

**Master Development Drainage Plan for
PATRIOT PARK**
N. Powers and Platte Ave.
Colorado Springs, Colorado

Prepared For:
Patriot Park Investments, LLC
421 S. Tejon Street, Suite 330
Colorado Springs, CO 80903

Prepared by:
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Attn: Scott Brown

September 22, 2017



09/22/2017

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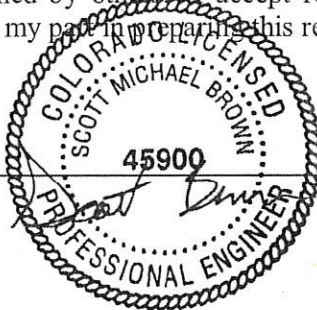
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CERTIFICATION STATEMENTS

This report and plan for the drainage design of Patriot Park was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the *City of Colorado Springs Drainage Criteria Manual* and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.



Scott Brown
Registered Professional Engineer
State of Colorado No. 45900

Date

09/22/2017

Developer's Statement:

Patriot Park Investments, LLC hereby certifies that the drainage facilities for Patriot Park 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 Patriot Park Investments, LLC, guarantee that final drainage design review will absolve Patriot Park 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.

Patriot Park Investments, LLC

Authorized Signature

Kevin Butcher
Printed Name

Manager
Title

Sep 28 2017

Address: 421 S. Tejon St., Suite 330
Colorado Springs, CO 80903

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. Scherer
For City Engineer

10/02/2017
Date

Conditions:

I. INTRODUCTION

This document is the Master Development Drainage Plan for the remaining vacant land in the area known as Patriot Park. It was prepared for Patriot Park Investments, LLC which owns approximately 44.216 acres of vacant land within this area ("project"). The project is to have residential uses on about 23.2 acres west of Space Center Drive, commercial uses on about 18.3 acres east of Space Center Drive, and the existing 2.7 approximate acres water quality pond in the southwest corner. It is Patriot Park Investments intent to donate this 2.7 acre site to the City in addition to the property donation described below.

The purpose of this MDDP is to identify on and offsite drainage patterns, locate and identify tributary or downstream drainage features and facilities that impact the site and to identify which types of drainage facilities will be needed and where they will be located. Potential drainage issues associated with the proposed development will also be discussed, as well as possible solutions.

The offsite parcel immediate west of the project will be overlot graded with this project due to the need to export earthwork from the site. The impact from this grading activity is included within this report. This 19.856 acres offsite parcel is owned by GRDS, LLC. The intended land use for this property is identified on the proposed Concept Plan as park/open space. No channel improvements to Sand Creek will be required until the 19.856 acre GRDS parcel (proposed open space parcel) is platted.

II. GENERAL LOCATION AND DESCRIPTION

Patriot Park is located in the Southwest ¼ of Section 12, township 14 South, Range 66 West of the 6th Principal Meridian, in the City of Colorado Springs, El Paso County, Colorado. The project site is located on both sides of Space Center Drive in Colorado Springs, Colorado. Patriot Park is bounded by Sand Creek to the west, North Powers Blvd to the east, East Platte Avenue to the south, and Technology Court and the Science Park Subdivision to the North. The site itself is currently undeveloped with office buildings to the north and south with associated drives, parking, landscape and utilities. The Sand Creek East Tributary borders the western portion of Patriot Park, but is outside of the property boundary. The project site is bounded to the west by the GRDS parcel, to the north by Technology Court, to the north by Science Park Subdivision No. 1 Lot 1, Block 1 Filing No. 1, Phase 2, to the east by East Powers Boulevard, to the south by Patriot Park Subdivision Filing No. 2, to the south by Space Center Drive, and to the south by the existing water quality pond.

A Vicinity Map is located in Appendix A for reference.

Patriot Park occupies approximately 64.073 total acres, including the 44.2 acres owned by Patriot Park Investments, LLC., and is comprised of undeveloped land covered mostly by native grasses and weeds. The site generally drains to the south along either side of Space Center Drive. The far western edge of the property drains west into Sand Creek. The slopes are between 2% and 5%.

Soil data for Patriot Park was obtained from the United States Department of Agriculture Natural Resources Conservation Service (NRCS) Web Soil Survey. Soils within the site are predominately Bresser Sandy Loam (56%), soil classification B, and Truckton Sandy Loam (40%), soil classification A. A map depicting the soil types on the project site and the GRDS property is contained in Appendix A for reference.

Other than the Sand Creek East Tributary located along the western portion of the overall development, there are no major drainage ways or irrigation facilities located on the site.

III. HISTORIC DRAINAGE PATTERNS AND FEATURES

The Patriot Park project site is located within the Sand Creek Drainage Basin as described in the Sand Creek Drainage Basin Planning Study (DBPS) prepared by the Kiowa Engineering Corporation revised March 1996. Several MDDPs have been prepared for Patriot Park in the past. An MDDP, dated April 2006 was prepared by Nolte Associates, Inc and identified overlot grading, Space Center Drive, and the now existing water quality pond. It assumed office space uses for the full Patriot Park site. All runoff was directed to the water quality pond on the southwest corner of the site. An addendum was added to the Nolte MDDP by Matrix Design Group in October 2007. The Matrix report followed the same patterns identified with the Nolte report. It provided more detail to the southern pads as one was existing and two others were proposed at the time. It highlighted more of the office use on this plan. Another addendum was added to the MDDP by JR Engineering in March 2009. The JR Engineering amendment continued with the same office use for Patriot Park, but proposed a series of water quality ponds for the area west of Space Center Drive. Although the site design presented in this report is significantly different in that the area west of Space Center Drive will be residential use and not office. In addition to the site design change the City's drainage criteria has changed requiring that all new developments provide EURV. This forced the addition of ponds within the development as the existing pond cannot be modified to provide the required volume for EURV for the entire property. The information for the existing conditions from the previously approved MDDP and addendums was reviewed and compared to field data and was determined that it is correct and could be used in this report. The storm sewer capacities and offsite flow patterns were taken from the previous reports.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map 751 (FIRM Number 08041C0751F), and 753 (FIRM Number 08041C0753F), effective date March 17, 1997. There are two preliminarily approved FIRM maps, 751 (FIRM Number 08041C0751G), and 753 (FIRM Number 08041C0753G preliminary dated July 29, 2015. These new FIRM map revisions do not affect the project area. The project site lies outside of the 100-year and 500-year floodplains of Sand Creek. A copy of the FIRM maps are included for reference in the Appendix A.

The site has been constructed slowly over the past ten years with parcels being developed at various times. The drainage reports for the individual sites (the drainage reports are listed in the References section) have been reviewed and the basin information was taken and used to identify runoff from the existing basins. At the time Space Center Drive was designed and constructed the intent was for all of the parcels within Patriot Park to be released untreated and undetained into Space Center Drive where a 100-year pipe system would collect the runoff and pipe it to a now existing water quality pond at the southwest corner of the site. As the parcels developed this drainage pattern would change. A historic basin map has been included in the appendix and can be used to reference the basins discussed below.

Basin OS-1 (6.77 AC) is associated with the existing Science Park Subdivision No. 1 Filing No. 1, Phase 1, Lot 1 which is north of Technology Court. Runoff from the basin splits with part of the runoff being directed into Sand Creek and a portion of the runoff entering Technology Court. There is no water quality or detention provided for this basin.

Basin OS-2 (5.00 AC) is associated with the existing Science Park Subdivision No. 1 Filing No. 1, Phase 2, Lot 1 which is south of Galley Road and east of Space Center Drive. Runoff from the basin is directed into Space Center Drive where it is conveyed via the existing storm sewer system to the existing Patriot Park water quality pond. Reviewing the design for the pond, this basin was not accounted for in the water quality capture volume. It was accounted for as a direct pass through in the pond.

Basin OS-3 (5.07 AC) is associated with the existing Patriot Park Filing No. 1. This basin followed the Matrix MDDP and allowed all runoff to enter into the Space Center Drive storm sewer system and the water quality pond provides WQCV for the basin.

Basin OS-4 (5.73 AC) is associated with the existing Patriot Park Filing No. 3, a.k.a. Patriot Park Building #6. Runoff from this basin does not follow the previously approved MDDPs. Runoff from the basin is directed into Porous Landscaped Detention Islands throughout the site. Excess runoff is then directed to a swale along the south side of the property where it is conveyed west to Sand Creek. Water quality is provided for the site in the form of the Porous Landscaped Detention Islands.

Basin OS-5 (5.73 AC) is associated with the existing Patriot Park Filing No. 4, a.k.a. Patriot Park Building #7. Runoff from this basin does not follow the previously approved MDDPs. Runoff from the basin is directed into Porous Landscaped Detention Islands throughout the site. Excess runoff is then directed to a swale along the south side of the property where it is conveyed west to Sand Creek. Water quality is provided for the site in the form of the Porous Landscaped Detention Islands.

Basin OS-6 (13.21 AC, Q5 = 2.6 cfs, Q100 = 4.3 cfs) is associated with the western portion immediately adjacent to and including Sand Creek. This basin is undeveloped and in a natural state. It has been identified that some fill has previously been placed in this area. Runoff from the basin overland flows into Sand Creek.

Basin OS-7 (9.33 AC, Q5 = 1.4 cfs, Q100 = 2.3 cfs) is associated with a portion of the site from the high point to the west up to the western property line of the proposed residential development. This basin is undeveloped and like Basin H1 it has been identified that fill has previously been placed in the area. Runoff from the basin overland flows into Sand Creek.

Basin H1 (23.60 AC, Q5 = 3.7 cfs, Q100 = 6.2 cfs) is associated with the area from the western property line of the proposed residential area to Space Center drive. This basin is undeveloped and may have been overlot graded in the past. Runoff from the basin overland flows into Space Center Drive where it is captured in the existing storm sewer system and is discharged through the existing water quality pond into Sand Creek.

Basin H2 (4.82 AC, Q5 = 10.9 cfs, Q100 = 18.2 cfs) is associated with Space Center Drive. All runoff from the basin is captured in the existing storm sewer system and is discharged through the existing water quality pond into Sand Creek.

Basin H3 (18.08 AC, Q5 = 3.0 cfs, Q100 = 5.1 cfs) is associated with the proposed commercial area. It is east of Space Center Drive and west of Powers Blvd. The basin is undeveloped. Runoff from the basin overland flows into Space Center Drive where it is captured in the existing storm sewer system and is discharged through the existing water quality pond into Sand Creek.

IV. DRAINAGE DESIGN CRITERIA

The analysis and design of the stormwater management system for this project was prepared in accordance with the criteria set forth in the City of Colorado Springs Drainage Criteria Manual (DCM) Volumes 1 & 2, dated May 2014.

The drainage calculations were based on the City of Colorado Springs drainage criteria manual Figure 6-5 and IDF equations to determine the intensity, and are listed in Table 1 below.

Table 1 - Precipitation Data

Return Period	One Hour Depth (in).	Intensity (in/hr)
5-year	1.50	5.17
100-year	2.52	8.68

The rational method was used to calculate peak flows as the tributary areas are less than 100 acres. The rational method has been proven to be accurate for basins of this size and is based on the following formula:

$$Q = CIA$$

Where:

Q = Peak Discharge (cfs)

C = Runoff Coefficient

I = Runoff intensity (inches/hour)

A = Drainage area (acres)

The runoff coefficients are calculated based on land use, percent imperviousness, and design storm for each basin, as shown in the Colorado Springs drainage criteria manual (Table 6-6). Percent impervious was assumed to be 95% for the commercial areas, 65% for the single family detached (1/8 acre or less lots), and 80% for the multifamily residential.

The 100-year event was used as the major storm event for pipes and inlets. The 5-year event was used as the minor event.

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 equations contained within the DCM were utilized to calculate the required EURV and WQCV values. The latest UD-Detention spreadsheet from UDFCD was not utilized as it significantly contradicts the DCM. Some areas which the new UD-Detention contradict the DCM include: different C values, allowable release rates, runoff methodology (it utilizes CUHP which is not an allowable method per the DCM), and utilizes a different

equation for calculating the EURV volume. Outlet structure design will be provided with final drainage reports and the drain time will be verified using the State's SDI spreadsheet.

V. PROPOSED DRAINAGE PLAN

A. General Concept

The proposed drainage system is designed to safely convey the storm runoff generated from the proposed development. Based on the overall planning for the entire Patriot Park site, the MDDP has provided three detention ponds. One is located on the southeast corner of the project property, the second is centrally located in the project, and the third pond is in the southwest corner.

The project site does not fall within the Streamside Ordinance area. Basin OS-6, which is the GRDS property, is adjacent to Sand Creek and does fall under the Streamside Ordinance. This section of Sand Creek is a Type-3 Streamside Overlay. Since the project site does not include this portion of Patriot Park the setbacks from the Ordinance will not impact the project.

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 discharged that are directly connected to impervious areas runoff is routed through pervious areas to promote infiltration. Due to the existing site constraints and topography this is a difficult task. Grass buffers and swales are used where practical.

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. All three proposed ponds will provide EURV volume for the new development which incorporates a 72 hour release. These ponds will also provide WQCV for the offsite tributary areas which will release in no less than 40 hours.

c. Stabilize Drainageways

This step implements stabilization to channels to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. Improvements to Sand Creek have recently been made. These improvements have already taken into account developed flows from the site (as the site was currently developed). With this project, these rates will be reduced back to predevelopment values. Therefore, the recently completed channel improvements will be adequate for this development. No channel improvements to Sand Creek will be required until the GRDS parcel is platted.

d. Implement Site Specific and Other Source Control BMPs

This step is typically implemented at a detailed level when the site develops. Source control BMPs protect the release of pollutants from outdoor storage areas. This will be identified and implemented within future Final Drainage reports for the site.

C. Proposed Basins

For the proposed drainage design, new basin designations were required as a result of the proposed improvements. The basins and their proposed size, shape and orientation can be seen on the proposed drainage map found in Appendix C.

Basin A1 (6.26 AC, Q5 = 26.0 cfs, Q100 = 43.7 cfs): a basin defining the area of future commercial development. With future development, a storm sewer system will collect runoff from this basin and tie into the proposed storm inlet at DP1. Flow will be routed to proposed Pond A.

Basin A2 (11.8 AC, Q5 = 40.7 cfs, Q100 = 68.3 cfs): a basin defining the area of future commercial development. With future development, a storm sewer system will collect runoff from this basin and tie into the proposed storm inlet at DP2. Flow will be routed to proposed Pond A.

Basin A3 (0.68 AC, Q5 = 0.2 cfs, Q100 = 0.3 cfs): a basin comprised of proposed Pond A, the confluence point for all A Basins. Released flow from Pond A will outfall into the existing storm sewer system that runs along Space Center Drive.

Basin B1 (4.84 AC, Q5 = 11.0 cfs, Q100 = 18.6 cfs): a basin defining the area of future single family homes development. With future development, a storm sewer system will collect runoff from this basin and tie into the proposed storm inlet at DP4. Flow will be routed to proposed Pond B.

Basin B2 (2.41 AC, Q5 = 5.6 cfs, Q100 = 9.4 cfs): a basin defining the area of future single family homes development. With future development, a storm sewer system will collect runoff from this basin and tie into the proposed storm inlet at DP5. Flow will be routed to proposed Pond B.

Basin B3 (2.16 AC, Q5 = 5.0 cfs, Q100 = 8.4 cfs): a basin defining the area of future single family homes development. With future development, a storm sewer system will collect runoff from this basin and tie into the proposed storm inlet at DP6. Flow will be routed to proposed Pond C.

Basin B4 (4.57 AC, Q5 = 10.5 cfs, Q100 = 17.7 cfs): a basin defining the area of future single family homes development. With future development, a storm sewer system will collect runoff from this basin and tie into the proposed storm inlet at DP7. Flow will be routed to proposed Pond C.

Basin B5 (0.52 AC, Q5 = 0.1 cfs, Q100 = 0.2 cfs): a basin comprised of proposed Pond B. Released flow from Pond B will outfall into the existing storm sewer system that runs along Space Center Drive.

Basin C1 (2.90 AC, Q5 = 10.2 cfs, Q100 = 17.1 cfs): a basin comprised of Multi-Family development. With future development, a storm sewer system will collect runoff from this basin and tie into the proposed storm inlet at DP10. Flow will be routed to proposed Pond C.

Basin C2 (1.00 AC, Q5 = 3.3 cfs, Q100 = 5.6 cfs): a basin comprised of Multi-Family development. With future development, a storm sewer system will collect runoff from this basin and tie into the proposed storm inlet at DP9. Flow will be routed to proposed Pond C.

Basin C3 (4.37 AC, Q5 = 13.0 cfs, Q100 = 21.9 cfs): a basin comprised of Multi-Family development. With future development, a storm sewer system will collect runoff from this basin and tie into the proposed storm inlet at DP10. Flow will be routed to proposed Pond C.

Basin C4 (4.72 AC, Q5 = 0.8 cfs, Q100 = 1.3 cfs): a basin comprised of park and open space area. A swale will be graded to collect runoff from this basin and tie into the proposed storm inlet at DP12. Flow will be routed to proposed Pond C.

Basin C5 (0.75 AC, Q5 = 0.2 cfs, Q100 = 0.3 cfs): a basin comprised of proposed Pond C, the confluence point for all C Basins. Released flow from Pond C will outfall into Sand Creek.

Basin OS1 (6.77 AC, Q5 = 1.3 cfs, Q100 = 2.2 cfs): a basin comprised of proposed open space area. Runoff from this basin will follow historic flow patterns into Sand Creek. This basin will be overlotted graded in order to balance the proposed site. Proposed flow rates will match historic rates.

D. Detention and Water Quality

There are three ponds on the proposed site: Pond A, located in the southwest corner of the commercial parcel; Pond B, located at the south end of the single family residential; and Pond C, located at the south end of the proposed park. All three ponds will provide water quality and detention for the tributary areas. All three ponds may be publicly maintained due to the runoff from adjacent public property. Ownership and maintenance of the ponds will be determined at a later date.

Pond A

Pond A is located at the southwest corner of the commercial property site. It provides water quality for 18.74 acres of commercial development. It has been designed with 4:1 soil side slopes surrounding the pond to provide the adequate amount of volume. Basins A1-A3 are tributary to the pond. The percent imperviousness of these tributary basins is approximately 92%. The full spectrum detention pond has been sized utilizing the UDFCD UD-Detention v2.35 spreadsheet. The EURV volume will release in 72 hours while the water quality volume releases in 40 hours. The release from the pond will be at or below historic rates. The pond will discharge into the existing storm sewer in Space Center Drive.

Pond B

Pond B is located at the middle of the Patriot Park Property at the south end of the single-family development. It will provide water quality and detention for this portion of the development. Basins B1, B2, and B5, which are comprised of 7.77 acres, are tributary to the pond. The percent imperviousness of these tributary basins is approximately 61%. The full spectrum detention pond has been sized utilizing the UDFCD UD-Detention v2.35 spreadsheet. The EURV volume will release in 72 hours while the water quality volume releases in 40 hours. The release from the pond will be at or below historic rates. The pond will discharge into the existing storm sewer in Space Center Drive.

Pond C

Pond C is located at the southwest corner of the Patriot Park Property at the south end of the Multi-family development. It will provide water quality and detention for this portion of the development. Basins B3-B4 and C1-C5, which are comprised of 20.47 acres, are tributary to the pond. The percent imperviousness of these tributary basins is approximately 55%. The full spectrum detention pond has been sized utilizing the UDFCD UD-Detention v2.35 spreadsheet. The EURV volume will release in 72 hours while the water quality volume releases in 40 hours. The release from the pond will be at or below historic rates. The pond will discharge directly into Sand Creek.

Existing Patriot Park Water Quality Pond

With the proposed development there is no plan to alter the existing water quality pond. The pond was originally designed for 64.15 acres at 75% impervious. This included all of Patriot Park from Platte Avenue north to the Science Park Subdivision. As the lots have developed some of them have provided water quality of their own. Currently only 11.71 acres of the 64.15 acres utilize the water quality pond for water quality. With the development of the commercial pads and residential area water quality will be provided outside of the existing pond. This means that the existing pond will still provide adequate volume for the development.

The existing storm sewer system within Space Center Drive was designed to capture the full 64.15 acres at undetained rates. With the proposed development providing onsite detention and removing large areas from draining into the existing system, there will be no issues with the existing system having capacity to handle the flows from the development. The downstream end of the existing storm system was designed to handle 243.07 cfs and the proposed flow in the system will be approximately 75 cfs.

As was previously noted the intent is to donate the property this pond sits on to the City. Additionally, due to the public property that drains to this pond it may be publicly maintained. Ownership and maintenance of the ponds will be determined at a later date.

VI. DRAINAGE AND BRIDGE FEES

The project is located within the Sand Creek Drainage Basin. The "2017 Drainage, Bridge, and Pond Fees - City of Colorado Springs", effective February 28, 2017 table identifies the following fees associated with the basin.

Basin: Sand Creek

Basin Fees-2017	Total Area (Acres)	Basin Fee (per Acre)	Total Cost Basin Fee
Drainage Fee	41.492	\$ 11,154	\$ 462,801.77
Bridge Fee	41.492	\$ 675	\$ 28,007.10
Pond Fee-Land	41.492	\$ 1,070	\$ 44,396.44
Pond Fee-Facility	41.492	\$ 3,259	\$ 135,222.43
Total			\$ 670,427.74

VII. CONCLUSIONS

This report for Patriot Park has been prepared using the criteria and methods as described in the City of Colorado Springs Drainage Criteria Manual Volumes 1 & 2. The proposed ponds will adequately provide water quality and full spectrum detention for all proposed development. They will also provide full spectrum detention for the onsite areas and ensure that the 100-year discharge from the site does not exceed the pre developed conditions in accordance with the DCM. The downstream facilities within Sand Creek are adequate to protect the runoff proposed from the site. The site runoff will not adversely affect the downstream and surrounding developments. No channel improvements to Sand Creek will be required until the 19.856 acre GRDS parcel (proposed open space parcel) is platted.

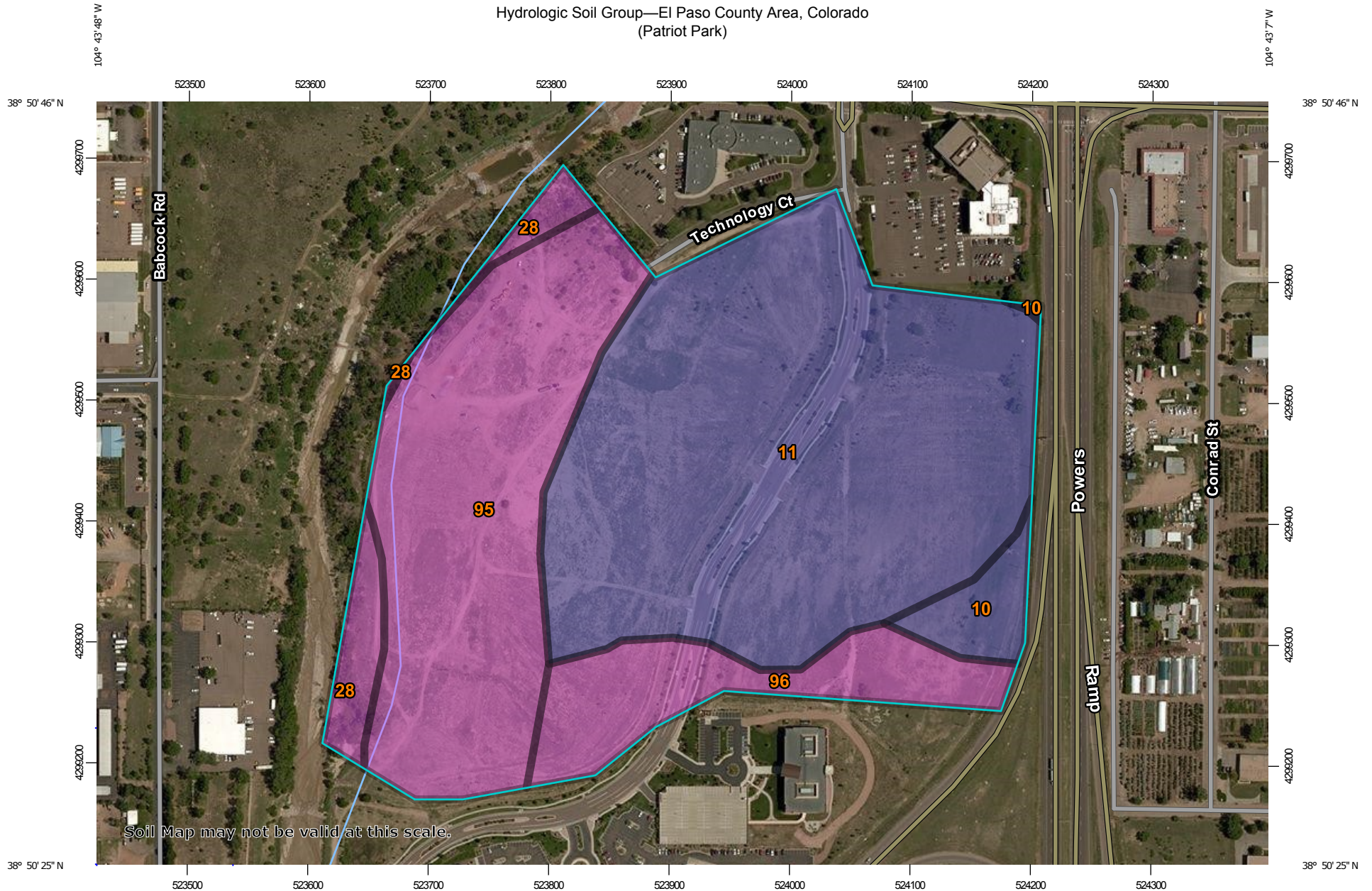
VIII. REFERENCES

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 Patriot Park*, March 31, 2009, by JR Engineering.
4. *Master Development Drainage Plan for Patriot Park*, September 2007, by Matrix Design Group, Inc.
5. *Master Development Drainage Plan for Patriot Park*, March 2006, by Nolte Associates, Inc.
6. *Sand Creek Drainage Basin Planning Study*, March 1996, by Kiowa Engineering.
7. *Final Drainage Report for Patriot Park Subdivision Filing 1*, July 2005, by Matrix Design Group, Inc.
8. *Drainage Letter Patriot Park Filing 2- A Final Plat of Space Center Drive and Replat of Patriot Park Filing 1*), September 2006, by Nolte Associates, Inc.
9. *Final Drainage Report Patriot Park Filing No .3 for Patriot Park Building #6*, February 2007, by Matrix Design Group, Inc.
10. *Final Drainage Report Patriot Park Filing No. 4 for Patriot Park Building #7*, December 2007, by CTR Engineering.

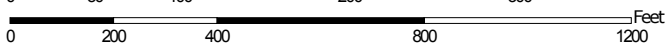
Appendix A
Figure and Exhibits



Hydrologic Soil Group—El Paso County Area, Colorado
(Patriot Park)



Map Scale: 1:4,450 if printed on A landscape (11" x 8.5") 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 Rating Polygons





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

Soil Rating Lines

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

Soil Rating Points





 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available


Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 14, Sep 23, 2016

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

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

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10	Blendon sandy loam, 0 to 3 percent slopes	B	1.7	3.1%
11	Bresser sandy loam, cool, 0 to 3 percent slopes	B	28.7	52.7%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	2.2	4.1%
95	Truckton loamy sand, 1 to 9 percent slopes	A	16.4	30.0%
96	Truckton sandy loam, 0 to 3 percent slopes	A	5.5	10.2%
Totals for Area of Interest			54.5	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

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

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

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

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

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

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

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

NGS Information Services
NOAA, NNGS-1
National Geodetic Survey
SSM-C-3, #5022
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3202 or visit its website at <http://www.ngs.noaa.gov/>.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

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

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

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

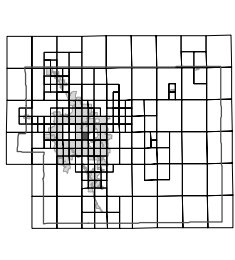
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/firm/>.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION.

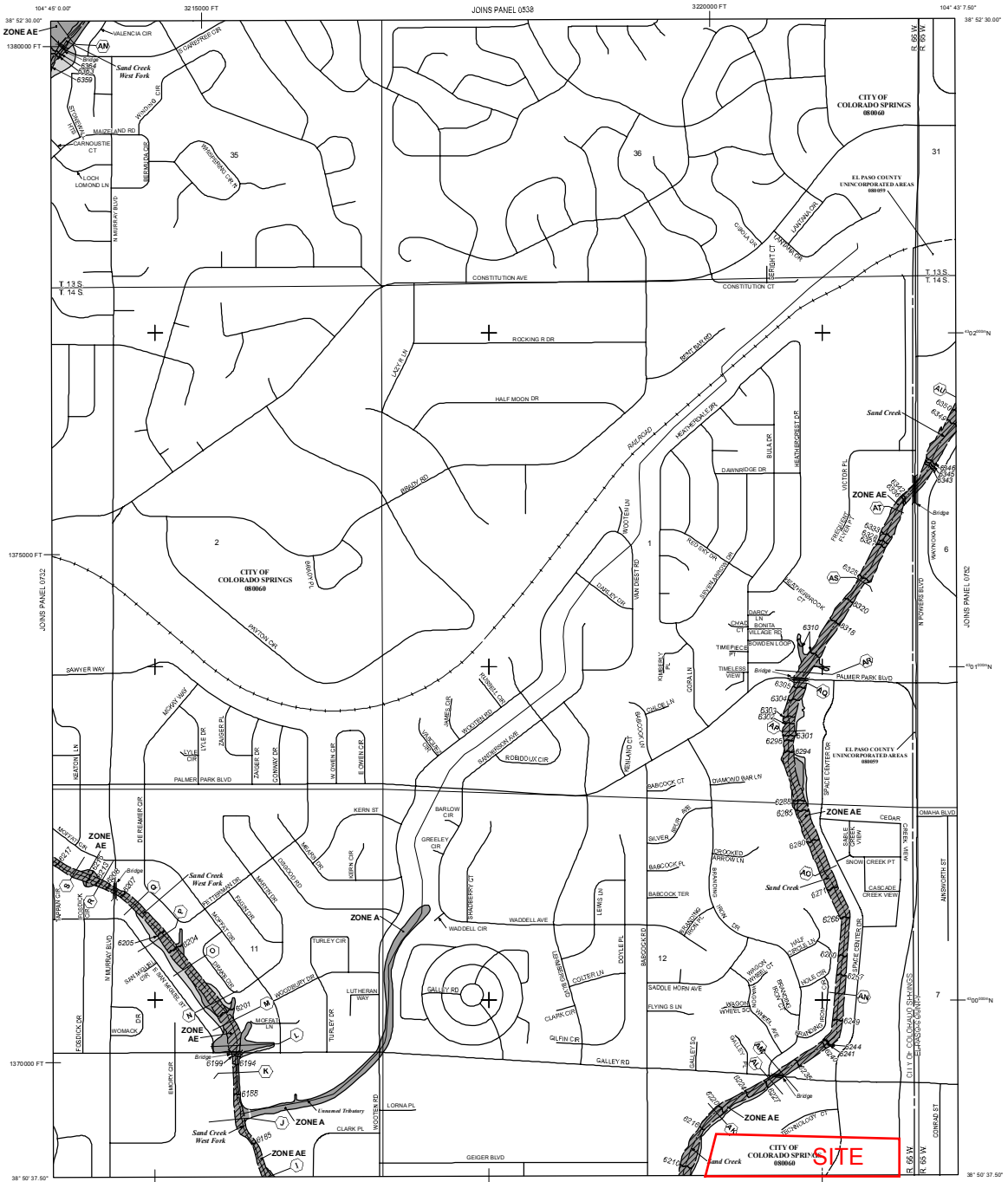
Panel Location Map



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



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



LEGEND

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

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

- ZONE AE** No Base Flood Elevations determined.
- ZONE AH** Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AR** Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was substantially destroyed. Zone AR indicates that the former flood control system is being reduced to provide protection from the 1% annual chance flood.
- ZONE ASB** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

- OTHER FLOOD AREAS**
 - ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with average area less than 1 square mile; and areas protected by levees from 1% annual chance flood.
 - OTHER AREAS** Areas determined to be outside the 0.2% annual chance floodplain.
 - ZONE D** Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**
- OTHERWISE PROTECTED AREAS (OPA)**

- CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations; flood depths on flood velocities
- Base Flood Elevation line and value; elevation in feet*
- Base Flood Elevation value where uniform within zone; elevation in feet*

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

- Cross section line
- Transverse line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (EPSG:5002)
- Lambert Conformal Conic Projection
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 River Mile

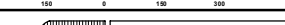
MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
MAP REVISION DATE: It updates previous maps to incorporate Flood Insurance and Special Flood Hazard Areas to update map forms, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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

To determine if flood insurance is available in this community, contact your insurance agent or the National Flood Insurance Program at 1-800-438-6620.



NFP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0751G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 751 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

COUNTY	COMMUNITY	NUMBER	PANEL	STATUS
COLORADO SPRINGS CITY OF	08888	000	0	0
EL PASO COUNTY	08888	000	0	0

PRELIMINARY
JULY 28, 2010

Notice to User: The Map Number shown below should be used when filing insurance applications. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0751G

MAP REVISED

Federal Emergency Management Agency

NOTES TO USERS

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

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

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

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

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

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

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

NGS Information Services
NOAA, NGS13
National Geodetic Survey
SSM-C-3, #5022
1315 East-West Highway
Silver Spring, MD 20910-3282

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

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

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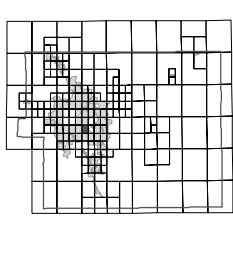
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El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION.

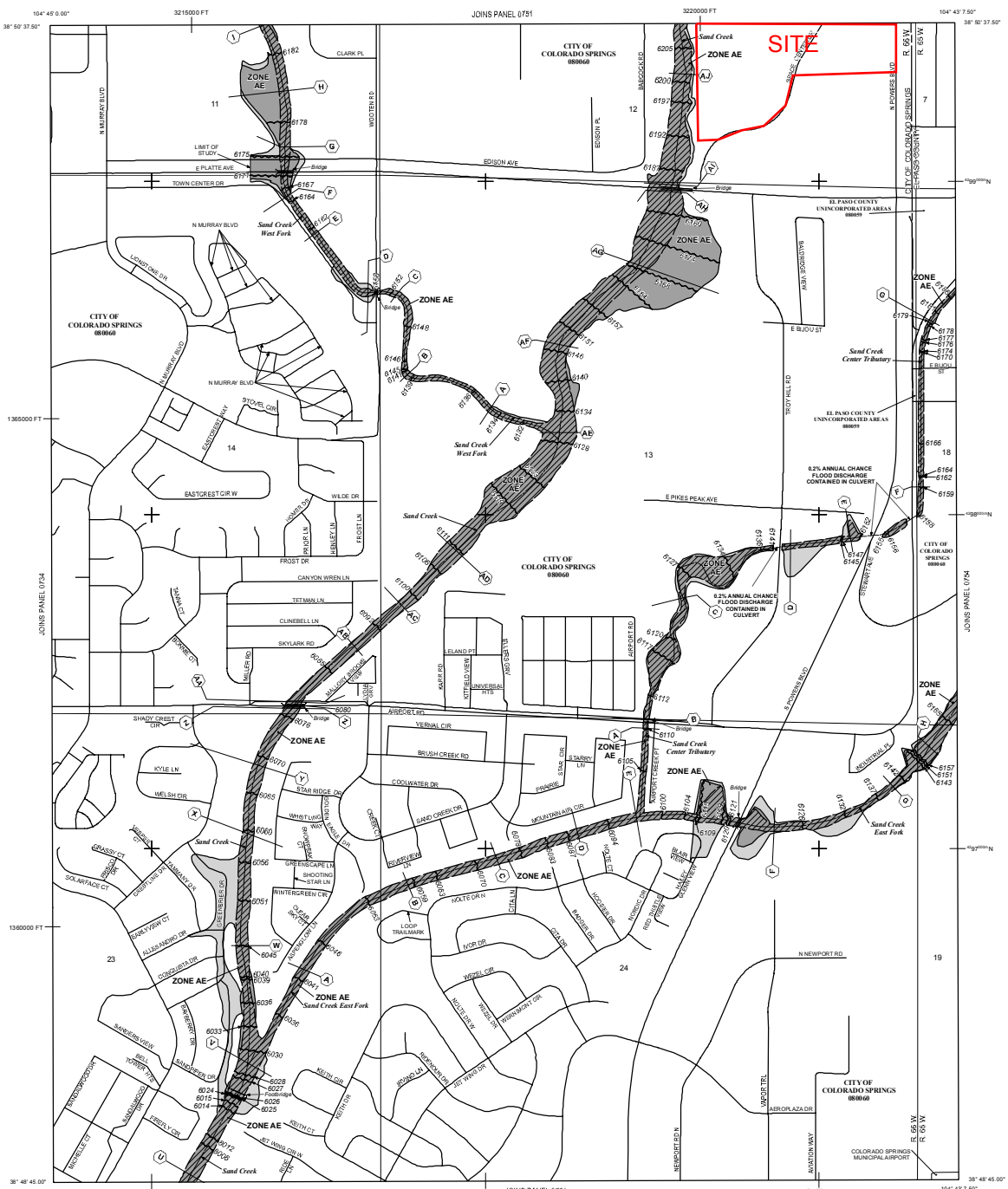
Panel Location Map



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



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



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 SOUTH, RANGE 65 WEST, AND TOWNSHIP 14 SOUTH, RANGE 66 WEST.

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

- OTHER FLOOD AREAS**
- ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with zone areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- OTHER AREAS**
- ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE D** Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**
- OTHERWISE PROTECTED AREAS (OPAs)**

- CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary defining Special Flood Hazard Areas of differing Base Flood Elevations. Flood depths or flood velocities.
- Base Flood Elevation line and value; elevation in feet (EL 987)
- Base Flood Elevation value where uniform within zone; elevation in feet

- Referenced to the North American Vertical Datum of 1988 (NAVD 88)
- 513 Cross section line
- 25-25 Tract line
- 51° 07' 30.00" 102° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone zone 13, Lambert Conformal Conic Projection
- DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 River Mile

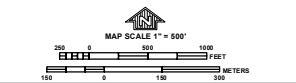
MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
Flood Insurance Study Report for this jurisdiction, Flood Profiles and Floodway Data and Special Flood Hazard Areas to update map format, to add ticks and road names, and to incorporate previously issued Letters of Map Revision.

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

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



NFP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0753G

FIRM FLOOD INSURANCE RATE MAP EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 753 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS	COMMUNITY	NUMBER	PANEL	SUFFIX
	COLORADO SPRINGS CITY OF	0888	075	G
	EL PASO COUNTY	0888	075	G

PRELIMINARY
JULY 28, 2015

MAP NUMBER 08041C0753G

MAP REVISED

Federal Emergency Management Agency

Appendix B
Hydrologic Calculations

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input		
Calculated cells		
***Design Storm: 1-Hour Rain Depth	WQCV Event	0.60
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52
Optional User Defined Storm	CUHP	
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	
Max Intensity for Optional User Defined Storm		0

Designer: Scott Brown
Company: Galloway & Co.
Date: August 25, 2017
Project: Patriot Park
Location: Colorado Springs, CO

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	A1	A2	A3	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	OS1
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Loamy Sand	Sandy Loam	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	6.260	11.800	0.680	4.840	2.410	2.160	4.570	0.520	2.900	1.000	4.370	4.720	0.750	6.770
Directly Connected Impervious Area (DCIA, acres)	5.060	9.530	0.030	1.580	0.790	0.700	1.490	0.000	1.860	0.640	2.800	0.000	0.000	0.000
Unconnected Impervious Area (UIA, acres)	0.890	1.680	0.000	1.570	0.780	0.700	1.480	0.000	0.460	0.160	0.700	0.000	0.000	0.000
Receiving Pervious Area (RPA, acres)	0.310	0.590	0.000	1.690	0.840	0.760	1.600	0.000	0.580	0.200	0.870	4.720	0.750	6.770
Separate Pervious Area (SPA, acres)	0.000	0.000	0.650	0.000	0.000	0.000	0.000	0.520	0.000	0.000	0.000	0.000	0.000	0.000
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	V	V	V	V	V	V	V	V	V	V	V	V	V	V

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	6.260	11.800	0.680	4.840	2.410	2.160	4.570	0.520	2.900	1.000	4.370	4.720	0.750	6.770
Directly Connected Impervious Area (DCIA, %)	80.8%	80.8%	4.4%	32.6%	32.8%	32.4%	32.6%	0.0%	64.1%	64.0%	64.1%	0.0%	0.0%	0.0%
Unconnected Impervious Area (UIA, %)	14.2%	14.2%	0.0%	32.4%	32.4%	32.4%	32.4%	0.0%	15.9%	16.0%	16.0%	0.0%	0.0%	0.0%
Receiving Pervious Area (RPA, %)	5.0%	5.0%	0.0%	34.9%	34.9%	35.2%	35.0%	0.0%	20.0%	20.0%	19.9%	100.0%	100.0%	100.0%
Separate Pervious Area (SPA, %)	0.0%	0.0%	95.6%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
A _s (RPA / UIA)	0.348	0.351	0.000	1.076	1.077	1.086	1.081	0.000	1.261	1.250	1.243	0.000	0.000	0.000
I _s Check	0.740	0.740	1.000	0.480	0.480	0.480	0.480	1.000	0.440	0.440	0.450	1.000	1.000	1.000
f / i for WQCV Event:	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	3.2	3.2	3.2	3.2	3.2	3.2
f / i for 5-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
f / i for 100-Year Event:	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.4	0.4	0.4
f / i for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IRF for 5-Year Event:	0.94	0.94	1.00	0.88	0.88	0.88	0.88	1.00	0.86	0.87	0.87	1.00	1.00	1.00
IRF for 100-Year Event:	0.99	0.99	1.00	0.93	0.93	0.93	0.93	1.00	0.90	0.92	0.90	1.00	1.00	1.00
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I _{total}	95.0%	95.0%	4.4%	65.1%	65.1%	64.8%	65.0%	0.0%	80.0%	80.0%	80.1%	0.0%	0.0%	0.0%
Effective Imperviousness for WQCV Event:	80.8%	80.8%	4.4%	32.6%	32.8%	32.4%	32.6%	0.0%	64.1%	64.0%	64.1%	0.0%	0.0%	0.0%
Effective Imperviousness for 5-Year Event:	94.2%	94.2%	4.4%	61.3%	61.3%	61.0%	61.2%	0.0%	77.8%	78.0%	77.9%	0.0%	0.0%	0.0%
Effective Imperviousness for 100-Year Event:	94.9%	94.8%	4.4%	62.9%	63.0%	62.6%	62.8%	0.0%	78.3%	78.8%	78.5%	0.0%	0.0%	0.0%
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	0.1%	0.2%	1.1%	3.2%	3.2%	3.3%	3.2%	N/A	1.9%	1.5%	1.9%	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	61.2%
Total Site Effective Imperviousness for WQCV Event:	45.5%
Total Site Effective Imperviousness for 5-Year Event:	59.6%
Total Site Effective Imperviousness for 100-Year Event:	60.3%
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

- * Use Green-Ampt average infiltration rate values from Table 3-3.
- ** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
- *** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Patriot Park
Location: CO, Colorado Springs

Project Name: Patriot Park
Project No.: SLV01.01
Calculated By: GAH
Checked By: _____
Date: #####

SUB-BASIN DATA						INITIAL/OVERLAND (T _i)			TRAVEL TIME (T _t)					T _c CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C ₁₀₀	C ₅	L (FT)	S (%)	T _i (MIN)	L (FT)	S (%)	C _v	VEL. (FPS)	T _t (MIN)	COMP. T _c (MIN)	TOTAL LENGTH(FT)	Urbanized T _c (MIN)	T _c (MIN)
A1	6.26	B	95.00	0.92	0.88	14	2.0	1.2	890	1.8	20.0	2.7	5.5	6.7	904.0	15.0	6.7
A2	11.80	B	95.00	0.92	0.88	55	1.0	3.0	1372	1.8	20.0	2.7	8.5	11.5	1427.0	17.9	11.5
A3	0.68	B	5.00	0.48	0.05	15	25.0	2.5	145	1.0	15.0	1.5	1.6	4.2	160.0	10.9	5.0
B1	4.84	B	65.00	0.77	0.60	85	1.1	8.2	725	2.1	20.0	2.9	4.2	12.3	810.0	14.5	12.3
B2	2.41	B	65.00	0.77	0.60	51	0.9	6.8	908	2.1	20.0	2.9	5.2	12.0	959.0	15.3	12.0
B3	2.16	B	65.00	0.77	0.60	100	2.0	7.3	837	2.1	20.0	2.9	4.8	12.1	937.0	15.2	12.1
B4	4.57	B	65.00	0.77	0.60	100	4.0	5.8	962	1.6	20.0	2.5	6.3	12.1	1062.0	15.9	12.1
B5	0.52	B	5.00	0.48	0.05	40	25.0	4.2	175	0.5	15.0	1.1	2.7	6.9	215.0	11.2	6.9
C1	2.90	A	80.00	0.80	0.74	100	4.4	4.0	345	1.2	20.0	2.2	2.6	6.6	445.0	12.5	6.6
C2	1.00	B	80.00	0.85	0.74	30	0.5	4.5	280	0.5	20.0	1.4	3.3	7.8	310.0	11.7	7.8
C3	4.37	A	80.00	0.80	0.74	20	2.0	2.3	1084	1.2	20.0	2.2	8.2	10.6	1104.0	16.1	10.6
C4	4.72	A	5.00	0.19	0.05	57	0.3	21.7	1393	2.1	15.0	2.2	10.7	32.3	1450.0	18.1	18.1
C5	0.75	A	5.00	0.19	0.05	71	7.0	8.5	211	4.7	15.0	3.3	1.1	9.6	282.0	11.6	9.6
OS1	6.77	A	5.00	0.19	0.05	100	3.3	12.9	198	1.5	7.0	0.9	3.8	16.8	298.0	11.7	11.7
OS6	13.21	A	5.00	0.19	0.05	260	7.5	15.8						15.8	260.0	11.4	11.4
OS7	9.33	A	5.00	0.19	0.05	300	3.5	21.9	1700	5.0	7.0	1.6	18.1	40.0	2000.0	21.1	21.1
H1	23.60	A	5.00	0.19	0.05	300	2.0	26.4	1250	2.0	7.0	1.0	21.0	47.5	1550.0	18.6	18.6
H2	4.82	A	90.00	0.88	0.84	40	2.0	2.4	2885	3.0	7.0	1.2	39.7	42.0	2925.0	26.3	26.3
H3	18.08	A	5.00	0.19	0.05	300	2.0	26.43	700	3.0	7.0	1.2	9.6	36.1	1000.0	15.6	15.6

NOTES:

$$T_i = (0.395 * (1.1 - C_5) * (L)^{0.5}) / ((S)^{0.33}), \text{ S in ft/ft}$$

$$T_t = L / 60V \text{ (Velocity From Fig. 501)}$$

$$\text{Velocity } V = C_v * S^{0.5}, \text{ S in ft/ft}$$

$$T_c \text{ Check} = 10 + L / 180$$

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

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

Subdivision: Patriot Park
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Patriot Park
Project No.: SLV01.01
Calculated By: GAH
Checked By: _____
Date: 5/25/17

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Rumoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	1	A1	6.26	0.88	6.7	5.51	4.72	26.0							26.0						Type R inlet Piped to DP3
	2	A2	11.80	0.88	11.5	10.38	3.92	40.7							40.7						Type R inlet Piped to DP3
	3	A3	0.68	0.05	5.0	0.03	5.17	0.2							0.2						
	3								11.5	15.92	3.92	62.4			62.4						Pond released and Piped west to existing storm
	4	B1	4.84	0.60	12.3	2.90	3.81	11.0							11.0						Type R inlet Piped to DP8
	5	B2	2.41	0.60	12.0	1.45	3.86	5.6							5.6						Type R inlet Piped to DP8
	4								12.3	4.35	3.81	16.6			16.6						Piped to DP8
	6	B3	2.16	0.60	12.1	1.30	3.85	5.0							5.0						Type R inlet Piped to DP8
	7	B4	4.57	0.60	12.1	2.74	3.84	10.5							10.5						Type R inlet Piped to DP8
	6								12.1	4.04	3.84	15.5			15.5						
	8	B5	0.52	0.05	6.9	0.03	4.68	0.1							0.1						
	8								12.3	8.42	3.81	32.1			32.1						Pond released and Piped east to existing storm
	10	C1	2.90	0.74	6.6	2.15	4.74	10.2							10.2						Type R inlet Piped to DP13
	9	C2	1.00	0.74	7.8	0.74	4.49	3.3							3.3						Type R inlet Piped to DP13
	11	C3	4.37	0.74	10.6	3.23	4.04	13.0							13.0						Type R inlet Piped to DP13
	11								10.6	6.12	4.04	24.7			24.7						
	12	C4	4.72	0.05	18.1	0.24	3.24	0.8							0.8						Type R inlet Piped to DP13
	13	C5	0.75	0.05	9.6	0.04	4.20	0.2							0.2						
	13								18.1	0.28	3.24	0.9			0.9						
	13								18.1	6.40	3.24	20.7			20.7						Pond released and Piped east to existing storm
	14	OS1	6.77	0.05	11.7	0.34	3.90	1.3							1.3						
		OS6	13.21	0.05	11.4	0.66	3.93	2.6							2.6						
		OS7	9.33	0.05	21.1	0.47	3.01	1.4							1.4						
		H1	23.60	0.05	18.6	1.18	3.20	3.8							3.8						
		H2	4.82	0.84	26.3	4.05	2.68	10.9							10.9						
		H3	18.08	0.05	15.6	0.90	3.47	3.1							3.1						

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

Subdivision: Patriot Park
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Patriot Park
Project No.: SLV01.01
Calculated By: GAH
Checked By:
Date: 5/25/17

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	1	A1	6.26	0.88	6.7	5.51	7.93	43.7							43.7						Type R inlet Piped to DP3
	2	A2	11.80	0.88	11.5	10.38	6.58	68.3							68.3						Type R inlet Piped to DP3
	3	A3	0.68	0.05	5.0	0.03	8.68	0.3							0.3						
	3								11.5	15.92	6.58	104.8			104.8						Pond released and Piped west to existing storm
	4	B1	4.84	0.60	12.3	2.90	6.40	18.6							18.6						Type R inlet Piped to DP8
	5	B2	2.41	0.60	12.0	1.45	6.47	9.4							9.4						Type R inlet Piped to DP8
	4								12.3	4.35	6.40	27.8			27.8						Piped to DP8 Type R inlet Piped to DP8
	6	B3	2.16	0.60	12.1	1.30	6.46	8.4							8.4						Type R inlet Piped to DP8
	7	B4	4.57	0.60	12.1	2.74	6.45	17.7							17.7						Type R inlet Piped to DP8
	6								12.1	4.04	6.45	26.1			26.1						
	8	B5	0.52	0.05	6.9	0.03	7.86	0.2							0.2						
	8								12.3	8.42	6.40	53.9			53.9						Pond released and Piped east to existing storm
	10	C1	2.90	0.74	6.6	2.15	7.96	17.1							17.1						Type R inlet Piped to DP13
	9	C2	1.00	0.74	7.8	0.74	7.54	5.6							5.6						Type R inlet Piped to DP13
	11	C3	4.37	0.74	10.6	3.23	6.79	21.9							21.9						Type R inlet Piped to DP13
	11								10.6	6.12	6.79	41.6			41.6						
	12	C4	4.72	0.05	18.1	0.24	5.44	1.3							1.3						Type R inlet Piped to DP13
	13	C5	0.75	0.05	9.6	0.04	7.05	0.3							0.3						
									18.1	0.28	5.44	1.5			1.5						
	13								18.1	6.40	5.44	34.8			34.8						Pond released and Piped east to existing storm
	14	OS1	6.77	0.05	11.7	0.34	6.55	2.2							2.2						
		OS6	13.21	0.05	11.4	0.66	6.59	4.3							4.3						
		OS7	9.33	0.05	21.1	0.47	5.05	2.4							2.4						
		H1	23.60	0.05	18.6	1.18	5.37	6.3							6.3						
		H2	4.82	0.84	26.3	4.05	4.50	18.2							18.2						
		H3	18.08	0.05	15.6	0.90	5.82	5.2							5.2						

Appendix C
Pond Calculations

Detention Pond Tributary Areas

Subdivision: Patriot Park
Location: CO, Colorado Springs

Project Name: Patriot Park
Project No.: SLV01.01
Calculated By: GAH
Checked By: _____
Date: 5/25/17

Pond A

Basin	Area	% Imp
A1	6.26	95
A2	11.80	95
A3	0.68	5
Total	18.74	91.7

Pond B

Basin	Area	% Imp
B1	4.84	65
B2	2.41	65
B5	0.52	5
Total	7.77	61.0

Pond C

Basin	Area	% Imp
B3	2.16	65
B4	4.57	65
C1	2.90	80
C2	1.00	80
C3	4.37	80
C4	4.72	5
C5	0.75	5
Total	20.47	55.0

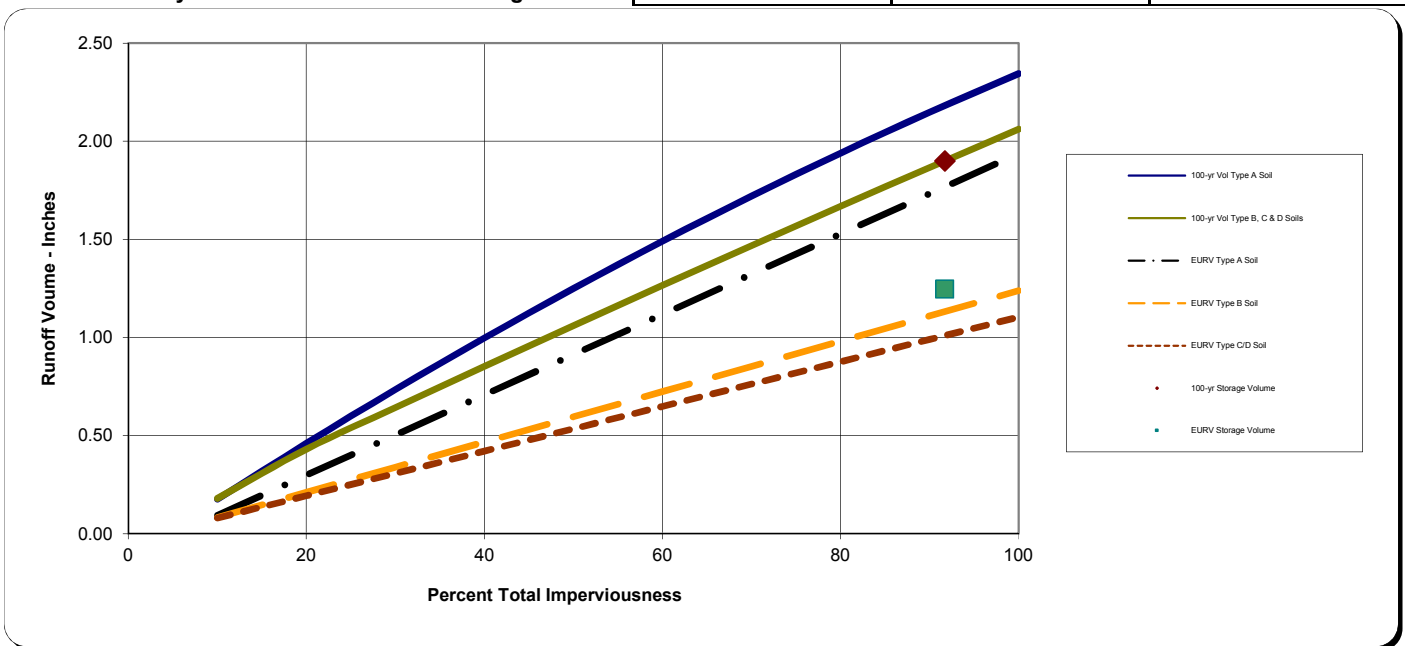
DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: Patriot Park
Basin ID: Pond A - Commercial Area

* User input data shown in blue.

Area of Watershed (acres)	18.74	
Subwatershed Imperviousness	91.7%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0 ▼
Effective Imperviousness ¹	91.7%	
Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A	0.0	0.0
Type B	100.0%	18.7
Type C or D	0.0	0.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient-- α
Initial-- f_i	Final-- f_o	
4.5	0.6	0.0018
Detention Volumes ^{2,5}		Maximum Allowable Release Rate, cfs ³
(watershed inches)	(acre-feet)	
1.25	1.94	
Excess Urban Runoff Volume⁴		Design Outlet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV⁵		15.93



Notes:

- 1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).
- 2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.
- 3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.
- 4) EURV approximates the difference between developed and pre-developed runoff volume.
- 5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

POND VOLUME CALCULATIONS

Subdivision Patriot Park
 Location CO, Colorado Springs

Project Name: Patriot Park
 Project No. SLV01.01
 By: GAH
 Checked By: _____
 Date: 5/25/17

Volume = $\frac{1}{3} \times \text{Depth} \times (A + B + (A \times B)^{0.5})$

A - Upper Surface

B - Lower Surface

Pond A

Stage	Stage Elevation	Stage Surface Area (square feet)	Stage Volume (cubic feet)	Cumulative Volume (cubic feet)	Cumulative Volume (acre feet)
0.00	6201.00	0	0	0	0.00
1.00	6202.00	11,562	3,854	3,854	0.09
2.00	6203.00	13,478	12,508	16,362	0.38
3.00	6204.00	15,514	14,484	30,846	0.71
4.00	6205.00	17,666	16,578	47,424	1.09
5.00	6206.00	19,906	18,775	66,199	1.52
6.00	6207.00	22,240	21,062	87,261	2.00
7.00	6208.00	24,779	23,498	110,759	2.54
8.00	6209.00	27,478	26,117	136,876	3.14
9.00	6210.00	30,479	28,966	165,842	3.81

Volume (acre feet)	Volume	Water Surface Elevation
EURV	1.94	6206.87
100-Year Detention	2.97	6208.72
1' Freeboard		6209.72

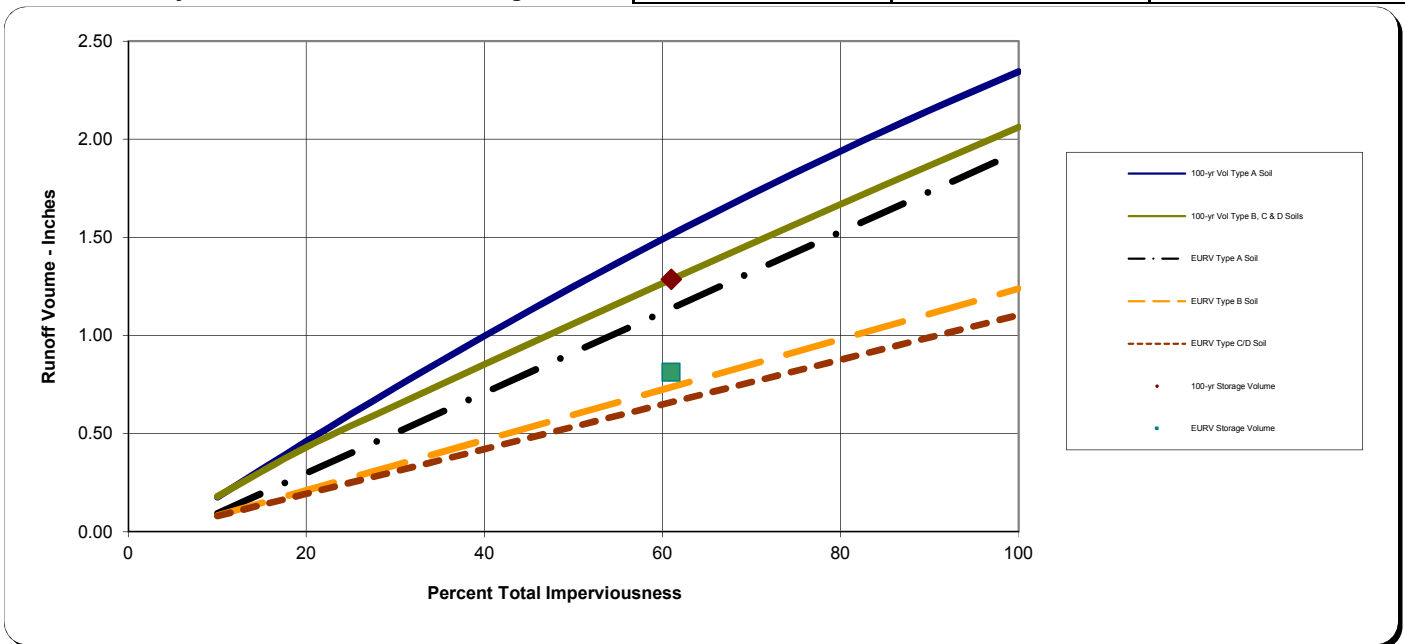
DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: Patriot Park
Basin ID: Pond B - Single Family

* User input data shown in blue.

Area of Watershed (acres)	7.77	
Subwatershed Imperviousness	61.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness ¹	61.0%	
Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A		0.0
Type B	100.0%	7.8
Type C or D		0.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient-- α
Initial-- f_i	Final-- f_o	
4.5	0.6	0.0018
Detention Volumes ^{2,5}		Maximum Allowable Release Rate, cfs ³
(watershed inches)	(acre-feet)	
0.81	0.53	
100-year Detention Volume Including WQCV⁵		6.60



Notes:

- 1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).
- 2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.
- 3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.
- 4) EURV approximates the difference between developed and pre-developed runoff volume.
- 5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

POND VOLUME CALCULATIONS

Subdivision Patriot Park
 Location CO, Colorado Springs

Project Name: Patriot Park
 Project No. SLV01.01
 By: GAH
 Checked By: _____
 Date: 5/25/17

Volume = $\frac{1}{3} \times \text{Depth} \times (A + B + (A \times B)^{0.5})$

A - Upper Surface

B - Lower Surface

Pond B

Stage	Stage Elevation	Stage Surface Area (square feet)	Stage Volume (cubic feet)	Cumulative Volume (cubic feet)	Cumulative Volume (acre feet)
0.00	6210.00	2,433	0	0	0.00
1.00	6211.00	4,423	3,379	3,379	0.08
2.00	6212.00	6,228	5,300	8,679	0.20
3.00	6213.00	8,150	7,167	15,846	0.36
4.00	6214.00	10,188	9,150	24,996	0.57
5.00	6215.00	12,353	11,253	36,249	0.83
6.00	6216.00	14,672	13,496	49,745	1.14

Volume (acre feet)	Volume	Water Surface Elevation
EURV	0.52	6213.75
100-Year Detention	0.83	6215.00
1' Freeboard		6216.00

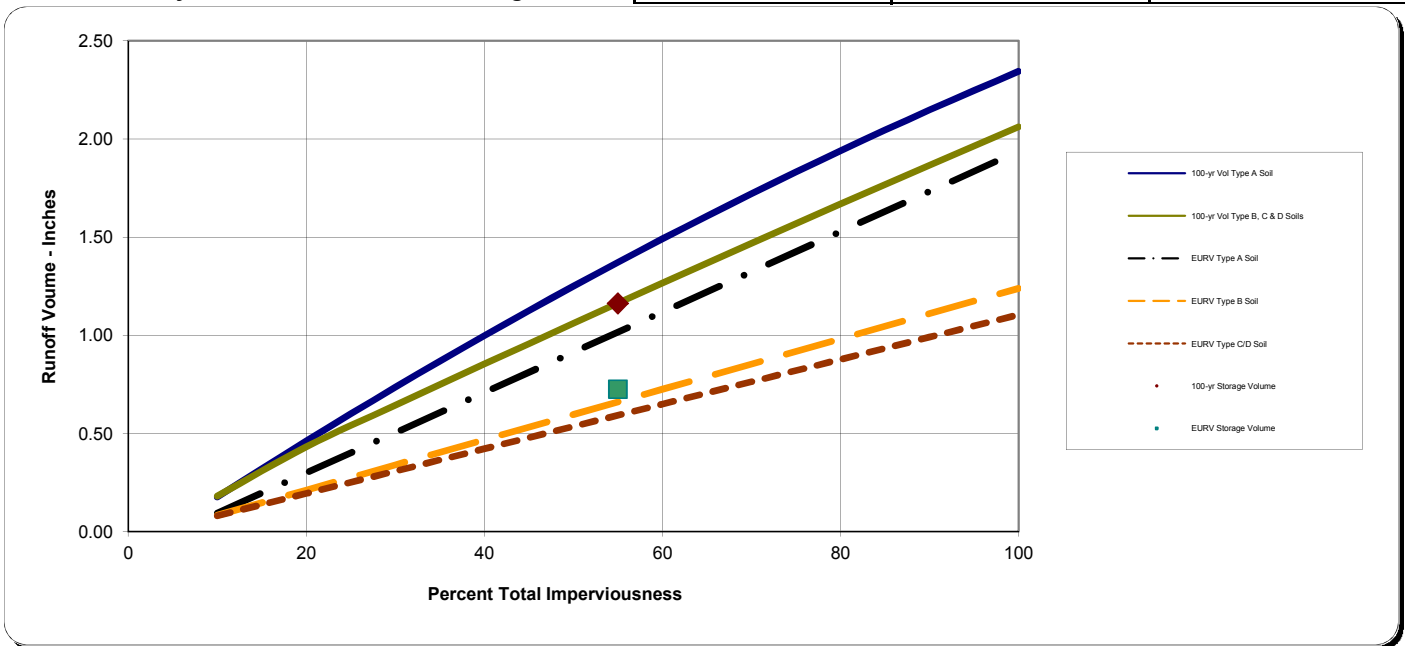
DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: Patriot Park
Basin ID: Pond C - Multifamily Residential

* User input data shown in blue.

Area of Watershed (acres)	20.47	
Subwatershed Imperviousness	55.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0 ▼
Effective Imperviousness ¹	55.0%	
Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A	0.0	0.0
Type B	100.0%	20.5
Type C or D	0.0	0.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient-- α
Initial-- f_i	Final-- f_o	
4.5	0.6	0.0018
Detention Volumes ^{2,5}		Maximum Allowable Release Rate, cfs ³
(watershed inches)	(acre-feet)	
0.73	1.24	
Excess Urban Runoff Volume⁴		Design Outlet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV⁵		17.40



Notes:

- 1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).
- 2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.
- 3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.
- 4) EURV approximates the difference between developed and pre-developed runoff volume.
- 5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

POND VOLUME CALCULATIONS

Subdivision Patriot Park
 Location CO, Colorado Springs

Project Name: Patriot Park
 Project No. SLV01.01
 By: GAH
 Checked By: _____
 Date: 5/25/17

Volume=1/3 x Depth x (A+B+(A*B)^0.5)
 A - Upper Surface
 B - Lower Surface

Pond C

Stage	Stage Elevation	Stage Surface Area (square feet)	Stage Volume (cubic feet)	Cumulative Volume (cubic feet)	Cumulative Volume (acre feet)
0.00	6189.00	8,334	0	0	0.00
1.00	6190.00	10,100	9,203	9,203	0.21
2.00	6191.00	11,966	11,020	20,223	0.46
3.00	6192.00	13,924	12,933	33,156	0.76
4.00	6193.00	15,970	14,935	48,091	1.10
5.00	6194.00	18,122	17,035	65,126	1.50
6.00	6195.00	20,693	19,393	84,519	1.94
7.00	6196.00	22,917	21,796	106,315	2.44
7.50	6196.50	24,326	11,809	118,124	2.71

Volume (acre feet)	Volume	Water Surface Elevation
EURV	1.24	6193.35
100-Year Detention	1.98	6195.08
1' Freeboard		6196.08

Appendix D
Drainage Map



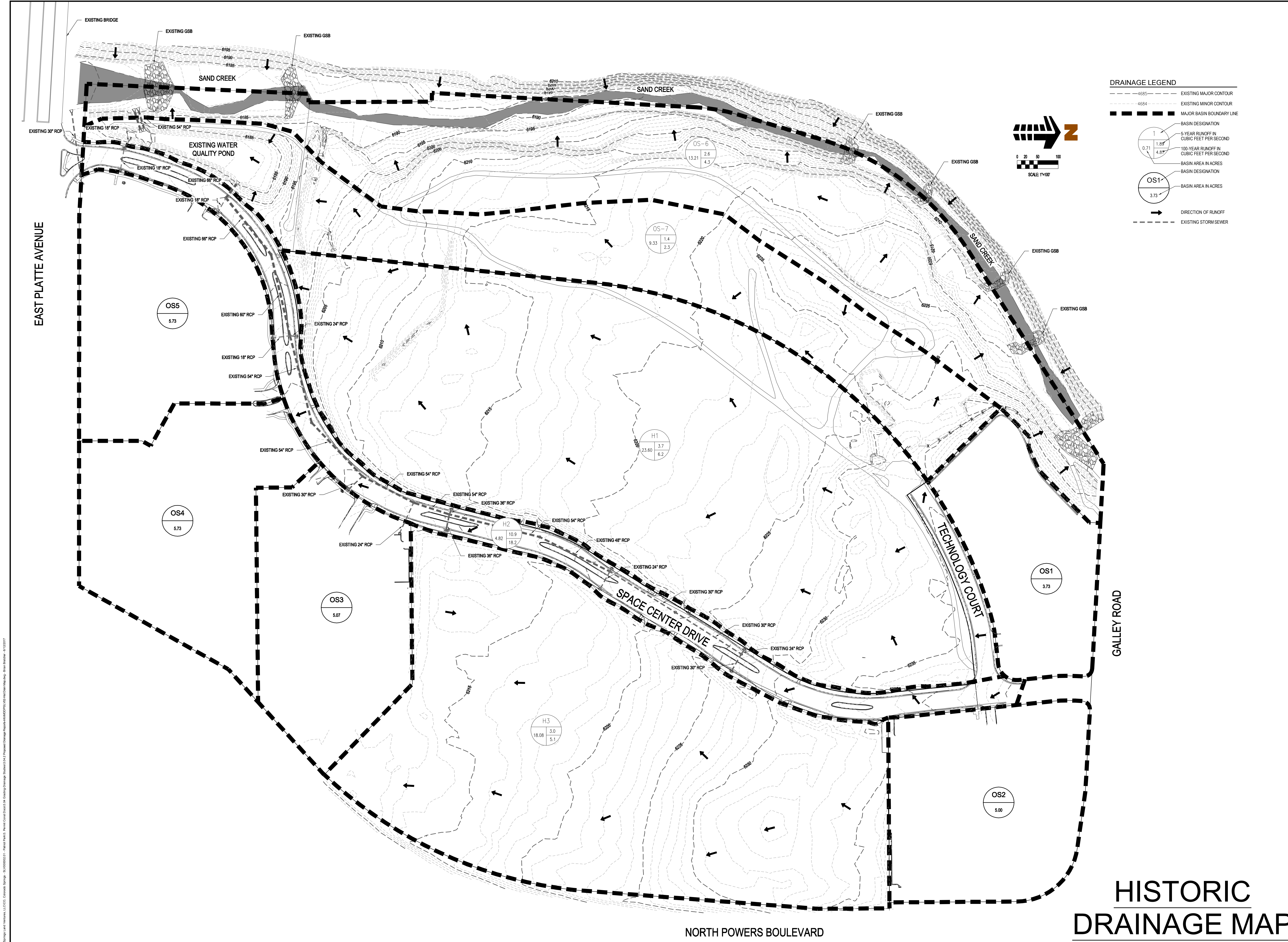
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#	Date	Issue / Description	Init.

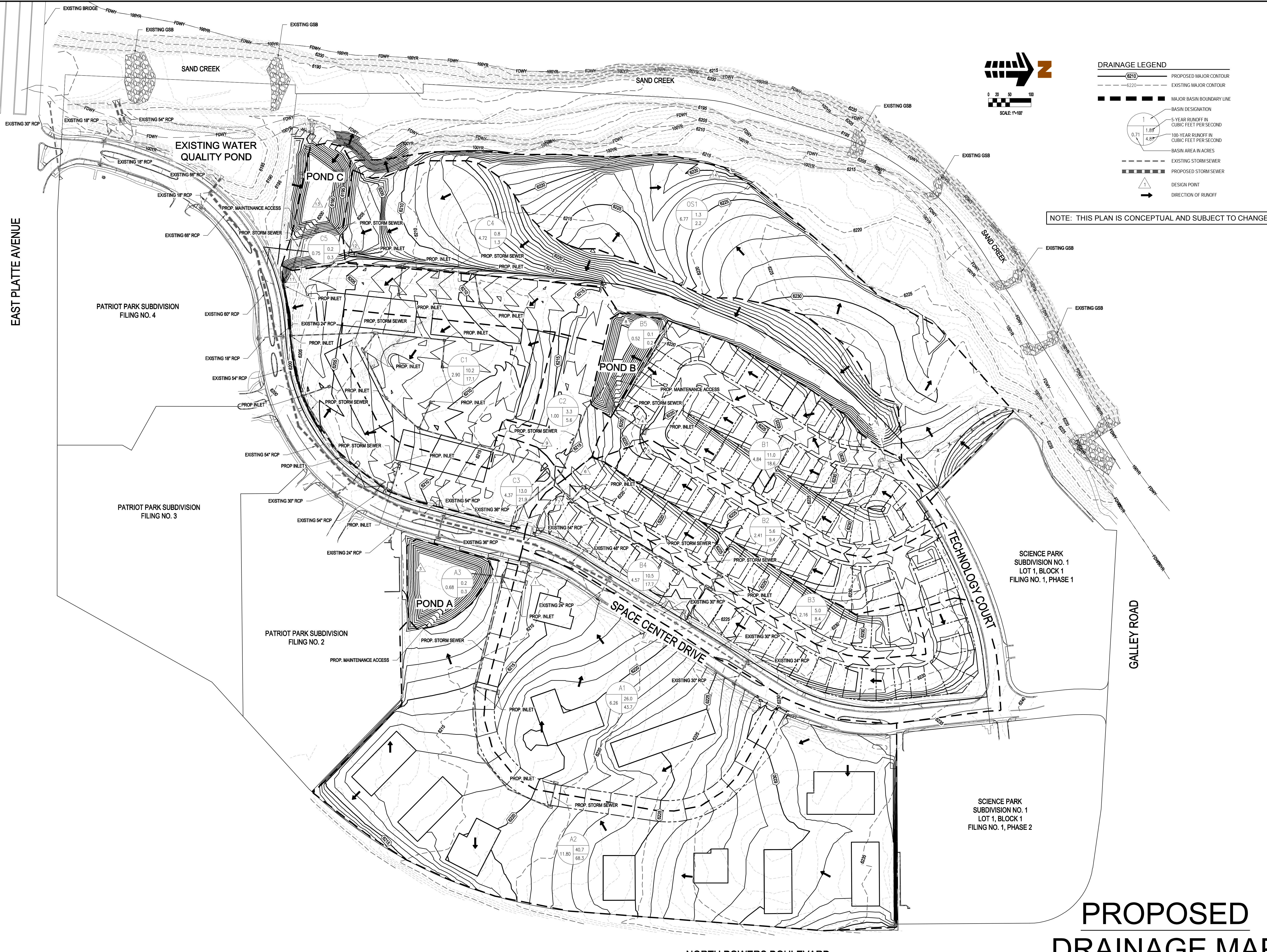
Project No: SLV002
 Drawn By: BHB
 Checked By: SMB
 Date: 06/07/17

HISTORIC DRAINAGE MAP
DR-1
 SHEET 1 of 2



HISTORIC DRAINAGE MAP

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DRAINAGE LEGEND

- PROPOSED MAJOR CONTOUR
- - - - - EXISTING MAJOR CONTOUR
- MAJOR BASIN BOUNDARY LINE
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- - - - - EXISTING STORM SEWER
- - - - - PROPOSED STORM SEWER
- ▲ DESIGN POINT
- ➔ DIRECTION OF RUNOFF

NOTE: THIS PLAN IS CONCEPTUAL AND SUBJECT TO CHANGE



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COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No: SLV002
Drawn By: GAH
Checked By: SMB
Date: 06/07/17

PROPOSED DRAINAGE MAP
DR-2
SHEET 2 of 2

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