

**FINAL DRAINAGE REPORT
FOR
A-1 CHIPSEAL
LOT 36 AND 37 CLAREMONT BUSINESS PARK FIL NO 2
7245 COLE VIEW
COLORADO SPRINGS, COLORADO**

MAY 2022

Prepared For:
A-1 CHIPSEAL
7245 Cole View
Colorado Springs, CO 80915
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Prepared By:
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TNE Job No. 2173.00
County Job No. COM-22-014

**FINAL DRAINAGE REPORT
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DESIGN ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Dane Frank, P.E. 50207
On behalf of Terra Nova Engineering, Inc.

Date

OWNER/DEVELOPER'S STATEMENT:

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

Authorized Signature

Date

Printed Name, Title

Business Name

Address

EL PASO COUNTY:

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

Josh Palmer, P.E.
Interim County Engineer

Date

Conditions:

I apologize for all the changes here, Joshua Palmer was just hired as the County Engineer. Please Change to: "County Engineer/ECM Administrator"

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PURPOSE

The purpose of this Final Drainage Report is to identify and analyze the proposed drainage patterns, determine proposed runoff quantities, size drainage structures for conveyance of developed runoff, and present solutions to drainage impacts on-site and off-site resulting from this development. The site has previously been platted and has previously been studied in:

“Final Drainage Report for Claremont Business Park Filing No. 2”, dated November 2006, prepared by Matrix Design Group.

GENERAL DESCRIPTION

This Final Drainage Report (FDR) is an analysis of approximately 1.36 acres of developed land located at 7245 and 7231 Cole View. This site is currently in use as a paving business. This report and water quality are required because 0.38 acres of asphalt was recently added to the southern portion of the site. The site is in the northeast quarter of Section 8, Township 14 South, Range 65 West of the 6th Principal Meridian within El Paso County. The parcels are bounded to the north and west by Sand Creek, to the southwest by LOT 35 CLAREMONT BUSINESS PARK FIL NO 2, to the southeast by LOTS 13 AND 14 CLAREMONT BUSINESS PARK FIL NO 2, and to the north by LOT 39 CLAREMONT BUSINESS PARK FIL NO 2. (see vicinity map).

The site lies within the Sand Creek Basin, with storm runoff surface draining west across the site, then into a gutter that flows off the site to the south, eventually entering a storm inlet, which drains into the adjacent East Fork Sand Creek. There are also storm inlets in Marksheffel Road that flow into a storm sewer that flows south along Marksheffel to an unknown outfall, which presumably also drains into Sand Creek.

Soils for this project are delineated by the map in the appendix as Ellicott loamy coarse sand, 0 to 5 percent slopes (28). Soils in the study area are shown as mapped by NRCS in the “Soils Survey of El Paso County Area” and contains soils of Hydrologic Group A.

The site is developed with mostly pavement and roof surfaces, and a small amount of landscaping. The site drains to the west, with an average slope of 3.7%.

EXISTING DRAINAGE CONDITIONS

The site was previously developed with one building and outdoor parking and equipment storage. Historically, the area that has now been given an asphalt surface was composed of dirt with little to no vegetation. There are two drainage basins. See attached Existing Drainage Map (in appendix).

Basin EX-A is 1.01 acres that is mostly roof and parking area and drains to Design Point A and leaves the site in an existing carry curb. Basin EX-A has flows of $Q_5 = 4.4$ cfs and $Q_{100} = 8.6$ cfs.

Basin EX-B is 0.35 acres that is mostly landscaping and half a street and drains to Design Point B at the south corner of the site and flows offsite in the street gutter. Basin EX-B has flows of $Q_5 = 1.2$ cfs and $Q_{100} = 2.7$ cfs.

The "existing conditions" should be the conditions prior to the additional asphalt, as this drainage report is retroactively addressing the recent paving.

PROPOSED DRAINAGE CONDITIONS

The proposed drainage conditions are the same as the existing drainage conditions, with the addition of a full infiltration water quality sand filter in the west corner of the site. The County is requiring the addition of a water quality structure retroactively following paving of 0.38 acres on the south side of the site. “The Final Drainage Report For Claremont Business Park Filing No. 2” assumed weighted coefficients of $C(5)=0.80$ and $C(100)=0.90$ for the proposed drainage basin which included this project site. In the appendix, this report has calculated weighted coefficients of $C(5)=0.86$ and $C(100)=0.94$ for Basin EX-A and $C(5)=0.71$ and $C(100)=0.84$ for Basin EX-B. Therefore, the imperviousness used in both reports match.

At the west corner of the site a full infiltration water quality sand filter will treat flow from Basin EX-A ($Q_5=4.4$ cfs and $Q_{100}=8.6$ cfs). Runoff entering the sand filter will flow in from gutters on two sides, and sheet flow in from the asphalt area. Runoff entering the sand filter will flow down a riprap rundown to the filter sand. After flowing through the filter sand, the runoff infiltrates into the ground. Any flow above the WQCV will enter the sand filter and flow out the existing curb chase in the corner of the sand filter / site if the water ponds high enough. The 1.01 acres tributary to the sand filter are 95% impervious. Based upon this we need a WQCV of 0.013 ac-ft. No detention volume is included in the sand filter. The top of the filter sand is at an elevation of 6333.6 feet and the top of the WQCV is at 6334.52 feet. The highest point on the wall will be at an elevation of 6337.1 feet and the top of the filter sand will be at an elevation of 6333.6 feet. Therefore, the largest distance from the top of the sand filter wall to the finished grade at the bottom of the wall will be approximately 3.5 feet.

In an effort to protect receiving water and as part of the “four-step process to minimize adverse impacts of urbanization” this site was analyzed in the following manner:

1. Reduce Runoff- The only development included in this FDR is the addition of a water quality structure. There is no runoff reduction associated with the installation of a water quality structure.
2. Stabilize Drainageways- There are no existing or proposed drainageways onsite. The adjacent East Fork Sand Creek has previously been stabilized and runoff from the site currently flows to a storm sewer system that discharges into East Fork Sand Creek.
3. Provide Water Quality Capture Volume (WQCV)- The proposed sand filter has been sized and designed to sufficiently capture the required WQCV and infiltrate the entire volume, thereby allowing solids and contaminants to settle out.
4. Consider Need for Industrial and Commercial BMPs- A water quality structure doesn't require any Industrial and Commercial BMPs. As the site is currently used for a paving business, there are likely existing industrial BMPs in place at the site. However, no industrial or commercial BMPs are required for the site.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County Storm Drainage Design Criteria Manual - Volumes 1 & 2, latest editions. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals. The Mile High Flood District Urban Drainage Criteria Manual was used to calculate the detention and water quality volume.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County Storm Drainage Design Criteria Manual – Volumes 1 & 2, latest editions. The pertinent data sheets are included in the appendix of this report.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain, as determined by Flood Insurance Rate Map No. 08041C0752 G, dated December 7, 2018 (see appendix).

WATER QUALITY

The proposed full infiltration water quality sand filter provides water quality treatment for all of the recently added 0.38 acres of asphalt, as well as most of the remainder of the site. Since full infiltration water quality is proposed, an on-site infiltration test meeting the County's standards is required. The percolation test has been added to the appendix.

There is no water quality treatment for existing basin EX-B. This basin is already fully developed and no changes to it are proposed.

CONSTRUCTION COST OPINION

Public Reimbursable

None

Public Non-Reimbursable

None

Private Non-Reimbursable

1. Sand Filter	1 EA	\$ 20,000	<u>\$ 20,000</u>
		Total \$	20,000

DRAINAGE FEES

This drainage report is part of a site development application; therefore, no drainage fees are due.

MAINTENANCE

The sand filter is private and will be maintained by the property owner.

SUMMARY

Development of this site will not adversely affect the surrounding development. This report is in general conformance with the previous reports which included this site. Site runoff and storm drain appurtenances from the A-1 Chipseal development will not adversely affect the downstream and surrounding developments and will be safely routed to the proposed sand filter to slowly treat the water quality capture volume. Runoff leaving the site is routed to the existing public storm sewer system.

PREPARED BY:
TERRA NOVA ENGINEERING, INC.

Dane Frank, P.E.
Project Engineer

BIBLIOGRAPHY

El Paso County Drainage Criteria Manual-Volumes 1 & 2, latest edition

El Paso County Board Resolution No 15-042 (Adoption of Chapter 6 and Section 3.2.1 Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014, Hydrology and Full Spectrum Detention)

“Final Drainage Report for Claremont Business Park Filing No. 2”, dated November 2006, prepared by Matrix Design Group.

Mile High Flood District-Volumes 1, 2, & 3, latest edition

VICINITY MAP

El Paso County - Community: Property Search

Schedule Number: 5408102040

A-1 Chipseal - Vicinity Map



North is up ^

GENERAL LOCATION MAP

A-1 Chipseal - Location Map

Image Dated May 2020

EAST
FORK
SAND
CREEK

SITE

Cole View

Google Earth



100 ft

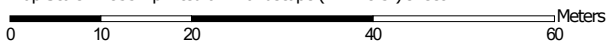


NRCS SOILS MAP

Soil Map—El Paso County Area, Colorado
(7245 Cole View - A1 Chipseal)



Map Scale: 1:833 if printed on A landscape (11" x 8.5") sheet.



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



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil 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 19, Aug 31, 2021

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	1.2	100.0%
Totals for Area of Interest		1.2	100.0%

El Paso County Area, Colorado

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Ellicott and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting

Landform: Flood plains, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile

A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R069XY031CO - Sandy Bottomland LRU's A and B
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquoll

Percent of map unit: 1 percent

Landform: Swales

Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 19, Aug 31, 2021

FEMA FIRM MAP

NOTES TO USERS

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

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

Coastal Base Flood Elevations shown on this map apply only to landward of 0' North American Vertical Datum of 1988 (NAVD83). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 24 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

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

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geospatial Vertical Datum of 1993 and the North American Vertical Datum of 1988, visit the National Geospatial Survey website at <http://www.ngs.noaa.gov> or contact the National Geospatial Survey at the following address:

NGS Information Services
 NOAA, NNGS-12
 National Geospatial Survey
 SSMC-3, #9022
 1315 East-West Highway
 Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geospatial Survey at (301) 715-3242 or visit its website at <http://www.ngs.noaa.gov>.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

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

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

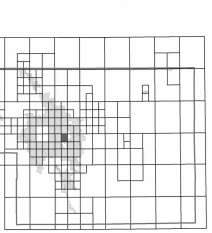
Contact **FEMA Map Service Center (MSC)** via the FEMA Map Information eXchange (FMIX) 1-877-335-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-368-9620 and its website at <http://www.msc.fema.gov>.

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

El Paso County Vertical Datum Offset Table

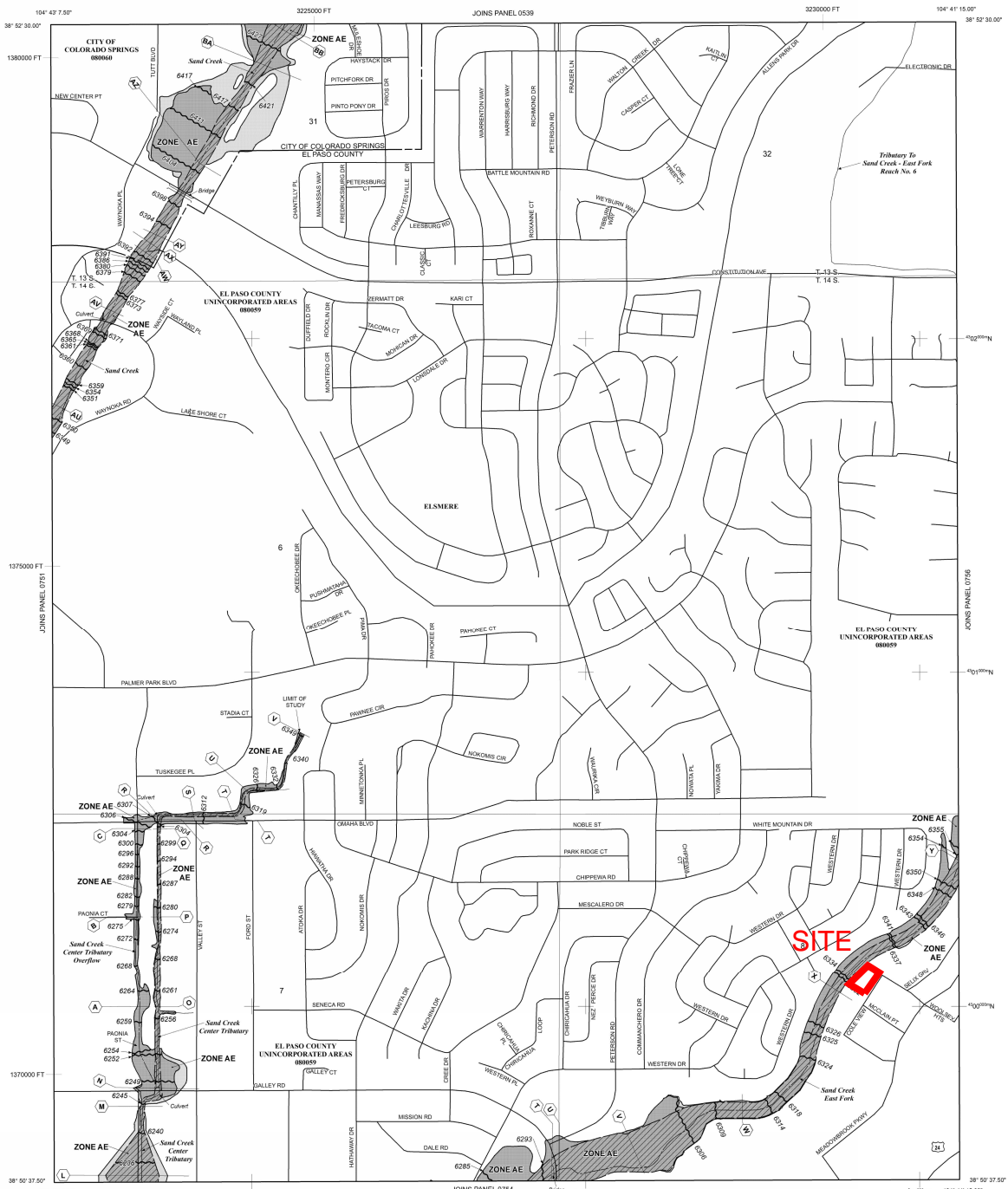
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 33 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM-BY-STREAM VERTICAL DATUM CONVERSION INFORMATION.	

Panel Location Map



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

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



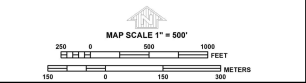
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST, AND TOWNSHIP 14 SOUTH, RANGE 65 WEST.

LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
- ZONE AE**
 No Base Flood Elevations determined.
 Base Flood Elevations determined.
- ZONE AH**
 Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); Base Flood Elevations determined.
- ZONE AO**
 Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR**
 Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently identified. Zone AR indicates that the former flood control system is being retained to provide protection from the 1% annual chance or greater flood.
- ZONE A99**
 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V**
 Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE**
 Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
- FLOODWAY AREAS IN ZONE AE
- OTHER FLOOD AREAS
- ZONE X**
 Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average stream depths of less than 1 foot in any given area. Areas less than 1 square mile, and areas protected by levees from 1% annual chance flood.
- ZONE X**
 Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE D**
 Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
- OTHERWISE PROTECTED AREAS (OPAs)
- CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area of different Base Flood Elevations, flood depths or flood velocities.
- Base Flood Elevation line and value; elevation in feet* (EL 987)
- Base Flood Elevation value where uniform within zone; elevation in feet*
- * Referenced to the North American Vertical Datum of 1988 (NAVD 88)
- Cross section line
- Transect line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 100-meter Universal Transverse Mercator grid ticks, zone 13
- 500-foot grid ticks: Colorado State Plane coordinate system, central zone (PROJZONE 020), Lambert Conformal Conic Projection
- Bench mark (See explanation in Notes to Users section of this FIRM panel)
- River Mile
- MAP REPOSITORIES
 Refer to Map Repositories list on Map Index
- EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
 MARCH 17, 1997
- EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
 DECEMBER 7, 2018: To update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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

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



PANEL 0752G

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

PANEL 752 OF 1300
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

COUNTY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS CITY OF	88800	0752	G
EL PASO COUNTY	88800	0752	G

Note: This map was last reissued on 05/13/2020 to make a corrected map. This version includes any previous revisions. See the Notice-to-User letter that accompanied this correction for details.

MAP NUMBER
08041C0752G
MAP REVISED
DECEMBER 7, 2018
 Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

A-1 CHIPSEAL
(Area Runoff Coefficient Summary)

EXISTING CONDITIONS

		<i>STREETS / DEVELOPED</i>			<i>OVERLAND / UNDEVELOPED</i>			<i>WEIGHTED</i>	
BASIN	TOTAL AREA	AREA	C₅	C₁₀₀	AREA	C₅	C₁₀₀	C₅	C₁₀₀
	<i>(Acres)</i>	<i>(Acres)</i>			<i>(Acres)</i>				
EX-A	1.01	0.96	0.90	0.96	0.05	0.16	0.51	0.86	0.94
EX-B	0.35	0.26	0.90	0.96	0.09	0.16	0.51	0.71	0.84

Calculated by: DLF
Date: 8/5/2020
Checked by: LD

DEVELOPED CONDITIONS

		<i>STREETS / DEVELOPED</i>			<i>OVERLAND / UNDEVELOPED</i>			<i>WEIGHTED</i>	
BASIN	TOTAL AREA	AREA	C₅	C₁₀₀	AREA	C₅	C₁₀₀	C₅	C₁₀₀
	<i>(Acres)</i>	<i>(Acres)</i>			<i>(Acres)</i>				
EX-A	1.01	0.96	0.90	0.96	0.05	0.16	0.51	0.86	0.94
EX-B	0.35	0.26	0.90	0.96	0.09	0.16	0.51	0.71	0.84

Calculated by: DLF
Date: 4/4/2022
Checked by: LD

**A-1 CHIPSEAL
AREA DRAINAGE SUMMARY**

EXISTING CONDITIONS

BASIN	AREA TOTAL (Acres)	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				T_t	INTENSITY		TOTAL FLOWS	
		C_5	C_{100}	C_5	Length (ft)	Slope (ft/ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
EX-A	1.01	0.86	0.94	0.86	100	0.03	3.0	300	3%	3.5	1.4	5.0	5.0	9.1	4.4	8.6
EX-B	0.35	0.71	0.84	0.71	30	0.03	2.7	150	3%	3.5	0.7	5.0	5.0	9.1	1.2	2.7

DEVELOPED CONDITIONS

BASIN	AREA TOTAL (Acres)	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				T_t	INTENSITY		TOTAL FLOWS	
		C_5	C_{100}	C_5	Length (ft)	Slope (ft/ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
EX-A	1.01	0.86	0.94	0.86	100	0.03	3.0	300	3%	3.5	1.4	5.0	5.0	9.1	4.4	8.6
EX-B	0.35	0.71	0.84	0.71	30	0.03	2.7	150	3%	3.5	0.7	5.0	5.0	9.1	1.2	2.7

Calculated by: DLF

Date: 4/4/2022

Checked by: LD

A-1 CHIPSEAL
PROPOSED SURFACE ROUTING SUMMARY

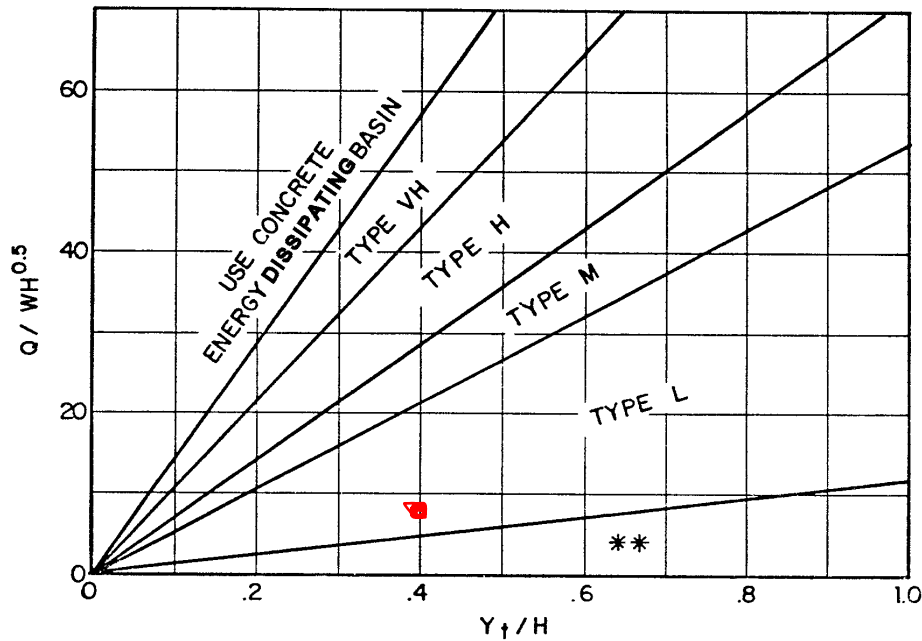
<i>Design Point(s)</i>	<i>Contributing Basins</i>	<i>Area Ac</i>	<i>Flow</i>	
			<i>Q₅</i>	<i>Q₁₀₀</i>
A	EX-A	1.01	4.4	8.6
B	EX-B	0.35	1.2	2.7

Calculated by: DLF

Date: 4/4/2022

Checked by: LD

Type M riprap is used when only Type L is necessary for sand filter.



Use H_d instead of H whenever culvert has supercritical flow in the barrel.
 **Use Type L for a distance of $3H$ downstream.

Figure 9-39. Riprap erosion protection at rectangular conduit outlet (valid for $Q/WH^{1.5} \leq 8.0$)

3.2.4 Outfalls and Rundowns

A grouted boulder outfall or “rundown” dissipates energy and provides erosion control protection. Grouted boulder outfalls are most commonly used in large rivers like the South Platte. Figure 9-40 provides a plan view and cross section for a standard grouted boulder rundown. See the grouted boulder drop profiles (A1, A2, and A3) in Figure 9-12 for site specific profile options, (i.e., depressed or free-draining basin for use with a stable downstream channel or with no basin for use in channels subject to degradation). Figure 9-41 provides a plan view of the same structure for use when the structure is in-line with the channel. Evaluate the following when designing a grouted boulder outfall or rundown:

- Minimize disturbance to channel bank
- Determine water surface elevation in receiving channel for base flow and design storm(s)
- Determine flow rate, velocity, depth, etc. of flow exiting the outfall pipe for the design storm(s)
- Evaluate permitting procedures and requirements for construction adjacent to large river system.

HYDRAULIC CALCULATIONS



March 4, 2022

A-1 Chipseal & Rocky Mountain Pavement, LLC (A-1 Chipseal)
2505 E. 74th Ave.
Denver, Colorado 80229

Attn: Stephanie Wallis – Controller
P: (720) 540-8264
E: swallis@a-1chipseal.com

Re: Letter for Geotechnical Services
A-1 Chipseal Percolation Testing
7231 Cole View
Colorado Springs, Colorado 80915
Terracon Project No. 23215092

Dear Ms. Wallis:

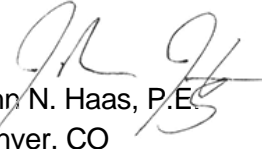
We have completed the Geotechnical services for the above referenced project. These services were performed in general accordance with Terracon Proposal No. 23215092 dated February 21, 2022. This letter presents the observations from the subsurface exploration and provides the test results from our percolation testing.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this letter or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Will Modrall

Will A. Modrall
Colorado Springs, CO
Geotechnical Department Manager


John N. Haas, P.E.
Denver, CO
Geotechnical Department Manager

PROJECT UNDERSTANDING

The project is located at 7231 Cole View in Colorado Springs, Colorado. The site is currently developed with a commercial building, asphalt paved parking lot with associated drive lanes and parking stalls. We understand that the project consists of constructing and infiltration basin at the southwest corner of the parking area. Percolation testing has been requested to aid the design of the basin.

We understand the infiltration basin design is still pending, however the infiltration surface has been reported to be about 1 foot below existing grade.

EXPLORATION AND TESTING PROCEDURES

Per the percolation testing requirements (City of Colorado Springs policy clarification “Infiltration Testing Using Percolation Test Method,” dated January 9, 2017) a test pit was excavated to determine the soil profile and 3 percolation tests were performed adjacent to the test pit.

A-1 Chipseal excavated a test pit on Tuesday March 1, 2022. A Terracon representative observed the excavation and visually logged the subsurface material. The test pit was terminated at a depth of 7 feet. We understand that A-1 Chipseal backfilled the test pit on the same working day. Documentation of the testpit backfill was beyond the scope of our services and was not performed.

A-1 Chipseal removed asphalt pavement and base stone in three locations immediately adjacent to the test pit. On March 2, 2022 Terracon performed percolation testing at two of the three provided locations. Materials directly below the pavements in the area of percolation hole P-1 could not be excavated using hand methods. Therefore P-1 was relocated to the backfilled test pit. A Terracon representative then performed percolation testing in general accordance with the City of Colorado Springs policy clarification “Infiltration Testing Using Percolation Test Method,” dated January 9, 2017.

TEST PIT OBSERVATIONS

On March 1, 2022, a Terracon representative visually logged the subsurface material from the test pit. The test pit encountered soils that were visually classified as Silty Sand (SM) to a depth of 3 feet, overlying visually classified Poorly Graded Sand (SP) extending to the termination depth of the test pit. The test pit was terminated at a depth of 7 feet. Please refer to the test pit log attached to this letter for additional details.



PERCOLATION TEST RESULTS

A Terracon representative then performed percolation testing in general accordance with the City of Colorado Springs policy clarification “Infiltration Testing Using Percolation Test Method,” dated January 9, 2017.

The results of the percolation testing are reported below:

Percolation Test Hole	Depth of Hole (in)	Percolation Rate (in/hr)
P-1 (in test pit backfill)	12	27 ¹
P-2	12	4.5
P-3	12	2.0

1. Percolation test was performed in the uncontrolled backfill of the test pit and is not representative of the in-situ percolation rate of subsurface soils at this site.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Letter for Geotechnical Services

A-1 Chipseal Percolation Testing ■ Colorado Springs, Colorado 80915
March 4, 2022 ■ Terracon Project No. 23215092



Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

Site Location Plan

Exploration Plan

Test Pit Log

Photography Log

Percolation Test Results

ATTACHMENTS

Letter for Geotechnical Services

A1 Chip Seal Percolation Testing ■ Colorado Springs, Colorado 80915

March 4, 2022 ■ Terracon Project No. 23215092



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Letter for Geotechnical Services

A1 Chip Seal Percolation Testing ■ Colorado Springs, Colorado 80915

March 4, 2022 ■ Terracon Project No. 23215092

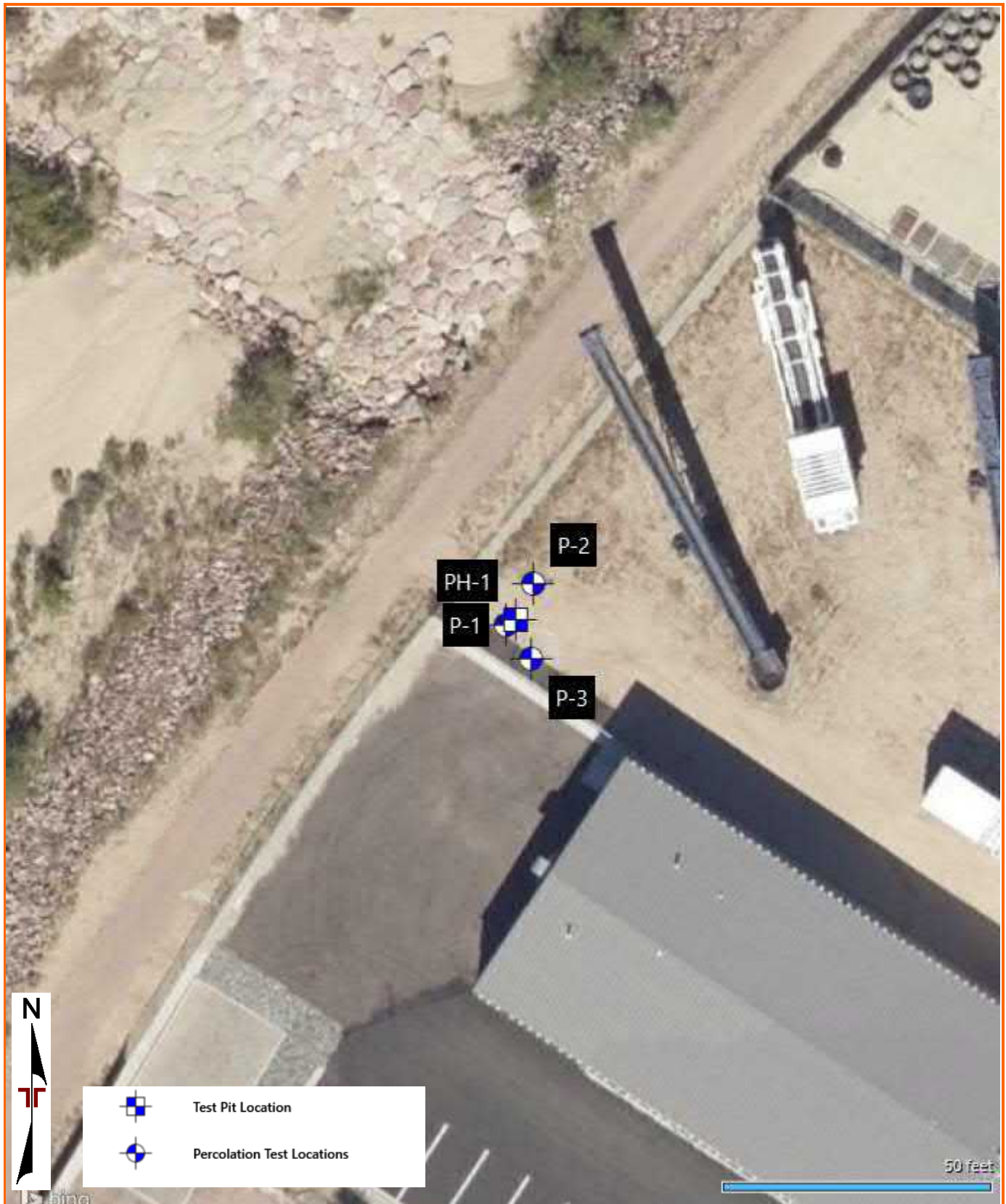


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

TEST PIT LOG NO. TP-1

PROJECT: A-1 ChipSeal Percolation Testing


CLIENT: A-1 Chipseal & Rocky Mountain Pavement
Denver, CO

SITE: 7231 Cole View
Colorado Springs, CO

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - 23215092 A-1 CHIPSEAL PERC.GPJ TERRACON DATATEMPLATE.GDT 3/4/22

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 38.8490° Longitude: -104.6913° Approximate Surface Elev.: 6341 (Ft.) +/- ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	DEPTH			
0.3	ASPHALT , about 4 inches	6340.5+/-		
1.0	SILTY SAND (SM) , fine to medium grained, light brown			
3.0				
7.0	POORLY GRADED SAND (SP) , fine to medium grained, brown	6338+/-		
	Test Pit Terminated at 7 Feet	6334+/-		

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: 24-inch Standard Tooth Bucket	See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any). See Supporting Information for explanation of symbols and abbreviations. Elevations were determined from Google Earth	Notes:	
Abandonment Method: Backfill of test pit was performed by others, not observed or documented by Terracon			
WATER LEVEL OBSERVATIONS <i>Groundwater not encountered</i>	 4172 Center Park Dr Colorado Springs, CO	Test Pit Started: 03-01-2022 Excavator: Bobcat E-42 Project No.: 23215092	Test Pit Completed: 03-01-2022 Operator: A-1 Chipseal

Letter for Geotechnical Services

A1 Chip Seal Percolation Testing ■ Colorado Springs, Colorado 80915

March 4, 2022 ■ Terracon Project No. 23215092



PHOTOGRAPHY LOG



General Test Location Layout



Sidewall and Bottom of Test Pit

Letter for Geotechnical Services

A1 Chip Seal Percolation Testing ■ Colorado Springs, Colorado 80915

March 4, 2022 ■ Terracon Project No. 23215092



Percolation Test Location P-1



Percolation Test Location P-2

Letter for Geotechnical Services

A1 Chip Seal Percolation Testing ■ Colorado Springs, Colorado 80915

March 4, 2022 ■ Terracon Project No. 23215092



Percolation Test Location P-3



Test Pit During Excavation

Field Percolation Rate Test



Field Percolation Rate Test					Terracon	
Project Name			A-1 Chipseal Perc		Test Hole	P-1
Project #			23215092		Date	3/2/2022
Engineer/Tech			KTH		Hole Diameter (in)	4
					Hole Depth (in)	12
Time	Length of Interval (min)	Total Time (min)	Beginning Water Level (in)	Ending Water Level (in)	Water Level Drop During Interval (in)	Percolation Rate (inches/hour)
11:30	10	10	12.5	16.0	3.5	21.0
11:40	10	20	12.5	17.1	4.6	27.6
11:50	10	30	11.5	16.0	4.5	27.0
12:00	10	40	12.5	16.0	3.5	21.0
12:10	10	50	12.0	16.5	4.5	27.0
12:20	10	60	10.5	15.0	4.5	27.0
12:30	10	70	12.5	15.8	3.3	19.5
12:40	10	80	10.5	15.0	4.5	27.0

Field Percolation Rate Test					Terracon	
Project Name			A-1 Chipseal Perc		Test Hole	P-2
Project #			23215092		Date	3/2/2022
Engineer/Tech			KTH		Hole Diameter (in)	4
					Hole Depth (in)	12
Time	Length of Interval (min)	Total Time (min)	Beginning Water Level (in)	Ending Water Level (in)	Water Level Drop During Interval (in)	Percolation Rate (inches/hour)
11:30	30	30	181.63	181.5	0.1	0.2
12:00	30	60	181.5	179.4	2.1	4.2
12:30	30	90	179.0	178.1	0.8	1.6
13:00	30	120	182.0	181.0	1.0	2.0
13:30	30	150	181.0	179.8	1.3	2.5
14:00	30	180	179.75	178.3	1.5	3.0
14:30	30	210	182.25	180.8	1.5	3.0
15:00	30	240	180.75	178.5	2.25	4.5

how was the water level measured if the hole depth was only 12"?

Field Percolation Rate Test



Field Percolation Rate Test					Terracon	
Project Name			A-1 Chipseal Perc		Test Hole	P-3
Project #			23215092		Date	3/2/2022
Engineer/Tech			KTH		Hole Diameter (in)	4
					Hole Depth (in)	12
Time	Length of Interval (min)	Total Time (min)	Beginning Water Level (in)	Ending Water Level (in)	Water Level Drop During Interval (in)	Percolation Rate (inches/hour)
11:30	30	30	179	178.0	1.0	2.0
12:00	30	60	178	177.1	0.8	1.6
12:30	30	90	177.0	176.4	0.6	1.2
13:00	30	120	180.0	179.8	0.3	0.6
13:30	30	150	179.8	178.1	1.6	3.2
14:00	30	180	177.13	176.0	1.2	2.4
14:30	30	210	182.25	180.3	2.0	4.0
15:00	30	240	180.25	179.3	1.0	2.0

INFILTRATION RATE TO VOLUME REQUIRED CONVERSION

2173.00 A-1 Chipseal
 Sand Filter - Full Infiltration Design Calcs
 Dane Frank, 2022/07/08

this is the average percolation rate, not the average infiltration rate.
 Infiltration Rate = Percolation Rate/Reduction Rate
 See City of Colorado Springs policy clarification "Infiltration Testing Using Percolation Test Method," dated January 9, 2017

Avg Infiltration Rate =
 (per Terracon Percolation Test)

3.25 in/hr

Sand Filter Surface Area =

1441 sq ft

Infiltration Rate of Sand Filter =

$$\frac{3.25 \text{ in}}{\text{hr}} \times \frac{1 \text{ ft}}{12 \text{ in}} \times 1441 \text{ sq ft} = \frac{390 \text{ cf}}{\text{hr}}$$

Volume Afer 12 Hours of Flow =

$$\frac{390 \text{ cf}}{\text{hr}} \times 12 \text{ hr} \times \frac{1 \text{ ac}}{43560 \text{ sq ft}} = \frac{0.108 \text{ ac-ft}}{\text{hr}}$$

Required WQCV =

0.033 ac-ft

Required volume exceeded by 3.3 times

(per UD-Detention Spreadsheet)

Underdrains are required for sand filters and should be provided if infiltration tests show infiltration rates slower than 2 times the required WQCV over 12 hours.

Please include UD-BMP
calculation spreadsheet for
sand filter basin design.
Unresolved.

DRAINAGE MAPS

A-1 CHIPSEAL COLORADO SPRINGS EXISTING DRAINAGE MAP JULY 2022

BASIN SUMMARY

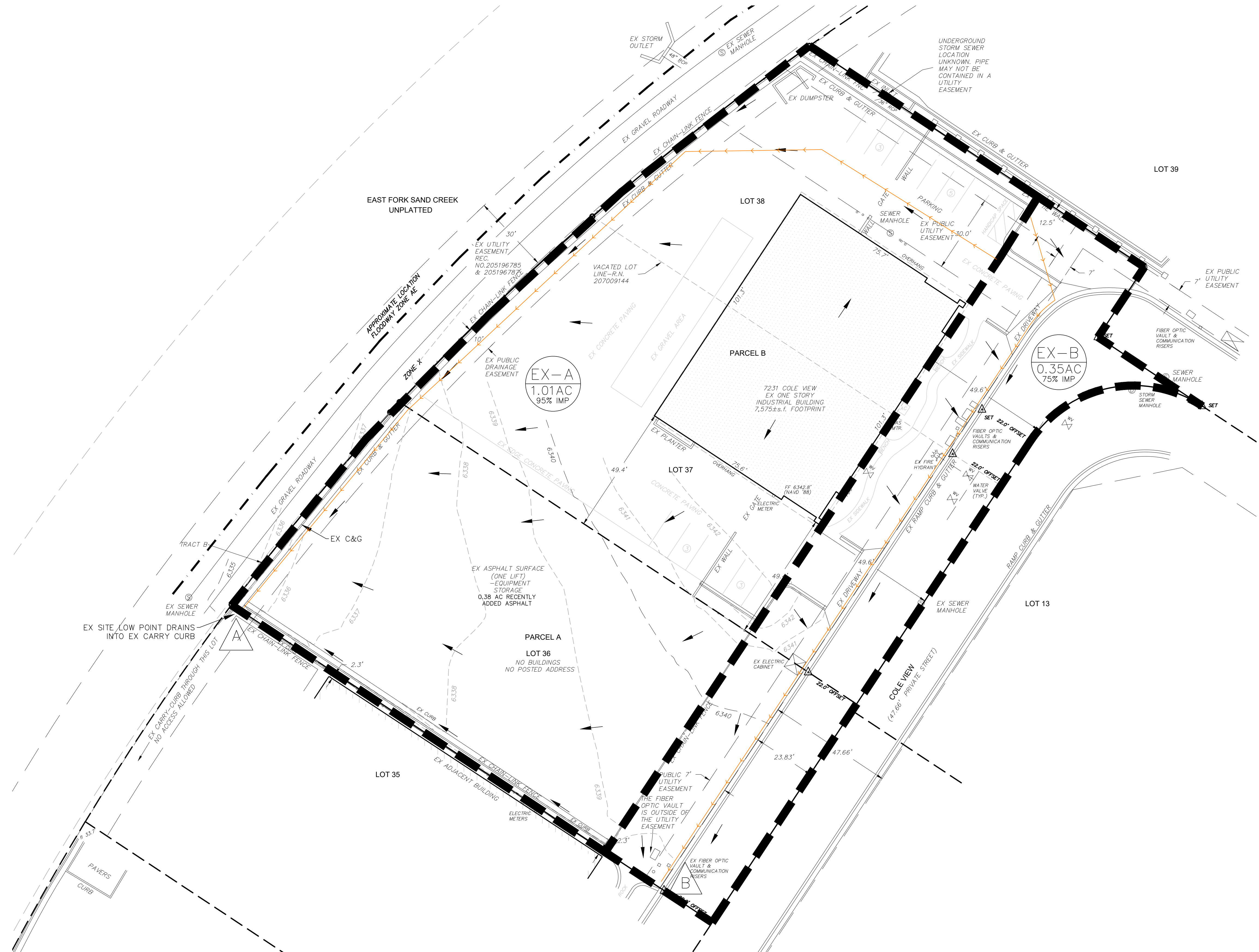
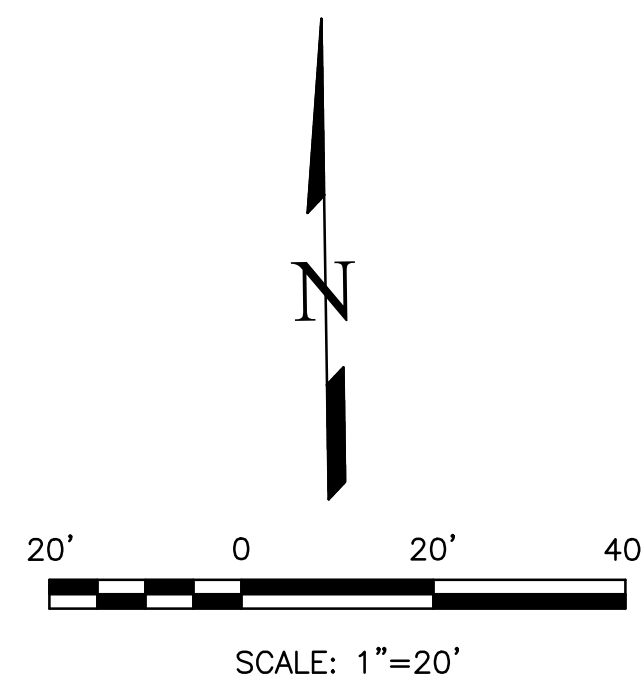
DESIGN POINT	BASIN	AREA (ACRES)	FLOW	
			5 YR (cfs)	100 YR (cfs)
A	EX-A	1.01	4.4	8.6
B	EX-B	0.35	1.2	2.7

LEGEND

- BASIN DESIGNATION
AREA IN BASIN (AC)
PERCENT IMPERVIOUS
- DESIGN POINT
- BASIN BOUNDARY
- EXISTING 1' CONTOUR
- EXISTING 10' CONTOUR
- GROUND SURFACE FLOW DIRECTION
- ROAD AND DITCH FLOW DIRECTION
- CHAIN-LINK FENCE
- TIME OF CONCENTRATION PATH

NOTES

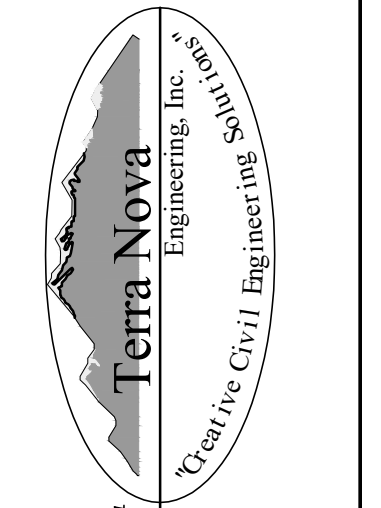
1. ALL FEATURE SHOWN ARE EXISTING.



REVISIONS NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, THIS INCORPORATES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
A-1 CHIPSEAL
ATTN: STEPHANIE WALLIS
2505 E 74TH AVE
DENVER, CO 80229
720.540.8264



721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnecinc.com

A-1 CHIPSEAL
EXISTING DRAINAGE MAP

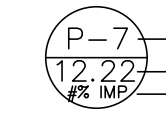
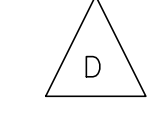







DESIGNED BY	DLF
DRAWN BY	DLF
CHECKED BY	LD
H-SCALE	AS SHOWN
V-SCALE	N/A
JOB NO.	2173.00
DATE ISSUED	07/08/22
SHEET NO.	1 OF 3

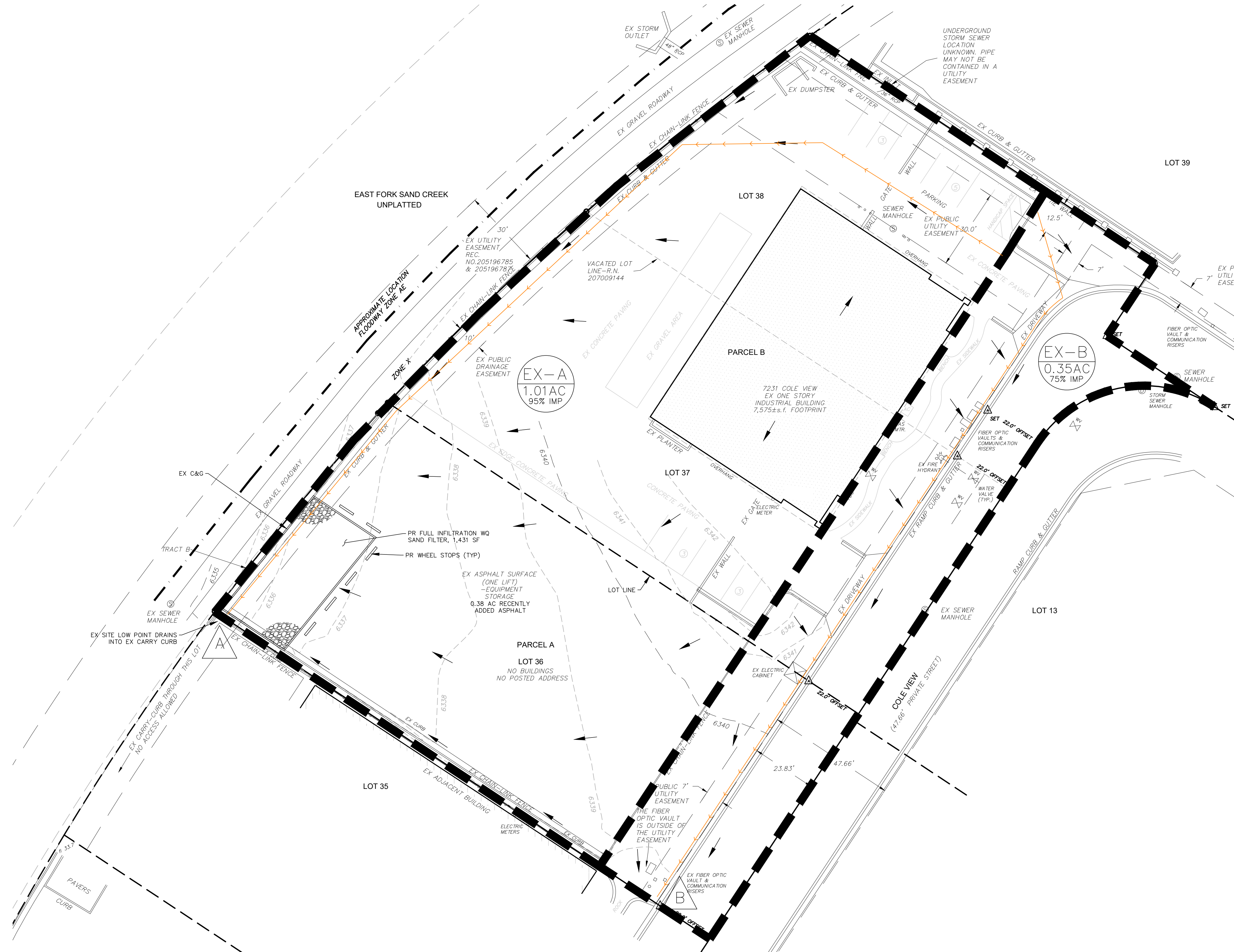
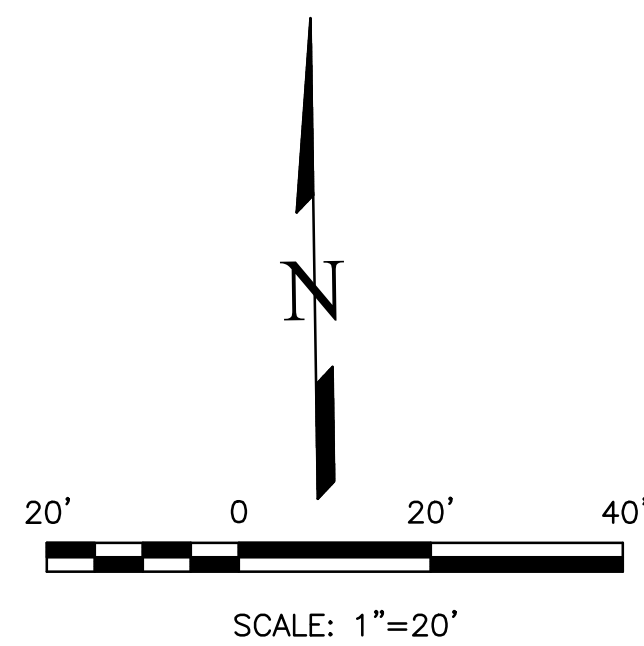
A-1 CHIPSEAL COLORADO SPRINGS PROPOSED DRAINAGE MAP JULY 2022

BASIN SUMMARY

DESIGN POINT	BASIN	AREA (ACRES)	FLOW	
			5 YR (cfs)	100 YR (cfs)
A	EX-A	1.01	4.4	8.6
B	EX-B	0.35	1.2	2.7

LEGEND

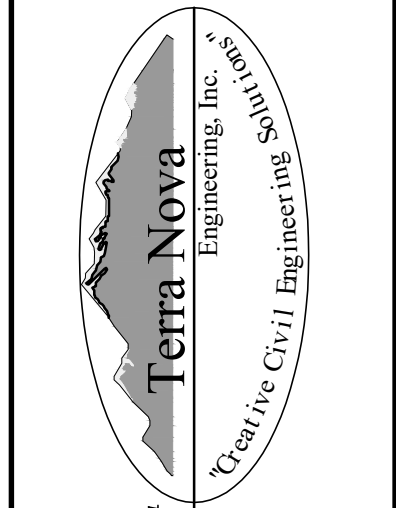
-  BASIN DESIGNATION
AREA IN BASIN (AC)
PERCENT IMPERVIOUS
-  DESIGN POINT
-  BASIN BOUNDARY
-  EXISTING 1' CONTOUR
-  EXISTING 10' CONTOUR
-  GROUND SURFACE FLOW DIRECTION
-  ROAD AND DITCH FLOW DIRECTION
-  CHAIN-LINK FENCE
-  TIME OF CONCENTRATION PATH



NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, THIS DRAWING IS NOT TO BE USED FOR ANY PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
A-1 CHIPSEAL
ATTN: STEPHANIE WALLIS
2505 E 74TH AVE
DENVER, CO 80229
720.540.8264



721 S. 23RD STREET
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www.tnecinc.com

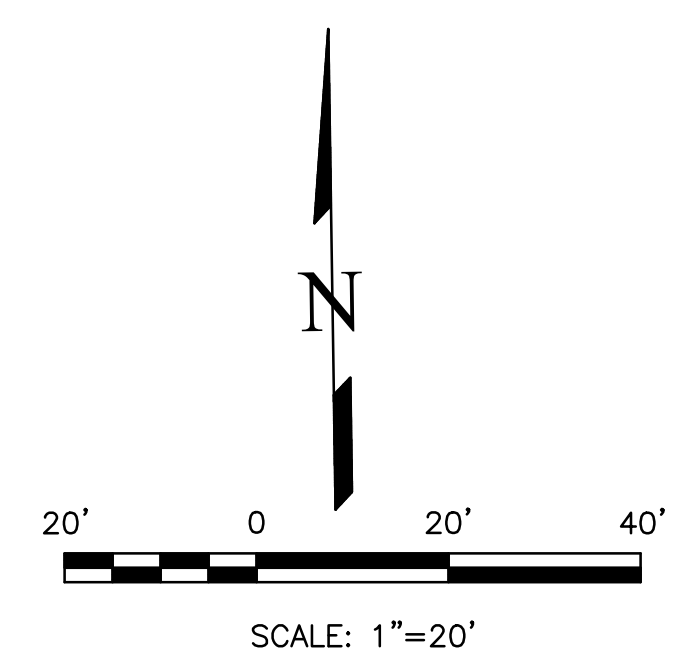
A-1 CHIPSEAL
PROPOSED DRAINAGE MAP

DESIGNED BY	DLF
DRAWN BY	DLF
CHECKED BY	LD
H-SCALE	AS SHOWN
V-SCALE	N/A
JOB NO.	2173.00
DATE ISSUED	07/08/22
SHEET NO.	2 OF 3

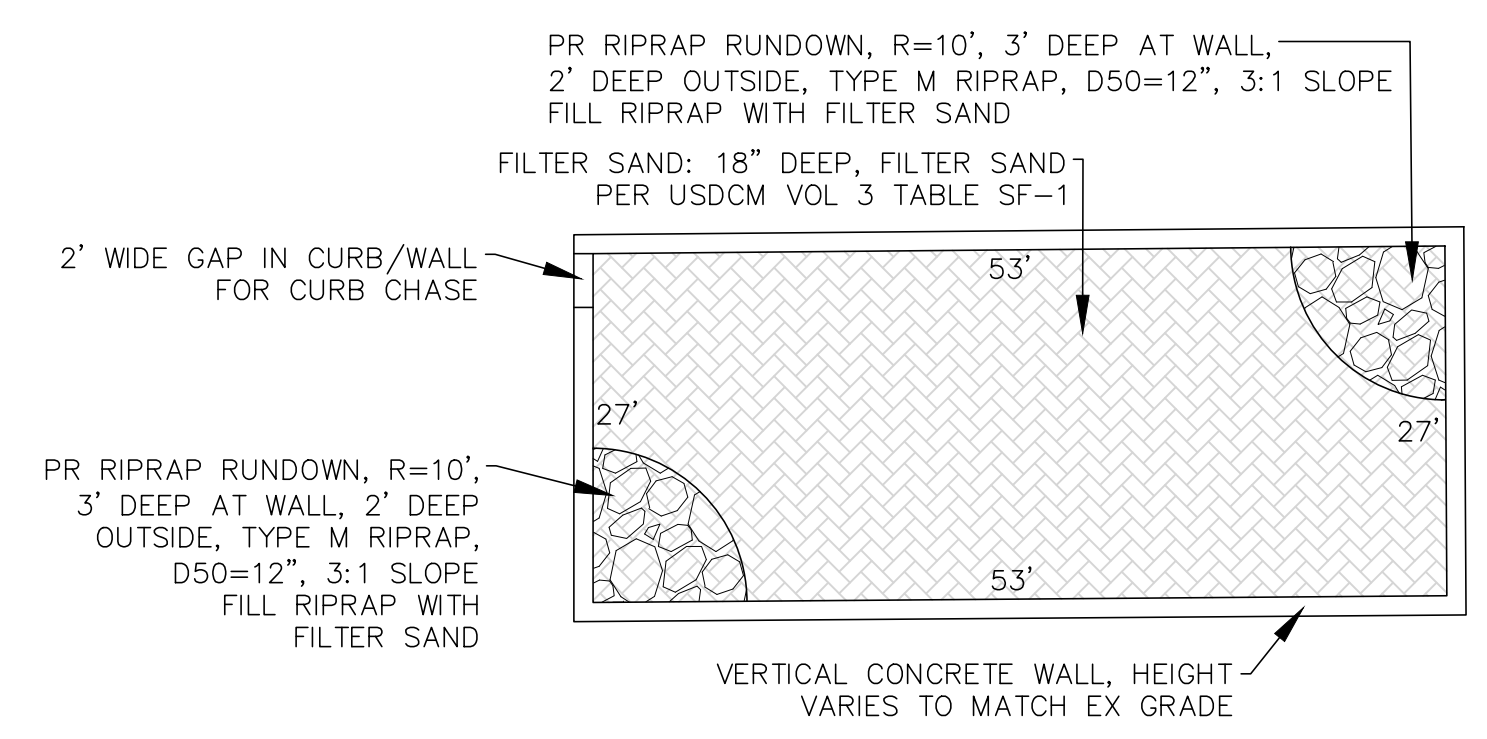
A-1 CHIPSEAL SITE DEVELOPMENT PLAN PROPOSED SAND FILTER JULY 2022

FOR REFERENCE ONLY
NOT FOR CONSTRUCTION

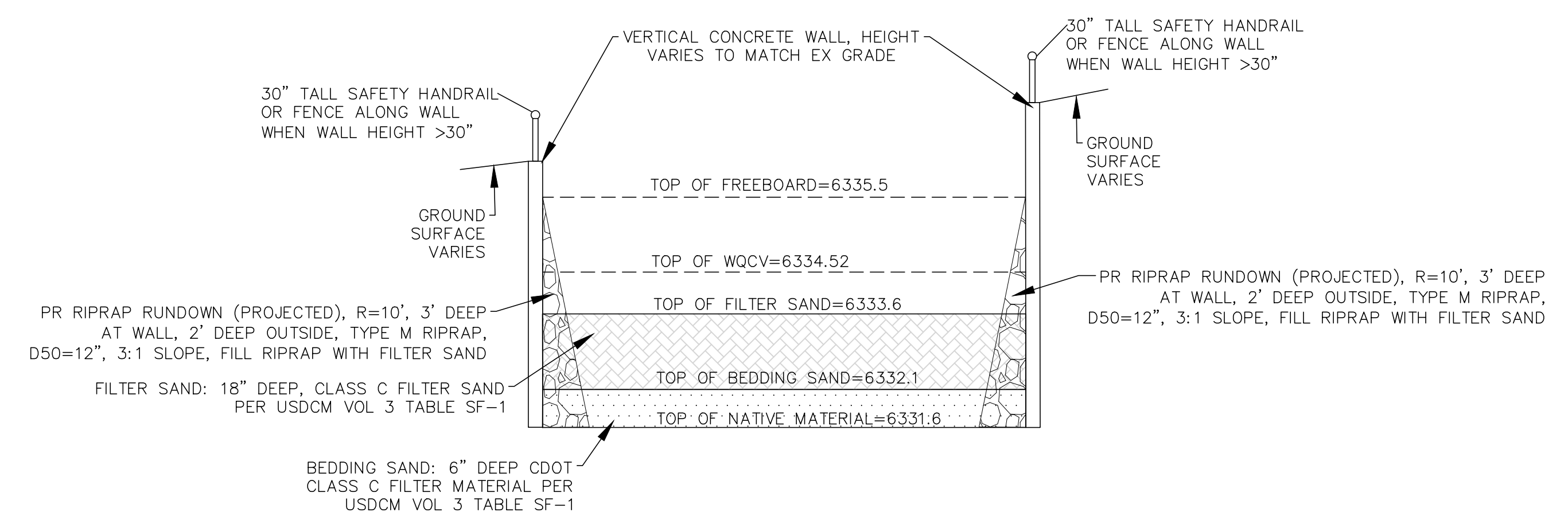
- LEGEND**
- P-7
12.22 BASIN DESIGNATION
 - AREA IN BASIN (AC)
 - DESIGN POINT
 - BASIN BOUNDARY
 - EXISTING 1' CONTOUR
 - EXISTING 10' CONTOUR
 - GROUND SURFACE FLOW DIRECTION
 - ROAD AND DITCH FLOW DIRECTION
 - CHAIN-LINK FENCE



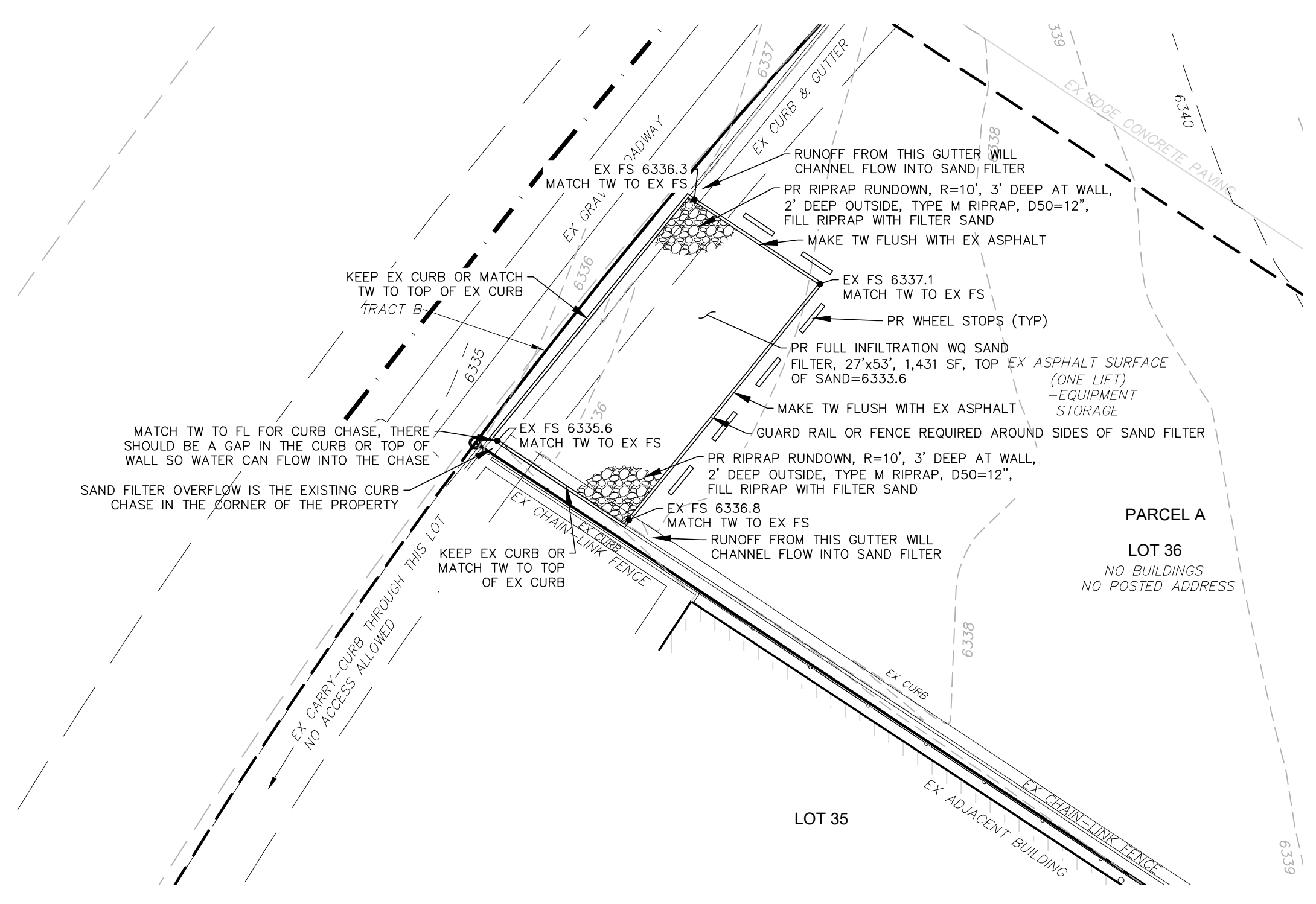
- NOTES**
1. THE SAND FILTER IS BEING BUILT INTO AN EXISTING PARKING LOT AND ALIGNS WITH THE EXISTING CURB AND GUTTER. THERE IS NO VEGETATION OR SEEDING INVOLVED WITH THIS SAND FILTER.
 2. FOR MAINTENANCE ACCESS, THE SAND FILTER HAS PARKING LOT ON TWO SIDES AND THE INTERIOR DEPTH IS 2' AT THE LOW POINT.



**SAND FILTER DESIGN – PLAN VIEW
N.T.S.**



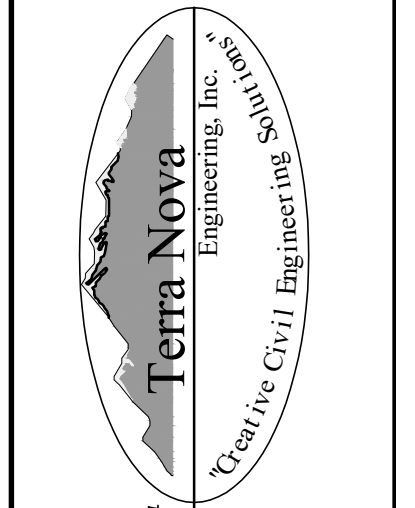
**SAND FILTER DESIGN – PROFILE VIEW
N.T.S.**



REVISIONS	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, THIS DRAWING IS NOT TO BE USED FOR ANY PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
A-1 CHIPSEAL
ATTN: STEPHANIE WALLIS
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OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnainc.com

A-1 CHIPSEAL	PROPOSED SAND FILTER
---------------------	----------------------

DESIGNED BY DLF
DRAWN BY DLF
CHECKED BY LD
H-SCALE AS SHOWN
V-SCALE N/A
JOB NO. 2173.00
DATE ISSUED 07/08/22
SHEET NO. 3 OF 3