COTTONWOOD CREEK & SOUTH PINE CREEK DRAINAGE BASIN PLANNING STUDY

FINAL REPORT

JULY 2019

Prepared for:

Department of Public Works
Water Resources Engineering

City of Colorado Springs

Prepared by:

Matrix

Selected Plan and Conceptual Design

Overview

Of the problem areas prioritized by the City. Three locations were moved forward for conceptual design. This included:

1. Mainstem Pipe Upheavals Sites – approximately 10 [ac-ft] of runoff escapes the subsurface system during the existing conditions
2. Additional Inlets along Mainstem – Additional Inlets placed throughout the watershed greatly reduce flooding by allowing storm runoff to reenter the subsurface system
3. Flooding concerns at East Boulder Street and North Pitkin Avenue – While this problem area does not contribute the greatest degree of flooding, it does experience a sustained ponding condition severely impacting local residents and businesses

Of the three projects moved forward for conceptual design, the mainstem upheavals and the flooding concerns at East Boulder Street and North Pitkin Avenue were taken to 30% design drawings which in turn were constructed by the City. The upheaval section of the Little Shooks Run Pipe began construction in March of 2018 with a projected completion date of May 2018. The construction of the Boulder and Pitkin improvements began in September of 2017 and were completed in November of 2017.

The City chose to take the recommendations for inlet placement for the basin and contract directly with an on-call construction company with the City to install the inlets throughout the basin. Additional information is provided below for the Boulder and Pitkin flood improvement projects and the Little Shooks Run Outfall Pipe Rehabilitation.

Boulder Street and Pitkin Avenue

Through the alternative selection process, it was determined that flooding issues around Boulder and Pitkin would be addressed through the improvement of the street conveyance and providing additional inlet capacity and increasing the height of the gutters to help alleviate street flooding and to reconfigure the street crown to help water drain to existing infrastructure. These improvements will help to provide additional conveyance and storage for the 5-year minor storm but will not provide substantial improvements for the major flood which will continue to inundate the surrounding area before it can drain. The conceptual design drawings and engineers cost estimate can be found in **Appendix C.**

Little Shooks Run 9-ft x 14-ft Rehabilitation Project

Through the alternative selection process, it was decided that a rehabilitation of the heaved sections of the 9-foot x 14-foot instead of replacing the culvert. The rehabilitation will include removing the bottom damaged heaved section of the 9-foot x 14-foot CMP. This will be accomplished within the pipe which will be braced from the inside. The bottom will be replaced with reinforced concrete, with the invert of the pipe matching the exiting upstream and downstream inverts. The conceptual design drawings and engineers cost estimate can be found in **Appendix C**.

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Appendix A
Hydrologic and Hydraulic Analysis

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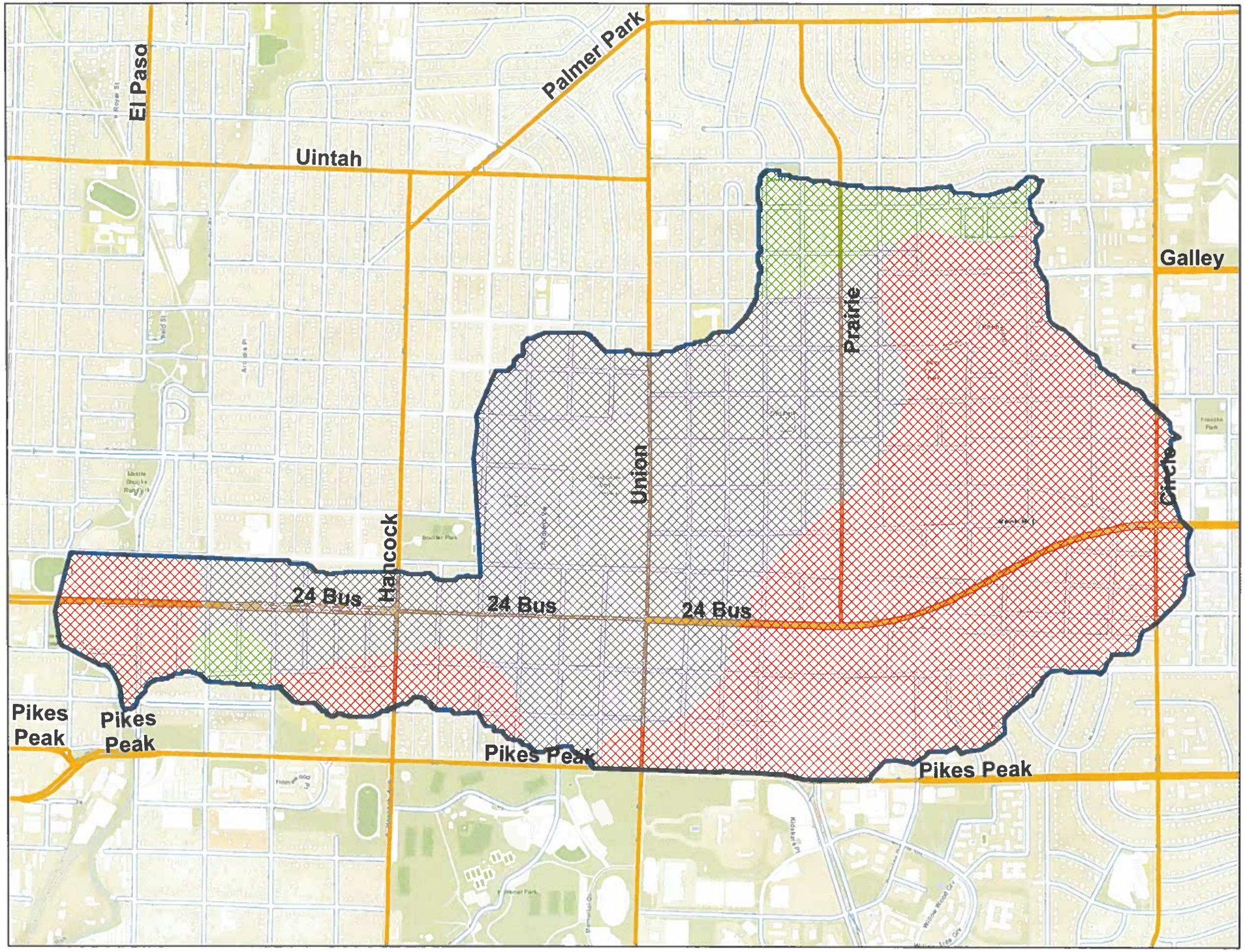

LEGEND

Little Shooks Run Watershed

HYDSG

- A
- B
- C
- D
- Water

N

0 2,000 Feet

Figure A-1
Little Shooks Run Soils Map
Little Shooks Run Outfall Systems Plan

May, 2018

CH2MHILL

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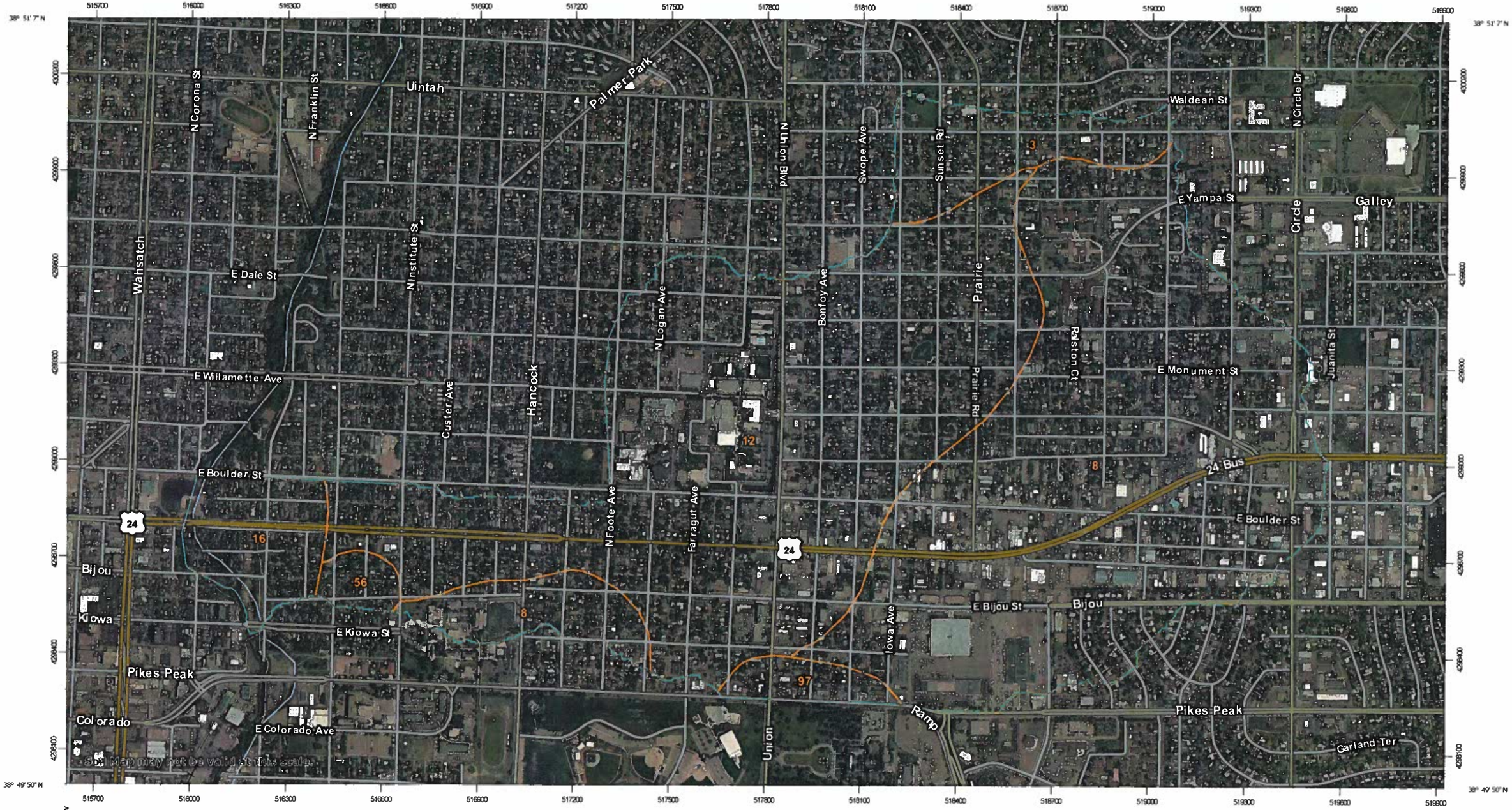
Soil Map—El Paso County Area, Colorado
(Little Shooks Run Soils Data)



Map Scale: 1:11,600 if printed on B landscape (17" x 11") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 15, Oct 10, 2017

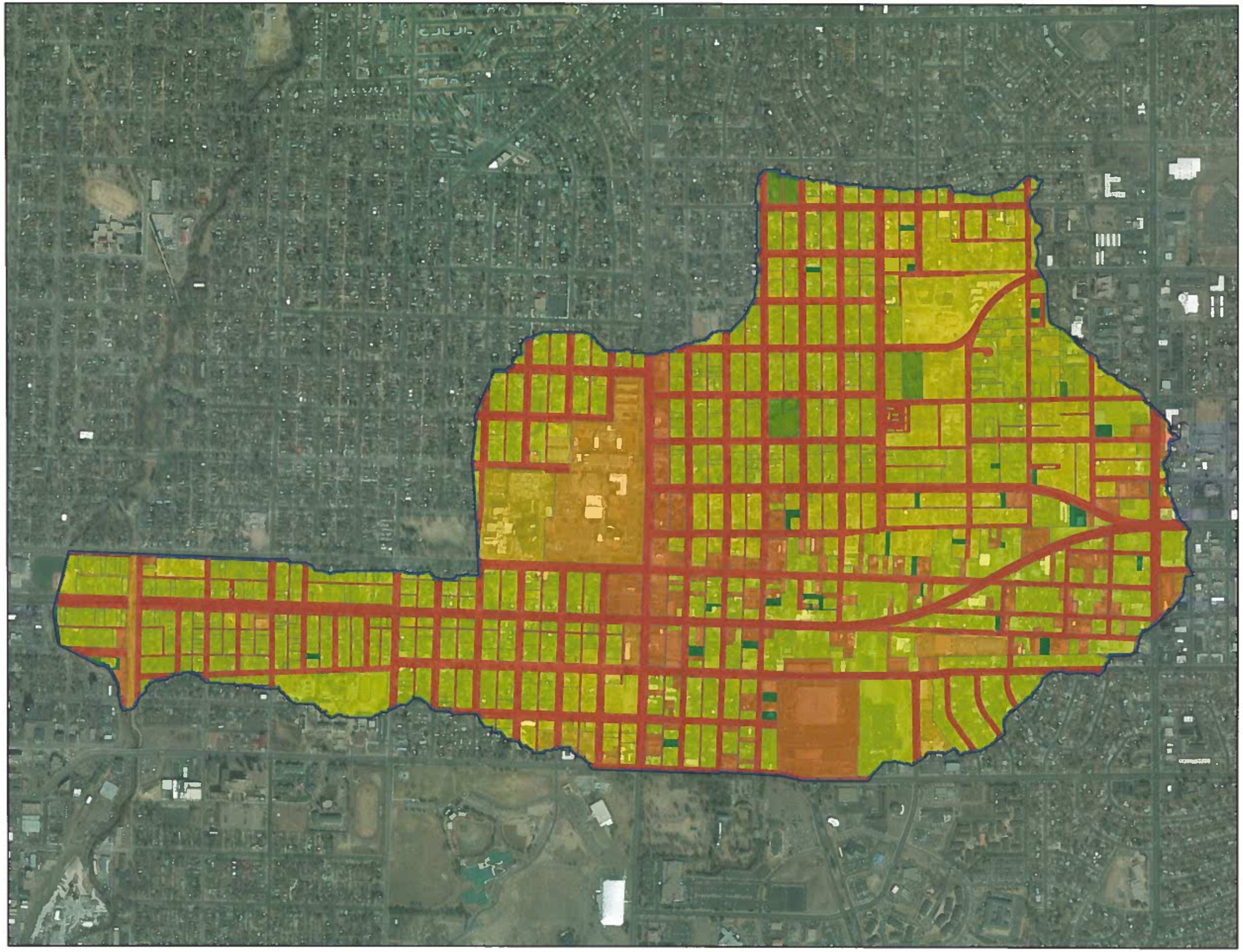
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Ascalon sandy loam, 3 to 9 percent slopes	47.2	5.2%
8	Blakeland loamy sand, 1 to 9 percent slopes	413.5	45.4%
12	Bresser sandy loam, cool, 3 to 5 percent slopes	386.8	42.4%
16	Chaseville gravelly sandy loam, 1 to 8 percent slopes	39.8	4.4%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	9.7	1.1%
97	Truckton sandy loam, 3 to 9 percent slopes	14.6	1.6%
Totals for Area of Interest		**911.6**	**100.0%**



LEGEND

Percent Impervious

- 2
- 7
- 13
- 25
- 40
- 65
- 80
- 90
- 95
- 100

Little Shooks Run Watershed

N

0 1,000 Feet

Figure A-2
Little Shooks Run Landuse/Percent Impervious Map
Little Shooks Run Outfall Systems Plan

May, 2018

CH2MHILL

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Table A-1 Zone Code Descriptions

ZONE CODE	DESCRIPTION	ENTITY
A	Agricultural	Colorado Springs
APD	Airport planned development	Colorado Springs
AO-CAD	Commercial Airport Overlay	Colorado Springs
C-5	Intermediate Business	Colorado Springs
C-6	General business	Colorado Springs
DFOZ	Design Flexibility Overlay	Colorado Springs
FBZ-CEN	Form Based-Central	Colorado Springs
FBZ-COR	Form Based-Corridor	Colorado Springs
FBZ-T1	Form Based-Transition Sector 1	Colorado Springs
FBZ-T2A	Form Based-Transition Sector 2A	Colorado Springs
FBZ-T2B	Form Based-Transition Sector 2B	Colorado Springs
HP	Historic Preservation Overlay	Colorado Springs
HR	High Rise Overlay	Colorado Springs
HS	Hillside Area Overlay	Colorado Springs
M-1	Light Industrial	Colorado Springs
M-2	Heavy Industrial	Colorado Springs
MU-NC	Mixed Use-Neighborhood Center	Colorado Springs
MU-CC	Mixed Use-Commercial Center	Colorado Springs
MU-R/EC	Mixed Use-Regional/Employment Center	Colorado Springs
NP	Navigation Preservation Overlay	Colorado Springs
OC	Office Complex	Colorado Springs
OR	Office Residential	Colorado Springs
P	Planned Provisional overlay	Colorado Springs
PBC	Planned business center	Colorado Springs
PCR	Planned cultural Resort	Colorado Springs
PF	Public Facilities	Colorado Springs
PIP-1	Planned Industrial Park	Colorado Springs
PIP-2	Planned Industrial Park	Colorado Springs
PK	Public Parks	Colorado Springs
PUD	Planned Unit Development	Colorado Springs
R	Estate Single-family Residential	Colorado Springs
R-1 6000 (R-1 6)	Single-family Residential	Colorado Springs
R-1 9000 (R-1 9)	Single-family Residential	Colorado Springs
R-2	Two-family Residential	Colorado Springs
R-4	Multi-family Residential	Colorado Springs
R-5	Multi-family Residential	Colorado Springs
SS	Streamside Overlay zone	Colorado Springs
SU	Special Use	Colorado Springs
TND	Traditional Neighborhood Development	Colorado Springs
UV	Use Variance Overlay	Colorado Springs
A-1	Agricultural obsolete	El Paso County
A-5	Agricultural	El Paso County
A-35	Agricultural	El Paso County
C-1	Commercial obsolete	El Paso County
C-2	Commercial obsolete	El Paso County
CAD-O	Commercial Airport District	El Paso County
CC	Commercial Community	El Paso County

Table B-1 Zone Code Descriptions

ZONE CODE	DESCRIPTION	ENTITY
CN	Commercial Neighborhood	El Paso County
CO	Commercial Office	El Paso County
CR	Commercial Regional	El Paso County
CS	Commercial Service	El Paso County
F	Forest & Recreation obsolete	El Paso County
F-5	Forestry and Recreation	El Paso County
GA-O	General Aviation Overlay District	El Paso County
I-1	Research and Development	El Paso County
I-2	Limited Industrial	El Paso County
I-3	Heavy Industrial	El Paso County
HR-O	High Rise Overlay District	El Paso County
HWT	Hazardous Waste Transfer, Storage, Treatment Facility	El Paso County
MHP	Mobile Home Park	El Paso County
MHP-R	Mobile Home Park Rural	El Paso County
MHS	Mobile Home Subdivision	El Paso County
NBD	Neighborhood Business obsolete	El Paso County
OA-CGM	Airport Zone obsolete	El Paso County
OA-G	Airport-General Aviation District obsolete	El Paso County
O-HR	High Rise Zone obsolete	El Paso County
PBC	Planned Business Center obsolete	El Paso County
PBD	Planned Business obsolete	El Paso County
PBP	Planned Business Park obsolete	El Paso County
PHID	Planned Heavy Industrial obsolete	El Paso County
PID	Planned Industrial obsolete	El Paso County
POC	Planned Office Complex obsolete	El Paso County
PUD	Planned Unit Development	El Paso County
R	Residential obsolete	El Paso County
R&D	Research and Development obsolete	El Paso County
R-1	Residential obsolete	El Paso County
R-2	Residential obsolete	El Paso County
R-3	Residential obsolete	El Paso County
R-4	Planned Development obsolete	El Paso County
RLUP-O	Rural Land Use Plan Overlay District	El Paso County
RM-12	Residential Multi-Dwelling	El Paso County
RM-30	Residential Multi-Dwelling	El Paso County
RR-0.5	Residential Rural	El Paso County
RR-1	Rural Residential obsolete	El Paso County
RR-2	Rural Residential obsolete	El Paso County
RR-2.5	Residential Rural	El Paso County
RR-3	Rural Residential obsolete	El Paso County
RR-5	Residential Rural	El Paso County
RS-5000	Residential Rural	El Paso County
RS-6000	Residential Suburban	El Paso County
RS-20000	Residential Suburban	El Paso County
R-T	Residential-Topographic	El Paso County
RVP	Recreational Vehicle Park	El Paso County
RVS	Recreational Vehicle Subdivision	El Paso County

Table B-1 Zone Code Use Descriptions

LANDUSE DESCRIPTION
ALL OTHER EXEMPT
CHARITABLE
CODE 200 AT PRESENT WORTH
COMMERCIAL CONDO
CONDOMINIUM
COUNTY
DUPLEXES & TRIPLEXES
EXEMPT GVT. LEASED
FEDERAL
HOMEOWNERS ASSOCIATION
INDUSTRIAL CONDOMINIUMS
LODGING
MANUFACTURING PROCESSING
MERCHANDISING
MULTI_UNIT (9 & UP)
MULTI-UNITS (4-8)
OFFICES
POLITICAL SUBDIVISION
RECREATION
RELIGIOUS WORSHIP
RES LAND AT RES RATE
RESIDENTIAL CHARITABLE
RESIDENTIAL COUNTY
RESIDENTIAL POLITICAL SUB
RESIDENTIAL PRIVATE SCHOOLS
RESIDENTIAL RELIGIOUS PURPOSES
SCHOOLS-PRIVATE
SINGLE FAMILY RES.
SPECIAL PURPOSE
VACANT COMMERCIAL LOTS
VACANT INDUSTRIAL LOTS
VACANT LAND = 1 AND < 5 ACRES
VACANT RESIDENTIAL LOTS
WAREHOUSE/STORAGE

Appendix B
Alternatives Analysis

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Little Shooks Run Outfall Systems Plan

Alternatives for the repair of the Little Shooks Run 9' x 14' Plate Arch Storm Sewer System

PREPARED FOR:	City of Colorado Springs
COPY TO:	File
PREPARED BY:	CH2M
DATE:	June 26, 2017
PROJECT NUMBER:	691414
REVISION NO.:	Draft

1.0 Introduction

An alternatives analysis was performed to determine the cost and feasibility of trenchless rehabilitation versus tradition trench and replacement for one section of the Little Shooks Run 9'x14' Plate Arch Culvert that has experienced severe corrosion and two sections of the Little Shooks Run 9'x14' Plate Arch that have experienced significant upheaval.

The first section of heaved pipe is located under the alley between North Hancock Avenue and Willow Street and is approximately 42' long. The second section of heaved pipe is located under the alley between North Sheridan Avenue and North Hancock Avenue and is approximately 52' long. The section of pipe that has experienced severe corrosion, which is approximately 30' in length, is located under North Institute Street.

Both trenchless rehabilitation solutions and traditional cut and repair open trench options are being considered as a viable rehabilitation approaches to the issues currently facing the repair of the Little Shooks Run Plate Arch Culvert. Both methods of repair, trenchless and conventional, are being investigated for a number of reasons.

1. To identify the potentially most cost effective repair technique.
2. Current Right-of-way (ROW) along the corridor varies from 20' to 40' with residential and business structures in close proximity to the pipeline making traditional open cut construction difficult, favoring an insitu solution.
3. Unknown geotechinical conditions surrounding the pipe corridor and unknown cause of the failure of the current Little Shooks Run Pipe.

This memorandum outlines the potential repair options, provides highlevel cost estimates, quantifies the pros and cons of each alternative and provides a recommendation for next steps. To determine the feasibility of any rehabilitation method it will be necessary to complete a survey of these locations to determine the precise location and length of each failure and complete a series of geotechnical borings to determine the cause of heaving of the existing Arch CMP.

2.0 Available Data

The City of Colorado Springs provided data for the horizontal location of the Little Shooks Run storm drain system. In addition the City provided utility information, ROW information, parcel data and landuse data. This information was provided to CH2M as a combination of GIS data and As-Builts information. The GIS data provided information for the horizontal location of the storm drain system and utilities. However, it did not contain essential geometric data for the storm drain system, such as inverts, slope, and dimensions of the pipe.

As-Builts were gathered to determine the inverts, slopes, and dimensions of the storm drain system. However, the As-Builts were not continuous or complete for the entire system and the vertical datum of the As-Builts was unable to be determined making the use on invert information unreliable. For this memorandum, the profile of the system was determined using the invert of the system at its discharge location into Shooks Run, which was determined from the topographical survey data provided by the City of Colorado Springs (2011 2-foot contour information and recent As-Built information from the Shooks Run reconstruction from Platte Avenue to Kiowa Street), as the reference point. From the reference point, As-Built data was utilized, where available, to develop the profile of the system based on the designed slope from the As-Builts. In areas where As-Built data was not available, it was assumed that the slope of the pipe matched surrounding As-Built Information and that the profile of storm drain was built per City criteria. Prior to final design the system will need to be surveyed to ensure accurate construction information.

3.0 Field Walk Results

Given the limited information the City of Colorado Springs possessed for the Little Shooks Run Storm Sewer System, a field walk was conducted to determine the condition of the system and to locate problem areas that would require rehabilitation.

During this field walk the following problem areas were observed:

Corrosion (See Figure 1 and Figure 2):

Under North Institute Street there is a section of the system, approximately 30' in length, that has experienced corrosion. If left unchecked this could cause future stability issues with the pipe. Upon review of field walk photographs CH2M pipe experts concluded that the corrosion may be caused by Magnesium Chloride seepage from winter de-icing operations and is becoming more common as liquid deicers and magnesium chloride is used.

Upheaval (See Figures 3 through Figure 6):

There are two sections of the system where, for reasons unknown at this time, the invert of the Plate Arch culvert has heaved. The first section occurs underneath the alley between North Hancock Avenue and Willow Street and is approximately 42' in length. The second section occurs underneath the alley between North Sheridan Avenue and North Hancock Avenue and is approximately 52' in length.

As mentioned above, in order to more accurately diagnose problem areas and provide appropriate solutions, a survey of the system will be necessary. Given the limited geotechnical information and the problems with the system observed, which hint at geotechnical issues, it is recommended that borings be performed and analyzed at each of these areas to have a better understanding of the cause.

Figure 1
Corrosion Along Little Shooks Run Pipe under North Institute

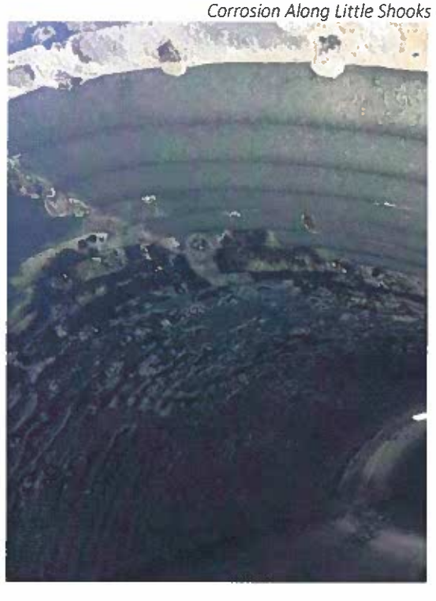


Figure 2
Corrosion Experienced

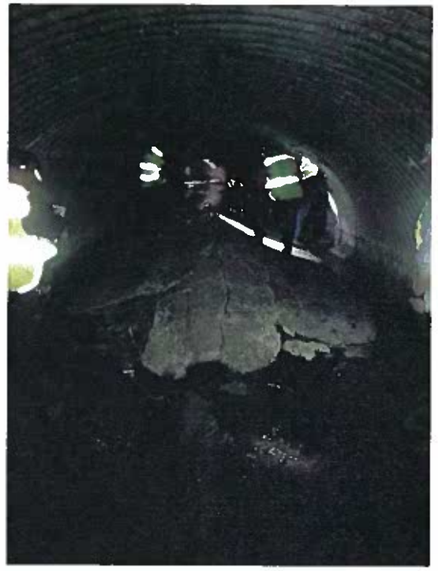


Figure 3
Upheaval between Willow and Hancock

Figure 4
Upheaval Between Willow and Hancock, Plate Arch and Concrete Flood Heaved but Intact

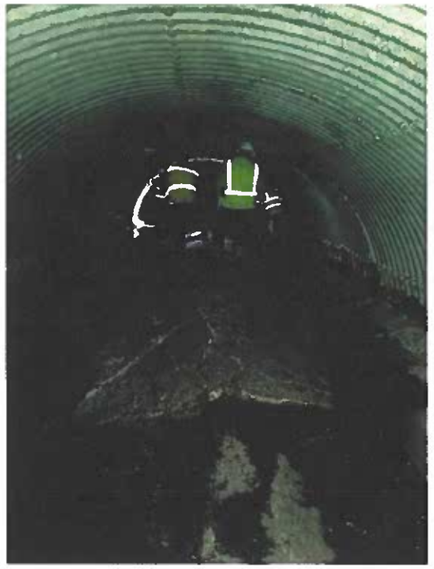


Figure 5
Second Upheaval Section

Figure 6
Second Upheaval Section, Arch CMP and Concrete Floor Heaved

4.0 Potential Trenchless Alternatives for Rehabilitation

Based on the results of the field walk, the data collected, and limited geotechnical information, trenchless reconstruction may not be feasible due to the structural requirements of the large diameter pipe. However, there are some insitu options that are preliminarily feasible based on the areas of concern listed below:

4.1 Corrosion Under North Institute (See Figure 1 and Figure 2):

1. A fiber-reinforced polymer (FPR) based, trenchless technology method for the repair, strengthening and retrofit of corrosion-damaged and distressed large-diameter pipes is a potential solution. This method would require manned entry into the pipe where shotcrete would be placed to fill the space between corrugations and create a smooth surface for the placement of FPR at approximately one inch thick. This solution would create a structural repair to the pipe as the repair would no longer rely on the steel plate arch for stability.
2. An epoxy trenchless technology method is another potential solution should there be no structural damage. This method would include the following:
   - Sand Blast clean the surface of the pipe;
   - Solvent clean to remove soluble salts;
   - Spray/apply two coats of epoxy;

4.2 Upheaval Sections (Figures 3 through Figure 6):

1. A fiber-reinforced geopolymer based, trenchless technology method is proposed solution. This method would require manned entry and would be a fully structural repair. This method would include the following:
   - Cut and remove the bottom of the pipe and concrete floor (pipe would be required to be stabilized with bracing in the floor to prevent failure of the Plate Arch);
   - Place concrete in removed bottom of floor to match upstream and downstream inverts;
   - Spray the entire rehabilitated section of the pipe with geopolymer to a thickness of approximately two inches;
   - Recommended to spray an extra 15-20' upstream and downstream of rehabilitated area to prevent infiltration of water into repair;
2. A secondary in-situ repair would be a partial structural repair very similar to the geopolymer repair described above that includes the following:
   - Cut and remove the bottom of the pipe and concrete floor;
   - Rehabilitate with metal like material to spray against;
   - Pour in concrete floor to match upstream and downstream characteristics;

Given the recommendation to spray an additional length upstream and downstream of the rehabilitated area, for the purposes of estimating cost the approximate length of the first upheaval was increased from 42' to 50' and the approximate length of the second upheaval was increased from 52' to 60'.

These are preliminary alternatives and may change as information is developed about the geotechnical conditions surrounding the pipes and additional survey data which will help inform the project team of the appropriate solution for the repair of the Little Shooks Run Plate Arch Pipe.

5.0 Conventional Rehabilitation Alternatives

Conventional rehabilitation alternatives were identified and analyzed for rehabilitation for the sections of the Plate Arch Pipe within the Little Shooks Run Storm Drain System that have been discussed in this technical memorandum. For the purposes of this technical memorandum, open cut replacement was evaluated for the above-mentioned sections of the Plate Arch pipe that require rehabilitation.

In 1997 a non-trenchless rehabilitation was performed just downstream of the first upheaval located between Willow and Hancock. A 12' x 7' Reinforced Concrete Box Culvert (RCBC) was constructed in place of the existing Plate Arch Pipe. Analysis of this section indicates that it has conveyance capacity for the minor storm event but becomes surcharged during larger events due to the smaller cross sectional areas that the existing Plate Arch Pipe.

The approximate cross-sectional area of the Plate Arch pipe, 14' x 9', is 99 square feet (SF). Therefore, a 12' x 8' RCBC is being recommended for the rehabilitation of these sections as its cross-sectional area is approximately 96 SF. Despite having a smaller cross-sectional area, the change in Manning's roughness coefficient allows the 12' x 8' RCBC to convey the same amount of flow as the existing Plate Arch Pipe.

This open cut rehabilitation method would require the following:

- Excavating around the sections needing rehabilitation;
- Shoring of the trench due to limited space and proximity to residential homes;
- dewatering;
- Removing and replacing existing sections of pipe with RCBC;
- Backfilling with approved material;

6.0 Qualitative Assessment of all Pipe Rehabilitation Alternatives

Each alternative evaluated has pros and cons for the rehabilitation of the Little Shooks Run Drainage System. Table 1 and table 2 below provides a qualitative assessment of the differing alternatives.

Table 1 - Comparison Table for Corrosion Rehabilitation

Conventional Alternative		Pros	Cons	Cost
1	Open Cut Replacement	• Maintains/increases original pipe flow capacity • Mitigates risk accepted with trenchless method • Accommodates installation along existing alignment • Structural repair	• Requires large amount of excavation • Requires larger construction area in a site with limited area • Dewatering -contingency for large storm events would be required or construction in the winter time • Traffic impacts • Cost	$262,000
Trenchless Alternatives		**Pros**	**Cons**	**Cost**
1	Fiber-Reinforced Polymer	• Used for large diameter pipes • Maintains/increases original pipe flow capacity • Accommodates installation along existing alignment • No excavation necessary • Structural repair • Cost	• Requires confined space entry and air monitoring • Access Could be problematic and may require moving material from pipe entrance if inlet cannot be used. • Dewatering- would have to demobilize from the pipe if there are large storm events (removal of all construction materials)	$200,000
2	Epoxy and Fiberglass	• Used for large diameter pipes • Maintains/increases original pipe flow capacity • Accommodates installation along existing alignment • No excavation necessary • Cost	• Requires confined space entry and air monitoring • Access Could be problematic and may require moving material from pipe entrance if inlet cannot be used • Dewatering- would have to demobilize from the pipe if there are large storm events (removal of all construction materials) • Not a structural repair	$65,600

Table 2 - Comparison Table for Upheaval Rehabilitation

Conventional Alternative		Pros	Cons	Cost
1	Open Cut Replacement	• Maintains/increases original pipe flow capacity • Accommodates installation along existing alignment • Structural repair	• Requires large amount of excavation • Requires larger construction area in a site with limited area • Traffic impacts • Dewatering -contingency for large storm events would be required or construction in the winter time. • Cost	50' Length: $372,000 60' Length: $437,000
Trenchless Alternatives		**Pros**	**Cons**	**Cost**
1	Fiber-Reinforced Geopolymer	• Used for large diameter pipes • Maintains/increases original pipe flow capacity • Accommodates installation along existing alignment • Minimal change to geometry of storm sewer system • Minimal impact to surface • Structural repair • Cost	• Requires confined space entry and air monitoring • Access Could be problematic and may require moving material from pipe entrance if inlet cannot be used. • Dewatering- would have to demobilize from the pipe if there are large storm events (removal of all construction materials) • Requires bracing after bottom of pipe is cut • Potential of pipe caving with construction crew inside	50' Length: $244,000 60' Length: $290,000
2	Replace Concrete Floor	• Maintains/increases original pipe flow capacity • Accommodates installation along existing alignment • Minimal change to geometry of storm sewer system • Minimal impact to surface • Structural Repair • Cost	• Requires confined space entry and air monitoring • Access Could be problematic and may require moving material from pipe entrance if inlet cannot be used. • Dewatering- would have to demobilize from the pipe if there are large storm events (removal of all construction materials) • Requires bracing after bottom of pipe is cut • Potential of pipe caving with construction crew inside	50' Length: $164,000 60' Length: $184,000

7.0 Summary, Recommendations and Next steps.

There are a limited number of opportunities to repair or rehabilitate the Little Shooks Run Plate Arch Culvert in areas where it has been damaged. There is the traditional remove and replace option and two insitu options, fiber wrap and geopolymer, that could be utilized to repair the pipe. Due to limited information on the geotechinical conditions surrounding the pipe and with the need to further inspect and evaluate the pipes structural stability and develop additional information about the invert and location of the failures through survey, the project team is making the following reccomendations.

7.1 Corrosion Under North Institute

The corrosion under North Institute lends itself to an insitu repair utilizing both fiber reinforcement and epoxy coating to extend the life of the pipe. It would be proposed to use Fiberwrap to fix areas that have been fully corroded and compromised while epoxy alone could be used to protect intact portions of the pipe. This would provide a cost effective alternative to replacement. It is recommended that the area be surveyed to understand the full location and length of the issue and to have the structural integrity of the pipe inspected to better understand the current condition of the pipe and to target the appropriate solutions for rehabilitation.

7.2 Upheaval Sections

Discussions with Fiberwrap have removed this alternative for the repair option for the =heaved sections as the fiberglass would not provide adequate structural support for the area. However, geopolymers, removal and replacement of the upheaved sections and full replacement are viable. There is risk in completing a partial replacement of only the bottom as removing the bottom of the pipe could cause structural instability and collapse. Careful bracing will be required to prevent structural failures.

At this time the project team is recommending that the area be surveyed to understand the full location and length of the issue and to have the structural integrity of the pipe inspected as well as removing a section of the pipe to understand what the conditions are under the heaved section of the pipe.

Kumar & Associates, Inc.
Geotechnical and Materials Engineers
and Environmental Scientists

6735 Kumar Heights
Colorado Springs, CO 80918
phone: (719) 632-7009
fax: (719) 632-1049
email: kacolospgs@kumarusa.com
www.kumarusa.com

ACEC MEMBER

Office Locations: Denver (HQ), Colorado Springs, Fort Collins, Glenwood Springs, Parker, and Summit County, Colorado

September 22, 2017

Mr. Tim Biolchini, PE
Water Resources Engineering Division
City of Colorado Springs
30 S. Nevada Avenue, Suite 401
Colorado Springs, Colorado 80901

Subject: Results of Subsurface Exploration, Little Shooks Run Culvert, Vicinity of Hancock Avenue and Platte Avenue, Colorado Springs, Colorado

Project No. 17-2-192

Dear Mr. Biolchini:

This report presents the results of a subsurface study adjacent to and within the Little Shooks Run Culvert, in Colorado Springs, Colorado. The study was conducted in general accordance with the scope of work in our proposal C17-230, dated July 25, 2017, to provide information on the subsurface conditions at the requested locations.

FIELD EXPLORATION

The field exploration of subsurface conditions consisted of drilling 3 borings at the approximate locations shown on the attached Fig. 1. The field exploration was completed on September 12th and 14th, 2017, using a conventional 2WD truck mounted drill rig for Boring 1 (in roadway), and hand auger equipment for Borings 2 and 3 (in culvert).

Boring 1 was drilled with 4-inch diameter continuous flight solid stem auger. Samples of the soils were taken with a 2-inch I.D. California sampler. The sampler was driven into the various strata with blows from a 140-pound hammer falling 30 inches. Penetration resistance values, when properly evaluated, provide an indication of the relative density or consistency of the soils. Depths at which the samples were taken and the penetration resistance values are shown on the boring log. Borings 2 and 3 were drilled with a 4-inch diameter hand auger, and small disturbed samples of the auger cuttings were collected. Prior to drilling, the corrugated metal floor was cut utilizing a gas powered demo saw. The boring logs are presented on Fig. 2, and the corresponding legend and notes are included on Fig. 3.

LABORATORY TESTING

Samples obtained from the exploratory borings were visually classified in the laboratory by the project engineer and samples were selected for laboratory testing. Laboratory testing included index property tests such as in-situ moisture content and dry unit weight, grain size analysis, Atterberg limits, and swell-consolidation. The testing was conducted in general accordance with recognized test procedures, primarily those of the American Society for Testing of Materials (ASTM). Results of the laboratory testing program are shown on Figs. 2 and 4 thru 7, and are summarized in Table I.

SITE CONDITIONS

The project site is located south of the intersection of E. Platte Avenue and N. Hancock Avenue, as shown on Fig. 1. The Little Shooks Run Culvert flows generally east to west within the study area and consists of a 9'x14' corrugated steel arch culvert. The floor of the culvert is lined with a 2 to 3-inch layer of concrete. In the locations of Borings 2 and 3, the culvert floor has bulged up about 2 to 3 feet, and the concrete lined floor has spalled away within portions of these bulges. Each of these bulged areas had a length of about 50 feet.

SUBSURFACE CONDITIONS

The following subsurface descriptions are of a generalized nature to highlight the major stratification features encountered. The boring logs presented on Fig. 2 should be referenced for more detailed information at each location.

In Roadway

In Boring 1, drilled within the southbound lane of Hancock Avenue and south of the culvert, approximately 9 inches of asphalt was encountered at the surface. The pavement was underlain by a granular fill (Poorly to well-graded sand with silt and silty sand with occasional gravel) to a depth of about 5 feet, followed by a cohesive fill consisting of sandy lean clay and clayey sand, which extended to a depth of about 13.75 feet. Our borings did not determine the exact lateral or vertical extent of the fill. At the 13.75-foot depth, concrete or grout was encountered, and the boring was terminated due to concerns for potential unknown utilities. Sampler penetration blow counts suggest the fill is generally marginally compact to noncompact. Swell-consolidation test results presented on Fig. 4 indicate the tested sample of clayey sand was nonexpansive and moderately compressible when wetted under a 1-ksf surcharge. Groundwater was not encountered at the time of drilling. The boring was backfilled with auger cuttings and the roadway was patched with hot-mix asphalt.

In Culvert

Borings 2 and 3 were drilled within the west and east bulge areas, respectively, at the approximate locations shown on Fig. 1. Below the steel floor in Boring 2, an approximate 3-foot void was found. The subsurface materials that followed included lean clay with sand and clayey sand to a depth of approximately 3.5 feet, followed by weathered claystone which extended to the 4.5-foot depth explored. Ground water was present at about the 3-foot depth (base of void), which corresponds to about what the normal culvert floor elevation would be away from the bulged area.

In Boring 3, below the steel floor, approximately 3 feet of silty sand was encountered, followed by weathered claystone which was present from about 3 to 3.1 feet. We were unable to advance the hand auger deeper due to the wet/caving soils. There was no void found at this location. Ground water was encountered at an approximate depth of 2 feet, which corresponds to a depth of about what the normal culvert floor elevation would be away from the bulged area.

We were unable to collect undisturbed samples of the claystone that could be utilized for swell-consolidation testing due to the drilling and sampling methods within the culvert; however, the claystone appeared to be very moist to wet, suggesting it would have a lower than typical potential for swell. Upon completion of drilling, the in-culvert borings were backfilled with auger cuttings. The holes within the metal floor were plugged at the surface with concrete pieces and covered with a mound of site-mixed concrete.

LIMITATIONS

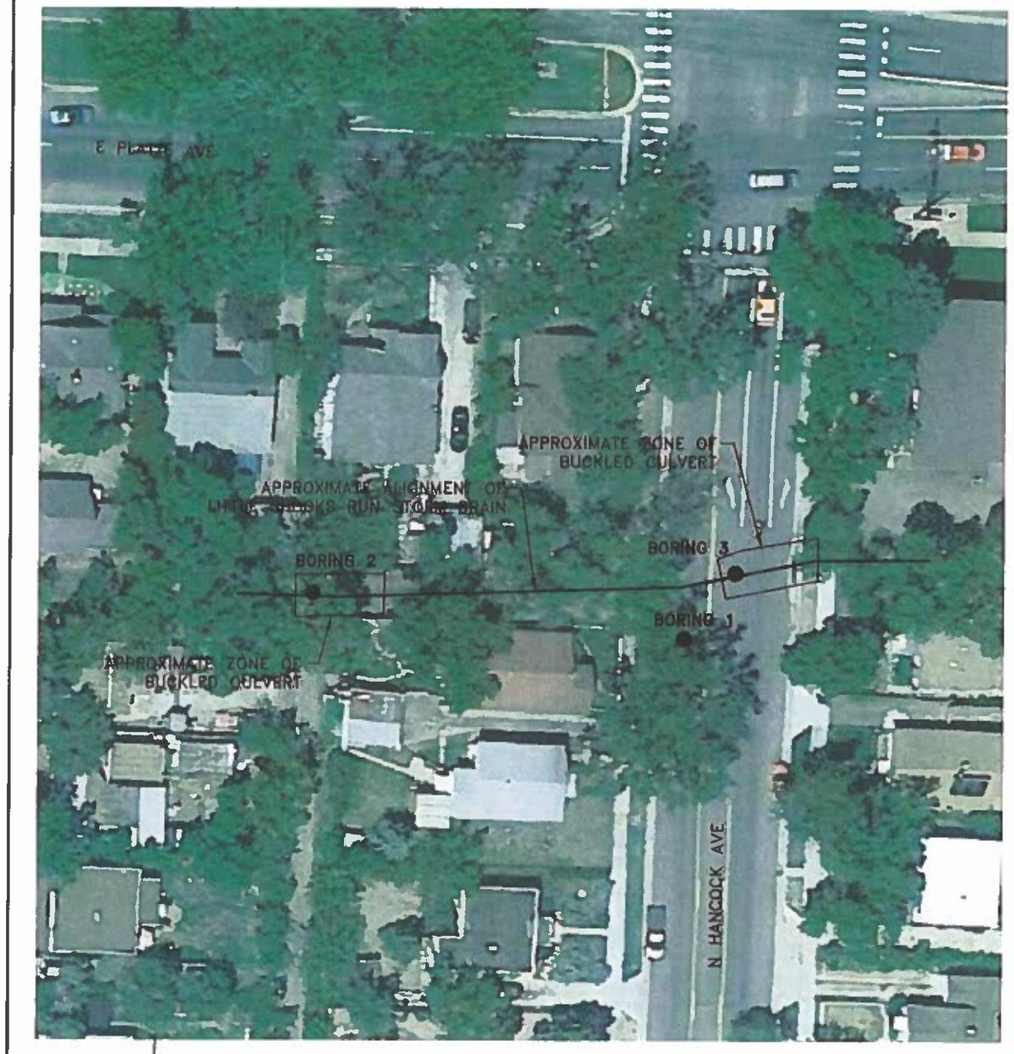
The scope of our study was to provide a report of the subsurface conditions encountered, and the requested scope did not include interpretation or analysis of the data. This study has been conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The conclusions submitted in this report are based upon the data obtained from the exploratory borings at the approximate locations indicated on Fig. 1. The nature and extent of subsurface variations across the site may not become evident until excavation is performed. If during construction, soil, rock or water conditions appear to be significantly different from those described herein, this office should be advised so additional subgrade investigation can be performed, if required.

If you have any questions or require any additional information, please do not hesitate to call.

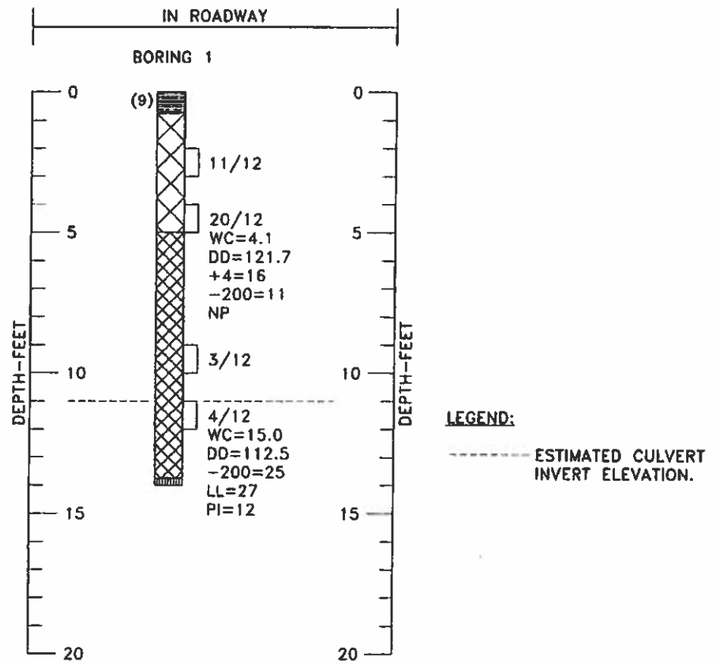
KUMAR & ASSOCIATES, INC.
Duane P. Craft, P.E.

COLORADO REGISTERED
DUANE P. CRAFT
37553
PROFESSIONAL ENGINEER
D.P. Craft 9/22/17

DPC:bj
Reviewed by: AFK
Attachments



17-2-192	Kumar & Associates	LOCATION OF EXPLORATORY BORINGS	Fig. 1



17-2-192	Kumar & Associates	LOGS OF EXPLORATORY BORINGS	Fig. 2

LEGEND

(9) ASPHALT, THICKNESS IN INCHES SHOWN IN PARENTHESES TO LEFT OF THE LOG.

FILL: POORLY TO WELL-GRADED SAND WITH SILT AND OCCASIONAL GRAVEL (SP-SM, SW-SM), AND SILTY SAND (SM), MOIST, REDISH-BROWN.

FILL: SANDY LEAN CLAY (CL) AND CLAYEY SAND (SC), MOIST, GRAY AND BROWN.

CONCRETE OR GROUT (ENCOUNTERED IN TIP OF BORING 1).

LEAN CLAY WITH SAND (CL) AND CLAYEY SAND (SC), WET, TAN AND BROWN.

SILTY SAND (SM), WET, TAN AND BROWN.

WEATHERED CLAYSTONE BEDROCK, HIGH PLASTICITY, BLOCKY, VERY MOIST TO WET, BROWN AND GRAY.

DRIVE SAMPLE, 2-INCH I.D. CALIFORNIA LINER SAMPLE.

DISTURBED BULK SAMPLE.

11/12 DRIVE SAMPLE BLOW COUNT. INDICATES THAT 11 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

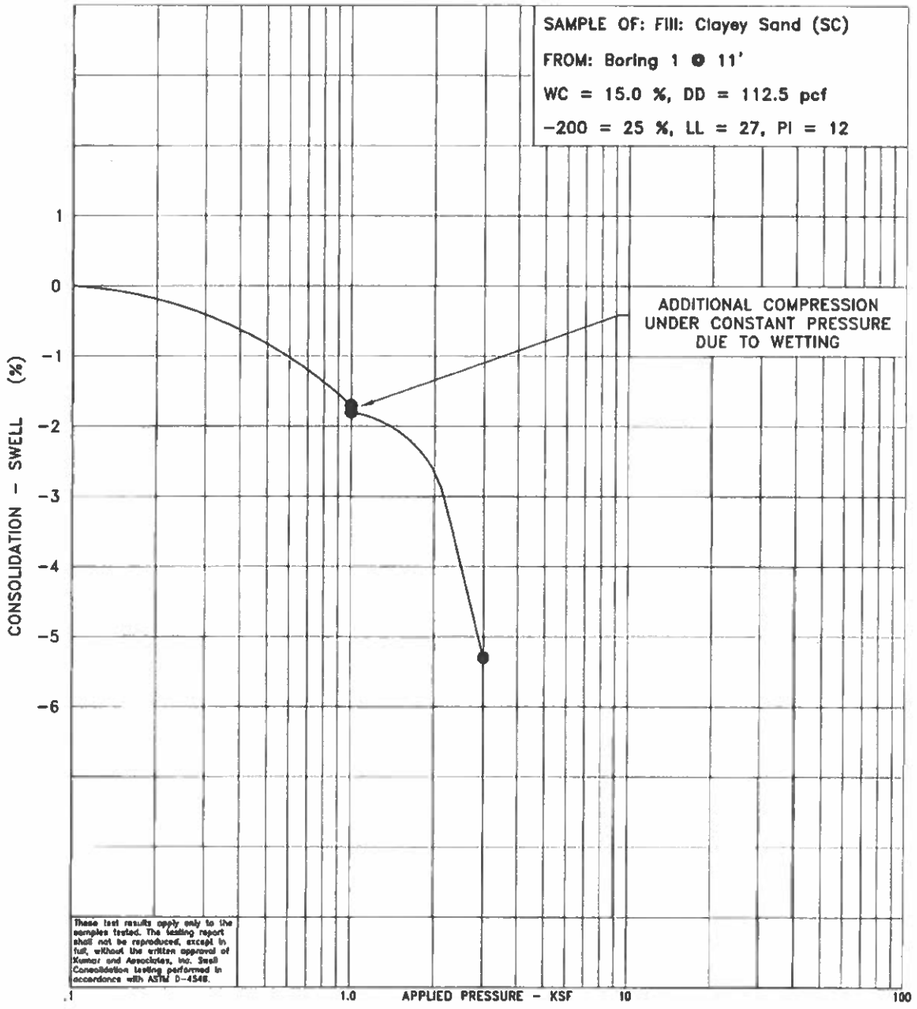
DEPTH TO WATER LEVEL ENCOUNTERED AT THE TIME OF DRILLING.

DEPTH AT WHICH BORING CAVED.

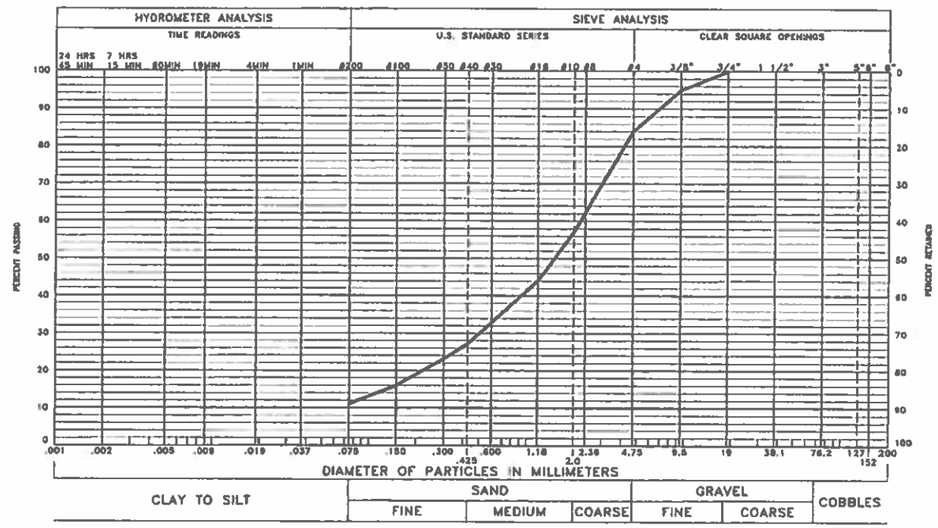
NOTES

1. BORING 1 WAS DRILLED ON SEPTEMBER 12, 2017 WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER. BORINGS 2 AND 3 WERE DRILLED ON SEPTEMBER 14, 2017 WITH A 4-INCH DIAMETER HAND AUGER.
2. THE LOCATIONS OF THE EXPLORATORY BORINGS WERE MEASURED APPROXIMATELY BY PACING FROM FEATURES SHOWN ON THE SITE PLAN PROVIDED.
3. THE ELEVATIONS OF THE EXPLORATORY BORINGS WERE NOT MEASURED AND THE LOGS OF THE EXPLORATORY BORINGS ARE PLOTTED TO DEPTH.
4. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
5. GROUNDWATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME OF DRILLING. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.
6. LABORATORY TEST RESULTS:
   - WC = WATER CONTENT (%) (ASTM D 2216);
   - DD = DRY DENSITY (pcf) (ASTM D 2216);
   - +4 = PERCENTAGE RETAINED ON NO. 4 SIEVE (ASTM D 422);
   - -200= PERCENTAGE PASSING NO. 200 SIEVE (ASTM D 1140);
   - LL = LIQUID LIMIT (ASTM D 4318);
   - PI = PLASTICITY INDEX (ASTM D 4318);
   - NP = NON-PLASTIC (ASTM D 4318).

17-2-192	Kumar & Associates	LEGEND AND NOTES	Fig. 3



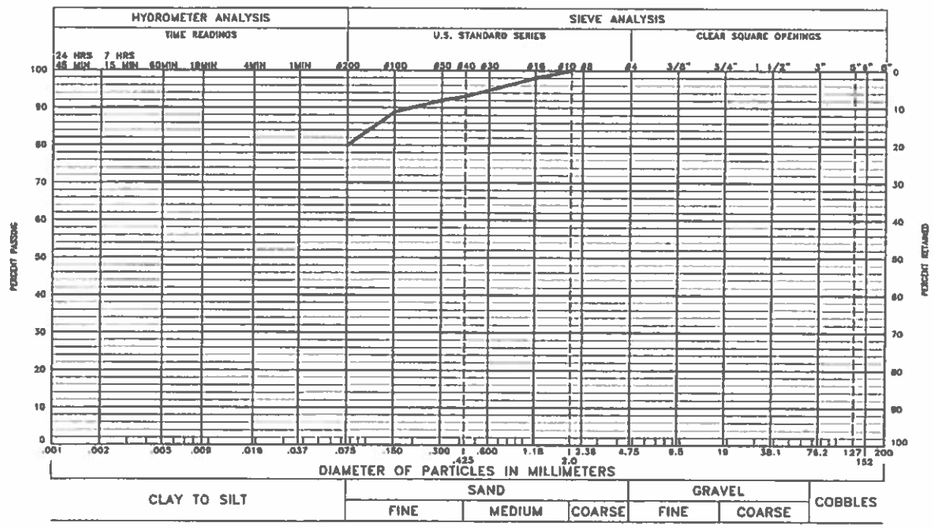
17-2-192	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULT	Fig. 4



GRAVEL 16 % SAND 73 % SILT AND CLAY 11 %

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Fill: Well Graded Sand with Silt and Gravel (SW-SM) FROM: Boring 1 @ 4'



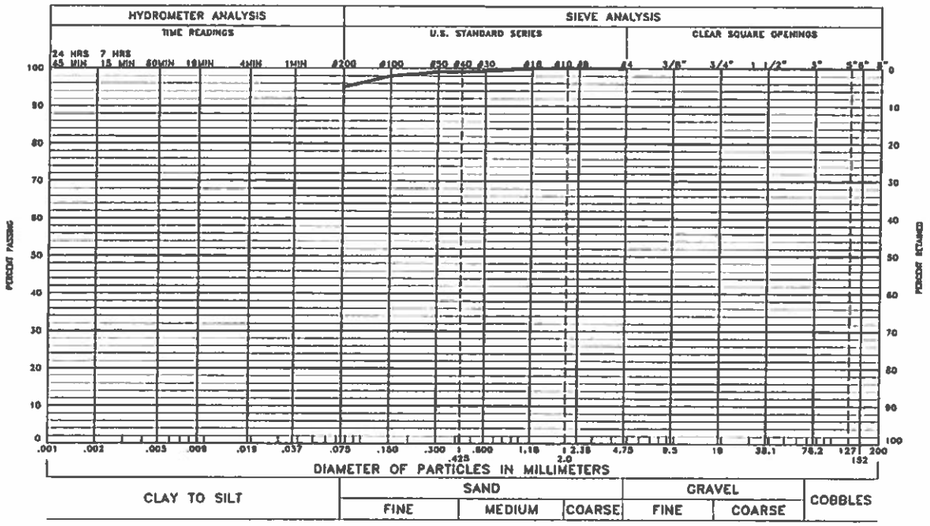
GRAVEL 0 % SAND 20 % SILT AND CLAY 80 %

LIQUID LIMIT 46 PLASTICITY INDEX 26

SAMPLE OF: Lean Clay with Sand (CL) FROM: Boring 2 @ 3'-3.5'

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 Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

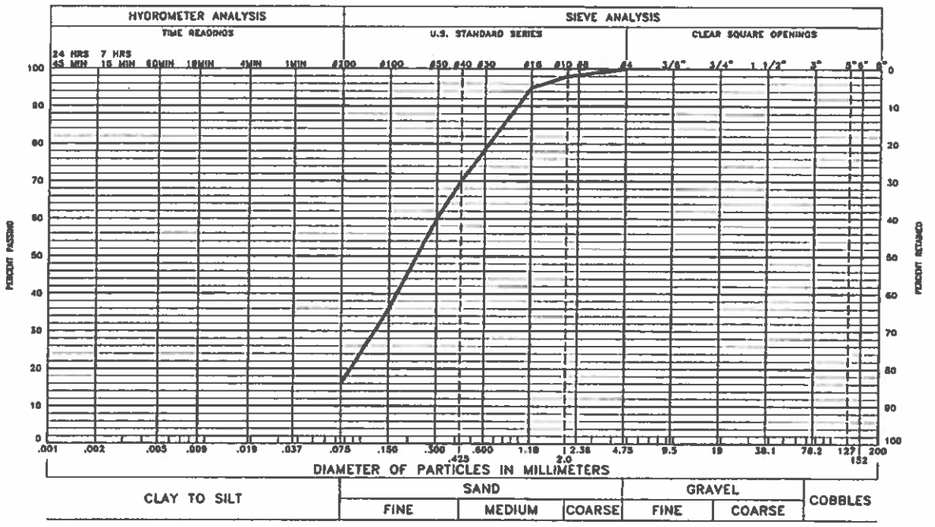
17-2-192	Kumar & Associates	GRADATION TEST RESULTS	Fig. 5



GRAVEL 0 % SAND 5 % SILT AND CLAY 95 %

LIQUID LIMIT 67 PLASTICITY INDEX 44

SAMPLE OF: Weathered Claystone FROM: Boring 2 @ 3.5'-4.5'



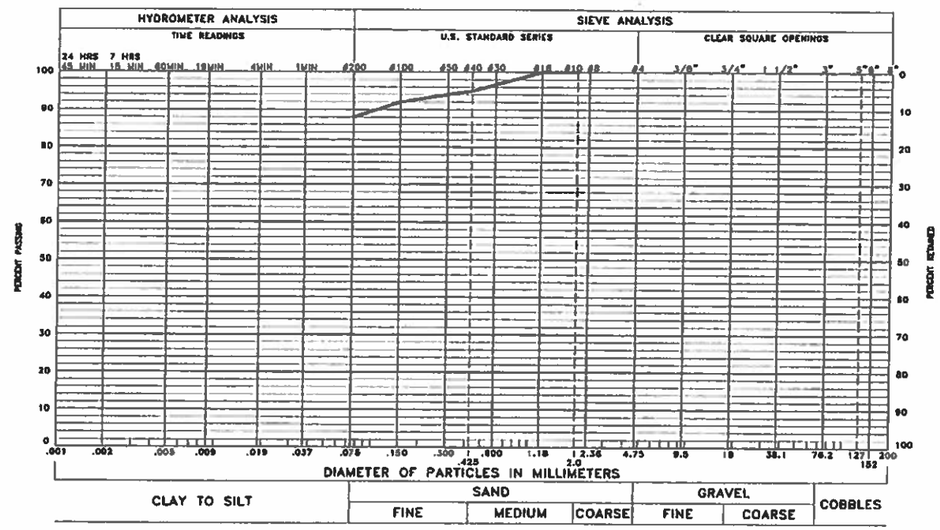
GRAVEL 0 % SAND 84 % SILT AND CLAY 16 %

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring 3 @ 0-3'

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 Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

17-2-192	Kumar & Associates	GRADATION TEST RESULTS	Fig. 6



GRAVEL 0 % SAND 12 % SILT AND CLAY 88 %

LIQUID LIMIT 58 PLASTICITY INDEX 36

SAMPLE OF: Weathered Claystone FROM: Boring 3 @ 3'-3.1'

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 Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

17-2-192	Kumar & Associates	GRADATION TEST RESULTS	Fig. 7

Kumar & Associates, Inc.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

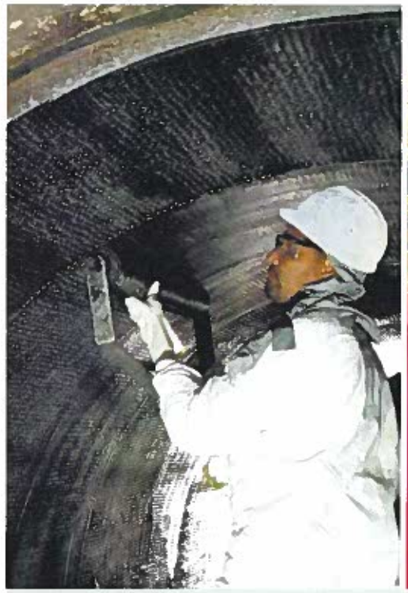
Project No.: 17-2-192
Project Name: Little Shooks Run Culvert
Date Sampled: 9/12/2017 and 9/14/2017
Date Received: 9/12-9/14/2017

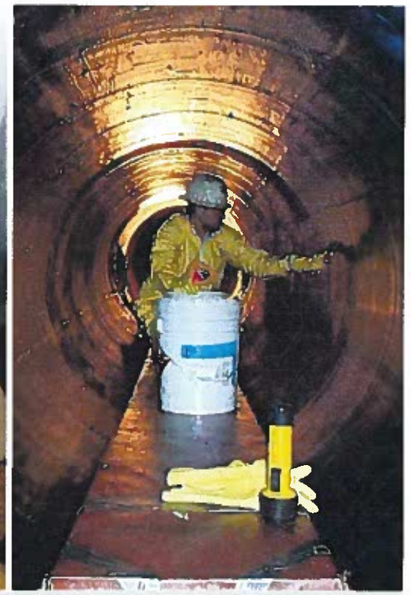
SAMPLE LOCATION		DATE TESTED	NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (pcf)	GRADATION		PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS		SOIL OR BEDROCK TYPE (Unified Soil Classification)
BORING	DEPTH (ft)				GRAVEL (%)	SAND (%)		LIQUID LIMIT	PLASTICITY INDEX	
1	4	9/19/17	4.1	121.7	16	73	11		NP	Fill: Well Graded Sand with Silt and Gravel (SW-SM)
1	11	9/19/17	15.0	112.5			25	27	12	Fill: Clayey Sand (SC)
2	3-3.5	9/19/17			0	20	80	46	26	Lean Clay with Sand (CL)
2	3.5-4.5	9/19/17			0	5	95	67	44	Weathered Claystone
3	0-3	9/19/17			0	84	16		NP	Silty Sand (SM)
3	3-3.1	9/19/17			0	12	88	58	36	Weathered Claystone

INFRASTRUCTURE SOLUTIONS

PIPELINES

Fiber-reinforced polymer (FRP) structural strengthening for pipelines





FYFE® an AEGION company

FIBRWRAP® an AEGION company

PIPELINES

Structural Strengthening

Since 1988, Fyfe Co. has been a pioneer in the fiber-reinforced polymer (FRP) structural strengthening industry. Fyfe is a world leader in designing and manufacturing specialized carbon, glass, aramid and hybrid fabrics, which are combined with polymers to strengthen a wide range of masonry, concrete, steel and wooden structures.

Through Fibrwrap Construction, Inc., we install Tyfo® Fibrwrap®, our patent-protected FRP composite.

Pipe Rehabilitation

When a pre-stressed concrete cylinder pipe (PCCP), reinforced concrete pipe (RCP) or steel pipe suffers from corrosion, it can experience significant structural loss. The Tyfo® Fibrwrap® system strengthens these pipes and enables them to accommodate increased internal pressure, flexural loads, internal and external loads (i.e. operating pressure, surge pressure, soil loads and traffic loads), traffic and soil loads.

The Tyfo® Fibrwrap® system is a fiber-reinforced polymer liner that can be bonded to either the inside or outside of pipes 30-inches in diameter or greater. Protective coatings can also be applied to address aggressive chemical or environmental exposures. Designed to resist internal and external pressure, the Tyfo® Fibrwrap® system meets NSF Standard 61 requirements and is designed for the life of the structure.

Fibrwrap Construction has used Tyfo® SCH carbon systems to strengthen and protect PCCP, RCP and steel pipe segments, including installations to protect against pipe bursting and provide corrosion mitigation.

Before

After

Industrial, Municipal, Power and Storage Facilities

Because of their high strength-to-weight ratio and ease of installation, Tyfo® Fibrwrap® systems are ideal for strengthening industrial structures. Conforming around existing equipment and instrumentation, construction of time-sensitive repairs can be completed with minimal impact to operations, significantly shortening shutdown times.

Fibrwrap Construction professionals are experienced at working in industrial environments, including refineries, water treatment plants, mills, nuclear power plants and manufacturing sites. Our stringent safety plan surpasses the toughest governmental and industrial standards. With the protection of our team's health and safety at the forefront, we maintain one of the best safety records in the industry. Our FRP and other solutions meet a wide range of industrial needs, including:

- Structural upgrades
- Corrosion repair
- High performance coatings
- Concrete repair
- Rapid shutdown turnaround

We complete turnkey repairs quickly with limited service disruption, even during emergency shutdowns.

FRP can be designed to the following codes:

- AWWA M11-water
- AWWA M45-water
- ASME B31.1-power
- ASME PCC-2-industrial
- ASTM F1216

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FCFY032 03/15

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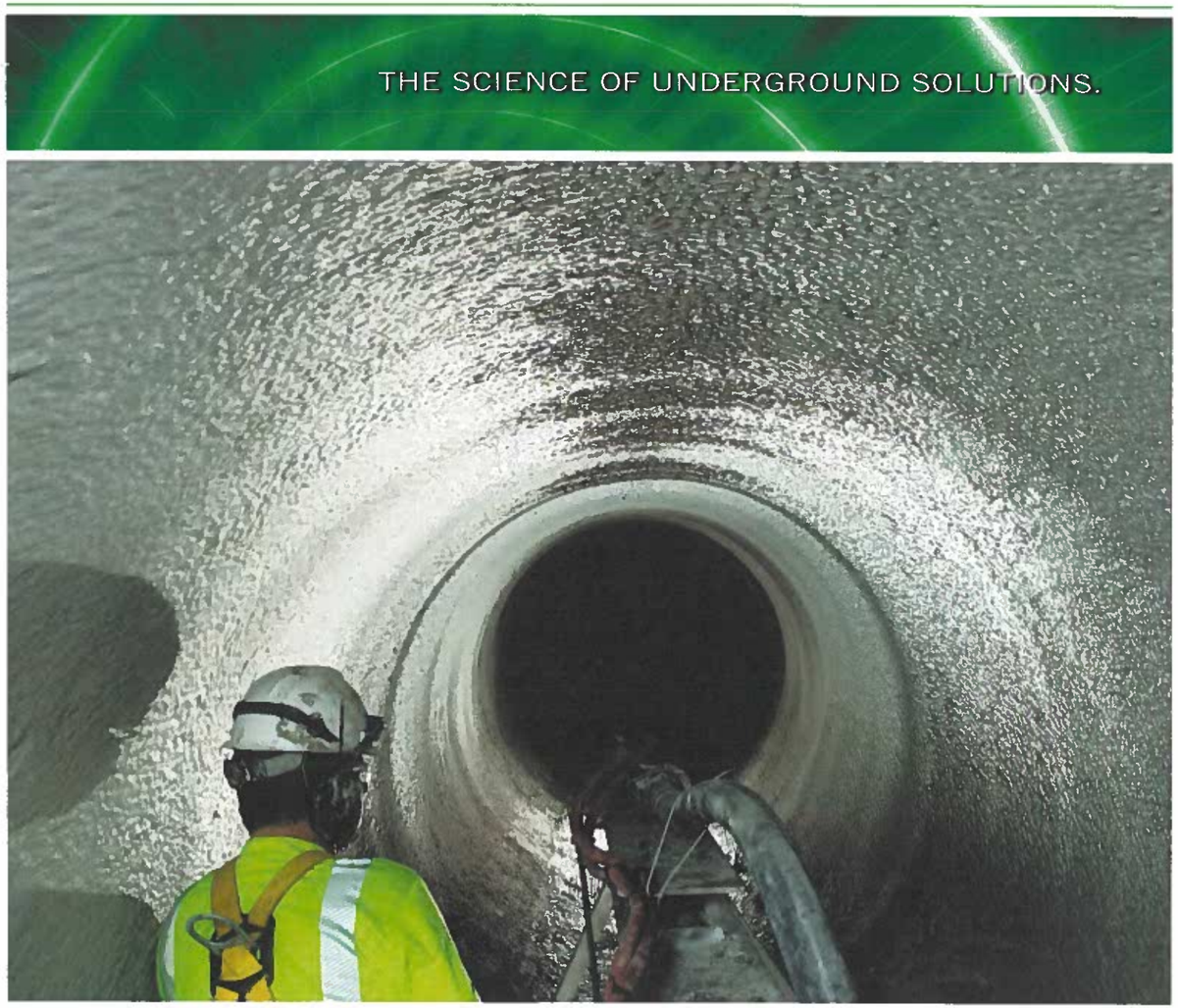
ADVANCED GEOPOLYMER TECHNOLOGY

Structural Repair
Safe for the Environment
Effective Large Diameter Rehabilitation



ECOCAST

AN ENVIRONMENTALLY FRIENDLY, PRECISION APPLIED, STRUCTURAL LINING SYSTEM

IPR Leads the Market with EcoCast™, the first "Green" Geopolymer

Historically, the industry has focused on four critical performance physical characteristics for the successful application of a geopolymer liner.

- Excellent Bond Strength
- Low Permeability
- High Compressive Strength
- Efficient Constructability

IPR, along with its development partner, Milliken Infrastructure Solutions, LLC adds a fifth crucial element ... it is sustainable. Together we have introduced a proprietary system that combines the most advanced application equipment with a custom formulated geopolymer, specifically designed for consistent application and long-term performance.

EcoCast will successfully restore your concrete, brick, or corrugated metal storm and sewer pipes. It is particularly effective for large diameter pipe sections starting at 36".

IPR EcoCast's geopolymer lining is perfect for pipe segment rehabilitation typically found in and around airports, road and highway overpasses, and municipal sewer applications.

THE ECOCAST SYSTEM IS A TECHNOLOGICAL BREAKTHROUGH IN THE TRADITIONAL PIPELINE REHABILITATION MARKET

EcoCast was developed with the sole purpose of meeting the market's demand for a large diameter, precision applied, environmentally friendly, pipe lining solution.

The end result is the first-ever geopolymer coating centrifugally cast through a state-of-the-art, precision controlled spray system. Unlike traditional, manual "pull through" applications, the EcoCast system's drive train allows the product to be consistently applied to preset coating thickness with each pass. Some of the other features include:

- A true structural repair
- Ability to work with a small footprint (10'-30')
- Can be used to restore round and non-round infrastructure
- Can rehabilitate any structure, decking or headwall
- Can rehabilitate pipes that have separated
- Extremely cost-effective for short segment repairs
- Advanced sealant can be specified for added corrosion protection

Typical Applications


DOT projects: highways and bridge overpasses


Concrete, sanitary and storm sewers


Corrugated metal pipe is the perfect candidate for EcoCast


Airports


Manholes and wet wells

THE ECOCAST ADVANTAGE

- EcoCast liners form an inorganic polymer network for higher resistance to acids and greater surface durability
- Cures quickly, providing shortened by-pass time and allows flows to be re-established much quicker than Portland cement based mortars.
- EcoCast is exceptionally resistant to environmental factors like heat and cold and allows for extended application environments through batch temperature controls
- EcoCast is a high strength fiber reinforced geopolymer specially designed for ease of use with mechanical pumping, spraying and application
- EcoCast is designed to stick and adhere to virtually any surface; unlike traditional cement mortars, the geopolymer is capable of bonding and building to greater thicknesses
- An engineered, 100% fully manufactured product with no added non-contributing fillers
- Qualifies for LEED credits and is styrene free

ECOCAST LINER MATERIAL PROPERTIES

Featuring Milliken Geopolymers

Geopolymers are a high performance fiber reinforced mortar specifically designed for structural rehabilitation. This high strength, ultra-low porosity material is made from natural mineral polymers and recycled industrial waste streams. Geopolymers are designed for use through multiple application techniques including pouring, placing, trowelling, spraying, or centrifugal casting. EcoCast can be used for rehabilitation of pipes and structures in Civil Infrastructure, Oil & Gas and Chemical industries. In addition, it is used to repair tunnels, bridges, and roads as well as to rehabilitate buildings and containment areas.

ECOCAST LINER PERFORMANCE DATA

Test Method	Duration	GeoSpray	Conventional Repair Mortar
Compressive Strength ASTM C-39/C-109	1 Day 28 Days	Min. 2,500 psi / 17 MPa Min. 8,000 psi / 55 MPa	5,000 psi / 34 MPa
Flexural Strength ASTM C-78	7 Day 28 Days	1,100 psi / 7.6 MPa 1,500 psi / 10.3 MPa	500 psi / 3.4 MPa
Modulus of Elasticity ASTM C-469	1 Day 28 Days	3,000,000 psi / 20,700 MPa 5,800,000 psi / 40,000 MPa	3,000,000 psi / 20,700 MPa
Bond Strength to Concrete ASTM C-882	1 Day 28 Days	Min 900 psi / 6.2 MPa Min. 2,500 psi / 17 MPa	N/A
Set Time ASTM C-807 Initial Cure Time	Initial Set Final Set	60 - 75 Minutes 90 - 110 Minutes	120 Minutes 300 minutes
Freeze Thaw Durability ASTM C-666	300 Cycles	100% Zero loss	80% to 90% 10% to 20% degradation
Shrinkage ASTM C-1090	28 Days	0.00% @ 65% R. H.	0.35% to 0.50% Shrinkage
Tensile Strength ASTM C-496	28 Days	Min. 800 psi / 5.5 MPa	400 psi / 2.7 MPa
Abrasion Resistance ASTM C-1138	5 Cycles @ 28 Day Maturity	2.7% Loss	4.7% Loss
Rapid Chloride Ion Permeability ASTM C-1202	28 Days	Very Low	N/A

The EcoCast Process

Typical condition of a corrugated metal pipe in need of repair

Corroded and damaged pipe is cleaned and patched

EcoCast spin casting sled begins the application process

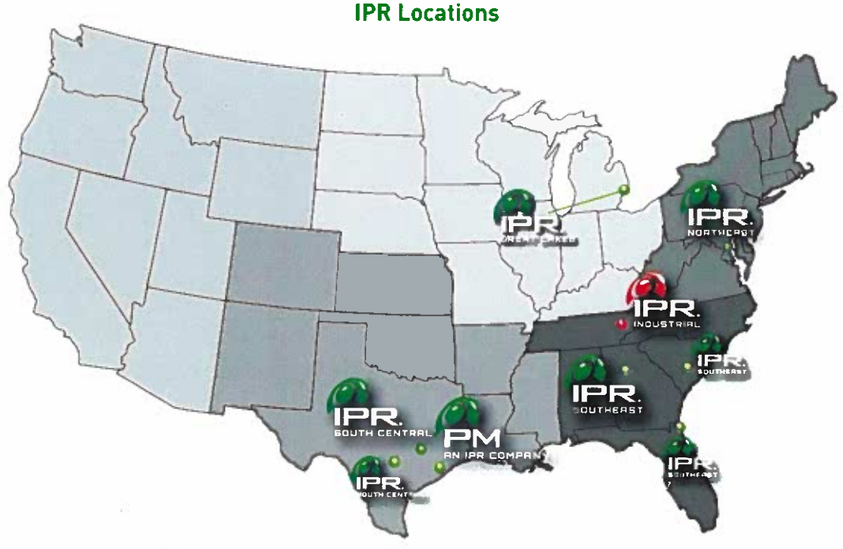
The proprietary EcoCast system applies the structural geopolymer with a high level of efficiency and precision

ECOCAST* WITH Milliken GEOPOLYMERS

IPR has partnered with Milliken Infrastructure Solutions, LLC to deploy its EcoCast system utilizing Milliken Geopolymers. IPR is the industry's leading full service provider of trenchless underground solutions across the United States.

www.teamipr.com

IPR Locations



IPR SERVICES ALSO INCLUDE:

• TV Inspection & Cleaning • CIPP • Pipe Bursting • Pressure Pipe Applications

OTHER SERVICES:

• Assessment • Design Build • Construction Management • Emergency Services

Made in the USA

StormTrap®

MODULAR CONCRETE
STORMWATER MANAGEMENT

COLORADO SPRINGS DETENTION OPTION 1

COLORADO SPRINGS, CO

DESIGN ASSUMPTIONS	
COVER:	MIN: 1.00" - MAX: 2.00"
GROUND WATER TABLE:	BELOW INVERT OF SYSTEM
SOIL PRESSURE:	3,000 PSF
LOADING:	HS-20 WHEEL LOADING

SHEET INDEX

JOB SITE INFORMATION

DESCRIPTION	
JOB NAME:	COLORADO SPRINGS DETENTION OPTION 1
JOB ADDRESS:	COLORADO SPRINGS, CO
ENGINEERING CO:	CH2M
CONTACT NAME:	
CONTACT PHONE:	720-286-0844
CONTACT FAX:	
STORM TRAP SUPPLIER:	STORMTRAP
CONTACT NAME:	JERAMY SHERWOOD
CONTACT PHONE:	815-955-6655
CONTACT EMAIL:	JSHERWOOD@STORMTRAP.COM
WATER STORAGE REQ'D:	36,000.00 CUBIC FEET
WATER STORAGE PROV:	22,092.32 CUBIC FEET
UNIT HEADROOM:	5'-0" SINGLETRAP
UNIT QUANTITY:	52 UNITS - 52 TOTAL PIECES

StormTrap®
PATENTS LISTED AT: [HTTP://STORMTRAP.COM/PATENT/]
1287 WINDHAM PARKWAY
ROMEOVILLE, IL 60446
P: 877-867-6872
F: 331-318-5347

ENGINEER INFORMATION:

CH2M

9189 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112
Phone: 720-286-0844
Fax:

PROJECT INFORMATION:

COLORADO SPRINGS
DETENTION OPTION 1

COLORADO SPRINGS, CO

CURRENT ISSUE DATE:

06-OCT-2017

APPROVED BY:

ISSUED FOR:

PRELIMINARY

REV.:	DATE:	DESC.	BY:
1	06-OCT-2017	ISSUED FOR PRELIMINARY	ADF

SCALE:

SHEET TITLE:

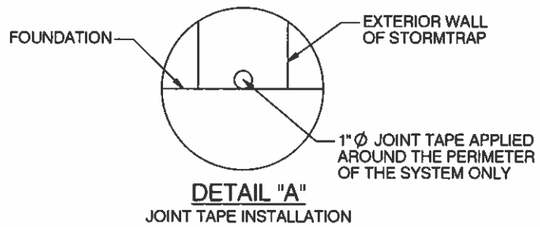
COVER SHEET

SHEET NUMBER:

0.0

STORMTRAP INSTALLATION SPECIFICATION

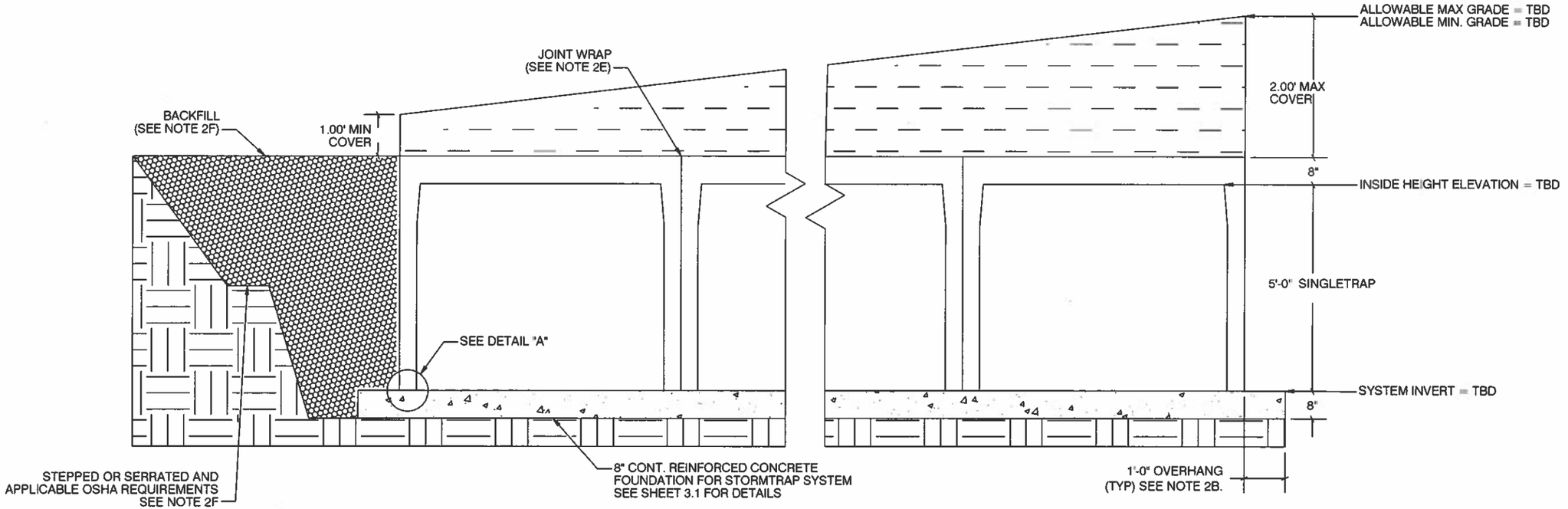
1. STORMTRAP MODULES SHALL BE MANUFACTURED ACCORDING TO SHOP DRAWINGS APPROVED BY THE INSTALLING CONTRACTOR AND ENGINEER. THE SHOP DRAWINGS SHALL INDICATE SIZE AND LOCATION OF ROOF OPENINGS AND INLET/ OUTLET PIPE OPENINGS.
2. STORMTRAP SHALL BE INSTALLED IN ACCORDANCE WITH ASTM C891-09, STANDARD PRACTICE FOR INSTALLATION OF UNDERGROUND PRE-CAST CONCRETE UTILITY STRUCTURES. THE FOLLOWING ADDITIONS AND/OR EXCEPTIONS SHALL APPLY:
   - A. SPECIFICATIONS ON THE ENGINEER'S DRAWINGS SHALL TAKE PRECEDENCE.
   - B. STORMTRAP MODULES SHALL BE PLACED ON LEVEL FOUNDATION (SEE SHEET 3.1) WITH A 1'-0" OVERHANG ON ALL SIDES THAT SHALL BE POURED IN PLACE BY INSTALLING CONTRACTOR.
   - C. THE STORMTRAP MODULES SHALL BE PLACED SUCH THAT THE MAXIMUM SPACE BETWEEN ADJACENT MODULES DOES NOT EXCEED 3/4". IF THE SPACE EXCEEDS 3/4", THE MODULES SHALL BE RESET WITH APPROPRIATE ADJUSTMENT MADE TO LINE AND GRADE TO BRING THE SPACE INTO SPECIFICATION.
   - D. THE PERIMETER HORIZONTAL JOINT OF THE STORMTRAP MODULES SHALL BE SEALED TO THE FOUNDATION WITH PREFORMED MASTIC JOINT SEALER ACCORDING TO ASTM C891-09, 8.8 AND 8.12. SEE DETAIL "A".
   - E. ALL EXTERIOR JOINTS BETWEEN ADJACENT STORMTRAP MODULES SHALL BE SEALED WITH PRE-FORMED, COLD-APPLIED, SELF-ADHERING ELASTOMERIC RESIN BONDED TO A WOVEN HIGHLY PUNCTURE RESISTANT POLYMER WRAP CONFORMING TO ASTM C891-09 AND SHALL BE 0'-8" INTEGRATED PRIMER SEALANT AS APPROVED BY STORMTRAP. THE ADHESIVE EXTERIOR JOINT WRAP SHALL BE INSTALLED ACCORDING TO THE FOLLOWING INSTALLATION INSTRUCTIONS:
     1. USE A BRUSH OR WET CLOTH TO THOROUGHLY CLEAN THE OUTSIDE SURFACE AT THE POINT WHERE THE JOINT WRAP IS TO BE APPLIED.
     2. A RELEASE PAPER PROTECTS THE ADHESIVE SIDE OF THE JOINT WRAP. PLACE THE ADHESIVE TAPE (BUTYL SIDE DOWN) AROUND THE STRUCTURE. REMOVING THE RELEASE PAPER AS YOU GO. PRESS THE JOINT WRAP FIRMLY AGAINST THE STORMTRAP MODULE SURFACE WHEN APPLYING.
   - F. THE FILL PLACED AROUND THE STORMTRAP UNITS MUST BE DEPOSITED ON BOTH SIDES AT THE SAME TIME AND TO APPROXIMATELY THE SAME ELEVATION. AT NO TIME SHALL THE FILL BEHIND ONE SIDE WALL BE MORE THAN 2'-0" HIGHER THAN THE FILL ON THE OPPOSITE SIDE. BACKFILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY OR OTHERWISE SPECIFIED BY ENGINEER. CARE SHALL BE TAKEN TO PREVENT ANY WEDGING ACTION AGAINST THE STRUCTURE, AND ALL SLOPES BOUNDING OR WITHIN THE AREA TO BE BACKFILLED MUST BE STEPPED OR SERRATED TO PREVENT WEDGE ACTION. (REFERENCE ARTICLE 502.10 I.D.O.T. S.S.R.B.C.) CARE SHALL ALSO BE TAKEN AS NOT TO DISRUPT THE JOINT WRAP FROM THE JOINT DURING THE BACKFILL PROCESS. BACKFILL MATERIAL SHALL BE CLEAN, CRUSHED, ANGULAR No.5 (AASHTO M43) AGGREGATE.



DETAIL "A"
JOINT TAPE INSTALLATION

STORMTRAP SPECIFICATION

1. TOTAL COVER: MIN. 1.00' MAX. 2.00' CONSULT STORMTRAP FOR ADDITIONAL COVER OPTIONS.
2. CONCRETE CHAMBER DESIGNED FOR AASHTO HS-20 WHEEL LOADING. MIN. SOIL PRESSURE 3,000 PSF.
3. ALL DIMENSIONS AND SOIL CONDITIONS, INCLUDING BUT NOT LIMITED TO GROUNDWATER AND SOIL BEARING CAPACITY ARE TO BE VERIFIED IN THE FIELD BY OTHERS PRIOR TO STORMTRAP INSTALLATION.
4. FOR STRUCTURAL CALCULATIONS THE WATER TABLE IS ASSUMED TO BE BELOW THE SYSTEM INVERT, IF DIFFERENT THAN ASSUMED, CONTACT STORMTRAP.
5. FOR STRUCTURAL CALCULATIONS THE SOIL DENSITY IS ASSUMED TO BE 120 PCF.
6. FOR FLOTATION CALCULATIONS THE WATER TABLE IS ASSUMED TO BE BELOW THE SYSTEM INVERT, IF DIFFERENT THAN ASSUMED, CONTACT STORMTRAP.
7. STORMTRAP IS NOT WATERTIGHT. CONTACT STORMTRAP FOR WATERTIGHT OPTIONS. WATERTIGHT APPLICATION TO BE PROVIDED BY OTHERS.



5'-0" SINGLETRAP

**FOR STRUCTURAL AND FLOTATION CALCULATIONS THE WATER TABLE IS ASSUMED TO BE BELOW THE SYSTEM INVERT, IF DIFFERENT THAN ASSUMED, CONTACT STORMTRAP.

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P: 877-867-6872
F: 331-318-5347

ENGINEER INFORMATION:

CH2M
9189 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112
Phone: 720-286-0844
Fax:

PROJECT INFORMATION:

COLORADO SPRINGS DETENTION OPTION 1
COLORADO SPRINGS, CO

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SHEET TITLE:
SINGLETRAP INSTALLATION SPECIFICATIONS

SHEET NUMBER:
1.0

RECOMMENDED ACCESS OPENING SPECIFICATION

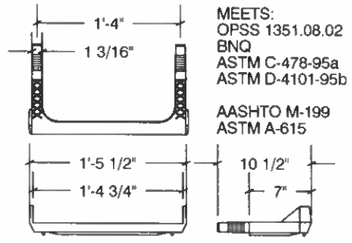
1. TYPICAL ACCESS OPENINGS FOR THE STORMTRAP SYSTEM ARE 2'-0" IN DIAMETER. ACCESS OPENINGS LARGER THAN 2'-0" IN DIAMETER NEED TO BE APPROVED BY STORMTRAP. ALL OPENINGS MUST RETAIN AT LEAST 1'-0" OF CLEARANCE IN ALL DIRECTIONS FROM THE EDGE OF THE STORMTRAP UNITS.
2. PLASTIC COATED STEEL STEPS PRODUCED BY M.A. INDUSTRIES PART #PS3-PFC (SEE DETAIL TO THE RIGHT) ARE PROVIDED INSIDE ANY UNIT WHERE DEEMED NECESSARY. THE HIGHEST STEP IN THE UNIT IS TO BE PLACED A DISTANCE OF 1'-0" FROM THE INSIDE EDGE OF THE STORMTRAP UNITS. ALL ENSUING STEPS SHALL BE PLACED WITH A MAXIMUM DISTANCE OF 1'-4" BETWEEN THEM. STEPS MAY BE MOVED OR ALTERED TO AVOID OPENINGS OR OTHER IRREGULARITIES IN THE UNIT.
3. STORMTRAP LIFTING INSERTS MAY BE RELOCATED TO COINCIDE WITH THE ACCESS OPENING OR THE CENTER OF GRAVITY OF THE UNIT AS NEEDED.
4. STORMTRAP ACCESS OPENINGS MAY BE RELOCATED TO AVOID INTERFERENCE WITH INLET AND/OR OUTLET PIPE OPENINGS SO PLACEMENT OF STEPS IS ATTAINABLE.
5. ACCESS OPENINGS SHOULD BE LOCATED IN ORDER MEET THE APPROPRIATE MUNICIPAL REQUIREMENTS. STORMTRAP RECOMMENDS AT LEAST ONE ACCESS OPENING PER SYSTEM FOR ACCESS AND INSPECTION.
6. USE PRECAST ADJUSTING RINGS AS NEEDED TO MEET GRADE. STORMTRAP RECOMMENDS FOR COVER OVER 2' TO USE PRECAST BARREL OR CONE SECTIONS. (BY OTHERS)

RECOMMENDED PIPE OPENING SPECIFICATION

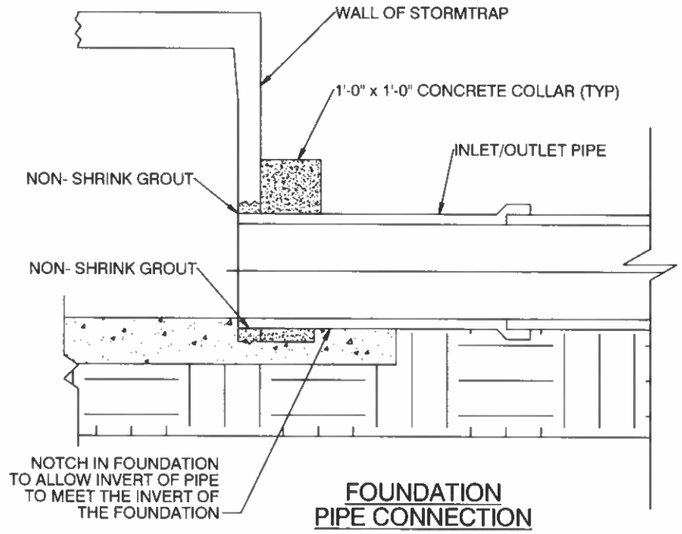
1. PIPE OPENINGS SHALL MAINTAIN A MINIMUM 1'-0" OF CLEARANCE FROM A VERTICAL EDGE OF THE STORMTRAP UNIT.
2. MAXIMUM OPENING SIZE TO BE DETERMINED BY UNIT HEIGHT. PREFERRED OPENING SIZE Ø36" OR LESS. ANY OPENING NEEDED THAT DOES NOT FIT THIS CRITERIA SHALL BE BROUGHT TO THE ATTENTION OF STORMTRAP FOR REVIEW.
3. CONNECTING PIPES SHALL BE INSTALLED WITH A 1'-0" CONCRETE COLLAR, AND A AGGREGATE CRADLE FOR AT LEAST ONE PIPE LENGTH, AS SHOWN. A STRUCTURAL GRADE CONCRETE OR GROUT WITH A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI SHALL BE USED.
4. THE ANNULAR SPACE BETWEEN THE PIPE AND THE HOLE SHALL BE FILLED WITH NON-SHRINK GROUT.

RECOMMENDED PIPE INSTALLATION INSTRUCTIONS

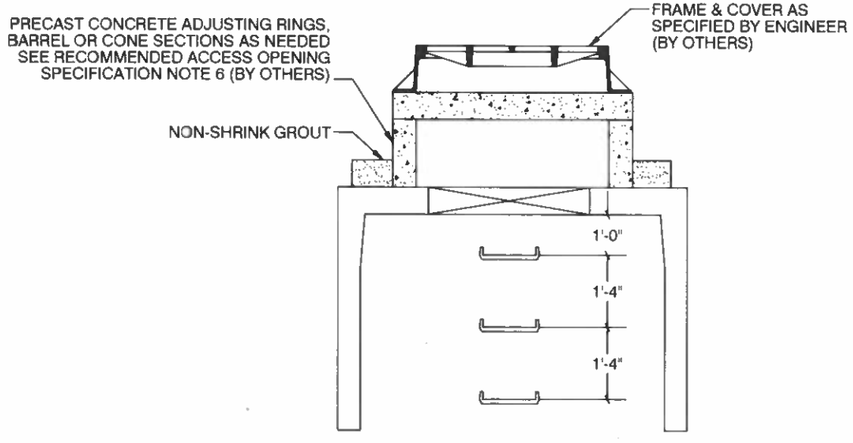
1. CLEAN AND LIGHTLY LUBRICATE ALL OF PIPE TO BE INSERTED INTO STORMTRAP.
2. IF PIPE IS CUT, CARE SHOULD BE TAKEN TO ALLOW NO SHARP EDGES. BEVEL AND LUBRICATE LEAD END OF PIPE.
3. ALIGN CENTER OF PIPE TO CORRECT ELEVATION AND INSERT INTO OPENING.



STEP DETAIL



FOUNDATION PIPE CONNECTION



RISER / STAIR DETAIL

StormTrap
PATENTS LISTED AT: [HTTP://STORMTRAP.COM/PATENT/]
1287 WINDHAM PARKWAY
ROMEOVILLE, IL 60446
P: 877-867-6872
F: 331-318-5347

ENGINEER INFORMATION:

CH2M
9189 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112
Phone: 720-286-0844
Fax:

PROJECT INFORMATION:

COLORADO SPRINGS DETENTION OPTION 1

COLORADO SPRINGS, CO

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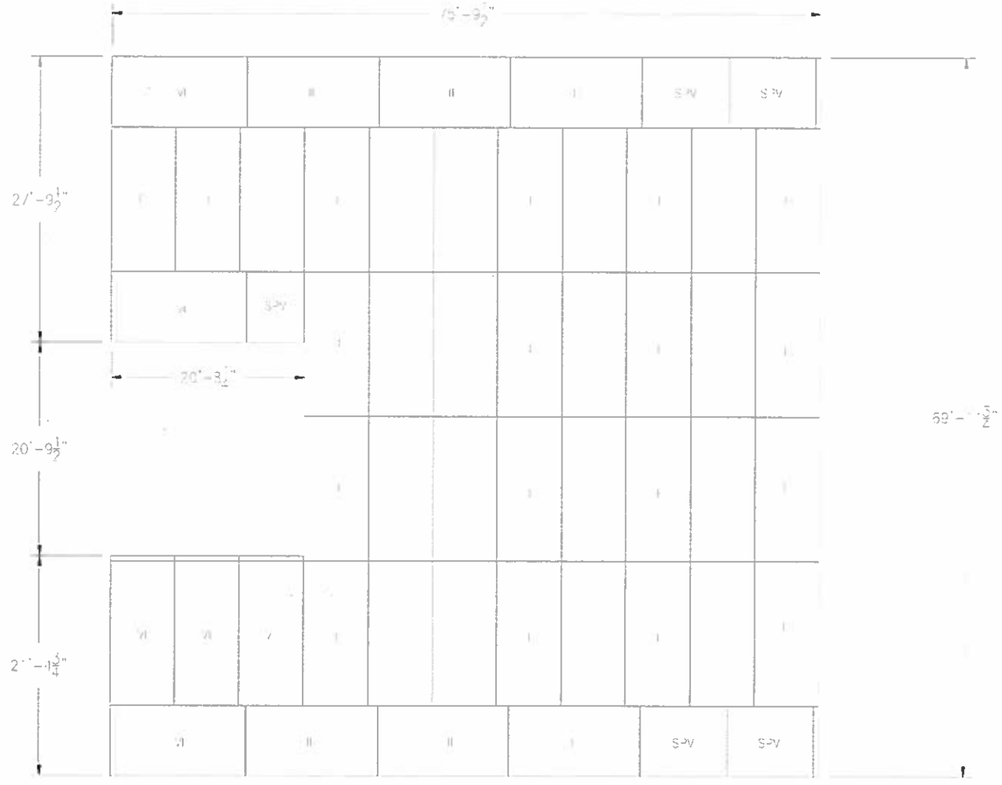
RECOMMENDED SINGLETRAP INSTALLATION SPECIFICATIONS

SHEET NUMBER:

2.0

BILL OF MATERIALS

QTY.	PART NO.	DESCRIPTION	WEIGHT
28	TYPE I	5'-0" SINGLETRAP TYPE I	13555
0	TYPE II	5'-0" SINGLETRAP TYPE II	8685
13	TYPE III	5'-0" SINGLETRAP TYPE III	16025
0	TYPE IV	5'-0" SINGLETRAP TYPE IV	9920
5	SPVI	5'-0" SINGLETRAP TYPE VI	VARIES
6	TYPE VI	5'-0" SINGLETRAP TYPE VI	18495
8	VI PANEL	5'-0" SINGLETRAP TYPE VII	2904
48	JOINT TAPE	JOINT TAPE - 14.5' PER ROLL	
10	JOINT WRAP	JOINT WRAP - 150' PER ROLL	



NOTES:

1. DIMENSION OF STORMTRAP SYSTEM ALLOW FOR A 3/4" GAP BETWEEN EACH UNIT.
2. ALL DIMENSIONS TO BE VERIFIED IN THE FIELD BY OTHERS.
3. SEE SHEET 2 FOR INSTALLATION SPECIFICATIONS.

LAYOUT DETAIL

DESIGN CRITERIA

INSIDE HEIGHT ELEVATION = TBD

ALLOWABLE MIN GRADE = TBD

ALLOWABLE MAX GRADE = TBD

SYSTEM INVERT = TBD

STORMTRAP VOLUME = 22,092.32 C.F. / 0.84 A.F.

StormTrap

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9189 SOUTH JAMAICA STREET
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SCALE:

SHEET TITLE:

LAYOUT DETAIL

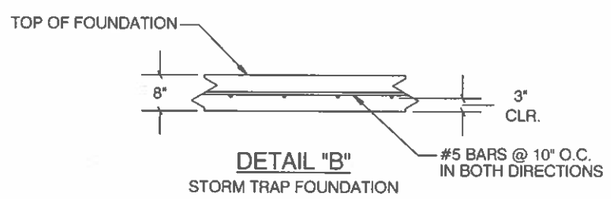
SHEET NUMBER:

3.0

NOTES:

1. DIMENSION OF FOUNDATION MUST HAVE 1'-0" OVERHANG BEYOND EXTERNAL FACE OF UNITS.
2. DIMENSION OF STORMTRAP SYSTEM ALLOW FOR A 3/4" GAP BETWEEN EACH UNIT.
3. ALL DIMENSIONS TO BE VERIFIED IN THE FIELD BY OTHERS.
4. SEE SHEET 2 FOR INSTALLATION SPECIFICATIONS.

CONCRETE FOUNDATION PLAN



DETAIL "B"
STORM TRAP FOUNDATION

NOTES:
1. 4,000 p.s.i. @ 28 DAYS, 5%-8% ENTRAINED AIR, 4" MAX. SLUMP.
2. NET ALLOWABLE SOIL PRESSURE GREATER THAN OR EQUAL TO 2,000 p.s.f.
3. SOIL CONDITIONS TO BE VERIFIED ON SITE BY OTHERS.
4. 1'-0" OVERHANG AROUND OUTSIDE OF SYSTEM.
5. REBAR: ASTM A-615 GRADE 60. BLACK BAR.

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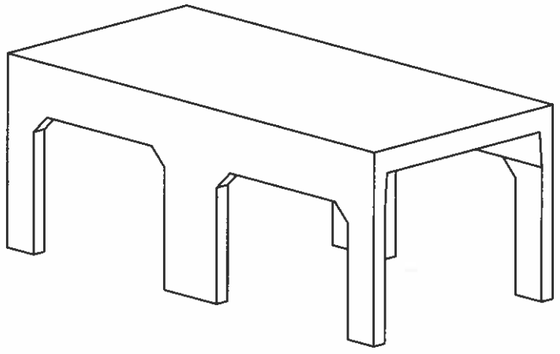
CONCRETE FOUNDATION PLAN

SHEET NUMBER:

3.1



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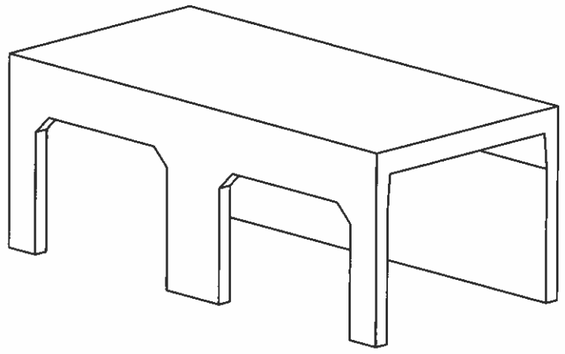

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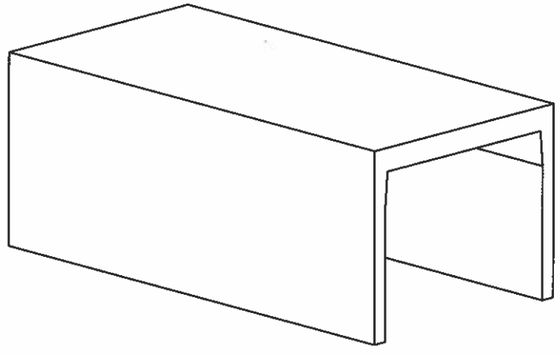

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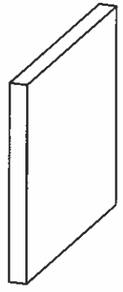

TYPE VI

StormTrap

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SCALE:

SHEET TITLE:

STANDARD
5'-0" SINGLETRAP
UNIT TYPES

SHEET NUMBER:

4.0

StormTrap®

MODULAR CONCRETE
STORMWATER MANAGEMENT

COLORADO SPRINGS DETENTION OPTION 2

COLORADO SPRINGS,

DESIGN ASSUMPTIONS	
COVER:	MIN: 1'-0" - MAX: 2'-0"
GROUND WATER TABLE:	BELOW INVERT OF SYSTEM
SOIL PRESSURE:	3,000 PSF
LOADING:	HS-20 WHEEL LOADING

SHEET INDEX

JOB SITE INFORMATION

DESCRIPTION

JOB NAME:	COLORADO SPRINGS DETENTION OPTION 2
JOB ADDRESS:	COLORADO SPRINGS,
ENGINEERING CO:	CH2M
CONTACT NAME:	
CONTACT PHONE:	720-286-0844
CONTACT FAX:	
STORM TRAP SUPPLIER:	STORMTRAP
CONTACT NAME:	JERAMY SHERWOOD
CONTACT PHONE:	815-955-6655
CONTACT EMAIL:	JSHERWOOD@STORMTRAP.COM
WATER STORAGE REQ'D:	36,000.00 CUBIC FEET
WATER STORAGE PROV:	28,218.67 CUBIC FEET
UNIT HEADROOM:	5'-0" SINGLETRAP
UNIT QUANTITY:	66 UNITS - 66 TOTAL PIECES

StormTrap

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COVER SHEET

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STORMTRAP INSTALLATION SPECIFICATION

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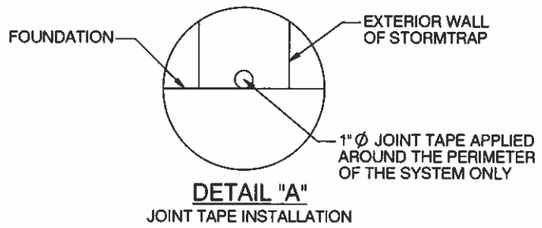
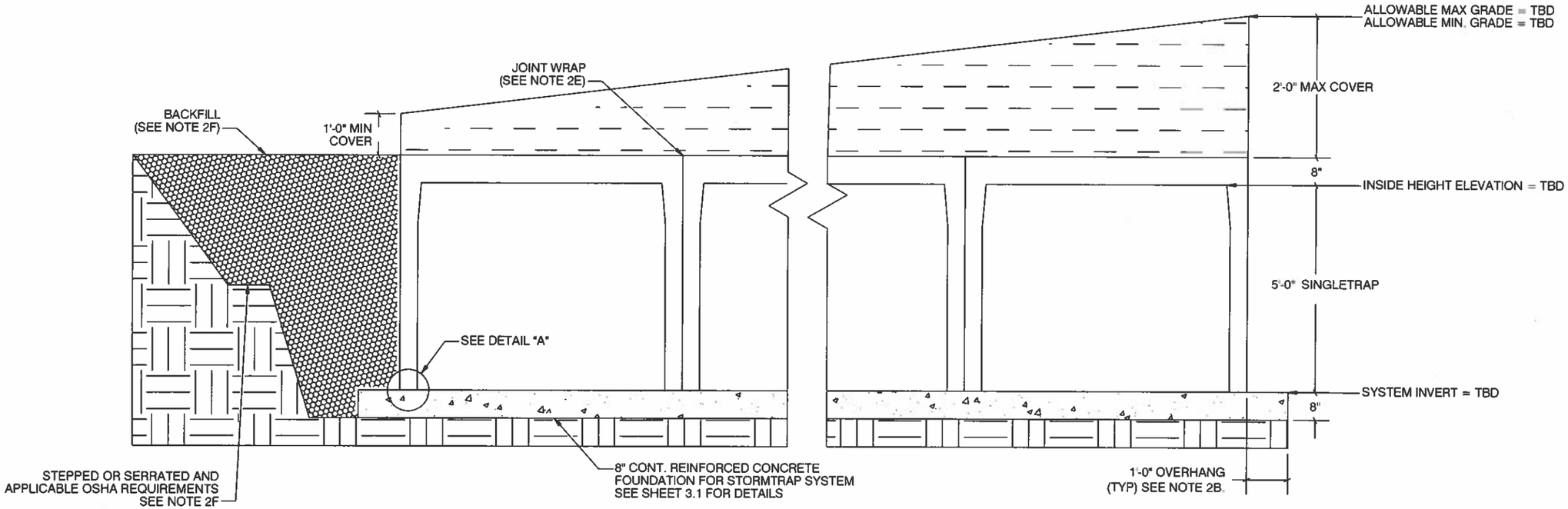
   - F. THE FILL PLACED AROUND THE STORMTRAP UNITS MUST BE DEPOSITED ON BOTH SIDES AT THE SAME TIME AND TO APPROXIMATELY THE SAME ELEVATION. AT NO TIME SHALL THE FILL BEHIND ONE SIDE WALL BE MORE THAN 2'-0" HIGHER THAN THE FILL ON THE OPPOSITE SIDE. BACKFILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY OR OTHERWISE SPECIFIED BY ENGINEER. CARE SHALL BE TAKEN TO PREVENT ANY WEDGING ACTION AGAINST THE STRUCTURE, AND ALL SLOPES BOUNDING OR WITHIN THE AREA TO BE BACKFILLED MUST BE STEPPED OR SERRATED TO PREVENT WEDGE ACTION. (REFERENCE ARTICLE 502.10 I.D.O.T. S.S.R.B.C.) CARE SHALL ALSO BE TAKEN AS NOT TO DISRUPT THE JOINT WRAP FROM THE JOINT DURING THE BACKFILL PROCESS. BACKFILL MATERIAL SHALL BE CLEAN, CRUSHED, ANGULAR No.5 (AASHTO M43) AGGREGATE.



DETAIL "A"
JOINT TAPE INSTALLATION

STORMTRAP SPECIFICATION

1. TOTAL COVER: MIN. 1'-0" MAX. 2'-0" CONSULT STORMTRAP FOR ADDITIONAL COVER OPTIONS.
2. CONCRETE CHAMBER DESIGNED FOR AASHTO HS-20 WHEEL LOADING. MIN. SOIL PRESSURE 3,000 PSF.
3. ALL DIMENSIONS AND SOIL CONDITIONS, INCLUDING BUT NOT LIMITED TO GROUNDWATER AND SOIL BEARING CAPACITY ARE TO BE VERIFIED IN THE FIELD BY OTHERS PRIOR TO STORMTRAP INSTALLATION.
4. FOR STRUCTURAL CALCULATIONS THE WATER TABLE IS ASSUMED TO BE BELOW THE SYSTEM INVERT, IF DIFFERENT THAN ASSUMED, CONTACT STORMTRAP.
5. FOR STRUCTURAL CALCULATIONS THE SOIL DENSITY IS ASSUMED TO BE 120 PCF.
6. FOR FLOTATION CALCULATIONS THE WATER TABLE IS ASSUMED TO BE BELOW THE SYSTEM INVERT, IF DIFFERENT THAN ASSUMED, CONTACT STORMTRAP.
7. STORMTRAP IS NOT WATERTIGHT. CONTACT STORMTRAP FOR WATERTIGHT OPTIONS. WATERTIGHT APPLICATION TO BE PROVIDED BY OTHERS.



5'-0" SINGLETRAP

**FOR STRUCTURAL AND FLOTATION CALCULATIONS THE WATER TABLE IS ASSUMED TO BE BELOW THE SYSTEM INVERT, IF DIFFERENT THAN ASSUMED, CONTACT STORMTRAP.

StormTrap
PATENTS LISTED AT: HTTP://STORMTRAP.COM/PATENT/
1287 WINDHAM PARKWAY
ROMEOVILLE, IL 60446
P: 877-867-6872
F: 331-318-5347

ENGINEER INFORMATION:

CH2M
9189 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112
Phone: 720-286-0844
Fax:

PROJECT INFORMATION:

COLORADO SPRINGS DETENTION OPTION 2

COLORADO SPRINGS,

CURRENT ISSUE DATE:

06-OCT-2017

APPROVED BY:

ISSUED FOR:

PRELIMINARY

REV.:	DATE:	DESC.	BY
1	06-OCT-2017	ISSUED FOR PRELIMINARY	AD

SCALE:

SHEET TITLE:

SINGLETRAP INSTALLATION SPECIFICATIONS

SHEET NUMBER:

1.0

RECOMMENDED ACCESS OPENING SPECIFICATION

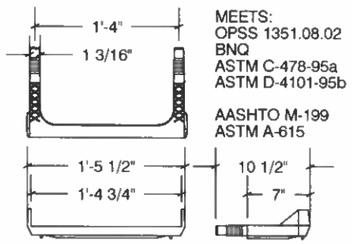
1. TYPICAL ACCESS OPENINGS FOR THE STORMTRAP SYSTEM ARE 2'-0" IN DIAMETER. ACCESS OPENINGS LARGER THAN 2'-0" IN DIAMETER NEED TO BE APPROVED BY STORMTRAP. ALL OPENINGS MUST RETAIN AT LEAST 1'-0" OF CLEARANCE IN ALL DIRECTIONS FROM THE EDGE OF THE STORMTRAP UNITS.
2. PLASTIC COATED STEEL STEPS PRODUCED BY M.A. INDUSTRIES PART #PS3-PFC (SEE DETAIL TO THE RIGHT) ARE PROVIDED INSIDE ANY UNIT WHERE DEEMED NECESSARY. THE HIGHEST STEP IN THE UNIT IS TO BE PLACED A DISTANCE OF 1'-0" FROM THE INSIDE EDGE OF THE STORMTRAP UNITS. ALL ENSUING STEPS SHALL BE PLACED WITH A MAXIMUM DISTANCE OF 1'-4" BETWEEN THEM. STEPS MAY BE MOVED OR ALTERED TO AVOID OPENINGS OR OTHER IRREGULARITIES IN THE UNIT.
3. STORMTRAP LIFTING INSERTS MAY BE RELOCATED TO COINCIDE WITH THE ACCESS OPENING OR THE CENTER OF GRAVITY OF THE UNIT AS NEEDED.
4. STORMTRAP ACCESS OPENINGS MAY BE RELOCATED TO AVOID INTERFERENCE WITH INLET AND/OR OUTLET PIPE OPENINGS SO PLACEMENT OF STEPS IS ATTAINABLE.
5. ACCESS OPENINGS SHOULD BE LOCATED IN ORDER MEET THE APPROPRIATE MUNICIPAL REQUIREMENTS. STORMTRAP RECOMMENDS AT LEAST ONE ACCESS OPENING PER SYSTEM FOR ACCESS AND INSPECTION.
6. USE PRECAST ADJUSTING RINGS AS NEEDED TO MEET GRADE. STORMTRAP RECOMMENDS FOR COVER OVER 2' TO USE PRECAST BARREL OR CONE SECTIONS. (BY OTHERS)

RECOMMENDED PIPE OPENING SPECIFICATION

1. PIPE OPENINGS SHALL MAINTAIN A MINIMUM 1'-0" OF CLEARANCE FROM A VERTICAL EDGE OF THE STORMTRAP UNIT.
2. MAXIMUM OPENING SIZE TO BE DETERMINED BY UNIT HEIGHT. PREFERRED OPENING SIZE Ø36" OR LESS. ANY OPENING NEEDED THAT DOES NOT FIT THIS CRITERIA SHALL BE BROUGHT TO THE ATTENTION OF STORMTRAP FOR REVIEW.
3. CONNECTING PIPES SHALL BE INSTALLED WITH A 1'-0" CONCRETE COLLAR, AND A AGGREGATE CRADLE FOR AT LEAST ONE PIPE LENGTH, AS SHOWN. A STRUCTURAL GRADE CONCRETE OR GROUT WITH A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI SHALL BE USED.
4. THE ANNULAR SPACE BETWEEN THE PIPE AND THE HOLE SHALL BE FILLED WITH NON-SHRINK GROUT.

RECOMMENDED PIPE INSTALLATION INSTRUCTIONS

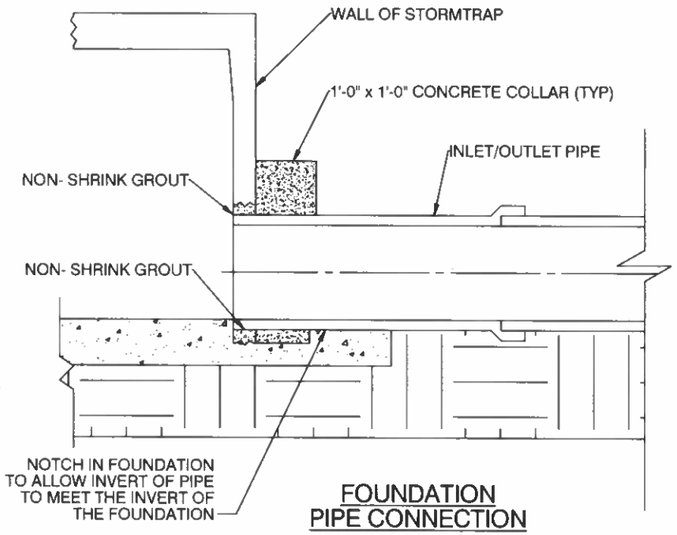
1. CLEAN AND LIGHTLY LUBRICATE ALL OF PIPE TO BE INSERTED INTO STORMTRAP.
2. IF PIPE IS CUT, CARE SHOULD BE TAKEN TO ALLOW NO SHARP EDGES. BEVEL AND LUBRICATE LEAD END OF PIPE.
3. ALIGN CENTER OF PIPE TO CORRECT ELEVATION AND INSERT INTO OPENING.



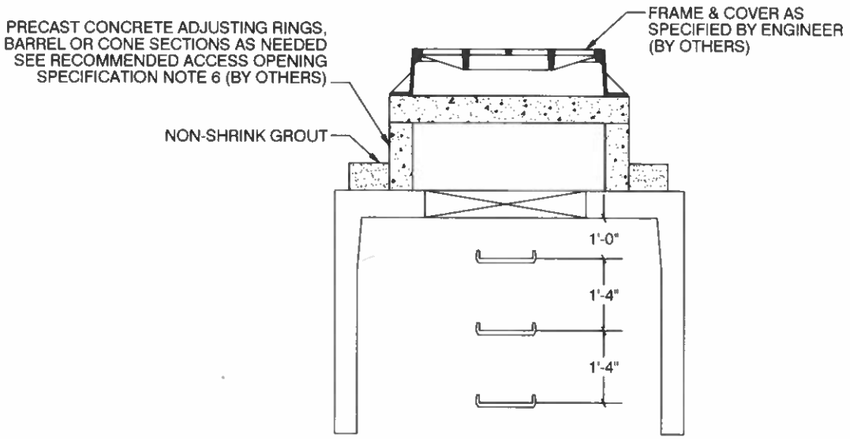
MEETS:
OPSS 1351.08.02
BNQ
ASTM C-478-95a
ASTM D-4101-95b

AASHTO M-199
ASTM A-615

STEP DETAIL



FOUNDATION PIPE CONNECTION



RISER / STAIR DETAIL

StormTrap
PATENTS LISTED AT: (HTTP://STORMTRAP.COM/PATENT/
1287 WINDHAM PARKWAY
ROMEOVILLE, IL 60446
P: 877-867-6872
F: 331-318-5347

ENGINEER INFORMATION:

CH2M

9189 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112
Phone: 720-286-0844
Fax:

PROJECT INFORMATION:

COLORADO SPRINGS
DETENTION OPTION 2

COLORADO SPRINGS,

CURRENT ISSUE DATE:

06-OCT-2017

APPROVED BY:

ISSUED FOR:

PRELIMINARY

REV.:	DATE:	DESC.	BY:
1	06-OCT-2017	ISSUED FOR PRELIMINARY	ADF

SCALE:

SHEET TITLE:

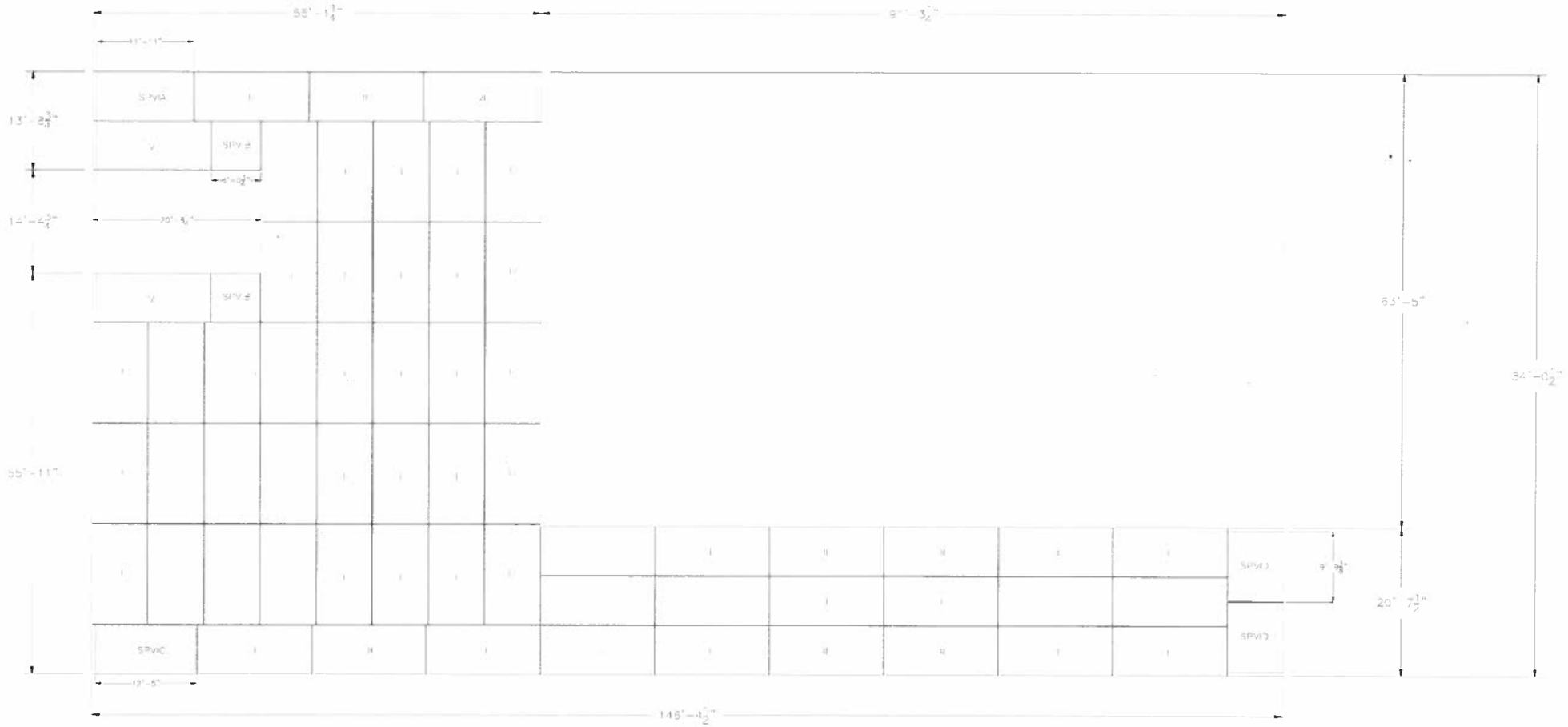
RECOMMENDED SINGLETRAP INSTALLATION SPECIFICATIONS

SHEET NUMBER:

2.0

BILL OF MATERIALS

QTY.	PART NO.	DESCRIPTION	WEIGHT
30	TYPE I	5'-0" SINGLETRAP TYPE I	13305
0	TYPE II	5'-0" SINGLETRAP TYPE II	8375
27	TYPE III	5'-0" SINGLETRAP TYPE III	15465
0	TYPE IV	5'-0" SINGLETRAP TYPE IV	9455
6	SPVI	5'-0" SINGLETRAP TYPE VI	VARIES
3	TYPE VI	5'-0" SINGLETRAP TYPE VI	17620
7	VI PANEL	6" THICK TYPE VI PANEL	2904
56	JOINT TAPE	JOINT TAPE - 14.5' PER ROLL	
13	JOINT WRAP	JOINT WRAP - 150' PER ROLL	



NOTES:

1. DIMENSION OF STORMTRAP SYSTEM ALLOW FOR A 3/4" GAP BETWEEN EACH UNIT.
2. ALL DIMENSIONS TO BE VERIFIED IN THE FIELD BY OTHERS.
3. SEE SHEET 2 FOR INSTALLATION SPECIFICATIONS.

LAYOUT DETAIL

DESIGN CRITERIA

INSIDE HEIGHT ELEVATION = TBD

ALLOWABLE MIN GRADE = TBD

ALLOWABLE MAX GRADE = TBD

SYSTEM INVERT = TBD

STORMTRAP VOLUME = 28,218.67 C.F. / 0.84 A.F.

N

StormTrap

PATENTS LISTED AT: [HTTP://STORMTRAP.COM/PATENT/]

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1	06-OCT-2017	ISSUED FOR PRELIMINARY	AD

SCALE:

SHEET TITLE:

LAYOUT DETAIL

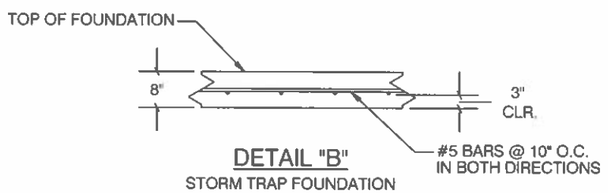
SHEET NUMBER:

3.0

NOTES:

1. DIMENSION OF FOUNDATION MUST HAVE 1'-0" OVERHANG BEYOND EXTERNAL FACE OF UNITS.
2. DIMENSION OF STORMTRAP SYSTEM ALLOW FOR A 3/4" GAP BETWEEN EACH UNIT.
3. ALL DIMENSIONS TO BE VERIFIED IN THE FIELD BY OTHERS.
4. SEE SHEET 2 FOR INSTALLATION SPECIFICATIONS.

CONCRETE FOUNDATION PLAN



DETAIL "B"
STORM TRAP FOUNDATION

NOTES:
1. 4,000 p.s.i. @ 28 DAYS, 5%-8% ENTRAINED AIR, 4" MAX. SLUMP.
2. NET ALLOWABLE SOIL PRESSURE GREATER THAN OR EQUAL TO 2,000 p.s.f.
3. SOIL CONDITIONS TO BE VERIFIED ON SITE BY OTHERS.
4. 1'-0" OVERHANG AROUND OUTSIDE OF SYSTEM.
5. REBAR: ASTM A-615 GRADE 60. BLACK BAR.

StormTrap
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ROMEOVILLE, IL 60446
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F: 331-318-5347

ENGINEER INFORMATION:

CH2M

9189 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112
Phone: 720-286-0844
Fax:

PROJECT INFORMATION:

COLORADO SPRINGS
DETENTION OPTION 2

COLORADO SPRINGS,

CURRENT ISSUE DATE:

06-OCT-2017

APPROVED BY:

ISSUED FOR:

PRELIMINARY

REV.:	DATE:	DESC.	BY:
1	06-OCT-2017	ISSUED FOR PRELIMINARY	ADF

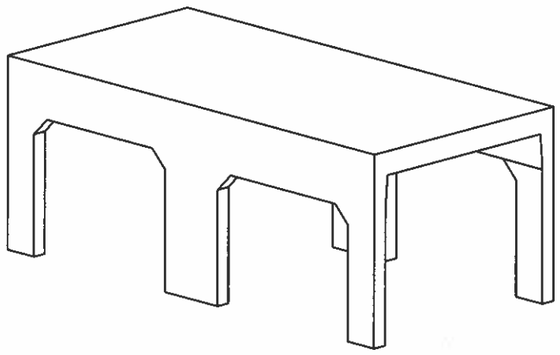
SCALE:

SHEET TITLE:

CONCRETE FOUNDATION PLAN

SHEET NUMBER:

3.1



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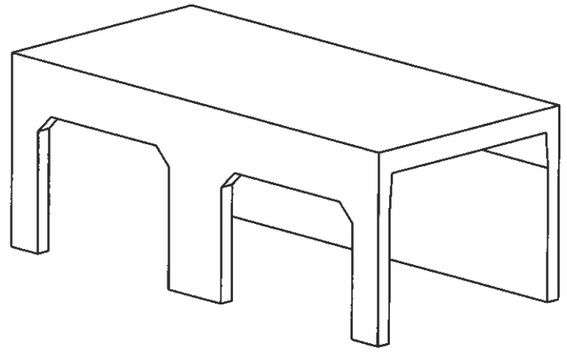
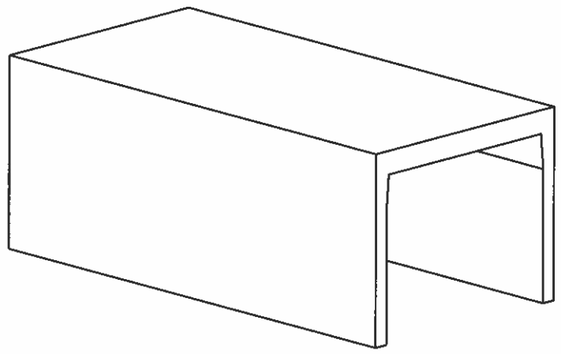
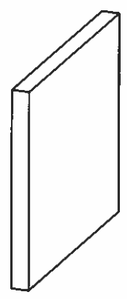


TYPE III



TYPE VI



TYPE VI PANEL

StormTrap

PATENTS LISTED AT: [HTTP://STORMTRAP.COM/PATENT/]

1287 WINDHAM PARKWAY
ROMEOVILLE, IL 60446
P: 877-867-6872
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9189 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112
Phone: 720-286-0844
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COLORADO SPRINGS
DETENTION OPTION 2

COLORADO SPRINGS,

CURRENT ISSUE DATE:

06-OCT-2017

APPROVED BY:

ISSUED FOR:

PRELIMINARY

REV.:	DATE:	DESC.	BY
1	06-OCT-2017	ISSUED FOR PRELIMINARY	AD

SCALE:

SHEET TITLE:

STANDARD
5'-0" SINGLETRAP
UNIT TYPES

SHEET NUMBER:

4.0

October 12, 2017

LEED Contribution and Water Quality Available Upon Request

CH2M
9189 South Jamaica Street
Englewood, CO 80112

RE: Colorado Springs Detention Option 2 - Colorado Springs,

StormTrap, LLC is pleased to offer the following opinion of cost for the installation of the StormTrap System for the above stated project. Please note that the opinion of cost assumes that all spoil will be left on site and is exclusive of any applicable taxes. *Assumptions used for this project are as follows (see page 2 of the design for complete design criteria): Cover: 6" (Max of 3'-5"); Groundwater: 3'-0" below grade; Loading ASTM C857 HS-20.*

5'- 0" SINGLETRAP
Total Water Storage Provided: 0.65 Acre-Feet or 28,219 C.F.
Footprint (Outside Area): (147 x 85)

66 StormTrap Units (see attached layout)
(StormTrap Units + Delivery + JointTape + JointWrap)

SUB TOTAL FOR MATERIAL AND FREIGHT: **$176,866.00**

Excavation (StormTrap Area + Overdig + The Average Cover + 8 Inch Pad)	2,305	C.Y.	@	$9.00	Per C.Y.	$20,745.00
Install Units (Crane + Labor Costs for Setting Units)	66	Pieces	@	$100.00	Per Piece	$6,600.00
Pad (Forming + Labor + Rebar + Finishing)	6,681	S.F.	@	$9.00	Per S.F.	$60,129.00
Backfill (Filling Overdig w/ 3/4" Stone, to Top of Roof Slab)	398	C.Y.	@	$30.00	Per C.Y.	$11,940.00

SUB-TOTAL FOR INSTALLATION: **$99,414.00**

TOTAL OPINION OF COST FOR MATERIAL AND INSTALLATION: **$276,280.00**

Please feel free to call me if you have any questions.

Sincerely,

Jeramy Sherwood

Jeramy Sherwood

815 941 4549
331 318 5347
www.stormtrap.com
info@stormtrap.com
1287 Windham Parkway
Romeoville, Illinois 60446

October 10, 2017

LEED Contribution and Water Quality Available Upon Request

CH2M
9189 South Jamaica Street
Englewood, CO 80112

RE: Colorado Springs Detention Option 1 - Colorado Springs, CO

StormTrap, LLC is pleased to offer the following opinion of cost for the installation of the StormTrap System for the above stated project. Please note that the opinion of cost assumes that all spoil will be left on site and is exclusive of any applicable taxes. *Assumptions used for this project are as follows (see page 2 of the design for complete design criteria): Cover: 6" (Max of 3'-5"); Groundwater: 3'-0" below grade; Loading ASTM C857 HS-20.*

5'- 0" SINGLETRAP
Total Water Storage Provided: 0.51 Acre-Feet or 22,092 C.F.
Footprint (Outside Area): (76 x 70)

52 StormTrap Units (see attached layout)
(StormTrap Units + Delivery + JointTape + JointWrap)

SUB TOTAL FOR MATERIAL AND FREIGHT: **$143,013.00**

Excavation (StormTrap Area + Overdig + The Average Cover + 8 Inch Pad)	1,722	C.Y.	@	$9.00	Per C.Y.	$15,498.00
Install Units (Crane + Labor Costs for Setting Units)	52	Pieces	@	$200.00	Per Piece	$10,400.00
Pad (Forming + Labor + Rebar + Finishing)	5,170	S.F.	@	$9.00	Per S.F.	$46,530.00
Backfill (Filling Overdig w/ 3/4" Stone, to Top of Roof Slab)	259	C.Y.	@	$30.00	Per C.Y.	$7,770.00

SUB-TOTAL FOR INSTALLATION: **$80,198.00**

TOTAL OPINION OF COST FOR MATERIAL AND INSTALLATION: **$223,211.00**

Please feel free to call me if you have any questions.

Sincerely,

Jeramy Sherwood

Jeramy Sherwood

815 941 4549
331 318 5347
www.stormtrap.com
info@stormtrap.com
1287 Windham Parkway
Romeoville, Illinois 60446

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CITY OF COLORADO SPRINGS
EAST BOULDER ST & PITKIN ST DRAINAGE IMPROVEMENTS
COLORADO SPRINGS, COLORADO
30% PRELIMINARY DESIGN DRAWINGS

NOVEMBER 2017

LOCATION MAP
NTS

N
VICINITY MAP
NTS

SHEET INDEX

AGENCIES

SERVICE	ENTITY	POINT OF CONTACT
PREPARED FOR:	CITY CAPITAL IMPROVEMENTS 30 SOUTH NEVADA AVENUE, SUITE 401 COLORADO SRPINGS. CO 80903	ADAM COPPER, PE (719) 385-XXXX
CIVIL ENGINEER:	CH2M HILL 9189 S JAMAICA ST ENGLEWOOD, CO 80112	ALLEN TURNER, PE (720) 286-4510
ENGINEERING DIVISION:	CITY OF COLORADO SPRINGS 30 S. NEVADA AVE. SUITE 401 COLORADO SPRINGS, CO 80903	MIKE CHAVEZ (719) 385-5408
WATER/WASTEWATER:	SPRINGS UTILITIES 1521 HANCOCK EXPRESSWAY COLORADO SPRINGS, CO 80901	ADAM BAKER (719) 668-4737

REVIEWED BY

CITY ENGINEERING DIVISION

BY: _____
ROADWAY DATE

BY: _____
TRAFFIC DATE

BY: _____
WATER RESOURCE DIVISION DATE

CITY STREETS DIVISION

BY: _____
DATE

SPRINGS UTILITIES WATER/WASTEWATER

BY: _____
DATE

UTILITY NOTIFICATION CENTER
OF COLORADO
CALL BEFORE YOU DIG
811
Call 2 days prior to any digging, grading or excavating for the marking of underground member utilities

DETAILED DRAINAGE CONSTRUCTION PLANS AND SPECIFICATIONS ENGINEERS STATEMENT

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

ALLEN TURNER, P.E. ######### DATE
FOR AND ON BEHALF OF CH2M ENGINEERS

PRELIMINARY NOT FOR CONSTRUCTION

NO.	DATE	REVISION	BY	APVD
DSGN	JM	DR	CHK	BS
			AT.	APVD
				AT.

9189 SOUTH JAMAICA ST
ENGLEWOOD, CO 80112
ch2m:

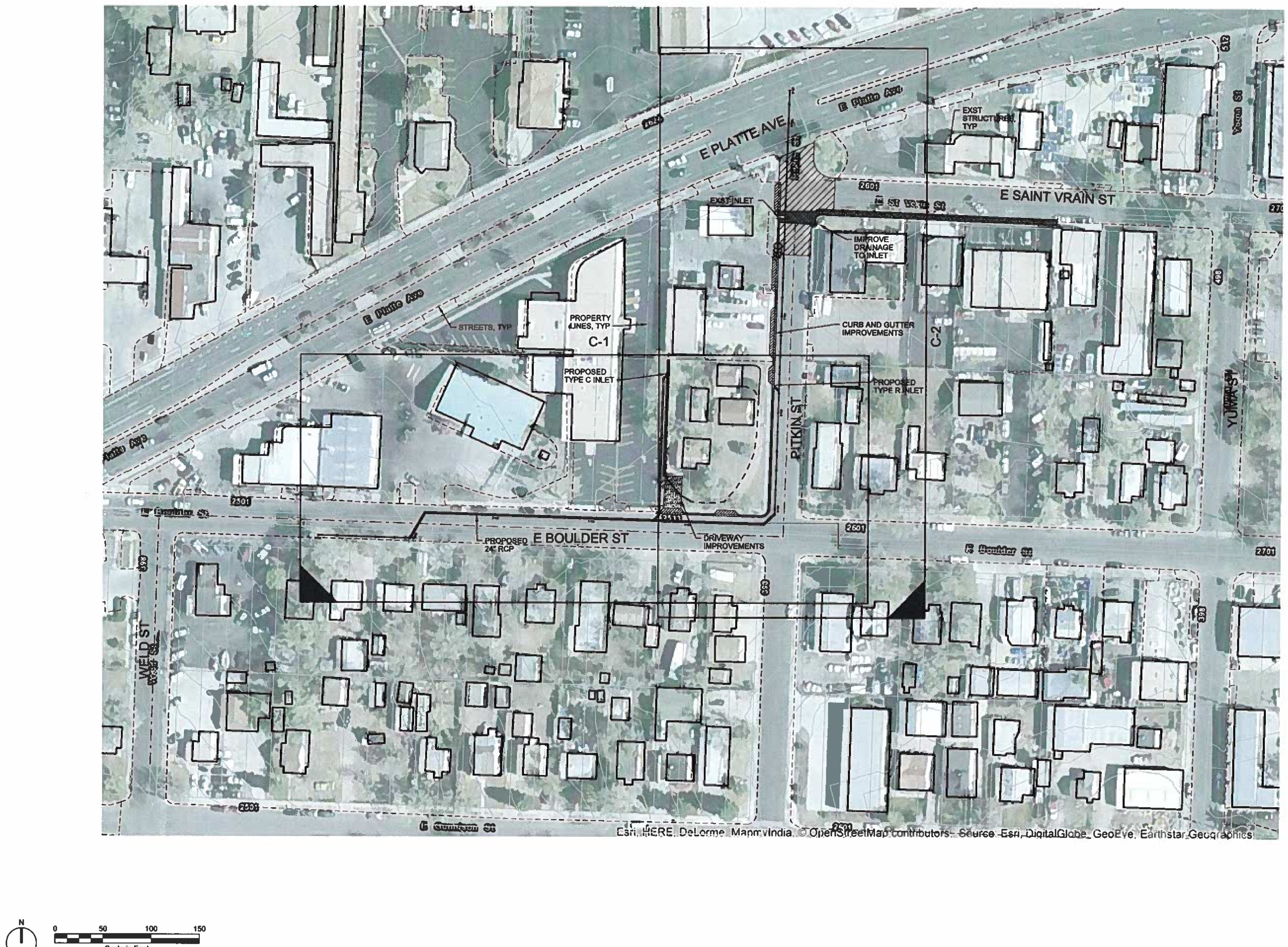
WATER RESOURCES ENGINEERING
COLORADO SPRINGS UTILITIES

LITTLE SHOOKS RUN -BOULDER & PITKIN IMPROVEMENTS
COVER SHEET

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	NOVEMBER 2017
PROJ	691414
DWG	G-1
SHEET	1 of 7

30% DOCUMENT



PRELIMINARY
NOT FOR
CONSTRUCTION

NO.	DATE	REVISION	BY	APVD

DSGN JM | DR BS | CHK AT | APVD AT

ch2m:

9189 SOUTH JAMAICA ST
ENGLEWOOD, CO 80112

COLORADO SPRINGS OLYMPIC CITY USA

WATER RESOURCES ENGINEERING

LITTLE SHOOKS RUN -BOULDER & PITKIN IMPROVEMENTS

OVERALL SITE PLAN AND KEYMAP

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	NOVEMBER 2017
PROJ	691414
DWG	G-3
SHEET	2 of 7

30% DOCUMENT

$PWURL $PWPATH FILENAME: LSP-050-C-G002.dgn PLOT DATE: 2017\11\01 PLOT TIME: 1:58:54 PM

GENERAL SITE NOTES:

1. SOURCE OF TOPOGRAPHY SHOWN ON THE CIVIL PLANS ARE BASE MAPS PROVIDED BY THE CITY OF COLORADO SPRINGS IN 2011 CITY FIMS DATA, NAVD88 STATE PLAN CENTRAL COORDINATE SYSTEM. EXISTING CONDITIONS MAY VARY FROM THOSE SHOWN ON THESE PLANS.
2. THE CONTRACTOR SHALL VERIFY EXISTING CONDITIONS AND ADJUST WORK PLAN ACCORDINGLY PRIOR TO BEGINNING CONSTRUCTION. EXISTING TOPOGRAPHY, STRUCTURES, AND SITE FEATURES ARE SHOWN SCREENED AND/OR LIGHT-LINED. NEW FINISH GRADE, STRUCTURES, AND SITE FEATURES ARE SHOWN HEAVY-LINED UNLESS INDICATED OTHERWISE ON PLANS.
3. MAINTAIN, RELOCATE, OR REPLACE EXISTING SURVEY MONUMENTS, CONTROL POINTS, AND STAKES WHICH ARE DISTURBED OR DESTROYED.
4. PERFORM THE WORK TO PRODUCE THE SAME LEVEL OF ACCURACY AS THE ORIGINAL MONUMENT(S) IN A TIMELY MANNER, AND AT THE CONTRACTOR'S EXPENSE.
5. STAGING AREA SHALL BE FOR CONTRACTOR'S EMPLOYEE PARKING, CONTRACTOR'S TRAILERS AND ON-SITE STORAGE OF MATERIALS. PROVIDE TEMPORARY FENCING AS NECESSARY TO MAINTAIN SECURITY AT ALL TIMES.
6. ELEVATIONS GIVEN ARE TO FINISH GRADE UNLESS OTHERWISE SHOWN.
7. SLOPE UNIFORMLY BETWEEN CONTOURS AND SPOT ELEVATIONS SHOWN.
8. CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING AND MAINTAINING EROSION CONTROL DEVICES DURING CONSTRUCTION.
9. CONTRACTOR SHALL TAKE ALL OTHER MEASURES TO POSITIVELY PRECLUDE EROSION MATERIALS FROM LEAVING THE SITE.

ABBREVIATIONS

ACI	AMERICAN CONCRETE INSTITUTE
ACWWA	ARAPAHOE COUNTY WATER AND WASTEWATER AUTHORITY
ADDL	ADDITIONAL
ADJ	ADJACENT
AGGR	AGGREGATE
APVD	APPROVED
AVG	AVERAGE
@	AT
BETW	BETWEEN
BL	BASELINE
BOC	BOTTOM OF CONCRETE
BPS	BEGIN POOL SECTION, LOOKING DOWNSTREAM
BRS	BEGIN RIFFLE SECTION, LOOKING DOWNSTREAM
BVC	BEGINNING OF VERTICAL CURVE
CFS	CUBIC FEET PER SECOND
CCBWQA	CHERRY CREEK BASIN WATER QUALITY AUTHORITY
CIP	CAST IN PLACE
CJ	CONSTRUCTION JOINT
CL	CENTERLINE
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
CONDO	CONDOMINIUM
CONT	CONTINUED, CONTINUOUS, CONTINUATION
COORD	COORDINATE
CS	CROSS SECTION
CTR	CENTER
CU FT	CUBIC FOOT
CY, CU YD	CUBIC YARD
DIA	DIAMETER
DT	DETAIL
EA	EACH
ECCV	EAST CHERRY CREEK VALLEY WATER AND SANITATION DISTRICT
EG	EXAMPLE
EL	ELEVATION, EASEMENT LINE
ENGR	ENGINEER
EQ	EQUATION
EQL	EQUAL
ESC	EROSION AND SEDIMENT CONTROL
EXST, EXIST	EXISTING
FIG	FIGURE
FES	FLARED END SECTION
FG	FINISH GRADE
FL	FLOW LINE
FT	FOOT OR FEET
FPS	FEET PER SECOND
G, GND	GROUND
GESC	GRADING, EROSION, AD SEDIMENT CONTROL
GPS	GLOBAL POSITION SYSTEM
HGL	HYDRAULIC GRADE LINE
HGT	HEIGHT
HORIZ	HORIZONTAL
INV EL	INVERT ELEVATION
IN	INCH
INV, INVT	INVERT
IP	INLET PROTECTION
JCT	JUNCTION
L	LENGTH
LAT	LATITUDE
LB	POUND
LB/FT^2	POUNDS PER SQUARE FOOT
LF	LINEAR FEET
LONG	LONGITUDINAL
LT	LEFT
MAX	MAXIMUM
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
NAVD	NORTH AMERICAN VERTICAL DATUM
N	NORTH
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NIC	NOT IN CONTRACT
NO., #	NUMBER
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
O.F.	OUTSIDE FACE
OPP	OPPOSITE
OZ	OUNCE
PC	POINT OF CURVE
PI	POINT OF INTERSECTION
PL	PROPERTY LINE
POB	POINT OF BEGIN
POE	POINT OF END
PP	POWER POLE
PRC	POINT OF REVERSE CURVE
PRCST	PRECAST
PROP	PROPERTY
PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE
PVI	POINT OF VERTICAL INTERSECTION
PVMT	PAVEMENT
PVT	POINT OF VERTICAL TANGENCY
R OR RAD	RADIUS
RCP	REINFORCED CONCRETE PIPE
REC	RECORDED
REF	REFER OR REFERENCE
REINF	REINFORCED, REINFORCING, REINFORCE
REQD	REQUIRED
RT	RIGHT
S	SLOPE, SOUTH
SB	SEDIMENT BASIN
SCHED	SCHEDULE
SECT	SECTION
SED	SEDIMENTATION
SEMSWA	SOUTHEAST METRO STORMWATER AUTHORITY
SH	SHEET
SPEC, SPECS	SPECIFICATIONS
SQ	SQUARE
SQ FT	SQUARE FOOT, FEET
SQ IN	SQUARE INCH
SQ YD	SQUARE YARD
ST	STORM DRAIN
STA	STATION
STD	STANDARD
STRL	STRUCTURAL
T	SHEAR
T&B	TOP AND BOTTOM
TAN	TANGENT
TB	TOP OF BOULDER
TCE	TEMPORARY CONSTRUCTION EASEMENT
TEL	TELEPHONE
THRU	THROUGH
TOC	TOP OF CONCRETE
TOF	TOP OF FOOTING
TOG	TOP OF GROUT, TOP OF GRATE
TOS	TOP OF SLAB
TOW	TOP OF WALL
TP	TURNING POINT
TRANS	TRANSITION
TYP	TYPICAL
UDFCD	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
VC	VERTICAL CURVE
VCC	VALLEY COUNTRY CLUB
VEL	VELOCITY
VERT	VERTICAL
VIF	VERIFY IN FIELD
VPC	POINT OF VERTICAL CURVATURE
VPI	POINT OF VERTICAL INTERSECTION
VPT	POINT OF VERTICAL TANGENT
W	WEST
W/	WITH
WS	WATER SURFACE

CIVIL LEGEND

EXISTING / THIS CONTRACT

- BM — BENCH MARK
- BRIDLE EASEMENT
- BRUSH/TREE LINE
- CENTER LINE, BUILDING, ROAD, ETC.
- CHANNEL STATIONING AND CENTERLINE (10+00)
- CONTOUR LINE (5280)
- CULVERT
- DEMOLITION (OR)
- DRAINAGE WAY OR DITCH
- FENCE LINE
- OVERHEAD POWERLINE (E-OVH)
- PROPERTY LINE
- CATCH BASIN OR INLET (CB OR CB)
- ELECTRIC OVERHEAD POWER POLE
- ELECTRIC TRANSFORMER
- FENCE POST OR GUARD POST
- FIRE HYDRANT
- GUY ANCHOR
- LIGHT POLE
- MANHOLE (D OR S)
- SLOPE, DIRECTION OF FLOW
- STRUCTURE, BUILDING OR FACILITY
- SPOT ELEVATION (5280.1)
- SURVEY CONTROL POINT OR POINT OF INTERSECTION
- UTILITY POLE
- WATER
- INLETS, TYPE R & C
- PROPOSED RCP
- ASPHALT REPLACEMENT
- CONCRETE GUTTER
- CONCRETE SIDEWALK CONCRETE GUTTER PAN
- CONCRETE RAMP
- ROADBASE CLASS 6

SECTION / DETAIL DESIGNATIONS

SECTION (LETTER) OR DETAIL (NUMERAL) DESIGNATION — DRAWING NUMBER (REPLACED WITH A LINE IF TAKEN AND SHOWN ON SAME SHEET) — ON DRAWING WHERE SECTION OR DETAIL IS TAKEN: 100-A-10010A1 — DRAWING NUMBER WHERE SHOWN

B SECTION — SCALE — 100-S-3001 — ON DRAWING WHERE SECTION IS SHOWN: DRAWING NUMBER(S) WHERE TAKEN

2 DETAIL — SCALE — 200-M-10B10A — ON DRAWING WHERE DETAIL IS SHOWN: DRAWING NUMBER(S) WHERE TAKEN

TITLE — SCALE — ON DRAWING WHERE ONLY A TITLE IS REQUIRED WITH NO REFERENCE (EG: ELEVATIONS)

B — SECTION CALLOUT WHERE SECTION IS ON THE SAME SHEET AND CUT EXTENDS TO A FIXED LIMIT

B / C-1 — SECTION CALLOUT WHERE SECTION IS ON ANOTHER SHEET AND CUT EXTENDS THROUGHOUT ENTIRE SHEET

1 — KEYNOTE NUMBER

1 — REVISION / ADDENDA NUMBER

N — NORTH ARROW

SHEET LIMITS KEY

DRAWING NUMBER PP-X — LOWER LEFT CORNER DWG

PRELIMINARY NOT FOR CONSTRUCTION

NO.	DATE	DSGN	DR	CHK	BS	REVISION	BY	APVD
			JM				AT	

ch2m:
9189 SOUTH JAMAICA ST
ENGLEWOOD, CO 80112

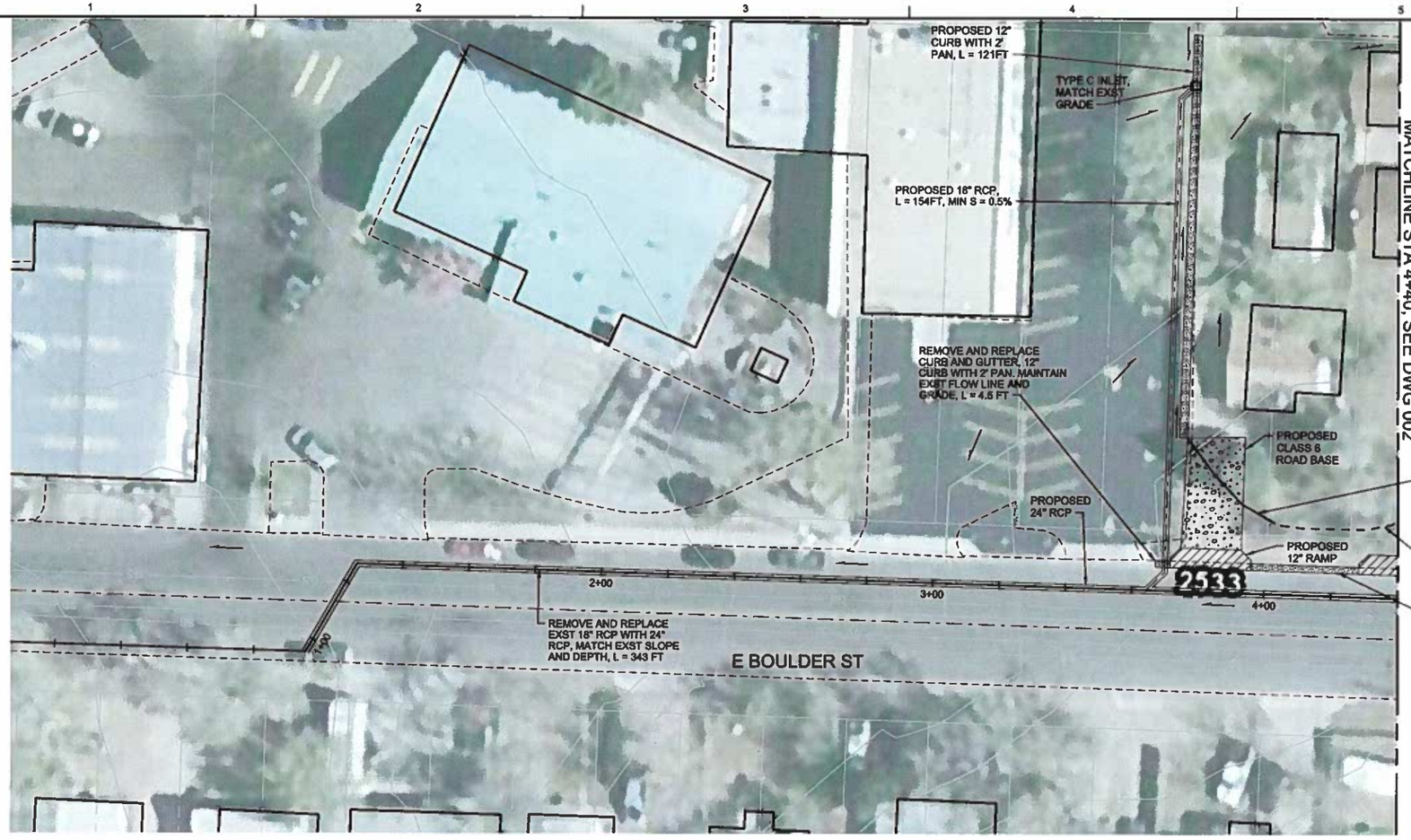
LITTLE SHOOKS RUN -BOULDER & PITKIN IMPROVEMENTS

NOTES, ABBREVIATIONS AND LEGEND

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	NOVEMBER 2017
PROJ	691414
DWG	G-2
SHEET	3 of 7

30% DOCUMENT

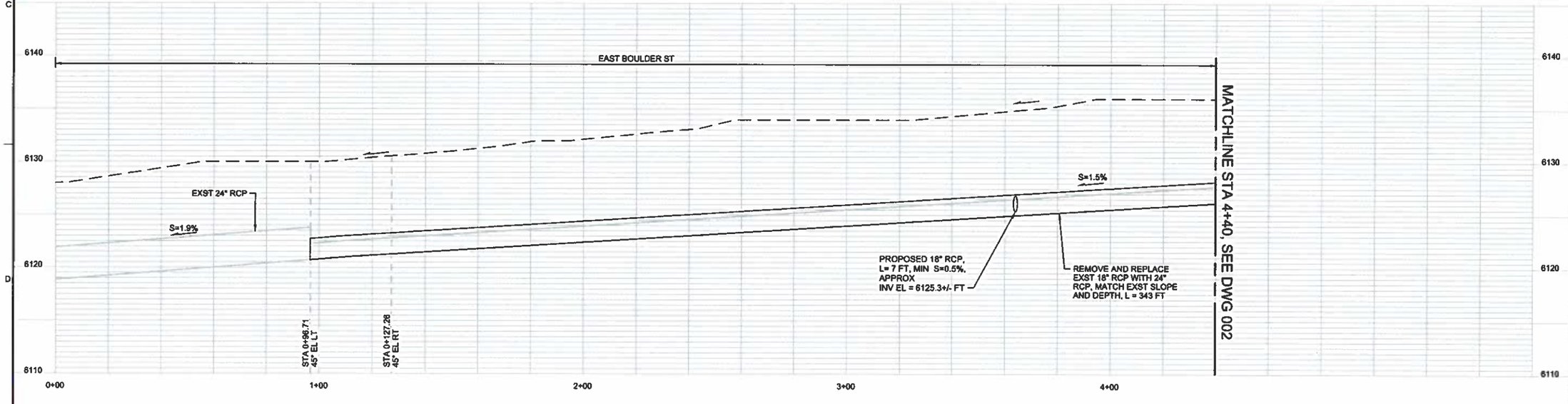


NOTE:

1. ELEVEATION'S NOTED ON THESE PLANS ARE BASED ON 2011 2' LIDAR DATA AND ARE APPROXIMATE. IN ALL CASES, PROPOSED FLOW LINE ELEVATIONS ARE TO MATCH EXISTING CONDITIONS OR MODIFIED PER OWNERS REPRESENATIVE.

N

0 20 40 60
Scale In Feet



PRELIMINARY NOT FOR CONSTRUCTION

NO.	DATE	DSGN	DR	CHK	APVD	BY	APVD
		JM	BS	AT	AT		

REVISION

9189 SOUTH JAMAICA ST
ENGLEWOOD, CO 80112
ch2m:

WATER RESOURCES ENGINEERING
COLORADO SPRINGS

LITTLE SHOOKS RUN -BOULDER & PITKIN IMPROVEMENTS

STA 0+00 TO STA 4+40

30% DOCUMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"

DATE	NOVEMBER 2017
PROJ	691414
DWG	C-1
SHEET	4 of 7

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