FINAL DRAINAGE REPORT FOR BRADLEY POINT FILING NO. 1

EL PASO COUNTY, COLORADO

APRIL 2023

Prepared for:

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Prepared by:

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Project #70-074
PCD Project # MS-21-002

FINAL DRAINAGE REPORT FOR
BRADLEY POINT FILING NO. 1

DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report was prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin.

Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc

DEVELOPER'S STATEMENT

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

BY: Stephen J. Schnurr, Manager
Stephen J. Schnurr

TITLE: Manager, Member
DATE: 4-26-23

ADDRESS: Stephen J. Schnurr
2010 Fox Mountain Point
Colorado Springs, CO 80906

EL PASO COUNTY'S STATEMENT

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

BY:_____ DATE:_____
Joshua Palmer, P.E.
County Engineer / ECM Administrator

FINAL DRAINAGE REPORT FOR BRADLEY POINT FILING NO. 1

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APPENDIX

FINAL DRAINAGE REPORT FOR BRADLEY POINT FILING NO. 1

PURPOSE

This document is the Final Drainage Report for Bradley Point Filing No. 1. The purpose of this document is to identify and analyze the on and offsite drainage patterns and to ensure that post development runoff is routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County Drainage Criteria Manual.

GENERAL LOCATION AND DESCRIPTION

"Bradley Point Filing No. 1" refers to the subdivision of two parcels, 6503-40-0038 and 6503-40-0040. Bradley Point Filing No. 1 is located within the southeast and northwest quarters of the southeast quarter of Section 3, Township 15 south, Range 66 West, of the 6th Principal Meridian, El Paso County, Colorado. The site boundary is defined by Highway 85/87 on the southwestern boundary, Parcel 1 of the Rocky Mountain Materials and Asphalt Exemption Plat Map – Rec. No. 211713132 on the northwestern boundary, A.T. & S.F. Railroad Right of Way on the northeastern boundary, and unplatted land – Book 2780, Page 119, Schedule No. 65112-00-001 on the southeastern boundary. Bradley Point Filing No. 1 lies within the Little Johnson Drainage Basin. Flows from this site are tributary the US 85-87 corridor and ultimately tributary to Fountain Creek.

Bradley Point Filing No. 1 consists of 9.736 acres and is presently undeveloped. Vegetation is sparse, consisting of native grasses. Approximately 23.5% of the site is covered in an aggregate base coarse material. Existing site terrain generally slopes from northwest to southeast at grade rates that vary between 0.7% and 10.4%. An existing dirt access road runs along the southwestern edge of the railroad. One end terminates at the fence along the northwestern boundary of the project site, while the other end terminates as it meets the asphalt road of the project site.

Bradley Point Filing No. 1 is currently zoned M for industrial use. The purpose of development is to provide secure materials storage and parking. The development is to be secured via a perimeter fence and controlled access gate. Additional improvements proposed for the site include paving for an internal access entrance and storm drainage improvements for both lots.

SOILS

Soils for this project are delineated by the Soils Map in the appendix as Blakeland Loamy Sand (8) and Nunn Clay Loam (59). Blakeland Loamy Sand is characterized as Hydrologic Soil Type "A", and comprises approximately 99.3% of the site. The remaining 0.7% on the southern corner of the site consists of the Nunn Clay Loam, which is characterized as Hydrologic Soil Group C. Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area". Natural vegetation is sparse, consisting of native grasses and weeds over a majority of the site. Approximately one quarter of the site is covered with an aggregate base material.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. The relevant data sheets are included in the appendix of this report.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain as determined by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0744 G, effective date December 7th, 2018. A copy of this panel can be found in the appendix.

DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual, Volumes I & II, dated November 1991, including subsequent updates. El Paso County has also adopted Chapter 6 and Section 3.2.1 of Chapter 13 in the City of Colorado Springs & El Paso County Drainage Criteria Manual Volumes I and II, dated May 2014. (Appendix I of the El Paso County's Engineering Criteria Manual (ECM), 2008). In addition to the ECM, the Urban Storm Drainage Criteria Manuals, Volumes 1-3, published by the Urban Drainage and Flood Control District (Volumes 1 & 2 dated January 2016, Volume 3 dated November 2010 and updates). Calculations were performed to determine runoff quantities for the 5-year and 100-year frequency storms for developed conditions using the Rational Method.

EXISTING DRAINAGE CONDITIONS

The Bradley Point Filing No. 1 site consists of 9.736 Drainage Basin. This area was previously studied in the "Little Johnson/Security Creek Drainage Basin Planning Study" (DBPS), dated April 1988, and prepared by Simons, LLI & Associates, Inc., in cooperation with Kiowa Engineering Corporation.

Design Point 1

Basin A consists of 4.65 undeveloped acres of moderately sparse natural grasses and vegetation, and is comprised of the northwestern half of the overall site. Runoff produced within **Basin A** is anticipated to reach peak runoff rates of Q5=4.6 cfs and Q100=11.8 cfs, and will flow east towards the **DP1**, where it collects in a localized depression. Runoff reaching **DP1**, continues east and discharges into Lot 2 (**Basin B)**. Any delays in routing potentially caused by intermittent ponding are not considered by this analysis.

Design Point 2

Basin B consists of 1.27 undeveloped acres of extremely sparse vegetation growing through a semi-compacted base material, located near the center of the site. Runoff produced within **Basin B** is anticipated to reach peak runoff rates of Q5=1.9 cfs and Q100=4.5 cfs, which will collect with runoff from **Design Point 1** to reach combined peak flow rates of Q5=5.3 and Q100=13.3 cfs. This flow naturally continues south towards the design point, where it collects in the roadside ditch and is redirected southeast towards downstream infrastructure.

Design Point 3

Basin C consists of 1.39 undeveloped acres, approximately 60% of which is extremely sparse vegetation growing through an aggregate base material, while the rest of the basin consists of moderately sparse natural grasses and vegetation. This basin is situated near the center of the site. Runoff produced within **Basin C** is anticipated to reach peak runoff rates of Q5=1.6 cfs and Q100=4.0 cfs, and will flow south towards the **DP3**, where it will be redirected south east via the roadside ditch.

Design Point 4

Basin D consists of 1.82 undeveloped acres, approximately 30% of which is extremely sparse vegetation growing through an aggregate base material, while the rest of the basin consists of sparse natural grasses and vegetation. This basin is situated on the southeastern side of the site. Runoff produced within **Basin D** flows from north to south, collecting in a localized depression at the design point, and is anticipated to reach peak runoff rates of Q5=1.9 cfs and Q100=5.0 cfs.

Design Point 5

Offsite **Basin E** consists of 5.53 acres, which is located to the northwest of the site, consisting of a portion of sparse natural grasses and vegetation within the borrow ditch and northern half of the existing asphalt paved US Highway 85/87. Peak runoff rates from **Basin E** reach Q5=4.1 cfs and Q100=10.3 cfs. **Basin E2** consists of approximately 1.08 acres of the northern half of existing Highway 85/87, located immediately adjacent to the southwest of the site. Approximately half of **Basin E2** consists of an asphalt paved roadway surface, and the other half consists of sparse natural grasses and vegetation, reaching peak runoff rates of Q5=1.4 cfs and Q100=3.3 cfs. Runoff produced within **Basin E** and **Basin E2** will combine and flow east towards **Design Point 5.** Runoff at **DP5** is anticipated to reach peak runoff rates of Q5=4.4 cfs and Q100=10.8 cfs.

Design Point 6

Basin F consists of approximately 0.45 acres of the northern half of existing Highway 85/87, and is located on the south end of the site. A majority of this basin consists of an asphalt paved roadway surface, while a small portion consists of sparse natural grasses and vegetation. Runoff produced within **Basin F** is anticipated to reach peak runoff rates of Q5=1.4 cfs and Q100=2.6 cfs. Runoff from **DP2** and **DP5 combine with runoff from Basin F at DP6**. This cumulative flow is expected to reach peak flow rates of Q5=8.6 and Q100=21.0 cfs.

Design Point 7

Basin G consists of approximately 0.65 acres of the northern half of existing Highway 85/87, located along the southwest of the site. Approximately half of this basin consists of an asphalt paved roadway surface, and the other half consists of sparse natural grasses and vegetation. Runoff produced within **Basin G** is

anticipated to reach peak runoff rates of Q5=1.7 cfs and Q100=3.4 cfs. This runoff will discharge into the existing roadside ditch. At **DP7**, runoff from **Basin G** will combine with flows from **Design Point 3** and **Design Point 6**, and shall continue within the existing roadside ditch. The cumulative flow is expected to reach rates of Q5=9.0 and Q100=21.7 cfs. A cross section of the existing ditch with 100 year event flows can be viewed on the Existing Drainage Map.

FOUR STEP PROCESS

Step 1 Reduce runoff by disconnecting impervious area, eliminating "unnecessary" impervious area and encouraging infiltration into soils that are suitable. An aggregate base material is proposed as the ground cover to minimize directly connected impervious areas from the proposed paved road. This material also serves the purpose of eliminating unnecessary impervious area (pavement) and encouraging infiltration.

Step 2 Treat and Slowly Release the WQCV. – Two infiltration detention facilities are planned collect and slowly discharge runoff by infiltration. The water quality capture volume is intended to slowly drain in approximately 12 hours.

Step 3 Stabilize Stream Channels. – With implementation of the two infiltration detention facilities, the runoff from the proposed industrial development will be significantly reduced to below predevelopment conditions. The developed discharge on and off the site is less than existing and, therefore, is not anticipated to have negative effects on downstream drainageways.

Step 4 Implement Source Controls. – The proposed project will use silt fences, vehicle tracking control pads, straw bale barriers, outlet protection, temporary sediment basins, erosion control blankets, and reseeding to mitigate the potential for erosion across the site and protect downstream waters.

PROPOSED DRAINAGE CHARACTERISTICS

General Concept Drainage Discussion

Unresolved from Submittal 3 - SFB? The UD-Detention worksheet in the appendices is for a SFB. If the facility is not a PLD or SFB, discuss design in more detail.

The following is a description of the onsite basins, offsite flows and the overall drainage characteristics for the development of Bradley Point Filing No. 1. The development of Bradley Point Filing No. 1 consists converting the two existing undeveloped lots into two distinct storage parking areas, one with a paved entrance. A shared access easement will be provided from the primary access, within Lot 1 to the southern second lot. At the request of the developer, the internal surface runoff from each lot will be routed its own onsite infiltration pond. This type of treatment has proved a suitable solution for the parcel located upstream from this subject site.

Specifically surface runoff will be collected and conveyed by swales located along the perimeter of the parcels and ponds. Flows conveyed by the swales which will direct runoff to low points and proposed 24" RCP culverts which will convey runoff to the bottom of the ponds. Riprap and forebays will be provided for the infiltration detention facilities. These facilities are detailed and designed within this drainage report.

The following detailed drainage discussion provides an overview of the proposed development. Surface flow is designated as Design Points (DP). Captured flow within the storm sewer system is designated as Pipe Runs (PR).

Detailed Drainage Discussion

Design Point 1

Basin A consists of 4.47 acres of gravel parking lot/storage area, including a portion of a proposed paved road and is comprised of the northeastern half of this site. Runoff produced within **Basin A** is anticipated to reach peak runoff rates of Q5=9.9 cfs and Q100=19.7 cfs, and will flow from north to south towards the design point as sheet flow over lot and following a proposed swale. The proposed swale to the western boundary of the basin conveys runoff to a 3'x 3' area sump inlet and east through a 24" RCP storm pipe, which leads to a forebay with a rip rap level spreader structure. The structure dissipates energy and approximates existing flow conditions, and the runoff continues east into a proposed infiltration **Pond 1**.

Design Point 2

Basin B consists of 4.17 acres of gravel parking lot/storage area. This basin is located within the southeastern half of the site. Runoff will be conveyed as sheet flow over lot and following a proposed swale. The proposed swale to the southern boundary of the basin conveys runoff to a 3'x 3' area sump inlet and east through a 24" RCP storm pipe, which leads to a forebay with a rip rap level spreader structure. The structure dissipates energy and approximates existing flow conditions, and the runoff continues east into a proposed infiltration **Pond 2**. Runoff produced within **Basin B** generally flows north to south and is anticipated to reach peak runoff rates of Q5=9.0 cfs and Q100=18.0 cfs at the proposed infiltration **Pond 2**. Runoff rates are less than existing flows.

Design Point 3

Basin E consists of 5.53 acres which is located to the northwest of the site, consisting of a portion of sparse natural grasses and vegetation within the borrow ditch and northern half of the existing asphalt paved US Highway 85/87. This basin is situated on the northwestern portion of the site. Runoff from this basin flows north to south onsite. See existing **Basin E** conditions. Runoff produced within **Basin E** is anticipated to reach peak runoff rates of Q5=6.5 cfs and Q100=16.2 cfs, and will combine with flows from **Basin F**. **Basin F** consists of 0.72 acres of the northern half of existing Highway 85/87, located to the southwest of the site. Approximately half of this basin consists of an asphalt paved roadway surface (proposed entrance with a cross pan and existing US Highway 85/87), and the other half consists of sparse natural grasses and vegetation. The eastern half of the proposed asphalt drive is part of **Basin A** and flows as described in the **DP1** summary. The remaining portion of the proposed asphalt paved road is part of **Basin F** and drains southwest to a proposed cross pan. The cross pan is sloped such that the runoff collected within the roadway cross pan will flow east into the existing roadside ditch. Runoff produced within **Basin F** is anticipated to reach peak runoff rates of Q5=1.4 and Q100=3.0 cfs, and will flow east from the crow of the road where it discharges into the existing roadside ditch and combines with runoff from **Basin E**. The combined flows are redirected southeast towards the design point at peak runoff rates of Q5=6.6 and Q100=16.0 cfs. From here, the runoff will continue southeast to downstream infrastructure

Design Point 4

Basin G consists of approximately 2.28 acres of the northern half of existing Highway 85/87, located to the southwest of the site. Approximately half of this basin consists of an asphalt paved roadway surface, and the other half consists of sparse natural grasses and vegetation. Runoff produced within **Basin G** is anticipated to reach peak runoff rates of Q5=4.0 cfs and Q100=8.8 cfs. At this point, the runoff will combine with flows from **Design Point 3** and will continue southeast. This flow will run east from the crown of the

road in order to discharge into the existing roadside ditch. A cross section of the roadside ditch at this point can be viewed on the Proposed Drainage Map, depicting what is experienced during the 100 year event. This cumulative flow is expected to reach rates of Q5=7.4 and Q100=17.5 cfs. Flows to the ditch have been reduced by not quite half from that of the existing condition (Q5=13.5 and Q100=32.7 cfs). As the roadside ditch flattens out near the corner of the subject site, the collected runoff will dissipate into sheet flow and be directed east towards an offsite 18" ADS culvert that drains into the existing railroad ditch. This conveyance process can be seen on the Roadside Ditch Conveyance Exhibit in the Appendix.

WATER QUALITY AND DETENTION

The appendices show MHFD calculations for a SFB. Comment response document stated a SFB is not proposed. If a SFB is not proposed, the spreadsheet should not be used for an infiltration only retention pond.and other calculation should be provided.

Two Private Infiltration Ponds are proposed for this site in order to reduce the fully developed flows from the site to pre-development levels and address water quality. The ponds have been sized utilizing the StormShed 4G program with the outlet being infiltration only. The ponds have been sized to store the WQCV, EURV, and the flood control volumes for the 2, 5, 10, 25, 50, and 100 year storm events. Based upon contributing area of 4.47 acres and watershed imperviousness is 82% for Pond 1 and a contributing area of 4.17 acres and 80% imperviousness for Pond 2. The WQCV for both ponds will be slowly released over approximately 12-12.5 hours. The 100 year storm events will drain fully in less than 120 hours. The maximum 100-Yr storage volume is 0.626 acre-feet (27,287.79 cf) for Pond 1 and 0.578 acre-feet (25,163.86 cf) for Pond 2, resulting in maximum ponding depths of 4.880 feet and 4.615 feet respectively. Each pond has a minimum of 2' of freeboard and is capable of storing the 500 year storm event. Print outs of the model are included in the appendix. If constructed as intended, it was determined that the infiltration rates for the ponds would be 8.0 inches/hour according to the percolation/infiltration testing by Entech Engineering, Inc. In addition, the full soils infiltration report is included in the appendix. It is important to note that the parcel to the northwest is currently utilizing a similarly constructed facility to detain onsite runoff.

How do these compare to MHFD calculations (SDI sheets)?

EROSION CONTROL

State construction requirements that would provide 8 in/hr infiltration rates - Add pertinent information to GEC Plan as well.

It is the policy of the El Paso County that M&S Civil Consultants, Inc submits an erosion control plan with the drainage report. Proposed straw wattles, silt fence, vehicle traffic control, a temporary sediment basin, permanent erosion control fabric, and reseeding are proposed as erosion control measures. The proposed total area of land disturbance is 9.74 acres. The proposed development will not adversely impact the existing surrounding industrial infrastructure. An ESQCP permit is required for site construction in order to ensure compliance with the SWMP report and permits. Infiltration Basin and Swale inspections are required to ensure all storm structures are functioning as designed.

CONSTRUCTION COST OPINION – BRADLEY POINT FILING NO. 1

Private Drainage Facilities:

Item	Description	Quantity		Unit Cost		Cost
1.	24" RCP	70	LF	$125	/LF	$8,750
2.	Infiltration Pond	2	EA	$8,000	/EA	$16,000
3.	Forebay	2	EA	$5,000	/EA	$10,000
4.	3' CDOT Type C Inlet	2	EA	$5,000	/EA	$10,000
					Total $	**$44,750**

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2021.

DRAINAGE & BRIDGE FEES – BRADLEY POINT FILING NO. 1

This site is within the Little Johnson Drainage Basin. The 2021 Drainage and Bridge Fees per El Paso County for the Bradley Point Filing No. 1 site are as follows:

Per Bradley Point Filing No. 1 Site Boundary – **Total Area** **9.74 Acres**

BRADLEY POINT FILING NO. 1 FEES:

Drainage Fees:	9.736	x	81.0%	x	$12,048	=	$ 95,012.46
						Total	**$ 95,012.46**

It should be noted that these fees are provided in this Final Drainage Report have been paid at the time of the plat recording and are included in this report for informational purposes only.

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2021.

SUMMARY

Development of this site will not adversely affect the surrounding developments per this final drainage report. Two infiltration ponds will be used to detain developed flows. Approximate historic runoff conditions flow onto the adjoining, vacant Rio Grande property to the southeast. A portion of this property discharges into the railroad ditch to the east, which eventually discharges into Fountain Creek. The proposed drainage facilities will adequately convey, detain and route runoff from tributary and onsite flows to the Fountain Creek Drainage Channel via proposed onsite improvements. Proposed flow rates are higher than existing, however a majority of the difference in these flow rates will be detained in the proposed onsite ponds. Care will be taken during construction to accommodate overland flow routes onsite and temporary drainage conditions. Overall, the development of the Bradley Point Filing No. 1 project shall not adversely affect adjacent or downstream property.

REFERENCES

1.) "City of Colorado Springs Drainage Criteria Manual", Volumes 1 & 2, City of Colorado May 2014.

2.) Mile High Flood District (2021). Criteria Manual. "Urban Storm Drainage Criteria Manuals, Volumes 1-3". Retrieved from https://mhfd.org/resources/criteria-manual/

3.) NRSC Web Soil Survey Map for El Paso County. http://websoilsurvey.nrcs.usda.gov

4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date December 7th, 2018.

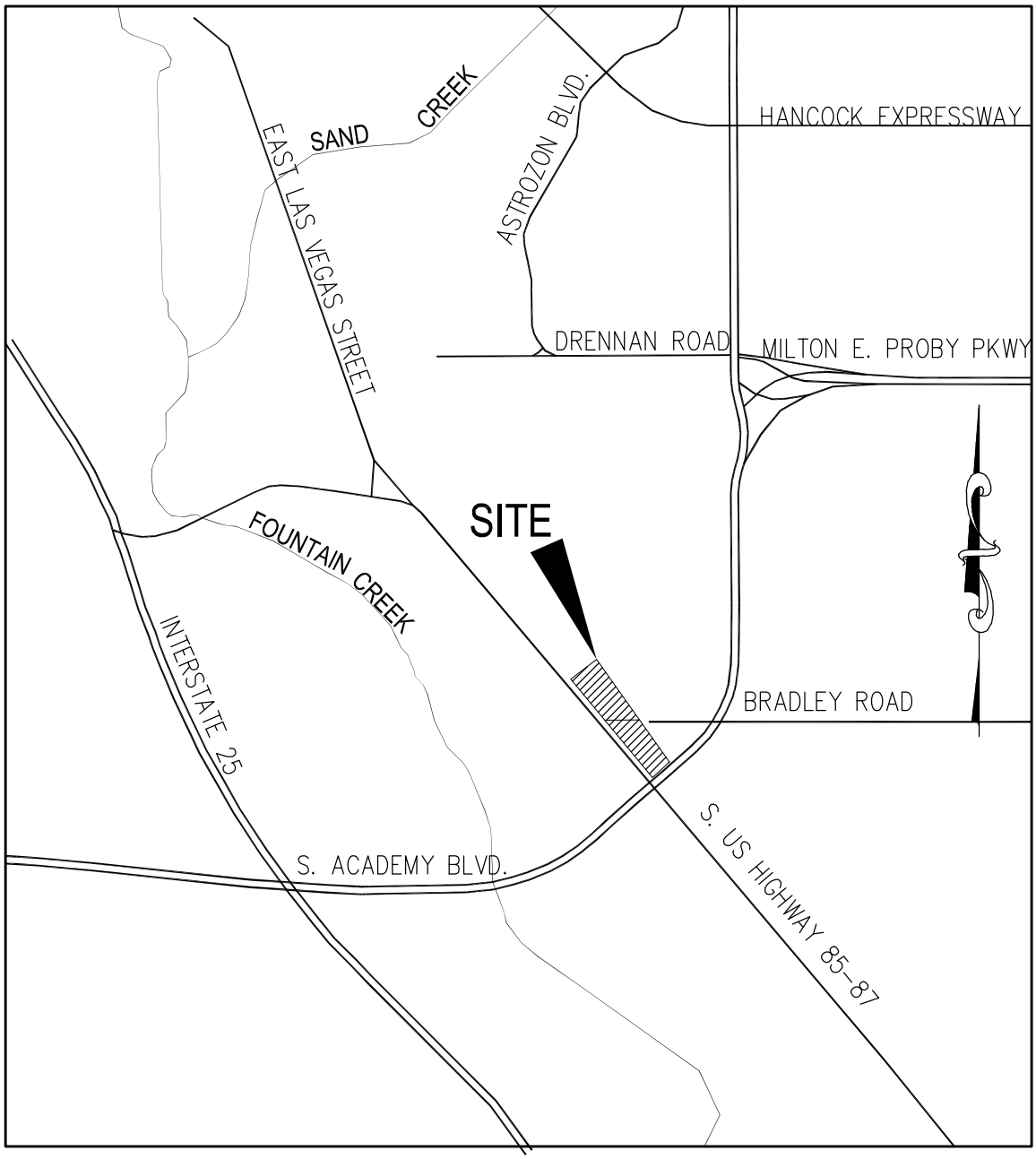
5.) Simons, LLI & Associates, Inc., in cooperation with Kiowa Engineering Corporation (April 1988). "Little Johnson/Security Creek Drainage Basin Planning Study". Retrieved from https://coloradosprings.gov/dbps

6.) Colorado Aggregate Recycling (2021). Colorado Springs: Products. Retrieved From https://www.coloradoaggregaterecycling.com/colorado-springs/

7.) "El Paso County Drainage Criteria Manual", Volumes 1 & 2, Municode 2021.

APPENDIX

VICINITY MAP

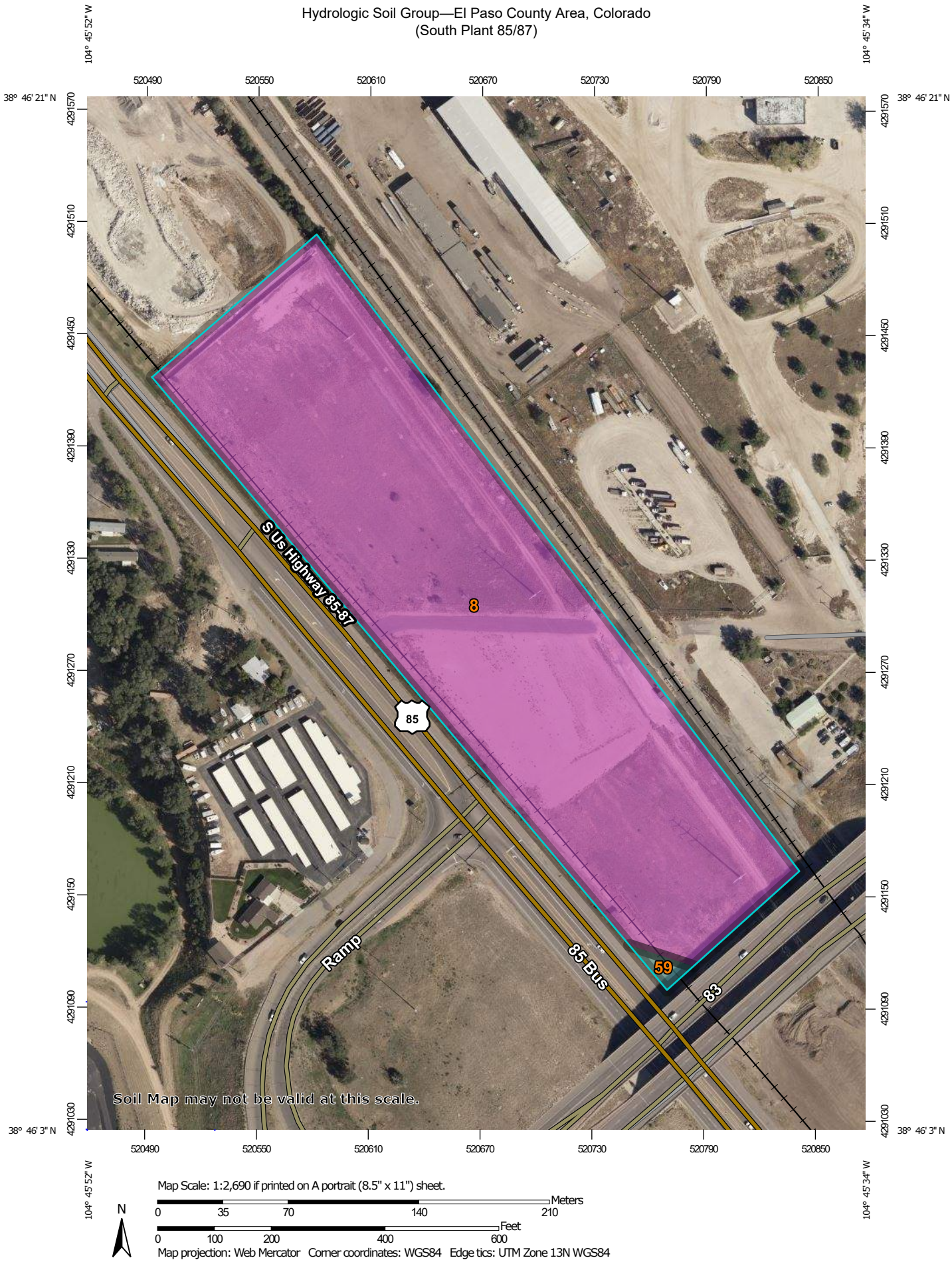


VICINITY MAP

N.T.S.

SOILS MAP

Hydrologic Soil Group—El Paso County Area, Colorado
(South Plant 85/87)



Map Scale: 1:2,690 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	11.2	99.3%
59	Nunn clay loam, 0 to 3 percent slopes	C	0.1	0.7%
Totals for Area of Interest			**11.3**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

FIRM PANEL

NOTES TO USERS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

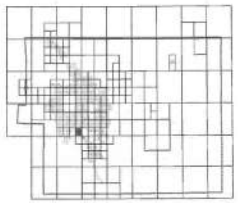
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

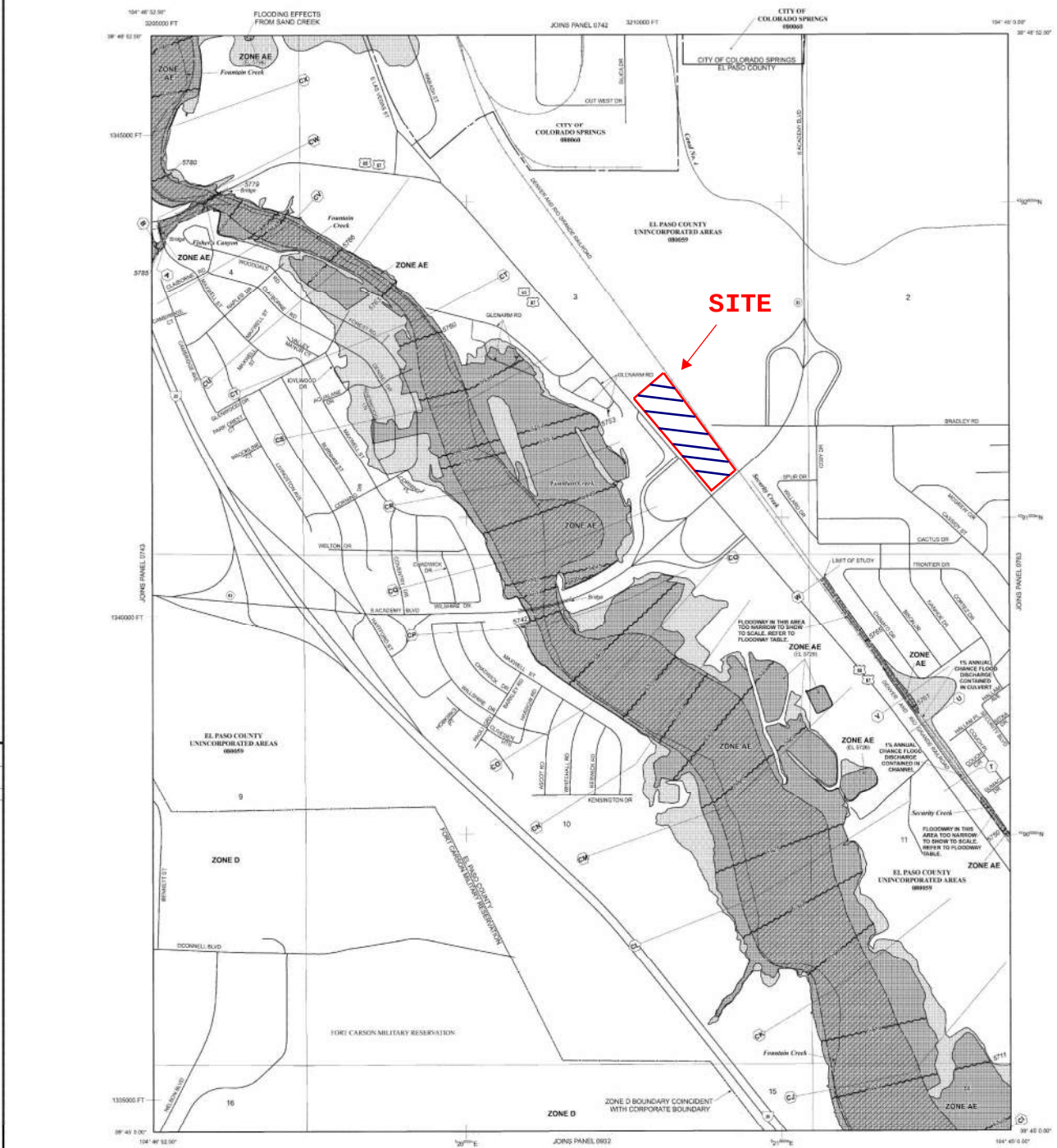
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



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

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



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 Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

Floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 Base flood elevation line and value; elevation in feet*
(EL 957) Base Flood Elevation value where uniform within zone; elevation in feet*
* Referenced to the North American Vertical Datum of 1988 (NAVD 88)
A — A Cross section line
23 — 23 Transect line
97° 07' 30.00" / 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4319000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13
4500000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

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

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0744G

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

PANEL 744 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0744	G
EL PASO COUNTY	080059	0744	G

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

MAP NUMBER
08041C0744G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

BRADLEY POINT FILING NO. 1
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

			STREETS/DEVELOPED			*AGGREGATE BASE MATERIAL*			*UNDEVELOPED/LANDSCAPE*			*RUNOFF COEFFICIENT*	
BASIN	**TOTAL AREA** *(SF)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	**C_5**	**C_{100}**	**AREA** *(Acres)*	**C_5**	**C_{100}**	**AREA** *(Acres)*	**C_5**	**C_{100}**	**C_5**	**C_{100}**
A	***202348.4143***	4.65	0.07	0.90	0.96	4.58	0.35	0.54	0.00	0.08	0.35	**0.36**	**0.55**
B	***55366.9622***	1.27	0.20	0.90	0.96	1.07	0.35	0.54	0.00	0.08	0.35	**0.44**	**0.61**
C	***60455.3113***	1.39	0.00	0.90	0.96	1.39	0.35	0.54	0.00	0.08	0.35	**0.35**	**0.54**
D	***79161.6725***	1.82	0.00	0.90	0.96	1.82	0.35	0.54	0.00	0.08	0.35	**0.35**	**0.54**
E	***240799.7172***	5.53	2.12	0.90	0.96	0.00	0.35	0.54	3.41	0.08	0.35	**0.39**	**0.58**
E2	***46914.4055***	1.08	0.50	0.90	0.96	0.00	0.35	0.54	0.58	0.08	0.35	**0.46**	**0.63**
F	***19702.8045***	0.45	0.35	0.90	0.96	0.00	0.35	0.54	0.10	0.08	0.35	**0.71**	**0.82**
G	***28387.025***	0.65	0.49	0.90	0.96	0.00	0.35	0.54	0.16	0.08	0.35	**0.70**	**0.81**

Calculated by: CVW
Date: 3/29/2023
Checked by: DLM

BRADLEY POINT FILING NO. 1
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**CHECK**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
A	4.65	0.36	0.55	0.36	100	2.75	9.6	613	0.9%	0.7	15.1	24.7	14.0	2.8	4.7	**4.6**	**11.8**
B	1.27	0.44	0.61	0.44	100	1.6	10.3	316	0.9%	1.0	5.5	15.8	12.3	3.4	5.8	**1.9**	**4.5**
C	1.39	0.35	0.54	0.35	100	1.4	12.1	417	1.1%	1.1	6.6	18.7	12.9	3.2	5.4	**1.6**	**4.0**
D	1.82	0.35	0.54	0.35	100	1.98	10.8	470	1.3%	0.8	9.7	20.5	13.2	3.1	5.1	**1.9**	**5.0**
E	5.53	0.39	0.58	0.39	30	0.6	5.6	2000	1.5%	0.9	38.7	44.2	21.3	1.9	3.2	**4.1**	**10.3**
E2	1.08	0.46	0.63	0.46	100	0.96	11.7	525	0.3%	0.8	10.8	22.5	13.5	2.9	4.9	**1.4**	**3.3**
F	0.45	0.71	0.82	0.71	75	1.06	5.4	298	0.7%	1.3	4.0	9.3	12.1	4.2	7.1	**1.4**	**2.6**
G	0.65	0.70	0.81	0.70	100	1.34	6.6	406	0.6%	1.1	5.9	12.5	12.8	3.8	6.4	**1.7**	**3.4**

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CVW
Date: 3/29/2023
Checked by: DLM

please be sure and check intensity formula if you expand and add columns!!!

BRADLEY POINT FILING NO. 1
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS/PIPES**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
1	**Basin A**	1.66	2.54				24.7					24.7	2.8	4.7	***4.6***	***11.8***	*LOCALIZED DEPRESSION*
				Basin A Tc was used													
2	**Basin B**	0.55	0.77				24.7	406	0.7%	1.1	7.0	31.6	2.4	4.0	***5.3***	***13.3***	*EXITS SITE TO ROADSIDE DITCH*
	Design Point 1	1.66	2.54														
		2.22	3.31	Design Pt 1 Tc was used													
3	**Basin C**	0.49	0.75				18.7					18.7	3.2	5.4	***1.6***	***4.0***	*EXITS SITE TO ROADSIDE DITCH*
				Basin C Tc was used													
4	**Basin D**	0.64	0.98				20.5					20.5	3.1	5.1	***1.9***	***5.0***	*LOCALIZED DEPRESSION*
				Basin D Tc was used													
5	**Basin E2**	0.50	0.68				44.2	525	0.3%	1.1	8.1	52.3	1.6	2.8	***4.4***	***10.8***	*EXISTING ROADSIDE DITCH*
	Basin E	2.18	3.23														
		2.67	3.91	Basin E Tc was used													
6	**Basin F**	0.32	0.37				52.3					52.3	1.6	2.8	***8.6***	***21.0***	*EXISTING ROADSIDE DITCH*
	Design Point 5	2.67	3.91														
	Design Point 2	2.22	3.31														
		5.22	7.59	Design Point 5 Tc was used													
7	**Basin G**	0.45	0.53				52.3	452	0.5%	1.1	7.0	59.3	1.5	2.4	***9.0***	***21.7***	*EXISTING ROADSIDE DITCH*
	Design Point 6	5.22	7.59														
	Design Point 3	0.49	0.75														
		6.16	8.87	Design Pt 6 Tc was used													

BRADLEY POINT FILING NO. 1
PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

			STREETS/DEVELOPED			*AGGREGATE BASE MATERIAL*			*UNDEVELOPED/LANDSCAPE*			*RUNOFF COEFFICIENT*	
BASIN	**TOTAL AREA** *(SF)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	**C_5**	**C_{100}**	**AREA** *(Acres)*	**C_5**	**C_{100}**	**AREA** *(Acres)*	**C_5**	**C_{100}**	**C_5**	**C_{100}**
A	***194500.7466***	4.47	0.12	0.90	0.96	4.34	0.59	0.70	0.00	0.08	0.35	**0.60**	**0.71**
B	***181766.1572***	4.17	0.00	0.90	0.96	4.17	0.59	0.70	0.00	0.08	0.35	**0.59**	**0.70**
E	***240799.7172***	5.53	2.12	0.90	0.96	0.00	0.35	0.54	3.41	0.08	0.35	**0.39**	**0.58**
F	***31224.2092***	0.72	0.38	0.90	0.96	0.00	0.35	0.54	0.33	0.08	0.35	**0.52**	**0.68**
G	***99495.0053***	2.28	1.19	0.90	0.96	0.00	0.35	0.54	1.09	0.08	0.35	**0.51**	**0.67**

Calculated by: CVW
Date: 12/7/2022
Checked by: DLM

BRADLEY POINT FILING NO. 1
PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	**C_5** *From DCM Table 5-1*	**C_{100}** *From DCM Table 5-1*	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**CHECK** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
A	4.47	0.60	0.71	0.60	100	0.6	10.7	460	0.5%	1.5	5.2	15.9	13.1	3.7	6.2	**9.9**	**19.7**
B	4.17	0.59	0.70	0.59	100	0.6	10.9	540	1.1%	1.0	8.7	19.6	13.6	3.7	6.2	**9.0**	**18.0**
E	5.53	0.39	0.58	0.39	30	0.6	5.6	2000	1.5%	1.8	18.1	23.6	21.3	3.0	5.0	**6.5**	**16.2**
F	0.72	0.52	0.68	0.52	60	0.8	7.4	525	0.3%	0.8	11.3	18.7	13.3	3.7	6.2	**1.4**	**3.0**
G	2.28	0.51	0.67	0.51	60	1	7.0	985	0.4%	0.9	17.8	24.8	15.8	3.4	5.8	**4.0**	**8.8**

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CVW
Date: 12/7/2022
Checked by: DLM

please be sure and check intensity formula if you expand and add columns!!!

BRADLEY POINT FILING NO. 1
PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS/PIPES**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
1	**Basin A**	2.67	3.16				13.1					13.1	3.7	6.2	***9.9***	***19.7***	*PROPOSED CULVERT*
				Basin A Tc was used													
2	**Basin B**	2.46	2.92				13.6					13.6	3.7	6.2	***9.0***	***18.0***	*PROPOSED CULVERT*
				Basin B Tc was used													
3	**Basin E**	2.18	3.23				21.3	525	0.4%	1.3	6.9	28.2	2.6	4.3	***6.6***	***16.0***	*ROADSIDE DITCH*
	Basin F	0.37	0.49														
		2.55	3.71	Basin E Tc was used													
4	**Design Pt 3**	2.55	3.71				28.2	985	0.4%	1.2	13.3	41.5	2.0	3.3	***7.4***	***17.5***	*ROADSIDE DITCH*
	Basin G	1.16	1.53														
		3.71	5.24	Design Pt 3 Tc was used													

BRADLEY POINT FILING NO. 1
PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Storm Sewer Routing Summary)

PIPE RUN	*Contributing Pipes/Design*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity**		*Flow*	
					I_5	*I_{100}*	*Q_5*	*Q_{100}*
PR 1	**DESIGN POINT 1**	2.67	**3.16**	13.1	3.7	6.2	***9.9***	***19.7***
PR 2	**DESIGN POINT 2**	2.46	**2.92**	13.6	3.7	6.2	***9.0***	***18.0***

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CVW

Date: 12/7/2022

Checked by: VAS

Unresolved from Submittal 3: include riprap sizing calcs for forebay

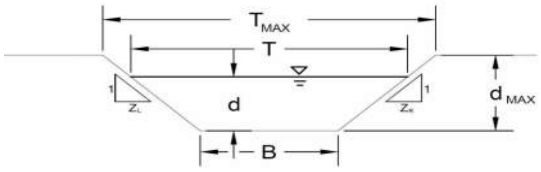
HYDRAULIC CALCULATIONS

Version 4.06 Released August 2018

AREA INLET IN A SWALE

Crossroads Mixed Use

Inlet 1



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

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.035	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	12.00	15.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.50	2.50	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	16.2	63.2	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.50	2.50	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	9.9	19.7	cfs
Water Depth	d =	1.25	1.61	feet

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

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

Version 4.06 Released August 2018

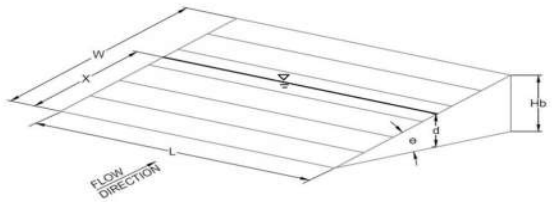
AREA INLET IN A SWALE

Crossroads Mixed Use

Inlet 1

Inlet Design Information (Input)

Type of Inlet: CDOT Type C — Inlet Type = CDOT Type C



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

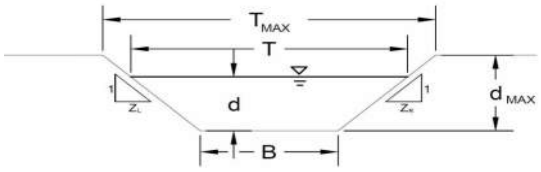
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.25	1.61	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**18.1**	**20.5**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

Version 4.06 Released August 2018

AREA INLET IN A SWALE

Crossroads Mixed Use

Inlet 2



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

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.035	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft

Check one of the following soil types:

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

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

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	12.00	15.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.50	2.50	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	16.2	63.2	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.50	2.50	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	9.0	18.0	cfs
Water Depth	d =	1.20	1.56	feet

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

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

Version 4.06 Released August 2018

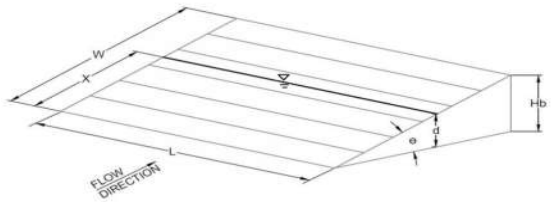
AREA INLET IN A SWALE

Crossroads Mixed Use

Inlet 2

Inlet Design Information (Input)

Type of Inlet: CDOT Type C — Inlet Type = CDOT Type C



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

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.20	1.56	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**17.7**	**20.2**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

CIVIL CONSULTANTS, INC.
212 N. Wahsatch Ave., Ste. 305
Colorado Springs, CO
719.955.5485

Project: BRADLEY POINT FILING NO. 1

Date: 04/19/23

FOREBAY VOLUME

MIN. FOREBAY VOLUME = 3% WQCV
H = 24 in = 2 ft

POND 1

WQCV = 6,173 cf

V_{TREQ} = 6,173 cf (0.03) = 185.2 cf

$A = \frac{V_{TREQ}}{H} = \frac{185.2 \text{ cf}}{2 \text{ ft}} = 92.6 \text{ ft}^2$

A_T = 92.6 + 15 = 107.6 ft² ≈ 108 ft²

POND 2

WQCV = 5,551 cf

V_{TREQ} = 5,551 (0.03) = 166.5 cf

$V_{TREQ} = \frac{166.5 \text{ cf}}{2 \text{ ft}} = 83.3 \text{ ft}^2$

A_T = 83.3 + 15 = 98.3 ft² ≈ 99 ft²

∴ THE FOREBAYS AREA SHALL BE ≥ 108 ft²

DIAMETER OF PIPE TO FOREBAY, D = 24 in = 2 ft

SEE CONSTRUCTION DRAWINGS FOREBAY DETAIL (13-9)
FROM CITY OF COLORADO SPRINGS DCM, VOL. 1 W/ D = 2 ft

∴ BOTH FOREBAYS HAVE A TOTAL AREA OF ≥ 112 ft²

CIVIL CONSULTANTS, INC.
212 N. Wahsatch Ave., Ste. 305
Colorado Springs, CO
719.955.5485

Project: BRADLEY POINT FILING NO.1

Date: 04/19/23

SIZE NOTCHES FOR FOREBAYS

2% OF CONTRIBUTING 100yr FLOW

WEIR EQN. $\Rightarrow Q = CLH^{1.5} \Rightarrow$ SOLVE FOR L $\Rightarrow L = \frac{Q_{NOTCH}}{CH^{1.5}}$

$H = 2\,ft$, $C = 3.1$

POND 1

$Q_{100} = 19.7\,cfs \Rightarrow (0.02)19.7 = 0.39\,cfs$

$L = \frac{0.39\,cfs}{3.1(2\,ft)^{1.5}}$

$L = 0.044\left(\frac{12\,in}{1\,ft}\right) = 0.53\,in$

∴ USE 0.75" WIDE NOTCH OR IT MAY CLOG

POND 2

$Q_{100} = 18.0\,cfs \Rightarrow 0.02(18) = 0.36\,cfs$

$L = \frac{0.36\,cfs}{3.1(2\,ft)^{1.5}}$

$L = 0.041\left(\frac{12\,in}{1\,ft}\right) = 0.49\,in$

∴ USE 0.50" WIDE NOTCH OR IT MAY CLOG

Weighted Percent Imperviousness of Site to Pond 1				
Contributing Basins	***Area (Acres)***	***C_5***	****Impervious % (I)***	***(Acres)*(I)***
A	4.47	0.60	82	366.14
Totals	***4.47***			***366.14***
Imperviousness to Infiltration Pond 1	***82.0***			

BRADLEY POINT FILING NO. 1
DRAINAGE REPORT DRAINAGE CALCULATIONS
(Pond Volume Calculation)

POND 1

Elevation	SF	CF	Storage AF	Storage Sum
5777.00	3,863.00			0
5778.00	4,846.00	4,354.50	0.10	0.10
5779.00	5,885.00	5,365.50	0.12	0.22
5780.00	6,980.00	6,432.50	0.15	0.37
5781.00	8,133.00	7,556.50	0.17	0.54
5782.00	9,343.00	8,738.00	0.20	0.74
5783.00	10,650.00	9,996.50	0.23	0.97
5784.00	55,435.00	33,042.50	0.76	1.73

Total = 75,486 CF

Total = 1.733 Ac-ft

Calculated by: DLM

Date: 5/3/2022

Checked by:

Weighted Percent Imperviousness of Stie to Pond 2				
Contributing Basins	***Area (Acres)***	***C_5***	****Impervious % (I)***	***(Acres)*(I)***
B	4.17	0.59	80	333.82
Totals	***4.17***			***333.82***
Imperviousness to Infiltration Pond 2	***80.0***			

	1	2	1*2	
Total Site Imperviousness	Ac	Imp		
Area 1	4.47	0.82	3.67	A
Area 2	4.17	0.8	3.34	B
Area 3				
Total	8.64		7.00	A+B
Site Imperviousness		7.00 / 8.64	0.81	

BRADLEY POINT FILING NO. 1
DRAINAGE REPORT DRAINAGE CALCULATIONS
(Pond Volume Calculation)

POND 2

Elevation	SF	CF	Storage AF	Storage Sum
5772.00	3,316.00			0
5773.00	4,278.00	3,797.00	0.09	0.09
5774.00	5,299.00	4,788.50	0.11	0.20
5775.00	6,373.00	5,836.00	0.13	0.33
5776.00	7,505.00	6,939.00	0.16	0.49
5777.00	8,692.00	8,098.50	0.19	0.68
5778.00	9,954.00	9,323.00	0.21	0.89
5779.00	24,989.00	17,471.50	0.40	1.29

Total = 56,254 CF

Total = 1.3 Ac-ft

#NUM!
#NUM!

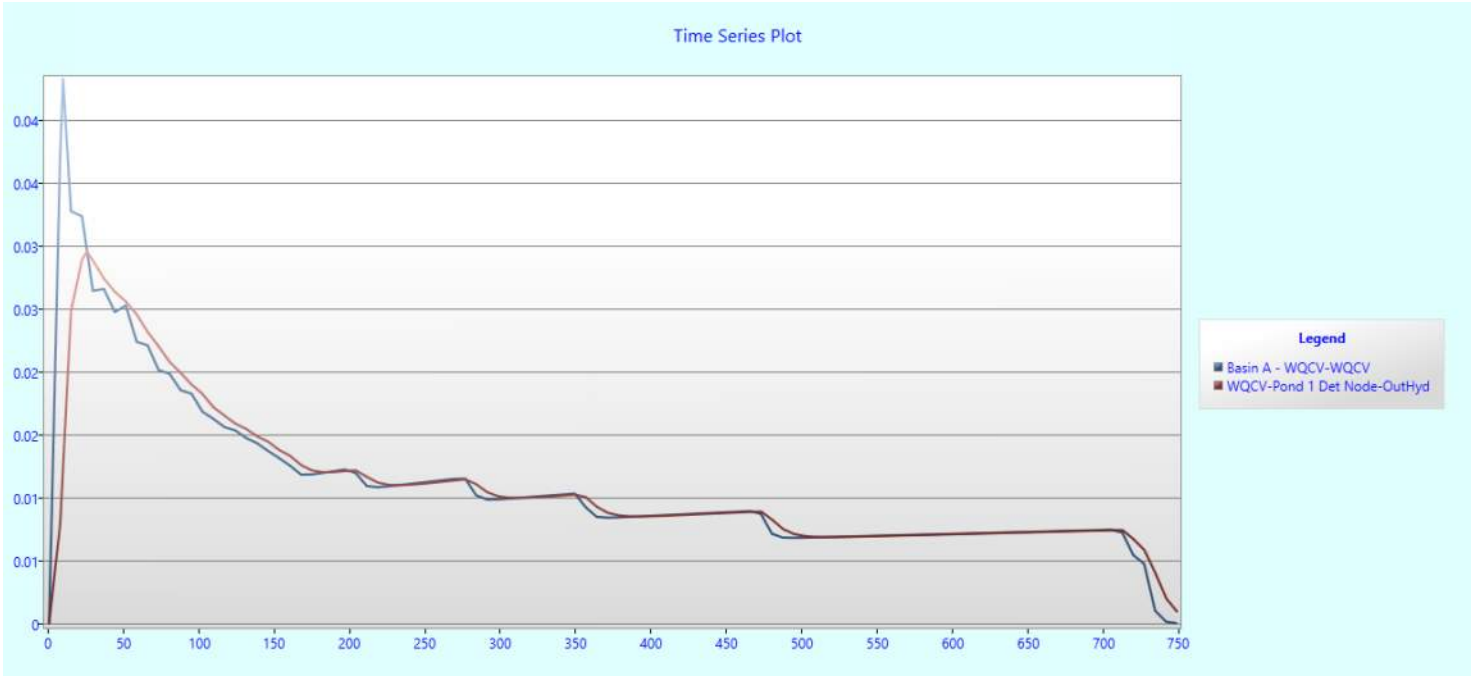
Calculated by: GT
Date: 9/15/2020
Checked by:

StormSHED 4G Analyses

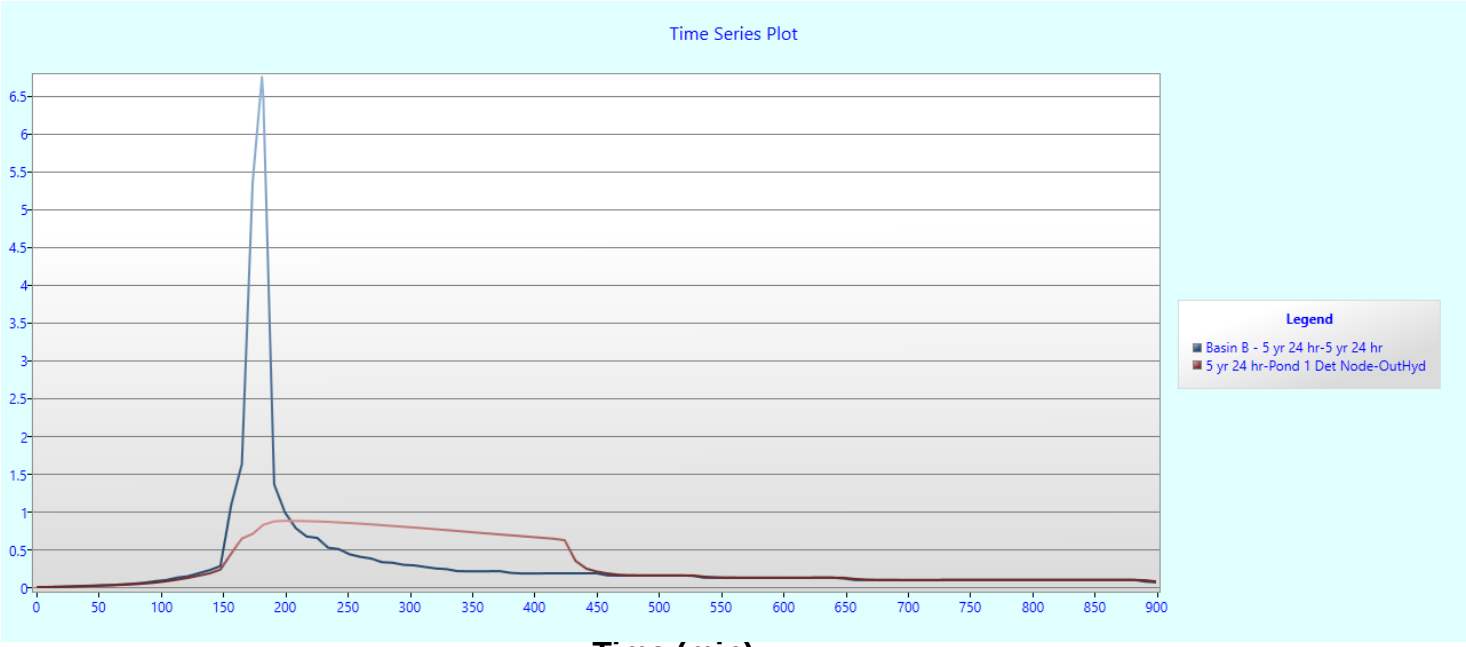
North Pond Summary Table (POND 1)

Design Evei	Match Flows (cfs)	Peak Q (cfs)	Max Depth (ft	Vol (cf)	HtoE	% Vol
WQCV	0.0432	0.0295	0.0047	15.7203	0.01	99.92
5 yr 24 hr	6.7560	0.8970	1.6587	6,668.4623	0.01	99.99
100 yr 24 hr	20.4919	1.5600	4.8800	27,287.7935	0.12	99.95

North Pond: WQCV Inflow and Outflow Hydrographs

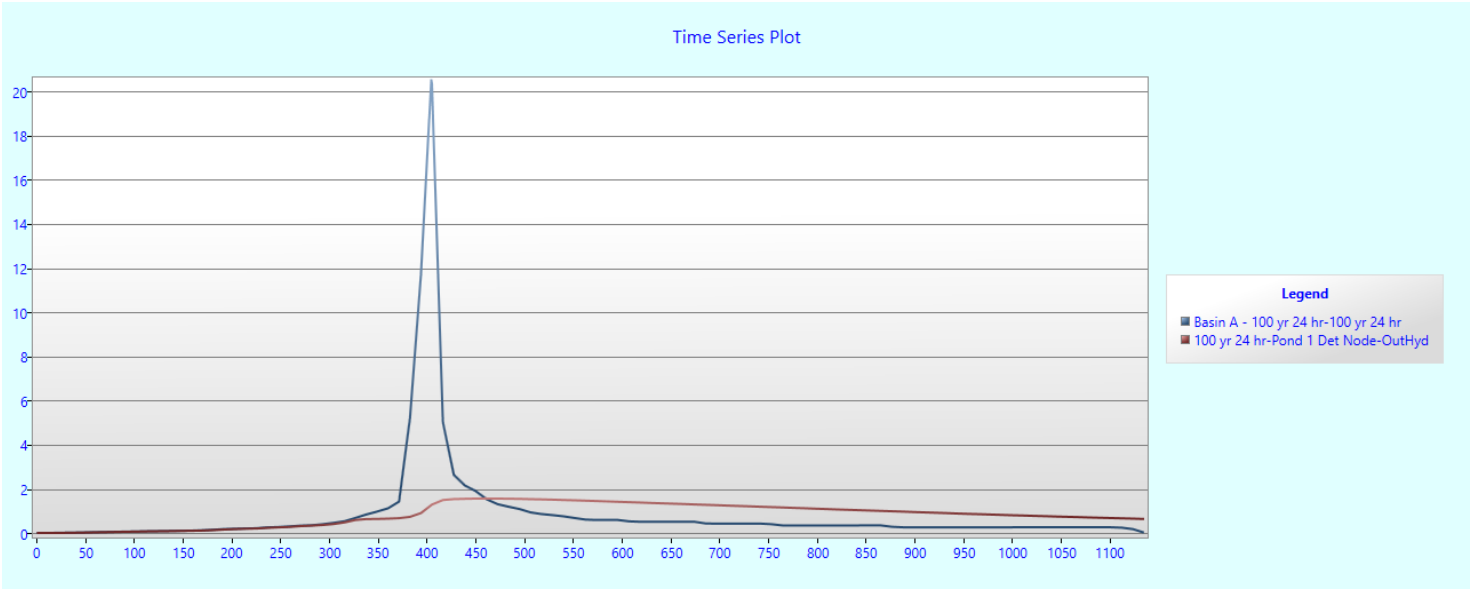


North Pond: 5 YR Inflow and Outflow Hydrographs

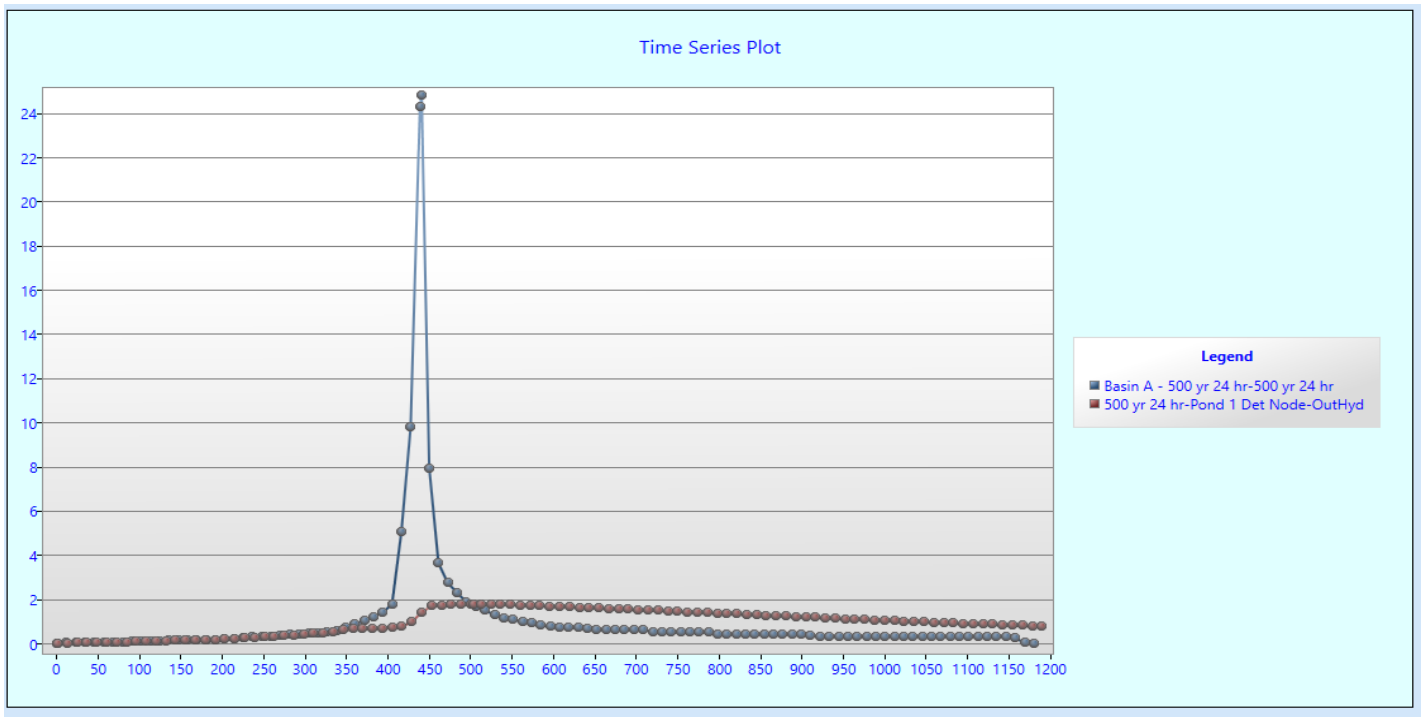


Address flows going through the spillway (overtopping) and flows being infiltrated. (See comment letter)

North Pond: 100 YR Inflow and Outflow Hydrographs



North Pond: 500 YR Inflow and Outflow Hydrograph and Summary Table

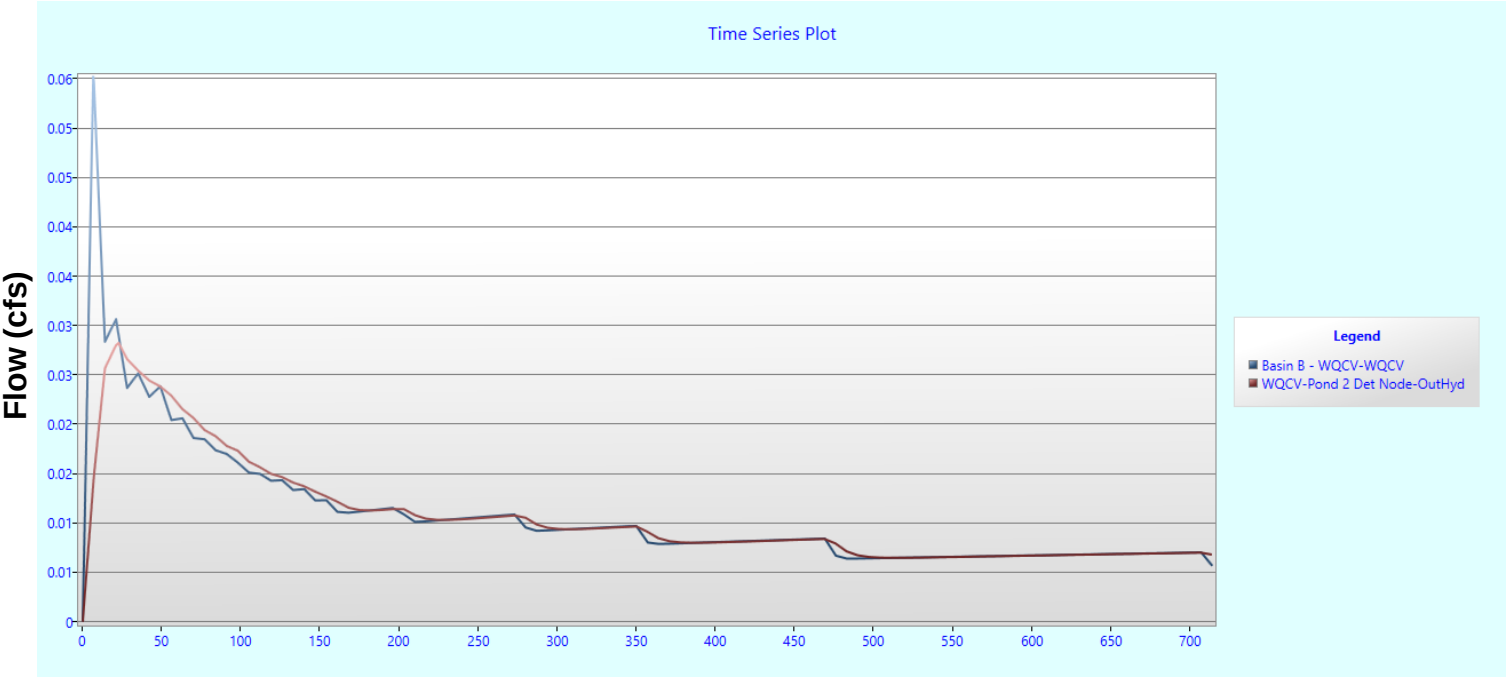


Design Evei	Match Flows (cfs)	Peak Q (cfs)	Max Depth (ft	Vol (cf)	HtoE	% Vol
500 yr 24 hr	24.7740	1.7555	5.7144	34,511.9753	1.42	99.96

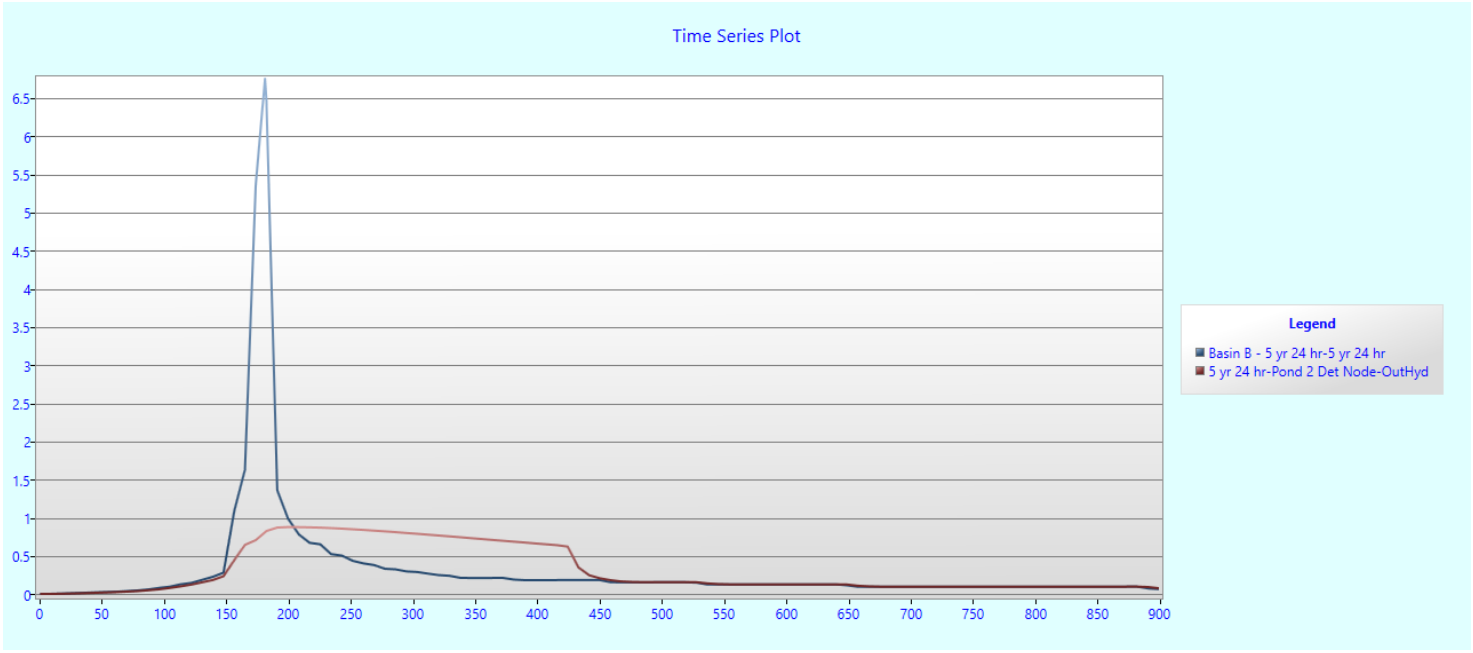
South Pond Summary Table (POND 2)

Design Event	Match Flows (cfs)	Peak Q (cfs)	Max Depth (ft)	Vol (cf)	HtoE	% Vol
WQCV	0.0551	0.0281	0.0045	14.9835	0.01	99.95
5 yr 24 hr	6.7430	0.8767	1.5473	6,143.8109	0.01	99.97
100 yr 24 hr	19.9827	1.4999	4.6147	25,163.8586	0.01	99.96

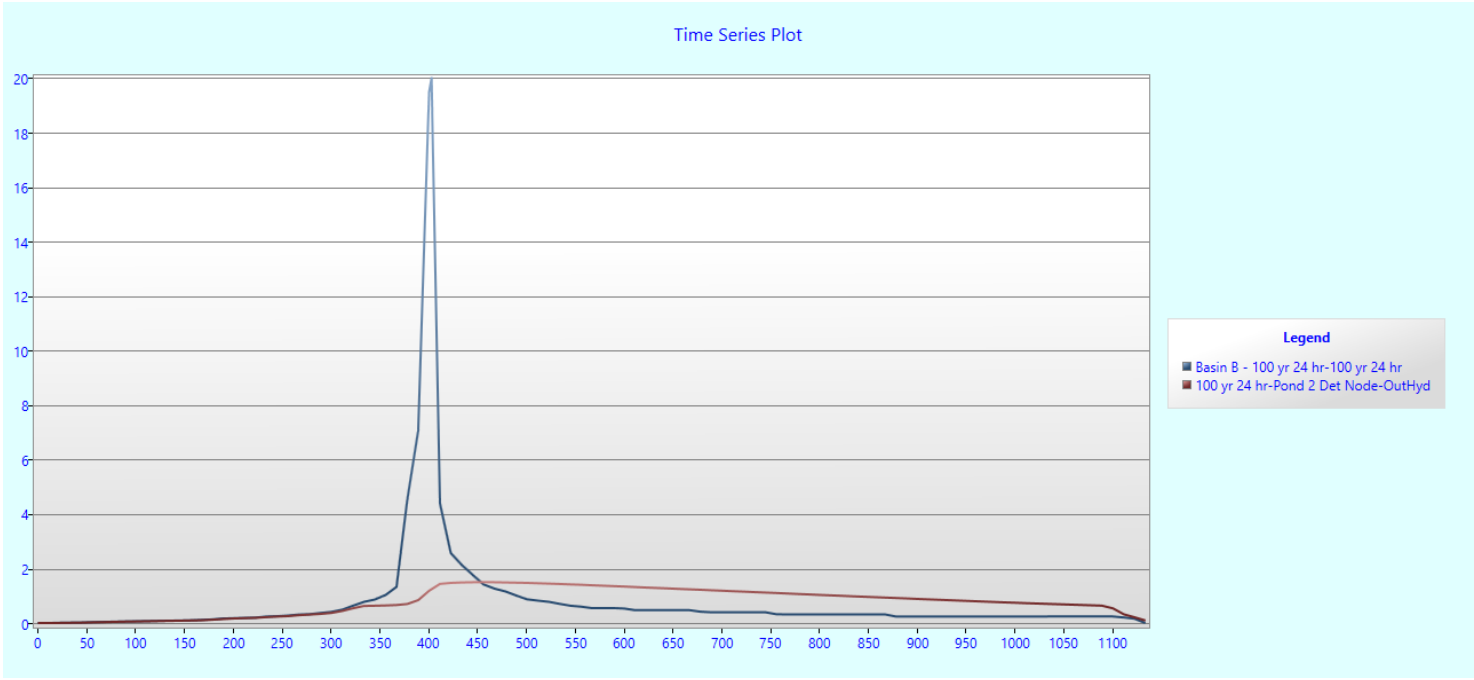
South Pond: WQCV Inflow and Outflow Hydrographs



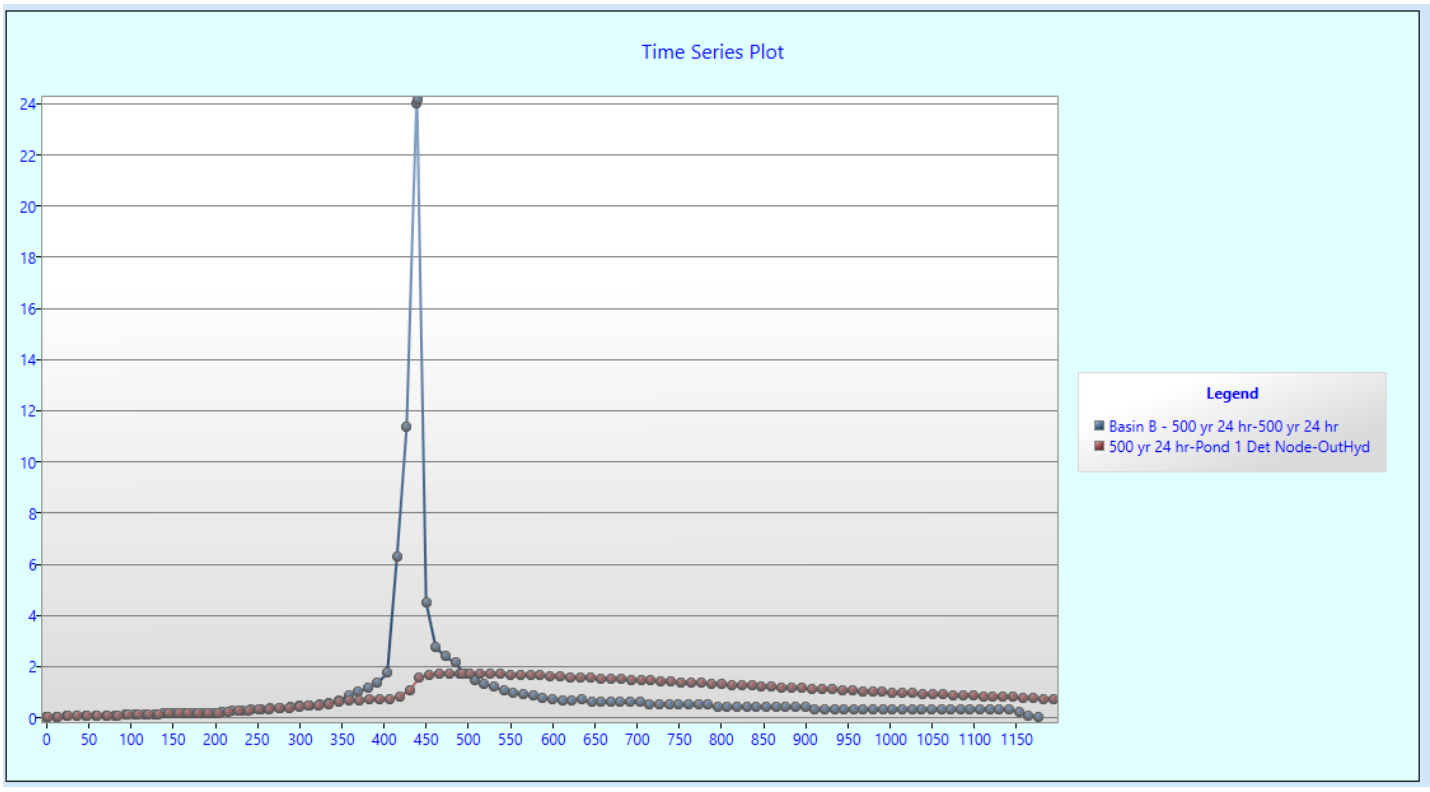
South Pond: 5 YR Inflow and Outflow Hydrographs



South Pond: 100 YR Inflow and Outflow Hydrographs



South Pond: 500 YR Inflow and Outflow Hydrograph and Summary Table



Design Evei	Match Flows (cfs)	Peak Q (cfs)	Max Depth (ft	Vol (cf)	HtoE	% Vol
500 yr 24 hr	24.0984	1.6845	5.4160	31,832.7139	1.05	99.95

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018)

Designer: dlm
Company: M&S Civil Consultants
Date: April 20, 2023
Project: Bradley Point Filing No. 1
Location: US Hwy 85-87 / Bradley Road

POND 1

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter): I_a = 82.0 %

B) Tributary Area's Imperviousness Ratio (i = I_a/100): i = 0.820

C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time
WQCV= 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i): WQCV = 0.27 watershed inches

D) Contributing Watershed Area (including sand filter area): Area = 194,501 sq ft

E) Water Quality Capture Volume (WQCV) Design Volume
V_{WQCV} = WQCV / 12 * Area: V_{WQCV} = cu ft

F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm: d_6 = 0.60 in

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume: $V_{WQCV\ OTHER}$ = 6,173 cu ft

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

2. Basin Geometry

A) WQCV Depth: D_{WQCV} = 0.1 ft

B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.: Z = 3.00 ft / ft
DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

C) Minimum Filter Area (Flat Surface Area): A_{Min} = 1994 sq ft

D) Actual Filter Area: A_{Actual} = 3863 sq ft

E) Volume Provided: V_T = cu ft

3. Filter Material

Choose One
- ○ 18" CDOT Class B or C Filter Material
- ◉ Other (Explain): In-situ eathern materials

4. Underdrain System

A) Are underdrains provided?

Choose One
- ○ YES
- ◉ NO

B) Underdrain system orifice diameter for 12 hour drain time

i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice: y = N/A ft

ii) Volume to Drain in 12 Hours: Vol_{12} = N/A cu ft

iii) Orifice Diameter, 3/8" Minimum: D_O = N/A in

Design Procedure Form: Sand Filter (SF)

Designer: dlm
Company: M&S Civil Consultants
Date: April 20, 2023
Project: Bradley Point Filing No. 1
Location: US Hwy 85-87 / Bradley Road

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One ○ YES ◉ NO
6. Inlet / Outlet Works A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet	

Notes:

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018)

Designer: dlm
Company: M&S Civil Consultants
Date: April 20, 2023
Project:
Location:

POND 2

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter): I_a = 80.0 %

B) Tributary Area's Imperviousness Ratio (i = I_a/100): i = 0.800

C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time
WQCV= 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i): WQCV = 0.26 watershed inches

D) Contributing Watershed Area (including sand filter area): Area = 181,766 sq ft

E) Water Quality Capture Volume (WQCV) Design Volume
V_{WQCV} = WQCV / 12 * Area: V_{WQCV} = cu ft

F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm: d_6 = 0.60 in

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume: $V_{WQCV\ OTHER}$ = 5,551 cu ft

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

2. Basin Geometry

A) WQCV Depth: D_{WQCV} = 0.0 ft

B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.: Z = 3.00 ft / ft
DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

C) Minimum Filter Area (Flat Surface Area): A_{Min} = 1818 sq ft

D) Actual Filter Area: A_{Actual} = 3316 sq ft

E) Volume Provided: V_T = cu ft

3. Filter Material

Choose One
- ○ 18" CDOT Class B or C Filter Material
- ◉ Other (Explain): In-situ eathern materials

4. Underdrain System

A) Are underdrains provided?

Choose One
- ○ YES
- ◉ NO

B) Underdrain system orifice diameter for 12 hour drain time

i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice: y = N/A ft

ii) Volume to Drain in 12 Hours: Vol_{12} = N/A cu ft

iii) Orifice Diameter, 3/8" Minimum: D_O = N/A in

Design Procedure Form: Sand Filter (SF)

Designer: dlm
Company: M&S Civil Consultants
Date: April 20, 2023
Project:
Location:

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One ◯ YES ◯ NO
6. Inlet / Outlet Works A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet	

Notes:

Worksheet for West Side of Proposed Entrance - Crosspan

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.003 ft/ft
Discharge	16.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+50	85.14
-0+25	84.19
-0+15	84.20
-0+03	83.90
0+00	83.77
0+03	83.89
0+46	85.09

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+50, 85.14)	(0+46, 85.09)	0.015

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	6.0 in
Roughness Coefficient	0.015
Elevation	84.27 ft
Elevation Range	83.8 to 85.1 ft
Flow Area	8.7 ft²
Wetted Perimeter	44.2 ft
Hydraulic Radius	2.4 in
Top Width	44.17 ft
Normal Depth	6.0 in
Critical Depth	5.5 in
Critical Slope	0.006 ft/ft
Velocity	1.84 ft/s
Velocity Head	0.05 ft
Specific Energy	0.55 ft

Worksheet for West Side of Proposed Entrance - Crosspan

Results	
Froude Number	0.730
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	6.0 in
Critical Depth	5.5 in
Channel Slope	0.003 ft/ft
Critical Slope	0.006 ft/ft

Worksheet for East Side of Proposed Entrance - Crosspan

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.003 ft/ft
Discharge	16.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+50	85.03
-0+25	84.49
-0+03	83.78
0+00	83.66
0+03	83.78
0+46	84.98

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+50, 85.03)	(0+46, 84.98)	0.015

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	6.1 in
Roughness Coefficient	0.015
Elevation	84.16 ft
Elevation Range	83.7 to 85.0 ft
Flow Area	7.6 ft²
Wetted Perimeter	31.9 ft
Hydraulic Radius	2.9 in
Top Width	31.89 ft
Normal Depth	6.1 in
Critical Depth	5.4 in
Critical Slope	0.005 ft/ft
Velocity	2.09 ft/s
Velocity Head	0.07 ft
Specific Energy	0.57 ft
Froude Number	0.753

Worksheet for East Side of Proposed Entrance - Crosspan

Results	
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	6.1 in
Critical Depth	5.4 in
Channel Slope	0.003 ft/ft
Critical Slope	0.005 ft/ft

Worksheet for Irregular Swale Section - A-A

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.004 ft/ft
Discharge	16.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	5,785.60
0+33	5,785.00
0+54	5,784.50
0+65	5,785.00
0+83	5,785.80

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5,785.60)	(0+65, 5,785.00)	0.030
(0+65, 5,785.00)	(0+83, 5,785.80)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	7.1 in
Roughness Coefficient	0.029
Elevation	5,785.09 ft
Elevation Range	5,784.5 to 5,785.8 ft
Flow Area	11.2 ft²
Wetted Perimeter	39.0 ft
Hydraulic Radius	3.4 in
Top Width	39.03 ft
Normal Depth	7.1 in
Critical Depth	5.2 in
Critical Slope	0.021 ft/ft
Velocity	1.43 ft/s
Velocity Head	0.03 ft
Specific Energy	0.62 ft
Froude Number	0.469

Worksheet for Irregular Swale Section - A-A

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	7.1 in
Critical Depth	5.2 in
Channel Slope	0.004 ft/ft
Critical Slope	0.021 ft/ft

Worksheet for Irregular Swale Section - B-B

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.003 ft/ft
Discharge	16.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	5,785.20
0+50	5,784.00
0+57	5,783.70
0+62	5,784.00
0+86	5,784.90

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5,785.20)	(0+62, 5,784.00)	0.030
(0+62, 5,784.00)	(0+86, 5,784.90)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	8.2 in
Roughness Coefficient	0.027
Elevation	5,784.39 ft
Elevation Range	5,783.7 to 5,785.2 ft
Flow Area	11.6 ft²
Wetted Perimeter	38.5 ft
Hydraulic Radius	3.6 in
Top Width	38.50 ft
Normal Depth	8.2 in
Critical Depth	6.2 in
Critical Slope	0.017 ft/ft
Velocity	1.38 ft/s
Velocity Head	0.03 ft
Specific Energy	0.71 ft
Froude Number	0.443

Worksheet for Irregular Swale Section - B-B

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	8.2 in
Critical Depth	6.2 in
Channel Slope	0.003 ft/ft
Critical Slope	0.017 ft/ft

Worksheet for Irregular Swale Section - C-C

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.004 ft/ft
Discharge	16.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	5,784.20
0+60	5,783.00
0+65	5,782.80
0+70	5,783.00
0+96	5,784.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5,784.20)	(0+70, 5,783.00)	0.030
(0+70, 5,783.00)	(0+96, 5,784.10)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	7.1 in
Roughness Coefficient	0.027
Elevation	5,783.40 ft
Elevation Range	5,782.8 to 5,784.2 ft
Flow Area	11.0 ft²
Wetted Perimeter	39.5 ft
Hydraulic Radius	3.3 in
Top Width	39.47 ft
Normal Depth	7.1 in
Critical Depth	5.5 in
Critical Slope	0.018 ft/ft
Velocity	1.46 ft/s
Velocity Head	0.03 ft
Specific Energy	0.63 ft
Froude Number	0.489

Worksheet for Irregular Swale Section - C-C

Results	
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	7.1 in
Critical Depth	5.5 in
Channel Slope	0.004 ft/ft
Critical Slope	0.018 ft/ft

Worksheet for Irregular Swale Section - D-D

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.005 ft/ft
Discharge	17.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	5,782.50
0+52	5,782.00
0+65	5,781.60
0+78	5,782.00
0+96	5,782.90

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5,782.50)	(0+78, 5,782.00)	0.030
(0+78, 5,782.00)	(0+96, 5,782.90)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	7.0 in
Roughness Coefficient	0.029
Elevation	5,782.19 ft
Elevation Range	5,781.6 to 5,782.9 ft
Flow Area	12.1 ft²
Wetted Perimeter	48.9 ft
Hydraulic Radius	3.0 in
Top Width	48.90 ft
Normal Depth	7.0 in
Critical Depth	5.5 in
Critical Slope	0.021 ft/ft
Velocity	1.45 ft/s
Velocity Head	0.03 ft
Specific Energy	0.62 ft
Froude Number	0.513

Worksheet for Irregular Swale Section - D-D

Results	
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	7.0 in
Critical Depth	5.5 in
Channel Slope	0.005 ft/ft
Critical Slope	0.021 ft/ft

Worksheet for Irregular Swale Section - E-E

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.020 ft/ft
Discharge	17.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	5,780.80
0+43	5,780.00
0+56	5,779.20
0+62	5,780.00
0+79	5,781.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5,780.80)	(0+62, 5,780.00)	0.030
(0+62, 5,780.00)	(0+79, 5,781.00)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	8.0 in
Roughness Coefficient	0.030
Elevation	5,779.86 ft
Elevation Range	5,779.2 to 5,781.0 ft
Flow Area	5.2 ft²
Wetted Perimeter	15.8 ft
Hydraulic Radius	4.0 in
Top Width	15.76 ft
Normal Depth	8.0 in
Critical Depth	8.0 in
Critical Slope	0.019 ft/ft
Velocity	3.35 ft/s
Velocity Head	0.17 ft
Specific Energy	0.84 ft
Froude Number	1.025

Worksheet for Irregular Swale Section - E-E

Results	
Flow Type	Supercritical

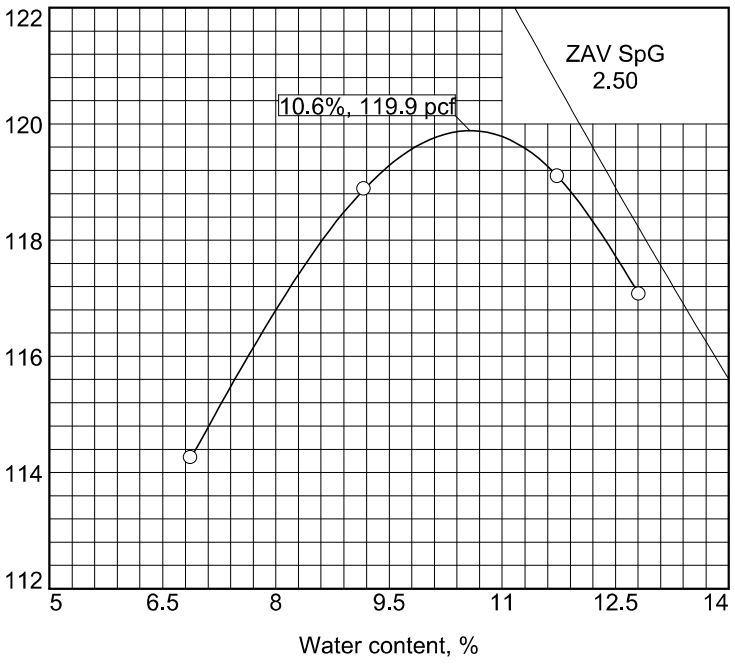
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	8.0 in
Critical Depth	8.0 in
Channel Slope	0.020 ft/ft
Critical Slope	0.019 ft/ft

AGGREGATE BASE EXHIBIT

COMPACTION TEST REPORT

Curve No. 1217



Preparation Method
Rammer: Wt. 10 lb. Drop 18 in.
Type Manual
Layers: No. five Blows per 56
Mold Size 0.075 cu. ft.
Test Performed on Material
Passing 3/4 in. Sieve

%>3/4 in. 1 %<No.200 6.8
Atterberg (D 4318): LL NV PI NP
NM (D 2216) Sp.G. (D 854) 2.5
USCS (D 2487) GP-GM
AASHTO (M 145) A-1-a
Date: Sampled 3-25-2021
Received 3-25-2021
Tested 4-6-2021
Tested By KP

COMPACTION TESTING DATA
ASTM D 1557-12 Method C Modified

	1	2	3	4	5	6
WM + WS	10658.0	10919.0	11031.0	10997.0		
WM	6504.0	6504.0	6504.0	6504.0		
WW + T #1	730.1	718.7	669.0	786.8		
WD + T #1	692.6	670.9	615.7	723.4		
TARE #1	147.1	149.6	161.5	228.7		
WW + T #2						
WD + T #2						
TARE #2						
MOIST.	6.9	9.2	11.7	12.8		
DRY DENS.	114.3	118.9	119.1	117.1		

SIEVE TEST RESULTS
ASTM D-422 ASTM D-1140

Opening Size	% Passing	Specs.
1"	100	100
3/4"	99	95 - 100
3/8"	68	
#4	48	30 - 65
#8	31	25 - 55
#16	21	
#30	16	
#50	12	
#100	9	
#200	6.8	3.0 - 12

TEST RESULTS

Maximum dry density = 119.9 pcf

Optimum moisture = 10.6 %

Material Description

Recycled Concrete/ Class 6 ABC/ poorly graded gravel with silt and sand

Remarks:

Project No. 21-1-235 **Client:**
Project: Colorado Aggregate Recycling

○ **Location:** Import, South Yard **Sample Number:** 1217

Checked by: DS
Title: Lab Manager

Kumar & Associates, Inc.

Denver, Colorado

Figure

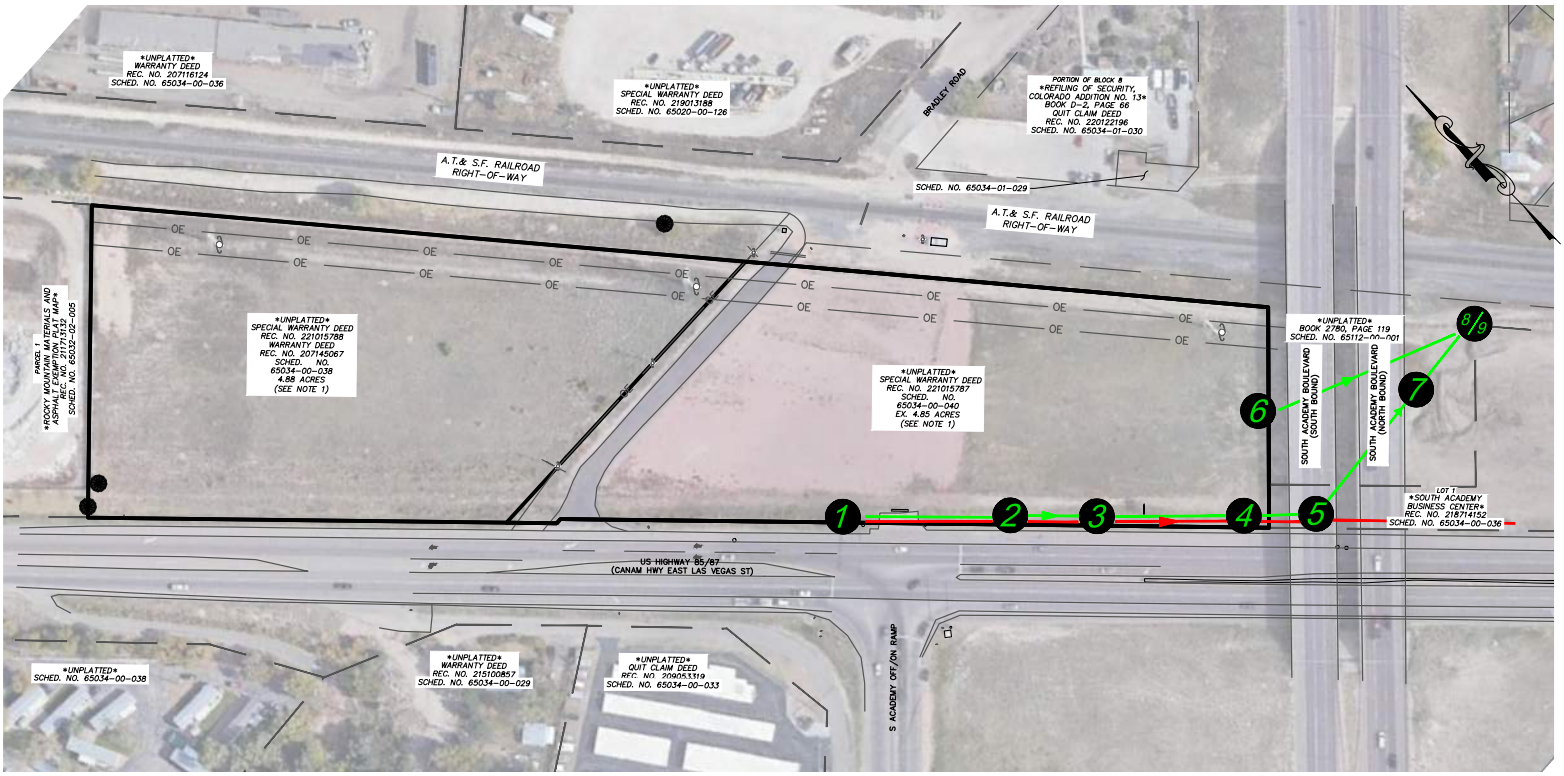
These test results apply only to the samples which were tested. the testing report shall not be reproduced, except in full, without the written approval of K & A, Inc

BRADLEY POINT FILING NO. 1
AGGREGATE BASE RUNOFF COEFFICIENT CALCULATION

		PASSING #4 SIEVE			*LARGER THAN #4 SIEVE*			*RUNOFF COEFFICIENT*	
ITEM	**ITEM DESCRIPTION**	**PERCENT** *(%)*	**C_5**	**C_{100}**	**PERCENT** *(%)*	**C_5**	**C_{100}**	**C_5**	**C_{100}**
3/4" Minus, CDOT CL6 Road Base	Recycled Concrete/ Class 6 ABC/ poorly graded gravel with silt and sand	0.48	0.09	0.36	0.52	0.59	0.70	**0.35**	**0.54**

Calculated by: CVW
Date: 5/5/2021

ROADSIDE DITCH CONVEYANCE EXHIBIT

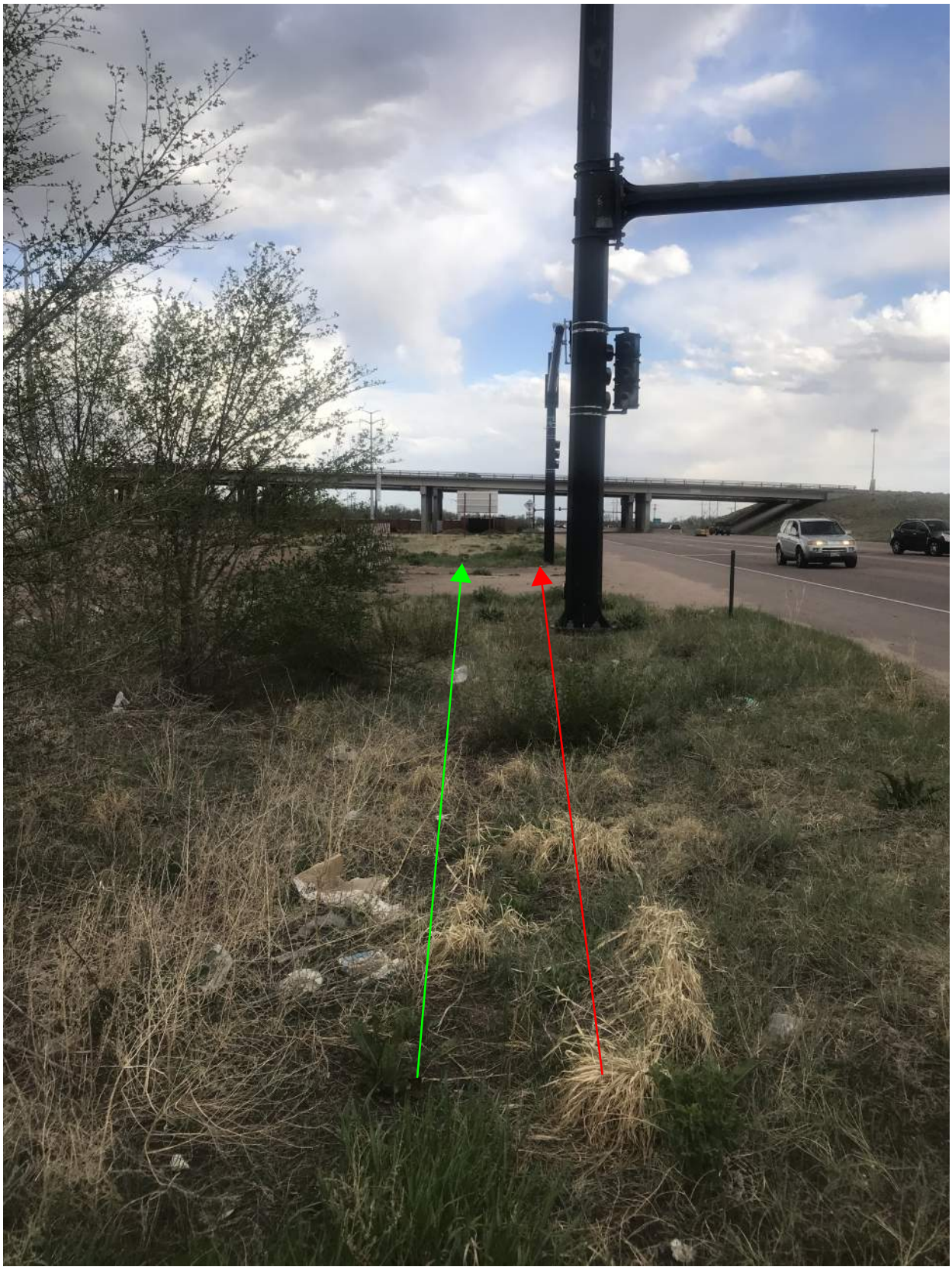


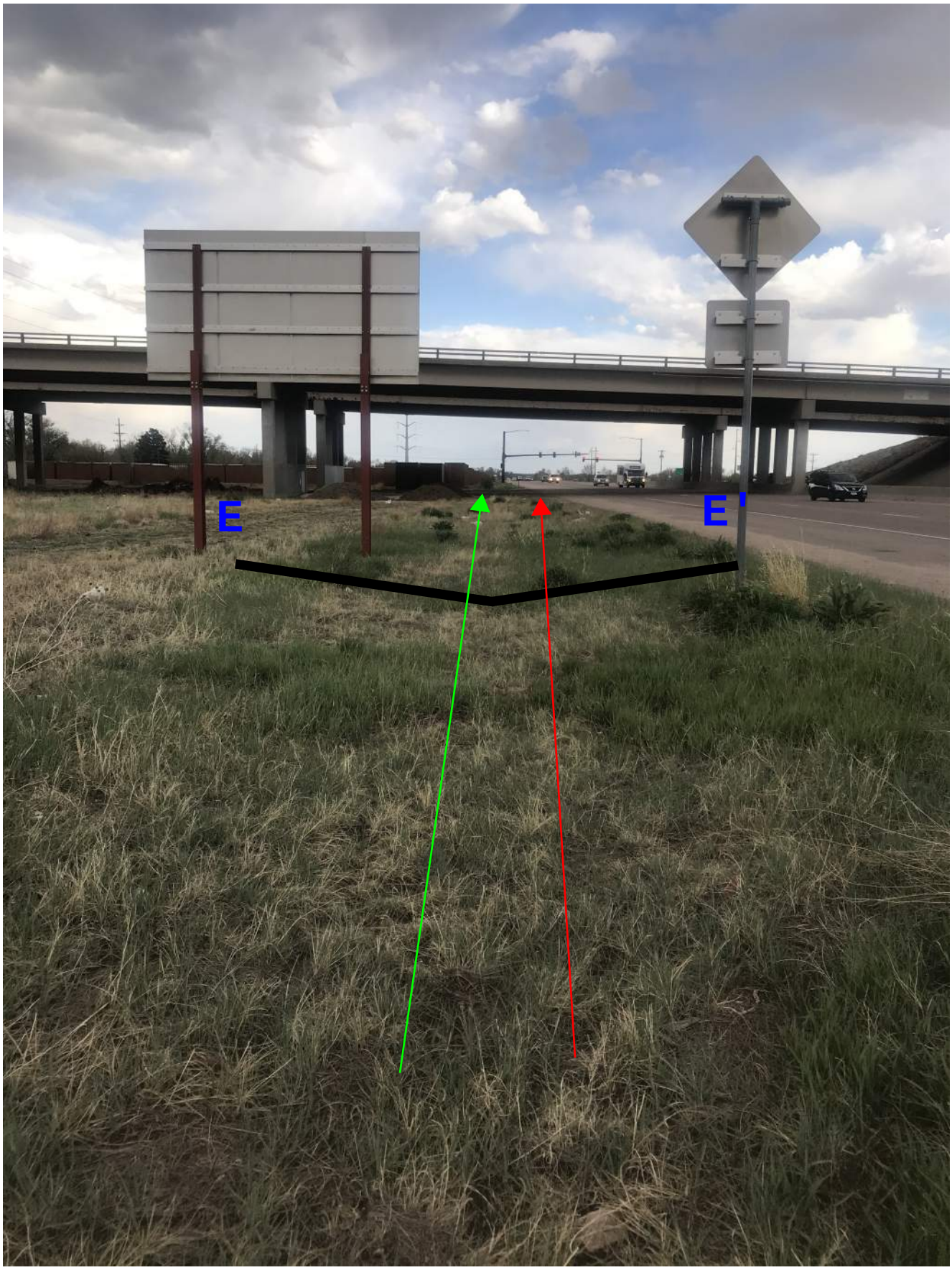
SITE MAP
N.T.S.

LEGEND

ACTUAL FLOWPATH

LOGICAL FLOWPATH




E
E'


18" ADS
CULVERT

SOILS INFILTRATION RATE REPORT

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
FAX (719) 531-5238

August 4, 2021
Revised October 19, 2021

Highway 85/87 Properties, LLC
2010 Fox Mountain Point
Colorado Springs, CO 80906

Attn: Steve Schnurr

Re: Infiltration Rates (Percolation Test Method)
Bradley Point, Filing No. 1
Parcel Nos. 65034-00-038 and 65034-00-040
Colorado Springs, Colorado

Underdrains and/or an outlet structure is required if infiltration tests show rates slower than 2 times that required to drain the WQCV over 12 hours. Clearly state that the infiltration rates are at least 2x the rate required to drain the WQCV over 12 hrs or add an underdrain to the design.

Dear Mr. Schnurr:

As requested, personnel of Entech Engineering, Inc. have performed percolation testing at the above referenced site to evaluate the site soils to determine the infiltration rate for the proposed detention ponds.

The testing was performed on July 22 and 26, 2021 and on August 20, 2021. The test locations are shown in Figure 1. The Test Boring Logs, Percolation Test results, Infiltration Rates, and Laboratory Test results are included with this report. Laboratory results are summarized in Table 1. Soils encountered in the profile and percolation holes consisted of clayey sand, clayey-silty sand, and silty sand. Very clean sand was encountered at 4 to 5 feet in the test pits. The percent passing the No. 200 sieve in the Test Pit Samples was 1.8 and 4.1 percent. Bedrock and groundwater were not encountered in the test borings which were drilled to 20 feet. Based on the soils encountered in the test borings, the pond locations tested will have good infiltration characteristics, if the granular soils are exposed. The test boring logs and laboratory testing (grain size) are included with this report.

Southern Pond

The percolation rates were 10 minutes/inch for P1 (TB-1A), and 3 minutes/inch for P2 (TB-1A). The percolation rates correspond to adjusted average Infiltration Rate of 1 inch/hour (TB-1A). An additional test pit (TP 2) was excavated to evaluate the sands and gravel encountered at depth. A percolation rate less than 1 min/in, which corresponds to an infiltration rate of 8.1 inches/hour was measured.

depth of what in ft?

Northern Pond

The percolation rates were 8 minutes/inch for P3 (TB-2A), and 10 minutes/inch for P4 (TB-2A). The percolation rates correspond to adjusted average Infiltration Rate of 0.35 inches/hour (TB-2A). An additional test pit (TP 1) was excavated to evaluate the sands and gravel encountered at depth. A percolation rate less than 1 min/in, which corresponds to an infiltration rate of 8.1 inches/hour was measured in the field. TB 3 was drilled in the northern site. A percolation rate of 4 minutes/inch, which corresponds to an infiltration rate of 1.7 inches/hour was measured.

Results of the percolation testing/infiltration testing is included in this report. If the proposed detention ponds penetrate into the sand and gravels, infiltration rates of 8.0 inches/hour can be used. The pond excavation should be observed to verify that suitable soils are encountered. The pond surfaces will require periodic cleaning to maintain the high infiltration rates. The ponds should be installed to El Paso County standards/specifications.

If sands and gravels are not encountered, what will the alternative be to ensure the IFBs function?

We trust that this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.
Geologist

10-19-2021

Reviewed by:

Joseph C. Goode Jr., P.E.
President

LLL

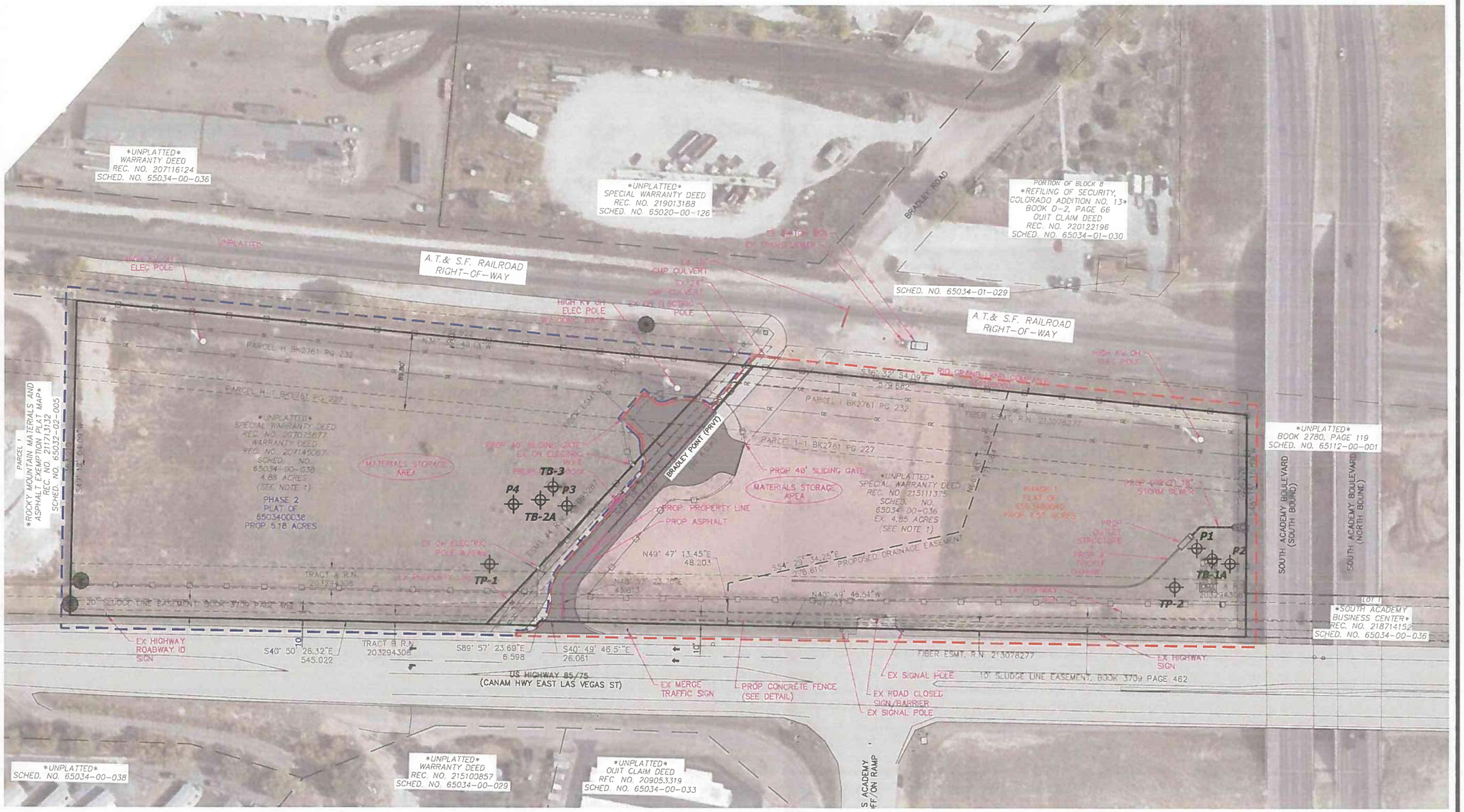
Encl.
Entech Job No. 210082
AAprojects/2021/210082 Infiltration Rate

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT HIGHWAY 85/87 PROPERTIES
PROJECT BRADLEY POINT, FILING 1
JOB NO. 210082

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1A	2-3			35.7	26	10	<0.01			SC	SAND, CLAYEY
1	2A	10			9.0						SM-SW	SAND, SLIGHTLY SILTY
1	TP-1	0-3			1.8						SW	SAND
1	TP-2	0-3			4.1						SW	SAND
1	P-1	2-3			36.4						SC	SAND, CLAYEY
1	P-2	2-3			20.2						SM	SAND, SILTY
1	P-3	2-3			9.0						SM-SW	SAND, SLIGHTLY SILTY
1	P-4	2-3			17.4						SM	SAND, SILTY



TB- APPROXIMATE PROFILE HOLE LOCATION AND NUMBER

N

REVISION	BY

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE (719) 531-5599
COLORADO SPRINGS, CO. 80907

SITE PLAN/TEST BORING LOCATION MAP
BRADLEY POINT FILING NO. 1
COLORADO SPRINGS, CO
FOR: HIGHWAY 85/87 PROPERTIES, LLC

DRAWN	LLL
CHECKED	
DATE	10/19/21
SCALE	AS SHOWN
JOB NO.	210082
FIGURE No.	1

INFILTRATION TESTING

Infiltration Rate (I) = Percolation Rate (P)/ Reduction Factor(R_F)
$I=P/R_F$

$R_f = [(2d_1 - \Delta d) / dia] + 1$

d_1 = initial water depth (in.)

Δd = final water level drop (in.)

dia = diameter of the percolation hole (in.)

Test No. TP-1 (21.6")
Perc Rate= 30 in/hr
dia = 8

P1
d_1 = 21.6
Δd = 21.6
R_f = 3.7

I = 8.108 in/hr

Test No. TP-2 (21.6")
Perc Rate= 30 in/hr
dia = 8

P2
d_1 = 21.6
Δd = 21.6
R_f = 3.7

I = 8.108 in/hr

Test No. TB-3 (106.8")
Perc Rate= 15 in/hr
dia = 8

P3
d_1 = 25.2
Δd = 8.4
R_f = 6.3

I = 2.400 in/hr

CLIENT HIGHWAY 85/87 PROPERTIES, LLC
PROJECT BRADLEY POINT FILING NO. 1
JOB NO. 210082

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ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

INFILTRATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.:

FIG NO.:

Infiltration Rate (I) = Percolation Rate (P)/ Reduction Factor(R_F)
$I=P/R_F$

$R_f = [(2d_1 - \Delta d) / dia] + 1$

d_1 = initial water depth (in.)

Δd = final water level drop (in.)

dia = diameter of the percolation hole (in.)

Test No. P1 (TB-1A) 5'4"

Perc Rate=	0.6	in/hr
dia =	8	

P1

d_1 =	35.0
Δd =	7.0
R_f =	8.9

I = 0.068 in/hr

Test No. P2 (TB-1A) 8'3"

Perc Rate=	20	in/hr
dia =	8	

P2

d_1 =	46.0
Δd =	20.0
R_f =	10.0

I = 2.000 in/hr

TB-1A I_{AVG}= 1.034 in/hr

Test No. P3 (TB-2A) 8'5"

Perc Rate=	1.8182	in/hr
dia =	8	

P3

d_1 =	26.0
Δd =	18.0
R_f =	5.3

I = 0.346 in/hr

Test No. P4 (TB-2A) 5'4"

Perc Rate=	6	in/hr
dia =	8	

P3

d_1 =	73.0
Δd =	17.0
R_f =	17.1

I = 0.350 in/hr

TB-2A I_{AVG}= 0.348 in/hr

CLIENT HIGHWAY 85/87 PROPERTIES, LLC
PROJECT BRADLEY POINT FILING NO. 1
JOB NO. 210082

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

INFILTRATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	8/2/21

JOB NO.: 210082
FIG NO.:

Client: Highway 85/87 Properties
Job Number: 210082
Test Location: Bradley Point, Detention Pond

PERCOLATION HOLES

Date Holes Prepared: 7/22/2021
Date Hole Completed: 7/22/2021

Hole No. 1
Depth: 64"

Trial	Time (min.)	Water Level Change (in.)
1	10	1
2	10	1
3	10	1

Perc Rate (min./in.): 10

Hole No. 2
Depth: 99"

Trial	Time (min.)	Water Level Change (in.)
1	10	6
2	10	2
3	10	4

Perc Rate (min./in.): 3

Hole No. 3
Depth: 101"

Trial	Time (min.)	Water Level Change (in.)
1	10	2 1/2
2	10	1 1/5
3	10	1 1/5

Perc Rate (min./in.): 8

Hole No. 4
Depth: 64"

Trial	Time (min.)	Water Level Change (in.)
1	10	1
2	10	1
3	10	1

Perc Rate (min./in.): 10

Average Perc Rate (min./in.) 8

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ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.:

FIG NO.:

Client: Highway 85/87 Propertires, LLC
Test Location: Bradley Point Filing No. 1

Job Number: 210082

PERCOLATION HOLES

Date Holes Prepared: 8/20/2021

Date Hole Completed: 8/20/2021

Hole No. TP-1
Depth: 21.6"

Trial	Time (min.)	Water Level Change (in.)
1	5	>5
2	5	>5
3	5	>5

Perc Rate (min./in.): <1

Hole No. TP-2
Depth: 21.6"

Trial	Time (min.)	Water Level Change (in.)
1	5	>5
2	5	>5
3	5	>5

Perc Rate (min./in.): <1

Hole No. TB-3
Depth: 106.8"

Trial	Time (min.)	Water Level Change (in.)
1	5	3 3/5
2	5	2 2/5
3	5	1 1/5

Perc Rate (min./in.): 4

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.:

FIG NO.:

TEST BORING LOGS AND LABORATORY TESTING

TEST BORING NO. 1 A
DATE DRILLED 7/16/2021
Job # 210082

REMARKS

DRY TO 20', 7/16/21

SAND, CLAYEY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE, MOIST

SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, DRY TO MOIST

* - BULK SAMPLE TAKEN

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			25	5.3	1
5			27	1.3	1
10			*	1.8	1
15			*	2.6	1
20			*	4.3	1

TEST BORING NO. 2 A
DATE DRILLED 7/16/2021
CLIENT HIGHWAY 85/87 PROPERTIES
LOCATION BRADLEY POINT, FILING 1

REMARKS

DRY TO 20', 7/16/21

SAND, SILTY, CLAYEY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST

SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, DRY TO MOIST

* - BULK SAMPLE TAKEN

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			29	5.8	2
5			25	1.3	2
10			*	2.0	2
15			*	3.1	2
20			*	3.8	2

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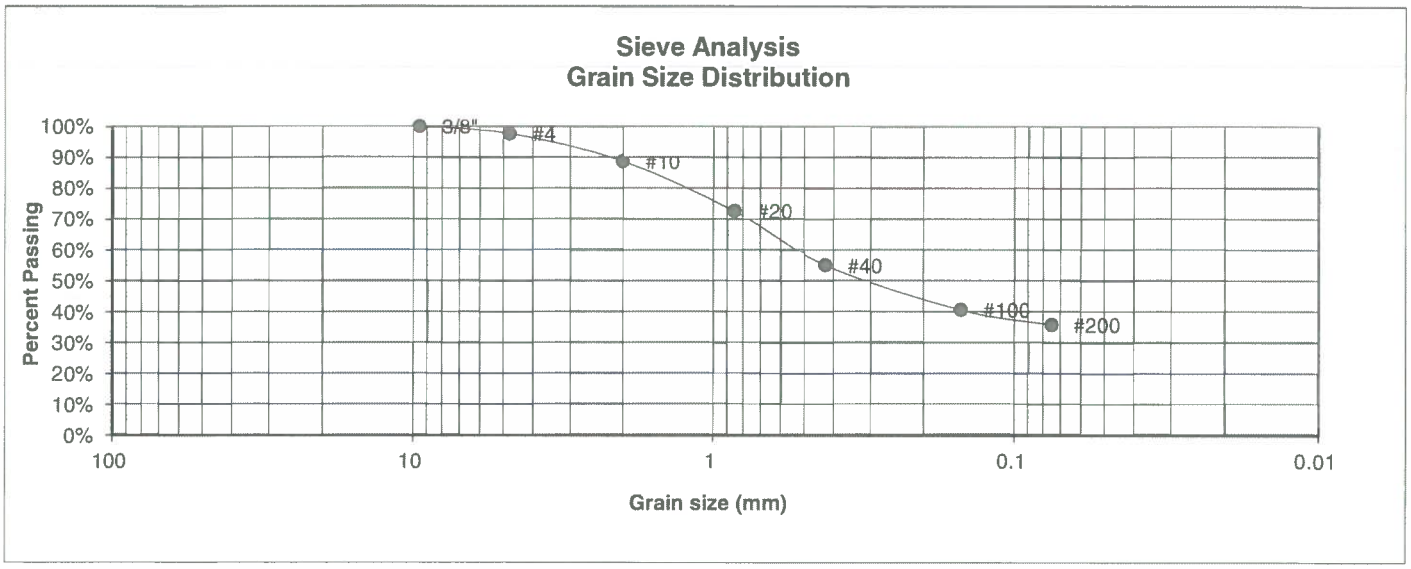
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			7/23/21

JOB NO.: 210082
FIG NO.:

UNIFIED CLASSIFICATION	SC	CLIENT	HIGHWAY 85/87 PROPERTIES
SOIL TYPE #	1	PROJECT	BRADLEY POINT, FILING 1
TEST BORING #	1A	JOB NO.	210082
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.5%
10	88.6%
20	72.5%
40	54.9%
100	40.5%
200	35.7%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	26
Plastic Index	10

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

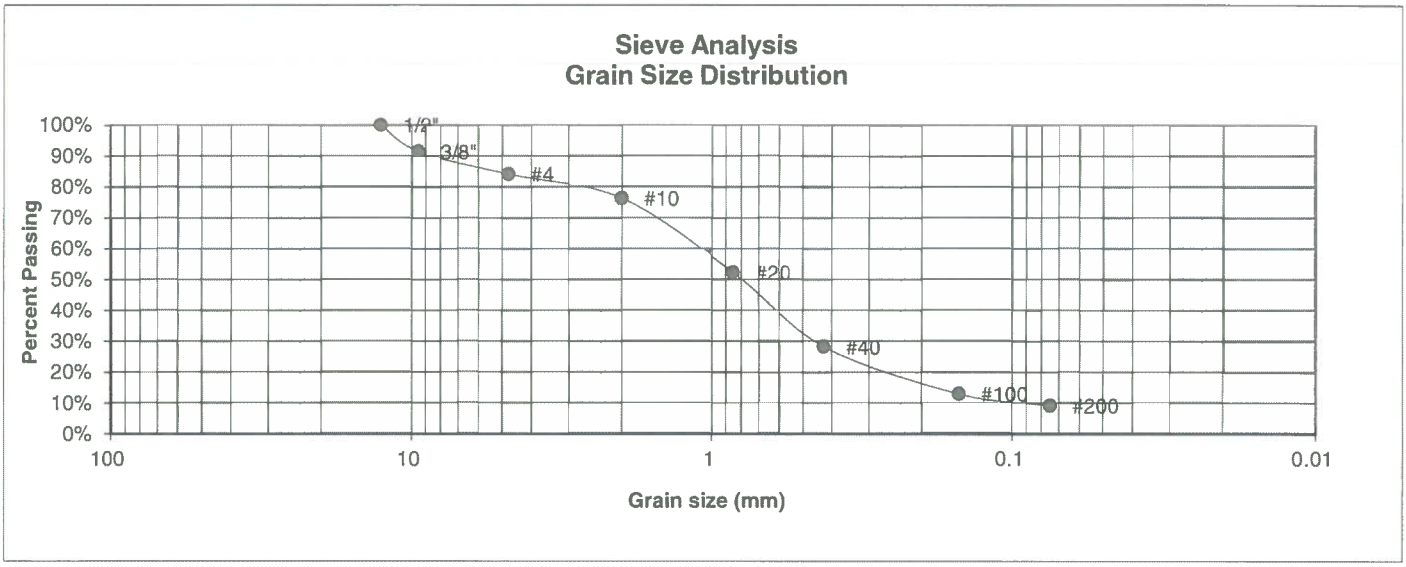
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 7/23/21

JOB NO.: 210082

FIG NO.:

UNIFIED CLASSIFICATION	SM-SW	CLIENT	HIGHWAY 85/87 PROPERTIES
SOIL TYPE #	1	PROJECT	BRADLEY POINT, FILING 1
TEST BORING #	2A	JOB NO.	210082
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	91.3%
4	84.0%
10	76.3%
20	52.2%
40	28.2%
100	12.9%
200	9.1%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

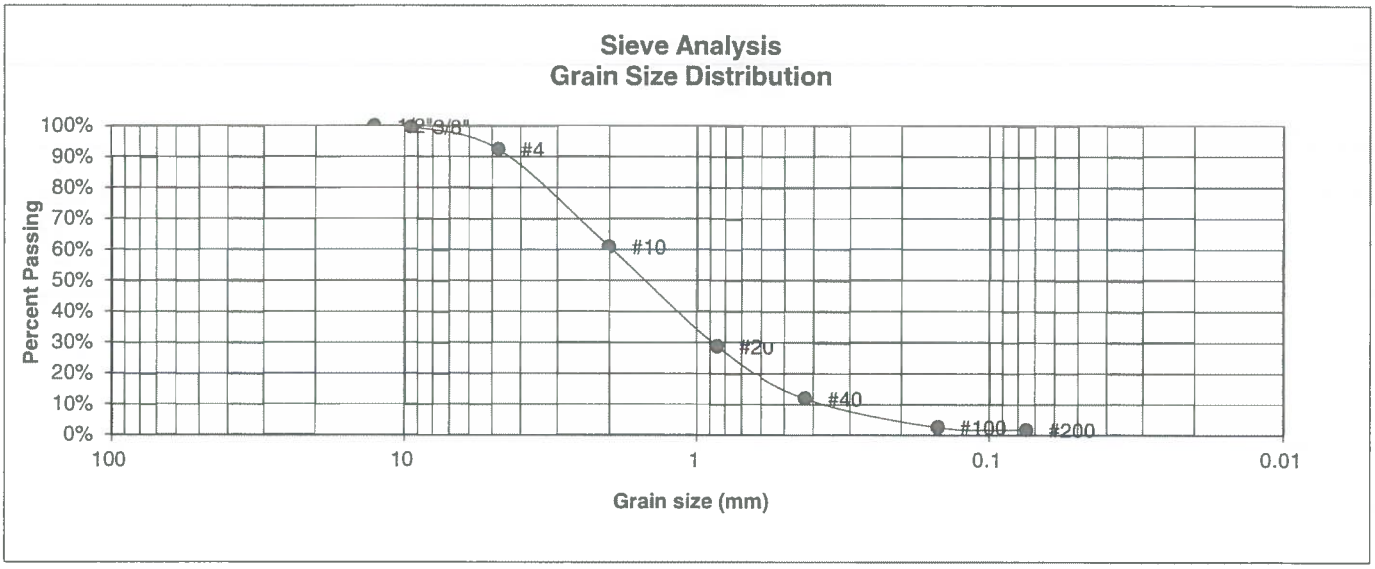
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 7/23/21

JOB NO.: 210082

FIG NO.:

BORING NO.	TP-1	UNIFIED CLASSIFICATION	SW	TEST BY	BL
DEPTH(ft)	GRAB	AASHTO CLASSIFICATION		JOB NO.	210082
CLIENT	HIGHWAY 85/87 PROPERTIES				
PROJECT	BRADLEY POINT, FILING 1				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	99.6%
4	92.3%
10	60.9%
20	28.7%
40	11.9%
100	2.6%
200	1.8%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

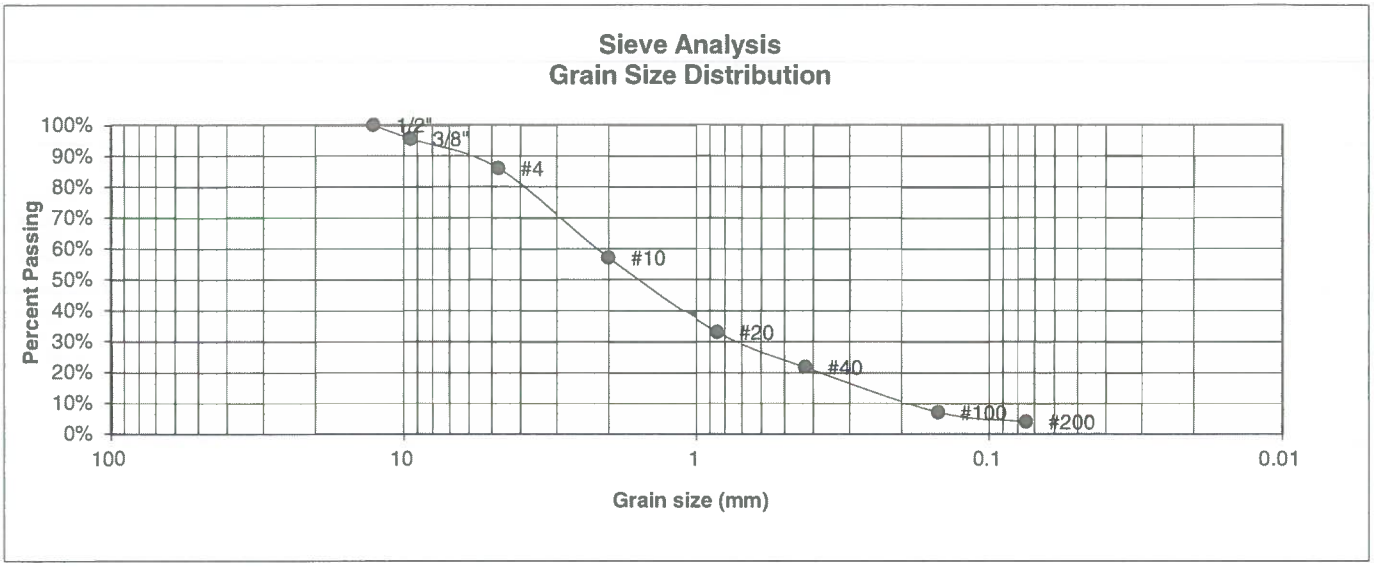
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.: 210082
FIG NO.:

BORING NO.	TP-2	UNIFIED CLASSIFICATION	SW	TEST BY	BL
DEPTH(ft)	GRAB	AASHTO CLASSIFICATION		JOB NO.	210082
CLIENT	HIGHWAY 85/87 PROPERTIES				
PROJECT	BRADLEY POINT, FILING 1				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	95.5%
4	86.0%
10	57.1%
20	33.1%
40	21.8%
100	7.2%
200	4.1%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

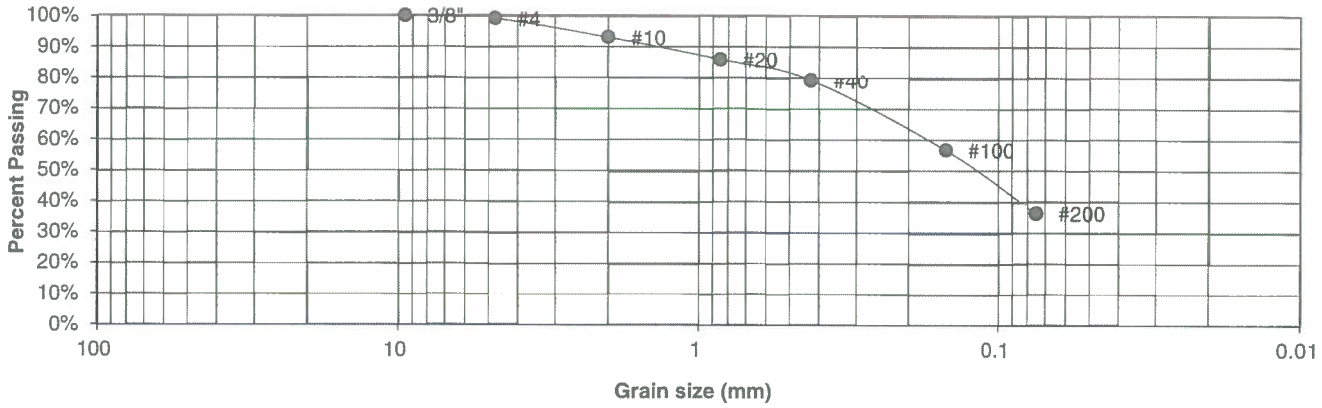
DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.: 210082

FIG NO.:

UNIFIED CLASSIFICATION	SC	CLIENT	HIGHWAY 85/87 PROPERTIES
SOIL TYPE #	1	PROJECT	BRADLEY POINT, FILING 1
TEST BORING #	P-1	JOB NO.	210082
DEPTH (FT)	2-3	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.0%
10	93.0%
20	85.9%
40	79.3%
100	56.7%
200	36.4%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

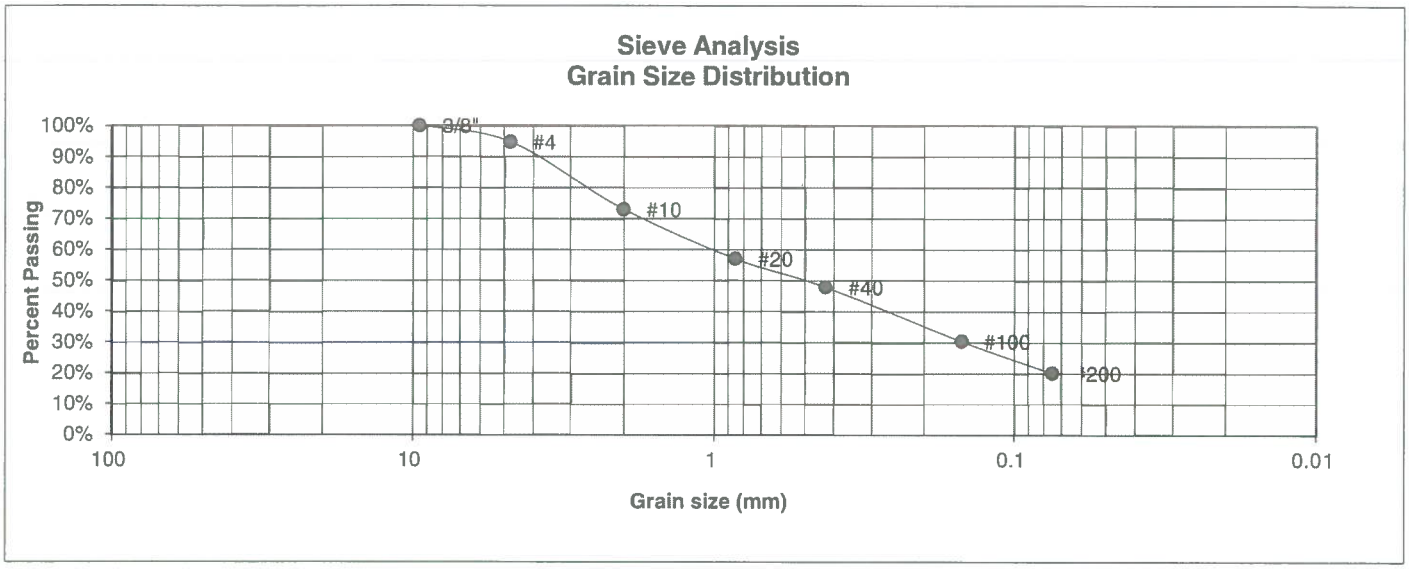
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.: 210082

FIG NO.:

UNIFIED CLASSIFICATION	SM	CLIENT	HIGHWAY 85/87 PROPERTIES
SOIL TYPE #	1	PROJECT	BRADLEY POINT, FILING 1
TEST BORING #	P-2	JOB NO.	210082
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.8%
10	72.9%
20	57.0%
40	47.9%
100	30.3%
200	20.2%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

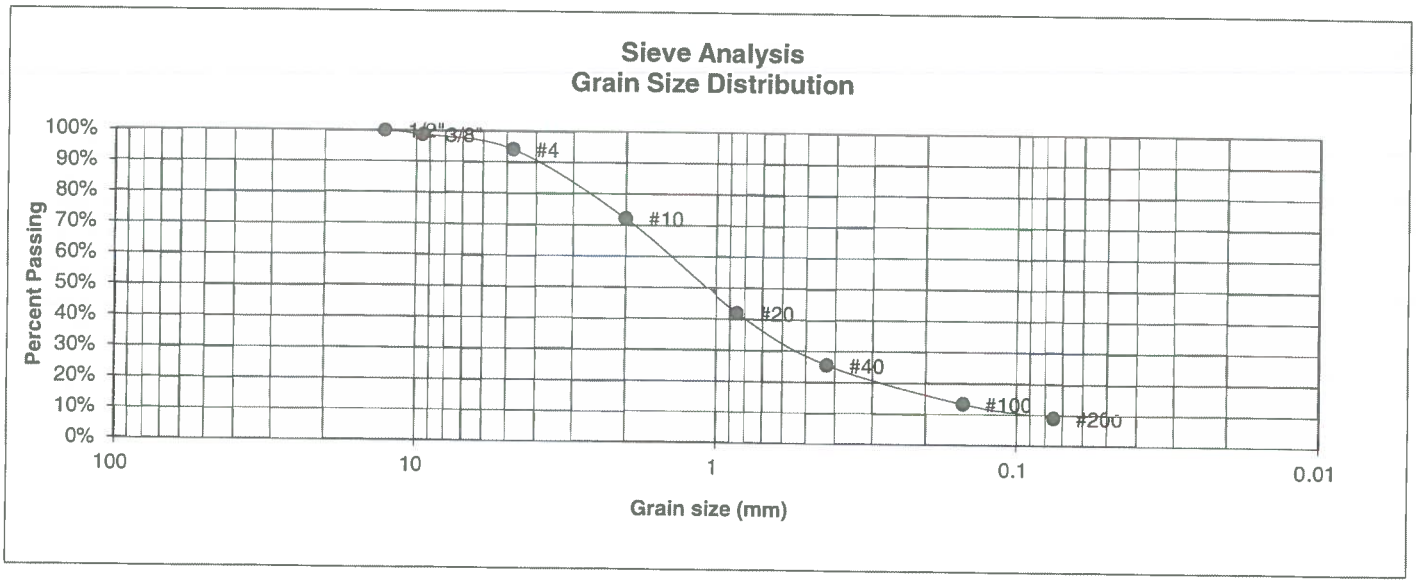
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.: 210082

FIG NO.:

UNIFIED CLASSIFICATION	SM-SW	CLIENT	HIGHWAY 85/87 PROPERTIES
SOIL TYPE #	1	PROJECT	BRADLEY POINT, FILING 1
TEST BORING #	P-3	JOB NO.	210082
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.6%
4	94.0%
10	72.1%
20	41.9%
40	25.4%
100	13.4%
200	9.0%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

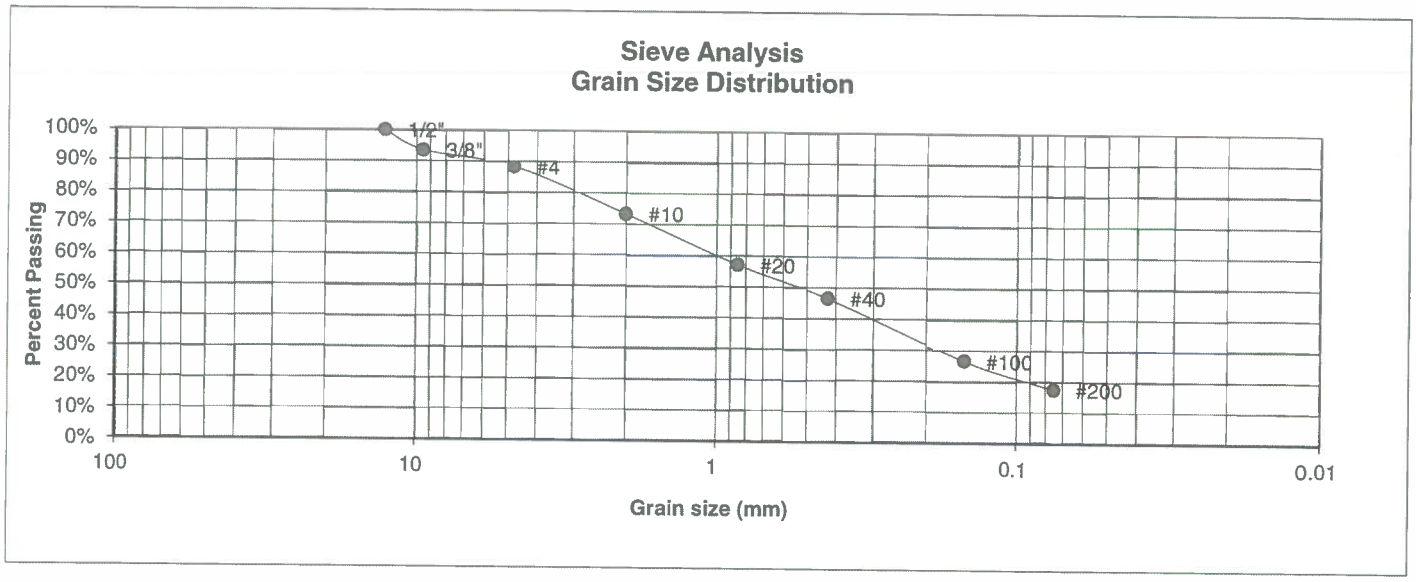
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.: 210082

FIG NO.:

UNIFIED CLASSIFICATION	SM	CLIENT	HIGHWAY 85/87 PROPERTIES
SOIL TYPE #	1	PROJECT	BRADLEY POINT, FILING 1
TEST BORING #	P-4	JOB NO.	210082
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	93.5%
4	88.3%
10	73.2%
20	57.1%
40	46.5%
100	26.5%
200	17.4%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:

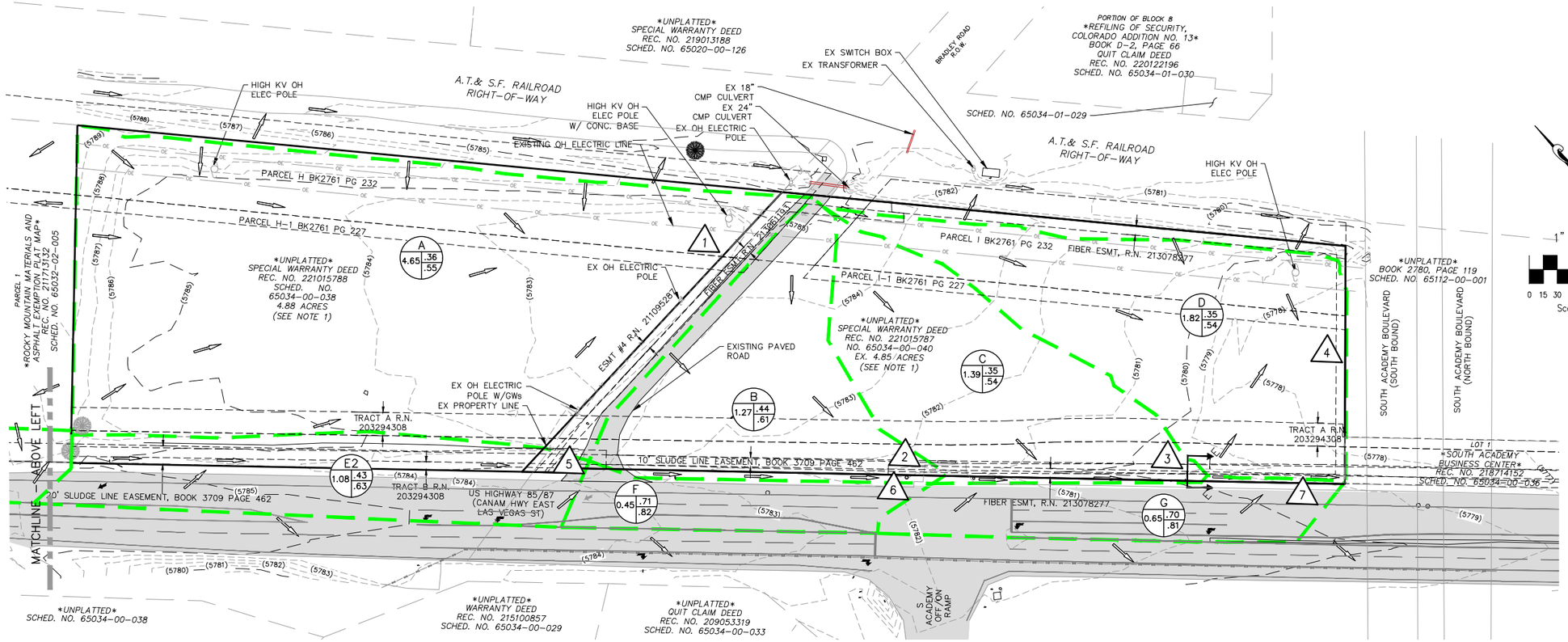
JOB NO.: 210082

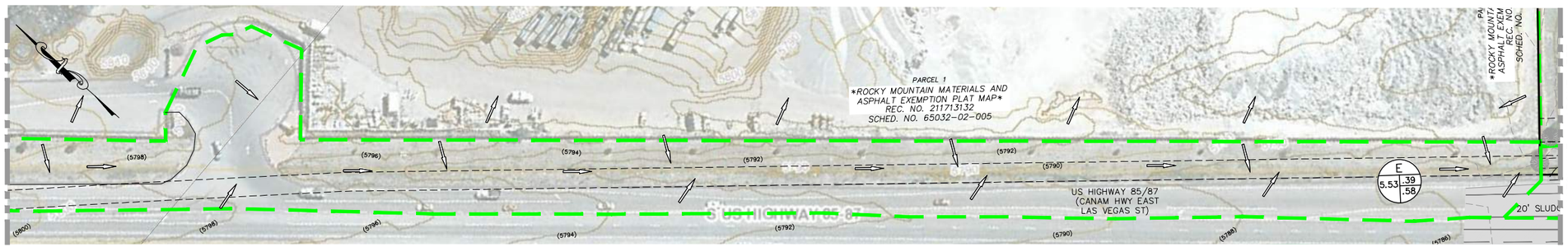
FIG NO.:

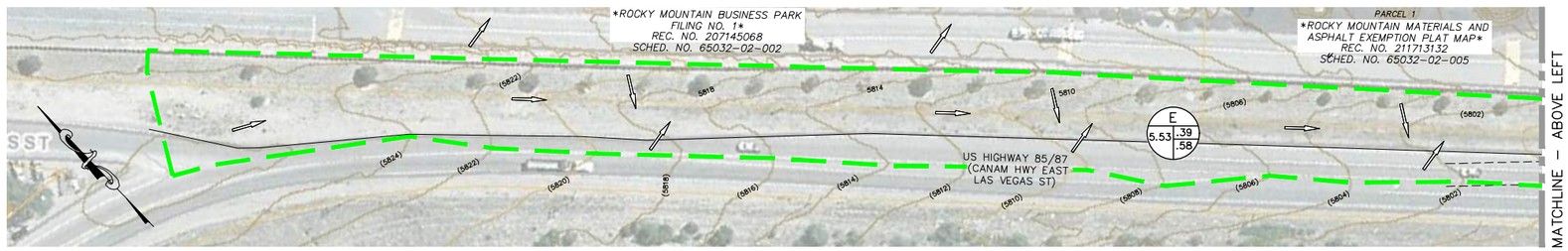
EXISTING DRAINAGE MAP

BRADLEY POINT FILING NO. 1 - EXISTING DRAINAGE MAP

AP NO. 65034-00-038 AND AP NO. 65034-00-040 ON HIGHWAY 85/87 (EAST LAS VEGAS STREET)
IN SECTION 3, T15S R66W, 6th P.M., EL PASO COUNTY, COLORADO







LEGEND

BASIN DESIGNATION — A | 0.07 | .90 | .95 | C5 | C100 (ACRES)

5 — SURFACE DESIGN POINT

BASIN BOUNDARY

(7070) EXIST MAJ CONT (5')

(7072) EXIST MIN CONT (1')

EX OR EXIST — EXISTING

ADJ. PROPERTY BOUNDARY

OE — OVERHEAD ELECTRIC

EXISTING FLOW DIRECTION ARROW

EXISTING TREE

1" = 60'

0 15 30 60 120
Scale in Feet

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
A	4.65	4.6	11.8
B	1.27	1.9	4.5
C	1.39	1.6	4.0
D	1.82	1.9	5.0
E	5.53	4.1	10.3
E2	1.08	1.4	3.3
F	0.45	1.4	2.6
G	0.65	1.7	3.4

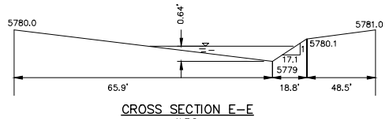
DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	CONTRIBUTING BASIN/DESIGN POINT	STRUCTURE
1	4.6	11.8	A	LOCALIZED DEPRESSION
2	5.3	13.3	B, DP 1	EXISTS TO ROADSIDE DITCH
3	1.6	4.0	C	EXISTS TO ROADSIDE DITCH
4	1.9	5.0	D	LOCALIZED DEPRESSION
5	4.4	10.8	E, E2	EXISTING ROADSIDE DITCH
6	8.6	21.0	F, DP 2, DP 5	EXISTING ROADSIDE DITCH
7	9.0	21.7	G, DP 3, DP 6	EXISTING ROADSIDE DITCH

BRADLEY POINT FILING NO. 1
EXISTING DRAINAGE MAP
DATE SUBMITTED: 04/20/23
SHEET 1 OF 1

NOTE 1:

PARCELS ARE UNDER THE SAME OWNERSHIP



CROSS SECTION E-E
N.T.S.
Q100=32.7 CFS, S=0.007 FT/FT,
V=1.91 FT/SEC, D=7.7 INCHES

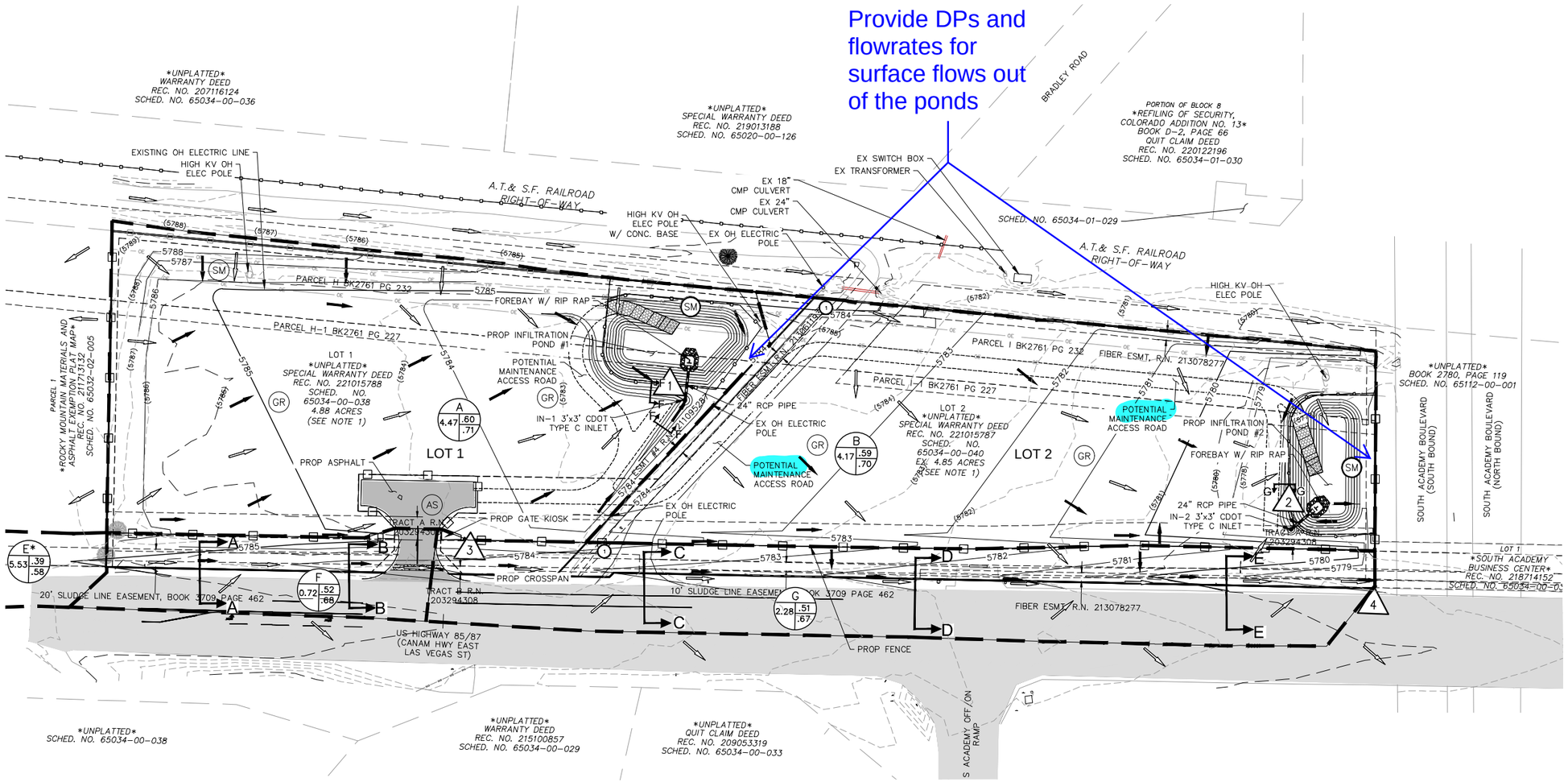
CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

File: O:\Y00744 SOUTH PLANT 85-87\SOUTH PLANT 85-87\Drainage\Existing Drainage Map.dwg Plotstamp: 4/24/2023 4:25 PM

PROPOSED DRAINAGE MAP

BRADLEY POINT FILING NO. 1 - PROPOSED DRAINAGE MAP

AP NO. 65034-00-038 AND AP NO. 65034-00-040 ON HIGHWAY 85/87 (EAST LAS VEGAS STREET)
IN SECTION 3, T15S R66W, 6th P.M., EL PASO COUNTY, COLORADO

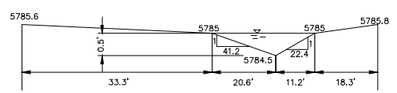


LEGEND

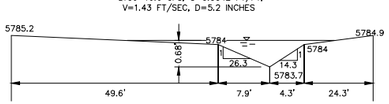
- BASIN DESIGNATION (661L, 0.07 ACRES, .90, .95, C5, C100)
- PIPE RUN REFERENCE LABEL
- SURFACE DESIGN POINT
- BASIN BOUNDARY
- 100 YEAR FLOOD BOUNDARY
- PROP MAJ CONT
- PROP MIN CONT
- EXIST MAJ CONT
- EXIST MIN CONT
- EX OR EXIST — EXISTING
- FUT — FUTURE
- PROP — PROPOSED
- ADJ. PROPERTY BOUNDARY
- OE — OVERHEAD ELECTRIC
- PROPOSED STORM SEWER PIPE
- PROP CONCRET FENCE
- EMERGENCY OVERFLOW DIRECTION
- PROPOSED RIPRAP
- MAINTENANCE/ACCESS ROAD ABOVE EURV
- MAINTENANCE/ACCESS ROAD BELOW EURV
- EXISTING FLOW DIRECTION ARROW
- PROPOSED FLOW DIRECTION ARROW
- ACCESS TO BE REMOVED AND NOT TO BE USED DURING CONSTRUCTION
- GR — GRAVEL
- SM — SEEDING/MULCHING
- AS — ASPHALT

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
A	4.47	9.9	19.7
B	4.17	9.0	18.0
E	5.53	6.5	16.2
F	0.72	1.4	3.0
G	2.28	4.0	8.8

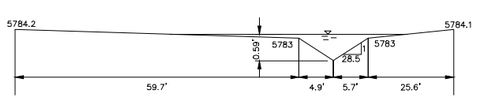
DESIGN POINT SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	9.9	19.7	A	PROPOSED INLET 1
2	9.0	18.0	B	PROPOSED INLET 2
3	6.6	16.0	E, F	ROADSIDE DITCH
4	7.4	17.5	G, DP 3	ROADSIDE DITCH



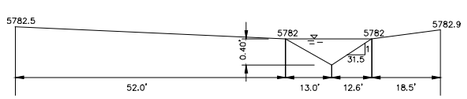
CROSS SECTION A-A
N.T.S.
Q100=16.0 CFS, S=0.0042 FT/FT,
V=1.43 FT/SEC, D=5.2 INCHES



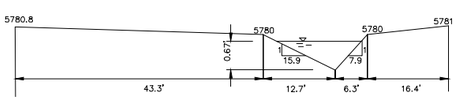
CROSS SECTION B-B
N.T.S.
Q100=16.0 CFS, S=0.003 FT/FT,
V=1.38 FT/SEC, D=8.2 INCHES



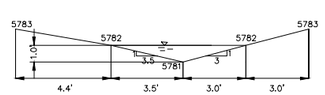
CROSS SECTION C-C
N.T.S.
Q100=16.0 CFS, S=0.004 FT/FT,
V=1.46 FT/SEC, D=7.1 INCHES



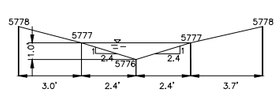
CROSS SECTION D-D
N.T.S.
Q100=17.5 CFS, S=0.005 FT/FT,
V=1.45 FT/SEC, D=7.0 INCHES



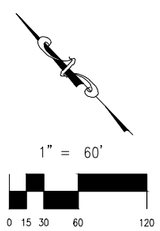
CROSS SECTION E-E
N.T.S.
Q100=17.5 CFS, S=0.02 FT/FT,
V=3.35 FT/SEC, D=8.0 INCHES



CROSS SECTION F-F
N.T.S.



CROSS SECTION G-G
N.T.S.



BRADLEY POINT FILING NO. 1
PROPOSED DRAINAGE MAP
DATE SUBMITTED: 04/20/23 SHEET 1 OF 1

NOTES:

1. PARCELS ARE UNDER THE SAME OWNERSHIP
2. * REFER TO OFFSITE BASIN E IN EXISTING CONDITIONS
3. FENCES AND SIGNAGE ADDED TO PREVENT ON-SITE, STORED MATERIALS FROM ENTERING THE PONDS.
4. EROSION CONTROL BLANKET SHALL BE USED ON SLOPES GREATER THAN 4:1.

CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

File: O:\70074A SOUTH PLANT 85-87\SOUTH PLANT 85-87\Drainage\Proposed Drainage Map.dwg Plotstamp: 4/24/2023 4:16 PM