

FINAL DRAINAGE REPORT

for

DEYOUNG SUBDIVISION
BENT GRASS MEADOWS DRIVE

Engineering Review

06/08/2022 3:05:07 PM

dsdrice

JeffRice@elpasoco.com

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EPC Planning & Community
Development Department

PCD-ENGINEERING REVIEW COMMENTS
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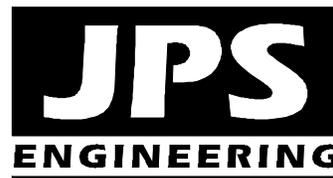
See comment letter.

Prepared for:

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December 18, 2019
Revised April 20, 2020
Revised May 5, 2021
Revised April 18, 2022

Prepared by:



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JPS Project No. 031901
PCD Project No. MS-20-001

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FINAL DRAINAGE REPORT
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DRAINAGE STATEMENT

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 master plan of the drainage basin. I accept responsibility for liability caused by negligent acts, errors or omissions on my part in preparing this report.

John P. Schwab, P.E. #29891

Developer's Statement:

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

By:

Randall DeYoung
2790 N. Academy Blvd. #150
Colorado Springs, CO 80917

Date

El Paso County's Statement

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

Jennifer Irvine, P.E.
County Engineer / ECM Administrator

Date

Conditions:

I. INTRODUCTION

A. Property Location and Description

Mr. Randall DeYoung (Owner) is planning to construct the Bent Grass Storage LLC RV / Mini Storage Complex on the vacant 17.2-acre property (El Paso County Assessor's Parcel No. 53010-00-016) located on the east side of Bent Grass Meadows Drive, north of Woodmen Road, in the Falcon area of El Paso County, Colorado. The site is zoned Industrial (I-2), and the proposed storage facility is a permitted use in this zone. The property is currently an unplatted tract described as a portion of the Southwest Quarter of Section 1, Township 13S, Range 65W of the 6th P.M., El Paso County, Colorado. The project will include platting the property as DeYoung Subdivision.

The west boundary of the property adjoins Bent Grass Meadows Drive, which is an improved public collector street, with the exception of the need for paving a final lift of asphalt, and extension of approximately 140 feet at the north end of the property. An existing storage facility platted as Lot 1, Latigo Business Center Filing No. 1 is located on the west side of Bent Grass Meadows Drive.

The north boundary of the property adjoins a 14.3-acre undeveloped tract (EPC Parcel No. 53010-00-023) and a 16.1-acre undeveloped tract (EPC Parcel No. 53010-00-036). We understand these parcels are planned for residential development as part of the Bent Grass PUD.

The east boundary of the property adjoins an unplatted 40-acre parcel (EPC Parcel No. 53000-00-202) which has been developed as the existing Mountain View Electric Association headquarters facility (zoned I-2). The south boundary of the property adjoins an undeveloped 8.1-acre tract (EPC Parcel No. 53010-00-017) zoned Industrial (I-2).

The proposed Site Development Plan consists of 6 new storage buildings along with open parking areas, providing a mixture of enclosed and open storage spaces, along with associated access drives, parking, and site improvements. Access will be provided by two private access drive connections to Bent Grass Meadows Drive along the western site boundary.

B. Scope

In support of the Subdivision Plat and Site Development Plan submittals to El Paso County, this report is intended to meet the requirements of a Final Drainage Report in accordance with El Paso County drainage criteria. This report will provide a summary of site drainage issues impacting the proposed development. The report will analyze impacts from upstream drainage patterns, site-specific developed drainage patterns, and impacts on downstream facilities. This report is based on the guidelines and criteria presented in the El Paso County "Drainage Criteria Manual."

C. References

City of Colorado Springs “Drainage Criteria Manual, Volumes 1 and 2,” revised May, 2014.

Classic Consulting Engineers & Surveyors, LLC, “Preliminary Drainage Report for Bent Grass Residential (Filing No. 1), revised June, 2014.

El Paso County “Drainage Criteria Manual,” revised November, 1991.

El Paso County Resolution No. 15-042, “Resolution for Adoption of Portions of the City of Colorado Springs Drainage Criteria Manual Volume 1 dated May 2014,” January 27, 2015.

El Paso County “Engineering Criteria Manual,” revised June 20, 2019.

FEMA, Flood Insurance Rate Map (FIRM) Number 08041C0553G, December 7, 2018.

Galloway & Company, Inc., “Final Drainage Report, Bent Grass Residential Subdivision Filing No. 2,” revised January 2020.

Kiowa Engineering Corporation, “Final Drainage Report and Erosion Control Plan, Latigo Business Center Filing No. 1,” revised November 30, 2004.

Kiowa Engineering Corporation, “Master Development Drainage Plan and Preliminary Drainage Plan, Bent Grass Subdivision,” revised December 18, 2006.

Matrix Design Group, “Falcon Drainage Basin Planning Study,” September, 2015.

USDA/NRCS, “Custom Soil Resource Report for El Paso County Area, Colorado,” October 27, 2019.

II. EXISTING DRAINAGE CONDITIONS

The existing site topography generally slopes downward to the southeast with grades in the range of 1-4 percent. According to the Soil Survey of El Paso County prepared by the Soil Conservation Service (SCS), on-site soils are comprised primarily of Columbine gravelly sandy loam soils, with a small area in the southeast corner of the site comprised of Blakeland-Fluvaquentic Haplaquolls. These well-drained soils are classified as hydrologic soils group “A” (see Appendix A).

As shown on the enclosed Historic Drainage Plan (Sheet EX1, Appendix D), the site has been delineated as one on-site drainage basin. The on-site area has been delineated as Basin A, which sheet flows towards the southeast corner of the property. Existing on-site flows from Basin A drain to Design Point #1, with historic peak flows calculated as $Q_5 = 2.9$ cfs and $Q_{100} = 21.3$ cfs. Hydrologic calculations are enclosed in Appendix A.

A major drainage channel identified as the Falcon Basin West Tributary Channel flows south across the east side of this property. According to the 2015 “Falcon Drainage Basin Planning Study” (DBPS) by Matrix Design Group, this channel conveys off-site drainage from an upstream area of approximately 3.1 square miles. The DBPS identifies future peak flows of $Q_2 = 120$ cfs and $Q_{100} = 1,300$ cfs at Design Point #JWT 210 (Woodmen Road) downstream of this site.

III. PROPOSED DRAINAGE CONDITIONS

On-Site Development

As shown on the enclosed Drainage Plan (Figures D1 and D1.1, Appendix F), the site has been delineated as three on-site drainage basins. Developed flows have been calculated based on the impervious areas associated with the proposed building and parking areas.

The proposed storage complex on the west side of the property has been delineated as Basin A1, which will drain southeasterly across the site to a private storm sewer system, discharging to the Falcon Basin West Tributary Channel flowing south across the east side of the property. The proposed building pads will be graded with protective slopes to provide positive drainage away from the buildings. Surface drainage swales and a private storm sewer system will convey developed flows to an on-site water quality pond discharging to the drainage channel on the east side of the property. Site grades will slope to storm inlets at selected locations, collecting surface drainage and conveying stormwater to the on-site water quality pond.

Asphalt swales, concrete crosspans, and curb and gutter will convey surface drainage across the Storage Complex area to Private Storm Inlets A1-A9 (Triple Type 13) located in the access driveways. Private Storm Sewer A1 (18”) will flow south to Private Storm Inlet A2 (Triple Type 13), and Storm Sewer A2 (24”) will continue south to Storm Inlet A3 (Triple Type 13). Private Storm Sewer A3 (24”) will flow south to Private Storm Inlet A5 (Triple Type 13). Private Storm Inlet A4 (Triple Type 13) will collect surface drainage in the southwest corner of the site, and Storm Sewer A4 (18”) will flow easterly to junction Inlet A5. Storm Sewer A5 (30”) will extend easterly from Inlet A5 to Inlet A9 (Triple Type 13) in the southeast corner of the development area.

The surface parking area on the east side of the developed site will include a similar layout of concrete crosspans and drainage swales conveying surface drainage to private storm inlet at selected locations. Private Storm Sewer A6 (18”) will flow south to Private Storm Inlet A7 (Triple Type 13), and Storm Sewer A7 (24”) will continue south to Storm Inlet A8 (Triple Type 13). Private Storm Sewer A8 (24”) will flow southwesterly to Private Storm Manhole A10 on the west side of the Detention Pond.

Storm Sewer A9 (30”) will extend from Inlet A9 to junction Manhole A10, and Storm Sewer A10 (30”) will flow southeasterly into Water Quality Detention Basin A in the southeast corner of the site. The Pond A Discharge Pipe (12”) will extend southeasterly to a riprap energy dissipator entering the West Tributary Channel.

The total developed peak flows entering Pond A at Design Point #A1 are calculated as $Q_5 = 37.6$ cfs and $Q_{100} = 70.3$ cfs. The increase in developed flow from this site will be mitigated by the downstream regional Detention Pond WU, and the on-site Water Quality Pond A will provide water quality treatment for the site. Documentation from the downstream property owners between this site and Pond WU has been provided acknowledging acceptance of the developed flows from this property (see Stormwater Drainage Maintenance Agreement and Easement documents in Appendix E).

Need site-specific agreement

The narrow landscaped area along the south boundary of the property has been delineated as Basin A2, which will sheet flow to the south following historic drainage patterns. The peak flows at Design Point #A2 are calculated as $Q_5 = 0.3$ cfs and $Q_{100} = 2.2$ cfs.

The total developed peak flows from the west side of the property at Design Point #1 (Basins A1 and A2) are calculated as $Q_5 = 37.9$ cfs and $Q_{100} = 71.9$ cfs.

The undeveloped area on the east side of the property has been delineated as Basin B, which will sheet flow into the West Tributary Channel. The on-site developed peak flows at Design Point #2 are calculated as $Q_5 = 1.0$ cfs and $Q_{100} = 7.1$ cfs.

Hydrologic calculations for the site are detailed in the attached spreadsheets (Appendix A), and peak flows are identified on Figures EX1, D1, and D1.1 (Appendix F).

The contractor will be required to implement standard best management practices for erosion control during construction.

West Tributary Channel

As previously noted, the West Tributary Channel of the Falcon Drainage Basin flows southerly across the east side of this property. In comparison to the flow in the main channel (DBPS future peak flow of $Q_{100} = 1,300$ cfs at Design Point #JWT 210), the total on-site flow contribution amounts to approximately 6 percent of the flow in the West Tributary Channel downstream of this site. As such, on-site flows from the proposed DeYoung Subdivision are relatively small in comparison to the total flows in the West Tributary Channel.

According to the Falcon DBPS, proposed regional channel improvements include re-establishing a natural cross section and implementing a series of rock cross vanes for grade control.

In conjunction with subdivision platting, this site will pay drainage basin fees towards the recommended regional drainage channel improvements.

This property is a part of the Bent Grass Metropolitan District, and the District is planning to construct channel improvements to the West Tributary Channel. The east side of this property will be platted as a tract to provide access for channel maintenance and channel

improvements, and the DeYoung Subdivision developer will provide a cost contribution to regional channel improvements through the drainage basin fee program and the metropolitan district. The major drainage channel will be owned and maintained by the Bent Grass Metropolitan District. ← or EPC.

IV. DRAINAGE PLANNING FOUR STEP PROCESS

El Paso County Drainage Criteria require drainage planning to include a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

As stated in DCM Volume 2, the Four Step Process is applicable to all new and re-development projects with construction activities that disturb 1 acre or greater or that disturb less than 1 acre but are part of a larger common plan of development. The Four Step Process has been implemented as follows in the planning of this project:

Step 1: Employ Runoff Reduction Practices

- **Minimize Impacts:** The existing drainage channel area crossing the east side of the property will be preserved as a drainage easement. No development is proposed in the easterly part of the property, which will minimize developed drainage impacts.

Step 2: Stabilize Drainageways

- The Falcon Basin West Tributary Channel flows in a southerly direction across the east side of this property. This site will pay Drainage Basin Fees as the applicable cost share towards the regional drainage channel improvements recommended in the Falcon Drainage Basin Planning Study. The east side of the property will be platted as a tract allowing for maintenance access to the channel.

Step 3: Provide Water Quality Capture Volume (WQCV)

- An on-site Water Quality Pond will be constructed to mitigate water quality impacts within the site. The on-site water quality pond will capture and slowly release the WQCV over a 40-hour design release period.

Step 4: Consider Need for Industrial and Commercial BMPs

- The proposed commercial development project will implement a Stormwater Management Plan including proper housekeeping practices and spill containment procedures.

V. FLOODPLAIN IMPACTS

Floodplain limits in vicinity of this site are delineated in the applicable Flood Insurance Rate Map, FIRM Panel No. 08041C0553G dated December 7, 2018. As depicted in the FIRM exhibit enclosed in Appendix D, this site is impacted by the delineated 100-year FEMA floodplain of the Falcon West Tributary Channel, which flows southerly across

the east side of this property. The existing 100-year floodplain limits are shown on the enclosed Drainage Plans (Appendix D).

On the enclosed Developed Drainage Plan (Sh. D1, Appendix F), the FEMA 100-year flood elevations based on the Flood Insurance Study (FIS) datum (NAVD 88) have been converted to the NGVD 1929 datum used in the topographic survey for this site. The proposed Northeast Storage Building Finished Floor Elevation is 6925.0, which is over one foot above the corresponding base flood elevation of 6923.5 (converted to NGVD 29), and the proposed Southeast Building Finished Floor Elevation is 6921.6, which is also well above the adjoining base flood elevation of 6915.0 (converted to NGVD 29).

The enclosed drainage plans have incorporated the proposed Bent Grass Drainage Channel improvements designed by Galloway & Company on behalf of the Bent Grass Subdivision to the north of this site. The Galloway channel improvement plans include diverting the channel east of the proposed development limits, generally consistent with the effective floodplain delineation.

VI. STORMWATER DETENTION AND WATER QUALITY

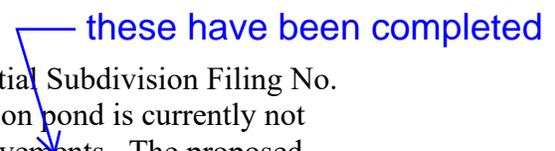
The proposed drainage and grading plan for the site conveys developed drainage southeasterly across the site to an on-site Water Quality Pond before discharging into the existing Falcon Basin West Tributary Drainage Channel. The channel flows south to the existing Regional Detention Pond WU located at the northwest corner of Meridian Road and US Highway 24.

Regional Detention Pond WU

According to the 2015 “Falcon Drainage Basin Planning Study” (DBPS) by Matrix Design Group, the existing regional detention pond has a capacity of 39.5 acre-feet and provides the required stormwater detention for this site.

As detailed in the “Final Drainage Report, Bent Grass Residential Subdivision Filing No. 2” by Galloway & Company, Inc., the existing regional detention pond is currently not functioning properly, and the pond requires a number of improvements. The proposed detention pond improvements to be completed by Bent Grass Residential include upgrade of the pond outlet structure, repair of the washed-out inlet and embankment, and installation of a new cutoff wall along the pond embankment.

— these have been completed



On-Site Water Quality Pond A

The proposed drainage and grading plan for this site includes a private Extended Detention Basin (EDB) at the southeast corner of the developed site to provide the required stormwater quality mitigation for the developed site in accordance with current El Paso County drainage criteria.

According to the calculations in Appendix D, the required Water Quality Capture Volume (WQCV) is 0.39 acre-feet, and the proposed Extended Detention Basin A provides a volume of 0.47 acre-feet.

The Water Quality Pond will discharge through an outlet structure and 12-inch outlet pipe draining into a riprap apron entering the **existing** channel.

The proposed stormwater quality facilities will be privately owned and maintained by the property owner, and maintenance access will be readily available from the adjoining parking area.

Basin A2 (Excluded Area)

The narrow landscaped area along the south boundary of the property (delineated as Basin A2) will be excluded from permanent water quality facilities under allowable exclusions delineated in the El Paso County Engineering Criteria Manual. The allowable exclusions include ECM I.7.1.B.t (land disturbance to undeveloped land that will remain undeveloped) and ECM I.7.1.C.1, which allows for 20% not to exceed one acre of the applicable development site area to not be captured. Basin A2 (0.72 acres) is under the one-acre exclusion size and will remain as a landscaped area.

VII. DRAINAGE BASIN FEES

Development of this commercial storage site will include construction of a private storm sewer system and water quality pond within the site. No public drainage improvements are proposed as part of this project.

Use the fees in place at time of original submittal.

The site lies entirely within the Falcon Drainage Basin, which is tributary to Black Squirrel Creek. The Falcon Drainage Basin is subject to an El Paso County **2022 drainage basin fee of \$34,117 per impervious acre, and a bridge fee of \$4,687 per impervious acre.** The required drainage and bridge fees are due at the time of recording the subdivision plat.

According to El Paso County Engineering Criteria Manual Section 3.13a, the required drainage basin fees for subdivision plats are assessed based upon the new impervious area if no such fee has been previously paid. As such, the required basin fees are calculated based on the developed impervious area calculation for this site.

The required drainage and bridge fees are calculated as follows:

Platted Area:		17.173 acres
Lot 1 Area (excluding drainage tract):		13.066 acres
Lot 1 Developed Impervious Area:		10.7 acres
Drainage Fee:	(10.7 ac.) @ (\$34,117/ac.) =	\$365,051.90
Bridge Fee:	(10.7 ac.) @ (\$4,687/ac.) =	\$ 50,150.90

VIII. SUMMARY

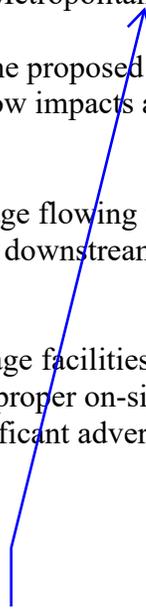
The developed drainage patterns associated with the proposed storage complex on Lot 1, DeYoung Subdivision will remain consistent with existing conditions and the overall drainage basin master plan for area. Developed flows from the site will drain southeasterly across the property through a private storm sewer system and on-site water quality pond, discharging to the Falcon Basin West Tributary Channel. The major drainage channel will be owned and maintained by the Bent Grass Metropolitan District.

The existing downstream regional stormwater detention pond and the proposed on-site water quality facilities have been designed to mitigate developed flow impacts and meet the County's stormwater detention and water quality requirements.

Drainage easements have been obtained accepting developed drainage flowing from this site across the downstream properties between this property and the downstream regional detention pond.

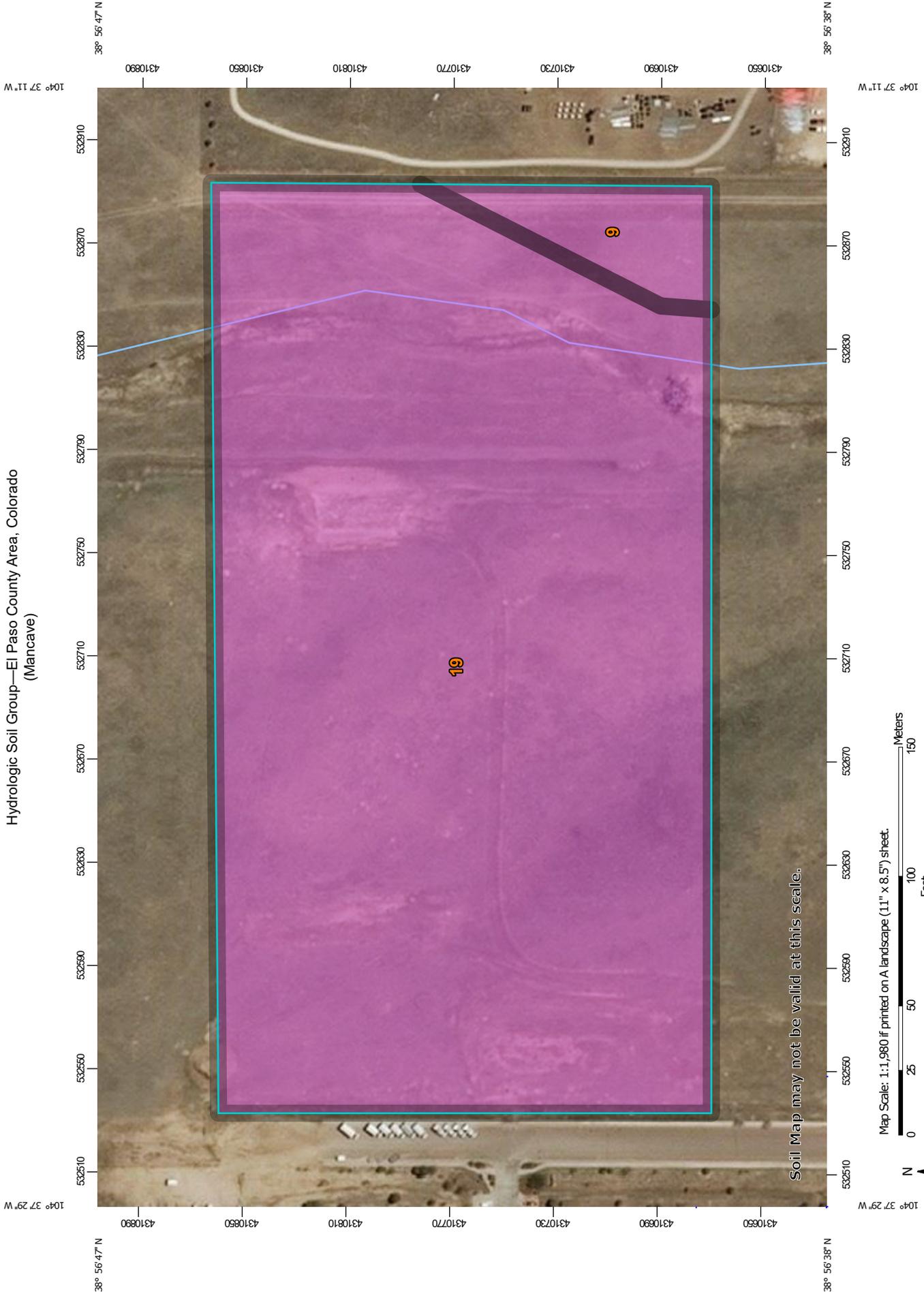
Construction and proper maintenance of the proposed private drainage facilities and existing downstream public drainage facilities, in conjunction with proper on-site erosion control practices, will ensure that this site development has no significant adverse drainage impact on downstream or surrounding areas.

or EPC?



APPENDIX A
SOILS INFORMATION

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



Soil Map may not be valid at this scale.

Map Scale: 1:1,980 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)	 C
Area of Interest (AOI)	 C/D
Soils	 D
Soil Rating Polygons	 Not rated or not available
Soil Rating Polygons	 A
Soil Rating Polygons	 A/D
Soil Rating Polygons	 B
Soil Rating Polygons	 B/D
Soil Rating Polygons	 C
Soil Rating Polygons	 C/D
Soil Rating Polygons	 D
Soil Rating Polygons	 Not rated or not available
Soil Rating Lines	 A
Soil Rating Lines	 A/D
Soil Rating Lines	 B
Soil Rating Lines	 B/D
Soil Rating Lines	 C
Soil Rating Lines	 C/D
Soil Rating Lines	 D
Soil Rating Lines	Not rated or not available
Soil Rating Points	A
Soil Rating Points	A/D
Soil Rating Points	B
Soil Rating Points	B/D

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 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
9	Blakeland-Fluvaquentic Haplaquolls	A	0.8	4.5%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	16.3	95.5%
Totals for Area of Interest			17.1	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Custom Soil Resource Report for El Paso County Area, Colorado



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

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scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

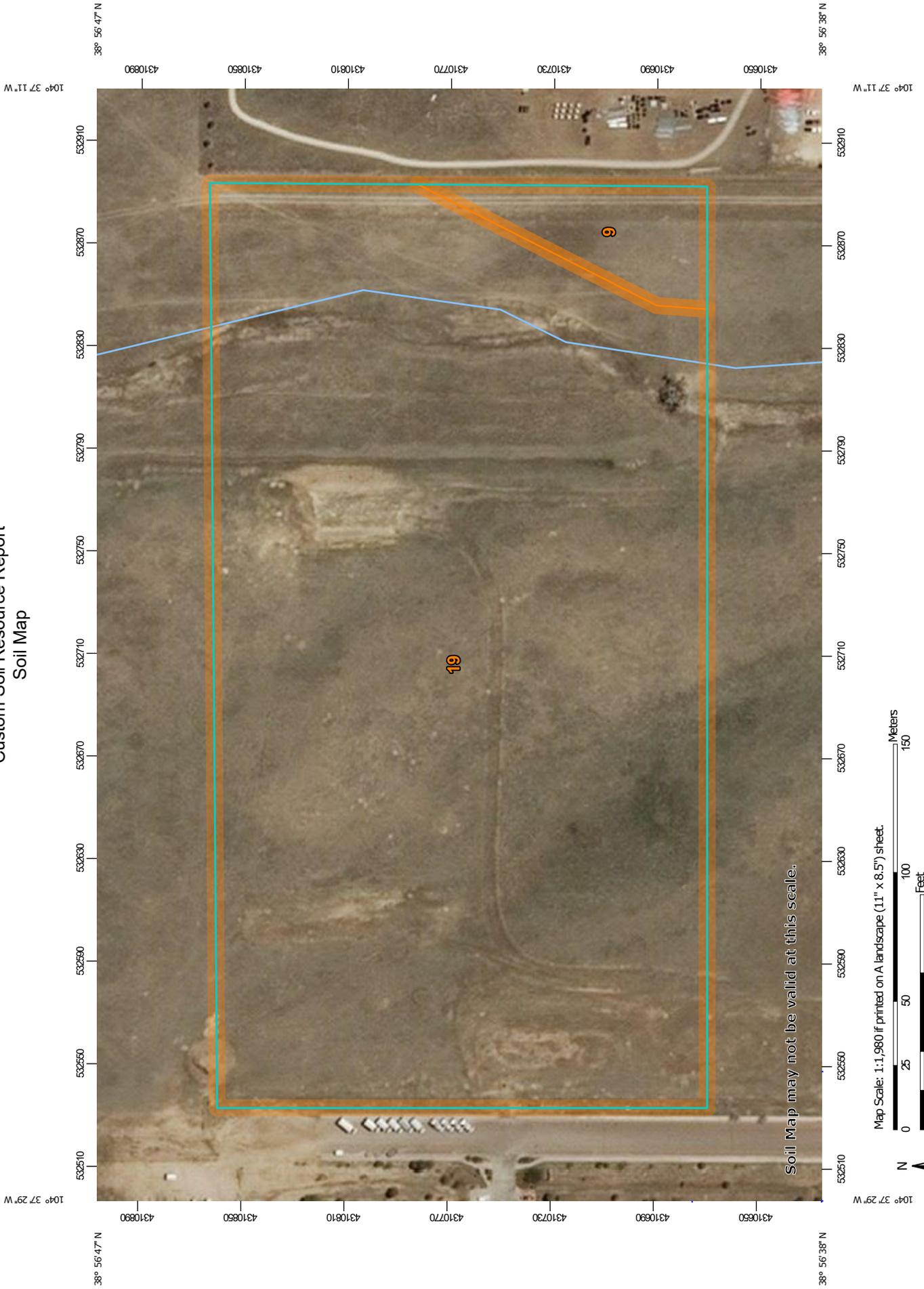
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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Soil Map may not be valid at this scale.

Map Scale: 1:1,980 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
- Water Features**
 - Streams and Canals
- Transportation**
 - Rails
 - Interstate Highways
 - US Routes
 - Major Roads
 - Local Roads
- Background**
 - Aerial Photography
- Other Features**
 - Spoil Area
 - Stony Spot
 - Very Stony Spot
 - Wet Spot
 - Other
 - Special Line Features

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 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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
9	Blakeland-Fluvaquentic Haplaquolls	0.8	4.5%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	16.3	95.5%
Totals for Area of Interest		17.1	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

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onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

9—Blakeland-Fluvaquentic Haplaquolls

Map Unit Setting

National map unit symbol: 36b6
Elevation: 3,500 to 5,800 feet
Mean annual precipitation: 13 to 17 inches
Mean annual air temperature: 46 to 55 degrees F
Frost-free period: 110 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 60 percent
Fluvaquentic haplaquolls and similar soils: 38 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose and/or eolian deposits derived from arkose

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: 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: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Sandy Foothill (R049BY210CO)
Hydric soil rating: No

Description of Fluvaquentic Haplaquolls

Setting

Landform: Swales
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 12 inches: variable

Properties and qualities

Slope: 1 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)

Interpretive groups

Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

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

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent

Minor components: 3 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Flood plains, fan terraces, fans

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam

C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well 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: None

Frequency of ponding: None

Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: Gravelly Foothill (R049BY214CO)

Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

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

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APPENDIX B
HYDROLOGIC CALCULATIONS

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_r) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_r) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

$$t_c = t_i + t_t \quad (\text{Eq. 6-7})$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i , may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad (\text{Eq. 6-8})$$

Where:

t_i = overland (initial) flow time (min)

C_5 = runoff coefficient for 5-year frequency (see Table 6-6)

L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)

S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t , which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t , can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad (\text{Eq. 6-9})$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \quad (\text{Eq. 6-10})$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional “calibration” of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

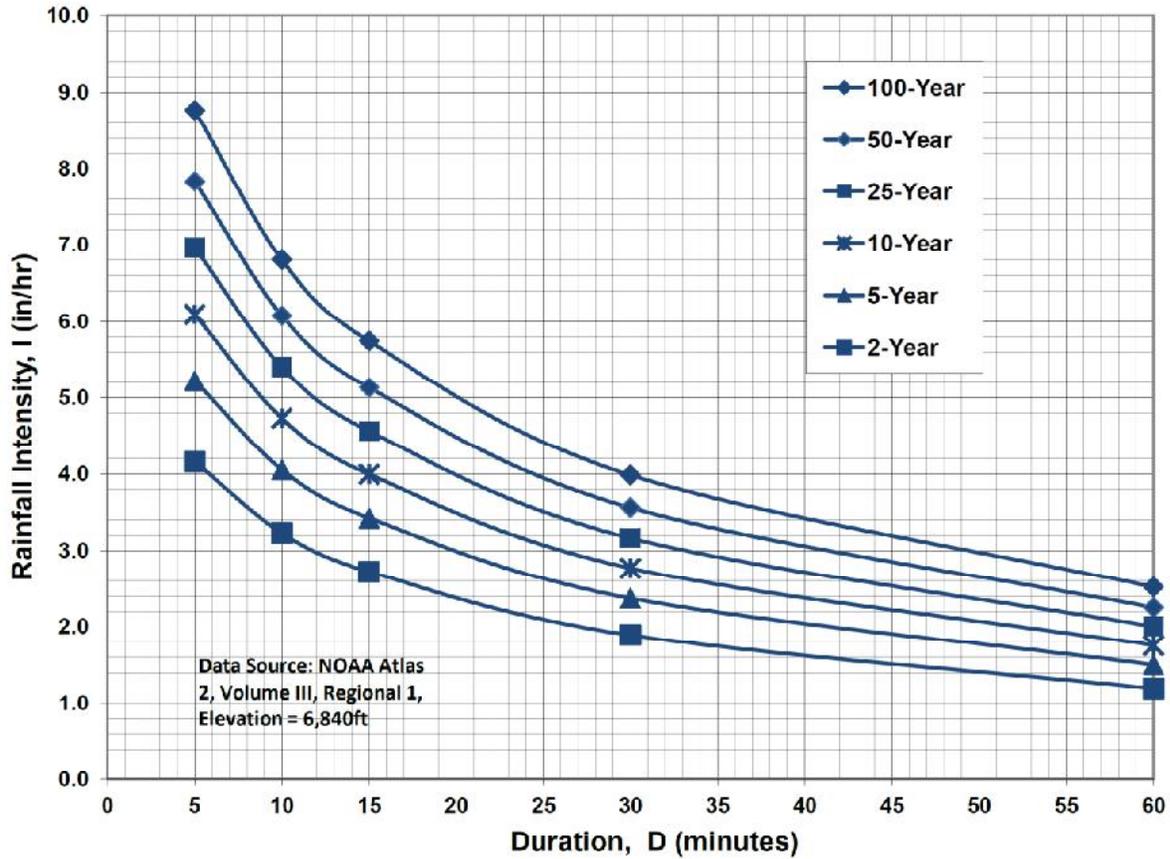
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$$I_{100} = -2.52 \ln(D) + 12.735$$

$$I_{50} = -2.25 \ln(D) + 11.375$$

$$I_{25} = -2.00 \ln(D) + 10.111$$

$$I_{10} = -1.75 \ln(D) + 8.847$$

$$I_5 = -1.50 \ln(D) + 7.583$$

$$I_2 = -1.19 \ln(D) + 6.035$$

Note: Values calculated by equations may not precisely duplicate values read from figure.

DEYOUNG SUBDIVISION
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS												
5-YEAR C VALUES												
BASIN	TOTAL AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	WEIGHTED C VALUE	
A1	12.66	10.93	BUILDINGS/IMPERVIOUS	0.9	1.73	LANDSCAPED		0.08			0.788	
A2	0.72	0.72	LANDSCAPED	0.08							0.080	
A1,A2	13.38										0.750	
B	3.79	3.79	MEADOW	0.08							0.080	
100-YEAR C VALUES												
BASIN	TOTAL AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	WEIGHTED C VALUE	
A1	12.66	10.93	BUILDINGS/IMPERVIOUS	0.96	1.73	LANDSCAPED		0.35			0.877	
A2	0.72	0.72	LANDSCAPED	0.35							0.350	
A1,A2	13.38										0.848	
B	3.79	3.79	MEADOW	0.35							0.350	
IMPERVIOUS AREAS												
BASIN	TOTAL AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A1	12.66	10.93	BUILDINGS/IMPERVIOUS	100	1.73	LANDSCAPED		0				86.335
A2	0.72	0.72	LANDSCAPED	0.00								0.000
A1,A2	13.38											81.689
B	3.79	3.79	MEADOW	0.00								0.000

DEYOUNG SUBDIVISION
RATIONAL METHOD

HISTORIC FLOWS

BASIN	DESIGN POINT	AREA (AC)	C		Overland Flow			Channel flow				INTENSITY ⁽⁵⁾		PEAK FLOW				
			5-YEAR	100-YEAR	LENGTH (FT)	SLOPE (FT/FT)	T _{co} ⁽¹⁾ (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS ⁽²⁾ VELOCITY (FT/S)	T _t ⁽³⁾ (MIN)	TOTAL T _c ⁽⁴⁾ (MIN)	TOTAL T _c ⁽⁴⁾ (MIN)	5-YR (IN/HR)	100-YR (IN/HR)	Q5 ⁽⁶⁾ (CFS)	Q100 ⁽⁶⁾ (CFS)
			0.080	0.350	620	0.027	33.4	330	7	0.024	1.08	5.1	38.5	38.5	2.11	3.54	2.90	21.26
A	1	17.17																

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	C		Overland Flow			Channel flow				INTENSITY ⁽⁵⁾		PEAK FLOW				
			5-YEAR	100-YEAR	LENGTH (FT)	SLOPE (FT/FT)	T _{co} ⁽¹⁾ (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS ⁽²⁾ VELOCITY (FT/S)	T _t ⁽³⁾ (MIN)	TOTAL T _c ⁽⁴⁾ (MIN)	TOTAL T _c ⁽⁴⁾ (MIN)	5-YR (IN/HR)	100-YR (IN/HR)	Q5 ⁽⁶⁾ (CFS)	Q100 ⁽⁶⁾ (CFS)
			0.080	0.350	100	0.075	2.9	1410	20	0.0145	2.41	9.8	12.7	12.7	3.77	6.33	37.64	70.33
A1	A1	12.66	0.788	0.877	100	0.075	2.9	1410	20	0.0145	2.41	9.8	12.7	12.7	3.77	6.33	37.64	70.33
A2	A2	0.72	0.080	0.350	30	0.330	3.2	0				0.0	3.2	5.0	5.17	8.68	0.30	2.19
A1,A2	1	13.38	0.750	0.848									12.7	12.7	3.77	6.33	37.86	71.87
B	2	3.79	0.080	0.350	100	0.020	14.8	580	15	0.026	2.42	4.0	18.8	18.8	3.18	5.34	0.96	7.08

1) OVERLAND FLOW T_{co} = (0.395⁽¹⁾(1-1-RUNOFF COEFFICIENT)⁽²⁾*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333)))

2) SCS VELOCITY = C * ((SLOPE(FT/FT)^{0.5})

C = 2.5 FOR HEAVY MEADOW

C = 5 FOR TILLAGE/FIELD

C = 7 FOR SHORT PASTURE AND LAWNS

C = 10 FOR NEARLY BARE GROUND

C = 15 FOR GRASSED WATERWAY

C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES

3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)

4) T_c = T_{co} + T_t

*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED

5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL

$$I_5 = -1.5 * \ln(T_c) + 7.583$$

$$I_{100} = -2.52 * \ln(T_c) + 12.735$$

6) Q = C_{IA}

APPENDIX C
HYDRAULIC CALCULATIONS

DEYOUNG SUBDIVISION
STORM INLET SIZING SUMMARY

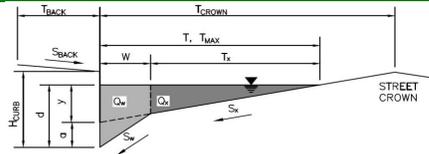
INLET	BASIN FLOW			INLET FLOW			INLET CONDITION / TYPE	INLET SIZE	INLET CAPACITY (CFS)
	DP	Q5 FLOW (CFS)	Q100 FLOW (CFS)	INLET FLOW % OF BASIN	Q5 FLOW (CFS)	Q100 FLOW (CFS)			
A1	A1	37.6	70.3	11	4.1	7.7	SUMP TYPE 13	TRIPLE	8.8
A2	1	37.6	70.3	11	4.1	7.7	SUMP TYPE 13	TRIPLE	8.8
A3	1	37.6	70.3	11	4.1	7.7	SUMP TYPE 13	TRIPLE	8.8
A4	1	37.6	70.3	11	4.1	7.7	SUMP TYPE 13	TRIPLE	8.8
A5	1	37.6	70.3	11	4.1	7.7	SUMP TYPE 13	TRIPLE	8.8
A6	1	37.6	70.3	11	4.1	7.7	SUMP TYPE 13	TRIPLE	8.8
A7	1	37.6	70.3	11	4.1	7.7	SUMP TYPE 13	TRIPLE	8.8
A8	1	37.6	70.3	11	4.1	7.7	SUMP TYPE 13	TRIPLE	8.8
A9	1	37.6	70.3	12	4.5	8.4	SUMP TYPE 13	TRIPLE	8.8

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:
Inlet ID:

Deyoung Subdivision - Inlets A1-A9 (Sump Condition)
Inlets A1-A9



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 25.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line
Distance from Curb Face to Street Crown

$H_{CURB} = 0.00$ inches
 $T_{CROWN} = 25.0$ ft

Gutter Width
Street Transverse Slope
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	25.0	25.0	ft
$d_{MAX} =$	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

Warning 02

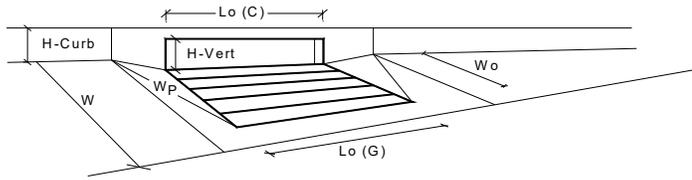
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

Minor Storm	Major Storm	
SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet	<input type="text" value="CDOT/Denver 13 Valley Gate"/>			
Local Depression (additional to continuous gutter depression 'a' from above)				
Number of Unit Inlets (Grate or Curb Opening)				
Water Depth at Flowline (outside of local depression)				
Grate Information				
Length of a Unit Grate				
Width of a Unit Grate				
Area Opening Ratio for a Grate (typical values 0.15-0.90)				
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)				
Grate Weir Coefficient (typical value 2.15 - 3.60)				
Grate Orifice Coefficient (typical value 0.60 - 0.80)				
Curb Opening Information				
Length of a Unit Curb Opening				
Height of Vertical Curb Opening in Inches				
Height of Curb Orifice Throat in Inches				
Angle of Throat (see USDCM Figure ST-5)				
Side Width for Depression Pan (typically the gutter width of 2 feet)				
Clogging Factor for a Single Curb Opening (typical value 0.10)				
Curb Opening Weir Coefficient (typical value 2.3-3.7)				
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)				
Low Head Performance Reduction (Calculated)				
Depth for Grate Midwidth				
Depth for Curb Opening Weir Equation				
Combination Inlet Performance Reduction Factor for Long Inlets				
Curb Opening Performance Reduction Factor for Long Inlets				
Grated Inlet Performance Reduction Factor for Long Inlets				
Total Inlet Interception Capacity (assumes clogged condition)				
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)				
		MINOR	MAJOR	
Type =	CDOT/Denver 13 Valley Gate			
a_{local} =	2.00	2.00	inches	
No =	3	3		
Ponding Depth =	6.0	8.0	inches	
		MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
L_o (G) =	3.00	3.00	feet	
W_o =	1.73	1.73	feet	
A_{ratio} =	0.43	0.43		
C_i (G) =	0.50	0.50		
C_w (G) =	3.30	3.30		
C_o (G) =	0.60	0.60		
		MINOR	MAJOR	
L_o (C) =	N/A	N/A	feet	
H_{vert} =	N/A	N/A	inches	
H_{throat} =	N/A	N/A	inches	
Theta =	N/A	N/A	degrees	
W_p =	N/A	N/A	feet	
C_i (C) =	N/A	N/A		
C_w (C) =	N/A	N/A		
C_o (C) =	N/A	N/A		
		MINOR	MAJOR	
d_{Grate} =	0.523	0.689	ft	
d_{Curb} =	N/A	N/A	ft	
$RF_{Combination}$ =	N/A	N/A		
RF_{Curb} =	N/A	N/A		
RF_{Grate} =	0.57	0.75		
		MINOR	MAJOR	
Q_a =	4.4	8.8	cfs	
$Q_{PEAK REQUIRED}$ =	4.2	7.9	cfs	

**DEYOUNG SUBDIVISION
STORM SEWER SIZING SUMMARY**

PIPE	PIPE FLOW			PIPE CAPACITY		
	BASINS	Q5 FLOW (CFS)	Q100 FLOW (CFS)	SELECTED PIPE SIZE (IN)	MIN. PIPE SLOPE	FULL PIPE CAPACITY (CFS)
A1	A1	4.1	7.7	18	0.6%	8.1
A2	A1,A2	8.3	15.5	24	0.5%	16.0
A3	A1-A3	12.4	23.2	24	1.1%	23.7
A4	A4	4.1	7.7	18	0.6%	8.1
A5	A1-A5	20.7	38.7	30	0.9%	38.9
A6	A6	4.1	7.7	18	0.6%	8.1
A7	A6,A7	8.3	15.5	24	0.5%	16.0
A8	A6-A8	12.4	23.2	24	1.1%	23.7
A9	A1-A5,A9	25.2	47.1	30	1.4%	48.5
A10	A1-A10	37.6	70.3	30	3.0%	71.0

ASSUMPTIONS:

1. STORM DRAIN PIPE ASSUMED TO BE RCP OR HDPE

Hydraulic Analysis Report

Project Data

Project Title: Project - DeYoung Subdivision
Designer: JPS
Project Date: Tuesday, December 17, 2019
Project Units: U.S. Customary Units
Notes:

Channel Analysis: SD-A1

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 1.5000 ft
Longitudinal Slope: 0.0060 ft/ft
Manning's n: 0.0130
Depth: 1.5000 ft

Result Parameters

Flow: 8.1366 cfs
Area of Flow: 1.7671 ft²
Wetted Perimeter: 4.7124 ft
Hydraulic Radius: 0.3750 ft
Average Velocity: 4.6044 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 1.1045 ft
Critical Velocity: 5.8336 ft/s
Critical Slope: 0.0075 ft/ft
Critical Top Width: 1.32 ft
Calculated Max Shear Stress: 0.5616 lb/ft²
Calculated Avg Shear Stress: 0.1404 lb/ft²

Channel Analysis: SD-A2

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 2.0000 ft
Longitudinal Slope: 0.0050 ft/ft
Manning's n: 0.0130
Depth: 2.0000 ft

Result Parameters

Flow: 15.9965 cfs
Area of Flow: 3.1416 ft²
Wetted Perimeter: 6.2832 ft
Hydraulic Radius: 0.5000 ft
Average Velocity: 5.0918 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 1.4414 ft
Critical Velocity: 6.5991 ft/s
Critical Slope: 0.0066 ft/ft
Critical Top Width: 1.79 ft
Calculated Max Shear Stress: 0.6240 lb/ft²
Calculated Avg Shear Stress: 0.1560 lb/ft²

Channel Analysis: SD-A3

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0110 ft/ft

Manning's n: 0.0130

Depth: 2.0000 ft

Result Parameters

Flow: 23.7266 cfs

Area of Flow: 3.1416 ft²

Wetted Perimeter: 6.2832 ft

Hydraulic Radius: 0.5000 ft

Average Velocity: 7.5524 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.7275 ft

Critical Velocity: 8.2251 ft/s

Critical Slope: 0.0101 ft/ft

Critical Top Width: 1.37 ft

Calculated Max Shear Stress: 1.3728 lb/ft²

Calculated Avg Shear Stress: 0.3432 lb/ft²

Channel Analysis: SD-A4

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 1.5000 ft
Longitudinal Slope: 0.0060 ft/ft
Manning's n: 0.0130
Depth: 1.5000 ft

Result Parameters

Flow: 8.1366 cfs
Area of Flow: 1.7671 ft²
Wetted Perimeter: 4.7124 ft
Hydraulic Radius: 0.3750 ft
Average Velocity: 4.6044 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 1.1045 ft
Critical Velocity: 5.8336 ft/s
Critical Slope: 0.0075 ft/ft
Critical Top Width: 1.32 ft
Calculated Max Shear Stress: 0.5616 lb/ft²
Calculated Avg Shear Stress: 0.1404 lb/ft²

Channel Analysis: SD-A5

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.5000 ft

Longitudinal Slope: 0.0090 ft/ft

Manning's n: 0.0130

Depth: 2.5000 ft

Result Parameters

Flow: 38.9123 cfs

Area of Flow: 4.9087 ft²

Wetted Perimeter: 7.8540 ft

Hydraulic Radius: 0.6250 ft

Average Velocity: 7.9271 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 2.1045 ft

Critical Velocity: 8.8236 ft/s

Critical Slope: 0.0086 ft/ft

Critical Top Width: 1.82 ft

Calculated Max Shear Stress: 1.4040 lb/ft²

Calculated Avg Shear Stress: 0.3510 lb/ft²

Channel Analysis: SD-A6

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 1.5000 ft
Longitudinal Slope: 0.0060 ft/ft
Manning's n: 0.0130
Depth: 1.5000 ft

Result Parameters

Flow: 8.1366 cfs
Area of Flow: 1.7671 ft²
Wetted Perimeter: 4.7124 ft
Hydraulic Radius: 0.3750 ft
Average Velocity: 4.6044 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 1.1045 ft
Critical Velocity: 5.8336 ft/s
Critical Slope: 0.0075 ft/ft
Critical Top Width: 1.32 ft
Calculated Max Shear Stress: 0.5616 lb/ft²
Calculated Avg Shear Stress: 0.1404 lb/ft²

Channel Analysis: SD-A7

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0130

Depth: 2.0000 ft

Result Parameters

Flow: 15.9965 cfs

Area of Flow: 3.1416 ft²

Wetted Perimeter: 6.2832 ft

Hydraulic Radius: 0.5000 ft

Average Velocity: 5.0918 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.4414 ft

Critical Velocity: 6.5991 ft/s

Critical Slope: 0.0066 ft/ft

Critical Top Width: 1.79 ft

Calculated Max Shear Stress: 0.6240 lb/ft²

Calculated Avg Shear Stress: 0.1560 lb/ft²

Channel Analysis: SD-A8

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0110 ft/ft

Manning's n: 0.0130

Depth: 2.0000 ft

Result Parameters

Flow: 23.7266 cfs

Area of Flow: 3.1416 ft²

Wetted Perimeter: 6.2832 ft

Hydraulic Radius: 0.5000 ft

Average Velocity: 7.5524 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.7275 ft

Critical Velocity: 8.2251 ft/s

Critical Slope: 0.0101 ft/ft

Critical Top Width: 1.37 ft

Calculated Max Shear Stress: 1.3728 lb/ft²

Calculated Avg Shear Stress: 0.3432 lb/ft²

Channel Analysis: SD-A9

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.5000 ft

Longitudinal Slope: 0.0140 ft/ft

Manning's n: 0.0130

Depth: 2.5000 ft

Result Parameters

Flow: 48.5321 cfs

Area of Flow: 4.9087 ft²

Wetted Perimeter: 7.8540 ft

Hydraulic Radius: 0.6250 ft

Average Velocity: 9.8869 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 2.2803 ft

Critical Velocity: 10.3317 ft/s

Critical Slope: 0.0122 ft/ft

Critical Top Width: 1.42 ft

Calculated Max Shear Stress: 2.1840 lb/ft²

Calculated Avg Shear Stress: 0.5460 lb/ft²

Channel Analysis: SD-A10

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 2.5000 ft
Longitudinal Slope: 0.0300 ft/ft
Manning's n: 0.0130
Depth: 2.5000 ft

Result Parameters

Flow: 71.0438 cfs
Area of Flow: 4.9087 ft²
Wetted Perimeter: 7.8540 ft
Hydraulic Radius: 0.6250 ft
Average Velocity: 14.4729 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 2.4438 ft
Critical Velocity: 14.5555 ft/s
Critical Slope: 0.0267 ft/ft
Critical Top Width: 0.74 ft
Calculated Max Shear Stress: 4.6800 lb/ft²
Calculated Avg Shear Stress: 1.1700 lb/ft²

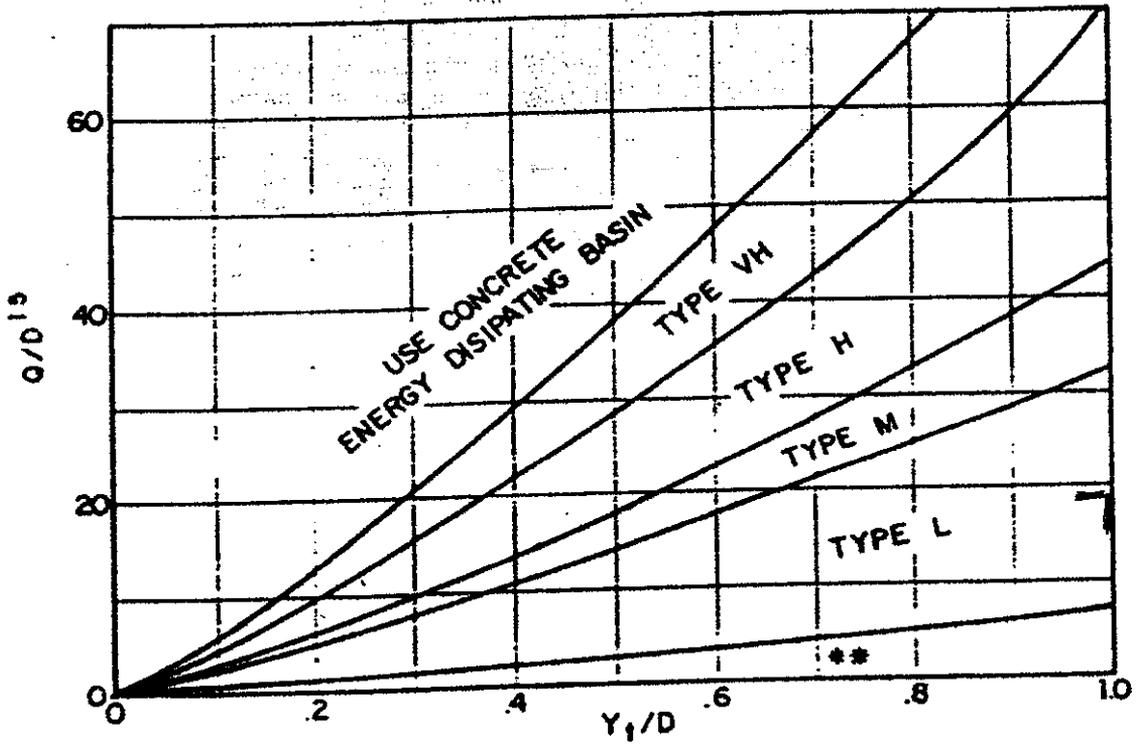
$$Q_{100} = 72.2 \text{ cfs}$$

$$\Delta = 30'' = 2.5'$$

$$\frac{Q}{\Delta^{1.5}} = \frac{72.2}{(2.5)^{1.5}} = 18.3$$

$Y_t = 4.7'$ (per Matrix HEL-RAS, West Trib-Future)

$$\frac{Y_t}{\Delta} = \frac{4.7}{2.5} = 1.9$$



Use D_0 instead of D whenever flow is supercritical in the barrel.
 ** Use Type L for a distance of $3D$ downstream.

→ Use Type M (minimum)

FIGURE 5-7. RIPRAP EROSION PROTECTION AT CIRCULAR CONDUIT OUTLET.

APPENDIX D

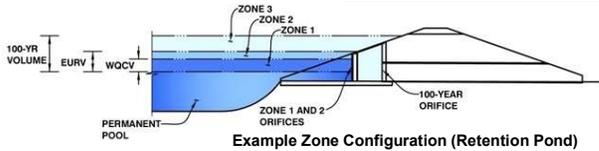
WATER QUALITY POND CALCULATIONS

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: DeYoung Subdivision

Basin ID: Detention Basin A1 - Ultimate Conditions - Water Quality Pond



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	6.45	0.393	Orifice Plate
Zone 2 (User)	6.84	0.050	Weir&Pipe (Restrict)
Zone 3			
Total (all zones)		0.443	

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	6.45	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	25.80	inches
Orifice Plate: Orifice Area per Row =	1.17	sq. inches (diameter = 1-3/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	8.125E-03	ft ²
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft ²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.15	4.30					
Orifice Area (sq. inches)	1.17	1.17	1.17					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =			ft ²
Vertical Orifice Centroid =			feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.45		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00		feet
Overflow Weir Grate Slope =	0.00		H:V
Horiz. Length of Weir Sides =	2.50		feet
Overflow Grate Type =	Type C Grate		
Debris Clogging % =	50%		%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Not Selected	
Height of Grate Upper Edge, H _u =	6.45		feet
Overflow Weir Slope Length =	2.50		feet
Grate Open Area / 100-yr Orifice Area =	17.72		
Overflow Grate Open Area w/o Debris =	6.96		ft ²
Overflow Grate Open Area w/ Debris =	3.48		ft ²

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

	Zone 2 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50		ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	12.00		inches
Restrictor Plate Height Above Pipe Invert =	6.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Restrictor	Not Selected	
Outlet Orifice Area =	0.39		ft ²
Outlet Orifice Centroid =	0.29		feet
Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	8.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	1.05	feet
Stage at Top of Freeboard =	9.05	feet
Basin Area at Top of Freeboard =	0.18	acres
Basin Volume at Top of Freeboard =	0.78	acre-ft

Routed Hydrograph Results

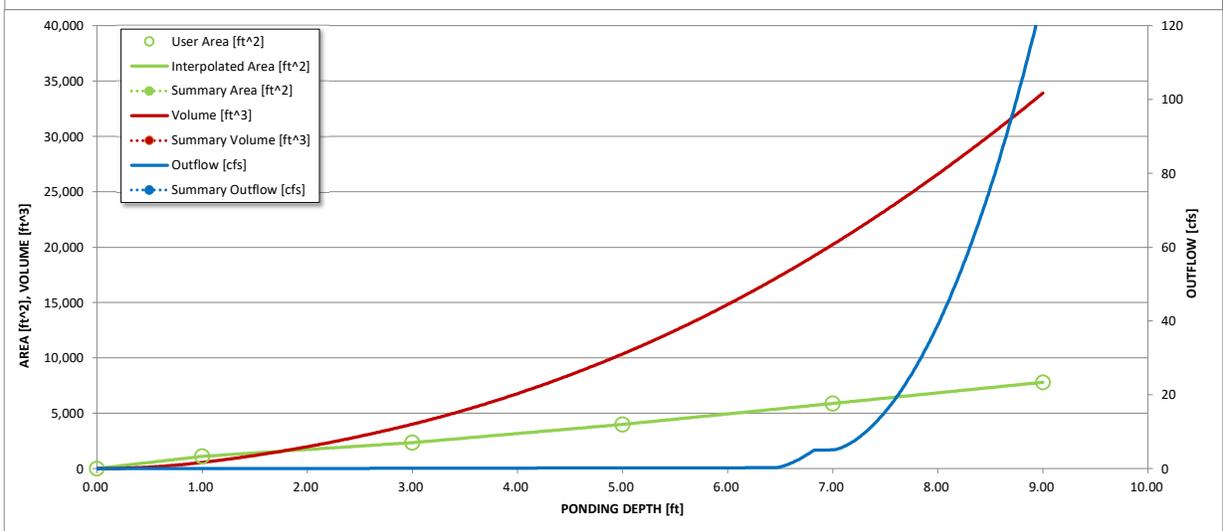
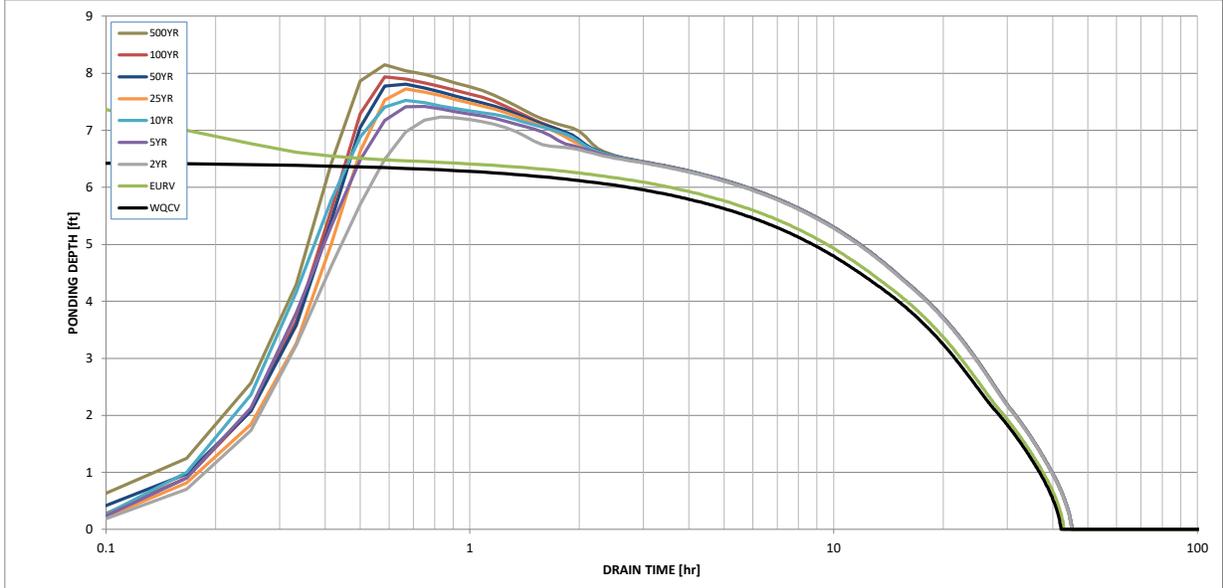
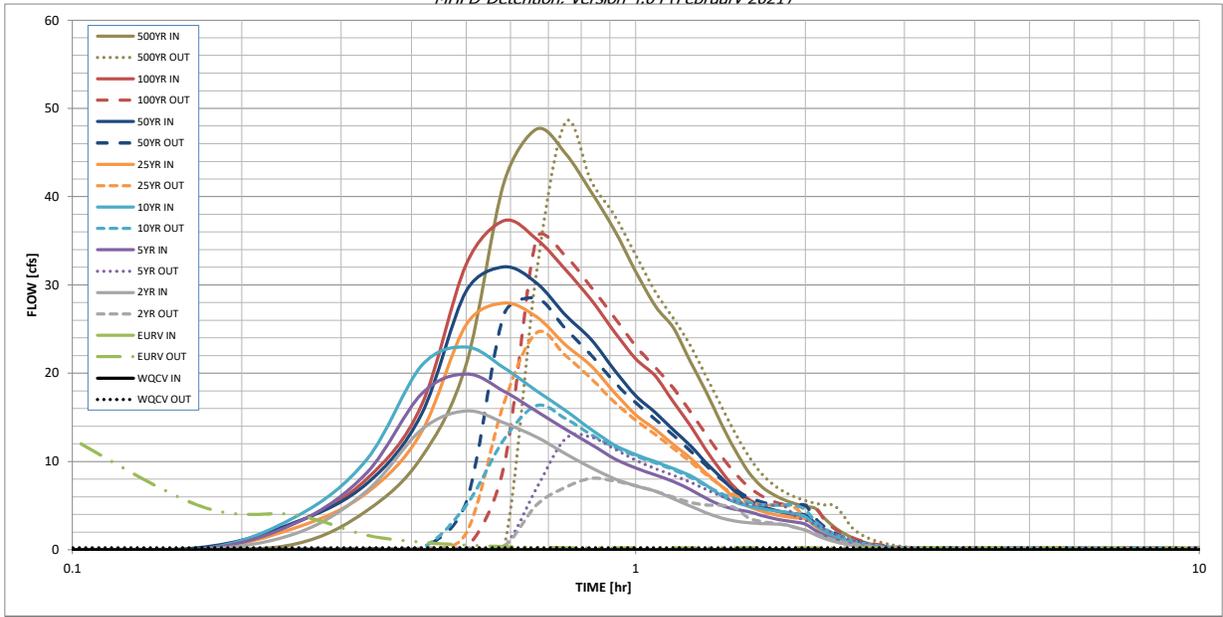
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	0.393	1.469	1.043	1.347	1.592	1.865	2.132	2.435	3.113
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.043	1.347	1.592	1.865	2.132	2.435	3.113
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	0.1	0.2	1.7	3.4	5.7	10.4
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.01	0.13	0.27	0.45	0.82
Peak Inflow Q (cfs) =	N/A	N/A	15.7	19.9	23.0	27.9	32.0	37.3	47.6
Peak Outflow Q (cfs) =	0.2	127.9	8.1	12.8	16.3	24.6	28.5	35.3	48.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	95.9	87.5	14.4	8.4	6.2	4.7
Structure Controlling Flow =	Overflow Weir 1	Spillway							
Max Velocity through Grate 1 (fps) =	N/A	0.72	0.70	0.7	0.7	0.7	0.7	0.7	0.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	33	35	33	31	30	28	27	25
Time to Drain 99% of Inflow Volume (hours) =	40	39	41	40	39	38	37	37	35
Maximum Ponding Depth (ft) =	6.45	7.50	7.23	7.42	7.53	7.73	7.81	7.94	8.15
Area at Maximum Ponding Depth (acres) =	0.12	0.15	0.14	0.14	0.15	0.15	0.15	0.16	0.16
Maximum Volume Stored (acre-ft) =	0.394	0.534	0.496	0.522	0.538	0.568	0.580	0.600	0.633

this should be closer to the calculated flow; verify watershed information input

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)



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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]	
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.02	0.68
	0:15:00	0.00	0.00	1.89	3.06	3.79	2.54	3.16	3.09	4.42	4.42
	0:20:00	0.00	0.00	6.67	8.74	10.25	6.45	7.50	8.03	10.44	10.44
	0:25:00	0.00	0.00	13.59	17.65	20.83	13.32	15.34	16.32	21.00	21.00
	0:30:00	0.00	0.00	15.74	19.91	22.98	15.50	17.30	18.34	23.34	23.34
	0:35:00	0.00	0.00	14.39	17.96	20.63	14.94	16.94	17.98	22.28	22.28
	0:40:00	0.00	0.00	12.76	15.69	18.00	13.38	15.22	16.19	20.92	20.92
	0:45:00	0.00	0.00	10.90	13.65	15.78	11.78	13.23	14.19	18.74	18.74
	0:50:00	0.00	0.00	9.31	11.94	13.64	10.25	11.84	12.70	16.32	16.32
	0:55:00	0.00	0.00	8.05	10.32	11.88	9.75	11.13	11.98	14.68	14.68
	1:00:00	0.00	0.00	7.24	9.26	10.79	9.26	10.52	11.37	13.63	13.63
	1:05:00	0.00	0.00	6.64	8.47	9.97	8.74	9.90	10.75	12.67	12.67
	1:10:00	0.00	0.00	5.76	7.74	9.19	8.22	9.26	10.11	11.72	11.72
	1:15:00	0.00	0.00	4.94	6.81	8.39	7.70	8.79	9.64	10.77	10.77
	1:20:00	0.00	0.00	4.21	5.83	7.32	6.89	7.98	8.83	9.78	9.78
	1:25:00	0.00	0.00	3.62	5.05	6.16	5.86	6.95	7.80	8.75	8.75
	1:30:00	0.00	0.00	3.25	4.58	5.41	5.36	6.45	7.30	8.25	8.25
	1:35:00	0.00	0.00	3.07	4.34	4.96	4.91	6.00	6.85	7.80	7.80
	1:40:00	0.00	0.00	2.97	3.91	4.66	4.61	5.65	6.50	7.45	7.45
	1:45:00	0.00	0.00	2.92	3.57	4.44	4.39	5.43	6.28	7.21	7.21
	1:50:00	0.00	0.00	2.87	3.32	4.29	4.24	5.26	6.11	7.04	7.04
	1:55:00	0.00	0.00	2.52	3.14	4.09	4.04	5.09	5.94	6.89	6.89
	2:00:00	0.00	0.00	2.23	2.91	3.73	3.68	4.92	5.77	6.72	6.72
	2:05:00	0.00	0.00	1.70	2.21	2.83	2.78	4.57	5.42	6.37	6.37
	2:10:00	0.00	0.00	1.26	1.64	2.09	2.04	4.22	5.07	6.02	6.02
	2:15:00	0.00	0.00	0.93	1.21	1.54	1.49	3.87	4.72	5.67	5.67
	2:20:00	0.00	0.00	0.69	0.89	1.13	1.08	3.52	4.37	5.32	5.32
	2:25:00	0.00	0.00	0.50	0.63	0.81	0.76	3.17	4.02	4.97	4.97
	2:30:00	0.00	0.00	0.35	0.44	0.58	0.53	2.82	3.67	4.62	4.62
	2:35:00	0.00	0.00	0.24	0.31	0.41	0.36	2.47	3.32	4.27	4.27
	2:40:00	0.00	0.00	0.16	0.21	0.27	0.22	2.12	3.07	4.02	4.02
	2:45:00	0.00	0.00	0.09	0.13	0.17	0.12	1.77	2.72	3.77	3.77
	2:50:00	0.00	0.00	0.04	0.07	0.09	0.04	1.42	2.47	3.52	3.52
	2:55:00	0.00	0.00	0.02	0.03	0.03	0.04	1.07	2.22	3.27	3.27
	3:00:00	0.00	0.00	0.00	0.01	0.01	0.01	0.72	2.02	3.02	3.02
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	1.77	2.77	2.77
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.52	2.52	2.52
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	2.27	2.27
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02	2.02	2.02
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	1.77	1.77
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	1.52	1.52
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	1.27	1.27
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.02	1.02
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.77
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.52
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.27
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 4

Designer: JPS
Company: JPS
Date: April 17, 2020
Project: DeYOUNG SUBDIVISION
Location: WATER QUALITY POND A

<p>1. Basin Storage Volume</p> <p>A) Effective Imperviousness of Tributary Area, I_a</p> <p>B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)</p> <p>C) Contributing Watershed Area</p> <p>D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm</p> <p>E) Design Concept (Select EURV when also designing for flood control)</p> <p>F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)) / 12 * Area$)</p> <p>G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * V_{DESIGN} / 0.43)$)</p> <p>H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)</p> <p>I) Predominant Watershed NRCS Soil Group</p> <p>J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$ </p>	<p>$I_a =$ <u>80.0</u> %</p> <p>$i =$ <u>0.800</u></p> <p>Area = <u>13.380</u> ac</p> <p>$d_6 =$ _____ in</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> Choose One <input checked="" type="radio"/> Water Quality Capture Volume (WQCV) <input type="radio"/> Excess Urban Runoff Volume (EURV) </div> <p>$V_{DESIGN} =$ <u>0.366</u> ac-ft</p> <p>$V_{DESIGN\ OTHER} =$ _____ ac-ft</p> <p>$V_{DESIGN\ USER} =$ _____ ac-ft</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> Choose One <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C / D </div> <p style="color: blue; margin-left: 20px;">WQCV selected. Soil group not required.</p> <p>EURV = _____ ac-ft</p>
<p>2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)</p>	<p>L : W = <u>3.0</u> : 1</p>
<p>3. Basin Side Slopes</p> <p>A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)</p>	<p>Z = <u>3.00</u> ft / ft DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE</p>
<p>4. Inlet</p> <p>A) Describe means of providing energy dissipation at concentrated inflow locations:</p>	<p>Concrete Forebay</p> <hr/> <hr/> <hr/>

Design Procedure Form: Extended Detention Basin (EDB)

Designer: JPS
Company: JPS
Date: April 17, 2020
Project: DeYOUNG SUBDIVISION
Location: WATER QUALITY POND A

<p>5. Forebay</p> <p>A) Minimum Forebay Volume ($V_{MIN} =$ <u>3%</u> of the WQCV)</p> <p>B) Actual Forebay Volume</p> <p>C) Forebay Depth ($D_F =$ <u>18</u> inch maximum)</p> <p>D) Forebay Discharge</p> <p style="padding-left: 20px;">i) Undetained 100-year Peak Discharge</p> <p style="padding-left: 20px;">ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)</p> <p>E) Forebay Discharge Design</p> <p style="padding-left: 20px;">F) Discharge Pipe Size (minimum 8-inches)</p> <p>G) Rectangular Notch Width</p>	<p>$V_{MIN} =$ <u>0.011</u> ac-ft</p> <p>$V_F =$ <u>0.011</u> ac-ft</p> <p>$D_F =$ <u>18.0</u> in</p> <p>$Q_{100} =$ <u>70.00</u> cfs</p> <p>$Q_F =$ <u>1.40</u> cfs</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p>Choose One</p> <p><input type="radio"/> Berm With Pipe</p> <p><input checked="" type="radio"/> Wall with Rect. Notch</p> <p><input type="radio"/> Wall with V-Notch Weir</p> </div> <p style="color: blue; font-size: small;">(flow too small for berm w/ pipe)</p> <p>Calculated $D_p =$ <u> </u> in</p> <p>Calculated $W_N =$ <u>6.3</u> in</p>
<p>6. Trickle Channel</p> <p>A) Type of Trickle Channel</p> <p>F) Slope of Trickle Channel</p>	<div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p>Choose One</p> <p><input checked="" type="radio"/> Concrete</p> <p><input type="radio"/> Soft Bottom</p> </div> <p>$S =$ <u>0.0050</u> ft / ft</p>
<p>7. Micropool and Outlet Structure</p> <p>A) Depth of Micropool (2.5-foot minimum)</p> <p>B) Surface Area of Micropool (10 ft² minimum)</p> <p>C) Outlet Type</p> <p>D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)</p> <p>E) Total Outlet Area</p>	<p>$D_M =$ <u>2.5</u> ft</p> <p>$A_M =$ <u>10</u> sq ft</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p>Choose One</p> <p><input checked="" type="radio"/> Orifice Plate</p> <p><input type="radio"/> Other (Describe):</p> </div> <hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/> <hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/> <hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/> <p>$D_{orifice} =$ <u>1.00</u> inches</p> <p>$A_{ot} =$ <u>2.83</u> square inches</p>

Design Procedure Form: Extended Detention Basin (EDB)

Designer: JPS
Company: JPS
Date: April 17, 2020
Project: DeYOUNG SUBDIVISION
Location: WATER QUALITY POND A

<p>8. Initial Surcharge Volume</p> <p>A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)</p> <p>B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)</p> <p>C) Initial Surcharge Provided Above Micropool</p>	<p>$D_{IS} = 6$ in</p> <p>$V_{IS} = 47.8$ cu ft</p> <p>$V_s = 5.0$ cu ft</p>
<p>9. Trash Rack</p> <p>A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5 * (e^{-0.095D})$</p> <p>B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)</p> <p style="padding-left: 40px;">Other (Y/N): N</p> <p>C) Ratio of Total Open Area to Total Area (only for type 'Other')</p> <p>D) Total Water Quality Screen Area (based on screen type)</p> <p>E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)</p> <p>F) Height of Water Quality Screen (H_{TR})</p> <p>G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)</p>	<p>$A_t = 99$ square inches</p> <p style="background-color: #e0ffe0; padding: 2px; text-align: center;"><i>S.S. Well Screen with 60% Open Area</i></p> <hr/> <hr/> <p>User Ratio =</p> <p>$A_{total} = 165$ sq. in.</p> <p>$H = 6.8$ feet</p> <p>$H_{TR} = 109.6$ inches</p> <p>$W_{opening} = 12.0$ inches</p>

Design Procedure Form: Extended Detention Basin (EDB)

Designer: JPS
Company: JPS
Date: April 17, 2020
Project: DeYOUNG SUBDIVISION
Location: WATER QUALITY POND A

<p>10. Overflow Embankment</p> <p>A) Describe embankment protection for 100-year and greater overtopping:</p> <p>B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)</p>	<p><u>Buried Riprap Spillway</u></p> <p>_____</p> <p>_____</p>
<p>11. Vegetation</p>	<p>Choose One</p> <p><input type="radio"/> Irrigated</p> <p><input checked="" type="radio"/> Not Irrigated</p>
<p>12. Access</p> <p>A) Describe Sediment Removal Procedures</p>	<p><u>Periodic inspection and maintenance by property owner as required</u></p> <p><u>Ramp provided for skid-loader access to pond bottom</u></p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Notes: _____</p> <p>_____</p> <p>_____</p>	

See GEC redlines

APPENDIX E

**STORMWATER DRAINAGE MAINTENANCE AGREEMENT AND
EASEMENT DOCUMENTS**

**STORMWATER DRAINAGE
MAINTENANCE AGREEMENT AND EASEMENT**

This STORMWATER DRAINAGE MAINTENANCE AGREEMENT AND EASEMENT (Agreement) is made by and between EL PASO COUNTY, by and through the BOARD OF COUNTY COMMISSIONERS OF EL PASO COUNTY ("County"), **Challenger Communities, LLC (Developer)**, BENT GRASS METROPOLITAN DISTRICT (Metro District), a quasi-municipal corporation and political subdivision of the State of Colorado, Randall L. DeYoung (Upstream Owner) and Lena Gail Case (Owner). The above may occasionally be referred to herein singularly as "Party" and collectively as "Parties."

Recitals

A. WHEREAS, the Metro District provides various municipal services to certain real property in El Paso County, Colorado referred to as Bent Grass Residential Filing 2; and

B. WHEREAS, Developer is the owner of certain real estate (the Subject Property) in El Paso County, Colorado, which Property is legally described in Exhibit A attached hereto and incorporated herein by this reference; and

C. WHEREAS, Owner is the owner of certain real property adjacent to or downstream of the Subject Property onto which developed stormwater runoff will be discharged, which property is legally described in Exhibit B attached hereto and incorporated herein by this reference (the Case Downstream Property); and

D. WHEREAS, Upstream Owner is the owner of certain real property adjacent to and upstream of the Case Downstream Property (the DeYoung Upstream Property), which property is legally described in Exhibit C attached hereto, through which developed stormwater runoff will be discharged from the Subject Property and onto the Case Upstream Property; and

E. WHEREAS, Owner is also the owner of certain real property adjacent to and upstream of the Case Downstream Property, which property is legally described in Exhibit D attached hereto (the Case Upstream Property), through which developed stormwater runoff will be discharged from the Subject Property and the DeYoung Upstream Property and onto the Case Downstream Property; and

F. WHEREAS, Developer desires to plat and develop on the Subject Property a Subdivision to be known as Bent Grass Residential Filing 2; and

G. WHEREAS, the development of the Subject Property will substantially increase the volume of stormwater runoff that will discharge from the Subject Property, through the DeYoung Upstream Property and the Case Upstream Property and to the Case Downstream Property, and

H. WHEREAS, Section 2.9 of the El Paso County Drainage Criteria Manual provides for a developer's promise to maintain a subdivision's drainage facilities in the event the County does not assume such responsibility; and

I. WHEREAS, Developer desires to meet requirements of the County's MS4 Permit, and to provide for operating, cleaning, maintaining and repairing the downstream drainage facilities in cooperation with the District; and

J. WHEREAS, Owner shall be charged herein with the duties of providing access to the stormwater drainage channel on the portion of the Case Downstream Property described in Exhibit E attached hereto and incorporated herein by this reference (the Stormwater Facilities Area); and

K. WHEREAS, Metro District shall be charged with the duties of operating, maintaining and repairing the stormwater drainage channel and any appurtenant improvements within the Stormwater Facilities Area described in Exhibit E; and

L. WHEREAS, the Parties hereto anticipate that when the Case Downstream Property develops in the future, the location of the Stormwater Facilities Area will likely change to the area depicted in Exhibit F, attached hereto; and

M. WHEREAS, El Paso County has conditioned approval of this Subdivision on the Developer's promise to provide a stormwater drainage easement and maintenance agreement, and further conditions approval on the Metro District's promise to maintain and/or repair the drainage channel within the Stormwater Facilities Area serving this Subdivision; and

N. WHEREAS, the County could condition subdivision approval on the Developer's promise to construct a different and more expensive drainage, water runoff control system and BMPs than those proposed herein, which more expensive system would mitigate the discharge of stormwater onto the Downstream Property at higher than historic rates; however, the County is willing to forego such right upon the performance of Developer's and the Metro District's promises contained herein; and

O. WHEREAS, the County, in order to secure performance of the promises contained herein, conditions approval of this Subdivision upon Owner's grant herein of a perpetual Easement over the Stormwater Facilities Area as described in Exhibit E for the purpose of allowing the Metro District access to upgrade, clean, maintain and/or repair the drainage channel, and allowing the County to periodically access and inspect the drainage channel.

Agreement

NOW, THEREFORE, in consideration of the mutual Promises contained herein, the sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Incorporation of Recitals: The Parties incorporate the Recitals above into this Agreement.

2. Covenants Running with the Land: Developer agrees that this entire Agreement and the performance thereof shall become a covenant running with the land, which land is legally described in Exhibit A attached hereto, and that this entire Agreement and the performance thereof shall be binding upon itself and its successors and assigns.

The Owner agrees that this entire Agreement and Owner's performance of its obligations hereunder shall become a covenant running with the land, which land is legally described in Exhibit B

attached hereto, and that this entire Agreement and Owner's performance of its obligations hereunder shall be binding upon itself and its successors and assigns.

3. Maintenance: The Metro District agrees for itself and its successors and assigns that it will regularly and routinely inspect, clean and maintain the stormwater drainage channel and any appurtenant improvements within the Stormwater Facilities Area first described in Exhibit E, and otherwise keep the same in good repair, all at its own cost and expense. Neither Developer nor Metro District shall suffer any mechanics' or materialmen's liens to be enforced against the Stormwater Facilities Area or other property of Owner for work done or materials furnished in connection with Metro District's obligations under this Agreement. Owner shall have no obligations with respect to the Stormwater Facilities Area other than to provide the property and access thereto, without obstruction, pursuant to the easement described in Section 4 of this Agreement.

4. Creation of Easement: Owner hereby grant Developer, Owner and Upstream Owner a non-exclusive perpetual easement upon and across the property described in Exhibit E for the discharge and flow of stormwater from the Subject Property, Case Upstream Property and DeYoung Upstream Property in higher than historic volumes and at higher than historic rates. Owner hereby grants the Metro District a non-exclusive perpetual easement upon and across the property described in Exhibit E for the purposes of access to and construction, cleaning, maintenance and repair of the stormwater drainage channel and any appurtenant improvements. Owner hereby grants the County a non-exclusive perpetual easement upon and across the property described in Exhibit E for the purposes of access to and inspection of the Stormwater Facilities Area. The creation of the County's easement does not expressly or implicitly impose on the County a duty to so inspect, nor to clean, repair or maintain the stormwater drainage channel or any appurtenant improvements.

5. New Agreement: Should the location of the Stormwater Facilities Area need to be modified in the future, due to the development of the Case Downstream Property or otherwise, then Owner shall be required to enter into a Private Detention Basin / Stormwater Quality Best Management Practice Maintenance Agreement and Easement (New Agreement) in connection with such development. Such New Agreement shall set forth the obligations for construction and maintenance of the new stormwater drainage channel and any appurtenant improvements and shall contain a provision terminating the perpetual easements created by this Agreement and establishing new perpetual easements over and across the new Stormwater Facilities Area.

6. Indemnification: Developer and Metro District shall indemnify, defend and hold Owner harmless from and against any and all obligations, liabilities, claims, liens, demands, loss, damage, injury, suit, causes of action, costs and expenses (including, without limitation, attorneys' fees) whatsoever in any way relating to or arising out of either (i) any stormwater runoff or drainage from the Subject Property and easement area shown in Exhibit E that enters or crosses the Case Downstream Property or other properties, or (ii) the activities or obligations of Developer, Metro District, or their respective agents or representatives under this Agreement. At all times during any construction or maintenance activities within the detention basin/BMP(s), Developer and Metro District shall maintain, or cause to be maintained, in full force and effect, a policy of comprehensive general liability insurance issued on a form and with an insurance company reasonably acceptable to Owner, and with such commercially reasonable coverage limits as Owner may from time to time require. Prior to any construction or maintenance activities, Developer and Metro District shall provide Owner with a certificate of insurance evidencing that Owner has been named as an additional insured under such

policy. Such certificate shall provide that such policy shall not be cancelled or amended without thirty (30) days' prior written notice to Owner.

7. Severability: In the event any Court of competent jurisdiction declares any part of this Agreement to be unenforceable, such declaration shall not affect the enforceability of the remaining parts of this Agreement.

8. Third Parties: This Agreement does not and shall not be deemed to confer upon or grant to any third party any right to claim damages or to bring any lawsuit, action or other proceeding against either the County, the Developer, the Metro District, the Owner, or their respective successors and assigns, because of any breach hereof or because of any terms, covenants, agreements or conditions contained herein.

9. Solid Waste or Hazardous Materials: Should any refuse from the stormwater drainage channel within the Stormwater Facilities Area be suspected or identified as solid waste or petroleum products, hazardous substances or hazardous materials (collectively referred to herein as "hazardous materials"), the Developer and the Metro District shall take all necessary and proper steps to characterize the solid waste or hazardous materials and properly dispose of it in accordance with applicable State and/or Federal environmental laws and regulations, including, but not limited to, the following: Solid Wastes Disposal Sites and Facilities Acts, §§ 30-20-100.5 – 30-20-119, C.R.S., Colorado Regulations Pertaining to Solid Waste Disposal Sites and Facilities, 6 C.C.R. 1007-2, *et seq.*, Solid Waste Disposal Act, 42 U.S.C. §§ 6901-6992k, and Federal Solid Waste Regulations 40 CFR Ch. I. The County shall not be responsible or liable for identifying, characterizing, cleaning up, or disposing of such solid waste or hazardous materials. Notwithstanding the previous sentence, should any refuse cleaned up and disposed of by the County for any reason be determined to be solid waste or hazardous materials, the Developer and the Metro District, but not the County, shall be responsible and liable as the owner, generator, and/or transporter of said solid waste or hazardous materials.

10. Applicable Law and Venue: The laws, rules, and regulations of the State of Colorado and El Paso County shall be applicable in the enforcement, interpretation, and execution of this Agreement, except that Federal law may be applicable regarding solid waste or hazardous materials. Venue shall be in the El Paso County District Court.

IN WITNESS WHEREOF, the Parties affix their signatures below.

Executed this 22nd day of July, 2020 by:

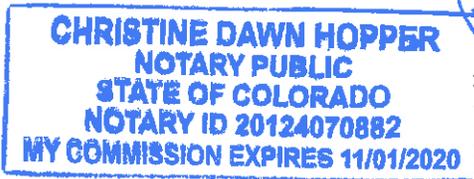
Challenger Communities, LLC

By: [Signature]
Jim Byers, VP of Community Development

The foregoing instrument was acknowledged before me this 22 day of July, 2020 by Jim Byers, VP of Community Development, Challenger Communities, LLC

Witness my hand and official seal.

My commission expires: 11/1/20



[Signature]
Notary Public

Executed this 23rd day of July, 2020, by:

BENT GRASS METROPOLITAN DISTRICT

By: [Signature]
Randle W. Case II, President
[Name]

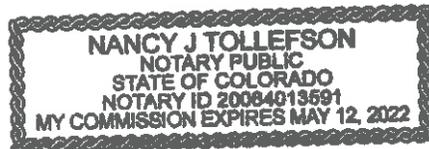
Attest:

By: Lena Gail Case
Lena Gail Case, Board Member
[Name] [Title]

The foregoing instrument was acknowledged before me this 23 day of July, 2020, by Randle W. Case II President, and Lena Gail Case, Board Member, BENT GRASS METROPOLITAN DISTRICT

Witness my hand and official seal.

My commission expires: May 12, 2022



[Signature]
Notary Public

Executed this 23rd day of July, 2020, by:

OWNER

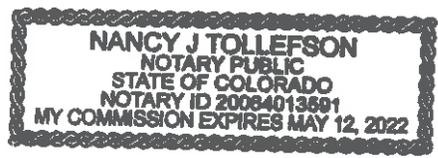
Lena Gail Case

By: Lena Gail Case
Lena Gail Case

The foregoing instrument was acknowledged before me this 23 day of July, 2020, by Lena Gail Case, Lena Gail Case.

Witness my hand and official seal.

My commission expires: 5/12/22



[Signature]
Notary Public

Executed this 21st day of July, 2020, by:

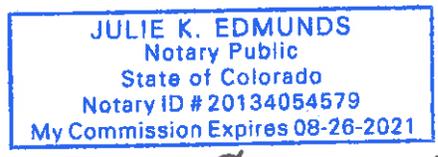
UPSTREAM OWNER:

Randall L. DeYoung
Randall L. DeYoung

The foregoing instrument was acknowledged before me this 21st day of July, 2020, by Randall L. DeYoung.

Witness my hand and official seal.

My commission expires: 8.26.2021



[Signature]
Notary Public

Executed this _____ day of _____, 20____, by:

BOARD OF COUNTY COMMISSIONERS
OF EL PASO COUNTY, COLORADO

By: _____
Craig Dossey, Executive Director
El Paso County Planning and Community Development Department
Authorized signatory pursuant to LDC

Attest:

County Clerk and Recorder

The foregoing instrument was acknowledged before me this _____ day of _____,
20____, by Craig Dossey, Executive Director of the El Paso County Planning and Community
Development Department, as Attested to by _____, County Clerk and Recorder.

Witness my hand and official seal.

My commission expires: _____

Notary Public

Approved as to Content and Form:

Assistant County Attorney

EXHIBIT A

PARCELS OF LAND AS DESCRIBED IN WARRANTY DEEDS RECORDED AT RECEPTION NO. 219074560 AND 219074561 OF THE EL PASO COUNTY CLERK AND RECORDER OFFICE, BEING A PORTION OF THE WEST HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST, OF THE 6TH/ PRINCIPAL MERIDIAN, LOCATED IN EL PASO COUNTY, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BASIS OF BEARINGS:

ALL BEARINGS ARE GRID BEARINGS OF THE COLORADO STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, NORTH AMERICAN DATUM 1983. THE BEARING OF THE LINE BETWEEN THE SOUTHWEST CORNER OF SECTION 1, T13S, R65W AND THE WEST QUARTER CORNER OF SECTION 1, T13S, R65W IS N00°13'46"W AND MONUMENTED AS SHOWN:

COMMENCING AT THE SOUTHWEST QUARTER CORNER OF SAID SECTION 1; THENCE N00°13'46"W WITH THE WEST LINE OF SAID SECTION 1, A DISTANCE OF 1928.67 FEET TO THE SOUTHWEST CORNER OF A PARCEL DESCRIBED IN WARRANTY DEED RECORDED AT RECEPTION NO. 21303554 OF THE EL PASO COUNTY CLERK AND RECORDER OFFICE; THENCE WITH THE SOUTH LINE OF SAID PARCEL, N89°47'22"E A DISTANCE OF 419.98 FEET TO THE SOUTHEAST CORNER OF SAID PARCEL AND BEING THE SOUTHWEST CORNER OF A STRIP OF LAND DESCRIBED IN QUIT CLAIM DEED AT RECEPTION NO. 209061972 AND ALSO BEING THE **POINT OF BEGINNING**:

THENCE N00°13'46"W, A DISTANCE OF 206.47 FEET TO A POINT OF CURVATURE;
THENCE ALONG SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 605.00 FEET, A CENTRAL ANGLE OF 23°58'12", A DISTANCE OF 253.10 FEET, A CHORD BEARING OF N11°45'20"E WITH A CHORD DISTANCE OF 251.26 FEET;
THENCE N23°44'26"E, A DISTANCE OF 301.49 FEET TO A POINT OF CURVATURE;
THENCE ALONG SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 605.00 FEET, A CENTRAL ANGLE OF 65°45'45", A DISTANCE OF 694.40 FEET, A CHORD BEARING OF N56°37'18"E WITH A CHORD DISTANCE OF 656.91 FEET;
THENCE N89°30'12"E, A DISTANCE OF 62.90 FEET;
THENCE N00°14'14"W, A DISTANCE OF 938.90 FEET TO A POINT ON THE SOUTH LINE OF THE MEADOWS FILING NO. 3, RECORDED AT RECEPTION NO. 200135677 AND ALSO BEING A POINT ON THE SOUTH LINE OF THE NORTH 1/16TH OF SAID SECTION 1;
THENCE WITH SAID SOUTH LINE, N89°36'34"E, A DISTANCE OF 1431.39 FEET TO THE NORTH 1/16TH CORNER OF SAID SECTION 1;
THENCE N89°36'02"E, A DISTANCE OF 28.34 FEET;
THENCE S00°22'19"E, DISTANCE OF 619.54 FEET TO A POINT ON THE NORTH RIGHT OF WAY LINE OF BENT GRASS MEADOWS DRIVE (AN 80' PUBLIC RIGHT OF WAY) AND BEING A POINT ON THE NORTH LINE OF BENT GRASS RESIDENTIAL FILING NO. 1, RECORDED AT RECEPTION NO. 215713636;
THENCE WITH SAID NORTH RIGHT OF WAY LINE AND THE NORTH LINE OF SAID BENT GRASS RESIDENTIAL FILING NO.1, S89°38'09"W, A DISTANCE OF 28.48 FEET TO THE NORTHWEST CORNER OF SAID BENT GRASS MEADOWS DRIVE RIGHT OF WAY AND BEING A POINT ON THE EAST 1/16 LINE OF SAID SECTION 1;
THENCE WITH SAID EAST 1/16 LINE, S00°21'34"E, A DISTANCE OF 699.51 FEET;
THENCE CONTINUING WITH SAID EAST 1/16 LINE, S00°21'50"E, A DISTANCE OF 693.63 FEET TO THE NORTHEAST CORNER OF A PARCEL DESCRIBED IN DEED AT BOOK 3233, PAGE 824 OF THE EL PASO COUNTY CLERK & RECORDER;
THENCE WITH THE NORTH OF LINE OF SAID PARCEL, S89°47'22"W, A DISTANCE OF 952.75 FEET TO THE NORTHWEST CORNER OF SAID PARCEL DESCRIBED IN BOOK 3233 AT PAGE 824;
THENCE ALONG THE WEST LINE OF SAID PARCEL, S00°22'01"E, A DISTANCE OF 18.25 FEET TO THE NORTHEAST CORNER OF A PARCEL DESCRIBED IN DEED AT RECEPTION NO. 208053974;
THENCE WITH THE NORTH LINE OF SAID PARCEL DESCRIBED AT RECEPTION NO. 208053974, S89°47'22"W, A DISTANCE OF 179.94 FEET;

THENCE N00°12'38"W, A DISTANCE OF 119.39 FEET TO A POINT OF CURVE;
THENCE ALONG SAID CURVE TO THE LEFT, HAVING A RADIUS OF 450.00 FEET, A CENTRAL ANGLE OF 55°58'18", A DISTANCE OF 439.60 FEET, A CHORD BEARING OF N28°11'47"W WITH A CHORD DISTANCE OF 422.33 FEET;
THENCE N56°10'56"W, A DISTANCE OF 198.31 FEET TO A POINT OF CURVE;
THENCE ALONG SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 540.00 FEET, A CENTRAL ANGLE OF 16°06'20", A DISTANCE OF 151.79 FEET, A CHORD BEARING OF N48°07'46"W WITH A CHORD DISTANCE OF 151.29 FEET;
THENCE N40°04'36"W, A DISTANCE OF 279.73 FEET TO A POINT OF NON-TANGENT CURVE;
THENCE ALONG SAID NON-TANGENT CURVE TO THE LEFT, HAVING A RADIUS OF 525.00 FEET, A CENTRAL ANGLE OF 32°26'00", A DISTANCE OF 297.18 FEET, A CHORD BEARING OF S39°57'26"W WITH A CHORD DISTANCE OF 293.23 FEET;
THENCE S23°44'26"W, A DISTANCE OF 301.49 FEET TO A POINT OF CURVATURE;
THENCE ALONG SAID CURVE TO THE LEFT, HAVING A RADIUS OF 525.00 FEET, A CENTRAL ANGLE OF 23°58'12", A DISTANCE OF 219.64 FEET, A CHORD BEARING OF S11°45'20"W WITH A CHORD DISTANCE OF 218.04 FEET;
THENCE S00°13'46"E, A DISTANCE OF 206.50 FEET TO THE SOUTHEAST CORNER OF SAID STRIP OF LAND DESCRIBED IN QUITCLAIM DEED AT RECEPTION NO. 209061972;
THENCE WITH SOUTH LINE OF SAID STRIP OF LAND, S89°47'22"W, A DISTANCE OF 80.00 FEET TO THE **POINT OF BEGINNING**.

THE ABOVE DESCRIBED PARCEL CONTAINS 2,985,862 SQUARE FEET OR 68.55 ACRES, MORE OR LESS.

EXHIBIT B

PARCEL DESCRIPTION:

LOTS 1 AND 2, LATIGO BUSINESS & RESEARCH CENTER FILING NO. 1, RECORDED AT RECEPTION NO. 724174 OF THE EL PASO COUNTY CLERK & RECORDER OFFICE, BEING A PORTION OF THE WEST HALF OF SECTION 1, TOWNSHIP 13 SOUTH., RANGE 65 WEST OF THE 6TH P.M., LOCATED WITHIN EL PASO COUNTY, STATE OF COLORADO.



BY: BRIAN J. DENNIS, PLS 38069
PREPARED FOR AND ON BEHALF OF
GALLOWAY & COMPANY, INC
PRJ #: CLH0000017.10

EXHIBIT C

PARCEL DESCRIPTION:

A PARCEL OF LAND AS DESCRIBED IN WARRANTY DEED RECORDED AT RECEPTION NO. 207122803 AND AFFIDAVIT OF CORRECTION RECORDED AT RECEPTION NO. 208053974 OF THE EL PASO COUNTY CLERK AND RECORDER OFFICE AND SITUATED IN THE WEST HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN, LOCATED WITHIN EL PASO COUNTY, STATE OF COLORADO, AND BEING MORE PARTICULARLY DESCRIBED IN SAID AFFIDAVIT OF CORRECTION AS FOLLOWS:

BEGINNING AT THE NORTHEAST CORNER OF LATIGO BUSINESS CENTER FILING NO. 1 (RECEPTION NO. 205075726, EL PASO COUNTY, COLORADO SPRINGS) (ALL BEARINGS IN THIS DESCRIPTION ARE RELATIVE TO THE NORTHERLY LINE OF SAID FILING, WHICH BEARS S DEGREES 42 MINUTES 50 SECONDS E ASSUMED); THENCE S 89 DEGREES 42 MINUTES 50 SECONDS E ALONG THE EASTERLY EXTENSION OF SAID FILING'S NORTHERLY LINE, 1190.72 FEET TO A POINT ON THE EASTERLY LINE OF THAT INGRESS/EGRESS AND UTILITY EASEMENT AS DESCRIBED BY DOCUMENT (BOOK 3265, PAGE 517, SAID EL PASO COUNTY RECORDS); THENCE S 00 DEGREES 07 MINUTES 47 SECONDS W ALONG SAID EASEMENT'S EASTERLY LINE, 627.84 FEET; THENCE N 89 DEGREES 42 MINUTES 50 SECONDS W, 1192.23 FEET TO A POINT ON THE EASTERLY LINE OF SAID FILING; THENCE N 00 DEGREES 16 MINUTES 02 SECONDS E ALONG SAID FILING'S EASTERLY LINE, 627.84 FEET TO THE POINT OF BEGINNING.

ALL LINEAL DISTANCES ARE REPRESENTED IN U.S. SURVEY FEET.



BY: BRIAN J. DENNIS, PLS 38069
PREPARED FOR AND ON BEHALF OF
GALLOWAY & COMPANY, INC
PRJ #: CLH0000017.10

EXHIBIT D

PARCEL DESCRIPTION:

A PARCEL OF LAND AS DESCRIBED IN WARRANTY DEED, RECORDED AT RECEPTION NO. 218113881 OF THE EL PASO COUNTY CLERK AND RECORDER OFFICE AND SITUATED IN THE WEST HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 88 WEST, OF THE 6TH PRINCIPAL MERIDIAN, LOCATED WITHIN EL PASO COUNTY, STATE OF COLORADO, AND BEING MORE PARTICULARLY DESCRIBED IN SAID WARRANTY DEED AS FOLLOWS:

BEING THE SOUTH HALF OF THE NORTHWEST QUARTER, AND THE SOUTHWEST QUARTER OF SAID SECTION 1:

LESS AND EXCEPT THAT PORTION CONVEYED IN WARRANTY DEED TO MOUNTAIN VIEW ELECTRIC ASSOCIATION, INC., RECORDED AT BOOK 3293, PAGE 824, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHWEST QUARTER OF SAID SECTION 1, THENCE S 89°42'50"E ALONG THE SOUTH LINE OF SAID SECTION 1, 2848.33 FEET TO THE SOUTH ONE-QUARTER CORNER OF SAID SECTION 1; THENCE N00°07'47"E ALONG THE EAST LINE OF THE SOUTHWEST ONE-QUARTER OF SAID SECTION 1, 30.00 FEET TO A POINT ON THE NORTHERLY RIGHT-OF-WAY LINE OF THE EL PASO COUNTY HIGHWAY #110, SAID POINT ALSO BEING THE POINT OF BEGINNING. THENCE N89°42'50"W ALONG SAID NORTHERLY RIGHT-OF-WAY LINE, 725.00 FEET; THENCE N00°17'10"E, 85.00 FEET. THENCE ON THE ARC OF A CURVE TO THE LEFT, HAVING A CENTRAL ANGLE OF 26°25'00", A RADIUS OF 250.04 FEET AND ARC LENGTH OF 118.03 FEET; THENCE N26°07'56"W ON THE FORWARD TANGENT TO THE LAST MENTIONED CURVE, 388.00 FEET; THENCE ON THE ARC OF A CURVE TO THE RIGHT HAVING A CENTRAL ANGLE OF 26°15'43", A RADIUS OF 490.87 FEET AND AN ARC LENGTH OF 216.42 FEET. THENCE N00°07'47"E ON THE FORWARD TANGENT TO THE LAST MENTIONED CURVE 1108.03 FEET; THENCE S89°42'50"E, 952.97 FEET TO A POINT ON THE EAST LINE OF SAID SOUTHWEST ONE-QUARTER, SAID POINT ALSO BEING ON THE WESTERLY LINE OF FALCON RANCHETTES AS RECORDED IN PLAT BOOK V-2 AT PAGE 15 OF THE RECORDS OF SAID EL PASO COUNTY; THENCE S00°07'47"W ALONG THE WESTERLY LINE OF SAID FALCON RANCHETTES AND ALONG THE EAST LINE OF SAID SOUTHWEST ONE-QUARTER 829.04 TO THE SOUTHWEST CORNER OF SAID FALCON RANCHETTES; THENCE CONTINUE S00°07'47"W ALONG THE EAST LINE OF SAID SOUTHWEST ONE-QUARTER, 1280.80 FEET TO THE POINT OF BEGINNING.

TOGETHER WITH:

LESS AND EXCEPT LOTS 1 AND 2, LATIGO BUSINESS & RESEARCH CENTER FILING NO. 1, RECORDED AT RECEPTION NUMBER 724174;

TOGETHER WITH:

LESS AND EXCEPT THAT PORTION CONVEYED IN WARRANTY DEED, RECORDED AT RECEPTION NUMBER 2032911895, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

A PARCEL OF LAND BEING A PORTION OF THE WEST ONE-HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 88 WEST OF THE 6TH P.M., SITUATE IN EL PASO COUNTY, COLORADO, DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHWEST CORNER OF SAID SECTION 1 (ALL BEARINGS IN THIS DESCRIPTION ARE RELATIVE TO THE WEST LINE OF THE SOUTHWEST ONE-QUARTER OF SAID SECTION 1, WHICH BEARS NORTH 00 DEGREES 10 MINUTES 02 SECONDS EAST "ASSUMED"); THENCE NORTH 00 DEGREES 10 MINUTES 02 SECONDS EAST ALONG SAID SECTION 1'S SOUTHWEST ONE-QUARTER'S WEST LINE (SAID LINE ALSO BEING COINCIDENT WITH THE WESTERLY LINE OF LATIGO BUSINESS & RESEARCH CENTER FILING NO. 1, (PLAT BOOK M-3, PAGE 73, EL PASO COUNTY, COLORADO RECORDS) AND THE EASTERLY LINE OF THE MEADOWS FILING NO. 1 (PLAT BOOK N-3, PAGE 125, SAID EL PASO COUNTY RECORDS), AS EXTENDED SOUTHERLY), 1928.59 FEET TO THE POINT OF BEGINNING OF THE PARCEL HEREIN DESCRIBED (THE FOLLOWING THREE (3) COURSES ARE ALONG THE EASTERLY LINE OF SAID THE MEADOWS FILING NO. 1, AND THE MEADOWS FILING NO. 2 (PLAT BOOK O-3, PAGE 94, SAID RECORDS), AND THE SOUTHERLY LINE OF THE MEADOWS FILING NO. 3 (RECEPTION NUMBER 200135007), SAID RECORDS), RESPECTIVELY); 1) CONTINUE NORTH 00 DEGREES 10 MINUTES 02 SECONDS EAST ALONG SAID SOUTHWEST ONE-QUARTER'S WEST LINE, 700.00 FEET TO THE SOUTHWEST CORNER OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 1; 2) NORTH 00 DEGREES 15 MINUTES 34 SECONDS EAST ALONG THE WEST LINE OF THE SOUTH ONE-HALF OF THE NORTHWEST ONE-QUARTER (SOUTH HALF OF THE NORTHWEST QUARTER) OF SAID SECTION 1, 1318.12 FEET TO THE NORTHWEST CORNER OF SAID SOUTH HALF OF THE NORTHWEST QUARTER; 3) SOUTH 80 DEGREES 52 MINUTES 38 SECONDS EAST ALONG THE NORTH LINE OF SAID HALF OF THE NORTHWEST QUARTER, 2839.01 FEET TO THE SOUTHEAST CORNER OF SAID FILING NO. 3 AND THE NORTHEAST CORNER OF SAID SOUTH HALF OF THE NORTHWEST QUARTER; THENCE SOUTH 00 DEGREES 08 MINUTES 14 SECONDS WEST ALONG THE EAST LINE OF SAID SOUTH HALF OF THE NORTHWEST QUARTER, 1318.04 FEET TO THE NORTHEAST CORNER OF THE SOUTHWEST ONE-QUARTER OF SAID SECTION 1; THENCE SOUTH 00 DEGREES 07 MINUTES 58 SECONDS WEST ALONG THE EAST LINE OF SAID SECTION 1'S SOUTHWEST ONE-QUARTER, 893.76 FEET TO THE NORTHEAST CORNER OF THAT TRACT DESCRIBED BY DOCUMENT (BOOK 3233, PAGE 824, SAID RECORDS); THENCE NORTH 89 DEGREES 42 MINUTES 50 SECONDS WEST ALONG THE NORTHERLY LINE OF SAID TRACT, 952.71 FEET TO THE NORTHWEST CORNER OF SAID TRACT; THENCE SOUTH 00 DEGREES 07 MINUTES 47 SECONDS WEST ALONG THE WESTERLY LINE OF SAID TRACT; 18.25 FEET; NORTH 89 DEGREES 42 MINUTES 50 SECONDS WEST, 1090.74 FEET TO THE POINT OF BEGINNING.

TOGETHER WITH;

LESS AND EXCEPT LOTS 1 AND 2, LATIGO BUSINESS CENTER FILING NO. 1, RECORDED AT RECEPTION NUMBER 205075728;

TOGETHER WITH;

LESS AND EXCEPT THAT PORTION AS DESCRIBED IN WARRANTY DEED AT RECEPTION NO 207122803 AND AFFIDAVIT OF CORRECTION RECORDED AT RECEPTION NO. 208053074, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

PROPOSED LOTS 1 THROUGH 8 INCLUDING WOLFBURG COURT WITHIN LATIGO BUSINESS CENTER FILING NO. 2 AND PROPOSED LOTS 1 AND 2 WITHIN LATIGO BUSINESS CENTER FILING NO. 3, MORE PARTICULARLY DESCRIBED AS:

A PARCEL OF LAND BEING THAT PORTION OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 8TH P.M., EL PASO COUNTY, COLORADO DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHEAST CORNER OF LATIGO BUSINESS CENTER FILING NO. 1 (RECEPTION NO. 205075728, EL PASO COUNTY, COLORADO RECORDS) (ALL BEARINGS IN THIS DESCRIPTION ARE RELATIVE TO THE NORTHERLY LINE OF SAID FILING, WHICH BEARS S 89 DEGREES 42 MINUTES 50 SECONDS E ASSUMED); THENCE S 89 DEGREES 42 MINUTES 50 SECONDS ALONG THE EASTERLY EXTENSION OF SAID FILING'S NORTHERLY LINE, 1190.72 FEET TO A POINT ON THE EASTERLY LINE OF THAT INGRESS/EGRESS AND UTILITY EASEMENT

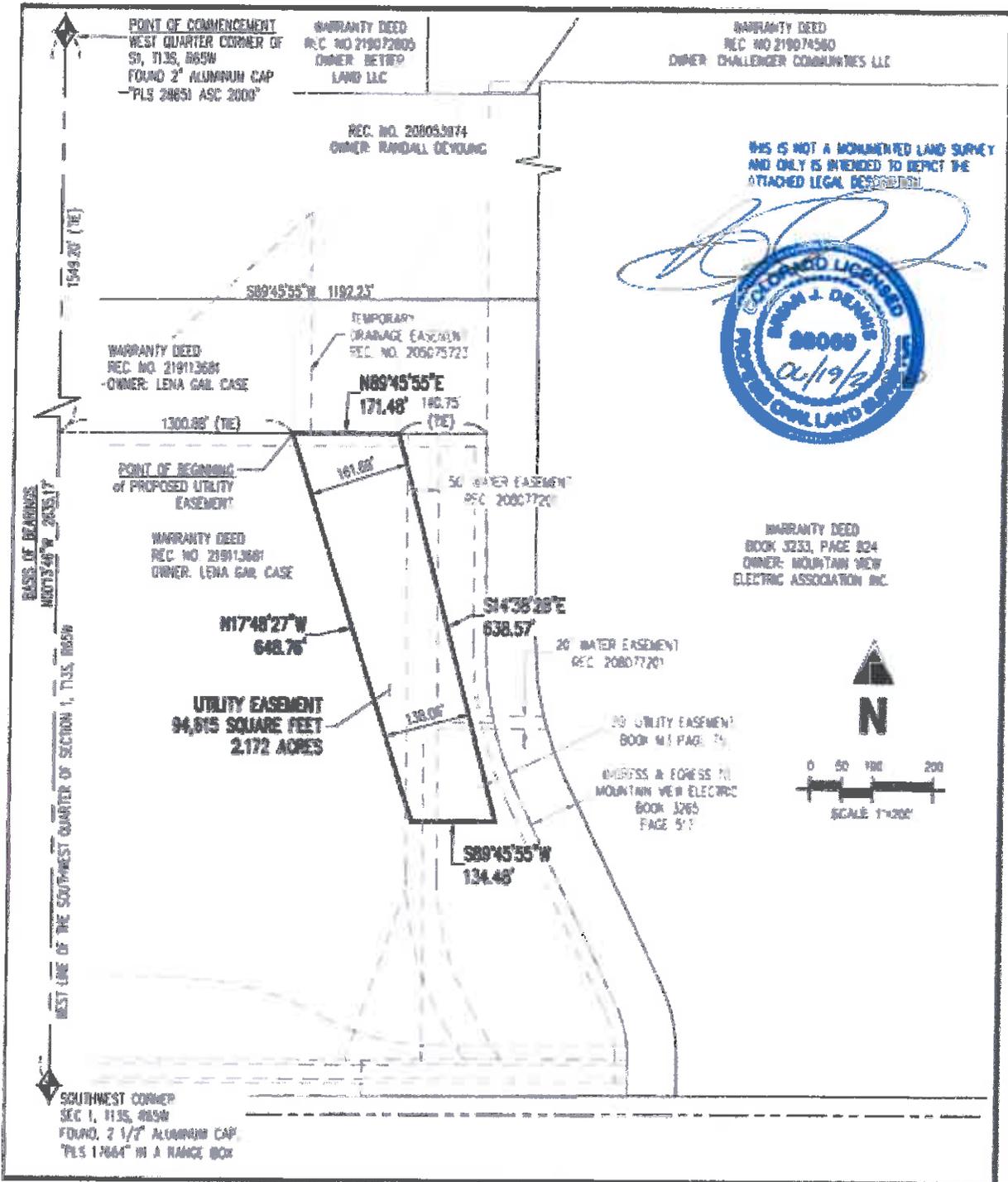
AS DESCRIBED BY DOCUMENT (BOOK 3285, PAGE 517. SAID EL PASO COUNTY RECORDS):
THENCE 00 DEGREES 07 MINUTES 47 SECONDS W ALONG SAID EASEMENT'S EASTERLY LINE,
827.84 FEET; THENCE N 89 DEGREES 42 MINUTES 50 SECONDS W, 1182.23 FEET TO A POINT
ON THE EASTERLY LINE OF SAID FILING; THENCE N 00 DEGREES 18 MINUTES 02 SECONDS E
ALONG SAID FILING'S EASTERLY LINE, 827.84 FEET TO THE POINT OF BEGINNING.

ALL LINEAL DISTANCES ARE REPRESENTED IN U.S. SURVEY FEET.



BY: BRIAN J. DENNIS, PLS 38069
PREPARED FOR AND ON BEHALF OF
GALLOWAY & COMPANY, INC.
PRJ #: CLH000017.10

EXHIBIT E



DRAINAGE EASEMENT
LOCATED IN THE WEST 1/2 OF SECT. ON 1, T13S, R65W OF THE 6TH P.M.
COUNTY OF EL PASO, STATE OF COLORADO

Project No.	CL HD00014 10
Drawn By	AAV
Checked By	BUD
Date	10/19/2009

Galloway

LAND SURVEYING & ENGINEERING
10000 W. 10TH AVENUE, SUITE 100
DENVER, CO 80202
TEL: 303.755.1100
WWW.GALLOWAY-SURVEYING.COM

EXHIBIT E

EASEMENT DESCRIPTION:

A DRAINAGE EASEMENT IN PARCELS AS DESCRIBED IN WARRANTY DEED TO LENA GAIL CASE, RECORDED AT RECEPTION NO. 219113681 OF THE EL PASO COUNTY CLERK AND RECORDER OFFICE AND SITUATED IN THE WEST HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN, LOCATED WITHIN EL PASO COUNTY, STATE OF COLORADO, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BASIS OF BEARING:

THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPLE MERIDIAN AND IS ASSUMED TO BEAR N00°13'46"W, MONUMENTED AS SHOWN:

COMMENCING AT THE WEST QUARTER CORNER OF SAID SECTION 1; THENCE WITH THE SAID WEST LINE OF SECTION 1, S00°13'46"E, A DISTANCE OF 1549.20 FEET TO A POINT ON THE WEST LINE OF SAID WARRANTY DEED RECORDED AT RECEPTION NO. 219113681; THENCE N89°45'55"E, A DISTANCE OF 1300.88 FEET TO THE POINT OF BEGINNING;

THENCE WITH THE NORTH LINE OF SAID WARRANTY DEED, N89°45'55"E, A DISTANCE OF 171.48 FEET;

THENCE S14°38'28"E, A DISTANCE OF 638.57 FEET;

THENCE S89°45'55"W, A DISTANCE OF 134.48 FEET;

THENCE N17°48'27"W, A DISTANCE OF 648.76 FEET TO A POINT ON THE SAID NORTH LINE AND BEING THE POINT OF BEGINNING.

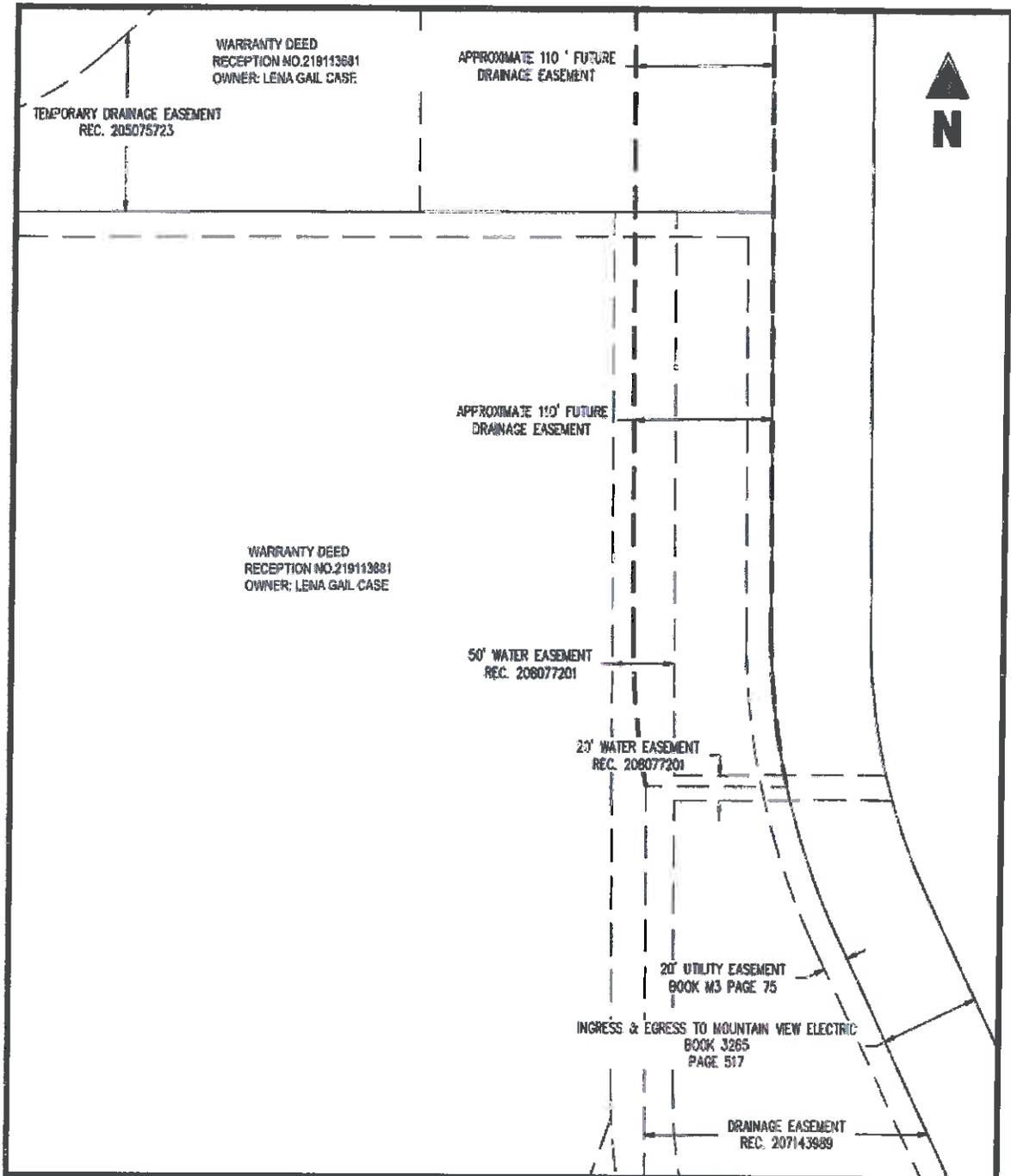
EASEMENT CONTAINS 94,615 SQUARE FEET OR 2.172 ACRES, MORE OR LESS.

ALL LINEAL DISTANCES ARE REPRESENTED IN U.S. SURVEY FEET.

BY: BRIAN J. DENNIS, PLS 38069

PREPARED FOR AND ON BEHALF OF
GALLOWAY & COMPANY, INC.
PRJ #: CLH0000014.10

EXHIBIT F



FUTURE DRAINAGE EASEMENT
 LOCATED IN THE WEST 1/2 OF SECTION 1, T13S, R65W OF THE 6TH P.M.
 COUNTY OF EL PASO, STATE OF COLORADO

Project No:	CLH00014.10
Drawn By:	RGD
Checked By:	NIP
Date:	06/24/2020

Galoway

1195 Kinky Arrows Blvd., Suite 325
 Colorado Springs, CO 80902
 714.935.7207 • GalowayUS.com

**STORMWATER DRAINAGE
MAINTENANCE AGREEMENT AND EASEMENT**

This STORMWATER DRAINAGE MAINTENANCE AGREEMENT AND EASEMENT (Agreement) is made by and between EL PASO COUNTY, by and through the BOARD OF COUNTY COMMISSIONERS OF EL PASO COUNTY ("County"), **Challenger Communities, LLC (Developer)**, BENT GRASS METROPOLITAN DISTRICT (Metro District), a quasi-municipal corporation and political subdivision of the State of Colorado, Randall L. DeYoung (Upstream Owner) and Lena Gail Case (Owner). The above may occasionally be referred to herein singularly as "Party" and collectively as "Parties."

Recitals

A. WHEREAS, the Metro District provides various municipal services to certain real property in El Paso County, Colorado referred to as Bent Grass Residential Filing 2; and

B. WHEREAS, Developer is the owner of certain real estate (the Subject Property) in El Paso County, Colorado, which Property is legally described in Exhibit A attached hereto and incorporated herein by this reference; and

C. WHEREAS, Owner is the owner of certain real property adjacent to or downstream of the Subject Property onto which developed stormwater runoff will be discharged, which property is legally described in Exhibit B attached hereto and incorporated herein by this reference (the Downstream Property); and

D. WHEREAS, Upstream Owner is the owner of certain real property adjacent to and upstream of the Downstream Property (the Upstream Property), which property is legally described in Exhibit C attached hereto, through which developed stormwater runoff will be discharged from the Subject Property and onto the Downstream Property; and

E. WHEREAS, Developer desires to plat and develop on the Subject Property a Subdivision to be known as Bent Grass Residential Filing 2; and

F. WHEREAS, the development of the Subject Property will substantially increase the volume of stormwater runoff that will discharge from the Subject Property, through the Upstream Property and to the Downstream Property, and

G. WHEREAS, Section 2.9 of the El Paso County Drainage Criteria Manual provides for a developer's promise to maintain a subdivision's drainage facilities in the event the County does not assume such responsibility; and

H. WHEREAS, Developer desires to meet requirements of the County's MS4 Permit, and to provide for operating, cleaning, maintaining and repairing the downstream drainage facilities in cooperation with the District; and

I. WHEREAS, Owner shall be charged herein with the duties of providing access to the stormwater drainage channel on the portion of the Downstream Property described in Exhibit D attached hereto and incorporated herein by this reference (the Stormwater Facilities Area); and

J. WHEREAS, Metro District shall be charged with the duties of operating, maintaining and repairing the stormwater drainage channel and any appurtenant improvements within the Stormwater Facilities Area described in Exhibit D; and

K. WHEREAS, the Parties hereto anticipate that when the Downstream Property develops in the future, the location of the Stormwater Facilities Area will likely change to the area depicted in Exhibit E, attached hereto; and

L. WHEREAS, El Paso County has conditioned approval of this Subdivision on the Developer's promise to provide a stormwater drainage easement and maintenance agreement, and further conditions approval on the Metro District's promise to maintain and/or repair the drainage channel within the Stormwater Facilities Area serving this Subdivision; and

M. WHEREAS, the County could condition subdivision approval on the Developer's promise to construct a different and more expensive drainage, water runoff control system and BMPs than those proposed herein, which more expensive system would mitigate the discharge of stormwater onto the Downstream Property at higher than historic rates; however, the County is willing to forego such right upon the performance of Developer's and the Metro District's promises contained herein; and

N. WHEREAS, the County, in order to secure performance of the promises contained herein, conditions approval of this Subdivision upon Owner's grant herein of a perpetual Easement over the Stormwater Facilities Area as described in Exhibit D for the purpose of allowing the Metro District access to upgrade, clean, maintain and/or repair the drainage channel, and allowing the County to periodically access and inspect the drainage channel.

Agreement

NOW, THEREFORE, in consideration of the mutual Promises contained herein, the sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Incorporation of Recitals: The Parties incorporate the Recitals above into this Agreement.

2. Covenants Running with the Land: Developer agrees that this entire Agreement and the performance thereof shall become a covenant running with the land, which land is legally described in Exhibit A attached hereto, and that this entire Agreement and the performance thereof shall be binding upon itself and its successors and assigns.

The Owner agrees that this entire Agreement and Owner's performance of its obligations hereunder shall become a covenant running with the land, which land is legally described in Exhibit B attached hereto, and that this entire Agreement and Owner's performance of its obligations hereunder shall be binding upon itself and its successors and assigns.

3. Maintenance: The Metro District agrees for itself and its successors and assigns that it will regularly and routinely inspect, clean and maintain the stormwater drainage channel and any appurtenant improvements within the Stormwater Facilities Area described in Exhibit D, and otherwise keep the same in good repair, all at its own cost and expense. Neither Developer nor Metro District shall suffer any mechanics' or materialmen's liens to be enforced against the Stormwater Facilities Area or other property of Owner for work done or materials furnished in connection with Metro District's obligations under this Agreement. Owner shall have no obligations with respect to the Stormwater Facilities Area other than to provide the property and access thereto, without obstruction, pursuant to the easement described in Section 4 of this Agreement.

4. Creation of Easement: Owner hereby grants Developer and Upstream Owner a non-exclusive perpetual easement upon and across the property described in Exhibit D for the discharge and flow of stormwater from the Subject Property and Upstream Property in higher than historic volumes and at higher than historic rates. Owner hereby grants the Metro District a non-exclusive perpetual easement upon and across the property described in Exhibit D for the purposes of access to and construction, cleaning, maintenance and repair of the stormwater drainage channel and any appurtenant improvements. Owner hereby grants the County a non-exclusive perpetual easement upon and across the property described in Exhibit D for the purposes of access to and inspection of the Stormwater Facilities Area. The creation of the County's easement does not expressly or implicitly impose on the County a duty to so inspect, nor to clean, repair or maintain the stormwater drainage channel or any appurtenant improvements.

5. New Agreement: Should the location of the Stormwater Facilities Area need to be modified in the future, due to the development of the Downstream Property or otherwise, then Owner shall be required to enter into a Private Detention Basin / Stormwater Quality Best Management Practice Maintenance Agreement and Easement (New Agreement) in connection with such development. Such New Agreement shall set forth the obligations for construction and maintenance of the new stormwater drainage channel and any appurtenant improvements and shall contain a provision terminating the perpetual easements created by this Agreement and establishing new perpetual easements over and across the new Stormwater Facilities Area.

6. Indemnification: Developer and Metro District shall indemnify, defend and hold Owner harmless from and against any and all obligations, liabilities, claims, liens, demands, loss, damage, injury, suit, causes of action, costs and expenses (including, without limitation, attorneys' fees) whatsoever in any way relating to or arising out of either (i) any stormwater runoff or drainage from the Subject Property and easement area shown in Exhibit D that enters or crosses the Downstream Property or other properties, or (ii) the activities or obligations of Developer, Metro District, or their respective agents or representatives under this Agreement. At all times during any construction or maintenance activities within the detention basin/BMP(s), Developer and Metro District shall maintain, or cause to be maintained, in full force and effect, a policy of comprehensive general liability insurance issued on a form and with an insurance company reasonably acceptable to Owner, and with such commercially reasonable coverage limits as Owner may from time to time require. Prior to any construction or maintenance activities, Developer and Metro District shall provide Owner with a certificate of insurance evidencing that Owner has been named as an additional insured under such policy. Such certificate shall provide that such policy shall not be cancelled or amended without thirty (30) days' prior written notice to Owner.

7. Severability: In the event any Court of competent jurisdiction declares any part of this Agreement to be unenforceable, such declaration shall not affect the enforceability of the remaining parts of this Agreement.

8. Third Parties: This Agreement does not and shall not be deemed to confer upon or grant to any third party any right to claim damages or to bring any lawsuit, action or other proceeding against either the County, the Developer, the Metro District, the Owner, or their respective successors and assigns, because of any breach hereof or because of any terms, covenants, agreements or conditions contained herein.

9. Solid Waste or Hazardous Materials: Should any refuse from the stormwater drainage channel within the Stormwater Facilities Area be suspected or identified as solid waste or petroleum products, hazardous substances or hazardous materials (collectively referred to herein as “hazardous materials”), the Developer and the Metro District shall take all necessary and proper steps to characterize the solid waste or hazardous materials and properly dispose of it in accordance with applicable State and/or Federal environmental laws and regulations, including, but not limited to, the following: Solid Wastes Disposal Sites and Facilities Acts, §§ 30-20-100.5 – 30-20-119, C.R.S., Colorado Regulations Pertaining to Solid Waste Disposal Sites and Facilities, 6 C.C.R. 1007-2, *et seq.*, Solid Waste Disposal Act, 42 U.S.C. §§ 6901-6992k, and Federal Solid Waste Regulations 40 CFR Ch. I. The County shall not be responsible or liable for identifying, characterizing, cleaning up, or disposing of such solid waste or hazardous materials. Notwithstanding the previous sentence, should any refuse cleaned up and disposed of by the County for any reason be determined to be solid waste or hazardous materials, the Developer and the Metro District, but not the County, shall be responsible and liable as the owner, generator, and/or transporter of said solid waste or hazardous materials.

10. Applicable Law and Venue: The laws, rules, and regulations of the State of Colorado and El Paso County shall be applicable in the enforcement, interpretation, and execution of this Agreement, except that Federal law may be applicable regarding solid waste or hazardous materials. Venue shall be in the El Paso County District Court.

IN WITNESS WHEREOF, the Parties affix their signatures below.

Executed this 22nd day of July, 2020 by:
Challenger Communities, LLC

By: [Signature]
Jim Byers, VP of Community Development

The foregoing instrument was acknowledged before me this 22 day of July, 2020 by Jim Byers, VP of Community Development, Challenger Communities, LLC

Witness my hand and official seal
My commission expires: 11/1/20

[Signature]
Notary Public
CHRISTINE DAWN HOPPER
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20124070882
MY COMMISSION EXPIRES 11/01/2020

Executed this 23rd day of July, 2021, by:
BENT GRASS METROPOLITAN DISTRICT

By: [Signature]
Randle W. Gese, President
[Name]

Attest:
By: Lana Gail Case
Lana Gail Case, Board Member
[Name] [Title]

The foregoing instrument was acknowledged before me this 23 day of July, 2020 by Randle W. Gese President, and Lana Gail Case, Board Member, BENT GRASS METROPOLITAN DISTRICT

Witness my hand and official seal.
My commission expires: May 12, 2022

[Signature]
Notary Public
NANCY J TOLLEFSON
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20084013691
MY COMMISSION EXPIRES MAY 12, 2022

Executed this 23rd day of July, 2020, by:

OWNER

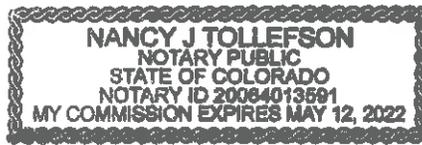
Lena Gail Case

By: Lena Gail Case
Lena Gail Case

The foregoing instrument was acknowledged before me this 23 day of July, 2020 by Lena Gail Case, Lena Gail Case.

Witness my hand and official seal.

My commission expires: May 12, 2021



[Signature]
Notary Public

Executed this 21st day of July, 2020, by:

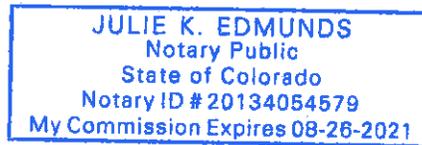
DOWNSTREAM OWNER:

Randall L. DeYoung
Randall L. DeYoung

The foregoing instrument was acknowledged before me this 21st day of July, 2020, by Randall L. DeYoung.

Witness my hand and official seal.

My commission expires: 8.26.2021



[Signature]
Notary Public

Executed this _____ day of _____, 20____, by:

**BOARD OF COUNTY COMMISSIONERS
OF EL PASO COUNTY, COLORADO**

By: _____
Craig Dossey, Executive Director
El Paso County Planning and Community Development Department
Authorized signatory pursuant to LDC

Attest:

County Clerk and Recorder

The foregoing instrument was acknowledged before me this _____ day of _____, 20____, by Craig Dossey, Executive Director of the El Paso County Planning and Community Development Department, as Attested to by _____, County Clerk and Recorder.

Witness my hand and official seal.

My commission expires: _____

Notary Public

Approved as to Content and Form:

Assistant County Attorney

EXHIBIT A

PARCELS OF LAND AS DESCRIBED IN WARRANTY DEEDS RECORDED AT RECEPTION NO. 219074560 AND 219074561 OF THE EL PASO COUNTY CLERK AND RECORDER OFFICE, BEING A PORTION OF THE WEST HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST, OF THE 6TH/ PRINCIPAL MERIDIAN, LOCATED IN EL PASO COUNTY, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BASIS OF BEARINGS:

ALL BEARINGS ARE GRID BEARINGS OF THE COLORADO STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, NORTH AMERICAN DATUM 1983. THE BEARING OF THE LINE BETWEEN THE SOUTHWEST CORNER OF SECTION 1, T13S, R65W AND THE WEST QUARTER CORNER OF SECTION 1, T13S, R65W IS N00°13'46"W AND MONUMENTED AS SHOWN:

COMMENCING AT THE SOUTHWEST QUARTER CORNER OF SAID SECTION 1; THENCE N00°13'46"W WITH THE WEST LINE OF SAID SECTION 1, A DISTANCE OF 1928.67 FEET TO THE SOUTHWEST CORNER OF A PARCEL DESCRIBED IN WARRANTY DEED RECORDED AT RECEPTION NO. 21303554 OF THE EL PASO COUNTY CLERK AND RECORDER OFFICE; THENCE WITH THE SOUTH LINE OF SAID PARCEL, N89°47'22"E A DISTANCE OF 419.98 FEET TO THE SOUTHEAST CORNER OF SAID PARCEL AND BEING THE SOUTHWEST CORNER OF A STRIP OF LAND DESCRIBED IN QUIT CLAIM DEED AT RECEPTION NO. 209061972 AND ALSO BEING THE **POINT OF BEGINNING**:

THENCE N00°13'46"W, A DISTANCE OF 206.47 FEET TO A POINT OF CURVATURE;
THENCE ALONG SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 605.00 FEET, A CENTRAL ANGLE OF 23°58'12", A DISTANCE OF 253.10 FEET, A CHORD BEARING OF N11°45'20"E WITH A CHORD DISTANCE OF 251.26 FEET;
THENCE N23°44'26"E, A DISTANCE OF 301.49 FEET TO A POINT OF CURVATURE;
THENCE ALONG SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 605.00 FEET, A CENTRAL ANGLE OF 65°45'45", A DISTANCE OF 694.40 FEET, A CHORD BEARING OF N56°37'18"E WITH A CHORD DISTANCE OF 656.91 FEET;
THENCE N89°30'12"E, A DISTANCE OF 62.90 FEET;
THENCE N00°14'14"W, A DISTANCE OF 938.90 FEET TO A POINT ON THE SOUTH LINE OF THE MEADOWS FILING NO. 3, RECORDED AT RECEPTION NO. 200135677 AND ALSO BEING A POINT ON THE SOUTH LINE OF THE NORTH 1/16TH OF SAID SECTION 1;
THENCE WITH SAID SOUTH LINE, N89°36'34"E, A DISTANCE OF 1431.39 FEET TO THE NORTH 1/16TH CORNER OF SAID SECTION 1;
THENCE N89°36'02"E, A DISTANCE OF 28.34 FEET;
THENCE S00°22'19"E, DISTANCE OF 619.54 FEET TO A POINT ON THE NORTH RIGHT OF WAY LINE OF BENT GRASS MEADOWS DRIVE (AN 80' PUBLIC RIGHT OF WAY) AND BEING A POINT ON THE NORTH LINE OF BENT GRASS RESIDENTIAL FILING NO. 1, RECORDED AT RECEPTION NO. 215713636;
THENCE WITH SAID NORTH RIGHT OF WAY LINE AND THE NORTH LINE OF SAID BENT GRASS RESIDENTIAL FILING NO.1, S89°38'09"W, A DISTANCE OF 28.48 FEET TO THE NORTHWEST CORNER OF SAID BENT GRASS MEADOWS DRIVE RIGHT OF WAY AND BEING A POINT ON THE EAST 1/16 LINE OF SAID SECTION 1;
THENCE WITH SAID EAST 1/16 LINE, S00°21'34"E, A DISTANCE OF 699.51 FEET;
THENCE CONTINUING WITH SAID EAST 1/16 LINE, S00°21'50"E, A DISTANCE OF 693.63 FEET TO THE NORTHEAST CORNER OF A PARCEL DESCRIBED IN DEED AT BOOK 3233, PAGE 824 OF THE EL PASO COUNTY CLERK & RECORDER;
THENCE WITH THE NORTH OF LINE OF SAID PARCEL, S89°47'22"W, A DISTANCE OF 952.75 FEET TO THE NORTHWEST CORNER OF SAID PARCEL DESCRIBED IN BOOK 3233 AT PAGE 824;
THENCE ALONG THE WEST LINE OF SAID PARCEL, S00°22'01"E, A DISTANCE OF 18.25 FEET TO THE NORTHEAST CORNER OF A PARCEL DESCRIBED IN DEED AT RECEPTION NO. 208053974;
THENCE WITH THE NORTH LINE OF SAID PARCEL DESCRIBED AT RECEPTION NO. 208053974, S89°47'22"W, A DISTANCE OF 179.94 FEET;
THENCE N00°12'38"W, A DISTANCE OF 119.39 FEET TO A POINT OF CURVE;

THENCE ALONG SAID CURVE TO THE LEFT, HAVING A RADIUS OF 450.00 FEET, A CENTRAL ANGLE OF 55°58'18", A DISTANCE OF 439.60 FEET, A CHORD BEARING OF N28°11'47"W WITH A CHORD DISTANCE OF 422.33 FEET;
THENCE N56°10'56"W, A DISTANCE OF 198.31 FEET TO A POINT OF CURVE;
THENCE ALONG SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 540.00 FEET, A CENTRAL ANGLE OF 16°06'20", A DISTANCE OF 151.79 FEET, A CHORD BEARING OF N48°07'46"W WITH A CHORD DISTANCE OF 151.29 FEET;
THENCE N40°04'36"W, A DISTANCE OF 279.73 FEET TO A POINT OF NON-TANGENT CURVE;
THENCE ALONG SAID NON-TANGENT CURVE TO THE LEFT, HAVING A RADIUS OF 525.00 FEET, A CENTRAL ANGLE OF 32°26'00", A DISTANCE OF 297.18 FEET, A CHORD BEARING OF S39°57'26"W WITH A CHORD DISTANCE OF 293.23 FEET;
THENCE S23°44'26"W, A DISTANCE OF 301.49 FEET TO A POINT OF CURVATURE;
THENCE ALONG SAID CURVE TO THE LEFT, HAVING A RADIUS OF 525.00 FEET, A CENTRAL ANGLE OF 23°58'12", A DISTANCE OF 219.64 FEET, A CHORD BEARING OF S11°45'20"W WITH A CHORD DISTANCE OF 218.04 FEET;
THENCE S00°13'46"E, A DISTANCE OF 206.50 FEET TO THE SOUTHEAST CORNER OF SAID STRIP OF LAND DESCRIBED IN QUITCLAIM DEED AT RECEPTION NO. 209061972;
THENCE WITH SOUTH LINE OF SAID STRIP OF LAND, S89°47'22"W, A DISTANCE OF 80.00 FEET TO THE **POINT OF BEGINNING.**

THE ABOVE DESCRIBED PARCEL CONTAINS 2,985,862 SQUARE FEET OR 68.55 ACRES, MORE OR LESS.

EXHIBIT B

PARCEL DESCRIPTION:

A PARCEL OF LAND AS DESCRIBED IN WARRANTY DEED, RECORDED AT RECEPTION NO. 219113881 OF THE EL PASO COUNTY CLERK AND RECORDER OFFICE AND SITUATED IN THE WEST HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 85 WEST, OF THE 6TH PRINCIPAL MERIDIAN, LOCATED WITHIN EL PASO COUNTY, STATE OF COLORADO, AND BEING MORE PARTICULARLY DESCRIBED IN SAID WARRANTY DEED AS FOLLOWS:

BEING THE SOUTH HALF OF THE NORTHWEST QUARTER, AND THE SOUTHWEST QUARTER OF SAID SECTION 1:

LESS AND EXCEPT THAT PORTION CONVEYED IN WARRANTY DEED TO MOUNTAIN VIEW ELECTRIC ASSOCIATION, INC., RECORDED AT BOOK 3293, PAGE 824, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHWEST QUARTER OF SAID SECTION 1, THENCE S 89°42'50"E ALONG THE SOUTH LINE OF SAID SECTION 1, 2648.33 FEET TO THE SOUTH ONE QUARTER CORNER OF SAID SECTION 1; THENCE N00°07'47"E ALONG THE EAST LINE OF THE SOUTHWEST ONE-QUARTER OF SAID SECTION 1, 30.00 FEET TO A POINT ON THE NORTHERLY RIGHT-OF-WAY LINE OF THE EL PASO COUNTY HIGHWAY #110, SAID POINT ALSO BEING THE POINT OF BEGINNING. THENCE N89°42'50"W ALONG SAID NORTHERLY RIGHT-OF-WAY LINE, 725.00 FEET; THENCE N00°17'18"E, 85.00 FEET; THENCE ON THE ARC OF A CURVE TO THE LEFT, HAVING A CENTRAL ANGLE OF 25°25'05", A RADIUS OF 288.04 FEET AND ARC LENGTH OF 118.03 FEET; THENCE N26°07'05"W ON THE FORWARD TANGENT TO THE LAST MENTIONED CURVE, 306.00 FEET; THENCE ON THE ARC OF A CURVE TO THE RIGHT HAVING A CENTRAL ANGLE OF 25°15'43", A RADIUS OF 490.87 FEET AND AN ARC LENGTH OF 216.42 FEET. THENCE N00°07'47"E ON THE FORWARD TANGENT TO THE LAST MENTIONED CURVE 1198.03 FEET; THENCE S89°42'50"E, 852.97 FEET TO A POINT ON THE EAST LINE OF SAID SOUTHWEST ONE-QUARTER, SAID POINT ALSO BEING ON THE WESTERLY LINE OF FALCON RANCHETTES AS RECORDED IN PLAT BOOK V-2 AT PAGE 15 OF THE RECORDS OF SAID EL PASO COUNTY; THENCE S00°07'47"W ALONG THE WESTERLY LINE OF SAID FALCON RANCHETTES AND ALONG THE EAST LINE OF SAID SOUTHWEST ONE-QUARTER 628.04 TO THE SOUTHWEST CORNER OF SAID FALCON RANCHETTES; THENCE CONTINUE S00°07'47"W ALONG THE EAST LINE OF SAID SOUTHWEST ONE-QUARTER, 1290.80 FEET TO THE POINT OF BEGINNING.

TOGETHER WITH:

LESS AND EXCEPT LOTS 1 AND 2, LATIGO BUSINESS & RESEARCH CENTER FILING NO. 1, RECORDED AT RECEPTION NUMBER 724174;

TOGETHER WITH:

LESS AND EXCEPT THAT PORTION CONVEYED IN WARRANTY DEED, RECORDED AT RECEPTION NUMBER 2032611895, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

A PARCEL OF LAND BEING A PORTION OF THE WEST ONE-HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 85 WEST OF THE 6TH P.M., SITUATE IN EL PASO COUNTY, COLORADO, DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHWEST CORNER OF SAID SECTION 1 (ALL BEARINGS IN THIS DESCRIPTION ARE RELATIVE TO THE WEST LINE OF THE SOUTHWEST ONE-QUARTER OF SAID SECTION 1, WHICH BEARS NORTH 00 DEGREES 16 MINUTES 02 SECONDS EAST "ASSUMED"); THENCE NORTH 00 DEGREES 16 MINUTES 02 SECONDS EAST ALONG SAID SECTION 1'S SOUTHWEST ONE-QUARTER'S WEST LINE (SAID LINE ALSO BEING COINCIDENT WITH THE WESTERLY LINE OF LATIGO BUSINESS & RESEARCH CENTER FILING NO. 1, (PLAT BOOK M-3, PAGE 73, EL PASO COUNTY, COLORADO RECORDS) AND THE EASTERLY LINE OF THE MEADOWS FILING NO. 1 (PLAT BOOK N-3, PAGE 125, SAID EL PASO COUNTY RECORDS), AS EXTENDED SOUTHERLY), 1928.59 FEET TO THE POINT OF BEGINNING OF THE PARCEL HEREIN DESCRIBED (THE FOLLOWING THREE (3) COURSES ARE ALONG THE EASTERLY LINE OF SAID THE MEADOWS FILING NO. 1, AND THE MEADOWS FILING NO. 2 (PLAT BOOK O-3, PAGE 94, SAID RECORDS), AND THE SOUTHERLY LINE OF THE MEADOWS FILING NO. 3 (RECEPTION NUMBER 200135007), SAID RECORDS), RESPECTIVELY; 1) CONTINUE NORTH 00 DEGREES 16 MINUTES 02 SECONDS EAST ALONG SAID SOUTHWEST ONE-QUARTER'S WEST LINE, 700.50 FEET TO THE SOUTHWEST CORNER OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 1; 2) NORTH 00 DEGREES 16 MINUTES 34 SECONDS EAST ALONG THE WEST LINE OF THE SOUTH ONE-HALF OF THE NORTHWEST ONE-QUARTER (SOUTH HALF OF THE NORTHWEST QUARTER) OF SAID SECTION 1, 1310.12 FEET TO THE NORTHWEST CORNER OF SAID SOUTH HALF OF THE NORTHWEST QUARTER; 3) SOUTH 89 DEGREES 52 MINUTES 38 SECONDS EAST ALONG THE NORTH LINE OF SAID HALF OF THE NORTHWEST QUARTER, 2039.01 FEET TO THE SOUTHEAST CORNER OF SAID FILING NO. 3 AND THE NORTHEAST CORNER OF SAID SOUTH HALF OF THE NORTHWEST QUARTER; THENCE SOUTH 00 DEGREES 08 MINUTES 14 SECONDS WEST ALONG THE EAST LINE OF SAID SOUTH HALF OF THE NORTHWEST QUARTER, 1319.04 FEET TO THE NORTHEAST CORNER OF THE SOUTHWEST ONE-QUARTER OF SAID SECTION 1; THENCE SOUTH 00 DEGREES 07 MINUTES 58 SECONDS WEST ALONG THE EAST LINE OF SAID SECTION 1'S SOUTHWEST ONE-QUARTER, 893.76 FEET TO THE NORTHEAST CORNER OF THAT TRACT DESCRIBED BY DOCUMENT (BOOK 1233, PAGE 824, SAID RECORDS); THENCE NORTH 89 DEGREES 42 MINUTES 50 SECONDS WEST ALONG THE NORTHERLY LINE OF SAID TRACT, 952.71 FEET TO THE NORTHWEST CORNER OF SAID TRACT; THENCE SOUTH 00 DEGREES 07 MINUTES 47 SECONDS WEST ALONG THE WESTERLY LINE OF SAID TRACT; 18.25 FEET; NORTH 89 DEGREES 42 MINUTES 50 SECONDS WEST, 1090.74 FEET TO THE POINT OF BEGINNING.

TOGETHER WITH;

LESS AND EXCEPT LOTS 1 AND 2, LATIGO BUSINESS CENTER FILING NO. 1, RECORDED AT RECEPTION NUMBER 205075720;

TOGETHER WITH;

LESS AND EXCEPT THAT PORTION AS DESCRIBED IN WARRANTY DEED AT RECEPTION NO. 207122803 AND AFFIDAVIT OF CORRECTION RECORDED AT RECEPTION NO. 208063074, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

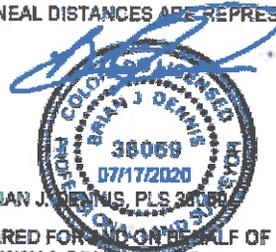
PROPOSED LOTS 1 THROUGH 8 INCLUDING WOLFBURG COURT WITHIN LATIGO BUSINESS CENTER FILING NO. 2 AND PROPOSED LOTS 1 AND 2 WITHIN LATIGO BUSINESS CENTER FILING NO. 3, MORE PARTICULARLY DESCRIBED AS:

A PARCEL OF LAND BEING THAT PORTION OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH P.M., EL PASO COUNTY, COLORADO DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHEAST CORNER OF LATIGO BUSINESS CENTER FILING NO. 1 (RECEPTION NO. 209075720, EL PASO COUNTY, COLORADO RECORDS) (ALL BEARINGS IN THIS DESCRIPTION ARE RELATIVE TO THE NORTHERLY LINE OF SAID FILING, WHICH BEARS S 89 DEGREES 42 MINUTES 50 SECONDS E ASSUMED); THENCE S 89 DEGREES 42 MINUTES 50 SECONDS ALONG THE EASTERLY EXTENSION OF SAID FILING'S NORTHERLY LINE, 1190.72 FEET TO A POINT ON THE EASTERLY LINE OF THAT INGRESS/EGRESS AND UTILITY EASEMENT

AS DESCRIBED BY DOCUMENT (BOOK 3285, PAGE 517, SAID EL PASO COUNTY RECORDS);
THENCE 00 DEGREES 07 MINUTES 47 SECONDS W ALONG SAID EASEMENT'S EASTERLY LINE,
627.84 FEET; THENCE N 89 DEGREES 42 MINUTES 50 SECONDS W, 1192.23 FEET TO A POINT
ON THE EASTERLY LINE OF SAID FILING; THENCE N 00 DEGREES 18 MINUTES 02 SECONDS E
ALONG SAID FILING'S EASTERLY LINE, 627.84 FEET TO THE POINT OF BEGINNING.

ALL LINEAL DISTANCES ARE REPRESENTED IN U.S. SURVEY FEET.



BY: BRIAN J. DENNIS, PLS 38069
PREPARED FOR: GFC ON BEHALF OF
GALLOWAY & COMPANY, INC.
PRJ #: CLH000017.10

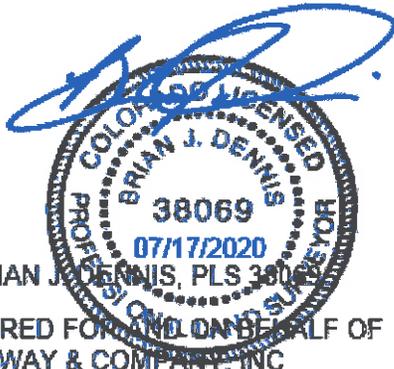
EXHIBIT C

PARCEL DESCRIPTION:

A PARCEL OF LAND AS DESCRIBED IN WARRANTY DEED RECORDED AT RECEPTION NO. 207122803 AND AFFIDAVIT OF CORRECTION RECORDED AT RECEPTION NO. 208053974 OF THE EL PASO COUNTY CLERK AND RECORDER OFFICE AND SITUATED IN THE WEST HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN, LOCATED WITHIN EL PASO COUNTY, STATE OF COLORADO, AND BEING MORE PARTICULARLY DESCRIBED IN SAID AFFIDAVIT OF CORRECTION AS FOLLOWS:

BEGINNING AT THE NORTHEAST CORNER OF LATIGO BUSINESS CENTER FILING NO. 1 (RECEPTION NO. 205075726, EL PASO COUNTY, COLORADO SPRINGS) (ALL BEARINGS IN THIS DESCRIPTION ARE RELATIVE TO THE NORTHERLY LINE OF SAID FILING, WHICH BEARS S DEGREES 42 MINUTES 50 SECONDS E ASSUMED); THENCE S 89 DEGREES 42 MINUTES 50 SECONDS E ALONG THE EASTERLY EXTENSION OF SAID FILING'S NORTHERLY LINE, 1190.72 FEET TO A POINT ON THE EASTERLY LINE OF THAT INGRESS/EGRESS AND UTILITY EASEMENT AS DESCRIBED BY DOCUMENT (BOOK 3265, PAGE 517, SAID EL PASO COUNTY RECORDS); THENCE S 00 DEGREES 07 MINUTES 47 SECONDS W ALONG SAID EASEMENT'S EASTERLY LINE, 627.84 FEET; THENCE N 89 DEGREES 42 MINUTES 50 SECONDS W, 1192.23 FEET TO A POINT ON THE EASTERLY LINE OF SAID FILING; THENCE N 00 DEGREES 16 MINUTES 02 SECONDS E ALONG SAID FILING'S EASTERLY LINE, 627.84 FEET TO THE POINT OF BEGINNING.

ALL LINEAL DISTANCES ARE REPRESENTED IN U.S. SURVEY FEET.



BY: BRIAN J. DENNIS, PLS 38069
PREPARED FOR AND ON BEHALF OF
GALLOWAY & COMPANY, INC
PRJ #: CLH000017.10

EXHIBIT D

EASEMENT DESCRIPTION:

A DRAINAGE EASEMENT IN PARCEL AS DESCRIBED IN WARRANTY DEED TO LENA GAIL CASE, RECORDED AT RECEPTION NO. 219113681 OF THE EL PASO COUNTY CLERK AND RECORDER OFFICE AND SITUATED IN THE WEST HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN, LOCATED WITHIN EL PASO COUNTY, STATE OF COLORADO, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BASIS OF BEARING:

THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPLE MERIDIAN AND IS ASSUMED TO BEAR N00°13'46"W, MONUMENTED AS SHOWN:

COMMENCING AT THE WEST QUARTER CORNER OF SAID SECTION 1; THENCE WITH THE SAID WEST LINE OF SECTION 1, S00°13'46"E, A DISTANCE OF 1335.04 FEET TO A POINT ON THE WEST LINE OF SAID WARRANTY DEED RECORDED AT RECEPTION NO. 219113681; THENCE N89°45'55"E, A DISTANCE OF 1300.46 FEET TO THE POINT OF BEGINNING;

THENCE WITH THE NORTH LINE OF SAID WARRANTY DEED, N89°45'55"E, A DISTANCE OF 171.48 FEET;

THENCE S00°14'05"E, A DISTANCE OF 214.16 FEET TO THE SOUTH LINE OF SAID WARRANTY DEED;

THENCE WITH THE SAID SOUTH LINE, S89°45'55"W, A DISTANCE OF 171.48 FEET;

THENCE N00°14'05"W, A DISTANCE OF 214.16 FEET TO A POINT ON THE SAID NORTH LINE AND BEING THE POINT OF BEGINNING.

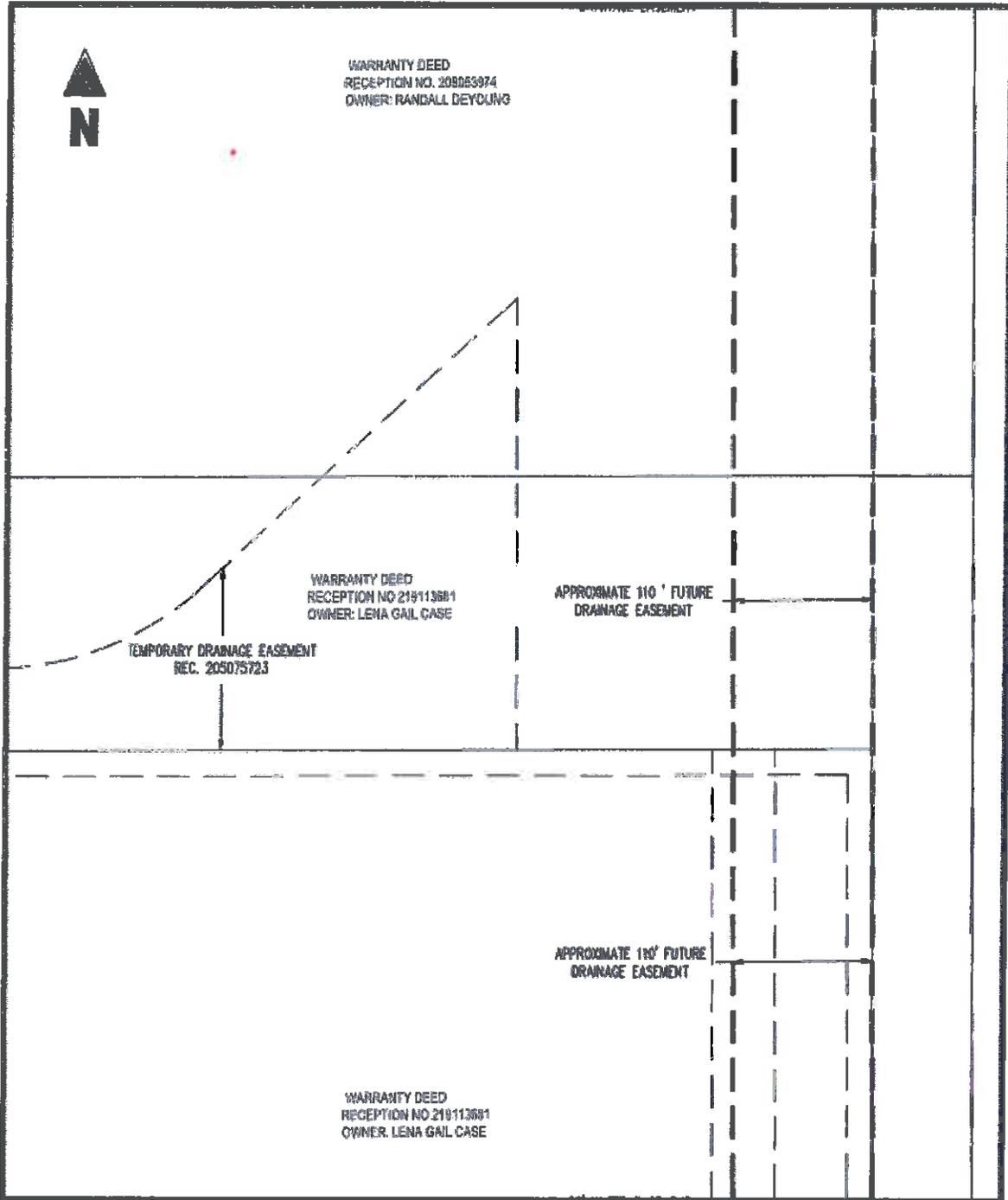
EASEMENT CONTAINS 36,724 SQUARE FEET OR 0.843 ACRES, MORE OR LESS.

ALL LINEAL DISTANCES ARE REPRESENTED IN U.S. SURVEY FEET.

BY: BRIAN J. DENNIS, PLS 38069

PREPARED FOR AND ON BEHALF OF
GALLOWAY & COMPANY, INC.
PRJ #: CLH0000014.10

EXHIBIT E



FUTURE DRAINAGE EASEMENT

LOCATED IN THE WEST 1/2 OF SECTION 1, T13S. R85W OF THE 6TH P.M.
COUNTY OF EL PASO, STATE OF COLORADO

Project No:	CLH00014.1G
Drawn By:	RGD
Checked By:	NIP
Date:	09/24/2020

Galloway

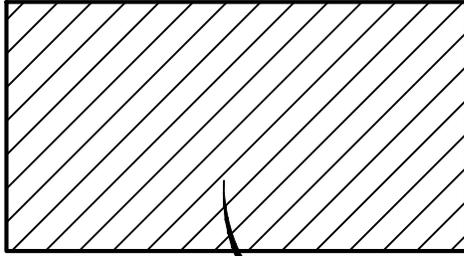
1120 Kelly Johnson Blvd., Suite 300
Colorado Springs, CO 80902
719.557.1220 • gallowayinc.com

APPENDIX F

FIGURES

OWL PLACE

BENT GRASS MEADOWS DRIVE

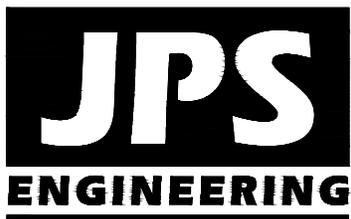


SITE

WOODMEN FRONTAGE ROAD

WOODMEN ROAD

VICINITY MAP



DEYOUNG SUBDIVISION

FIGURE A1
JPS PROJ NO. 031901

National Flood Hazard Layer FIRMMette



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/16/2019 at 3:00:55 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

38°56'58.71"N

104°37'41.03"W



104°37'3.58"W

USGS The National Map: Orthoimagery. Data refreshed April, 2019.

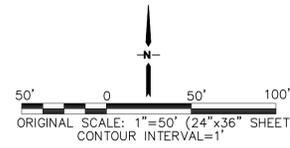


1:6,000

38°56'30.73"N

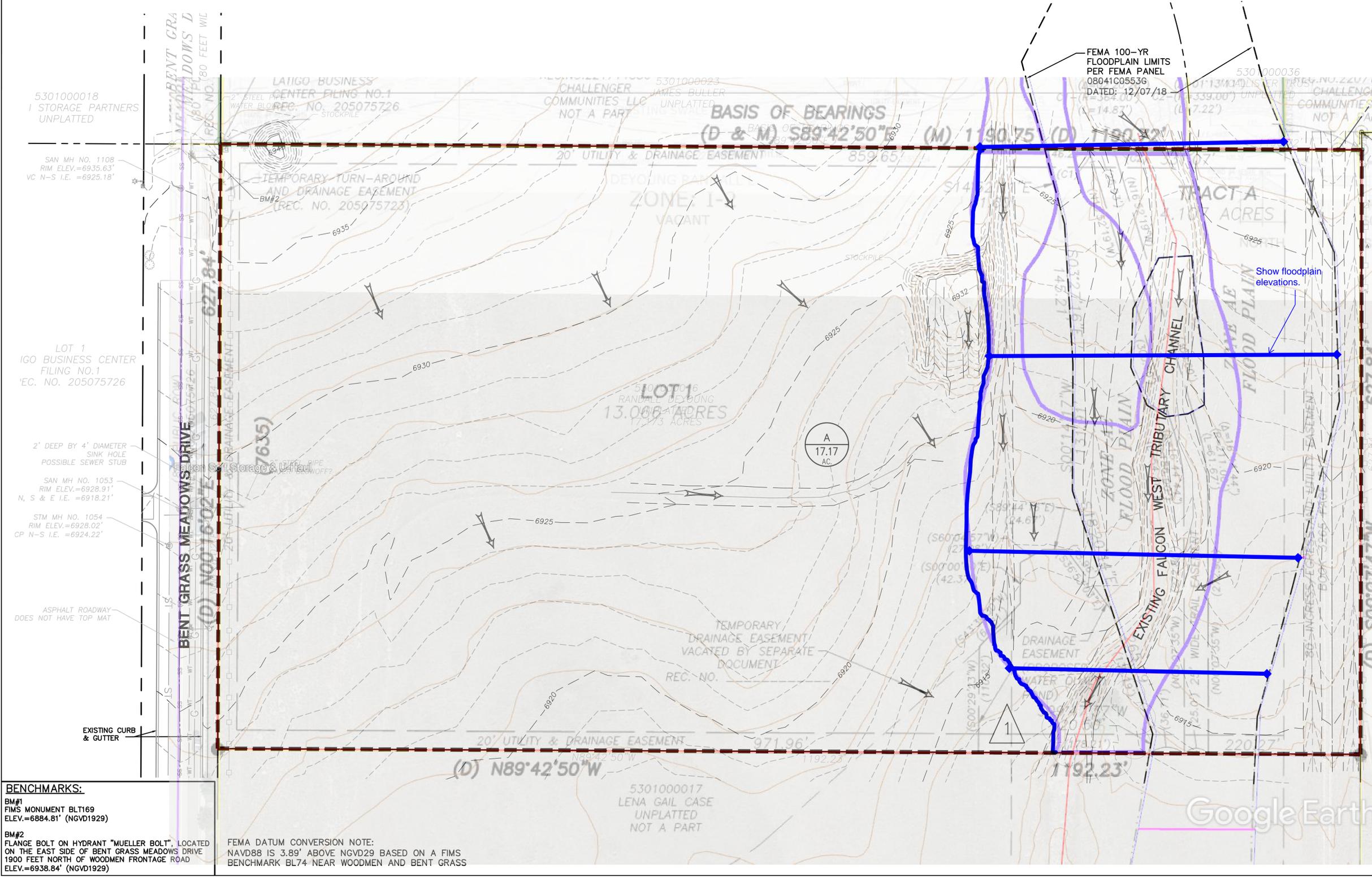
SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q _s (CFS)	Q ₁₀₀ (CFS)
1	2.9	21.3



DRAINAGE LEGEND

- RIPRAP
- FLOW DIRECTION ARROW
- FLOWLINE
- MAJOR DRAINAGE BASIN BOUNDARY
- DESIGN POINT
- DEVELOPED BASIN DESIGNATION
- DEVELOPED BASIN AREA (ACRES)



BENCHMARKS:
BM#1
 FIMS MONUMENT BLT169
 ELEV.=6884.81' (NGVD1929)
BM#2
 FLANGE BOLT ON HYDRANT "MUELLER BOLT", LOCATED ON THE EAST SIDE OF BENT GRASS MEADOWS DRIVE 1900 FEET NORTH OF WOODMEN FRONTAGE ROAD
 ELEV.=6938.84' (NGVD1929)

FEMA DATUM CONVERSION NOTE:
 NAVD88 IS 3.89' ABOVE NGVD29 BASED ON A FIMS BENCHMARK BL74 NEAR WOODMEN AND BENT GRASS

DEYOUNG SUBDIVISION

HISTORIC DRAINAGE PLAN



19 E. Willamette Ave.
 Colorado Springs, CO 80903
 PH: 719-477-9429
 FAX: 719-471-0766
 www.jpsegr.com



CALL UTILITY NOTIFICATION CENTER OF COLORADO
 1-800-922-1987
 CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MEMBER UTILITIES.

NO.	REVISION	BY	DATE

HORZ. SCALE: 1"=50'	DRAWN: BJJ
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: RIDGELINE	CHECKED: JPS
CREATED: 10/11/19	LAST MODIFIED: 12/18/19
PROJECT NO: 031901	MODIFIED BY: BJJ
SHEET:	EX1



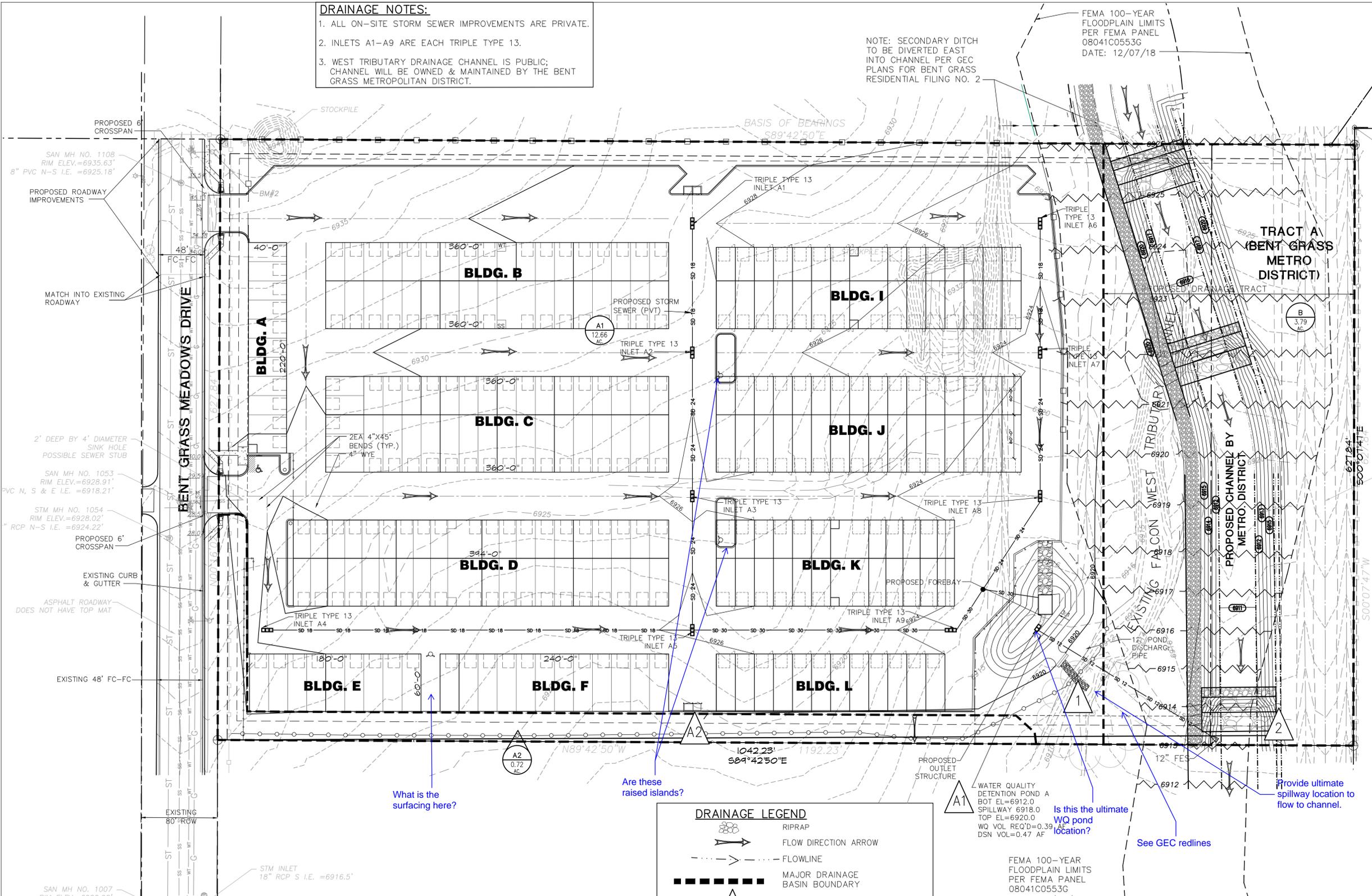
Z:\031901\031901\031901.dwg, 12/18/2019 11:07:21 AM, DWG To PDF.pc3

DRAINAGE NOTES:

1. ALL ON-SITE STORM SEWER IMPROVEMENTS ARE PRIVATE.
2. INLETS A1-A9 ARE EACH TRIPLE TYPE 13.
3. WEST TRIBUTARY DRAINAGE CHANNEL IS PUBLIC; CHANNEL WILL BE OWNED & MAINTAINED BY THE BENT GRASS METROPOLITAN DISTRICT.

NOTE: SECONDARY DITCH TO BE DIVERTED EAST INTO CHANNEL PER GEC PLANS FOR BENT GRASS RESIDENTIAL FILING NO. 2

FEMA 100-YEAR FLOODPLAIN LIMITS PER FEMA PANEL 08041C0553G DATE: 12/07/18



BENCHMARKS:

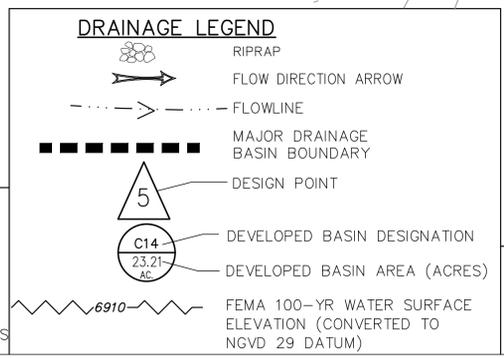
BM#1
FIMS MONUMENT BLT169
ELEV.=6884.81' (NGVD1929)

BM#2
FLANGE BOLT ON HYDRANT "MUELLER BOLT", LOCATED ON THE EAST SIDE OF BENT GRASS MEADOWS DRIVE 1900 FEET NORTH OF WOODMEN FRONTAGE ROAD
ELEV.=6938.84' (NGVD1929)

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q ₅ (CFS)	Q ₁₀₀ (CFS)
A1	37.6	70.3
A2	0.3	2.2
1	37.9	71.9
2	1.0	7.1

BASIN A AREA = 13.38 AC.
 IMPERVIOUS AREAS (PH 1 & PH 2):
 SURFACE TYPE AREA
 BUILDING & PAVEMENT 476,212 SF
 TOTAL 476,212 SF
 = 10.9 AC
 = **81.7% IMPERVIOUS**



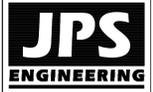
WATER QUALITY DETENTION POND A
 BOT EL=6912.0
 SPILLWAY 6918.0
 TOP EL=6920.0
 WQ VOL REQ'D=0.39 AF
 DSN VOL=0.47 AF

FEMA 100-YEAR FLOODPLAIN LIMITS PER FEMA PANEL 08041C0553G DATE: 12/07/18

FEMA DATUM CONVERSION NOTE:
 NAVD88 IS 3.89' ABOVE NGVD29 BASED ON A FIMS BENCHMARK BL74 NEAR WOODMEN AND BENT GRASS



DEYOUNG SUBDIVISION



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 1-800-922-1987
 CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MEMBER UTILITIES.

NO.	REVISION	BY	DATE

DEVELOPED DRAINAGE PLAN (ULTIMATE - FOR INFORMATION ONLY)

HORZ. SCALE: 1"=50'	DRAWN: BJJ
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: RIDGELINE	CHECKED: JPS
CREATED: 10/11/19	LAST MODIFIED: 04/19/22
PROJECT NO: 031901	MODIFIED BY: BJJ

D1

DRAINAGE NOTES:
 1. ALL ON-SITE STORM SEWER IMPROVEMENTS ARE PRIVATE.
 2. INLETS A1-A9 ARE EACH TRIPLE TYPE 13.
 3. WEST TRIBUTARY DRAINAGE CHANNEL IS PUBLIC; CHANNEL WILL BE OWNED & MAINTAINED BY THE BENT GRASS METROPOLITAN DISTRICT.

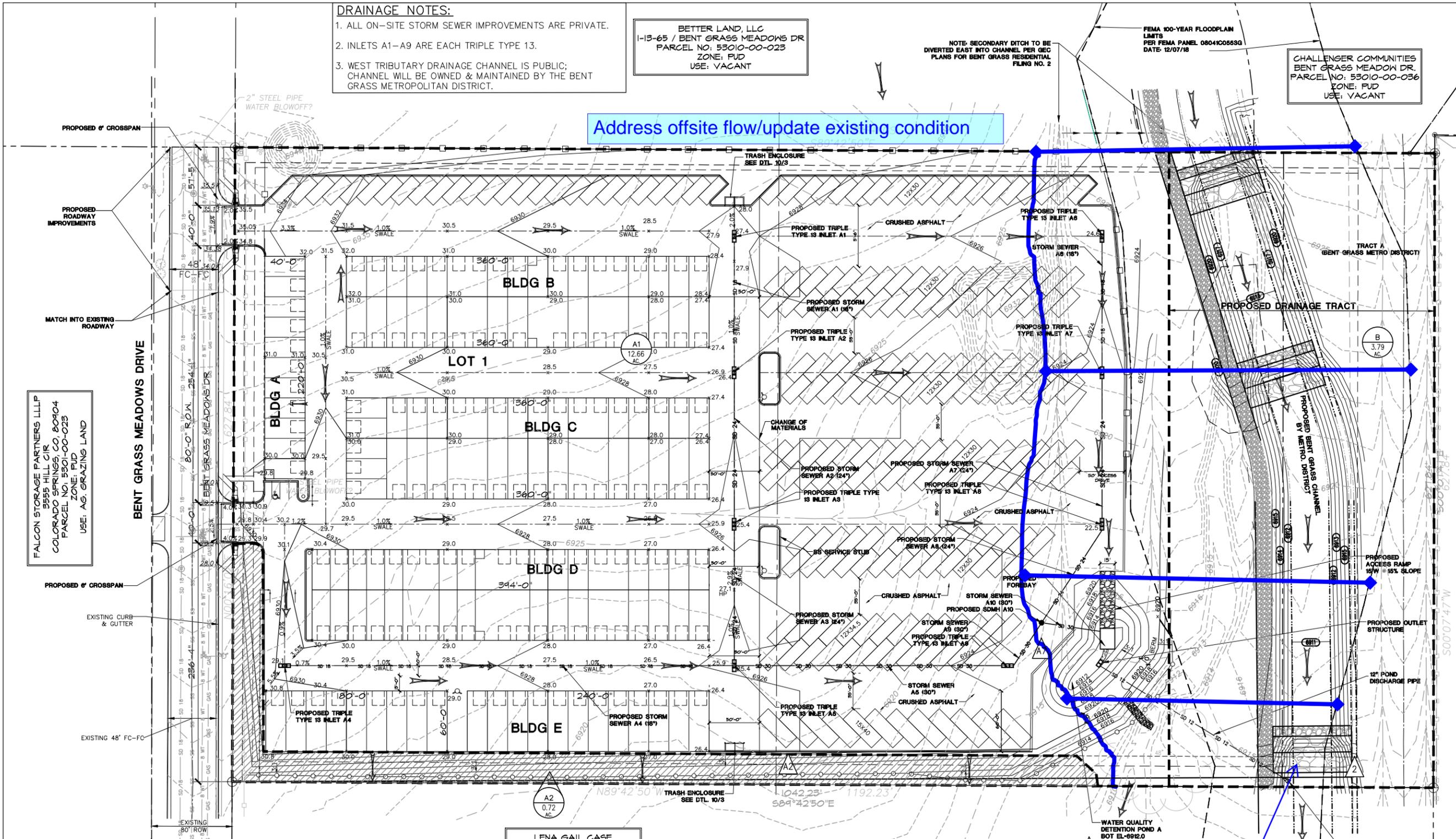
BETTER LAND, LLC
 1-13-65 / BENT GRASS MEADOWS DR
 PARCEL NO: 53010-00-023
 ZONE: FUD
 USE: VACANT

NOTE: SECONDARY DITCH TO BE DIVERTED EAST INTO CHANNEL PER GEC PLANS FOR BENT GRASS RESIDENTIAL FILING NO. 2

FEMA 100-YEAR FLOODPLAIN LIMITS PER FEMA PANEL 0804100683G DATE: 12/07/18

CHALLENGER COMMUNITIES
 BENT GRASS MEADOW DR.
 PARCEL NO: 53010-00-036
 ZONE: FUD
 USE: VACANT

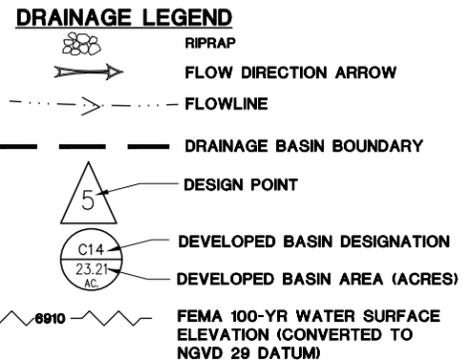
Address offsite flow/update existing condition



FALCON STORAGE PARTNERS LLLP
 3555 HILL CIR
 COLORADO SPRINGS, CO, 80904
 PARCEL NO: 53010-00-023
 ZONE: FUD
 USE: AG, GRAZING LAND

BASIN A AREA = 13.38 AC.
IMPERVIOUS AREAS (PH 1 & PH 2)
 SURFACE TYPE AREA
 BUILDING & PAVEMENT 476,212 SF
 TOTAL 476,212 SF
 = 10.9 AC
 = 81.7% IMPERVIOUS

LENA GAIL CASE
 LOMOTTE DR.
 PARCEL NO: 53010-00-017
 ZONE: 1-2
 USE: VACANT



DETECTION BASIN CONTOUR AREAS

CONTOURS	AREA (SF.)
6912	1,109
6914	2,346
6916	3,995
6918	5,899

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
A1	37.6	70.3
A2	0.3	2.2
1	37.9	71.9
2	1.0	7.1

BENCHMARKS:
 BM#1
 FIMS MONUMENT BLT169
 ELEV.=6884.81' (NGVD1929)
 BM#2
 FLANGE BOLT ON HYDRANT "MUELLER BOLT", LOCATED ON THE EAST SIDE OF BENT GRASS MEADOWS DRIVE 1900 FEET NORTH OF WOODMEN FRONTAGE ROAD
 ELEV.=6938.84' (NGVD1929)

FEMA DATUM CONVERSION NOTE:
 NAVD88 IS 3.89' ABOVE NGVD29
 BASED ON A FIMS BENCHMARK
 BL74 NEAR WOODMEN AND BENT GRASS

If phase 1 is before the channel is constructed, don't show the channel and adjust pond outfall pipe

DEYOUNG SUBDIVISION

JPS ENGINEERING
 19 E. Willamette Ave.
 Colorado Springs, CO 80903
 PH: 719-477-9429
 FAX: 719-471-0766
 www.jpsegr.com

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 1-800-922-1987
 CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

NO.	REVISION	BY	DATE

PHASE 1 DEVELOPED DRAINAGE PLAN

HORIZ. SCALE: 1"=50'
 VERT. SCALE: 1"=5'
 SURVEYED: RIDGELINE
 CREATED: 12/18/19
 PROJECT NO: 031901
 SHEET: D1.1

DRAWN: BJJ
 DESIGNED: JPS
 CHECKED: JPS
 LAST MODIFIED: 04/18/22
 MODIFIED BY: PV