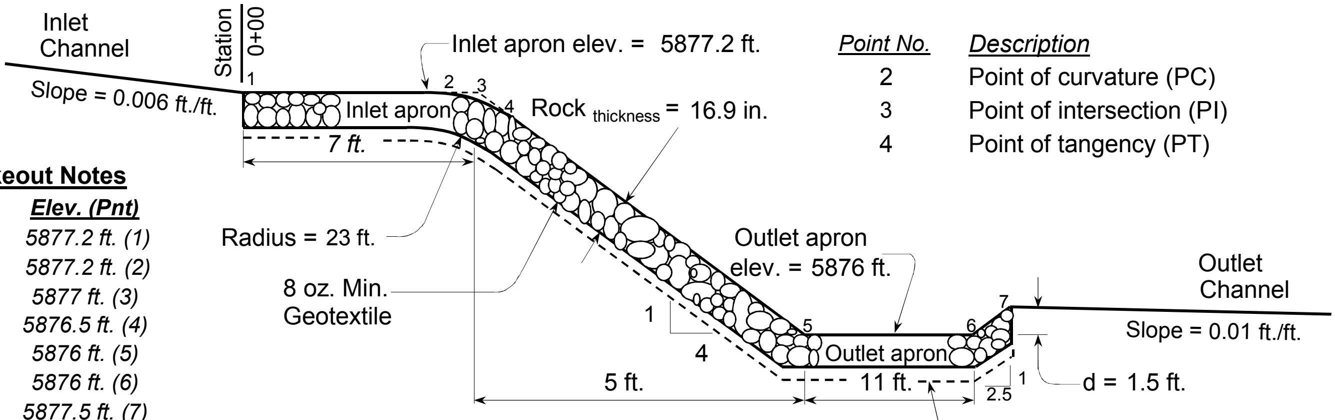
% Passing	Diameter, in. (weight, lbs.)
D_{100} ---------	13 - 17 (146 - 346)
D_{85} ---------	11 - 15 (95 - 252)
D_{50} ---------	8 - 13 (43 - 146)
D_{10} ---------	7 - 11 (22 - 95)

Coefficient of Uniformity, $(D_{60})/(D_{10}) \leq 2.0$

Quantities[a]

Angular Rock = 117 yd^3
Geotextile (8 oz.)[b] = 334 yd^2
Bedding (6 in.) = 61 yd^3
Excavation = 0 yd^3
Earthfill = 0 yd^3
Seeding = 0.0 acres

Notes: [a] *Rock, bedding, and geotextile quantities are determined from x-section below (neglect radius).*
[b] *Geotextile shall be overlapped (18-in. minimum) and anchored (18-in. minimum along sides and 24-in. minimum on the ends) --- quantity not included.*



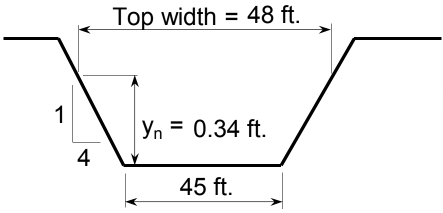
Point No.	Description
2	Point of curvature (PC)
3	Point of intersection (PI)
4	Point of tangency (PT)

Stakeout Notes

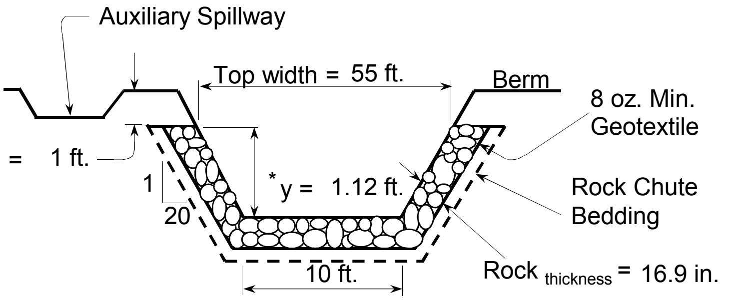
Sta.	Elev. (Pnt)
0+00	5877.2 ft. (1)
0+4.2	5877.2 ft. (2)
0+7	5877 ft. (3)
0+9.7	5876.5 ft. (4)
0+12	5876 ft. (5)
0+23	5876 ft. (6)
0+26.8	5877.5 ft. (7)

Profile Along Centerline of Rock Chute

Rock Chute Bedding

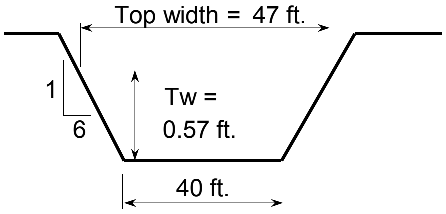


Inlet Channel Cross Section



Rock Chute Cross Section

* Use H_p throughout chute but not less than z_2.



Outlet Channel Cross Section

Profile, Cross Sections, and Quantities

Project: Emergency Overflow
Location: El Paso County

U.S. Department of Agriculture
Natural Resources Conservation Service

Designed: GAH
Drawn: NRCS Standard Dwg.
Traced:
Checked: SMB
Approved by:
Title:
Sheet No. of
Drawing No.

Forebay #1

Project Description

Solve For	Crest Length

Input Data

Discharge	1.50	ft^3/s
Headwater Elevation	2.50	ft
Crest Elevation	0.00	ft
Tailwater Elevation	0.00	ft
Weir Coefficient	3.00	US
Number Of Contractions	2	

Results

Crest Length	0.63	ft
Headwater Height Above Crest	2.50	ft
Tailwater Height Above Crest	0.00	ft
Flow Area	1.57	ft^2
Velocity	0.96	ft/s
Wetted Perimeter	5.63	ft
Top Width	0.63	ft

Forebay #2

Project Description

Solve For	Crest Length		

Input Data

Discharge		0.20	ft^3/s
Headwater Elevation		1.50	ft
Crest Elevation		0.00	ft
Tailwater Elevation		0.00	ft
Weir Coefficient		3.00	US
Number Of Contractions	2		

Results

Crest Length	0.34	ft
Headwater Height Above Crest	1.50	ft
Tailwater Height Above Crest	0.00	ft
Flow Area	0.50	ft^2
Velocity	0.40	ft/s
Wetted Perimeter	3.34	ft
Top Width	0.34	ft

Appendix E

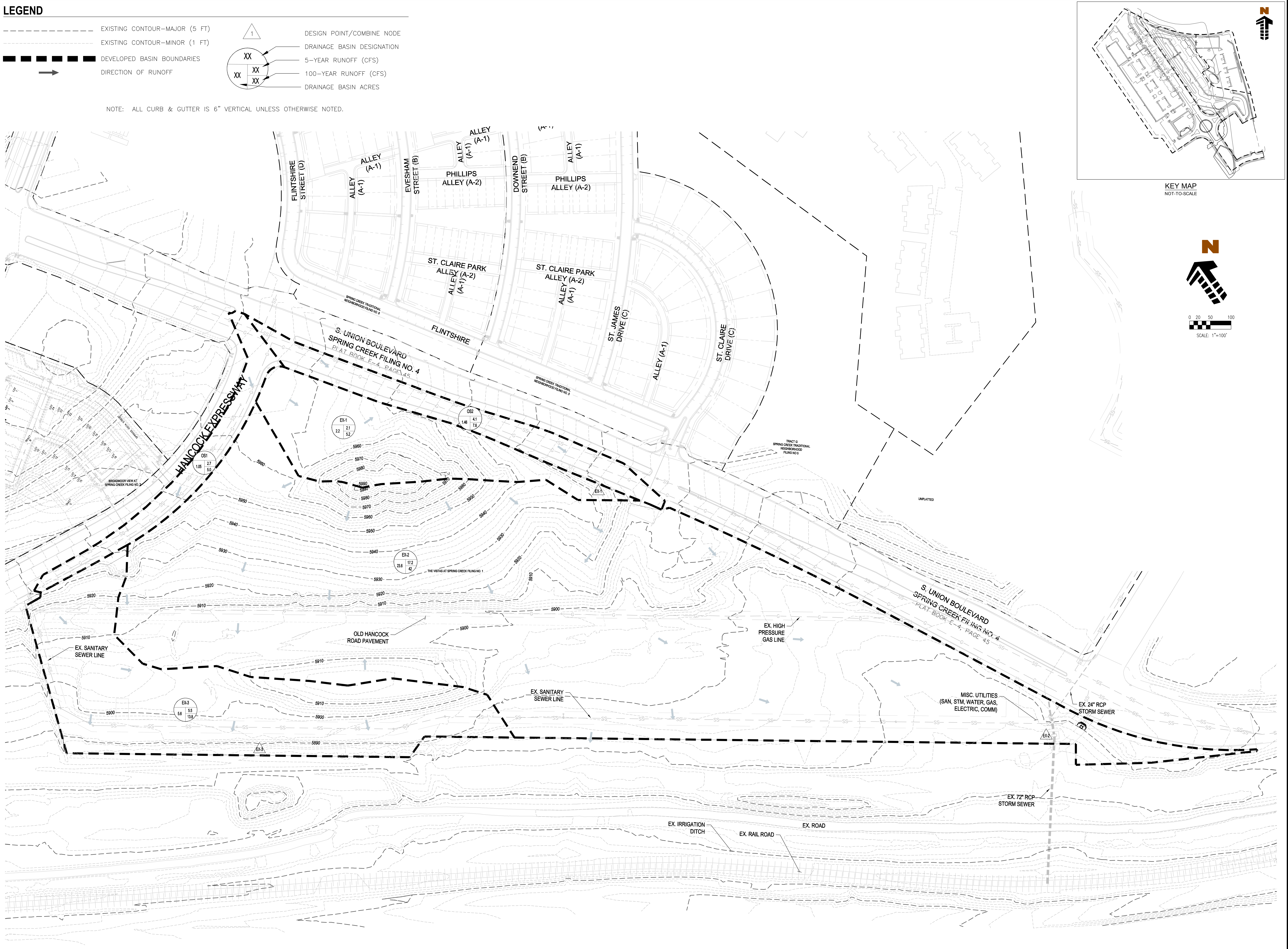
Drainage Maps

LEGEND

EXISTING CONTOUR–MAJOR (5 FT)
EXISTING CONTOUR–MINOR (1 FT)
DEVELOPED BASIN BOUNDARIES
DIRECTION OF RUNOFF

DESIGN POINT/COMBINE NODE
DRAINAGE BASIN DESIGNATION
5–YEAR RUNOFF (CFS)
100–YEAR RUNOFF (CFS)
DRAINAGE BASIN ACRES

NOTE: ALL CURB & GUTTER IS 6" VERTICAL UNLESS OTHERWISE NOTED.



Galloway
Planning. Architecture. Engineering.
1755 Telstar Drive, Suite 107
Colorado Springs, CO 80920
719.900.7220 O
www.gallowayUS.com

RIVERS DEVELOPMENT
13530 NORTHGATE ESTATES DRIVE,
SUITE 200
COLORADO SPRINGS, CO 80921
719-598-5190

NOT FOR CONSTRUCTION

DEVELOPMENT PLAN
SPRING CREEK

SWC OF HANCOCK EXPWY & UNION BLVD
COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No:	CLH000002.01
Drawn By:	RG
Checked By:	TAC
Date:	JANUARY 2017

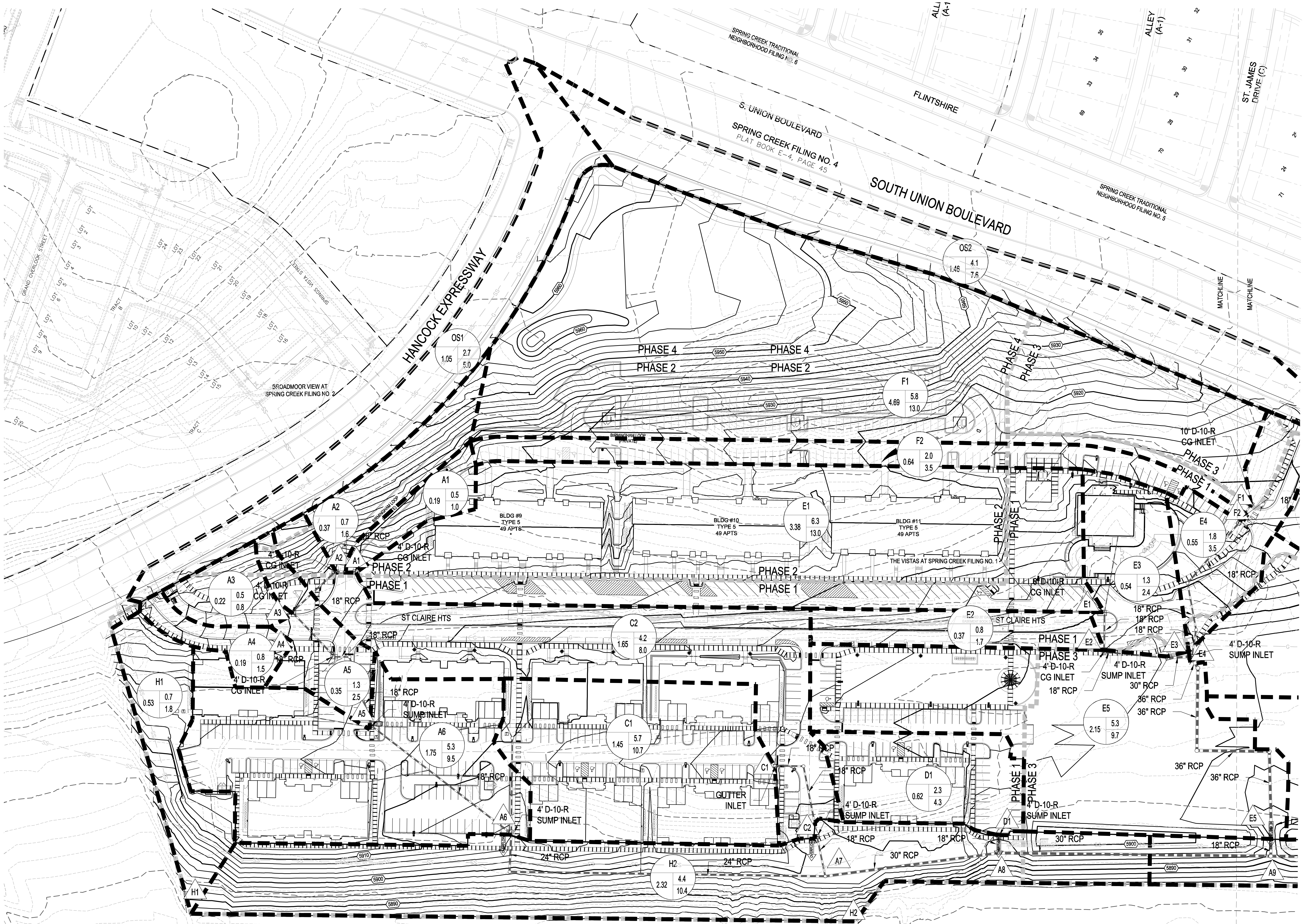
SHEET TITLE:
HISTORIC DRAINAGE PLAN

H1

LEGEND

- - - - -	EXISTING CONTOUR–MAJOR (5 FT)
- - - - -	EXISTING CONTOUR–MINOR (1 FT)
———	PROPOSED CONTOUR–MAJOR (5 FT)
———	PROPOSED CONTOUR–MINOR (1 FT)
▪▪▪▪▪	PROPOSED STORM SEWER
▬ ▬ ▬	DEVELOPED BASIN BOUNDARIES
→	DIRECTION OF RUNOFF
— — —	MATCHLINE
△ 1	DESIGN POINT/COMBINE NODE
XX	DRAINAGE BASIN DESIGNATION
XX	5–YEAR RUNOFF (CFS)
XX	100–YEAR RUNOFF (CFS)
XX	DRAINAGE BASIN ACRES

NOTE: ALL CURB & GUTTER IS 6" VERTICAL UNLESS OTHERWISE NOTED.



N

0 10 30 60

SCALE: 1"=60'

SURFACE RUNOFF SUMMARY TABLE - PR			
Design Point	Area (AC)	Q_5 (cfs)	Q_{100} (cfs)
A1	0.19	0.5	1.0
A2	0.37	0.7	1.2
A3	0.22	0.5	0.8
A4	0.19	0.8	1.5
A5	0.35	1.3	3.0
A6	1.75	5.3	9.5
A7	-	-	-
A8	-	-	-
A9	-	-	-
A10	-	-	-
A11	-	48	92
C1	1.45	5.6	10.7
C2	1.65	5.6	10.7
D1	0.62	2.3	4.3
E1	3.38	6.3	12.6
E2	0.37	0.8	1.7
E3	0.54	3.1	7.4
E4	0.55	6.6	14.2
E5	2.15	5.2	9.5
F1	4.69	5.8	12.7
F2	0.64	2.0	3.5
G1	3.25	6.8	13.2
H1	0.53	0.7	1.8
H2	2.32	4.0	9.4
H3	0.52	0.7	1.9
H4	2.16	2.6	6.4
P1	1.96	3.1	6.7
P2	1.81	2.1	5.2
OS1	1.05	2.7	5.0
OS2	1.46	4.1	7.6

Galloway
Planning. Architecture. Engineering.
1755 Telstar Drive, Suite 107
Colorado Springs, CO 80920
719.900.7220 O
www.gallowayUS.com

RIVERS DEVELOPMENT
13530 NORTHGATE ESTATES DRIVE,
SUITE 200
COLORADO SPRINGS, CO 80921
719-598-5190

NOT FOR CONSTRUCTION

DEVELOPMENT PLAN
SPRING CREEK

SWC OF HANCOCK EXPWY & UNION BLVD
COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No: CLH000002.01
Drawn By: RCG
Checked By: TAC
Date: OCT 2017

SHEET TITLE:
PRELIMINARY / FINAL
DRAINAGE PLAN

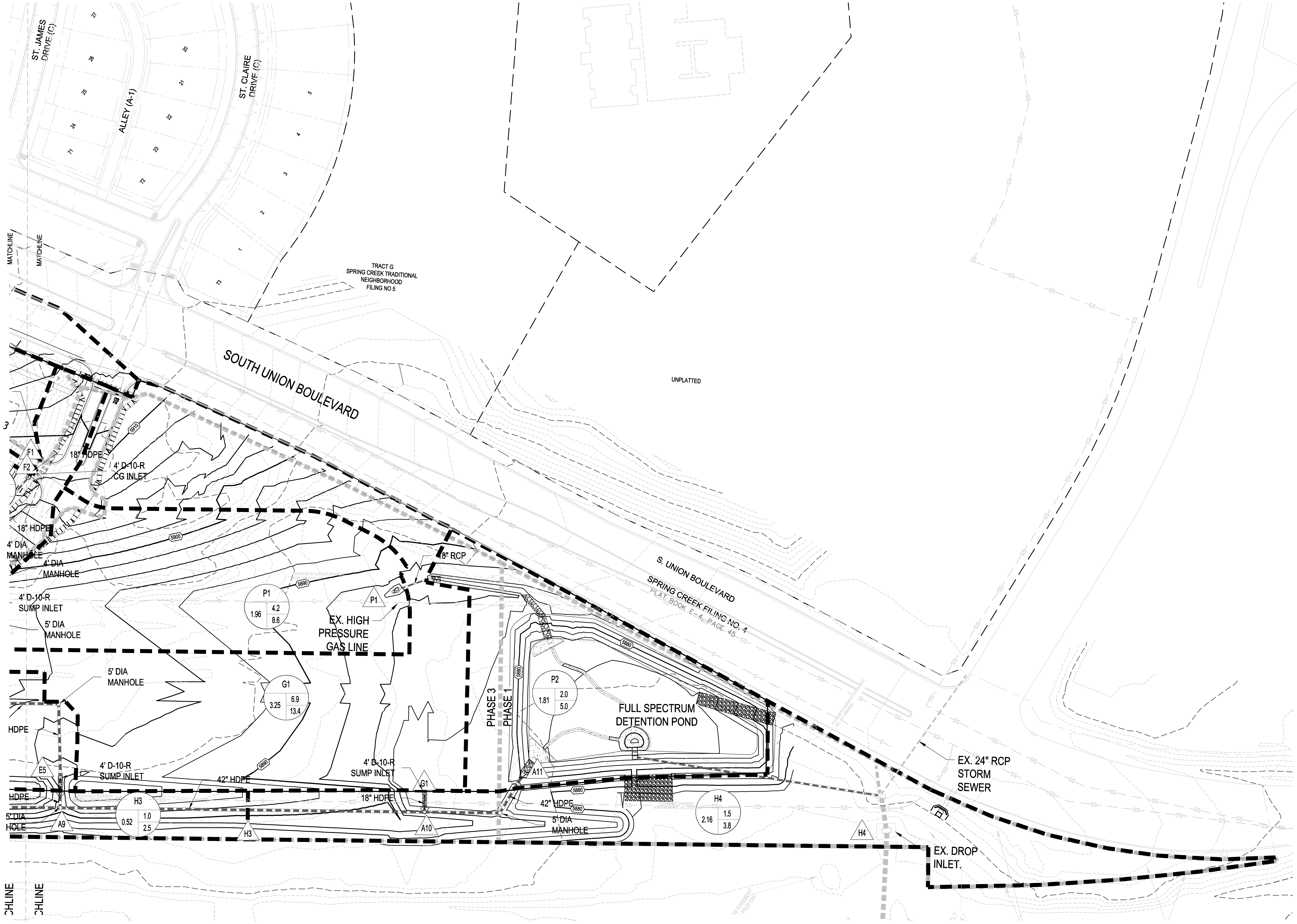
PDR1

LEGEND

EXISTING CONTOUR–MAJOR (5 FT)
EXISTING CONTOUR–MINOR (1 FT)
PROPOSED CONTOUR–MAJOR (5 FT)
PROPOSED CONTOUR–MINOR (1 FT)
PROPOSED STORM SEWER
DEVELOPED BASIN BOUNDARIES
DIRECTION OF RUNOFF
MATCHLINE

DESIGN POINT/COMBINE NODE
DRAINAGE BASIN DESIGNATION
5–YEAR RUNOFF (CFS)
100–YEAR RUNOFF (CFS)
DRAINAGE BASIN ACRES

NOTE: ALL CURB & GUTTER IS 6" VERTICAL UNLESS OTHERWISE NOTED.



N

0 10 30 60
SCALE: 1"=60'

SURFACE RUNOFF SUMMARY TABLE - PR			
Design Point	Area (AC)	Q_5 (cfs)	Q_{100} (cfs)
A1	0.19	0.5	1.0
A2	0.37	0.7	1.2
A3	0.22	0.5	0.8
A4	0.19	0.8	1.5
A5	0.35	1.3	3.0
A6	1.75	5.3	9.5
A7	-	-	-
A8	-	-	-
A9	-	-	-
A10	-	-	-
A11	-	42	79
C1	1.45	5.6	10.7
C2	1.65	5.6	10.7
D1	0.62	2.3	4.3
E1	3.38	6.3	12.6
E2	0.37	0.8	1.7
E3	0.54	3.1	7.4
E4	0.55	6.6	14.2
E5	2.15	5.2	9.5
F1	4.69	5.8	12.7
F2	0.64	2.0	3.5
G1	3.25	6.8	13.2
H1	0.53	0.7	1.8
H2	2.32	4.0	9.4
H3	0.52	0.7	1.9
H4	1.66	2.0	4.9
P1	1.96	3.1	6.7
P2	1.81	2.1	5.2
OS1	1.05	2.7	5.0
OS2	1.46	4.1	7.6

Galloway
Planning. Architecture. Engineering.
1755 Telstar Drive, Suite 107
Colorado Springs, CO 80920
719.900.7220 O
www.gallowayUS.com

RIVERS DEVELOPMENT
13530 NORTHGATE ESTATES DRIVE,
SUITE 200
COLORADO SPRINGS, CO 80921
719-598-5190

NOT FOR CONSTRUCTION

DEVELOPMENT PLAN
SPRING CREEK

SWC OF HANCOCK EXPWY & UNION BLVD
COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No: CLH000002.01
Drawn By: RCG
Checked By: TAC
Date: OCT 2017

SHEET TITLE:
PRELIMINARY / FINAL DRAINAGE PLAN

PDR2

Appendix F

Approved Variance Letter

Galloway
Planning. Architecture. Engineering.

April 9, 2018

Jonathan Scherer
City of Colorado Springs
Engineering Development Review
30 S. Nevada
Suite 401
Colorado Springs, CO 80903

Re: The Vistas at Spring Creek Filing No. 1 – Variance Request – Drop Manholes

Dear Jonathan,

A variance is being requested on behalf of Challenger Homes, Inc. regarding the project titled "The Vistas at Spring Creek Filing No. 1". The **Variance requested** deals with the crowns of upstream and downstream pipes not matching and a manhole with a drop of over 1'.

The project in question is bounded on the north by Hancock Expressway, on the east by S. Union Blvd; and to the southwest by an irrigation channel, railroads (Atchinson, Topeka, and Santa Fe RR right-of-way), and property owned by the City of Colorado Springs and underdeveloped privately owned property.

Variance #1 – Drop Manholes

A variance is being requested for the crowns of upstream and downstream pipes not matching when the pipe size changes in addition to a manhole with a drop in excess of 1'. The variance is being requested from the standards set forth in the City of Colorado Springs Drainage Criteria Manual – Volume 1 – Chapter 9, as noted below:

> ### 6.4 Drop Manholes
>
> The drop within a manhole from the upstream to downstream pipe invert should normally not exceed 1 foot. There are cases when a drop larger than 1 foot may be necessary to avoid a utility conflict, reduce the slope of the downstream pipe, match the crowns of the upstream and downstream pipes or to account for the energy losses in the manhole. Drops that exceed 1 foot will be evaluated on a case-by-case basis and additional analysis may be required.
>
> ### 6.5 Other Design Considerations
>
> The following design criteria shall also be met:
>
> - The elevation of the downstream pipe crown shall be no higher than the upstream pipe crown(s). This will minimize the backwater effects on the upstream pipe.

There are four cases where we are not able to match the crowns and/or exceed a drop of 1', refer to the explanation as follows:

- **Case #1** –Location: Storm Segment SD-C (STA. 51+90) Manhole C1.1. The difference between the downstream 18" HDPE pipe and upstream 18" HDPE pipe is 0.4', which is less than a 1' drop. This enables the downstream pipe to have a flatter slope and thus reduce the velocity in the storm sewer system. A variance is requested for pipes not to match crowns at this proposed manhole.

- **Case #2** –Location: Storm Segment SD-A (STA. 31+51 and STA 30+79) Manholes A2 and A3. The difference between the downstream 18” HDPE pipe and upstream 18” HDPE pipe is 0.3’ in both cases, which is less than a 1’ drop. This enables the downstream pipe to have a flatter slope and thus reduce the velocity in the storm sewer system. A variance is requested for pipes not to match crowns at these proposed manholes.
- **Case #3** – Location: All of Segment SD-F (STA. 80+51.66 – STA. 82+72.08), Manholes F2, F2.1, and F2.2. This entire segment needs to make a dive underneath the existing 20” 150# high-pressure gas main (5 ft. minimum clear distance). To achieve this, we are unable to match the crowns throughout this segment. In addition, flattening the pipes was necessary to reduce the velocity in the storm sewer system. Thus, a variance is requested for the pipe profile to have drops in manholes in excess of 1’ and not to match crowns at these proposed manholes (2.5’ drop is the maximum at manhole F2).
- **Case #4** – Location: Storm Segment SD-Pond Outfall (STA. 113+79.85), Existing Public Manhole. The 24” HDPE pipe is unable to match crowns due to the elevation at the Full Spectrum Detention Pond. We are running at a minimum pipe slope of 0.25% and below the crown of the existing 72” outfall by approx. 9”. A variance is requested for the pipes not to match crowns at this existing manhole.

There will be no increase in flows to Fountain Creek as a result of granting the requested variances. In addition, there will be no decrease in water quality in Fountain Creek as a result of granting the requested variances.

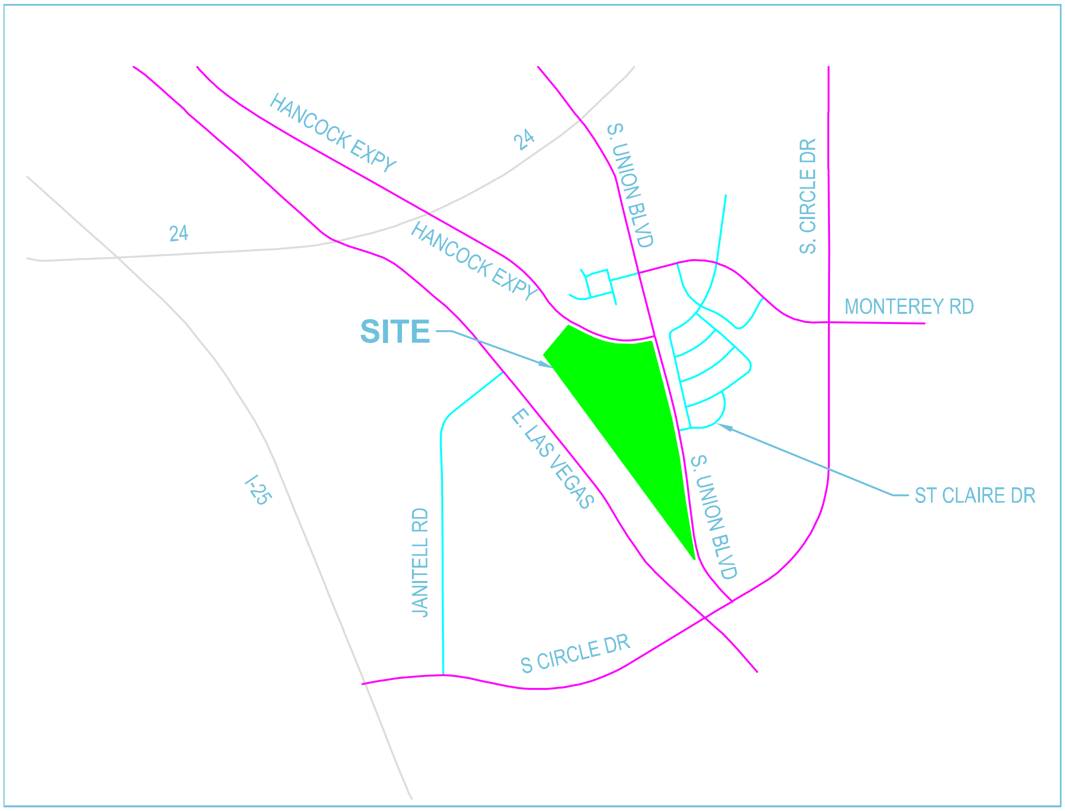
Sincerely,
Galloway & Company, Inc.

Scott Brown

SCOTT MICHAEL BROWN
45900
04/09/2018

Scott Brown, PE
Senior Civil Project Engineer
scottbrown@GallowayUS.com

cc: John Radcliffe



VICINITY MAP

1"=2000'

N